

U.S. DEPARTMENT OF THE INTERIOR  
U.S. GEOLOGICAL SURVEY

**The Northern California Seismic  
Network Bulletin  
January - December 1992**

by  
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**Open-File Report 93-578**

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1993

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## Introduction

Since 1967 the U.S. Geological Survey has operated the Northern California Seismic Network (NCSN) to provide earthquake data for a wide range of research topics and hazard-reduction activities. In addition to regional earthquake monitoring, the network has played a role in advancing studies of earthquake forecasting, fault mechanics, tectonics, volcano hazards, earth structure, and geothermal phenomena. A review of the research derived from data recorded by the NCSN and a complete bibliography can be found in *Oppenheimer et al.* (1992). This bulletin documents the status of the network for 1992 and reviews highlights of the year's seismicity.

## Network Operations

The Northern California Seismic Network is designed to detect all local earthquakes having signal strength above the background level of microseisms. The network configuration was motivated by the need to monitor active faults and volcanoes with a station density sufficient to determine the focal depth of shallow (0-15 km) crustal earthquakes. Depending on the concentration of stations in a region, the magnitude ( $M$ ) level at which earthquake detection is complete varies from approximately 1.4 in parts of the central Coast Ranges to 2.6 in the Klamath Mountain range. However, earthquakes with  $M < 1.0$  are routinely detected throughout the network. The network in 1992 operated 359 stations, and recorded an additional 56 stations operated by other networks (Tables 1 and 2; Figure 1). During 1992 eight new stations were installed, and four were removed (Table 3).

Earthquake detection and location occurs on two independent data acquisition systems, the Real-Time-Picker (RTP) and CalTech-USGS-Seismic-Processing (CUSP) system. The RTP is a parallel microprocessor system developed by the NCSN (*Allen*, 1978, 1982) which measures station arrival times and coda-durations from all of the stations in the network. This information is then associated to calculate earthquake origin times, locations, and duration magnitudes. The RTP locations form the basis of the NCSN earthquake notification system that automatically alerts seismologists within minutes of the occurrence of any significant seismicity. Unlike the CUSP system, no seismograms are retained.

The same data are processed through the CUSP system, a complete earthquake detection, location, and data management system originally developed by Carl Johnson of the California Institute of Technology and subsequently enhanced by scientists from the Southern California Seismic Network (SCSN) and NCSN. The CUSP system digitizes 512 channels of input at 100 samples/sec with 12 bit A/D resolution, detects earthquakes, demultiplexes the digital data stream, and tags each "trigger" with a unique identification number for data management. The system then automatically computes the  $P$ -arrival times and coda durations, locates the earthquake, and "posts" the earthquake for review by seismic analysts. The analysts examine the digital seismograms on computer screens and revise the parameters as necessary to properly locate the earthquake. Subsequently the digital seismograms and earthquake locations are stored on magnetic and optical media for later research. In addition, a continuous digital recording of the entire network provides a backup. The combined power of the CUSP, RTP, and backup tape systems ensures complete recording of ongoing earthquake sequences.

Because of monitoring responsibilities, the NCSN has taken considerable efforts to operate their earthquake detection system with a high degree of reliability. Electricity for the computers and portions of the microwave telemetry system is supplied through an uninterruptable power supply with standby emergency power backup, critical hardware is seismically braced, and earthquake acquisition and monitoring functions occur simultaneously on backup computers. The NCSN also operates software that automatically notifies the seismologist on duty if seismicity exceeds pre-established criteria or if the computers malfunction.



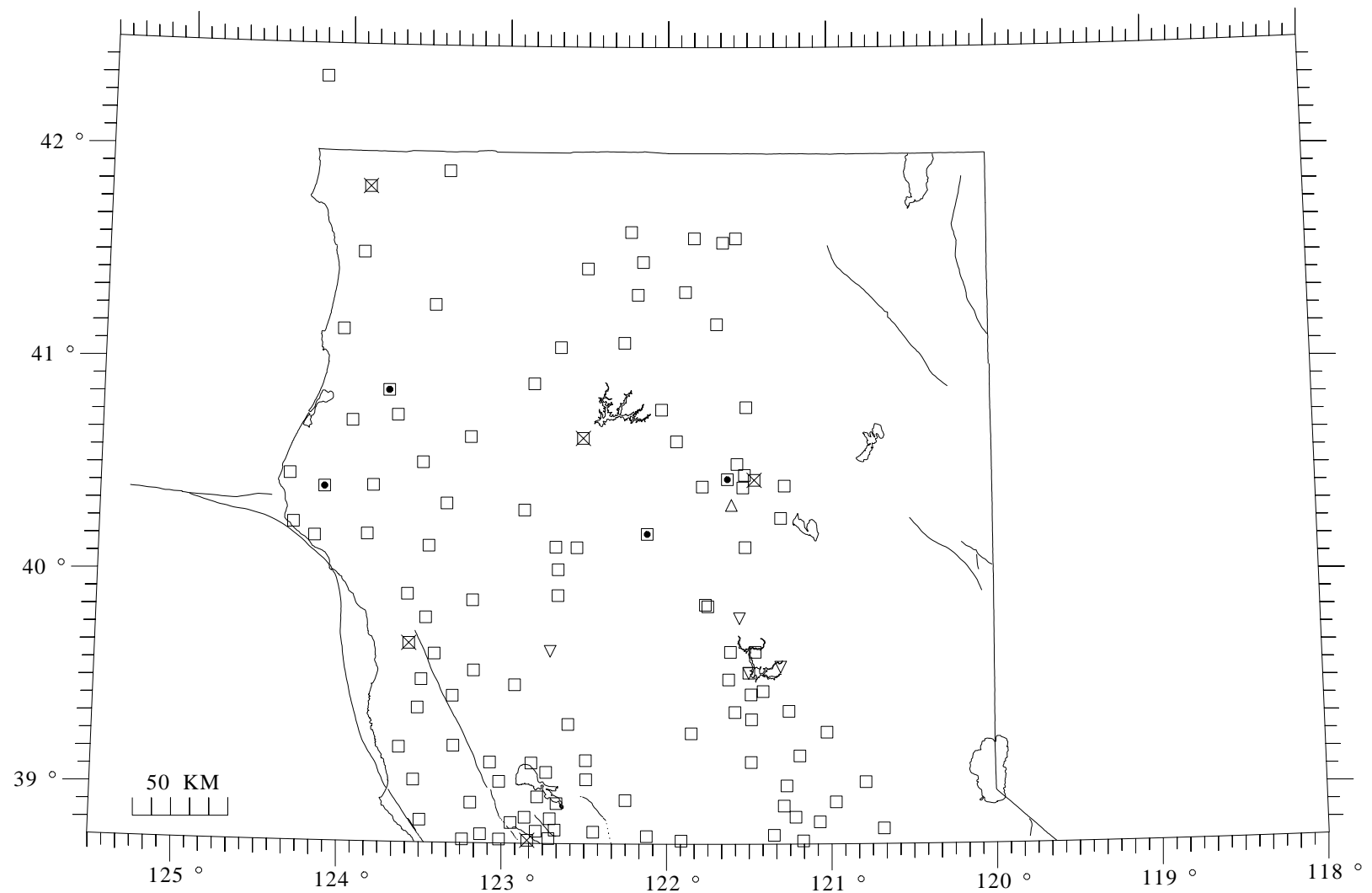


Figure 1. Seismic stations recorded by the NCSN during 1992. Solid lines depict faults with displacement during the Quaternary.

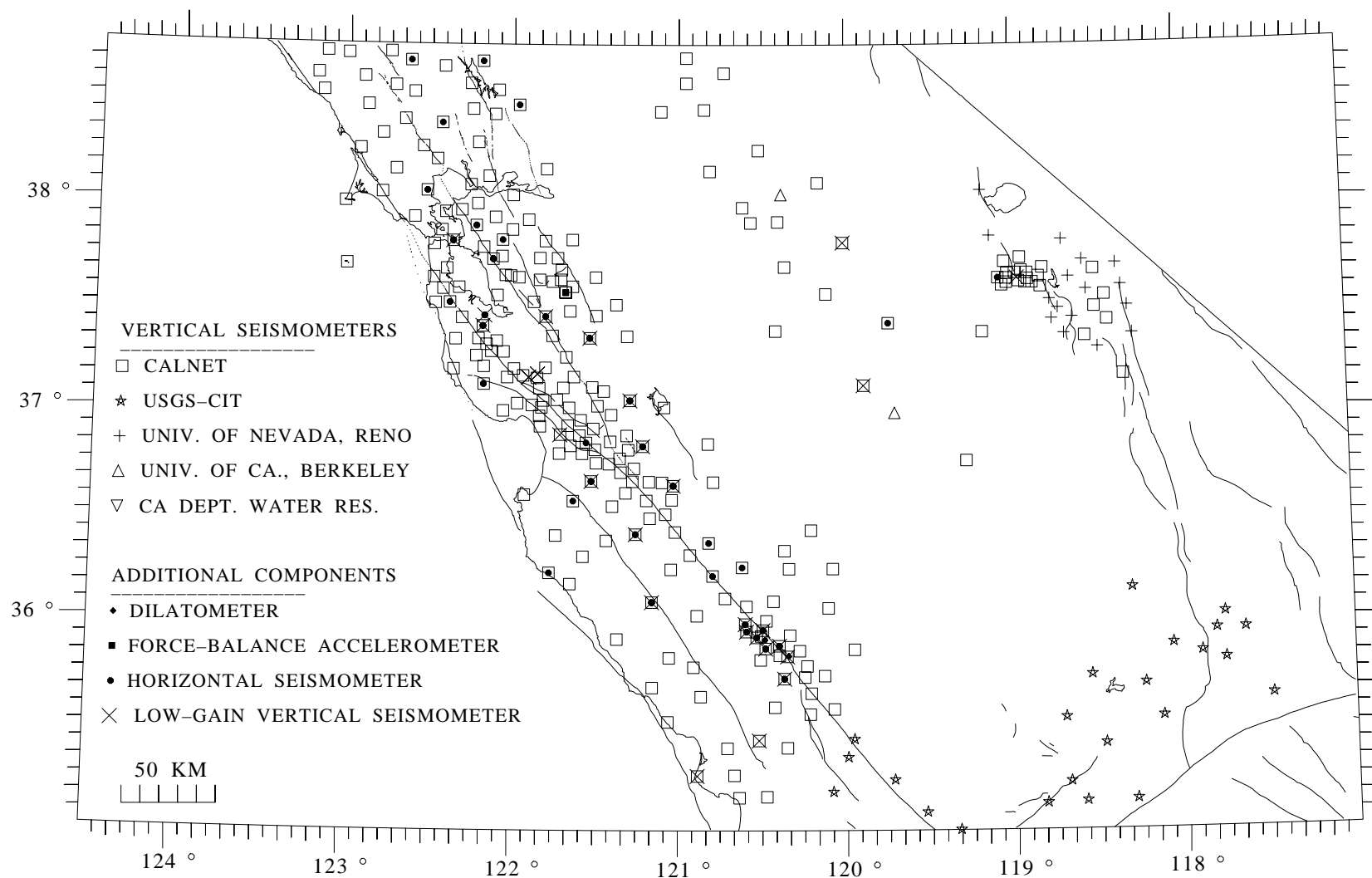


Figure 1 (cont.).



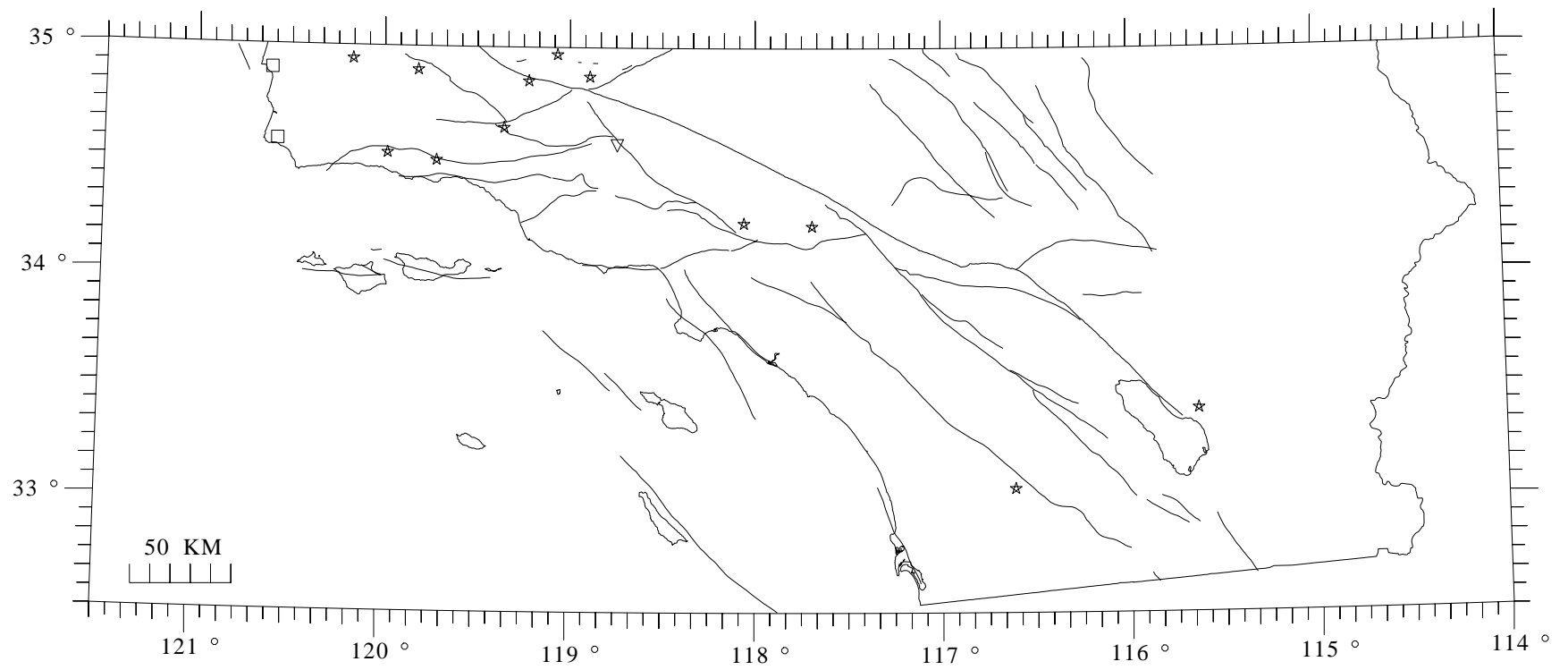


Figure 1 (cont.).

Table 1. Station Locations, Attenuations, Components, and Magnitude Correction Factors

| Table 1: Station Data for the Eastern United States |                   |          |       |           |       |       |                   |                                     | Table 2: Station Data for the Western United States |      |                   |          |       |           |       |       |                   | Table 3: Station Data for the Southern United States |                                    |      |                   |          |       |           |       |       |                   |                                     |                                    |
|---|-------------------|----------|-------|-----------|-------|-------|-------------------|-------------------------------------|---|------|-------------------|----------|-------|-----------|-------|-------|-------------------|--|------------------------------------|------|-------------------|----------|-------|-----------|-------|-------|-------------------|-------------------------------------|------------------------------------|
| Name  | IRIS <sup>¶</sup> | Latitude |       | Longitude |       | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$                  | Name | IRIS <sup>¶</sup> | Latitude |       | Longitude |       | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$                  | $\Delta M_{\text{amp}}^{\ddagger}$ | Name | IRIS <sup>¶</sup> | Latitude |       | Longitude |       | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|   | Code              | (deg     | min)  | (deg      | min)  | Code  | (dB)              |                                     |   |      | Code              | (deg     | min)  | (deg      | min)  | Code  | (dB)              |  |                                    |      | Code              | (deg     | min)  | (deg      | min)  | Code  | (dB)              |                                     |                                    |
| AAR   | NC                | 39       | 16.57 | 121       | 1.53  | VHZ   | 24                | -0.06                               | -0.18   | BSM  | NC                | 36       | 23.00 | 121       | 25.67 | VHZ   | 18                | 0.04   | -0.10                              |      |                   |          |       |           |       | VLE   | 42                |                                     |                                    |
| AAS   | NC                | 38       | 25.80 | 121       | 6.51  | VHZ   | 18                | 0.14                                | 0.28  | BSR  | NC                | 36       | 39.99 | 121       | 31.12 | VHZ   | 12                | 0.09   | 0.04                               | CSP  | NC                | 37       | 57.45 | 122       | 18.65 | VHZ   | 24                | -0.26                               | -0.31                              |
| ABJ   | NC                | 39       | 9.92  | 121       | 11.47 | VHZ   | 18                | 0.28                                | 0.13  |      |                   |          |       |           |       | VLZ   | 48                | -0.14  | -0.07                              | CST  | NC                | 37       | 38.35 | 121       | 29.89 | VHZ   | 12                |                                     |                                    |
| ABR   | NC                | 39       | 8.11  | 121       | 29.21 | VHZ   | 24                | -0.18                               | -0.10   |      |                   |          |       |           |       | VLN   | 42                | -0.04  | 0.02                               | CSV  | NC                | 37       | 51.88 | 122       | 0.16  | VHZ   | 24                | -0.34                               | -0.24                              |
| ADW   | NC                | 38       | 26.35 | 120       | 50.89 | VHZ   | 12                | 0.19                                | 0.18  |      |                   |          |       |           |       | VLE   | 42                | -0.08  | -0.10                              | CVA  | NC                | 37       | 37.10 | 121       | 45.49 | VHZ   | 18                |                                     |                                    |
| AFD   | NC                | 38       | 56.88 | 120       | 58.34 | VHZ   | 6                 | 0.37                                | 0.30  | BVL  | NC                | 36       | 34.51 | 121       | 11.34 | VHZ   | 6                 | -0.06  | 0.08                               | CVL  | NC                | 37       | 37.58 | 121       | 50.14 | VHZ   | 12                |                                     |                                    |
| AFH   | NC                | 39       | 2.51  | 120       | 47.48 | VHZ   | 24                | -0.09                               | -0.17   | BVY  | NC                | 36       | 44.96 | 121       | 24.80 | VHZ   | 6                 | 0.20   | 0.38                               | CVP  | NC                | 37       | 53.04 | 122       | 13.32 | VHZ   | 18                |                                     |                                    |
| AFR   | NC                | 38       | 47.54 | 121       | 20.91 | VHZ   | 24                | -0.26                               | -0.15   | CAD  | NC                | 37       | 9.83  | 121       | 37.55 | VHZ   | 18                | 0.11   | 0.00                               |      |                   |          |       |           |       | VLN   | 42                |                                     |                                    |
| AHR   | NC                | 38       | 51.26 | 121       | 4.23  | VHZ   | 6                 | 0.29                                | 0.29  | CAI  | NC                | 37       | 51.68 | 122       | 25.77 | VHZ   | 18                | 0.11   | -0.05                              |      |                   |          |       |           |       | VLE   | 42                |                                     |                                    |
| ALA   | NC                | 38       | 34.00 | 120       | 57.37 | VHZ   | 12                | 0.36                                | 0.27  | CAL  | NC                | 37       | 27.07 | 121       | 47.95 | VHZ   | 12                | 0.25   | 0.33                               | CYB  | NC                | 37       | 48.68 | 122       | 21.65 | VHZ   | 24                |                                     |                                    |
| ALN   | NC                | 38       | 55.78 | 121       | 17.27 | VHZ   | 24                | -0.02                               | -0.04   |      |                   |          |       |           |       | VLZ   | 48                | 0.18   | 0.22                               |      |                   |          |       |           | VLZ   | 48    |                   |                                     |                                    |
| AOD   | NC                | 38       | 36.89 | 120       | 43.71 | VHZ   | 12                | 0.24                                | 0.19  |      |                   |          |       |           |       | VLN   | 42                | 0.25   | 0.21                               |      |                   |          |       |           | VLN   | 42    |                   |                                     |                                    |
| AOH   | NC                | 39       | 22.52 | 121       | 15.36 | VHZ   | 18                | 0.17                                | 0.01  |      |                   |          |       |           |       | VLE   | 42                | 0.25   | 0.24                               |      |                   |          |       |           | VLE   | 42    |                   |                                     |                                    |
| APR   | NC                | 38       | 52.62 | 121       | 13.03 | VHZ   | 6                 | 0.29                                | 0.40  | CAO  | NC                | 37       | 20.96 | 121       | 31.96 | VHZ   | 12                | 0.19   | 0.27                               | GAC  | NC                | 38       | 52.37 | 122       | 51.73 | VHZ   | 12                | 0.42                                | 0.46                               |
| ARJ   | NC                | 38       | 41.19 | 120       | 57.38 | VHZ   | 12                | 0.28                                | 0.23  |      |                   |          |       |           |       | VLZ   | 48                | 0.18   | 0.21                               | GAR  | NC                | 38       | 57.31 | 122       | 15.13 | VHZ   | 12                | -0.30                               | -0.02                              |
| ARR   | NC                | 38       | 45.92 | 121       | 10.31 | VHZ   | 12                | 0.52                                | 0.45  |      |                   |          |       |           |       | VLN   | 42                | 0.29   | 0.19                               | GAX  | NC                | 38       | 42.65 | 122       | 45.30 | VHZ   | 12                | 0.48                                | 0.28                               |
| ASM   | NC                | 38       | 49.40 | 120       | 41.00 | VHZ   | 18                | 0.10                                | -0.05   |      |                   |          |       |           |       | VLE   | 42                | 0.34   | 0.20                               | GBD  | NC                | 39       | 26.52 | 123       | 18.55 | VHZ   | 18                | 0.01                                | 0.06                               |
| AVR   | NC                | 39       | 1.47  | 121       | 16.25 | VHZ   | 6                 | 0.39                                | 0.34  | CBR  | NC                | 37       | 48.97 | 122       | 3.72  | VHZ   | 18                | 0.09   | 0.07                               | GBG  | NC                | 38       | 48.84 | 122       | 40.76 | VHZ   | 18                | 0.09                                | 0.14                               |
| BAP   | NC                | 36       | 10.55 | 121       | 38.56 | VHZ   | 18                | 0.00                                | -0.17   |      |                   |          |       |           |       | VLN   | 42                | 0.23   | 0.15                               | GBM  | NC                | 39       | 8.51  | 122       | 29.64 | VHZ   | 18                | 0.24                                | 0.34                               |
| BAV   | NC                | 36       | 38.75 | 121       | 1.79  | VHZ   | 12                | 0.22                                | 0.27  | CBS  | NC                | 37       | 49.06 | 121       | 38.43 | VHZ   | 18                | -0.35  | -0.17                              | GCB  | NC                | 39       | 23.03 | 123       | 31.28 | VHZ   | 12                | 0.17                                | 0.23                               |
|   |                   |          |       |           |       | VLZ   | 48                | 0.16                                | 0.16  | CBW  | NC                | 37       | 55.45 | 122       | 6.40  | VHZ   | 18                | -0.17  | -0.07                              | GCR  | NC                | 38       | 46.39 | 122       | 42.92 | VHZ   | 12                | 0.46                                | 0.44                               |
|   |                   |          |       |           |       | VLN   | 42                | 0.27                                | 0.11  | CCO  | NC                | 37       | 15.46 | 121       | 40.35 | VHZ   | 12                | 0.05   | 0.08                               | GCV  | NC                | 38       | 46.18 | 123       | 0.83  | VHZ   | 12                | 0.24                                | 0.20                               |
|   |                   |          |       |           |       | VLE   | 42                | 0.30                                | 0.17  | CCY  | NC                | 37       | 33.10 | 122       | 5.45  | VHZ   | 18                | 0.32   | 0.24                               | GCW  | NC                | 39       | 7.85  | 123       | 4.55  | VHZ   | 12                | 0.27                                | 0.28                               |
| BBG   | NC                | 36       | 34.70 | 121       | 2.31  | VHZ   | 18                | -0.39                               | -0.21   | CDA  | NC                | 37       | 43.80 | 121       | 43.70 | VHZ   | 18                |  |                                    | GDC  | NC                | 38       | 46.03 | 123       | 14.31 | VHZ   | 12                | 0.17                                | 0.07                               |
| BBN   | NC                | 36       | 30.57 | 121       | 4.57  | VHZ   | 6                 | -0.30                               | -0.04   | CDO  | NC                | 37       | 43.80 | 121       | 50.12 | VHZ   | 24                | -0.38  | -0.31                              | GDX  | NC                | 38       | 48.46 | 122       | 47.63 | VHZ   | 12                | 0.55                                | 0.57                               |
| BCG   | NC                | 36       | 42.55 | 121       | 20.60 | VHZ   | 18                | 0.01                                | 0.07  | CDU  | NC                | 38       | 1.78  | 122       | 0.05  | VHZ   | 24                | -0.72  | -0.47                              | GGP  | NC                | 38       | 45.88 | 122       | 50.65 | VHZ   | 18                | 0.22                                | 0.25                               |
| BCW   | NC                | 36       | 18.40 | 121       | 33.96 | VHZ   | 18                | 0.17                                | -0.05   | CDV  | NC                | 37       | 33.98 | 121       | 40.81 | VHZ   | 12                | 0.40   | 0.40                               |      |                   |          |       |           |       | VLZ   | 48                | 0.20                                | 0.18                               |
| BEH   | NC                | 36       | 39.88 | 121       | 10.45 | VHZ   | 18                | -0.19                               | -0.14   |      |                   |          |       |           |       | VLZ   | 42                | 0.11   | 0.11                               | GGU  | NC                | 38       | 51.39 | 123       | 29.87 | VHZ   | 18                | 0.30                                | 0.16                               |
| BEM   | NC                | 36       | 39.68 | 121       | 5.76  | VHZ   | 12                | 0.01                                | -0.05   | CGP  | NC                | 37       | 38.72 | 122       | 0.62  | VHZ   | 18                |  |                                    | GHC  | NC                | 38       | 36.36 | 123       | 11.81 | VHZ   | 12                | 0.31                                | 0.21                               |
| BHR   | NC                | 36       | 43.67 | 121       | 15.83 | VHZ   | 18                | -0.30                               | -0.13   | CLC  | NC                | 37       | 44.28 | 122       | 3.83  | VHZ   | 18                | -0.13  | -0.20                              | GHG  | NC                | 39       | 7.70  | 122       | 49.47 | VHZ   | 12                | 0.46                                | 0.51                               |
| BJC   | NC                | 36       | 32.82 | 121       | 23.56 | VHZ   | 6                 | 0.28                                | 0.20  | CMC  | NC                | 37       | 46.88 | 122       | 10.55 | VHZ   | 24                | -0.22  | -0.15                              | GHL  | NC                | 39       | 2.43  | 123       | 1.12  | VHZ   | 6                 | 0.47                                | 0.48                               |
| BJO   | NC                | 36       | 36.65 | 121       | 18.81 | VHZ   | 12                | 0.21                                | 0.14  | CMH  | NC                | 37       | 21.57 | 121       | 45.38 | VHZ   | 18                | 0.08   | 0.08                               | GHM  | NC                | 39       | 29.74 | 122       | 55.80 | VHZ   | 12                | 0.31                                | 0.43                               |
| BLR   | NC                | 36       | 39.96 | 121       | 16.36 | VHZ   | 12                | -0.33                               | -0.07   | CMJ  | NC                | 37       | 31.25 | 121       | 52.23 | VHZ   | 12                | 0.15   | 0.12                               | GHO  | NC                | 39       | 2.67  | 123       | 32.41 | VHZ   | 12                |                                     |                                    |
| BMS   | NC                | 36       | 39.78 | 120       | 47.51 | VHZ   | 12                | 0.00                                | -0.05   | CML  | NC                | 37       | 28.64 | 121       | 39.09 | VHZ   | 18                | 0.33   | 0.24                               | GHV  | NC                | 39       | 5.10  | 122       | 44.06 | VHZ   | 18                | 0.32                                | 0.28                               |
| BPC   | NC                | 36       | 34.32 | 121       | 37.56 | VHZ   | 12                | -0.20                               | -0.16   | CMM  | NC                | 37       | 27.34 | 121       | 29.62 | VHZ   | 12                | 0.33   | 0.29                               | GMC  | NC                | 38       | 47.56 | 123       | 7.80  | VHZ   | 12                | 0.42                                | 0.30                               |
| BPC   | NC                | 36       | 34.32 | 121       | 37.56 | VLN   | 42                | -0.17                               | -0.15   | CMN  | NC                | 37       | 37.65 | 121       | 42.50 | VHZ   | 12                |  |                                    | GMK  | NC                | 38       | 58.17 | 122       | 47.22 | VHZ   | 12                | 0.01                                | 0.10                               |
| BPI   | NC                | 36       | 29.40 | 121       | 10.11 | VHZ   | 6                 | 0.30                                | 0.22  | CMO  | NC                | 37       | 48.68 | 121       | 48.15 | VHZ   | 12                | -0.09  | -0.02                              | GMO  | NC                | 38       | 42.61 | 123       | 8.59  | VHZ   | 6                 | 0.44                                | 0.42                               |
| BPO   | NC                | 36       | 13.72 | 121       | 46.00 | VHZ   | 12                |                                     |   | CMP  | NC                | 37       | 21.46 | 121       | 18.51 | VHZ   | 18                | 0.19   | 0.11                               | GNA  | NC                | 39       | 11.85 | 123       | 37.85 | VHZ   | 18                | -0.08                               | -0.12                              |
| BPO   | NC                | 36       | 13.72 | 121       | 46.00 | VLN   | 42                |                                     |   | CMR  | NC                | 37       | 35.68 | 121       | 38.22 | VHZ   | 12                | 0.15   | 0.13                               | GPM  | NC                | 38       | 50.85 | 122       | 56.78 | VHZ   | 18                | 0.27                                | 0.14                               |
| BPR   | NC                | 36       | 24.42 | 121       | 43.77 | VHZ   | 18                | 0.03                                | -0.13   | COS  | NC                | 37       | 30.51 | 121       | 22.44 | VHZ   | 18                | 0.25   | 0.12                               | GRO  | NC                | 39       | 55.04 | 122       | 40.23 | VHZ   | 12                |                                     |                                    |
| BRM   | NC                | 36       | 50.70 | 120       | 49.40 | VHZ   | 18                | -0.26                               | -0.21   | CPI  | NC                | 37       | 59.33 | 122       | 12.88 | VHZ   | 18                |  |                                    | GRT  | NC                | 38       | 56.32 | 122       | 40.18 | VHZ   | 12                | 0.14                                | 0.16                               |
| BRV   | NC                | 36       | 25.49 | 121       | 1.10  | VHZ   | 18                | -0.15                               | 0.02  | CPL  | NC                | 37       | 38.25 | 121       | 57.64 | VHZ   | 18                | 0.28   | 0.09                               | GSG  | NC                | 38       | 52.03 | 122       | 42.58 | VHZ   | 12                | -0.07                               | -0.12                              |
| BSG   | NC                | 36       | 24.83 | 121       | 15.22 | VHZ   | 18                | 0.14                                | 0.06  | CPM  | NC                | 37       | 56.94 | 122       | 24.46 | VHZ   | 24                |  |                                    | GSN  | NC                | 38       | 56.43 | 123       | 11.50 | VHZ   | 12                | 0.24                                | 0.13                               |
|   |                   |          |       |           |       | VLZ   | 48                | 0.02                                | 0.07  | CRP  | NC                | 37       | 54.75 | 121       | 54.33 | VHZ   | 24                | -0.29  | -0.29                              | GSS  | NC                | 38       | 42.12 | 123       | 0.81  | VHZ   | 12                | 0.30                                | 0.16                               |
|   |                   |          |       |           |       | VLN   | 42                | 0.14                                | 0.09  | CSA  | NC                | 37       | 40.42 | 121       | 42.25 | VHZ   | 24                |  |                                    | GTS  | NC                | 39       | 18.70 | 122       | 36.15 | VHZ   | 12                | 0.29                                | 0.36                               |
|   |                   |          |       |           |       | VLE   | 42                | 0.14                                | 0.09  | CSL  | NC                | 37       | 43.46 | 122       | 7.10  | VHZ   | 24                |  |                                    | GWK  | NC                | 39       | 3.12  | 122       | 29.46 | VHZ   | 12                | 0.12                                | 0.32                               |
| BSL   | NC                | 36       | 46.53 | 121       | 20.96 | VHZ   | 24                | -0.57                               | -0.38   |      |                   |          |       |           |       | VLN   | 42                |  |                                    | GWR  | NC                | 39       | 12.43 | 123       | 17.99 | VHZ   | 18                | 0.18                                | 0.21                               |

| Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ | Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ | Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|
| Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    | Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    | Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    |
| HAZ  | NC                | 36 53.08  | 121 35.45 | VHZ   | 18                | 0.18                                | 0.29                               | JHL  | NC                | 37 6.54   | 121 49.99 | VHZ   | 18                | 0.29                                | 0.49                               | KIP  | NC                | 39 48.52  | 123 28.83 | VHZ   | 6                 | 0.31                                | 0.41                               |
| HBT  | NC                | 36 51.01  | 121 33.04 | VHZ   | 24                | 0.04                                | 0.26                               | JHP  | NC                | 37 26.65  | 122 18.09 | VHZ   | 18                | -0.16                               | -0.10                              | KJJ  | NC                | 40 14.86  | 124 18.41 | VHZ   | 18                |                                     |                                    |
|      |                   |           |           | VLN   | 42                | -0.06                               | 0.16                               | JJR  | NC                | 37 20.68  | 122 12.09 | VHZ   | 18                |                                     |                                    | KKP  | NC                | 40 8.75   | 123 28.10 | VHZ   | 12                | 0.25                                | 0.27                               |
| HCA  | NC                | 37 1.52   | 121 29.02 | VHZ   | 12                | 0.04                                | 0.06                               | JLX  | NC                | 37 12.11  | 121 59.17 | VHZ   | 18                | 0.11                                | 0.06                               | KMP  | NC                | 40 25.04  | 124 7.21  | VHZ   | 18                | 0.08                                | 0.04                               |
| HCB  | NC                | 36 55.88  | 121 39.63 | VHZ   | 18                | -0.24                               | -0.14                              | JMG  | NC                | 37 38.22  | 122 28.43 | VHZ   | 18                | 0.12                                | 0.13                               |      |                   |           |           | VLN   | 42                | -0.11                               | -0.36                              |
| HCO  | NC                | 36 53.25  | 121 42.49 | VHZ   | 18                | -0.53                               | -0.31                              | JMP  | NC                | 37 27.33  | 122 9.93  | VFZ   | 72                | -0.34                               | -0.05                              |      |                   |           |           | VLE   | 42                | -0.08                               | -0.30                              |
|      |                   |           |           | VLZ   | 48                | -0.53                               | -0.25                              |      |                   |           |           | VFN   | 72                | -0.46                               | -0.33                              | KOM  | NC                | 41 16.73  | 123 27.13 | VHZ   | 6                 | 0.43                                | 0.42                               |
| HCR  | NC                | 36 57.46  | 121 35.01 | VHZ   | 12                | 0.28                                | 0.28                               |      |                   |           |           | VFE   | 72                | -0.52                               | -0.32                              | KPP  | NC                | 40 20.76  | 123 21.73 | VHZ   | 12                | 0.30                                | 0.35                               |
| HDL  | NC                | 36 50.12  | 121 38.64 | VHZ   | 12                | 0.22                                | 0.18                               | JNA  | NC                | 37 10.62  | 121 50.68 | VLZ   | 36                | -0.08                               | -0.01                              | KRK  | NC                | 39 33.77  | 123 10.93 | VHZ   | 12                | 0.25                                | 0.41                               |
| HER  | NC                | 36 47.90  | 121 42.64 | VHZ   | 24                | -0.54                               | -0.14                              |      |                   |           |           | VFZ   | 72                | -0.38                               | -0.21                              | KRM  | NC                | 41 31.31  | 123 54.31 | VHZ   | 18                | 0.28                                | 0.24                               |
| HFE  | NC                | 36 59.00  | 121 24.09 | VHZ   | 18                | 0.07                                | 0.04                               | JPL  | NC                | 36 58.62  | 121 49.93 | VHZ   | 18                | -0.69                               | -0.37                              | KRP  | NC                | 41 9.49   | 124 1.38  | VHZ   | 12                | 0.23                                | 0.46                               |
| HFP  | NC                | 36 45.22  | 121 29.43 | VHZ   | 6                 | 0.39                                | 0.49                               | JPP  | NC                | 37 15.81  | 122 12.78 | VHZ   | 12                | -0.24                               | 0.00                               | KSC  | NC                | 42 20.64  | 124 9.88  | VLZ   | 18                |                                     |                                    |
| HGS  | NC                | 37 5.75   | 121 26.83 | VHZ   | 12                | 0.25                                | 0.18                               | JPR  | NC                | 37 47.70  | 122 28.43 | VHZ   | 24                | -0.25                               | -0.35                              | KSM  | NC                | 40 11.15  | 124 10.48 | VHZ   | 12                | 0.06                                | 0.21                               |
| HGW  | NC                | 37 1.02   | 121 39.20 | VHZ   | 12                | 0.27                                | 0.23                               | JPS  | NC                | 37 11.94  | 122 20.90 | VHZ   | 18                | -0.19                               | -0.14                              | KSP  | NC                | 39 31.04  | 123 30.09 | VHZ   | 12                | 0.22                                | 0.37                               |
| HJG  | NC                | 36 47.88  | 121 34.43 | VHZ   | 12                | 0.30                                | 0.44                               | JRG  | NC                | 37 2.22   | 121 57.87 | VHZ   | 18                | -0.36                               | -0.24                              | KSX  | NC                | 41 49.85  | 123 52.55 | VHZ   | 12                | 0.44                                | 0.33                               |
| HJS  | NC                | 36 48.99  | 121 17.92 | VHZ   | 12                | 0.08                                | 0.16                               | JRR  | NC                | 37 3.27   | 121 43.61 | VHZ   | 12                | 0.22                                | 0.17                               |      |                   |           |           | VLZ   | 48                | 0.17                                | 0.04                               |
| HLT  | NC                | 36 53.07  | 121 18.49 | VHZ   | 12                | 0.19                                | 0.37                               | JSA  | NC                | 37 34.95  | 122 25.03 | VHZ   | 18                | 0.18                                | -0.02                              | KTR  | NC                | 41 54.52  | 123 22.59 | VHZ   | 12                |                                     |                                    |
| HMO  | NC                | 36 36.03  | 121 55.06 | VHZ   | 18                | 0.24                                | 0.01                               | JSB  | NC                | 37 40.74  | 122 23.80 | VHZ   | 24                |                                     |                                    | LAS  | NC                | 41 35.96  | 121 34.60 | VHZ   | 18                | 0.36                                | 0.12                               |
| HOR  | NC                | 36 55.03  | 121 30.46 | VHZ   | 18                | -0.54                               | -0.11                              | JSC  | NC                | 37 17.07  | 122 7.42  | VHZ   | 18                | 0.04                                | 0.06                               | LBF  | NC                | 41 20.82  | 121 53.42 | VHZ   | 12                | 0.06                                | -0.05                              |
| HPH  | NC                | 36 51.38  | 121 24.37 | VHZ   | 36                | -0.80                               | -0.60                              | JSF  | NC                | 37 24.31  | 122 10.55 | VHZ   | 24                | -0.21                               | -0.16                              | LBK  | NC                | 41 5.05   | 122 39.91 | VHZ   | 6                 | 0.32                                | 0.27                               |
| HPL  | NC                | 37 3.13   | 121 17.40 | VHZ   | 18                | 0.31                                | 0.23                               |      |                   |           |           | VLZ   | 48                | -0.25                               | -0.08                              | LBP  | NC                | 40 19.10  | 122 52.88 | VHZ   | 12                | 0.62                                | 0.55                               |
|      |                   |           |           | VLZ   | 48                | 0.30                                | 0.26                               |      |                   |           |           | VLN   | 42                | -0.10                               | -0.07                              | LCF  | NC                | 40 29.18  | 121 31.44 | VHZ   | 18                | -0.14                               | -0.24                              |
|      |                   |           |           | VLN   | 42                | 0.43                                | 0.27                               |      |                   |           |           | VLE   | 42                | 0.09                                | 0.17                               | LCM  | NC                | 40 8.79   | 121 31.26 | VHZ   | 18                | -0.20                               | -0.22                              |
|      |                   |           |           | VLE   | 42                | 0.30                                | 0.23                               | JSG  | NC                | 37 16.96  | 122 3.00  | VHZ   | 18                | -0.23                               | -0.08                              | LDB  | NC                | 40 25.90  | 121 47.08 | VHZ   | 18                | -0.16                               | -0.21                              |
| HQR  | NC                | 36 50.02  | 121 12.76 | VHZ   | 18                | 0.17                                | 0.15                               | JSJ  | NC                | 37 20.03  | 122 5.48  | VHZ   | 24                | -0.53                               | -0.44                              | LGB  | NC                | 41 20.00  | 122 11.20 | VHZ   | 12                | -0.23                               | -0.17                              |
|      |                   |           |           | VLZ   | 48                | 0.03                                | 0.07                               | JSM  | NC                | 37 12.74  | 122 10.06 | VHZ   | 18                | -0.06                               | -0.08                              | LGM  | NC                | 41 35.98  | 121 50.11 | VHZ   | 12                | 0.00                                | -0.06                              |
|      |                   |           |           | VLN   | 42                | 0.11                                | 0.00                               | JSS  | NC                | 37 10.17  | 121 55.84 | VHZ   | 18                | 0.09                                | 0.07                               | LGP  | NC                | 40 54.75  | 122 49.72 | VHZ   | 6                 | 0.35                                | 0.29                               |
|      |                   |           |           | VLE   | 42                | 0.11                                | 0.05                               | JST  | NC                | 37 12.41  | 121 47.84 | VHZ   | 12                | 0.02                                | 0.04                               | LHC  | NC                | 40 48.30  | 121 30.84 | VHZ   | 24                | -0.11                               | -0.28                              |
| HSF  | NC                | 36 49.03  | 121 29.81 | VHZ   | 18                | -0.18                               | -0.02                              | JTG  | NC                | 37 1.71   | 121 52.58 | VHZ   | 18                | -0.41                               | -0.24                              | LHE  | NC                | 41 37.71  | 122 13.83 | VHZ   | 18                | 0.09                                | -0.05                              |
| HSL  | NC                | 37 1.16   | 121 5.13  | VHZ   | 18                | -0.19                               | -0.23                              | JUC  | NC                | 37 0.07   | 122 2.91  | VHZ   | 12                | 0.08                                | 0.04                               | LHK  | NC                | 40 26.12  | 121 16.67 | VHZ   | 12                | -0.12                               | -0.17                              |
| HSP  | NC                | 37 6.91   | 121 30.94 | VHZ   | 12                | -0.03                               | 0.01                               | JUM  | NC                | 37 9.65   | 121 53.86 | VLZ   | 36                | 0.10                                | 0.07                               | LME  | NC                | 40 32.27  | 121 34.21 | VHZ   | 24                | -0.11                               | -0.58                              |
| JAL  | NC                | 37 9.50   | 121 50.82 | VHZ   | 18                | 0.06                                | 0.02                               |      |                   |           |           | VFZ   | 72                | -0.10                               | -0.17                              | LMH  | NC                | 41 34.74  | 121 39.44 | VHZ   | 24                | -0.16                               | -0.41                              |
| JBC  | NC                | 37 9.62   | 122 1.57  | VHZ   | 18                | 0.14                                | 0.27                               | KBB  | NC                | 40 11.82  | 123 51.00 | VHZ   | 12                | 0.02                                | 0.06                               | LMP  | NC                | 41 29.25  | 122 9.28  | VHZ   | 12                | -0.34                               | -0.26                              |
| JBG  | NC                | 37 20.52  | 122 20.34 | VHZ   | 24                | -0.30                               | -0.15                              | KBN  | NC                | 39 53.56  | 123 11.64 | VHZ   | 12                | 0.34                                | 0.33                               | LPD  | NC                | 41 11.72  | 121 41.76 | VHZ   | 18                | -0.08                               | -0.10                              |
| JBL  | NC                | 37 7.69   | 122 10.08 | VHZ   | 18                | 0.14                                | 0.12                               | KBR  | NC                | 40 43.79  | 123 57.34 | VHZ   | 12                | 0.36                                | 0.25                               | LPG  | NC                | 40 8.72   | 122 41.20 | VHZ   | 12                |                                     |                                    |
|      |                   |           |           | VLN   | 42                | 0.21                                | 0.20                               | KBS  | NC                | 39 55.07  | 123 35.68 | VHZ   | 12                | 0.11                                | 0.14                               | LPK  | NC                | 41 27.34  | 122 30.05 | VHZ   | 6                 |                                     |                                    |
|      |                   |           |           | VLE   | 42                | 0.23                                | 0.22                               | KCP  | NC                | 39 41.23  | 123 34.84 | VHZ   | 18                | -0.03                               | 0.01                               | LRB  | NC                | 40 8.60   | 122 33.40 | VHZ   | 12                |                                     |                                    |
| JBM  | NC                | 37 19.09  | 122 9.16  | VHZ   | 12                | 0.06                                | 0.22                               |      |                   |           |           | VLZ   | 48                | -0.10                               |                                    | LRD  | NC                | 40 27.78  | 121 27.85 | VHZ   | 12                | -0.28                               | -0.33                              |
| JBZ  | NC                | 37 1.07   | 121 49.15 | VHZ   | 18                | -0.63                               | -0.44                              | KCR  | NC                | 40 25.58  | 123 49.11 | VHZ   | 12                | 0.27                                | 0.23                               |      |                   |           |           | VLZ   | 48                |                                     |                                    |
| JCB  | NC                | 37 6.71   | 121 41.33 | VHZ   | 12                | 0.00                                | -0.10                              | KCS  | NC                | 40 32.26  | 123 30.76 | VHZ   | 12                |                                     |                                    | LRR  | NC                | 40 27.98  | 121 37.78 | VHZ   | 18                | -0.21                               | -0.33                              |
| JCH  | NC                | 37 31.02  | 122 22.56 | VHZ   | 18                |                                     |                                    | KCT  | NC                | 40 28.55  | 124 20.18 | VHZ   | 18                | 0.01                                | 0.00                               |      |                   |           |           | VLE   | 30                |                                     | -0.07                              |
|      |                   |           |           | VLN   | 42                |                                     |                                    | KFP  | NC                | 39 38.35  | 123 25.44 | VHZ   | 12                | 0.30                                | 0.31                               | LSF  | NC                | 40 39.49  | 122 31.36 | VHZ   | 18                | 0.28                                | 0.09                               |
|      |                   |           |           | VLE   | 42                |                                     |                                    | KGM  | NC                | 40 45.53  | 123 40.46 | VHZ   | 18                | 0.28                                | 0.18                               |      |                   |           |           | VLZ   | 48                |                                     |                                    |
| JCP  | NC                | 37 35.29  | 122 19.33 | VHZ   | 24                |                                     |                                    | KHB  | NC                | 40 39.61  | 123 13.11 | VHZ   | 24                |                                     |                                    | LSH  | NC                | 40 47.59  | 122 2.29  | VHZ   | 6                 | 0.42                                | 0.31                               |
| JEC  | NC                | 37 3.04   | 121 48.56 | VHZ   | 12                | 0.05                                | 0.16                               | KHM  | NC                | 40 52.48  | 123 43.89 | VHZ   | 18                |                                     |                                    | LSL  | NC                | 40 25.64  | 121 32.05 | VHZ   | 12                | 0.20                                | 0.07                               |
| JEG  | NC                | 37 30.84  | 122 27.74 | VHZ   | 24                | -0.14                               | -0.28                              |      |                   |           |           | VLN   | 42                |                                     |                                    | LSM  | NC                | 40 17.00  | 121 18.09 | VHZ   | 18                | -0.09                               | -0.21                              |
| JEL  | NC                | 36 55.64  | 121 49.61 | VHZ   | 24                | -0.69                               | -0.33                              |      |                   |           |           | VLE   | 42                |                                     |                                    | LSR  | NC                | 41 6.43   | 122 16.16 | VHZ   | 12                |                                     |                                    |

| Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|
| Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    |
| LTC  | NC                | 40 12.50  | 122 7.45  | VHZ   | 18                | -0.22                               | -0.11                              |
|      |                   |           |           | VLN   | 42                | -0.23                               | -0.12                              |
| LVR  | NC                | 40 2.35   | 122 40.25 | VHZ   | 12                |                                     |                                    |
| LWH  | NC                | 40 38.66  | 121 56.70 | VHZ   | 6                 | 0.25                                | 0.28                               |
| MBE  | NC                | 36 45.75  | 119 16.90 | VLZ   | 42                |                                     |                                    |
| MBO  | NC                | 37 41.35  | 120 21.86 | VHZ   | 12                | 0.43                                | 0.29                               |
| MBU  | NC                | 37 33.58  | 120 7.00  | VHZ   | 12                |                                     |                                    |
| MCD  | NC                | 37 32.89  | 118 26.50 | VHZ   | 18                | -0.83                               | -0.56                              |
| MCL  | NC                | 37 35.41  | 118 49.45 | VHZ   | 18                |                                     |                                    |
| MCM  | NC                | 37 36.59  | 118 52.40 | VHZ   | 18                | -0.25                               | -0.55                              |
| MCS  | NC                | 37 39.30  | 118 54.27 | VHZ   | 18                | -0.25                               | -0.42                              |
| MCU  | NC                | 37 58.36  | 120 37.02 | VHZ   | 6                 | 0.30                                | 0.24                               |
| MDC  | NC                | 37 42.60  | 119 2.50  | VHZ   | 12                | 0.24                                | -0.11                              |
| MDP  | NC                | 37 37.94  | 119 4.74  | VHZ   | 24                | -0.03                               | -0.30                              |
|      |                   |           |           | VLN   | 42                |                                     |                                    |
| MDR  | NC                | 37 38.32  | 118 50.13 | VHZ   | 18                |                                     |                                    |
| MEM  | NC                | 37 39.98  | 118 56.35 | VHZ   | 18                | -0.33                               | -0.57                              |
| MFB  | NC                | 37 25.77  | 118 25.70 | VHZ   | 24                | -0.89                               | -0.59                              |
| MGP  | NC                | 37 37.59  | 118 54.08 | VHZ   | 18                | -0.58                               | -0.60                              |
| MHD  | NC                | 37 7.36   | 119 53.60 | VHZ   | 12                | 0.22                                | 0.09                               |
|      |                   |           |           | VLZ   | 48                |                                     | 0.00                               |
| MLC  | NC                | 37 36.63  | 118 54.95 | VHZ   | 24                | -0.09                               | -0.39                              |
| MLH  | NC                | 37 40.78  | 118 48.75 | VHZ   | 18                |                                     |                                    |
| MLM  | NC                | 37 43.73  | 118 56.79 | VHZ   | 18                | -0.46                               | -0.53                              |
| MLR  | NC                | 38 5.44   | 120 9.84  | VHZ   | 6                 | 0.27                                | 0.17                               |
| MMI  | NC                | 37 25.20  | 119 44.56 | VHZ   | 6                 | 0.26                                | 0.02                               |
|      |                   |           |           | VLN   | 42                | 0.12                                | 0.04                               |
| MML  | NC                | 37 39.36  | 118 58.68 | VHZ   | 24                | -0.56                               | -0.73                              |
| MMP  | NC                | 37 36.60  | 119 1.68  | VHZ   | 18                | 0.03                                | -0.27                              |
| MMS  | NC                | 37 37.83  | 119 1.84  | VHZ   | 24                |                                     |                                    |
| MMT  | NC                | 37 22.55  | 119 10.68 | VHZ   | 24                | 0.09                                | -0.26                              |
| MNH  | NC                | 38 8.75   | 120 48.82 | VHZ   | 6                 | 0.25                                | 0.24                               |
| MOG  | NC                | 37 29.50  | 118 30.19 | VHZ   | 24                | -0.74                               | -0.56                              |
| MOY  | NC                | 37 54.00  | 120 34.04 | VHZ   | 18                | 0.25                                | 0.18                               |
| MPR  | NC                | 37 48.26  | 120 0.80  | VHZ   | 12                |                                     |                                    |
|      |                   |           |           | VLZ   | 48                |                                     |                                    |
| MRC  | NC                | 37 40.30  | 118 30.38 | VHZ   | 24                | -0.03                               | -0.35                              |
| MRD  | NC                | 37 35.88  | 119 3.40  | VHZ   | 18                |                                     |                                    |
| MRF  | NC                | 38 14.72  | 120 31.24 | VHZ   | 18                | 0.29                                | 0.14                               |
| MSK  | NC                | 37 39.18  | 119 1.44  | VHZ   | 30                | -0.27                               | -0.43                              |
| MSL  | NC                | 37 37.00  | 118 57.30 | VHZ   | 24                | 0.06                                | -0.19                              |
| MST  | NC                | 37 54.27  | 120 24.29 | VHZ   | 12                | 0.33                                | 0.25                               |
| MTC  | NC                | 37 37.90  | 118 57.90 | VLZ   | 42                | -0.27                               | -0.33                              |
| MTU  | NC                | 37 21.20  | 118 33.81 | VHZ   | 18                | 0.07                                | -0.21                              |
| MWB  | NC                | 37 10.13  | 118 20.19 | VHZ   | 12                | -0.20                               | -0.28                              |
| MYL  | NC                | 37 23.02  | 120 25.16 | VHZ   | 18                | -0.29                               | -0.16                              |
| NAD  | NC                | 38 27.60  | 121 58.18 | VHZ   | 18                | -0.32                               | -0.09                              |

| Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|
| Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    |
| NAD  | NC                | 38 27.60  | 121 58.18 | VLN   | 42                | -0.14                               | -0.08                              |
| NAP  | NC                | 38 26.34  | 122 14.99 | VHZ   | 18                | -0.31                               | -0.13                              |
| NBP  | NC                | 38 40.07  | 122 11.60 | VHZ   | 12                | -0.15                               | 0.07                               |
|      |                   |           |           | VLN   | 42                | 0.03                                | 0.07                               |
| NBR  | NC                | 38 15.65  | 122 32.99 | VHZ   | 24                | -0.16                               | -0.15                              |
| NCF  | NC                | 38 19.28  | 122 47.73 | VHZ   | 18                | 0.02                                | 0.03                               |
| NCP  | NC                | 38 47.17  | 122 7.33  | VHZ   | 18                | -0.19                               | 0.00                               |
| NDH  | NC                | 38 45.93  | 121 54.75 | VHZ   | 12                | -0.43                               | -0.02                              |
| NFI  | NC                | 37 41.90  | 123 0.00  | VHZ   | 24                | 0.26                                | 0.07                               |
| NFR  | NC                | 38 31.36  | 123 9.66  | VHZ   | 12                | 0.13                                | 0.02                               |
| NGV  | NC                | 38 16.84  | 122 12.89 | VHZ   | 18                | -0.01                               | 0.05                               |
| NHF  | NC                | 38 2.98   | 122 31.34 | VHZ   | 18                |                                     |                                    |
|      |                   |           |           | VLN   | 42                |                                     |                                    |
|      |                   |           |           | VLE   | 42                |                                     |                                    |
| NHM  | NC                | 38 9.28   | 121 48.02 | VHZ   | 18                | -0.45                               | -0.08                              |
| NIM  | NC                | 38 33.69  | 122 15.86 | VHZ   | 12                | 0.11                                | 0.17                               |
| NLH  | NC                | 38 7.19   | 122 8.87  | VHZ   | 18                | -0.07                               | -0.01                              |
| NLN  | NC                | 38 9.15   | 122 42.75 | VHZ   | 18                | 0.13                                | 0.03                               |
| NMC  | NC                | 38 35.46  | 122 54.74 | VHZ   | 12                | 0.28                                | 0.21                               |
| NMH  | NC                | 38 40.17  | 122 37.93 | VHZ   | 12                | 0.24                                | 0.21                               |
|      |                   |           |           | VLN   | 42                | 0.14                                | 0.14                               |
| NMI  | NC                | 38 4.69   | 122 15.44 | VHZ   | 24                |                                     |                                    |
| NMT  | NC                | 38 48.34  | 122 26.76 | VHZ   | 6                 | 0.14                                | 0.37                               |
| NMW  | NC                | 38 33.03  | 122 43.37 | VHZ   | 18                | -0.10                               | -0.03                              |
| NOL  | NC                | 38 2.50   | 122 47.64 | VHZ   | 18                | -0.20                               | -0.51                              |
| NPR  | NC                | 37 59.79  | 123 0.98  | VHZ   | 30                | 0.11                                | -0.07                              |
| NPV  | NC                | 38 38.55  | 122 25.55 | VHZ   | 18                | 0.15                                | 0.21                               |
| NRR  | NC                | 38 31.82  | 122 5.73  | VHZ   | 12                | -0.07                               | 0.11                               |
| NSH  | NC                | 38 31.20  | 122 36.43 | VHZ   | 12                | 0.05                                | 0.09                               |
| NSP  | NC                | 38 12.02  | 122 27.82 | VHZ   | 12                | -0.01                               | 0.03                               |
| NTA  | NC                | 37 55.43  | 122 35.70 | VHZ   | 18                | 0.37                                | 0.32                               |
| NTB  | NC                | 38 14.87  | 122 55.86 | VHZ   | 18                | 0.07                                | -0.09                              |
| NTY  | NC                | 38 23.37  | 122 39.70 | VHZ   | 18                | -0.14                               | -0.07                              |
| NVA  | NC                | 38 24.92  | 122 6.88  | VHZ   | 18                | -0.05                               | 0.06                               |
| NVE  | NC                | 38 22.36  | 122 26.17 | VHZ   | 24                | -0.03                               | -0.01                              |
|      |                   |           |           | VLN   | 42                | -0.04                               | -0.02                              |
| NWR  | NC                | 38 27.42  | 122 53.26 | VHZ   | 24                | -0.04                               | -0.04                              |
| OBH  | NC                | 39 39.22  | 121 27.64 | VHZ   | 18                | 0.07                                | -0.07                              |
| OCH  | NC                | 39 52.55  | 121 45.93 | VHZ   | 12                | -0.27                               | -0.05                              |
| OCM  | NC                | 39 31.43  | 121 37.40 | VHZ   | 18                | -0.23                               | -0.14                              |
| OCR  | NC                | 39 52.09  | 121 45.04 | VHZ   | 12                |                                     |                                    |
| OGO  | NC                | 39 39.22  | 121 36.72 | VHZ   | 12                | -0.07                               | -0.03                              |
| OHC  | NC                | 39 20.18  | 121 29.05 | VHZ   | 12                | 0.38                                | 0.25                               |
| ORA  | NC                | 39 28.13  | 121 24.80 | VHZ   | 12                | 0.33                                | 0.14                               |
| ORD  | NC                | 39 33.33  | 121 30.00 | VHZ   | 18                | 0.33                                | 0.12                               |
| OST  | NC                | 39 22.22  | 121 35.11 | VHZ   | 18                | -0.19                               | -0.06                              |
| OSU  | NC                | 39 16.23  | 121 51.10 | VHZ   | 12                | -0.36                               | 0.04                               |

| Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|
| Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    |
| OWY  | NC                | 39 27.19  | 121 29.20 | VHZ   | 18                | 0.31                                | 0.19                               |
| PAB  | NC                | 35 9.41   | 120 38.17 | VHZ   | 24                | -0.14                               | -0.25                              |
| PAD  | NC                | 35 38.36  | 120 51.86 | VHZ   | 18                | -0.25                               | -0.27                              |
| PAG  | NC                | 35 43.92  | 120 14.96 | VHZ   | 24                | -0.05                               | -0.08                              |
| PAN  | NC                | 35 46.78  | 120 54.44 | VHZ   | 24                | -0.27                               | -0.33                              |
| PAP  | NC                | 35 54.77  | 121 21.70 | VHZ   | 12                | 0.26                                | 0.10                               |
| PAR  | NC                | 36 14.95  | 120 20.52 | VHZ   | 18                | -0.26                               | -0.16                              |
| PBI  | NC                | 35 9.68   | 120 28.42 | VHZ   | 24                | -0.31                               | -0.41                              |
| PBM  | NC                | 35 23.68  | 120 21.16 | VHZ   | 24                | 0.29                                | 0.02                               |
| PBP  | NC                | 35 34.73  | 120 4.58  | VHZ   | 24                | -0.02                               | -0.16                              |
| PBW  | NC                | 36 18.90  | 120 55.75 | VHZ   | 24                | -0.17                               | 0.02                               |
| PCA  | NC                | 35 55.90  | 120 20.22 | VHZ   | 24                | -0.04                               | -0.11                              |
| PCB  | NC                | 35 31.11  | 121 3.56  | VHZ   | 18                | 0.30                                | 0.07                               |
| PCR  | NC                | 36 5.65   | 120 26.08 | VHZ   | 24                | 0.04                                | 0.00                               |
| PDR  | NC                | 36 20.14  | 120 22.12 | VHZ   | 18                | -0.29                               | -0.14                              |
| PGH  | NC                | 35 49.86  | 120 21.17 | VHZ   | 24                | 0.32                                | 0.28                               |
|      |                   |           |           | VLZ   | 48                | 0.60                                | 0.31                               |
| PHA  | NC                | 35 50.16  | 120 23.91 | VHZ   | 24                | -0.28                               | -0.07                              |
| PHB  | NC                | 36 14.93  | 120 4.96  | VHZ   | 24                | -0.57                               | -0.31                              |
| PHC  | NC                | 35 40.93  | 121 9.15  | VHZ   | 24                | 0.07                                | -0.11                              |
| PHF  | NC                | 35 52.91  | 120 24.03 | VHZ   | 24                | 0.12                                | 0.05                               |
|      |                   |           |           | VLZ   | 48                | 0.14                                | 0.14                               |
|      |                   |           |           | VLN   | 42                | 0.17                                | 0.12                               |
|      |                   |           |           | VLE   | 42                | 0.16                                | 0.12                               |
| PHO  | NC                | 35 52.12  | 120 28.88 | VHZ   | 24                | -0.40                               | -0.30                              |
|      |                   |           |           | VLZ   | 48                | -0.34                               | -0.23                              |
|      |                   |           |           | VLN   | 42                | -0.30                               | -0.21                              |
|      |                   |           |           | VLE   | 42                | -0.35                               | -0.29                              |
| PHP  | NC                | 35 59.13  | 120 36.12 | VHZ   | 24                | -0.18                               | -0.25                              |
|      |                   |           |           | VLZ   | 48                | -0.22                               | -0.22                              |
|      |                   |           |           | VLN   | 42                | -0.31                               | -0.38                              |
|      |                   |           |           | VLE   | 42                | -0.33                               | -0.41                              |
| PHR  | NC                | 36 22.38  | 120 49.10 | VHZ   | 12                | -0.26                               | -0.33                              |
|      |                   |           |           | VLN   | 42                | 0.04                                | 0.13                               |
| PHS  | NC                | 35 49.45  | 121 3.17  | VHZ   | 24                | -0.16                               | -0.18                              |
| PIR  | NC                | 35 33.28  | 120 13.06 | VHZ   | 24                | -0.27                               | -0.22                              |
| PJL  | NC                | 36 5.39   | 121 9.33  | VHZ   | 18                | -0.08                               | -0.12                              |
|      |                   |           |           | VLZ   | 48                | -0.09                               | -0.03                              |
|      |                   |           |           | VLN   | 42                | -0.01                               | 0.04                               |
|      |                   |           |           | VLE   | 42                | -0.03                               | -0.03                              |
| PKE  | NC                | 36 3.69   | 120 6.54  | VHZ   | 24                | -0.30                               | -0.23                              |
| PKY  | NC                | 35 15.83  | 120 39.94 | VHZ   | 24                | -0.19                               | -0.34                              |
| PLO  | NC                | 36 14.79  | 121 2.55  | VHZ   | 18                | -0.34                               | -0.34                              |
| PMC  | NC                | 35 43.48  | 120 22.23 | VHZ   | 24                | -0.39                               | -0.21                              |
|      |                   |           |           | VLZ   | 48                | -0.26                               | -0.11                              |
|      |                   |           |           | VLN   | 42                | 0.02                                | 0.02                               |
|      |                   |           |           | VLE   | 42                | -0.19                               | -0.03                              |

| Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|
| Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    |
| PMG  | NC                | 35 25.79  | 120 31.22 | VHZ   | 24                | 0.28                                | -0.01                              |
|      |                   |           |           | VLZ   | 48                | 0.20                                | -0.03                              |
| PML  | NC                | 34 53.70  | 120 36.51 | VHZ   | 24                | -0.15                               | -0.27                              |
| PMM  | NC                | 35 57.39  | 120 29.84 | VHZ   | 24                | -0.02                               | -0.03                              |
|      |                   |           |           | VLZ   | 48                | -0.05                               | 0.04                               |
|      |                   |           |           | VLN   | 42                | -0.10                               | -0.08                              |
|      |                   |           |           | VLE   | 42                | -0.08                               | -0.07                              |
| PMP  | NC                | 36 12.91  | 120 47.69 | VHZ   | 24                | -0.10                               | 0.02                               |
| PMP  | NC                | 36 12.91  | 120 47.69 | VLN   | 42                | -0.09                               | 0.09                               |
| PMR  | NC                | 35 47.09  | 120 14.14 | VHZ   | 24                | 0.01                                | -0.02                              |
| POP  | NC                | 35 44.29  | 120 7.95  | VHZ   | 24                | -0.02                               | -0.05                              |
| PPB  | NC                | 35 15.63  | 120 53.07 | VHZ   | 24                | -0.04                               | -0.18                              |
|      |                   |           |           | VLZ   | 48                | 0.09                                | -0.13                              |
| PPC  | NC                | 35 56.98  | 120 35.66 | VHZ   | 24                | -0.03                               | -0.06                              |
|      |                   |           |           | VLZ   | 48                | -0.16                               | -0.03                              |
|      |                   |           |           | VLN   | 42                | -0.01                               | -0.04                              |
|      |                   |           |           | VLE   | 42                | 0.11                                | 0.07                               |
| PPG  | NC                | 35 51.78  | 119 57.35 | VHZ   | 24                | -0.48                               | -0.21                              |
| PPT  | NC                | 36 6.50   | 120 43.27 | VHZ   | 24                | -0.34                               | -0.27                              |
| PRC  | NC                | 36 15.37  | 120 37.20 | VHZ   | 24                | -0.03                               | 0.07                               |
|      |                   |           |           | VLN   | 42                | -0.15                               | -0.03                              |
| PRP  | NC                | 36 0.05   | 120 28.60 | VHZ   | 24                |                                     |                                    |
| PSA  | NC                | 36 1.52   | 120 53.30 | VHZ   | 24                | -0.61                               | -0.34                              |
| PSC  | NC                | 35 35.30  | 120 25.58 | VHZ   | 24                | -0.32                               | -0.08                              |
| PSM  | NC                | 36 4.18   | 120 35.68 | VHZ   | 24                | -0.26                               | -0.31                              |
| PSR  | NC                | 35 51.47  | 120 16.81 | VHZ   | 24                | 0.06                                | 0.01                               |
| PST  | NC                | 35 55.73  | 120 30.50 | VHZ   | 24                | 0.09                                | 0.02                               |
| PTA  | NC                | 35 23.56  | 120 42.40 | VHZ   | 18                | 0.18                                | 0.05                               |
| PTQ  | NC                | 34 34.88  | 120 34.29 | VHZ   | 24                | 0.17                                | 0.03                               |
| PTR  | NC                | 35 39.28  | 120 12.67 | VHZ   | 24                | -0.12                               | -0.13                              |
| PVC  | NC                | 35 55.32  | 120 32.06 | VHZ   | 24                | -0.24                               | -0.30                              |
|      |                   |           |           | VLZ   | 48                | -0.33                               | -0.28                              |
|      |                   |           |           | VLN   | 42                | -0.29                               | -0.32                              |
|      |                   |           |           | VLE   | 42                | -0.34                               | -0.32                              |
| PWK  | NC                | 35 48.87  | 120 30.67 | VHZ   | 24                | -0.31                               | -0.02                              |
| PWM  | NC                | 36 25.97  | 120 12.66 | VHZ   | 24                | -0.48                               | -0.14                              |
| FRI  | BK                | 36 59.50  | 119 42.50 | VHZ   | 24                |                                     |                                    |
| MIN  | BK                | 40 20.70  | 121 36.30 | VHZ   | 30                |                                     |                                    |
| ABL  | CI                | 34 51.05  | 119 13.25 | VHZ   | 6                 | 0.29                                | 0.10                               |
| ARV  | CI                | 35 7.63   | 118 49.76 | VHZ   | 12                | 0.30                                | 0.03                               |
| BCH  | CI                | 35 11.10  | 120 5.05  | VHZ   | 12                | 0.10                                | 0.12                               |
| BMT  | CI                | 35 8.15   | 118 35.81 | VHZ   | 6                 | 0.36                                | 0.15                               |
| CRG  | CI                | 35 14.53  | 119 43.40 | VHZ   | 12                | -0.17                               | -0.14                              |
| FRK  | CI                | 33 24.05  | 115 38.21 | VHZ   | 18                |                                     |                                    |
| FTC  | CI                | 34 52.25  | 118 53.51 | VHZ   | 18                | 0.58                                | 0.41                               |
| JUL  | CI                | 33 2.90   | 116 36.77 | VHZ   | 12                |                                     |                                    |
| MAR  | CI                | 35 0.15   | 119 20.36 | VHZ   | 12                | -0.05                               | -0.02                              |

| Name | IRIS <sup>¶</sup> | Latitude  | Longitude | Comp* | Attn <sup>†</sup> | $\Delta M_{\text{coda}}^{\ddagger}$ | $\Delta M_{\text{amp}}^{\ddagger}$ |
|------|-------------------|-----------|-----------|-------|-------------------|-------------------------------------|------------------------------------|
| Code | (deg min)         | (deg min) | Code      | (dB)  |                   |                                     |                                    |
| MWC  | CI                | 34 13.40  | 118 3.50  | VHZ   | 15                |                                     |                                    |
| PKM  | CI                | 34 53.75  | 119 49.13 | VHZ   | 12                | 0.13                                | 0.08                               |
| PLE  | CI                | 34 58.11  | 119 4.08  | VHZ   | 24                | -0.16                               | -0.31                              |
| RYS  | CI                | 34 38.60  | 119 21.10 | VHZ   | 12                | -0.12                               | -0.23                              |
| SCC  | CI                | 34 56.48  | 120 10.32 | VHZ   | 18                | -0.07                               | -0.15                              |
| SIM  | CI                | 35 21.02  | 119 59.74 | VHZ   | 24                | -0.39                               | -0.16                              |
| SLC  | CI                | 34 29.79  | 119 42.81 | VHZ   | 12                | -0.03                               | 0.04                               |
| SND  | CI                | 35 8.58   | 118 18.13 | VHZ   | 12                |                                     |                                    |
| SUN  | CI                | 34 12.64  | 117 41.58 | VHZ   | 24                |                                     |                                    |
| SYN  | CI                | 34 31.63  | 119 58.67 | VHZ   | 26                |                                     |                                    |
| TEJ  | CI                | 35 13.79  | 118 41.37 | VHZ   | 18                |                                     |                                    |
| TMB  | CI                | 35 5.24   | 119 32.08 | VHZ   | 30                | -0.58                               | -0.64                              |
| TOW  | CI                | 35 48.50  | 117 45.90 | VHZ   | 12                | -0.67                               | -0.37                              |
| WAS  | CI                | 35 44.29  | 118 33.42 | VHZ   | 12                | 0.24                                | 0.12                               |
| WBS  | CI                | 35 32.22  | 118 8.37  | VHZ   | 12                | 0.12                                | -0.14                              |
| WCH  | CI                | 35 52.98  | 118 4.48  | VHZ   | 12                | 0.26                                | 0.15                               |
| WJP  | CI                | 35 24.65  | 118 28.84 | VHZ   | 12                | 0.21                                | -0.01                              |
| WLH  | CI                | 36 9.14   | 118 18.70 | VHZ   | 12                | 0.03                                | -0.04                              |
| WNM  | CI                | 35 50.57  | 117 54.29 | VHZ   | 12                |                                     |                                    |
| WOF  | CI                | 35 32.14  | 118 42.75 | VHZ   | 6                 | 0.40                                | 0.20                               |
| WOR  | CI                | 35 41.79  | 118 14.52 | VHZ   | 12                | 0.37                                | 0.06                               |
| WRC  | CI                | 35 57.04  | 117 38.89 | VHZ   | 6                 | -0.01                               | 0.14                               |
| WSH  | CI                | 35 37.96  | 117 29.50 | VHZ   | 6                 | 0.13                                | 0.14                               |
| WVP  | CI                | 35 56.98  | 117 49.02 | VHZ   | 6                 | 0.48                                | 0.28                               |
| YEG  | CI                | 35 26.18  | 119 57.56 | VHZ   | 12                | 0.08                                | 0.17                               |
| BCK  | NN                | 37 41.85  | 118 22.32 | VHZ   | 12                |                                     |                                    |
| BEN  | NN                | 37 42.93  | 118 34.40 | VHZ   | 6                 |                                     |                                    |
| BHP  | NN                | 37 17.97  | 118 29.24 | VHZ   | 12                |                                     |                                    |
| CAS  | NN                | 37 34.49  | 118 33.09 | VHZ   | 12                |                                     |                                    |
| CWC  | NN                | 37 29.69  | 118 18.38 | VHZ   | 12                |                                     |                                    |
| HTC  | NN                | 37 31.79  | 118 46.26 | VHZ   | 12                |                                     |                                    |
| LUL  | NN                | 38 3.14   | 119 10.82 | VHZ   | 18                |                                     |                                    |
| MGN  | NN                | 37 48.80  | 118 41.73 | VHZ   | 12                |                                     |                                    |
| MLN  | NN                | 37 35.63  | 118 20.56 | VHZ   | 12                |                                     |                                    |
| ORC  | NN                | 37 38.12  | 118 39.36 | VHZ   | 36                |                                     |                                    |
| POC  | NN                | 37 21.74  | 118 16.75 | VHZ   | 12                |                                     |                                    |
| RCC  | NN                | 37 29.26  | 118 43.30 | VHZ   | 12                |                                     |                                    |
| SCH  | NN                | 37 21.95  | 118 41.22 | VHZ   | 12                |                                     |                                    |
| SLK  | NN                | 37 50.04  | 119 7.72  | VHZ   | 12                |                                     |                                    |
| STR  | NN                | 37 26.20  | 118 45.60 | VHZ   | 12                |                                     |                                    |
| WMD  | NN                | 37 26.61  | 118 38.22 | VHZ   | 12                |                                     |                                    |
| GAS  | WR                | 39 39.29  | 122 42.91 | VHZ   | 24                |                                     |                                    |
| KPK  | WR                | 39 35.01  | 121 18.32 | VHZ   | 24                |                                     |                                    |
| MGL  | WR                | 39 48.71  | 121 33.42 | VHZ   | 0                 |                                     |                                    |
| ORV  | WR                | 39 33.23  | 121 30.02 | VHZ   | 12                |                                     |                                    |

## Notes to Table 1.

<sup>¶</sup> IRIS codes for network operator:

NC = USGS-Menlo Park  
BK = Univ. CA Berkeley  
CI = USGS/Caltech-Pasadena  
NN = Univ. Nev. Reno  
WR = CA Div. Water Res.

\* Component Code Definition in use by NCSN and SCSN

Sensor type (first letter of 3-letter code)

V=short period seismometer

Gain (second letter)

H=high gain (0-24 dB attenuation)

L=low gain (36-48 dB attenuation)

F=very low gain (54-72 dB attenuation)

Orientation (third letter)

Z=vertical

E=east-west

N=north-south

<sup>†</sup> Attenuation down from 90dB gain, except staton GASW which is down from 120 dB. Please see non-NC operators for appropriate system responses.

<sup>‡</sup> Magnitude correction in magnitude units. Blank value indicates no correction available.

**Table 2. Summary of Seismic Stations Recorded by the NCSN**

| OPERATOR                                | SITES | COMPONENTS       |
|---|-------|------------------|
| NCSN (NC)                               |       |                  |
| High-gain vertical                      | 359   | 359              |
| Low-gain vertical                       | 33    | 35               |
| Horizontal                              | 42    | 65               |
| Dilatometer                             | 4     | 7                |
| Force-balance accelerometer             | 1     | 2                |
| USGS-CIT <sup>†</sup> (CI)              | 34    | 34               |
| Univ. of Nevada, Reno <sup>†</sup> (NN) | 16    | 16               |
| U.C. Berkeley <sup>†</sup> (BK)         | 2     | 2                |
| Ca Dept. Water Res. <sup>†</sup> (WR)   | 4     | 4                |
| Total                                   | 425   | 528 <sup>‡</sup> |

<sup>†</sup>High-gain vertical only

<sup>‡</sup>Number of components exceeds digitizer channels due to network changes throughout year

**Table 3. Network Changes in 1992**

| NEW STATIONS          |            |             |                    |                      |                            |                   |
|-----------------------|------------|-------------|--------------------|----------------------|----------------------------|-------------------|
| CODE <sup>†</sup>     | LAT        | LONG        | ELEV<br>(M)        | SITE NAME            | SENSOR.                    | DATE<br>INSTALLED |
| CGP VHZ               | 37° 38.72′ | 122° 00.62′ | 366                | Garin Park (Surface) | L4                         | 92/02/05          |
| CYB VLE               | 37° 48.68′ | 122° 21.65′ | 24                 | Yerba Buena Island   | L4                         | 92/06/04          |
| CYB VLN               |            |             |                    |                      | L4                         |                   |
| CYB VHZ               |            |             |                    |                      | L4                         |                   |
| CYB VLZ               |            |             |                    |                      | L4                         |                   |
| HSF VHZ               | 36° 49.03′ | 121° 29.81′ | 183                | St. Francis Retreat  | L4                         | 92/11/04          |
| KCS VHZ               | 40° 32.26′ | 123° 30.76′ | 1640               | Cold Springs         | L4                         | 92/08/13          |
| KTR VHZ               | 41° 54.52′ | 123° 22.59′ | 1378               | Thompson Ridge       | L4                         | 92/08/05          |
| MBE VHZ               | 36° 45.75′ | 119° 16.90′ | 1023               | Bear Mountain        | L4                         | 92/09/17          |
| MBU VHZ               | 37° 33.58′ | 120° 07.00′ | 1265               | Mt. Bullion          | L4                         | 92/09/16          |
| OCR VHZ               | 39° 52.09′ | 121° 45.04′ | 564                | Cohasset Ridge       | L4                         | 92/01/22          |
| DISCONTINUED STATIONS |            |             |                    |                      |                            |                   |
| CODE <sup>†</sup>     | LAT        | LONG        | SITE NAME          | DATE<br>REMOVED      | REASON                     |                   |
| HQR VLE               | 36° 50.02′ | 121° 12.76′ | Quien Sabe Ranch   | 92/10/19             | Lost lease                 |                   |
| HQR VLN               |            |             |                    |                      |                            |                   |
| HQR VHZ               |            |             |                    |                      |                            |                   |
| HQR VLZ               |            |             |                    |                      |                            |                   |
| HSF VHZ               | 36° 48.98′ | 121° 29.88′ | St Francis Retreat | 92/11/04             | Slight move (see Table 1)  |                   |
| OCH VHZ               | 39° 52.55′ | 121° 45.93′ | Cohasset Ridge     | 92/01/22             | Moved to OCR (see Table 1) |                   |
| PRP VHZ               | 36° 0.05′  | 120° 28.60′ | Reason Peak        | 92/09/15             | Large rent increase        |                   |

<sup>†</sup>CODE convention: Last 3 letters describe instrument as follows:

Letter 1 - Instrument

V - short-period

Letter 2 - Attenuation

H - high (0-24 db)  
L - low (36-42 db)

Letter 3 - Orientation

Z - vertical  
N - north-south  
E - east-west

## Earthquake Catalog

The NCSN maintains a catalog of earthquake locations for the area spanned by the seismograph net (Figure 1). All earthquakes have a minimum of 4 *P* and *S* arrival time readings from at least 3 independent stations. During 1992 the NCSN located 21,365 earthquakes (Figure 2), bringing the total number of earthquakes in the catalog to about 324,000 events since 1968. Because the CUSP and RTP systems detect and locate earthquakes independently, their data are merged together to generate a comprehensive catalog. CUSP data takes precedence over RTP data for events which have data from both sources.

The merged arrival time data are relocated using the program Hypoinverse (*Klein, 1989*). The location program uses one of thirty-four crustal velocity models, whose velocity varies only with depth (Table 4; Figure 3), and associated station traveltimes corrections (Table 5). Multiple crustal models partly account for lateral velocity variations within the crust and consequently improve the accuracy of earthquake locations. The velocity model used depends on the current epicentral coordinates during the earthquake location iteration process; thus the model can change from that used for the trial hypocenter to the model appropriate for the final location. For some models the travel-time delays are assumed from an adjacent model if there is insufficient earthquake data to determine a value. Please note that the models given in Tables 4 and 5 reflect the location procedures at the time this report was written. The catalog periodically undergoes revision to reflect improved velocity models and location procedures.

All models have layers in which the velocity increases linearly with depth (gradient models) that have been adapted from homogenous layered velocity models referenced in Table 4. Events falling between regions are located with an interpolation between the closest two or three models. Two of the regions along the San Andreas fault, Loma Prieta and the Bear Valley, have different models for either side of the San Andreas Fault. An event in either of these regions uses separate models for stations on different sides of the fault regardless of which side of the fault the epicenter is on. The Loma Prieta region uses model LOM for stations on the west (Pacific) side and model LON for stations on the east (North American) side. The geographic region code LOM (see Table 7) labels all events that use these two models. The Bear Valley region uses model GAB for stations on the Gabilan (west) side and model DIA for stations on the Diablo (east) side. The three Parkfield areas use identical models but slightly different sets of station delays.

Duration and amplitude magnitudes are calculated using the equations of *Eaton (1992)* which produce magnitudes that are in close agreement with the  $M_L$  scale applied by U.C. Berkeley. The magnitude calculations utilize station corrections (Table 1), a distance and depth term, and the time dependent gain history of the seismic station.

## Data Access and Archival

With the advent of large capacity storage devices and computer networks, data access and exchange is improving. Because the number of earthquakes in the NCSN catalog exceeds 320,000, it is neither practical nor desirable to distribute the catalog through printed media. Instead, most users prefer to have the data in a computer-readable format. Therefore, we provide 24-hour access to the earthquake database for scientists anywhere in the world who are connected to the Internet computer network. The NCSN phase, location, and focal mechanism data is stored on a 330 Gbyte optical data storage system operated by U.C. Berkeley. This storage device provides random access to all files within seconds, and the optical storage media are purported to have a life on the order of 100 years. During 1992 the NCSN began transcribing the 230 Gbytes of digital waveform data acquired by the CUSP system since 1984 from 9-track tape to the optical storage device. The UCB - USGS data center also provides access to the broadband waveform data collected by UCB and historical phase and location data. Data requests by individuals without Internet access are routinely obliged through the distribution of computer tapes, floppy disks, customized maps, and paper records. Appendix A provides instructions for obtaining an account at the UCB - USGS data center. The Appendix also provides a list of commands for obtaining documentation on the programs at the data center that retrieve the seismic data.

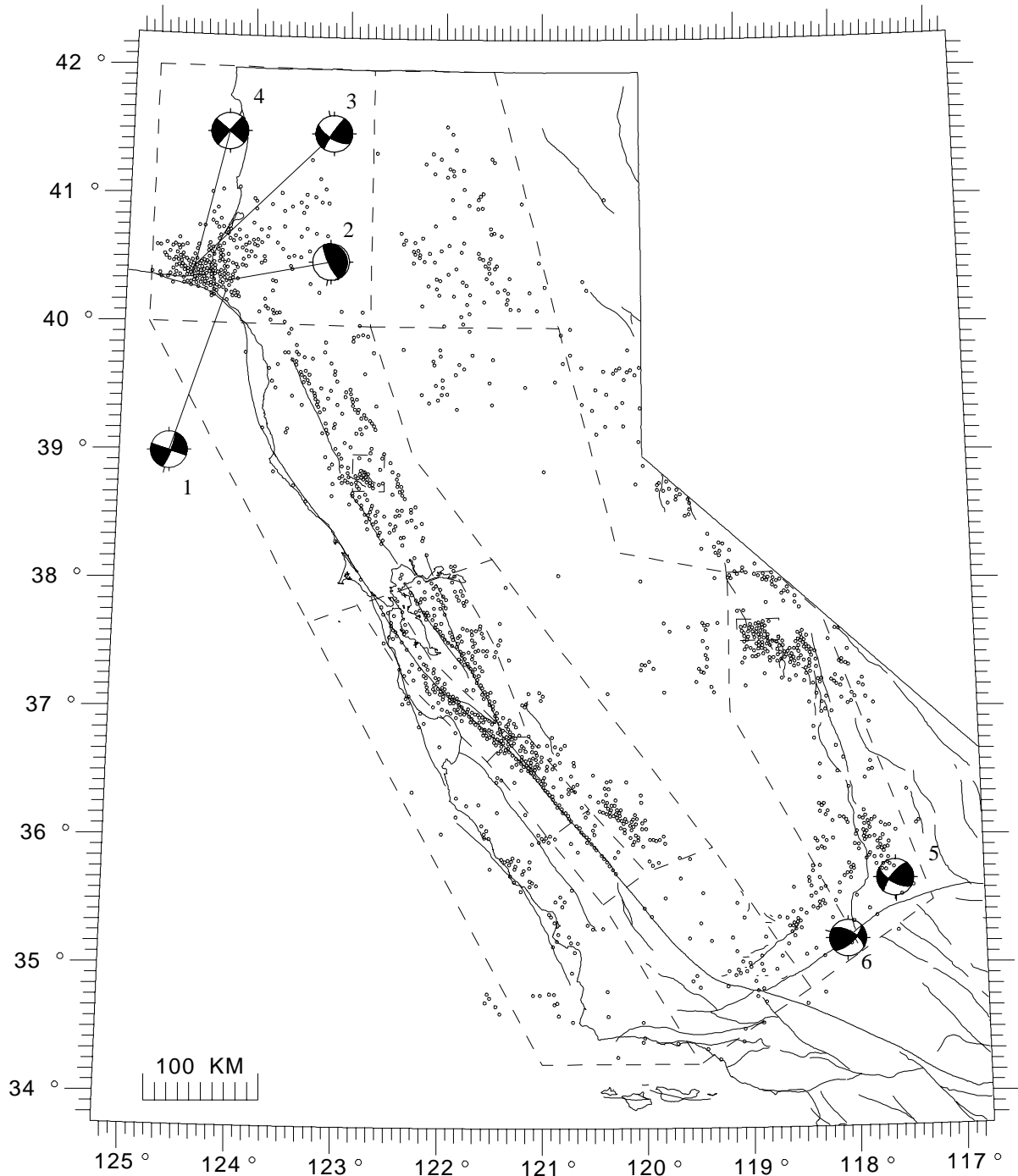


Figure 2. Seismicity recorded by the NCSN during 1992 (small circles) and focal mechanisms for  $M \geq 4.5$  earthquakes. Symbol size is independent of magnitude. All plotted earthquakes have at least 8  $P$  readings and horizontal and vertical location uncertainties less than 2.5 and 5.0 km, respectively. Epicenters within 2.5 km of other epicenters are not plotted. Focal mechanisms are lower-hemisphere, equal-area projections; the compressional quadrant is shaded solid. Numbers adjacent to focal mechanisms are referenced in text. The seismicity in each dashed polygonal region (see Figure 4) is discussed in text. The region enclosed by the dashed lines corresponds to the limits of reliable network coverage.



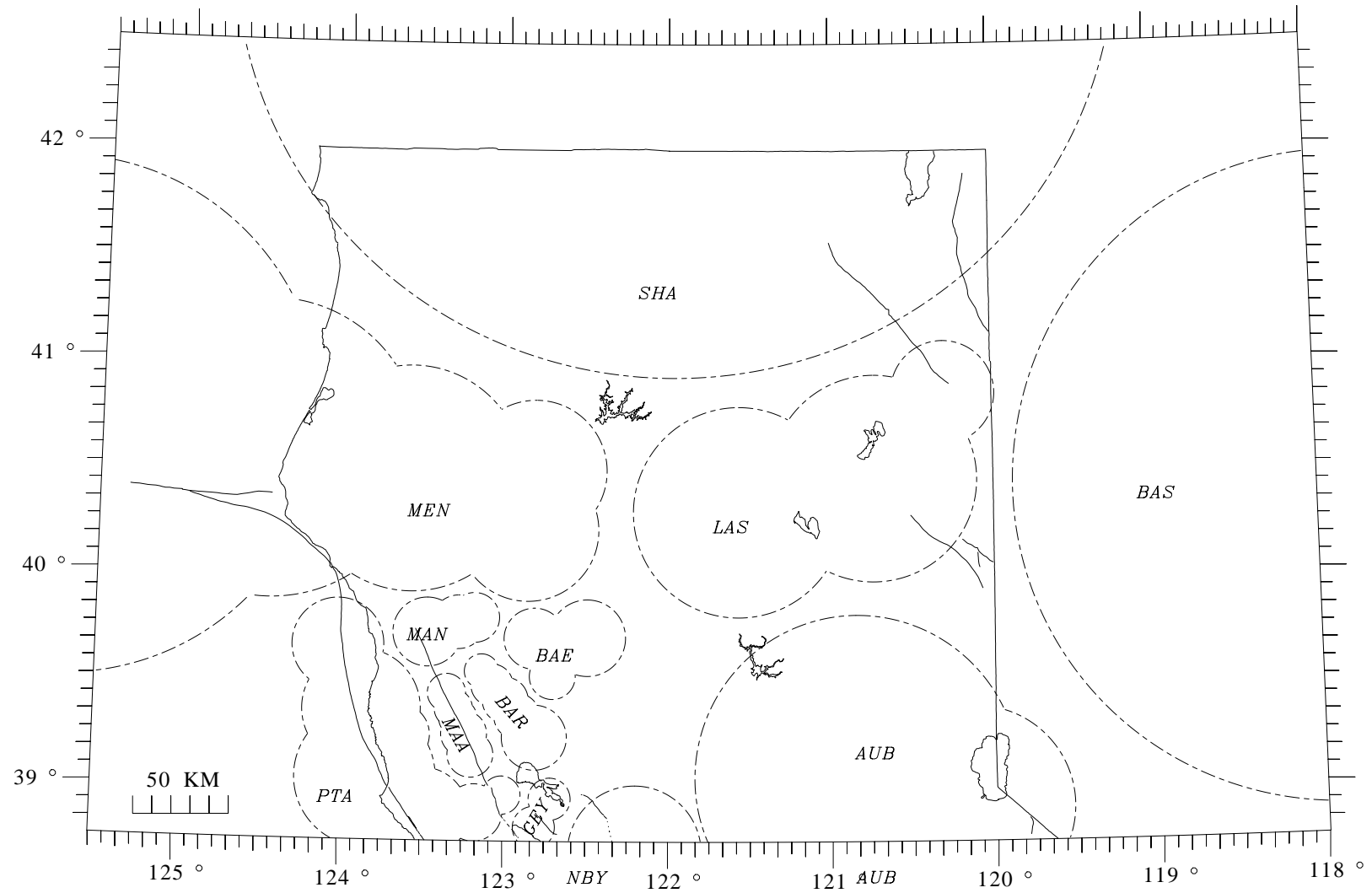


Figure 3. Boundaries of local velocity regions used by HYPOINVERSE (Klein, 1989) to locate earthquakes. The velocity-depth distribution for each region is given in Table 4. Earthquakes occurring between models have locations based on a combination of up to 3 adjacent models. The default Coast Range model (NCG, Table 4) is used to locate earthquakes in areas without a local model, such as the Great Valley and the Pacific Ocean.

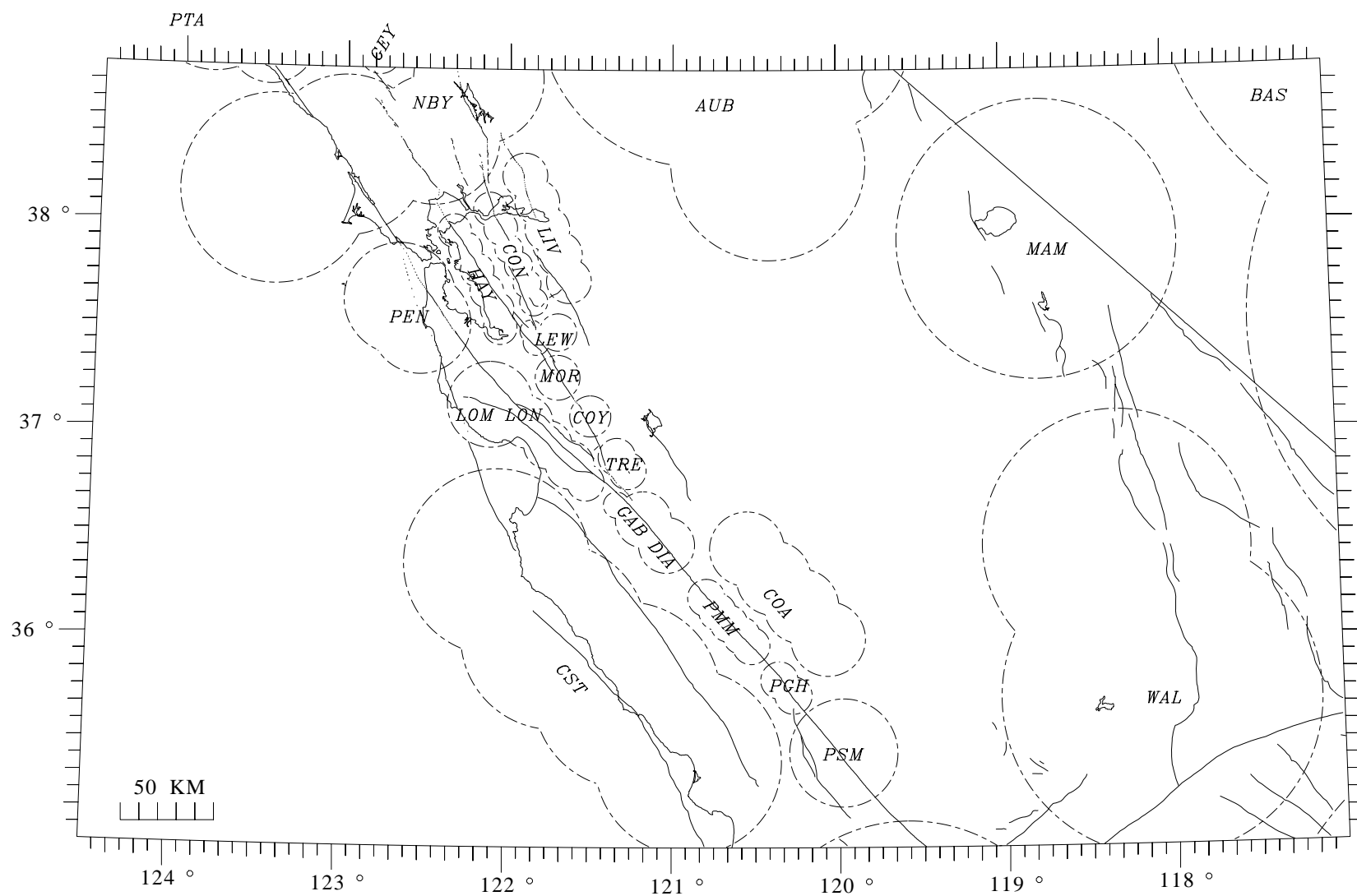


Figure 3 (cont.).

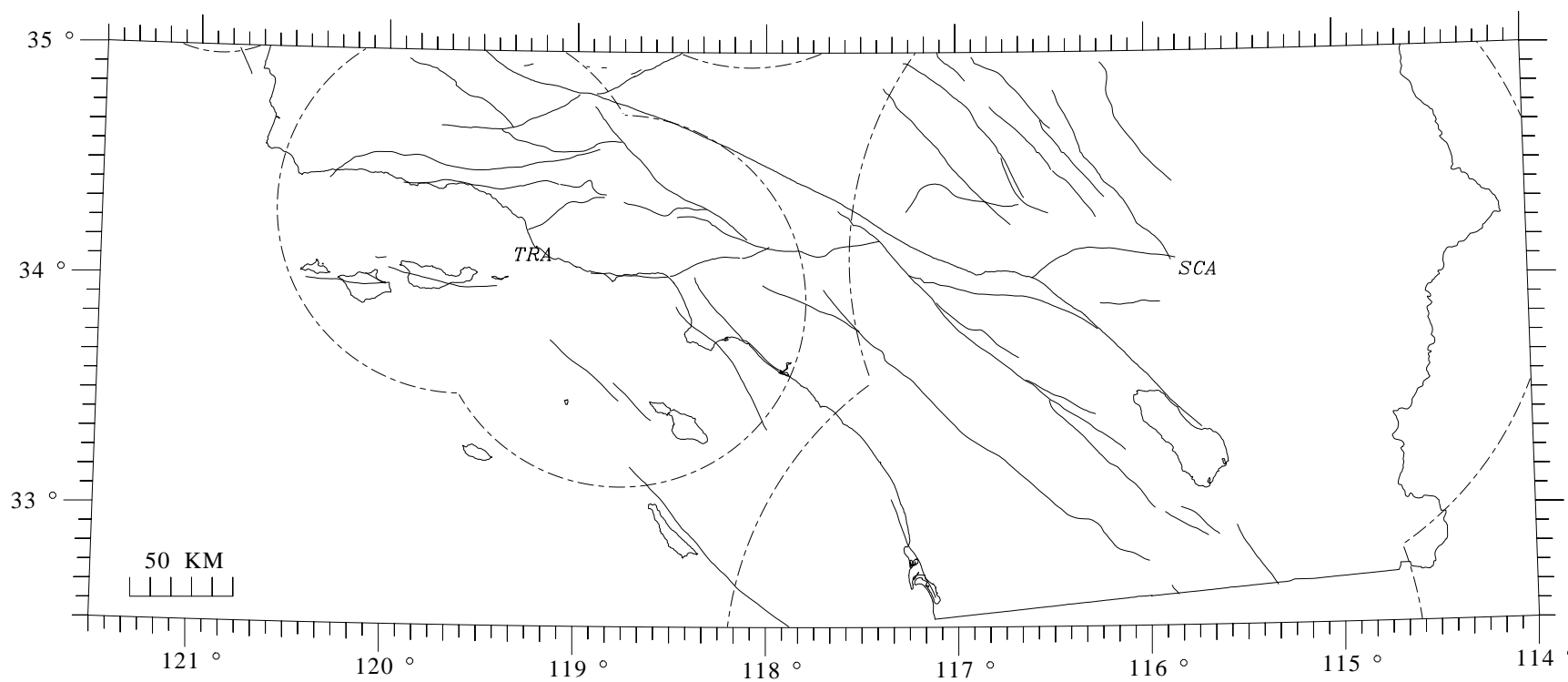


Figure 3 (cont.).

**Table 4: Gradient P-Velocity Models<sup>¶</sup>**

**Auburn - Sierra Foothills (AUB)<sup>2</sup>**

*Eaton & Simirenko (1980)<sup>‡</sup>*

Z (km) 0.00 1.00 34.00 36.00

V (km/s) 4.80 6.20 6.85 8.00

**Bartlett Springs Fault - East (BAE)<sup>2</sup>**

*Castillo and Ellsworth (1993)\**

Z (km) 0.00 4.50 18.60 28.50

V (km/s) 4.20 5.80 6.05 7.80

**Bartlett Springs Fault (BAR)<sup>2</sup>**

*Castillo and Ellsworth (1993)\**

Z (km) 0.00 2.00 19.00 21.00 29.00 31.00

V (km/s) 4.00 5.46 6.08 6.60 6.80 7.80

**Basin & Range (BAS)<sup>0</sup>**

*Prodehl (1979)<sup>†</sup>*

Z (km) 0.00 7.10 28.60 32.60

V (km/s) 4.00 5.95 6.60 7.85

**Coalinga (COA)<sup>2</sup>**

*Eaton (1985)<sup>‡</sup>*

Z (km) 0.00 2.20 14.00 26.00 30.00

V (km/s) 2.00 4.30 6.25 6.80 7.95

**Concord-Calaveras Faults(CON)<sup>2</sup>**

*F. Klein pers. comm. (1991)\**

Z (km) 0.00 2.00 12.00 24.00 26.00

V (km/s) 2.50 4.70 5.77 6.12 7.95

**Coyote Lake (COY)<sup>2</sup>**

*Reasenber & Ellsworth (1982)\**

Z (km) 0.00 1.40 5.80 10.60 24.00 26.00

V (km/s) 3.80 5.30 6.12 6.37 6.59 8.00

**Central Coast Ranges (CST)<sup>2</sup>**

*K. Poley and J. Eaton (pers. comm.)<sup>‡</sup>*

Z (km) 0.00 2.50 8.00 23.80 26.80

V (km/s) 2.95 5.13 6.20 6.65 8.12

**Bear Valley - Diablo Range side (DIA)<sup>2</sup>**

*L. Dietz (pers. comm.)\*; Walter & Mooney (1982)<sup>†</sup>*

Z (km) 0.00 1.50 5.80 14.40 15.60 29.00 31.00

V (km/s) 2.45 4.62 5.80 6.05 6.85 7.15 7.95

**Bear Valley - Gabilan Range side (GAB)<sup>2</sup>**

*L. Dietz (pers. comm.)\*; Walter & Mooney (1982)<sup>†</sup>*

Z (km) 0.00 4.00 22.50 25.50

V (km/s) 3.73 6.07 6.47 7.95

**The Geysers (GEY)<sup>2</sup>**

*Eberhart-Phillips & Oppenheimer (1984)\**

Z (km) 0.00 3.00 8.00 20.00 22.00

V (km/s) 4.10 5.47 5.75 6.02 7.90

**Hayward Fault (HAY)<sup>2</sup>**

*F. Klein pers. comm. (1991)\**

Z (km) 0.00 3.00 9.00 24.00 26.00

V (km/s) 3.70 5.17 5.90 6.38 7.98

**Lassen (LAS)<sup>2</sup>**

*S. Walter (pers. comm.)\**

Z (km) 0.00 4.50 9.00 29.00 31.00

V (km/s) 4.00 6.00 6.28 6.55 8.05

**Mount Lewis (LEW)<sup>2</sup>**

*F. Klein pers. comm. (1991)\**

Z (km) 0.00 2.00 6.30 24.00 26.00

V (km/s) 3.18 5.23 5.89 6.40 7.95

**Livermore-Antioch (LIV)<sup>2</sup>**

*F. Klein pers. comm. (1991)\**

Z (km) 0.00 6.80 14.00 24.00 26.00

V (km/s) 2.27 5.85 6.10 6.44 7.95

**Loma Prieta - Pacific side (LOM)<sup>2</sup>**

*Dietz & Ellsworth (1990)\**

Z (km) 0.00 2.00 6.70 24.00 26.00

V (km/s) 3.00 4.95 5.94 6.64 8.00

**Loma Prieta-North American side (LON)<sup>2</sup>**

*Dietz & Ellsworth (1990)\**

Z (km) 0.00 2.50 8.90 24.00 26.00

V (km/s) 2.53 5.44 6.29 6.69 7.98

**Maacama Fault (MAA)<sup>2</sup>**

*Castillo and Ellsworth (1993)\**

Z (km) 0.00 3.60 16.60 24.00 26.00

V (km/s) 3.93 5.55 5.96 6.80 7.80

**Mammoth Lakes - Long Valley (MAM)<sup>2</sup>**

*Kissling (1987)<sup>†</sup>; Cockerham & Kissling (pers. comm.)\**

Z (km) 0.00 1.30 2.80 7.00 29.00 31.00 49.00 51.00

V (km/s) 3.52 3.67 5.53 6.03 6.28 6.51 6.85 8.00

**North Maacama/Bartlett Springs Faults - (MAN)<sup>2</sup>**

*Castillo and Ellsworth (1993)\**

Z (km) 0.00 2.10 14.00 24.00 26.00

V (km/s) 4.00 5.43 5.93 6.78 7.80

**Cape Mendocino (MEN)<sup>2</sup>**

*M. Magee (pers. comm., 1992)\**

Z (km) 0.00 4.20 22.00 24.00

V (km/s) 3.50 5.05 6.90 7.90

**Morgan Hill (MOR)<sup>2</sup>**

*Cockerham & Eaton (1987)\**

Z (km) 0.00 1.00 4.20 10.00 24.00 26.00

V (km/s) 3.60 4.75 5.48 6.05 6.33 7.60

**North Bay - Coast Ranges (NBY)<sup>2</sup>**

*Eberhart-Phillips & Oppenheimer (1984)\**

Z (km) 0.00 3.00 8.00 20.00 22.00

V (km/s) 4.10 5.47 5.75 6.02 7.90

**Default Northern California (NCG)<sup>1</sup>**

*J. Eaton (pers. comm.)<sup>‡</sup>*

Z (km) 0.00 3.50 23.00 27.00

V (km/s) 2.70 5.70 6.80 8.05

**San Francisco Peninsula (PEN)<sup>2</sup>***Olson (1986)\**

Z (km) 0.00 3.00 9.00 24.00 26.00  
V (km/s) 2.20 5.37 6.10 6.62 7.75

**Parkfield - Gold Hill (PGH)<sup>2</sup>***K. Poley and J. Eaton (pers. comm.)<sup>‡</sup>*

Z (km) 0.00 2.60 9.40 23.30 27.00  
V (km/s) 2.25 5.30 6.10 6.70 8.00

**Parkfield - Middle Mountain (PMM)<sup>2</sup>***K. Poley and J. Eaton (pers. comm.)<sup>‡</sup>*

Z (km) 0.00 2.60 9.40 23.30 27.00  
V (km/s) 2.25 5.30 6.10 6.70 8.00

**Parkfield - Simmler (PSM)<sup>2</sup>***K. Poley and J. Eaton (pers. comm.)<sup>‡</sup>*

Z (km) 0.00 2.60 9.40 23.30 27.00  
V (km/s) 2.25 5.30 6.10 6.70 8.00

**Point Arena - Fort Bragg (PTA)<sup>2</sup>***Castillo and Ellsworth (1993)\**

Z (km) 0.00 2.50 19.80 26.60  
V (km/s) 4.00 5.40 6.40 7.80

**Southern California (SCA)<sup>0</sup>***L. Jones (pers. comm.)<sup>‡</sup>*

Z (km) 0.00 5.50 16.60 31.00 33.00  
V (km/s) 4.80 6.17 6.60 6.85 7.80

**Shasta (SHA)<sup>0</sup>***Zucca et al. (1986)<sup>†</sup>*

Z (km) 0.00 5.00 38.10 42.50  
V (km/s) 3.10 6.20 6.80 7.95

**Transverse Ranges (TRA)<sup>0</sup>***Prodehl (1979)<sup>†</sup>*

Z (km) 0.00 7.00 32.30 36.80  
V (km/s) 3.10 6.10 6.73 8.10

**Tres Piños (TRE)<sup>1</sup>***L. Dietz (pers. comm.)\*; Walter & Mooney (1982)<sup>†</sup>*

Z (km) 0.00 2.00 5.60 14.40 16.00 28.40 30.00  
V (km/s) 2.70 5.33 5.75 6.00 6.83 7.07 7.95

**Walker Pass (WAL)<sup>1</sup>***Jones and Dollar (1986)<sup>‡</sup>*

Z (km) 0.00 1.20 36.40 38.00  
V (km/s) 2.80 5.70 7.20 7.90

<sup>0</sup>No station delays at present.<sup>1</sup>Delays are from original investigator for layer model.<sup>2</sup>Delays revised for gradient model adaptation.

\*Derived from joint hypocenter-velocity determination

<sup>‡</sup>Derived from test/modify procedure<sup>†</sup>Derived from seismic refraction study<sup>¶</sup> $V_P/V_S = 1.78$

Table 5. Seismic Station Traveltime Corrections

| Name | IRIS | Delays (sec) by Velocity Model <sup>‡</sup> |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |       |       |       |       |       |       |       |       |       |       |     |     |       |       |       |
|------|------|---|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-------|-------|-------|
|      |      | CODE  | AUB | BAE | BAR | BAS   | COA   | CON   | COY   | CST   | DIA   | GAB   | GEY   | HAY   | LAS   | LEW   | LIV   | LOM   | LON   | MAA   | MAM | MAN | MEN   | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM   | PTA   | SCA   | SHA | TRA | TRE   | WAL   |       |
| AAR  | NC   | 0.08  |     |     |     |       | -0.08 |       |       |       | -0.12 | -0.12 | -0.12 | 0.22  | 0.01  |       | 1.27  | 1.27  |       |       |     |     |       | -0.12 | -0.12 | 0.05  |       |       |       |       |       |       |     |     |       | -0.12 |       |
| AAS  | NC   |   |     |     |     |       | -1.15 |       |       |       |       |       |       | -0.33 |       |       | -0.82 | 0.19  | 0.19  |       |     |     |       |       |       |       |       |       |       |       |       |       |     |     |       |       |       |
| ABJ  | NC   | -0.09                                       |     |     |     |       | -0.26 |       |       |       | -0.22 | -0.22 | -0.22 | -0.49 | -0.25 |       | 0.90  | 0.90  |       |       |     |     |       |       |       | -0.22 | -0.09 |       |       |       |       |       |     |     |       | -0.22 |       |
| ABR  | NC   | 0.24  |     |     |     |       |       |       |       |       | -0.09 | -0.09 | -0.09 |       |       |       |       |       |       |       |     |     |       |       |       | -0.09 | -0.12 |       |       |       |       |       |     |     |       | -0.09 |       |
| ADW  | NC   | 0.13  |     |     |     |       | -0.83 |       |       |       | -0.01 | -0.01 | -0.01 | -0.40 |       | -0.51 | 0.17  | 0.64  | 0.64  | -1.02 |     |     |       |       |       | -0.01 | -0.03 |       |       |       |       |       |     |     |       | -0.01 |       |
| AFD  | NC   | 0.06  |     |     |     |       | -0.46 |       |       |       | -0.13 | -0.13 | -0.13 | 0.27  | -0.04 |       |       | 0.93  | 0.93  |       |     |     |       |       |       | -0.13 | 0.03  |       |       |       |       |       |     |     |       | -0.13 |       |
| AFH  | NC   | 0.09  |     |     |     |       | 0.16  |       |       |       | -0.22 | -0.22 | -0.22 | 1.17  |       |       |       | 1.30  | 1.30  |       |     |     |       |       |       | -0.22 | -0.22 |       |       |       |       |       |     |     |       | -0.22 |       |
| AFR  | NC   | 0.31  |     |     |     |       | -0.67 |       |       |       | 0.32  | 0.32  | 0.32  | -0.43 |       |       | -0.32 | 0.85  | 0.85  |       |     |     |       |       |       | 0.32  | 0.32  |       |       |       |       |       |     |     |       | 0.32  |       |
| AHR  | NC   | -0.07                                       |     |     |     |       | -0.53 |       |       |       | -0.15 | -0.15 | -0.15 | -0.35 |       |       |       | 0.51  | 0.51  |       |     |     |       |       |       | -0.15 | 0.14  |       |       |       |       |       |     |     |       | -0.15 |       |
| ALA  | NC   | -0.10                                       |     |     |     |       | -1.14 |       |       |       | -0.08 | -0.08 | -0.08 | -0.60 |       | -1.00 |       | 0.47  | 0.47  | -1.07 |     |     |       |       |       | -0.08 | -0.12 |       |       |       |       |       |     |     |       | -0.08 |       |
| ALN  | NC   | -0.02                                       |     |     |     |       | 0.27  |       |       |       | 0.23  | 0.23  | 0.23  | -0.73 |       |       |       | 0.66  | 0.66  |       |     |     |       |       |       | 0.23  | 0.19  |       |       |       |       |       |     |     |       | 0.23  |       |
| AOD  | NC   | 0.02  |     |     |     |       | -0.50 |       |       |       | -0.18 | -0.18 | -0.18 | 0.48  |       |       |       | 1.01  | 1.01  | -1.06 |     |     |       |       |       | -0.18 | -0.18 |       |       |       |       |       |     |     |       | -0.18 |       |
| AOH  | NC   | -0.06                                       |     |     |     |       | 0.22  |       |       |       | -0.05 | -0.05 | -0.05 | -0.08 | -0.16 |       |       | 0.95  | 0.95  |       |     |     | -0.05 |       | -0.05 | -0.08 |       |       |       |       |       |       |     |     |       | -0.05 |       |
| APR  | NC   | -0.01                                       |     |     |     |       | -0.35 |       |       |       | 0.17  | 0.17  | 0.17  | -0.52 |       |       | -0.37 | 0.47  | 0.47  |       |     |     |       |       | 0.17  | 0.19  |       |       |       |       |       |       |     |     |       | 0.17  |       |
| ARJ  | NC   | 0.01  |     |     |     |       | -0.74 |       |       |       | -0.22 | -0.22 | -0.22 | -0.17 |       |       |       | 0.75  | 0.75  | -1.06 |     |     |       |       |       | -0.22 | 0.14  |       |       |       |       |       |     |     |       | -0.22 |       |
| ARR  | NC   | 0.09  |     |     |     |       |       |       |       |       | 0.13  | 0.13  | 0.13  | -0.65 |       |       | -0.38 | 0.37  | 0.37  |       |     |     |       |       | 0.13  | 0.14  |       |       |       |       |       |       |     |     |       | 0.13  |       |
| ASM  | NC   | 0.02  |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       | 1.30  | 1.30  |       |     |     |       |       |       |       |       |       |       |       |       |       |     |     |       |       |       |
| AVR  | NC   | -0.11                                       |     |     |     |       | -0.28 |       |       |       | -0.24 | -0.24 | -0.24 | -0.66 | -0.54 |       |       | 0.54  | 0.54  |       |     |     |       |       |       | -0.24 | -0.04 |       |       |       |       |       |     |     |       | -0.24 |       |
| BAP  | NC   |   |     |     |     |       | -0.25 |       | 0.03  | -0.06 | -0.06 |       | -0.36 |       |       |       |       | 0.03  | 0.03  |       |     |     |       |       |       | -0.29 |       | -0.36 | -0.36 | -0.36 |       |       |     |     |       |       |       |
| BAV  | NC   |   |     |     |     | -0.51 | 0.03  | -0.19 | 0.50  | 0.29  | 0.29  | 0.29  | 0.04  | 0.58  |       | -0.38 |       | 0.21  | 0.21  |       |     |     | -2.16 | -0.30 | 0.04  | -0.10 |       | 0.02  | 0.02  | 0.02  |       |       |     |     |       | -0.09 |       |
| BBG  | NC   |   |     |     |     | -0.09 | 0.62  |       | 0.69  | 0.61  | 0.61  | 0.12  | 1.09  |       |       |       |       | 0.50  | 0.50  |       |     |     |       |       |       | 0.12  | 0.13  |       | 0.12  | 0.12  | 0.12  |       |     |     |       | 0.20  |       |
| BBN  | NC   |   |     |     |     | -0.18 | 0.14  |       | 0.26  | 0.24  | 0.24  | 0.26  | 0.53  |       |       |       |       | 0.53  | 0.53  |       |     |     |       |       |       | 0.26  | 0.33  |       | 0.30  | 0.30  | 0.30  |       |     |     |       | 0.46  |       |
| BCG  | NC   |   |     |     |     | -0.01 | 0.10  | 0.33  | -0.13 | 0.06  | 0.06  | 0.16  | 0.65  |       | -0.03 |       |       | -0.09 | -0.09 |       |     |     |       | 0.44  | 0.16  | 0.15  |       | 0.16  | 0.16  | 0.16  |       |       |     |     |       | 0.41  |       |
| BCW  | NC   |   |     |     |     | -0.19 | 0.16  |       | -0.03 | -0.02 | -0.02 |       | 0.63  |       | -0.33 |       |       | -0.10 | -0.10 |       |     |     |       |       |       | -0.26 |       | -0.24 | -0.24 | -0.24 |       |       |     |     |       |       |       |
| BEH  | NC   |   |     |     |     | -0.19 | 0.31  | -0.07 | 0.58  | 0.48  | 0.48  | 0.19  | 0.13  |       | -0.29 |       |       | 0.49  | 0.49  |       |     |     |       |       |       | 0.19  | -0.03 |       | 0.19  | 0.19  | 0.19  |       |     |     |       | 0.07  |       |
| BEM  | NC   |   |     |     |     | -0.36 | 0.07  | -0.08 | 0.44  | 0.35  | 0.35  | 0.03  | 0.28  |       | -0.40 |       |       | 0.27  | 0.27  |       |     |     |       |       | -0.18 | 0.03  | -0.10 |       | 0.03  | 0.03  | 0.03  |       |     |     |       | -0.06 |       |
| BHR  | NC   |   |     |     |     | -0.20 | 0.88  | -0.10 | 0.50  | 0.44  | 0.44  |       | 0.34  |       | -0.09 |       |       | 0.57  | 0.57  |       |     |     |       |       | 0.12  | -0.06 |       |       |       |       |       |       |     |     | 0.10  |       |       |
| BJC  | NC   |   |     |     |     | -0.54 | 0.07  | -0.10 | -0.15 | -0.29 | -0.29 | -0.25 | -0.51 |       | -0.86 |       |       | -0.72 | -0.72 |       |     |     |       |       | -0.34 | -0.25 | -0.43 |       | -0.03 | -0.03 | -0.03 |       |     |     |       | -0.19 |       |
| BJO  | NC   |   |     |     |     | -0.47 | 0.37  |       | -0.08 | -0.10 | -0.10 | -0.19 | -0.46 |       | -0.54 |       |       | -0.65 | -0.65 |       |     |     |       |       | -0.05 | -0.19 | -0.11 |       | -0.19 | -0.19 | -0.19 |       |     |     |       | 0.10  |       |
| BLR  | NC   |   |     |     |     | 0.04  | 0.21  | 0.47  | -0.09 | 0.22  | 0.22  | 0.26  | 0.72  |       | 0.04  |       |       | 0.19  | 0.19  |       |     |     |       |       | 0.53  | 0.26  | 0.45  |       | 0.26  | 0.26  | 0.26  |       |     |     |       | 0.63  |       |
| BMS  | NC   |   |     |     |     | -0.18 | 0.56  |       |       | 0.62  | 0.62  | 0.08  | 0.65  |       | 0.32  |       |       | 0.85  | 0.85  | -0.35 |     |     |       |       |       | 0.08  | 0.17  |       | 0.08  | 0.08  | 0.08  |       |     |     |       | 0.07  |       |
| BPC  | NC   |   |     |     |     | -0.25 | 0.17  | 0.10  | -0.07 | 0.07  | 0.07  | -0.11 | -0.02 |       | -0.27 |       |       | -0.08 | -0.08 |       |     |     |       |       | -0.02 | -0.11 | -0.17 |       | -0.03 | -0.03 | -0.03 |       |     |     |       | 0.04  |       |
| BPI  | NC   |   |     |     |     | -0.73 | 0.10  | -0.10 | -0.26 | -0.12 | -0.12 | -0.16 | -0.46 |       | -0.62 |       |       | -0.69 | -0.69 |       |     |     |       |       | -0.61 | -0.16 | -0.17 |       | -0.57 | -0.57 | -0.57 |       |     |     |       | -0.05 |       |
| BPO  | NC   |   |     |     |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |     |       |       |       |       |       |       |       |       |       |       |     |     |       |       |       |
| BPR  | NC   |   |     |     |     |       | -0.02 | -0.02 | -0.15 | -0.06 | -0.06 |       | -0.20 |       | 0.12  |       |       | -0.16 | -0.16 |       |     |     |       |       | -0.27 |       | -0.35 |       | -0.28 | -0.28 | -0.28 |       |     |     |       | -0.03 |       |
| BRM  | NC   |   |     |     |     | -0.05 |       | 0.57  |       | 1.09  | 1.09  | 0.21  | 0.78  |       | 0.54  |       |       | 0.77  | 0.77  | -0.29 |     |     |       |       |       | 0.21  | 0.54  |       | 0.21  | 0.21  | 0.21  |       |     |     |       | 0.52  |       |
| BRV  | NC   |   |     |     |     | -0.29 | 0.64  |       | 0.20  | 0.46  | 0.46  | 0.31  | 0.01  |       |       |       |       | 0.19  | 0.19  |       |     |     |       |       |       | 0.31  | 0.23  |       | 0.14  | 0.14  | 0.14  |       |     |     |       | 0.30  |       |
| BSG  | NC   |   |     |     |     | -0.58 | 0.28  |       | -0.27 | -0.32 | -0.32 | -0.24 | -0.42 |       | -0.66 |       |       | -0.61 | -0.61 |       |     |     |       |       |       | -0.24 | -0.46 |       | -0.54 | -0.54 | -0.54 |       |     |     |       | -0.29 |       |
| BSL  | NC   |   |     |     |     |       | 0.34  | 0.16  | 0.54  | 0.51  | 0.51  | 0.24  | 0.66  |       | 0.18  |       |       | 0.82  | 0.82  |       |     |     |       |       | 0.35  | 0.24  | -0.02 |       | 0.24  | 0.24  | 0.24  |       |     |     |       | 0.28  |       |
| BSM  | NC   |   |     |     |     | -0.29 | 0.38  | 0.13  | -0.11 | 0.01  | 0.01  |       | 0.07  |       |       |       |       | -0.07 | -0.07 |       |     |     |       |       | -0.25 | -0.19 |       | -0.29 | -0.29 | -0.29 |       |       |     |     | -0.09 |       |       |
| BSR  | NC   |   |     |     |     | -0.40 | -0.58 | -0.03 | -0.11 | -0.20 | -0.20 | -0.20 | -0.56 |       | -0.57 |       |       | -0.56 | -0.56 |       |     |     |       |       | -2.09 | -0.13 | -0.20 | -0.30 |       | -0.20 | -0.20 | -0.20 |     |     |       |       | -0.03 |
| BVL  | NC   |   |     |     |     | -0.38 | 0.17  | 0.26  | -0.05 | 0.17  | 0.17  | 0.03  | -0.16 |       | -0.33 |       |       | -0.44 | -0.44 |       |     |     |       |       | -0.01 | 0.03  | 0.24  |       | 0.03  | 0.03  | 0.03  |       |     |     |       | 0.35  |       |
| BVY  | NC   |   |     |     |     | -0.29 | 0.29  | 0.39  | -0.22 |       |       | -0.06 | 0.12  |       | 0.23  |       |       | -0.45 | -0.45 |       |     |     |       |       | 0.58  | -0.06 | 0.17  |       | -0.06 | -0.06 | -0.06 |       |     |     |       | 0.45  |       |
| CAD  | NC   |   |     |     |     | -0.04 | -0.11 |       |       | 0.09  | 0.09  | -0.09 | -0.05 |       | 0.26  | 0.30  | 0.20  | 0.20  |       |       |     |     |       |       | 0.40  | -0.09 | -0.08 | -0.30 |       | -0.09 | -0.09 | -0.09 |     |     |       | -0.20 |       |
| CAI  | NC   |   |     |     |     | -0.51 |       |       |       | -0.13 | -0.13 | -0.13 | -0.34 |       | -0.45 | -0.71 | -0.17 | -0.17 |       |       |     |     |       |       | -0.42 | -0.29 | -0.13 | -0.15 |       | -0.13 | -0.13 | -0.13 |     |     |       | -0.13 |       |

| Name | IRIS | Delays (sec) By Velocity Model <sup>‡</sup> |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
|------|------|---|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-----|-------|-------|-------|
|      |      | CODE  | AUB   | BAE   | BAR   | BAS   | COA   | CON | COY   | CST   | DIA   | GAB   | GEY   | HAY   | LAS   | LEW   | LIV   | LOM   | LON   | MAA   | MAM | MAN   | MEN   | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM   | PTA | SCA | SHA | TRA   | TRE   | WAL   |
| CAL  | NC   |   |       |       |       | -0.14 | -0.08 |     |       | 0.07  | 0.07  | -0.01 | -0.19 |       | -0.14 | -0.12 | 0.62  | 0.62  |       |       |     |       | -1.54 | 0.01  | -0.01 | -0.04 | -0.03 | -0.01 | -0.01 | -0.01 |     |     |     |       |       |       |
| CAO  | NC   |   |       |       | -0.17 | -0.31 | -0.26 |     |       | 0.40  | 0.40  | -0.01 | -0.39 |       | -0.12 | -0.07 | 0.48  | 0.48  |       |       |     |       | -1.63 | -0.07 | -0.01 | -0.02 | -0.12 | -0.01 | -0.01 | -0.01 |     |     |     |       |       | -0.11 |
| CBR  | NC   |   |       |       | -0.17 |       |       |     | 0.04  | 0.04  | 0.04  | 0.10  |       | 0.45  | -0.15 | 0.77  | 0.77  |       |       |       |     |       | 0.35  | 0.04  | 0.04  | 0.13  | 0.04  | 0.04  | 0.04  |       |     |     |     |       |       | 0.04  |
| CBS  | NC   |   |       |       |       | 0.56  |       |     |       |       |       |       | 0.95  |       | 0.74  | 0.30  | 1.07  | 1.07  |       |       |     |       | 0.66  |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CBW  | NC   |   |       |       |       | 0.15  |       |     | 0.07  | 0.07  | 0.07  | 0.41  |       | 0.47  | -0.19 | 0.92  | 0.92  |       |       |       |     |       | 0.27  | 0.08  | 0.07  | 0.22  | 0.07  | 0.07  | 0.07  |       |     |     |     |       | 0.07  |       |
| CCO  | NC   |   |       |       |       | 0.15  | 0.24  |     | 0.82  | 0.82  | 0.31  | 0.15  |       | 0.15  | 0.31  | 0.82  | 0.82  |       |       |       |     |       | 0.38  | 0.31  | 0.31  | 0.33  | 0.31  | 0.31  | 0.31  |       |     |     |     |       | 0.61  |       |
| CCY  | NC   |   |       |       | -0.41 |       |       |     | -0.24 | -0.24 | -0.24 | -0.40 |       | -0.33 | -0.47 | 0.15  | 0.15  |       |       |       |     |       | -0.41 | -0.24 | -0.34 | -0.34 |       |       |       |       |     |     |     |       | -0.24 |       |
| CDA  | NC   |   |       |       |       | 0.35  |       |     | -0.20 | -0.20 | -0.20 | 0.63  |       | 0.65  | 0.03  | 1.26  | 1.26  |       |       |       |     |       | 0.40  | -0.20 | -0.20 |       |       |       |       |       |     |     |     |       | -0.20 |       |
| CDO  | NC   |   |       |       |       | 0.37  |       |     | 0.20  | 0.20  | 0.20  | 0.74  |       | 0.79  | -0.01 | 1.29  | 1.29  |       |       |       |     |       | 0.79  | 0.20  | 0.20  | 0.61  |       |       |       |       |     |     |     |       | 0.20  |       |
| CDU  | NC   |   |       |       |       | 0.55  |       |     | 0.21  | 0.21  | 0.21  | 1.05  |       | 0.49  | 0.21  | 1.21  | 1.21  |       |       |       |     |       | 0.19  | 0.19  | 0.21  |       |       |       |       |       |     |     |     |       | 0.21  |       |
| CDV  | NC   |   |       |       |       | 0.13  | -0.01 |     |       |       |       |       | 0.11  |       | 0.09  | -0.12 | 0.82  | 0.82  |       |       |     | 0.40  | 0.04  |       | -0.14 | 0.06  |       |       |       |       |     |     |     |       |       |       |
| CGP  | NC   |   |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CLC  | NC   |   |       |       | -0.06 | 0.53  |       |     | 0.02  | 0.02  | 0.02  |       |       | 0.24  | -0.13 | 0.71  | 0.71  |       |       |       |     |       | 0.09  | 0.02  | 0.12  | -0.03 | 0.02  | 0.02  | 0.02  |       |     |     |     |       | 0.02  |       |
| CMC  | NC   |   |       |       | -0.20 |       |       |     | -0.05 | -0.05 | -0.05 | -0.05 |       | -0.10 | -0.32 | 0.49  | 0.49  |       |       |       |     |       | -0.05 | -0.05 | -0.05 | -0.13 | -0.05 | -0.05 | -0.05 |       |     |     |     |       | -0.05 |       |
| CMH  | NC   |   |       |       | -0.05 | 0.24  |       |     | 0.69  | 0.69  | 0.16  | 0.01  |       | -0.01 | 0.08  | 0.76  | 0.76  |       |       |       |     |       | 0.28  | 0.16  | 0.09  | 0.14  | 0.16  | 0.16  | 0.16  |       |     |     |     |       |       |       |
| CMJ  | NC   |   |       |       | -0.02 | 0.23  |       |     | -0.01 | -0.01 | -0.01 | -0.12 |       | -0.01 |       | 0.57  | 0.57  |       |       |       |     |       | 0.04  | -0.01 | 0.06  | -0.06 | -0.01 | -0.01 | -0.01 |       |     |     |     |       | -0.01 |       |
| CML  | NC   |   |       |       |       | 0.17  | 0.04  |     |       |       |       |       | 0.17  |       | 0.12  | -0.03 | 0.80  | 0.80  |       |       |     |       | 0.12  |       | 0.11  | 0.09  |       |       |       |       |     |     |     |       |       |       |
| CMM  | NC   |   |       |       | -0.10 | -0.04 |       |     | 0.46  | 0.46  |       | -0.05 |       | 0.09  | -0.12 | 0.76  | 0.76  |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CMN  | NC   |   |       |       |       | 0.50  |       |     | -0.10 | -0.10 | -0.10 | 0.49  |       | 0.20  | 0.11  | 1.02  | 1.02  |       |       |       |     |       | 0.15  | -0.10 | -0.06 | 0.44  |       |       |       |       |     |     |     |       | -0.10 |       |
| CMO  | NC   |   |       |       |       | 0.19  |       |     | 0.06  | 0.06  | 0.06  | 0.55  |       | 0.80  | -0.06 | 0.92  | 0.92  |       |       |       |     |       | 0.91  | 0.06  | 0.06  | 0.55  | 0.06  | 0.06  | 0.06  |       |     |     |     |       | 0.06  |       |
| CMP  | NC   |   |       |       | -0.44 | -0.50 | -0.21 |     | 0.96  | 0.96  |       | -0.23 |       | -0.19 | -0.29 | 0.59  | 0.59  |       |       |       |     |       | -0.27 |       | 0.02  |       |       |       |       |       |     |     |     |       |       |       |
| CMR  | NC   |   |       |       |       | 0.16  | 0.04  |     | -0.06 | -0.06 | -0.06 | 0.22  |       | 0.06  | -0.11 | 0.73  | 0.73  |       |       |       |     |       | -0.03 | -0.06 | -0.07 | 0.09  | -0.06 | -0.06 | -0.06 |       |     |     |     |       | -0.06 |       |
| COS  | NC   |   |       |       |       | -0.25 | -0.01 |     |       |       |       | 0.19  |       | 0.23  | -0.35 | 0.91  | 0.91  |       |       |       |     |       | 0.01  |       | 0.14  |       |       |       |       |       |     |     |     |       |       |       |
| CPI  | NC   |   |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CPL  | NC   |   |       |       | -0.03 | 0.25  |       |     | -0.03 | -0.03 | -0.03 | -0.06 |       |       | -0.12 | 0.60  | 0.60  |       |       |       |     |       | -0.05 | -0.03 | 0.15  | -0.10 |       |       |       |       |     |     |     |       | -0.03 |       |
| CPM  | NC   |   |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CRP  | NC   |   |       |       | -0.24 |       |       |     | -0.29 | -0.29 | -0.29 | 0.14  |       | 0.47  | -0.60 | 0.66  | 0.66  |       |       |       |     |       | 0.21  | -0.29 | -0.29 | 0.15  | -0.29 | -0.29 | -0.29 |       |     |     |     |       | -0.29 |       |
| CSA  | NC   |   |       |       |       | 0.72  |       |     | 0.10  | 0.10  | 0.10  | 0.97  |       | 0.35  | 0.25  | 1.25  | 1.25  |       |       |       |     |       | 0.28  | 0.10  | 0.10  |       | 0.10  | 0.10  | 0.10  |       |     |     |     |       | 0.10  |       |
| CSL  | NC   |   |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CSP  | NC   |   |       |       |       | 0.04  |       |     |       |       |       |       | 0.17  |       | -0.03 | -0.17 | 0.51  | 0.51  |       |       |     |       | 0.11  | 0.17  |       |       |       |       |       |       |     |     |     |       |       |       |
| CST  | NC   |   |       |       |       | 0.20  | 0.40  |     |       |       |       |       | 0.53  |       | 0.49  | 0.17  | 1.04  | 1.04  |       |       |     |       | 0.40  |       | 0.40  |       |       |       |       |       |     |     |     |       |       |       |
| CSV  | NC   |   |       |       |       |       |       |     |       |       |       |       | 0.69  |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CVA  | NC   |   |       |       |       | 0.42  |       |     |       |       |       |       | 0.44  |       | 0.15  | 0.22  | 0.89  | 0.89  |       |       |     |       | 0.16  |       | 0.22  | 0.26  |       |       |       |       |     |     |     |       |       |       |
| CVL  | NC   |   |       |       |       | 0.49  |       |     | 0.20  | 0.20  | 0.20  | 0.55  |       | 0.31  | 0.19  | 1.06  | 1.06  |       |       |       |     |       | 0.32  | 0.20  | 0.28  | 0.43  |       |       |       |       |     |     |     |       | 0.20  |       |
| CVP  | NC   |   |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| CYB  | NC   |   |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |     |     |     |       |       |       |
| GAC  | NC   |   |       |       |       | 0.92  |       |     |       |       | -0.09 | 0.73  |       |       |       | 0.92  | 0.92  |       |       |       |     |       | 0.01  |       |       |       |       |       |       |       |     |     |     |       |       |       |
| GAR  | NC   |   | 1.56  | 1.17  |       | 0.63  |       |     |       |       |       | 0.90  |       | 0.28  | 1.30  | 1.30  | 1.21  |       | 0.14  |       |     |       | 0.14  | 0.12  |       |       |       |       | 0.69  |       |     |     |     |       |       |       |
| GAX  | NC   |   | -0.06 | -0.15 |       | -0.48 |       |     | -0.30 | -0.30 | -0.32 | -0.30 |       | -0.71 | -0.32 | -0.32 | -0.44 |       | -0.06 |       |     |       | -0.23 | -0.19 |       |       |       |       | -0.41 |       |     |     |     | -0.30 |       |       |
| GBD  | NC   |   |       | 0.03  | -0.20 |       |       |     | -0.06 | -0.06 | -0.06 |       |       |       |       | -0.10 |       |       | -0.25 | -0.46 |     |       | -0.04 | -0.06 |       |       |       |       | -0.18 |       |     |     |     | -0.06 |       |       |
| GBG  | NC   |   | 1.54  | 0.11  |       | 0.10  |       |     |       |       |       | 0.03  | 0.15  |       | -0.02 | 0.17  | 0.17  | -0.05 | 0.20  |       |     |       | 0.13  | 0.03  |       |       |       |       | -0.15 |       |     |     |     |       |       |       |
| GBM  | NC   |   | -0.16 | -0.43 |       |       |       |     |       |       |       |       |       |       |       |       | -0.23 |       | -0.09 |       |     |       | -0.03 |       |       |       |       | 0.30  |       |       |     |     |     |       |       |       |
| GCB  | NC   |   | 0.12  | -0.21 |       |       |       |     |       |       |       |       |       |       |       | 0.20  | 0.20  | -0.07 | -0.14 | -0.49 |     |       | -0.05 |       |       |       |       | -0.09 |       |       |     |     |     |       |       |       |
| GCR  | NC   |   |       |       |       | -0.37 |       |     | -0.25 | -0.25 | -0.26 | -0.30 |       | -0.53 | -0.30 | -0.30 |       |       |       |       |     |       | -0.23 |       |       |       |       |       |       |       |     |     |     |       | -0.25 |       |
| GCV  | NC   |   | 0.30  | 0.34  |       | -0.31 |       |     |       |       | 0.06  | -0.04 |       |       | 0.15  | 0.15  | 0.03  |       | 0.30  | -0.33 |     |       | 0.06  | 0.05  |       | 0.05  | 0.05  | 0.05  | -0.05 |       |     |     |     |       |       |       |
| GCW  | NC   |   | 0.05  | -0.12 |       |       |       |     | -0.25 | -0.25 | -0.26 |       |       | 0.38  | 0.38  | -0.12 |       | -0.26 | -0.40 |       |     | -0.09 | -0.07 |       |       |       |       | -0.32 |       |       |     |     |     | -0.25 |       |       |
| GDC  | NC   |   | 0.15  | 0.40  |       |       |       |     | -0.11 | 0.05  | 0.05  | 0.07  | 0.11  |       | 0.23  | 0.23  | 0.12  |       | 0.15  | -0.65 |     |       | 0.14  | 0.09  |       |       |       | 0.09  |       |       |     |     |     | 0.05  |       |       |
| GDX  | NC   |   |       |       |       | -0.09 |       |     | -0.20 | -0.20 | -0.19 | -0.29 |       |       | 0.01  | 0.01  |       |       |       |       |     |       | -0.21 | 0.03  |       |       |       |       |       |       |     |     |     |       | -0.20 |       |

| Name | IRIS | Delays (sec) By Velocity Model <sup>‡</sup> |       |       |     |       |       |       |       |       |       |       |       |       |       |      |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |     |     |     |       |       |
|------|------|---|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|-----|-------|-------|
|      |      | CODE  | AUB   | BAE   | BAR | BAS   | COA   | CON   | COY   | CST   | DIA   | GAB   | GEY   | HAY   | LAS   | LEW  | LIV   | LOM   | LON   | MAA   | MAM | MAN   | MEN   | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM   | PTA   | SCA   | SHA | TRA | TRE | WAL   |       |
| GGP  | NC   |   |       |       |     | 0.16  |       |       |       | -0.09 | -0.09 | -0.12 | -0.15 |       |       |      | 0.10  | 0.10  |       |       |     |       | -0.43 |       | 0.03  | 0.07  |       |       |       |       |       |       |     |     |     |       | -0.09 |
| GGU  | NC   |   | 0.09  | 0.13  |     | -0.40 |       |       |       |       |       |       | -0.08 | -0.30 |       |      |       |       | 0.20  |       |     | 0.04  | -0.72 |       | 0.02  |       |       |       |       |       | 0.11  |       |     |     |     |       |       |
| GHC  | NC   |   |       |       |     | -0.56 |       |       |       | -0.07 | -0.07 | -0.03 | 0.42  |       |       |      | -0.39 | -0.39 |       |       |     |       | -0.27 |       | 0.06  | -0.04 |       |       |       |       |       |       |     |     |     | -0.07 |       |
| GHG  | NC   |   | 0.01  | -0.22 |     |       |       |       |       | -0.05 | -0.05 | -0.12 |       |       |       |      |       |       | -0.12 |       |     | -0.13 | -0.12 |       | -0.13 | -0.05 |       |       |       |       |       | -0.18 |     |     |     | -0.05 |       |
| GHL  | NC   |   | 0.02  | -0.18 |     | -0.53 |       |       |       | -0.18 | -0.18 | -0.19 | -0.32 |       |       |      | 0.10  | 0.10  | -0.17 |       |     | -0.11 | -0.37 |       | -0.02 | -0.04 |       | -0.04 | -0.04 | -0.04 | -0.16 |       |     |     |     | -0.18 |       |
| GHM  | NC   |   | -0.29 | -0.06 |     |       |       |       |       | 0.17  | 0.17  | 0.17  |       |       |       |      |       |       | 0.21  |       |     |       | -0.19 |       | 0.15  | 0.17  |       |       |       |       | 0.15  |       |     |     |     | 0.17  |       |
| GHO  | NC   |   | -0.10 | 0.03  |     | -0.80 |       |       |       |       |       | 0.03  |       |       |       |      | -0.21 | -0.21 | 0.21  |       |     | -0.01 | -0.57 |       | 0.16  |       |       |       |       |       | 0.11  |       |     |     |     |       |       |
| GHV  | NC   |   | -0.02 | -0.21 |     | -0.50 |       |       |       |       |       | 0.06  |       |       |       |      | 0.22  | 0.22  | -0.03 |       |     | -0.03 | 0.03  |       | 0.04  |       |       |       |       |       | -0.01 |       |     |     |     |       |       |
| GMC  | NC   |   | -0.13 | -0.13 |     | 0.03  |       |       |       | -0.18 | -0.18 | -0.13 | 0.23  |       |       |      | -0.25 | -0.25 | -0.08 |       |     | -0.13 | -0.82 |       | -0.04 | -0.02 |       |       |       |       | -0.06 |       |     |     |     | -0.18 |       |
| GMK  | NC   |   | 0.30  | 0.06  |     |       |       |       |       | 0.25  | 0.25  | 0.26  | 0.46  |       |       |      | 0.55  | 0.55  | 0.11  |       |     | 0.28  | 0.12  |       | 0.12  | -0.04 |       |       |       |       | 0.17  |       |     |     |     | 0.25  |       |
| GMO  | NC   |   |       |       |     | 0.36  |       |       |       | -0.13 | -0.13 | -0.08 | -0.23 |       |       |      | -0.33 | -0.33 |       |       |     |       | -0.68 |       | -0.03 | -0.13 |       | -0.13 | -0.13 | -0.13 |       |       |     |     |     | -0.13 |       |
| GNA  | NC   |   | -0.12 | -0.08 |     | -0.02 |       |       |       |       |       |       |       |       |       |      | 0.08  | 0.08  | 0.08  |       |     | 0.18  | -0.62 |       | -0.08 |       |       |       |       |       | -0.06 |       |     |     |     | -0.06 |       |
| GPM  | NC   |   | 0.22  | 0.07  |     | -0.37 |       |       |       | -0.06 | -0.06 | -0.08 | -0.03 |       |       |      | 0.25  | 0.25  | -0.02 |       |     | 0.05  | -0.03 |       | 0.08  | 0.02  |       |       |       |       | -0.03 |       |     |     |     | -0.06 |       |
| GRO  | NC   |   |       |       |     |       |       |       |       |       |       |       |       |       |       |      |       |       |       |       |     | 0.41  |       |       |       |       |       |       |       |       |       |       |     |     |     |       |       |
| GRT  | NC   |   | 0.07  | -0.34 |     | 0.43  |       |       |       | -0.26 | -0.26 | -0.19 | 0.42  |       |       |      | 0.19  | 0.19  | -0.26 |       |     | -0.14 |       |       | -0.24 | -0.13 |       |       |       |       | -0.30 |       |     |     |     | -0.26 |       |
| GSG  | NC   |   | 0.18  | 0.02  |     | 0.91  |       |       |       | 0.28  | 0.28  | 0.26  | 1.13  |       |       |      |       |       | -0.03 |       |     | 0.26  |       |       | 0.29  | 0.37  |       |       |       |       | 0.12  |       |     |     |     | 0.28  |       |
| GSN  | NC   |   | 0.16  | 0.02  |     | -0.31 |       |       |       | 0.03  | 0.03  | 0.05  | -0.17 |       |       |      | -0.07 | -0.07 | 0.06  |       |     | 0.44  | -0.36 |       | 0.09  | 0.19  |       |       |       |       | 0.01  |       |     |     |     | 0.03  |       |
| GSS  | NC   |   |       |       |     | 0.27  |       |       |       | -0.02 | -0.02 | -0.02 | 0.17  |       |       |      | -0.18 | -0.18 |       |       |     |       |       |       | -0.13 |       |       |       |       |       |       |       |     |     |     | -0.02 |       |
| GTS  | NC   |   | -0.25 | -0.25 |     |       |       |       |       |       |       |       |       |       |       |      | 0.70  | 0.70  | 0.05  |       |     | -0.33 | 0.01  |       | 0.16  |       |       |       |       |       | 0.19  |       |     |     |     |       |       |
| GWK  | NC   |   | 0.14  | -0.12 |     | 0.14  |       |       |       | 0.19  | 0.19  | 0.05  |       |       |       |      |       |       | 0.03  |       |     | 0.01  |       |       | -0.11 | 0.15  |       |       |       |       | 0.01  |       |     |     |     | 0.19  |       |
| GWR  | NC   |   | 0.18  | -0.03 |     |       |       |       |       | 0.05  | 0.05  | -0.24 |       |       |       |      |       |       | 0.04  |       |     | -0.02 | -0.43 |       | -0.11 | 0.05  |       |       |       |       | -0.20 |       |     |     |     | 0.05  |       |
| HAZ  | NC   |   |       |       |     | 0.67  | 0.19  | -0.24 | 0.28  | 0.28  | -0.22 | -0.23 |       |       | 0.21  | 0.06 | -0.44 | -0.44 |       |       |     |       |       | 0.34  | -0.22 | 0.26  | -0.56 | -0.22 | -0.22 | -0.22 |       |       |     |     |     | 0.37  |       |
| HBT  | NC   |   |       |       |     | 0.63  | 0.42  | -0.01 | 0.43  | 0.43  | -0.16 | 0.10  |       |       | 0.39  |      | -0.44 | -0.44 |       |       |     |       |       | 0.48  | -0.16 | 0.31  |       | -0.16 | -0.16 | -0.16 |       |       |     |     |     |       | 0.58  |
| HCA  | NC   |   |       |       |     | 0.35  | -0.33 | 0.19  | 0.33  | 0.33  | 0.03  | 0.37  |       |       | -0.09 |      | 0.26  | 0.26  |       |       |     |       |       | 0.06  | 0.03  | -0.07 | -0.24 | 0.03  | 0.03  | 0.03  |       |       |     |     |     | 0.07  |       |
| HCB  | NC   |   |       |       |     | 0.86  | 0.01  | 0.01  | 0.21  | 0.21  | -0.17 | 0.11  |       |       | 0.18  | 0.13 | 0.13  | 0.13  |       |       |     |       |       | 0.24  | -0.17 | 0.07  | -0.19 | -0.17 | -0.17 | -0.17 |       |       |     |     |     | 0.40  |       |
| HCO  | NC   |   |       |       |     | 0.23  | 0.13  | -0.09 | 0.26  | 0.26  | -0.15 | -0.30 |       |       | 0.22  |      | 0.05  | 0.05  |       |       |     |       |       | 0.37  | -0.15 | 0.07  | -0.32 | -0.15 | -0.15 | -0.15 |       |       |     |     |     | 0.31  |       |
| HCR  | NC   |   |       |       |     | 0.17  | -0.38 | 0.07  | 0.04  | 0.04  | -0.18 | -0.44 |       |       | -0.13 |      | 0.02  | 0.02  |       |       |     |       |       | -0.02 | -0.18 | -0.37 | -0.20 | -0.18 | -0.18 | -0.18 |       |       |     |     |     | -0.20 |       |
| HDL  | NC   |   |       |       |     | 0.38  | 0.01  | -0.19 | -0.04 | -0.04 | -0.28 | -0.58 |       |       | 0.02  |      | -0.24 | -0.24 |       |       |     |       |       | 0.15  | -0.28 |       | -0.52 | -0.28 | -0.28 | -0.28 |       |       |     |     |     | 0.20  |       |
| HER  | NC   |   |       |       |     |       |       |       |       |       |       |       |       |       |       |      |       |       | -0.03 | -0.03 |     |       |       |       |       |       |       |       |       |       |       |       |     |     |     |       |       |
| HFE  | NC   |   |       |       |     | -0.09 | 0.06  | -0.41 |       | 0.29  | 0.29  | -0.05 | 0.06  |       |       |      | -0.21 | 0.01  | 0.23  | 0.23  |     |       |       | -0.16 | -0.05 | -0.11 |       | -0.05 | -0.05 | -0.05 |       |       |     |     |     |       |       |
| HFP  | NC   |   |       |       |     | -0.48 | -0.36 | 0.16  | -0.20 | -0.22 | -0.22 | -0.27 | -0.62 |       |       |      |       |       | -0.62 | -0.62 |     |       |       | 0.28  | -0.27 | -0.11 | -0.88 | -0.27 | -0.27 | -0.27 |       |       |     |     |     | 0.17  |       |
| HGS  | NC   |   |       |       |     | 0.01  | -0.33 | -0.43 |       | 0.27  | 0.27  | -0.07 | -0.35 |       |       |      | -0.19 | -0.07 | 0.33  | 0.33  |     |       |       | -0.15 | -0.07 | -0.08 | -0.15 | -0.07 | -0.07 | -0.07 |       |       |     |     |     | -0.09 |       |
| HGW  | NC   |   |       |       |     | 0.06  | -0.30 | -0.11 | -0.14 | -0.14 | -0.24 | -0.50 |       |       |       |      | -0.11 | -0.07 | -0.12 | -0.12 |     |       |       | 0.02  | -0.24 | -0.47 | -0.41 | -0.24 | -0.24 | -0.24 |       |       |     |     |     | -0.33 |       |
| HJG  | NC   |   |       |       |     | -0.36 | 0.10  | 0.11  | -0.20 | -0.20 | -0.20 | -0.34 | -0.63 |       |       |      | 0.05  |       | -0.51 | -0.51 |     |       |       | 0.19  | -0.34 | -0.09 | -0.64 | -0.34 | -0.34 | -0.34 |       |       |     |     |     | 0.11  |       |
| HJS  | NC   |   |       |       |     | -0.12 | -0.09 | -0.19 | 0.43  | 0.38  | 0.38  | -0.02 | 0.49  |       |       |      | -0.18 |       | 0.38  | 0.38  |     |       |       | 0.02  | -0.02 | -0.12 |       | -0.02 | -0.02 | -0.02 |       |       |     |     |     |       |       |
| HLT  | NC   |   |       |       |     | -0.14 | 0.51  | -0.36 | 0.46  | 0.29  | 0.29  | 0.06  | 0.29  |       |       |      | -0.26 |       | 0.31  | 0.31  |     |       |       | -0.23 | 0.06  | -0.06 |       | 0.06  | 0.06  | 0.06  |       |       |     |     |     | -0.04 |       |
| HMO  | NC   |   |       |       |     | -0.42 | 0.04  | -0.06 | -0.19 | -0.01 | -0.01 | -0.18 | -0.06 |       |       |      | -0.32 |       | -0.25 | -0.25 |     |       |       | -0.24 | -0.18 | -0.24 |       | -0.18 | -0.18 | -0.18 |       |       |     |     |     | -0.25 |       |
| HOR  | NC   |   |       |       |     | 0.77  | -0.21 |       | 0.41  | 0.41  | -0.10 | 0.05  |       |       |       |      | -0.02 | 0.13  | 0.13  | 0.13  |     |       |       | 0.03  | -0.10 | -0.02 | -0.32 | -0.10 | -0.10 | -0.10 |       |       |     |     |     | 0.17  |       |
| HPH  | NC   |   |       |       |     |       | 0.35  |       | 0.70  | 0.70  | 0.26  | 0.74  |       |       |       |      | 0.53  |       | 0.91  | 0.91  |     |       |       | 0.63  | 0.26  | 0.15  | 0.22  | 0.26  | 0.26  | 0.26  |       |       |     |     |     | 0.43  |       |
| HPL  | NC   |   |       |       |     | -0.16 | 0.05  | -0.47 |       | 0.29  | 0.29  | 0.01  | -0.08 |       |       |      | -0.35 | 0.03  | 0.40  | 0.40  |     |       |       | -2.50 | -0.25 | 0.01  | -0.01 |       | 0.01  | 0.01  | 0.01  |       |     |     |     | -0.12 |       |
| HQR  | NC   |   |       |       |     | -0.05 | -0.09 | -0.20 | 0.47  | 0.45  | 0.45  | 0.07  | 0.03  |       |       |      | -0.30 |       | 0.32  | 0.32  |     |       |       | -0.20 | 0.07  | 0.01  |       | 0.07  | 0.07  | 0.07  |       |       |     |     |     | -0.03 |       |
| HSF  | NC   |   |       |       |     | 0.49  | 0.49  | 0.06  | 0.29  | 0.29  | 0.09  | 0.51  |       |       |       |      | 0.68  |       | 0.06  | 0.06  |     |       |       | 0.78  | 0.09  | 0.27  | -0.14 | 0.09  | 0.09  | 0.09  |       |       |     |     |     | 0.55  |       |
| HSL  | NC   |   |       |       |     | -0.44 | 0.65  | -0.07 | 0.72  | 0.72  | -0.16 | 0.74  |       |       |       |      | 0.09  |       | 0.87  | 0.87  |     |       |       | 0.06  | -0.16 | 0.22  |       | -0.16 | -0.16 | -0.16 |       |       |     |     |     | 0.16  |       |
| HSP  | NC   |   |       |       |     | -0.34 | -0.11 | -0.28 | 0.39  | 0.35  | 0.35  |       | -0.13 |       |       |      | -0.03 | 0.06  | 0.36  | 0.36  |     |       |       | 0.05  |       | -0.06 | -0.10 |       |       |       |       |       |     |     |     | -0.03 |       |
| JAL  | NC   |   |       |       |     | -0.40 | -0.21 |       | -0.47 | -0.47 | -0.11 | -0.32 |       |       |       |      | -0.01 | -0.21 | -0.11 | -0.11 |     |       |       | -2.30 | 0.20  | -0.11 | -0.38 | -0.49 | -0.11 | -0.11 | -0.11 |       |     |     |     | -0.18 |       |
| JBC  | NC   |   |       |       |     | -0.30 | 0.01  |       | 0.33  | 0.33  | 0.01  | -0.09 |       |       |       |      |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |     |     |     |       |       |



| Name | IRIS | Delays (sec) By Velocity Model <sup>‡</sup> |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
|------|------|---|-----|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-----|-----|------|-------|
|      |      | CODE  | AUB | BAE   | BAR   | BAS | COA   | CON   | COY   | CST   | DIA   | GAB   | GEY   | HAY | LAS   | LEW   | LIV   | LOM   | LON   | MAA   | MAM   | MAN   | MEN   | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM   | PTA  | SCA   | SHA | TRA | TRE  | WAL   |
| JB   | M    | NC  |     |       |       |     | -0.40 | -0.16 |       | -0.08 | -0.08 | -0.08 | -0.17 |     | -0.02 | -0.11 | -0.05 | -0.05 |       |       |       |       |       | 0.05  | -0.08 | -0.25 | -0.31 | -0.08 | -0.08 | -0.08 |      |       |     |     |      | -0.08 |
| JBZ  |      | NC  |     |       |       |     | 0.44  | 0.23  |       | 0.36  | 0.36  | 0.19  | 0.11  |     | 0.31  | 0.56  | 0.21  | 0.21  |       |       |       |       |       | 0.44  | 0.19  | 0.15  | 0.01  | 0.19  | 0.19  | 0.19  |      |       |     |     |      | 0.26  |
| JCB  |      | NC  |     |       |       |     | -0.28 | -0.32 | -0.04 | -0.04 | -0.04 | -0.07 | -0.44 |     | 0.01  | -0.02 | 0.11  | 0.11  |       |       |       |       |       | 0.17  | -0.07 | -0.37 | -0.34 | -0.07 | -0.07 | -0.07 |      |       |     |     |      | -0.33 |
| JCH  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JCP  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JEC  |      | NC  |     |       |       |     | -0.06 | -0.13 | 0.17  | 0.48  | 0.48  | -0.04 | -0.19 |     | 0.04  | 0.10  | -0.05 | -0.05 |       |       |       |       |       | 0.20  | -0.04 | -0.25 | -0.22 | -0.04 | -0.04 | -0.04 |      |       |     |     |      | -0.21 |
| JEG  |      | NC  |     |       |       |     | -0.77 |       |       | -0.14 | -0.14 | -0.14 | -0.47 |     | -0.52 | -0.62 | -0.49 | -0.49 |       |       |       |       |       | -0.34 | -0.14 | -0.14 | -0.38 | -0.14 | -0.14 | -0.14 |      |       |     |     |      | -0.14 |
| JEL  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       | 0.11  | 0.11  |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JHL  |      | NC  |     |       |       |     | -0.35 | -0.23 | -0.09 | -0.22 | -0.22 | -0.15 | -0.24 |     | -0.04 | -0.08 | -0.02 | -0.02 |       |       |       |       |       | 0.18  | -0.15 | -0.39 | -0.45 | -0.15 | -0.15 | -0.15 |      |       |     |     |      | -0.28 |
| JHP  |      | NC  |     |       |       |     | -0.39 | 0.03  |       |       |       |       | -0.14 |     | -0.19 | -0.15 | -0.13 | -0.13 |       |       |       |       |       | -0.18 |       | -0.16 |       |       |       |       |      |       |     |     |      |       |
| JJR  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JLX  |      | NC  |     |       |       |     | -0.39 | -0.28 |       | -0.40 | -0.40 | -0.07 | -0.27 |     | -0.17 | -0.18 | -0.03 | -0.03 |       |       |       |       |       | 0.03  | -0.07 | -0.56 | -0.44 | -0.07 | -0.07 | -0.07 |      |       |     |     |      | -0.07 |
| JMG  |      | NC  |     |       |       |     | -0.68 |       |       | -0.10 | -0.10 | -0.10 | -0.43 |     | -0.51 | -0.65 | -0.32 | -0.32 |       |       |       |       |       | -0.29 | 0.04  | -0.10 | -0.35 |       |       |       |      |       |     |     |      | -0.10 |
| JMP  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JNA  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JPL  |      | NC  |     |       |       |     | 0.55  | 0.33  | 0.02  | 0.26  | 0.26  | 0.06  | 0.23  |     | 0.37  | 0.73  | 0.08  | 0.08  |       |       |       |       |       | 0.50  | 0.06  | 0.11  | -0.24 | 0.06  | 0.06  | 0.06  |      |       |     |     |      | 0.31  |
| JPP  |      | NC  |     |       |       |     | -0.32 | -0.05 |       | 0.06  | 0.06  | -0.05 | -0.04 |     | 0.07  |       | -0.07 | -0.07 |       |       |       |       |       | 0.18  | -0.05 | -0.29 | -0.16 | -0.05 | -0.05 | -0.05 |      |       |     |     |      | -0.05 |
| JPR  |      | NC  |     |       |       |     | -0.46 |       |       | -0.11 | -0.11 | -0.11 | -0.21 |     | -0.42 | -0.57 | -0.06 | -0.06 |       |       |       |       |       | -0.38 | 0.04  | -0.11 | -0.05 |       |       |       |      |       |     |     |      | -0.11 |
| JPS  |      | NC  |     |       |       |     | -0.51 | -0.11 |       | 0.49  | 0.49  | -0.03 | -0.07 |     | -0.11 | -0.21 | -0.23 | -0.23 |       |       |       |       |       | -0.02 | -0.03 | -0.03 | -0.09 | -0.03 | -0.03 | -0.03 |      |       |     |     |      | 0.24  |
| JRG  |      | NC  |     |       |       |     | -0.22 | 0.02  |       | -0.15 | -0.15 | -0.15 | -0.12 |     | 0.02  | 0.16  | -0.17 | -0.17 |       |       |       |       |       | 0.23  | -0.15 | -0.43 | -0.40 | -0.15 | -0.15 | -0.15 |      |       |     |     |      |       |
| JRR  |      | NC  |     |       |       |     | -0.18 | -0.31 | -0.14 | -0.20 | -0.20 | -0.20 | -0.27 |     | -0.06 | 0.04  |       |       |       |       |       |       |       | 0.07  | -0.20 | -0.49 | -0.46 | -0.20 | -0.20 | -0.20 |      |       |     |     |      | -0.43 |
| JSA  |      | NC  |     |       |       |     | -0.59 |       |       | -0.08 | -0.08 | -0.08 | -0.30 |     | -0.37 | -0.50 | -0.26 | -0.26 |       |       |       |       |       | -0.39 | 0.13  | -0.08 | -0.32 |       |       |       |      |       |     |     |      | -0.08 |
| JSB  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| JSC  |      | NC  |     |       |       |     | -0.46 | -0.18 |       | -0.10 | -0.10 | -0.10 | -0.19 |     | -0.08 | -0.09 | -0.26 | -0.26 |       |       |       |       |       | 0.01  | -0.10 | -0.10 | -0.34 | -0.10 | -0.10 | -0.10 |      |       |     |     |      | -0.10 |
| JSF  |      | NC  |     |       |       |     | -0.32 | 0.10  |       | 0.09  | 0.09  | 0.09  |       |     | -0.13 | -0.15 | 0.22  | 0.22  |       |       |       | -1.03 | -0.06 | 0.09  | 0.09  | -0.02 | 0.09  | 0.09  | 0.09  |       |      |       |     |     | 0.09 |       |
| JSG  |      | NC  |     |       |       |     | 0.05  | 0.14  |       | 0.15  | 0.15  | 0.15  | 0.23  |     | 0.38  | 0.33  | 0.26  | 0.26  |       |       |       |       |       | 0.53  | 0.15  | 0.02  | -0.17 | 0.15  | 0.15  | 0.15  |      |       |     |     |      | 0.15  |
| JSJ  |      | NC  |     |       |       |     | -0.08 | 0.41  |       | 0.16  | 0.16  | 0.16  | 0.19  |     | 0.24  | 0.25  | 0.42  | 0.42  |       |       |       |       |       | 0.40  | 0.16  | 0.19  | -0.06 | 0.16  | 0.16  | 0.16  |      |       |     |     |      | 0.16  |
| JSM  |      | NC  |     |       |       |     | -0.25 | -0.03 |       | 0.07  | 0.07  | 0.07  | 0.07  |     | 0.15  | 0.08  | -0.13 | -0.13 |       |       |       |       |       | 0.21  | 0.07  | -0.10 | -0.08 | 0.07  | 0.07  | 0.07  |      |       |     |     |      | 0.07  |
| JSS  |      | NC  |     |       |       |     | -0.35 | -0.26 |       | -0.44 | -0.44 | -0.09 | -0.25 |     | -0.09 | -0.21 | -0.03 | -0.03 |       |       |       |       |       | 0.13  | -0.09 | -0.51 | -0.39 | -0.09 | -0.09 | -0.09 |      |       |     |     |      | -0.30 |
| JST  |      | NC  |     |       |       |     | -0.31 | -0.26 | 0.03  | -0.05 | -0.05 | -0.10 | -0.45 |     | 0.05  | -0.08 | 0.15  | 0.15  |       |       |       |       |       | 0.26  | -0.10 | -0.37 | -0.25 | -0.10 | -0.10 | -0.10 |      |       |     |     |      | -0.43 |
| JTG  |      | NC  |     |       |       |     | 0.46  | 0.23  | 0.01  | 0.07  | 0.07  | 0.11  | 0.38  |     | 0.27  | 0.02  | 0.05  | 0.05  |       |       |       |       |       | 0.44  | 0.11  | 0.01  | -0.17 | 0.11  | 0.11  | 0.11  |      |       |     |     |      | 0.13  |
| JUC  |      | NC  |     |       |       |     | -0.53 | -0.17 | -0.42 | -0.29 | -0.29 | -0.16 | -0.16 |     | -0.28 | -0.11 | -0.33 | -0.33 |       |       |       |       |       | -0.01 | -0.16 | -0.62 | -0.60 | -0.16 | -0.16 | -0.16 |      |       |     |     |      | 0.05  |
| JUM  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| KBB  |      | NC  |     | 0.06  | 0.06  |     |       |       |       |       |       |       |       |     |       | 0.82  | 0.82  | 0.44  |       | 0.26  | 0.16  |       |       | 0.18  |       |       |       |       |       |       | 0.34 |       |     |     |      |       |
| KBN  |      | NC  |     | -0.21 | -0.07 |     |       |       |       |       |       |       |       |     |       |       | 0.33  |       | 0.23  | 0.50  |       |       |       |       |       |       |       |       |       |       |      | 0.35  |     |     |      |       |
| KBR  |      | NC  |     | -0.27 | -0.27 |     |       |       |       |       |       |       |       |     |       |       | -0.27 | -0.22 |       | -0.27 | -0.22 |       |       |       |       |       |       |       |       |       |      | -0.27 |     |     |      |       |
| KBS  |      | NC  |     | 0.49  | -0.01 |     |       |       |       |       |       |       |       |     |       |       | 0.06  |       | -0.13 | 0.06  |       |       |       | 0.16  |       |       |       |       |       |       |      | -0.09 |     |     |      |       |
| KCP  |      | NC  |     | 0.45  | -0.03 |     |       |       |       |       |       |       |       |     |       | 0.59  | 0.59  | 0.07  |       | -0.08 | -0.05 |       |       |       |       |       |       |       |       |       |      | -0.08 |     |     |      |       |
| KCR  |      | NC  |     | -0.12 | -0.12 |     |       |       |       |       |       |       |       |     |       |       | 0.27  |       | 0.46  | 0.04  |       |       |       | 0.02  |       |       |       |       |       |       | 0.69 |       |     |     |      |       |
| KCS  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       | 0.25  |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| KCT  |      | NC  |     | 0.09  | 0.09  |     |       |       |       |       |       |       |       |     |       | 0.25  | 0.25  | 0.19  |       | 0.09  | 0.15  |       |       |       |       |       |       |       |       |       |      | -0.95 |     |     |      |       |
| KFP  |      | NC  |     | 0.11  | -0.30 |     |       |       |       |       |       |       |       |     |       | 0.69  | 0.69  | -0.17 |       | -0.21 | -0.21 |       |       |       |       |       |       |       |       |       |      | -0.01 |     |     |      |       |
| KGM  |      | NC  |     | 0.13  | 0.13  |     |       |       |       |       |       |       |       |     |       |       | 0.13  |       | 0.13  | 0.15  |       |       |       |       |       |       |       |       |       |       |      | 0.13  |     |     |      |       |
| KHB  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| KHM  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| KIP  |      | NC  |     | 0.10  | -0.26 |     |       |       |       |       |       |       |       |     |       | 0.87  | 0.87  | -0.13 |       | -0.25 | 0.15  |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| KJJ  |      | NC  |     |       |       |     |       |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |       |     |     |      |       |
| KKP  |      | NC  |     | 0.22  | 0.22  |     |       |       |       |       |       |       |       |     |       |       |       | 0.40  |       | 0.22  | 0.55  |       |       |       |       |       |       |       |       |       | 0.26 |       |     |     |      |       |

| Name | IRIS | Delays (sec) By Velocity Model† |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
|------|------|---------------------------------|-----|-------|-------|-------|-------|-----|-----|-----|-----|-----|------|-------|-------|-----|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-----|-----|-----|-----|------|-------|-----|-----|-----|-----|
|      |      | CODE                            | AUB | BAE   | BAR   | BAS   | COA   | CON | COY | CST | DIA | GAB | GEY  | HAY   | LAS   | LEW | LIV   | LOM   | LON   | MAA   | MAM  | MAN   | MEN   | MOR   | NBY   | NCG   | PEN | PGH | PMM | PSM | PTA  | SCA   | SHA | TRA | TRE | WAL |
| KMP  | NC   |                                 |     | -0.31 | -0.31 |       | -0.20 |     |     |     |     |     |      |       |       |     |       |       |       | -0.17 |      | -0.31 | -0.12 |       |       | -0.12 |     |     |     |     | 0.50 |       |     |     |     |     |
| KOM  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| KPP  | NC   |                                 |     | 0.10  | 0.10  |       |       |     |     |     |     |     |      |       |       |     |       |       |       | 0.42  |      | 0.24  | 0.42  |       |       | 0.20  |     |     |     |     |      | 0.38  |     |     |     |     |
| KRK  | NC   |                                 |     | -0.12 | -0.20 |       |       |     |     |     |     |     |      |       |       |     |       |       |       | 0.09  |      | 0.03  | -0.05 |       |       |       |     |     |     |     |      | 0.13  |     |     |     |     |
| KRM  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| KRP  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| KSC  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| KSM  | NC   |                                 |     | -0.40 | -0.40 |       |       |     |     |     |     |     |      |       |       |     | -0.63 | -0.63 | 0.25  |       | 0.19 | -0.17 |       |       |       |       |     |     |     |     |      | -0.88 |     |     |     |     |
| KSP  | NC   |                                 |     | 0.22  | -0.14 |       |       |     |     |     |     |     |      |       |       |     | 0.56  | 0.56  | -0.02 |       | 0.02 | -0.36 |       |       |       |       |     |     |     |     |      | -0.19 |     |     |     |     |
| KSX  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| KTR  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LAS  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LBF  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.34  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LBK  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.24 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LBP  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LCF  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.13  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LCM  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.02  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LDB  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.09 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LGB  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.09 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LGM  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LGP  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.31 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LHC  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.36  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LHE  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LHK  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.28  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LME  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.20  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LMH  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LMP  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LPD  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.13  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LPG  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LPK  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LRB  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LRD  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.13  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LRR  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LSF  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LSH  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.43 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LSL  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.04 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LSM  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | 0.03  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LSR  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LTC  | NC   |                                 |     |       |       | -0.20 |       |     |     |     |     |     |      | 0.02  |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LVR  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| LWH  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      | -0.51 |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| MBE  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| MBO  | NC   |                                 |     |       |       | -0.13 | -0.23 |     |     |     |     |     | 0.02 |       | -0.25 |     | 0.23  | 0.23  |       | -0.68 |      |       |       |       | -0.14 | 0.07  |     |     |     |     |      |       |     |     |     |     |
| MBU  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       |       |      |       |       |       |       |       |     |     |     |     |      |       |     |     |     |     |
| MCD  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       | 0.13  |      |       |       |       | 0.27  |       |     |     |     |     |      |       |     |     |     |     |
| MCL  | NC   |                                 |     |       |       | 1.58  |       |     |     |     |     |     |      |       |       |     |       |       |       | -0.08 |      |       |       | -0.03 |       |       |     |     |     |     |      |       |     |     |     |     |
| MCM  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       | -0.16 |      |       |       | -0.08 |       |       |     |     |     |     |      |       |     |     |     |     |
| MCS  | NC   |                                 |     |       |       |       |       |     |     |     |     |     |      |       |       |     |       |       |       | 0.04  |      |       |       | 0.20  |       |       |     |     |     |     |      |       |     |     |     |     |

| Name | IRIS | Delays (sec) By Velocity Model† |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
|------|------|---------------------------------|-----|-----|-----|-------|-------|-----|-----|-------|-------|-------|-------|-----|-------|-------|-------|-------|------|-------|-----|------|-------|-------|-------|-------|-------|-------|------|-----|-----|-----|-----|------|-------|------|
|      | CODE | AUB                             | BAE | BAR | BAS | COA   | CON   | COY | CST | DIA   | GAB   | GEY   | HAY   | LAS | LEW   | LIV   | LOM   | LON   | MAA  | MAM   | MAN | MEN  | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM  | PTA | SCA | SHA | TRA | TRE  | WAL   |      |
| MCU  | NC   |                                 |     |     |     | -0.54 |       |     |     | 0.17  | 0.17  | 0.17  | -0.15 |     | -0.63 |       | 0.45  | 0.45  |      | -0.94 |     |      | -0.55 | 0.17  | 0.02  |       |       |       |      |     |     |     |     |      |       | 0.17 |
| MDC  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.16 |     |      |       |       | -0.01 |       |       |       |      |     |     |     |     |      |       |      |
| MDP  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.22 |     |      |       |       | -0.05 |       |       |       |      |     |     |     |     |      |       |      |
| MDR  | NC   |                                 |     |     |     | 1.96  |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.07  |     |      |       |       | 0.11  |       |       |       |      |     |     |     |     |      |       |      |
| MEM  | NC   |                                 |     |     |     | 1.86  |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.06  |     |      |       |       | 0.17  |       |       |       |      |     |     |     |     |      |       |      |
| MFB  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.07  |     |      |       |       | 0.09  |       |       |       |      |     |     |     |     |      |       |      |
| MGP  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.01  |     |      |       |       | 0.09  |       |       |       |      |     |     |     |     |      |       |      |
| MHD  | NC   |                                 |     |     |     | -1.35 | 0.55  |     |     | 0.65  | 0.65  |       |       |     | 0.35  |       | 0.72  | 0.72  |      | -0.41 |     |      |       |       | 0.14  |       |       |       |      |     |     |     |     |      |       |      |
| MLC  | NC   |                                 |     |     |     | 1.52  |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.16 |     |      |       |       | -0.05 |       |       |       |      |     |     |     |     |      |       |      |
| MLH  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.45  |     |      |       |       | 0.46  |       |       |       |      |     |     |     |     |      |       |      |
| MLM  | NC   |                                 |     |     |     | 2.16  |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.26  |     |      |       |       | 0.29  |       |       |       |      |     |     |     |     |      |       |      |
| MLR  | NC   |                                 |     |     |     |       | 0.51  |     |     |       |       |       | 0.96  |     |       |       | 1.28  | 1.28  |      | -0.77 |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MMI  | NC   |                                 |     |     |     |       | 0.89  |     |     |       |       |       |       |     |       |       | 1.27  | 1.27  |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MML  | NC   |                                 |     |     |     | 1.83  |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.14  |     |      |       |       | 0.25  |       |       |       |      |     |     |     |     |      |       |      |
| MMP  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.23 |     |      |       |       | -0.06 |       |       |       |      |     |     |     |     |      |       |      |
| MMS  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MMT  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MNH  | NC   |                                 |     |     |     | -1.01 |       |     |     | -0.03 | -0.03 | -0.03 | -0.63 |     |       | -0.04 | 0.33  | 0.33  |      | -1.00 |     |      |       | -0.03 | -0.03 |       |       |       |      |     |     |     |     |      | -0.03 |      |
| MOG  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.02 |     |      |       |       | -0.26 |       |       |       |      |     |     |     |     |      |       |      |
| MOY  | NC   |                                 |     |     |     | -0.46 |       |     |     | 0.11  | 0.11  | 0.11  | -0.26 |     | -0.60 |       | 0.38  | 0.38  |      | -0.96 |     |      | -0.45 | 0.11  | -0.01 |       | 0.11  | 0.11  | 0.11 |     |     |     |     |      | 0.11  |      |
| MPR  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MRC  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.07 |     |      |       |       | 0.04  |       |       |       |      |     |     |     |     |      |       |      |
| MRD  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MRF  | NC   |                                 |     |     |     | 0.06  |       |     |     | -0.10 | -0.10 | -0.10 | 0.43  |     | 0.13  |       | 1.08  | 1.08  |      | -1.07 |     |      | -0.10 | -0.03 |       |       |       |       |      |     |     |     |     |      | -0.10 |      |
| MSK  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | 0.04  |     |      |       |       | 0.07  |       |       |       |      |     |     |     |     |      |       |      |
| MSL  | NC   |                                 |     |     |     | 1.50  |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.12 |     |      |       |       | 0.02  |       |       |       |      |     |     |     |     |      |       |      |
| MST  | NC   |                                 |     |     |     |       | 0.06  |     |     |       |       |       | 0.16  |     | 0.12  |       | 0.64  | 0.64  |      | -1.04 |     |      |       |       | 0.04  |       |       |       |      |     |     |     |     |      |       |      |
| MTC  | NC   |                                 |     |     |     | 1.67  |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       | 0.20  |       |       |       |      |     |     |     |     |      |       |      |
| MTU  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.17 |     |      |       |       | -0.02 |       |       |       |      |     |     |     |     |      |       |      |
| MWB  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      | -0.14 |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| MYL  | NC   |                                 |     |     |     | -0.50 |       |     |     | 0.61  | 0.61  |       | -0.03 |     | -0.24 |       | 0.41  | 0.41  |      | -0.49 |     |      | -0.49 |       | -0.13 |       |       |       |      |     |     |     |     |      |       |      |
| NAD  | NC   |                                 |     |     |     |       | 0.43  |     |     |       |       |       | 0.98  |     |       | 0.40  | 1.22  | 1.22  |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| NAP  | NC   |                                 |     |     |     |       | -0.37 |     |     |       |       |       | 0.18  |     |       | -0.60 | 0.52  | 0.52  |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| NBP  | NC   |                                 |     |     |     | -0.03 |       |     |     | 0.49  | 0.49  | 0.46  | 0.77  |     | -0.07 | -0.09 | 1.01  | 1.01  |      |       |     |      | 0.35  | 0.21  |       | 0.21  | 0.21  | 0.21  |      |     |     |     |     |      | 0.49  |      |
| NBR  | NC   |                                 |     |     |     | -0.57 |       |     |     | -0.10 | -0.10 | -0.41 | -0.04 |     | -0.69 | -0.79 | 0.35  | 0.35  |      |       |     |      | 0.11  | -0.10 | 0.03  | -0.10 | -0.10 | -0.10 |      |     |     |     |     |      | -0.10 |      |
| NCF  | NC   |                                 |     |     |     | -0.94 |       |     |     | -0.16 | -0.16 | -0.08 | -0.32 |     | -0.37 | -0.74 | -0.04 | -0.04 |      |       |     |      | -0.02 | -0.17 | -0.11 | -0.17 | -0.17 | -0.17 |      |     |     |     |     |      | -0.16 |      |
| NCP  | NC   |                                 |     |     |     |       | 0.37  |     |     |       |       |       |       |     |       |       | 0.31  | 1.34  | 1.34 |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| NDH  | NC   |                                 |     |     |     | 0.54  |       |     |     | 0.18  | 0.18  | 0.18  | 0.44  |     |       | -0.07 | 1.33  | 1.33  |      |       |     |      | 0.45  | 0.18  |       | 0.18  | 0.18  | 0.18  |      |     |     |     |     |      | 0.18  |      |
| NFI  | NC   |                                 |     |     |     | -0.77 |       |     |     | -0.09 | -0.09 | -0.09 | -0.56 |     |       |       | -0.31 | -0.31 |      |       |     |      | -0.09 | -0.09 |       | -0.09 | -0.09 | -0.09 |      |     |     |     |     |      | -0.09 |      |
| NFR  | NC   |                                 |     |     |     | -0.45 |       |     |     | 0.04  | 0.04  | 0.08  | 0.25  |     |       |       | 0.08  | 0.08  |      |       |     | 0.07 | 0.10  | -0.04 |       |       |       |       |      |     |     |     |     | 0.04 |       |      |
| NGV  | NC   |                                 |     |     |     | -0.08 |       |     |     | -0.13 | -0.13 | -0.50 | 0.34  |     | -0.41 | -0.51 | 0.39  | 0.39  |      |       |     |      | -0.20 | -0.13 | 0.24  | -0.13 | -0.13 | -0.13 |      |     |     |     |     |      | -0.13 |      |
| NHF  | NC   |                                 |     |     |     |       |       |     |     |       |       |       |       |     |       |       |       |       |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| NHM  | NC   |                                 |     |     |     | 0.54  |       |     |     | 0.51  | 0.51  | 0.51  | 0.93  |     | 1.06  | 0.91  | 1.01  | 1.01  |      |       |     |      | 0.36  | 0.51  |       | 0.51  | 0.51  | 0.51  |      |     |     |     |     |      | 0.51  |      |
| NIM  | NC   |                                 |     |     |     | -0.31 |       |     |     |       |       |       | 0.18  |     |       | -0.74 | 0.43  | 0.43  |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| NLH  | NC   |                                 |     |     |     | 0.28  |       |     |     |       |       | -0.01 | 0.52  |     | 0.02  | -0.15 | 0.50  | 0.50  |      |       |     |      | -0.12 |       | 0.50  |       |       |       |      |     |     |     |     |      |       |      |
| NLN  | NC   |                                 |     |     |     | -0.98 |       |     |     | -0.11 | -0.11 | -0.13 | -0.52 |     | -0.58 | -0.73 | -0.77 | -0.77 |      |       |     |      | -0.15 | -0.11 | -0.19 | -0.11 | -0.11 | -0.11 |      |     |     |     |     |      | -0.11 |      |
| NMC  | NC   |                                 |     |     |     | -0.16 |       |     |     |       |       |       | -0.25 |     |       |       | -0.66 | -0.66 |      |       |     |      |       |       |       |       |       |       |      |     |     |     |     |      |       |      |
| NMH  | NC   |                                 |     |     |     | -0.20 | -0.11 |     |     | -0.39 | -0.39 | -0.39 | 0.09  |     |       | -0.39 | -0.01 | -0.01 |      |       |     |      | -0.05 | -0.20 |       |       |       |       |      |     |     |     |     |      | -0.39 |      |

| Name | IRIS | Delays (sec) By Velocity Model <sup>‡</sup> |     |     |       |       |       |     |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
|------|------|---|-----|-----|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|------|-----|-----|-----|-------|-----|--|
|      |      | CODE  | AUB | BAE | BAR   | BAS   | COA   | CON | COY   | CST   | DIA   | GAB   | GEY   | HAY   | LAS | LEW   | LIV   | LOM   | LON   | MAA   | MAM   | MAN   | MEN   | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM | PTA  | SCA | SHA | TRA | TRE   | WAL |  |
| NMI  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| NMT  | NC   |   |     |     | -0.08 |       | 0.45  |     |       | -0.19 | -0.19 | -0.12 | -0.02 |       |     |       | -0.41 | 0.16  | 0.16  | -0.13 |       | -0.12 |       | -0.18 | -0.18 |       |       |       |       |     | 0.10 |     |     |     | -0.19 |     |  |
| NMW  | NC   |   |     |     |       |       | -0.11 |     |       | -0.12 | -0.12 | -0.12 | 0.14  |       |     |       | -0.30 | 0.02  | 0.02  |       |       | -0.17 |       | 0.02  | -0.17 |       | -0.17 | -0.17 | -0.17 |     |      |     |     |     | -0.12 |     |  |
| NOL  | NC   |   |     |     |       |       | -0.94 |     |       | -0.10 | -0.10 | -0.11 | -0.60 |       |     | -0.50 | -0.58 | 0.42  | 0.42  |       |       |       |       | -0.07 | -0.10 | -0.16 |       |       |       |     |      |     |     |     | -0.10 |     |  |
| NPR  | NC   |   |     |     |       |       | -0.80 |     |       |       |       |       | -0.63 |       |     |       | -0.20 | -0.20 |       |       |       |       |       | -0.06 | -0.19 |       |       |       |       |     |      |     |     |     |       |     |  |
| NPV  | NC   |   |     |     |       |       | -0.31 |     |       |       |       |       | -0.09 |       |     |       | -0.85 | 0.22  | 0.22  |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| NRR  | NC   |   |     |     |       |       | -0.21 |     |       |       |       |       | 0.98  |       |     |       | -0.30 | 0.76  | 0.76  |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| NSH  | NC   |   |     |     |       |       | -0.70 |     |       | -0.27 | -0.27 | -0.27 | -0.26 |       |     |       | -0.82 | -0.11 | -0.11 |       |       | -0.27 |       | -0.07 | -0.23 |       | -0.23 | -0.23 | -0.23 |     |      |     |     |     | -0.27 |     |  |
| NSP  | NC   |   |     |     |       |       | -0.42 |     |       | -0.10 | -0.10 | -0.79 | 0.06  |       |     | -0.70 | -0.74 | -0.19 | -0.19 |       |       |       |       | -0.24 | -0.10 | 0.31  |       |       |       |     |      |     |     |     | -0.10 |     |  |
| NTA  | NC   |   |     |     |       |       | -0.82 |     |       |       |       |       | -0.56 |       |     | -0.81 | -0.77 | -0.01 | -0.01 |       |       | -0.62 | -0.19 |       | -0.18 |       |       |       |       |     |      |     |     |     |       |     |  |
| NTB  | NC   |   |     |     |       |       | -0.75 |     |       |       |       | 0.03  | -0.55 |       |     |       | -0.32 | -0.50 | -0.50 |       |       | -0.68 |       | 0.07  | -0.23 |       |       |       |       |     |      |     |     |     |       |     |  |
| NTY  | NC   |   |     |     |       |       | -0.95 |     |       | 0.18  | 0.18  | -0.12 | -0.03 |       |     | -0.32 | -0.66 | 0.54  | 0.54  |       |       | -0.30 |       | 0.02  | -0.10 |       | -0.10 | -0.10 | -0.10 |     |      |     |     |     | 0.18  |     |  |
| NVA  | NC   |   |     |     |       |       | 0.14  |     |       |       |       | -0.06 | 0.95  |       |     | -0.36 | -0.04 | 0.91  | 0.91  |       |       |       |       | 0.05  |       |       |       |       |       |     |      |     |     |     |       |     |  |
| NVE  | NC   |   |     |     |       |       | -0.40 |     |       | -0.53 | -0.53 | -0.44 | 0.36  |       |     |       | -0.89 | -0.01 | -0.01 |       |       |       |       | -0.03 |       |       |       |       |       |     |      |     |     |     | -0.53 |     |  |
| NWR  | NC   |   |     |     |       |       | -0.38 |     |       | -0.04 | -0.04 |       | -0.30 |       |     | -0.69 | 0.44  | 0.44  |       |       | -0.40 |       | 0.01  | -0.18 |       |       |       |       |       |     |      |     |     |     | -0.04 |     |  |
| OBH  | NC   | 0.06  |     |     |       |       | 0.36  |     |       | 0.02  | 0.02  | 0.02  |       | -0.18 |     |       | 1.06  | 1.06  |       |       | -0.04 |       | 0.02  | 0.14  |       |       |       |       |       |     |      |     |     |     | 0.02  |     |  |
| OCH  | NC   | 0.06  |     |     |       |       | -0.21 |     |       | -0.14 | -0.14 | -0.14 |       | 0.13  |     |       | 0.01  | 0.01  |       |       | -0.38 |       | -0.14 | -0.12 |       |       |       |       |       |     |      |     |     |     | -0.14 |     |  |
| OCM  | NC   | 0.20  |     |     |       |       |       |     |       |       |       |       |       | -0.16 |     |       | 0.35  | 0.35  |       |       |       |       |       | 0.03  |       |       |       |       |       |     |      |     |     |     |       |     |  |
| OCR  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| OGO  | NC   | 0.05  |     |     |       |       | -0.07 |     |       | -0.11 | -0.11 | -0.11 |       | -0.07 |     |       | 0.57  | 0.57  |       |       | -0.11 |       | -0.11 | 0.04  |       |       |       |       |       |     |      |     |     |     | -0.11 |     |  |
| OHC  | NC   | -0.08                                       |     |     |       |       | -0.39 |     |       | -0.14 | -0.14 | -0.14 | -0.70 | -0.27 |     |       | 0.60  | 0.60  |       |       | -0.14 |       | -0.14 | -0.15 |       |       |       |       |       |     |      |     |     |     | -0.14 |     |  |
| ORA  | NC   | -0.04                                       |     |     |       |       |       |     |       | -0.06 | -0.06 | -0.06 | -0.71 | -0.16 |     |       | 0.81  | 0.81  |       |       | -0.06 |       | -0.06 | -0.05 |       |       |       |       |       |     |      |     |     |     | -0.06 |     |  |
| ORD  | NC   | -0.01                                       |     |     |       |       |       |     |       |       |       |       |       | -0.31 |     |       | 0.65  | 0.65  |       |       |       |       | -0.15 | -0.15 |       |       |       |       |       |     |      |     |     |     |       |     |  |
| OST  | NC   | 0.38  |     |     |       |       | 0.18  |     |       | -0.08 | -0.08 | -0.08 |       | -0.05 |     |       | 0.23  | 0.23  |       |       | -0.08 |       | -0.08 | -0.10 |       |       |       |       |       |     |      |     |     |     | -0.08 |     |  |
| OSU  | NC   | 0.69  |     |     |       |       |       |     |       | -0.24 | -0.24 | -0.24 | -0.81 | 0.03  |     |       | 0.14  | 0.14  |       |       | -0.24 |       | -0.43 | 0.09  |       |       |       |       |       |     |      |     |     |     | -0.24 |     |  |
| OWY  | NC   | 0.01  |     |     |       |       |       |     |       | 0.09  | 0.09  | 0.09  | -0.90 | -0.10 |     |       | 0.47  | 0.47  |       |       | 0.09  |       | 0.09  | 0.09  |       |       |       |       |       |     |      |     |     |     | 0.09  |     |  |
| PAB  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       | 0.44  | 0.44  |       |       |       |       |       |       |       |       |       |       | 0.20  |     |      |     |     |     |       |     |  |
| PAD  | NC   |   |     |     |       | -0.49 |       |     | -0.01 | 0.23  | 0.23  |       |       |       |     |       | 0.56  | 0.56  |       |       |       |       |       | 0.13  |       | -0.23 | -0.23 | -0.16 |       |     |      |     |     |     | 0.13  |     |  |
| PAG  | NC   |   |     |     |       | -0.58 |       |     | -0.02 |       |       | -0.03 |       |       |     |       | 1.00  | 1.00  |       |       |       |       | -0.03 | 0.04  |       | 0.01  | 0.15  | 0.08  |       |     |      |     |     |     | -0.03 |     |  |
| PAN  | NC   |   |     |     |       | -0.44 |       |     | -0.03 | 0.20  | 0.20  | -0.07 |       |       |     |       | 0.44  | 0.44  |       |       |       |       | -0.07 | 0.26  |       | -0.24 | -0.24 | -0.09 |       |     |      |     |     |     | 0.29  |     |  |
| PAP  | NC   |   |     |     | -0.63 | 0.39  |       |     | -0.01 | 0.20  | 0.20  |       |       |       |     |       | 0.53  | 0.53  |       |       |       |       |       | 0.29  |       | -0.54 | -0.54 | -0.54 |       |     |      |     |     |     | 0.23  |     |  |
| PAR  | NC   |   |     |     | 0.16  |       |       |     |       | 0.88  | 0.88  | 0.25  |       |       |     |       | 1.25  | 1.25  | -0.50 |       |       |       | 0.25  | 0.20  |       | 1.29  | 1.29  | 1.29  |       |     |      |     |     |     | 0.68  |     |  |
| PBI  | NC   |   |     |     | -0.08 |       |       |     | 0.11  |       |       |       |       |       |     |       | 0.66  | 0.66  |       |       |       |       |       | 0.16  |       | 0.51  | 0.51  | 0.22  |       |     |      |     |     |     |       |     |  |
| PBM  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       | 0.28  | 0.28  |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| PBP  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       | 0.94  | 0.94  |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| PBW  | NC   |   |     |     | -0.34 | 0.61  |       |     | -0.01 | 0.28  | 0.28  |       |       |       |     |       | 0.41  | 0.41  |       |       |       |       |       | 0.14  |       | -0.15 | -0.15 | -0.15 |       |     |      |     |     |     | 0.63  |     |  |
| PCA  | NC   |   |     |     | -0.22 |       |       |     | 0.51  | 0.83  | 0.83  | 0.29  |       |       |     |       |       |       |       |       |       |       | 0.29  | 0.34  |       | 0.47  | 0.66  | 0.35  |       |     |      |     |     |     | 0.83  |     |  |
| PCB  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       | -0.05 | -0.05 |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| PCR  | NC   |   |     |     | -0.49 |       |       |     | 0.42  | 0.30  | 0.30  | 0.03  |       |       |     |       | 1.15  | 1.15  | -0.80 |       |       |       | 0.03  | 0.08  |       | 0.48  | 0.60  | 0.48  |       |     |      |     |     |     | 0.02  |     |  |
| PDR  | NC   |   |     |     | 0.18  | 0.61  |       |     |       | 0.81  | 0.81  |       |       |       |     |       | 1.16  | 1.16  | -0.47 |       |       |       |       | 0.24  |       | 1.40  | 1.40  | 1.40  |       |     |      |     |     |     |       |     |  |
| PFR  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| PG1  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       |       |       |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| PGH  | NC   |   |     |     | -0.53 |       |       |     | -0.12 | -0.33 | -0.33 | -0.17 |       |       |     |       | 0.68  | 0.68  |       |       |       |       | -0.17 | -0.27 |       | -0.08 | -0.19 | -0.16 |       |     |      |     |     |     | -0.33 |     |  |
| PHA  | NC   |   |     |     | -0.21 |       |       |     | -0.04 | 0.34  | 0.34  |       |       |       |     |       | 0.92  | 0.92  |       |       |       |       |       | -0.03 |       | 0.04  | 0.07  | -0.13 |       |     |      |     |     |     | 0.34  |     |  |
| PHB  | NC   |   |     |     | 0.60  |       |       |     |       |       |       |       |       |       |     |       | 1.29  | 1.29  | -0.29 |       |       |       |       | 0.07  |       | 1.90  | 1.90  | 1.90  |       |     |      |     |     |     |       |     |  |
| PHC  | NC   |   |     |     | -0.35 |       |       |     | 0.08  | 0.20  | 0.20  | -0.10 |       |       |     |       | 0.56  | 0.56  |       |       |       |       | -0.10 | -0.10 |       | -0.26 | -0.26 | -0.26 |       |     |      |     |     |     | 0.38  |     |  |
| PHF  | NC   |   |     |     |       |       |       |     |       |       |       |       |       |       |     |       | 0.55  | 0.55  |       |       |       |       |       |       |       |       |       |       |       |     |      |     |     |     |       |     |  |
| PHO  | NC   |   |     |     | -0.16 |       |       |     | 0.05  | 0.59  | 0.59  | -0.05 |       |       |     |       | 0.54  | 0.54  |       |       |       |       | -0.05 | -0.07 |       | 0.04  | 0.13  | -0.12 |       |     |      |     |     |     | 0.32  |     |  |

| Name | IRIS | Delays (sec) By Velocity Model <sup>‡</sup> |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
|------|------|---|-----|-----|-----|-------|-------|-----|-----|-------|-------|-------|-------|-----|-----|-----|-----|-------|-------|-----|-----|-----|-----|-------|-------|-------|-------|-------|-------|-------|-------|-----|-----|------|-------|-------|-------|
|      |      | CODE  | AUB | BAE | BAR | BAS   | COA   | CON | COY | CST   | DIA   | GAB   | GEY   | HAY | LAS | LEW | LIV | LOM   | LON   | MAA | MAM | MAN | MEN | MOR   | NBY   | NCG   | PEN   | PGH   | PMM   | PSM   | PTA   | SCA | SHA | TRA  | TRE   | WAL   |       |
| PHP  | NC   |   |     |     |     | -0.10 | 0.79  |     |     | -0.20 | 0.06  | 0.06  |       |     |     |     |     | 0.36  | 0.36  |     |     |     |     |       |       | -0.10 |       | -0.31 | -0.19 | -0.31 |       |     |     |      |       |       |       |
| PHR  | NC   |   |     |     |     | -0.45 | 0.33  |     |     | 0.19  | 0.09  | 0.09  | 0.16  |     |     |     |     | 0.59  | 0.59  |     |     |     |     |       | 0.16  | 0.05  |       | 0.26  | 0.26  | 0.26  |       |     |     |      |       | 0.17  |       |
| PHS  | NC   |   |     |     |     | -0.38 | 0.52  |     |     | -0.02 | 0.10  | 0.10  |       |     |     |     |     | 0.59  | 0.59  |     |     |     |     |       |       |       |       | -0.16 | -0.16 | 0.01  |       |     |     |      |       | 0.04  |       |
| PIR  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.83  | 0.83  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PJL  | NC   |   |     |     |     | -0.52 | -0.33 |     |     | 0.02  | 0.18  | 0.18  | -0.01 |     |     |     |     | 0.18  | 0.18  |     |     |     |     | -2.93 | -0.01 | 0.09  |       | -0.20 | -0.20 | -0.20 |       |     |     |      |       | 0.21  |       |
| PKE  | NC   |   |     |     |     | -0.01 |       |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       | 1.56  | 1.56  | 1.56  |       |     |     |      |       |       |       |
| PKY  | NC   |   |     |     |     | -0.17 |       |     |     | -0.09 |       |       |       |     |     |     |     | 0.37  | 0.37  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PLO  | NC   |   |     |     |     | -0.62 | 0.28  |     |     | -0.10 | -0.09 | -0.09 | -0.23 |     |     |     |     | 0.24  | 0.24  |     |     |     |     |       | -0.23 | -0.06 |       | -0.35 | -0.35 | -0.35 |       |     |     |      |       | -0.07 |       |
| PMC  | NC   |   |     |     |     | -0.36 |       |     |     | 0.24  | 0.08  | 0.08  | 0.08  |     |     |     |     | 0.84  | 0.84  |     |     |     |     |       | 0.08  | 0.25  |       | 0.13  | 0.17  | 0.09  |       |     |     |      |       | 0.08  |       |
| PMG  | NC   |   |     |     |     | -0.88 |       |     |     | -0.27 |       |       | -0.13 |     |     |     |     | 0.28  | 0.28  |     |     |     |     |       | -0.13 | -0.22 |       | -0.61 | -0.61 | -0.49 |       |     |     |      |       | -0.13 |       |
| PML  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.20  | 0.20  |     |     |     |     |       |       |       |       | 0.64  | 0.64  | 0.65  |       |     |     |      |       |       |       |
| PMM  | NC   |   |     |     |     | 0.13  |       |     |     | 0.12  | 0.71  | 0.71  |       |     |     |     |     | 0.77  | 0.77  |     |     |     |     |       | 0.16  |       |       | 0.28  | 0.28  | 0.16  |       |     |     |      |       |       |       |
| PMP  | NC   |   |     |     |     | -0.15 |       |     |     | 0.09  | 0.39  | 0.39  | 0.11  |     |     |     |     | 0.48  | 0.48  |     |     |     |     |       | 0.11  | 0.24  |       | -0.09 | 0.02  | -0.09 |       |     |     |      |       | 0.33  |       |
| PMR  | NC   |   |     |     |     | -0.40 |       |     |     | -0.03 |       |       |       |     |     |     |     | 1.06  | 1.06  |     |     |     |     |       | 0.12  |       |       | 0.07  | 0.13  | 0.18  |       |     |     |      |       |       |       |
| POP  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.95  | 0.95  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PPB  | NC   |   |     |     |     |       |       |     |     | 0.12  |       |       |       |     |     |     |     | 0.01  | 0.01  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PPC  | NC   |   |     |     |     | -0.29 |       |     |     | -0.13 | 0.09  | 0.09  |       |     |     |     |     | 0.35  | 0.35  |     |     |     |     |       |       | -0.14 |       | -0.35 | -0.27 | -0.35 |       |     |     |      |       |       |       |
| PPG  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 1.42  | 1.42  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PPT  | NC   |   |     |     |     | -0.28 | 0.88  |     |     | 0.03  | 0.27  | 0.27  | -0.01 |     |     |     |     | 0.47  | 0.47  |     |     |     |     |       | -0.01 | 0.13  |       | -0.01 | -0.08 | 0.09  |       |     |     |      |       | 0.22  |       |
| PRC  | NC   |   |     |     |     | -0.33 |       |     |     | 0.37  | 0.28  | 0.28  | 0.13  |     |     |     |     | 0.98  | 0.98  |     |     |     |     |       | 0.13  | 0.01  |       | 0.70  | 0.66  | 0.70  |       |     |     |      |       | 0.23  |       |
| PRP  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PSA  | NC   |   |     |     |     | -0.58 | 0.46  |     |     | -0.02 | 0.09  | 0.09  | 0.02  |     |     |     |     | 0.42  | 0.42  |     |     |     |     |       | 0.02  | 0.01  |       | -0.03 | -0.29 | -0.09 |       |     |     |      |       | 0.06  |       |
| PSC  | NC   |   |     |     |     | -0.45 |       |     |     | -0.03 |       |       |       |     |     |     |     | 0.56  | 0.56  |     |     |     |     |       | 0.13  |       |       | -0.03 | -0.14 | 0.09  |       |     |     |      |       |       |       |
| PSM  | NC   |   |     |     |     | 0.12  |       |     |     | 0.24  | 0.34  | 0.34  | 0.25  |     |     |     |     | 0.97  | 0.97  |     |     |     |     |       | 0.25  | 0.32  |       | 0.28  | 0.41  | 0.41  |       |     |     |      |       | 0.11  |       |
| PSR  | NC   |   |     |     |     | -0.19 |       |     |     | -0.10 |       |       |       |     |     |     |     | 0.94  | 0.94  |     |     |     |     |       | 0.01  |       |       | 0.01  | 0.21  | -0.13 |       |     |     |      |       |       |       |
| PST  | NC   |   |     |     |     | -0.11 |       |     |     | -0.21 | 0.26  | 0.26  |       |     |     |     |     | 0.62  | 0.62  |     |     |     |     |       | -0.12 |       |       | -0.11 | -0.15 | -0.23 |       |     |     |      |       | 0.49  |       |
| PTA  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.76  | 0.76  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PTQ  | NC   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | -0.13 | -0.13 |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PTR  | NC   |   |     |     |     | -0.46 |       |     |     | -0.10 |       |       |       |     |     |     |     | 0.65  | 0.65  |     |     |     |     |       | 0.07  |       |       | -0.11 | -0.11 | -0.06 |       |     |     |      |       |       |       |
| PVC  | NC   |   |     |     |     | -0.16 |       |     |     | -0.07 | 0.28  | 0.28  |       |     |     |     |     | 0.58  | 0.58  |     |     |     |     |       |       | -0.08 |       | -0.16 | -0.08 | -0.25 |       |     |     |      |       |       |       |
| PWK  | NC   |   |     |     |     | -0.21 |       |     |     | 0.23  | 0.60  | 0.60  | 0.11  |     |     |     |     | 0.83  | 0.83  |     |     |     |     |       | 0.11  | -0.01 |       | 0.16  | 0.16  | 0.02  |       |     |     |      |       | 0.44  |       |
| PWM  | NC   |   |     |     |     | 0.62  |       |     |     |       |       |       |       |     |     |     |     | 1.38  | 1.38  |     |     |     |     |       |       | 0.13  |       | 1.76  | 1.76  | 1.76  |       |     |     |      |       |       |       |
| FRI  | BK   |   |     |     |     | -1.26 |       |     |     |       | -0.03 | -0.03 | -0.03 |     |     |     |     | 0.81  | 0.81  |     |     |     |     |       |       | -0.03 | -0.02 |       | -0.03 | -0.03 | -0.03 |     |     |      |       | -0.03 | -0.35 |
| MIN  | BK   |   |     |     |     |       | 0.74  |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| ABL  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.52  | 0.52  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| ARV  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 1.15  | 1.15  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      | -0.30 |       |       |
| BCH  | CI   |   |     |     |     | -1.16 |       |     |     | -0.29 |       |       |       |     |     |     |     | 0.36  | 0.36  |     |     |     |     |       |       |       |       |       | -0.08 | -0.08 | -0.23 |     |     |      |       |       |       |
| BMT  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.86  | 0.86  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| CRG  | CI   |   |     |     |     | -0.87 |       |     |     | 0.21  |       |       |       |     |     |     |     | 0.90  | 0.90  |     |     |     |     |       |       |       |       | 0.07  |       |       | 0.08  |     |     |      |       |       |       |
| FRK  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       |       |       |       |       |     |     | 0.30 |       |       |       |
| FTC  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.69  | 0.69  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| JUL  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| MAR  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.98  | 0.98  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| MWC  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     |       |       |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PKM  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 0.71  | 0.71  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| PLE  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 1.19  | 1.19  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| RYS  | CI   |   |     |     |     |       |       |     |     |       |       |       |       |     |     |     |     | 1.09  | 1.09  |     |     |     |     |       |       |       |       |       |       |       |       |     |     |      |       |       |       |
| SCC  | CI   |   |     |     |     | -0.15 |       |     |     | -0.01 |       |       |       |     |     |     |     | 0.48  | 0.48  |     |     |     |     |       |       |       |       | 0.17  |       | -0.27 |       |     |     |      |       |       |       |

| Name | IRIS | Delays (sec) By Velocity Model <sup>‡</sup> |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      |       |
|------|------|---|-----|------|-------|-------|------|-----|------|------|------|-----|-----|-------|-------|-----|------|------|-------|------|------|-----|-----|------|------|-------|-----|-------|-------|-------|-----|-------|-----|-----|-------|------|-------|
|      |      | CODE  | AUB | BAE  | BAR   | BAS   | COA  | CON | COY  | CST  | DIA  | GAB | GEY | HAY   | LAS   | LEW | LIV  | LOM  | LON   | MAA  | MAM  | MAN | MEN | MOR  | NBY  | NCG   | PEN | PGH   | PMM   | PSM   | PTA | SCA   | SHA | TRA | TRE   | WAL  |       |
| SIM  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     | 0.87 | 0.87 |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      |       |
| SLC  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     | 0.86 | 0.86 |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      |       |
| SND  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      | 0.05  |
| SUN  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      |       |
| SYP  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     | 0.75 | 0.75 |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      |       |
| TEJ  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      | -0.13 |
| TMB  | CI   |   |     |      |       | -0.67 |      |     |      |      |      |     |     |       |       |     | 1.19 | 1.19 |       |      |      |     |     |      |      | 0.20  |     |       |       |       |     |       |     |     |       |      |       |
| TOW  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      |       |      |      |     |     |      |      |       |     |       |       |       |     | 0.40  |     |     |       | 0.40 |       |
| WAS  | CI   |   |     |      |       | -0.29 |      |     |      |      |      |     |     |       |       |     | 1.34 | 1.34 | -0.70 |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       | 0.10 |       |
| WBS  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | 0.17  |      |      |     |     |      |      |       |     |       |       |       |     | -0.30 |     |     | -0.03 |      |       |
| WCH  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.61 |      |      |     |     |      |      |       |     |       |       |       |     | -0.30 |     |     | 0.04  |      |       |
| WJP  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     | 1.26 | 1.26 |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     | -0.15 |      |       |
| WLH  | CI   |   |     |      |       | -0.07 |      |     |      |      |      |     |     |       |       |     |      |      | -0.55 |      |      |     |     |      |      |       |     |       |       |       |     | -0.30 |     |     |       |      |       |
| WNM  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.60 |      |      |     |     |      |      |       |     |       |       |       |     | -0.30 |     |     | -0.09 |      |       |
| WOF  | CI   |   |     |      |       | -1.29 |      |     |      |      |      |     |     |       |       |     | 0.85 | 0.85 | -0.62 |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     | 0.02  |      |       |
| WOR  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.80 |      |      |     |     |      |      |       |     |       |       |       |     | -0.30 |     |     | -0.04 |      |       |
| WRC  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.34 |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     | 0.11  |      |       |
| WSH  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.59 |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     | 0.22  |      |       |
| WVP  | CI   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -1.00 |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     | -0.05 |      |       |
| YEG  | CI   |   |     |      |       | -0.67 |      |     | 0.11 |      |      |     |     |       |       |     | 0.84 | 0.84 |       |      |      |     |     |      |      | -0.07 |     | 0.12  | 0.12  | 0.12  |     |       |     |     |       |      |       |
| BCK  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.02 |      |      |     |     |      |      | -0.04 |     |       |       |       |     |       |     |     |       |      |       |
| BEN  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.20 |      |      |     |     |      |      | -0.13 |     |       |       |       |     |       |     |     |       |      |       |
| BHP  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.11 |      |      |     |     |      |      | -0.02 |     |       |       |       |     |       |     |     |       |      |       |
| CAS  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.01 |      |      |     |     |      |      | 0.10  |     |       |       |       |     |       |     |     |       |      |       |
| CWC  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.08 |      |      |     |     |      |      | -0.15 |     |       |       |       |     |       |     |     |       |      |       |
| HTC  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | 0.08  |      |      |     |     |      |      | 0.04  |     |       |       |       |     |       |     |     |       |      |       |
| LUL  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     | 2.73 | 2.73 | -0.10 |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       |      |       |
| MGN  | NN   |   |     |      |       | 2.37  |      |     |      |      |      |     |     |       |       |     |      |      | 0.07  |      |      |     |     |      |      | 0.06  |     |       |       |       |     |       |     |     |       |      |       |
| MLN  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.01 |      |      |     |     |      |      | 0.04  |     |       |       |       |     |       |     |     |       |      |       |
| ORC  | NN   |   |     |      |       | 2.02  |      |     |      |      |      |     |     |       |       |     |      |      | -0.12 |      |      |     |     |      |      | -0.05 |     |       |       |       |     |       |     |     |       |      |       |
| POC  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.33 |      |      |     |     |      |      | -0.05 |     |       |       |       |     |       |     |     |       |      |       |
| RCC  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.14 |      |      |     |     |      |      | -0.10 |     |       |       |       |     |       |     |     |       |      |       |
| SCH  | NN   |   |     |      |       | 1.49  |      |     |      |      |      |     |     |       |       |     |      |      | -0.17 |      |      |     |     |      |      | -0.17 |     |       |       |       |     |       |     |     |       |      |       |
| SLK  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.21 |      |      |     |     |      |      | 0.13  |     |       |       |       |     |       |     |     |       |      |       |
| STR  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.02 |      |      |     |     |      |      | 0.02  |     |       |       |       |     |       |     |     |       |      |       |
| WMD  | NN   |   |     |      |       |       |      |     |      |      |      |     |     |       |       |     |      |      | -0.19 |      |      |     |     |      |      | -0.16 |     | -0.23 | -0.23 | -0.23 |     |       |     |     |       |      |       |
| GAS  | WR   |   |     | 0.02 | -0.02 |       |      |     |      |      |      |     |     |       |       |     |      | 0.30 |       | 0.08 | 0.27 |     |     | 0.14 | 0.11 |       |     |       |       | 0.24  |     |       |     |     |       |      |       |
| KPK  | WR   | -0.01                                       |     |      |       |       |      |     |      |      |      |     |     | 0.03  |       |     |      |      |       |      |      |     |     |      |      | 0.22  |     |       |       |       |     |       |     |     |       | 0.06 |       |
| MGL  | WR   | -0.03                                       |     |      |       |       | 0.83 |     |      | 0.07 | 0.07 |     |     | -0.18 |       |     | 1.25 | 1.25 |       |      |      |     |     |      |      |       |     |       |       |       |     |       |     |     |       | 0.07 |       |
| ORV  | WR   |   |     |      |       |       |      |     |      |      |      |     |     | -0.60 | -0.23 |     |      |      |       |      |      |     |     |      |      | -0.05 |     |       |       |       |     |       |     |     | -0.15 |      |       |

<sup>‡</sup>Blank delay field denotes a value of zero or no delay available.

## Network Response

Most of the stations in the NCSN have identical instrumentation but operate at different gains. The amplified output of each velocity transducer (seismometer) is frequency modulated, multiplexed, and transmitted to Menlo Park, California via a combination of radio, telephone, and microwave communications, so that all stations are digitized in common with the same time base. Most of the network is designed to record ground motion between 0.2 and 20 Hz with 40-50 db of dynamic range, but the passband and dynamic range is greater for special instrument clusters along the Hayward fault and at Parkfield. To provide on-scale recordings for larger earthquakes, the NCSN records 34 stations located throughout the network that have low-gain vertical seismometers (Figure 1, Table 1).

*Healy and O'Neill* (1977) showed how the response of the network can be modelled as a series of response functions, or filters, for each of the instrument components. These response functions are solutions of first and second order ordinary differential equations that describe the movement of a damped mass-and-spring system (*e.g.*, a seismometer) and the currents and voltages in an L-R-C electrical circuit. *Stewart and O'Neill* (1980) applied the method of *Healy and O'Neill* to determine the responses of the individual components used in the USGS short-period seismic networks. A discussion of the network and its response spectra previously and currently used by the NCSN is given by *Eaton* (1993). Table 6 provides the instrument response in terms of the complex poles and zeroes of the spectral elements, following the convention of *Stewart and O'Neill* (1980). The total response of the system at different attenuator settings is shown in Figure 4.

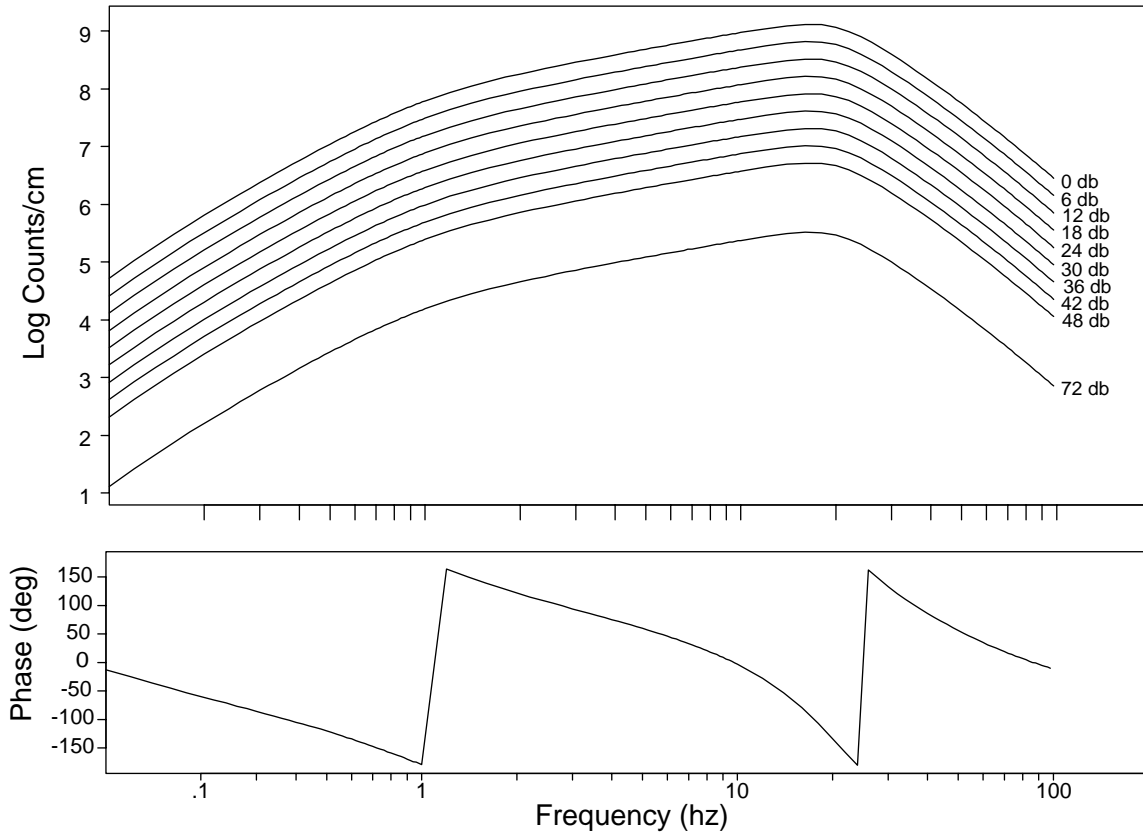


Figure 4. Amplitude and phase response of NCSN corresponding to parameters given in Table 6. Amplitude response is given as a function of attenuator settings.

**Table 6. USGS Instrument Response Parameters**

| Instrument/<br>Amplitude function                          | $f_0$<br>(hz) | Damping | Poles <sup>1</sup><br>(rad/s)                                    | Zeroes                                       | Amplitude<br>constant |
|--|---------------|---------|--|--|-----------------------|
| <b>Mark Products L4-C<br/>Seismometer</b>                  | 1.0           | 0.8     | $\alpha_j = +3.7699 + 5.0265i$<br>$\alpha_k = -3.7699 + 5.0265i$ | $0.0 + 0.0i$<br>$0.0 + 0.0i$<br>$0.0 + 0.0i$ | 1.0                   |
| $\frac{i\omega^3}{(\omega - \alpha_j)(\omega - \alpha_k)}$ |               |         |  |  |                       |

Sensitivity:  $A_S = 1.00$  v/cm/sec

#### J512 Preamp/Voltage control oscillator

|   |       |     |  |                              |                  |
|---|-------|-----|--|------------------------------|------------------|
| Hi-pass filter  | 0.095 | 1.0 | $\alpha_j = 0.0 + 0.5969i$<br>$\alpha_k = 0.0 + 0.5969i$   | $0.0 + 0.0i$<br>$0.0 + 0.0i$ | 1.0<br>1.0       |
| $\frac{\omega^2}{(\omega - \alpha_j)(\omega - \alpha_k)}$ |       |     |  |                              |                  |
| Lo-pass filter  | 44.0  | 1.0 | $\alpha_j = 0.0 + 276.460i$<br>$\alpha_k = 0.0 + 276.460i$ | none                         | 276.46<br>276.46 |
| $\frac{-1}{(\omega - \alpha_j)(\omega - \alpha_k)}$       |       |     |  |                              |                  |

Sensitivity:  $A_A = \text{amplifier gain} = 10^{(92.6 - \text{attn})/20}$

$A_M = \text{modulator gain} = 105/4.05 = 25.926$  hz/v

$A_{VCO} = \text{VCO gain} = 25.926 \times 10^{(92.6 - \text{attn})/20} = 25.926 \times 10^{2.3/20} \times 10^{(90.3 - \text{attn})/20}$  hz/v

#### 121 Discriminator

|   |      |       |  |      |                    |
|---|------|-------|--|------|--------------------|
| Lo-pass # 1   | 20.0 | .3827 | $\alpha_j = +116.0973 + 48.0915i$<br>$\alpha_k = -116.0973 + 48.0915i$ | none | 125.664<br>125.664 |
| $\frac{-1}{(\omega - \alpha_j)(\omega - \alpha_k)}$ |      |       |  |      |                    |
| Lo-pass #2  | 20.0 | .9239 | $\alpha_j = +48.0832 + 116.1007i$<br>$\alpha_j = -48.0832 + 116.1007i$ | none | 125.664<br>125.664 |
| $\frac{-1}{(\omega - \alpha_j)(\omega - \alpha_k)}$ |      |       |  |      |                    |

Sensitivity:  $A_D = \text{discriminator gain} = 2.2$  v/125 hz = 0.0176 v/hz

#### 12-bit Tustin digitizer

Sensitivity:  $A_R = \text{digitizer gain} = 2047$  counts/2.5 v = 818.8 counts/v.

#### System sensitivity

The response of the system as a whole is obtained by combining the spectral elements and sensitivity factors of its constituent parts. The overall system sensitivity  $A = A_S \times A_{VCO} \times A_D \times A_R = 486.4 \times 10^{(90.3 - \text{attn})/20}$  counts/cm/sec.

<sup>1</sup> The poles can be expressed in the SEED convention (IRIS, 1990) by multiplying by  $(0.0 + i)$ .



## Synopsis of Seismicity

In general, 1992 was notable for the absence of any significant earthquake sequences in the center of the network. However, two  $M > 7$  earthquakes occurred at the edge of the net. The first event occurred in April at Cape Mendocino, but its aftershocks occurred primarily in the Pacific ocean, where the network's ability to locate earthquakes is degraded. Then on 28 June the Landers earthquake occurred within the Southern California Seismic Network. Only the northernmost Landers aftershocks that occurred within the NCSN are discussed in this report. A total of 21,365 earthquakes and blasts were detected by the NCSN during 1992. Of this total, 170 events had a coda magnitude ( $M_c$ )  $\geq 3.5$  and 5 events were  $M \geq 5$  (Table 7, Figure 2). The following sections summarize the seismicity that occurred within the sub-regions shown in Figure 5. All origin times are UTC.

### Cape Mendocino Sub-region A

Two significant earthquake sequences occurred near the Mendocino Triple Junction, where the Pacific, North America, and southernmost Juan de Fuca (Gorda) plates meet. On 8 March at 03:43 a  $M$  5.3 earthquake occurred at a depth of 11.2 km (Table 7) and caused minor damage near the town of Honeydew. This strike-slip earthquake (#1, Figure 2) had only 11 aftershocks within 20 km of the mainshock epicenter in the following 30 days, of which the largest event was approximately  $M$  3.0. While this earthquake did not produce a large aftershock sequence, it should be noted that the magnitude of uniform detection for this region is approximately 1.9 due to the sparse network and the occurrence of earthquakes offshore. The aftershock distribution did not indicate which plane was the slip plane, but the prevailing geologic structure of the region would favor right-lateral slip on the vertical plane striking N60°W.

[The following summary is an excerpt from Oppenheimer et al. (1993) which provides a review of geophysical observations of the Cape Mendocino earthquake sequence and implications for the hazards of the region.] On 25 April, 1992 at 18:06 a surface wave magnitude ( $M_s$ ) 7.1 earthquake occurred near the town of Petrolia, California (#2, Figures 2 and 6). The mainshock was followed the next day by two  $M_s$  6.6 aftershocks at 07:41 (#3) and 11:41 (#4) located offshore approximately 25 km west-northwest of Petrolia. These three earthquakes generated more than 2000 recorded aftershocks in the triple junction region. The occurrence of a  $M$  7 earthquake is not unusual at the triple junction; over 60 earthquakes of Modified Mercalli intensity (1) ( $MMI$ )  $\geq VI$  or  $M \geq 5.5$  have occurred there since 1853 (Dengler et al., 1992). Damage estimates ranged from \$48 to \$66 million dollars, and the sequence caused 356 reported injuries, destroyed 202 buildings, and caused damage to an additional 906 structures primarily in the towns of Petrolia, Ferndale, Rio Dell, Scotia and Fortuna. It also triggered numerous landslides and rock falls and caused widespread liquefaction in local river valleys. The peak Modified Mercalli intensity was IX in the Petrolia region and decreased in approxi-

mately a radial pattern around the epicenter. The strong ground motions of the mainshock and two aftershocks were recorded on 14 instruments at epicentral distances from 5 to 130 km, and the peak accelerations were some of the highest ever recorded (Shakal et al., 1992).

The hypocenter of the 25 April 1992 mainshock was 4 km east of Petrolia at a depth of 10.6 km (Figure 6). A focal mechanism determined by inverting teleseismic mantle Rayleigh waves and aftershock locations indicate nearly pure thrust motion on a N10°W-striking fault plane dipping 13° to the east-northeast (Figures 2 and 6). The location of the hypocenter at the southeast end of the aftershock zone suggests that the fault ruptured unilaterally to the west. Most aftershocks less than 12 km deep occurred within 10 km of the coast in a region bounded on the east by the main shock epicenter, on the south by the Mendocino fault, and on the north by a west-northwest trend of earthquakes. The location, depth, and orientation of the rupture plane are consistent with the absence of surface faulting onshore.

The two  $M_s$  6.6 aftershocks locate 30 km west of the mainshock at depths near 20 km, and their mechanisms indicate right-lateral, strike-slip motion on planes striking to the southeast (Figure 6). The slip plane of the first aftershock is unknown because of the paucity of aftershocks. However, the second aftershock locates within a trend of smaller aftershocks at depths of 14 to 30 km on a southeast-striking plane dipping about 80° to the southwest; this orientation is consistent with the focal mechanism. The depths and mechanisms of the two large aftershocks provide evidence that rupture took place on faults in the Gorda plate and distinct from the mainshock fault. Although no large shocks ruptured the Mendocino fault during this sequence, many aftershocks occurred on the eastward projection of the fault. The aftershock activity was bounded on the south where the distribution of hypocenters is near vertical and extends to a depth of 25 km.

The elastic strain released by the mainshock caused significant horizontal and vertical deformation in the epicentral region. The mainshock elevated about 25 km of the coast from 3 km south of Punta Gorda to Cape Mendocino.

no. Many intertidal organisms inhabiting rocky reefs perished in the three weeks following the mainshock. Maximum uplift was  $140 \pm 20$  cm at Mussel Rock and 40 to 50 cm at the northernmost reef at Cape Mendocino. Modeling of coseismic horizontal and vertical site displacements measured by GPS surveys indicates shallow thrusting on a plane consistent with the teleseismic focal mechanism of the mainshock. The mainshock also generated a small tsunami recorded by sea level gauges along the California, southern Oregon, and Hawaiian coastlines. The largest tsunami amplitudes were recorded at Crescent City where two well-defined packets of wave energy with maximum positive heights of 35 and 53 cm within the first five hours were recorded.

## **Shasta and Lassen**

### **Sub-region B**

The most noteworthy seismicity recorded in this region occurred in response to the June 28  $M$  7.3 Landers earthquake (Figure 7) (Hill *et al.*, 1993). Significant increases in seismicity were triggered 12 minutes after the earthquake at Lassen (840 km) and 23 hours later at Burney (900 km). Otherwise, no unusual seismicity occurred in this region during 1992 (Figure 2). Of the 214 earthquakes located by the NCSN during this period, only three exceeded  $M$  3.5. The largest event, a  $M$  4.0 occurred on 16 July at a depth of 19 km approximately 18 km north-northeast of Red Bluff (Table 7). No aftershocks occurred within 20 km of the epicenter in the following 30 days.

## **Coast Ranges north of S.F. Bay**

### **Sub-region C**

The NCSN recorded 501 earthquakes primarily along the Rodgers Creek-Healdsburg-Maacama fault system and the Green Valley-Cedar Roughs-Bartlett Springs fault system (Figure 2) (see sub-region D for a discussion of The Geysers-lower Clear Lake region). No unusual earthquake sequences were recorded and no earthquakes above  $M$  3.5 occurred. The San Andreas fault was nearly aseismic except for five  $M \leq 2$  earthquakes near Gualala. A localized cluster of fourteen earthquakes ( $M \leq 2$ ) occurred throughout the year 60-65 km west-southwest of Red Bluff at a depth range of 2 to 13 km. Another cluster of  $M \leq 2$  events was located at depths of 6 - 8 km in the Montezuma Hills north of Antioch.

## **The Geysers - Lower Clear Lake**

### **Sub-region D**

The Geysers region continued to be one of the most seismogenic regions monitored by the NCSN. Earthquakes in this region are induced by activities associated with production of electricity, such as steam withdrawal, cooling of the reservoir, and fluid injection. We recorded an average

of 7 earthquakes per day in 1992 and over 2600 events for the year. Four earthquakes had  $M \geq 3.5$ ; the largest event, a  $M$  4.4, occurred on 19 September at 23:04 at a depth of 3 km beneath the northern region of the geothermal steam field. Two events, a  $M$  3.7 followed by a  $M$  3.5 occurred on 24 March at 14:27 and 14:28 at depths of 1.7 and 1.5 km near the same location as the  $M$  4.4 event. The Geysers was the only region in the northern San Andreas fault system which exhibited triggered seismicity in response to the Landers earthquake (distance = 740 km) (Hill *et al.*, 1993). A swarm of  $M < 1$  triggered seismicity occurred 30 s after the arrival of the main shock  $S$  wave.

## **Central California Coast Range**

### **Sub-region E**

There was very little seismicity recorded in sub-region E during 1992. Of the 155 events shown in Figure 2, only one event exceeded  $M$  3.5. This event had a magnitude of 4.1 and occurred on 2 July at 13:59 about 4 km south-southwest of San Simeon at a depth of 3 km.

## **Loma Prieta - S. F. Peninsula**

### **Sub-region F**

Of the 908 earthquakes recorded in this sub-region during 1992, 805 occurred in the aftershock region of the 1989  $M$  7 Loma Prieta earthquake. The number of aftershocks is 51% the number that occurred in 1991 and 24% of the number that occurred in 1990. The two largest events in this sub-region both were magnitude 3.7 and occurred within 5 minutes of each other on 12 December at 15:53 and 15:58. They ruptured the San Andreas fault 4 km west of San Juan Bautista at a depth of 4.5 km and produced about 24 aftershocks in the following week. The largest event on the San Francisco Peninsula, north of the Loma Prieta region, was a  $M$  3.4 event on 29 April at 01:16 that occurred at a depth of 6.7 km 1 km southeast of Pacifica.

## **San Francisco East Bay**

### **Sub-region G**

Seismicity in the East Bay continued on the same faults that have exhibited seismicity in the previous two decades. Two thirds of the activity (520 earthquakes) occurred on the Calaveras fault south of the Calaveras reservoir, with the remainder occurring primarily on the Hayward, Mission, Greenville, and Concord faults. The largest event to occur in this region during 1992 was a  $M$  3.9 event on 15 February; it occurred 14 km east of Livermore at a depth of 16.6 km near the Tesla fault. A  $M$  3.6 also occurred near San Leandro along the Hayward fault on 20 December at a depth of 5.5 km.

## **Creeping San Andreas**

### **Sub-region H**

The NCSN recorded 997 events in this region, and the largest event was a  $M$  3.7 event on 28 February at a depth of 6.3 km on the San Andreas fault 29 km east of King City. This earthquake was followed by a brief swarm of 25 events over the next two days. Scattered seismicity also occurred on the Tres Piños and Quien Sabe faults.

### **Parkfield**

#### **Sub-region I**

Two earthquakes in 1992 occurred in the vicinity of the nucleation points of the  $M$  6 1934 and 1966 Parkfield earthquakes. On 20 October at 05:28 a  $M$  4.5 event ruptured the San Andreas at a depth of 10.0 km near Middle Mountain, followed 6 days later by a  $M$  3.7 aftershock at 10.5 km on 26 October at 07:27. The former event triggered the first "A" level alert for the Parkfield experiment since its inception in 1985 (*Bakun et al.*, 1987), whereas the latter event resulted in a "B" level alert. The remaining 261 events located were otherwise typical (*Parkfield Working Group*, 1993).

## **Western margin of the S. Central Valley**

### **Sub-region J**

Six earthquakes above  $M$  3.5 occurred in this region. A  $M$  4.3 on 16 September occurred at a depth of 10.6 km 20 km east of Avenal. This event was followed by a  $M$  4.2 event on 27 September. Three  $M$  3.7-3.8 events occurred in the Coalinga region (15 January 04:58; 22 April 16:52; 5 December 02:52). A  $M$  3.7 event also occurred 15 km west-northwest of Los Baños. The remaining 300 events were typical of activity of this region.

## **Central Valley/Western Sierra Nevada**

### **Sub-region K**

More than two hundred events occurred in this region. The largest event was a  $M$  5.7 event on 11 July at 18:14 20 km north-northeast of Mojave (#6 Figure 2). This event is related to the Landers earthquake sequence and is discussed more fully in the SCSN Bulletin (*Wald et al.*, 1993). Similarly, about half of the events shown in Figure 2 are related to this earthquake. The remaining significant event was a poorly located  $M$  3.8 on 25 December 10 km east-northeast of Quincy.

## **Long Valley Caldera**

### **Sub-region L**

This region continued to be very seismically active, recording 13% of all the seismicity in the network. Although there were no earthquakes greater than  $M$  3.8 in 1992 (29 June), several noteworthy swarms occurred (Figure 7). In

particular, the Long Valley region exhibited one of the most pronounced triggered seismicity responses to the Landers earthquake (*Hill et al.*, 1993). At an epicentral distance of about 415 km from the main shock, the number of earthquakes jumped from 38 in the week preceding the main shock to 340 in the week following the event. Seismicity commenced 9 minutes after the mainshock during the passage of the  $S$  wave and the Love and Rayleigh surface waves. Seismicity returned to the background level in the second half of July.

Most of the significant swarms occurred in the latter half of the year about 2 km east of Mammoth Lakes with focal depths of 5 to 8 km. The swarm of 27 August included a  $M$  2.9 event, and the largest event of the swarm of 23 September was  $M$  2.7. On 20 November a swarm of over 80 events occurred which included a  $M$  2.7 earthquake.

## **Central/Southern Sierra Nevada**

### **Sub-region M**

The Rose Valley swarm began on February 15 near Coso Junction and was jointly recorded by the NCSN and SCSN networks (see *Wald et al.*, 1993) (Figures 2 and 7). The largest event in this swarm was a  $M$  4.1 event on 19 February at a depth of 6.6 km. The activity returned to normal by the end of March. Another  $M$  4.0 event occurred in the same vicinity on 4 September. The biggest event to occur in the region was a  $M$  4.5 on 30 June that occurred 6 km east of China Lake (#5 Figure 2). About another 12  $M$  3.5-4.0 events occurred in the Coso-Indian Wells region throughout the year, but this activity was typical. Similar magnitude events were recorded in the Round Valley, Mt. Morrison, Chalfant, Silver Peak, and Owens Valley regions.

The Coso-Indian Wells, Mono Basin, Chalfant Valley, and region south of Long Valley caldera also exhibited triggered seismicity in response to the 28 June Landers earthquake (*Hill et al.*, 1993). The Coso region sustained the largest triggered event ( $M$  4.4), and was closest to the source region (165-205 km). The seismicity in the Mono Basin region increased from 3 events in the week preceding Landers to 12 events in the week following the earthquake. Most triggered seismicity did not occur until 8 hours after the mainshock.

## **Carrizo Plain**

### **Sub-region N**

No unusual seismicity was recorded except for a  $M$  3.6 event 10 km northeast of Taft at a depth of 21 km and a  $M$  3.8 event on 3 March 24 km northwest of Tejon Pass at a depth of 25 km.

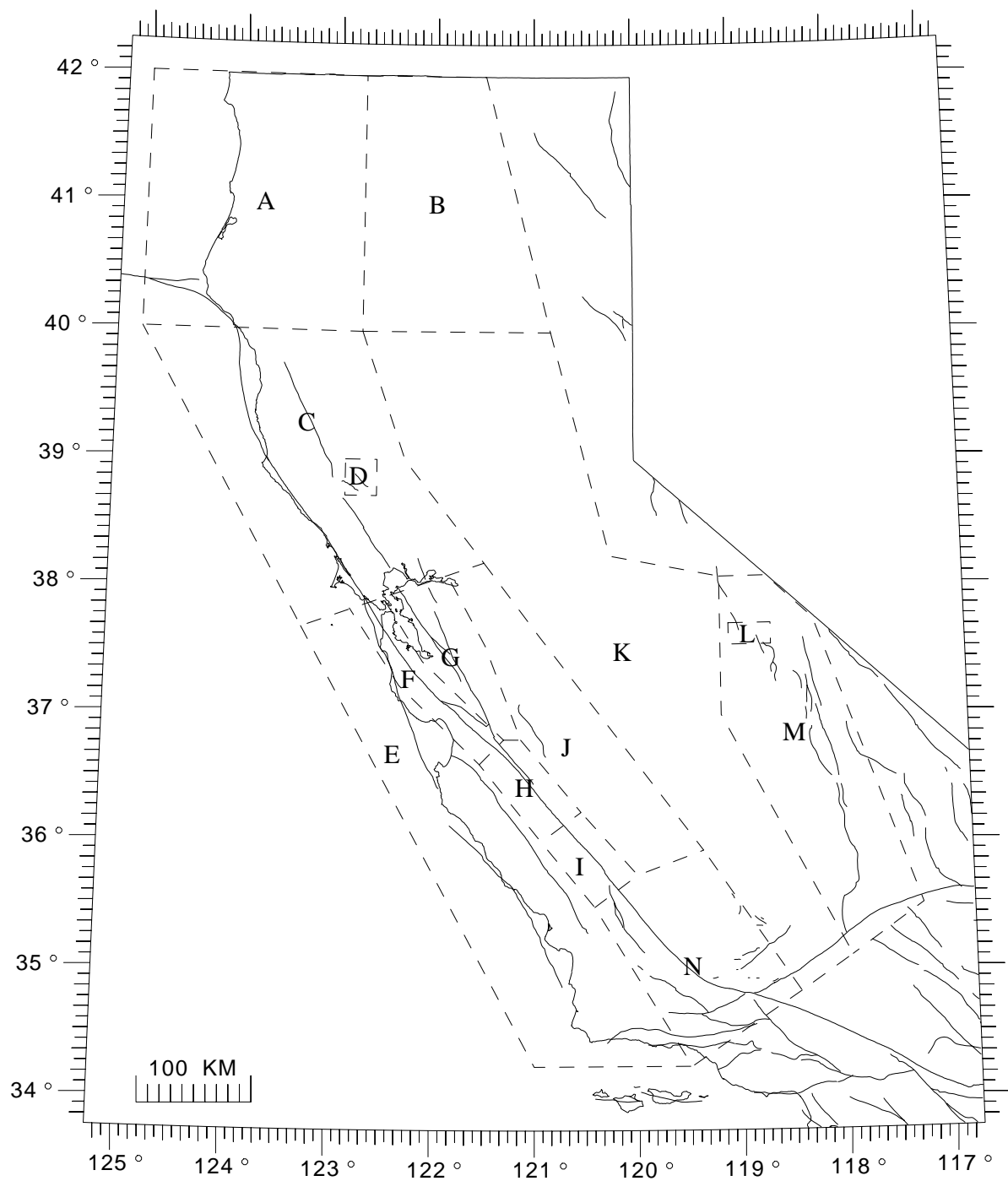


Figure 5. Boundaries of seismicity regions discussed in text.

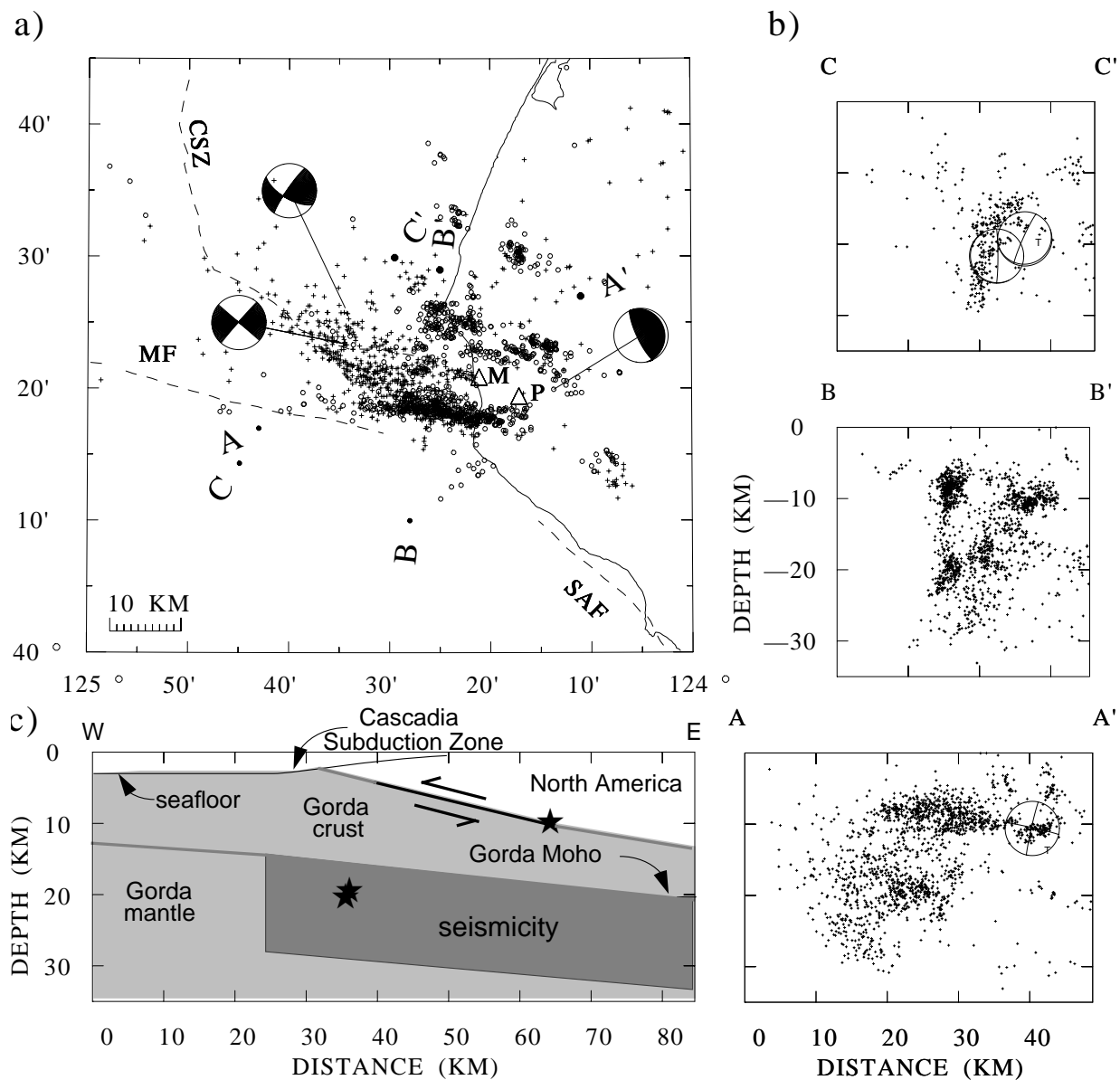


Figure 6. a) Focal mechanisms of the main shock and two large aftershocks at their epicentral locations and location of other aftershocks for 25 April 1992 to 30 September 1992 (open circles for foci < 12 km depth and plus symbols for deeper foci). b) Depth of earthquakes on cross sections aa' (perpendicular to main shock strike, width  $\pm 20$  km), bb' (perpendicular to Mendocino fault, width  $\pm 20$  km), and cc' (perpendicular to strike of  $M_s$  6.6 aftershocks, width  $\pm 9$  km. Compressional quadrant marked by "T". c) East-west cross section depicts location of main shock rupture plane (solid line), hypocenters (stars), and pre-main-shock seismicity with respect to plausible interpretation of Gorda North American plate geometry (Figure after Oppenheimer et al., 1993).

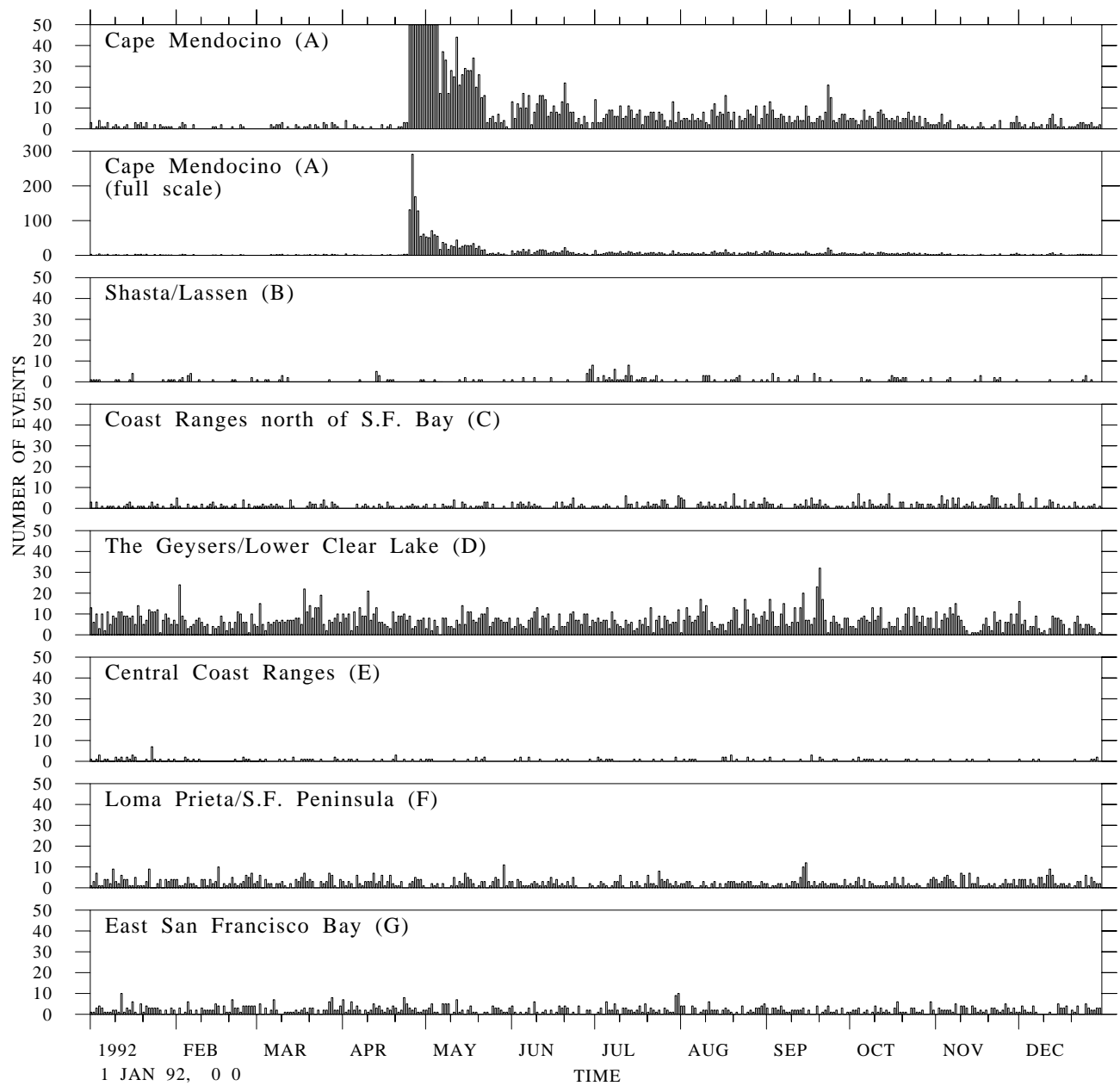


Figure 7. Time-histograms of the seismicity regions shown in Figures 2 and 5.

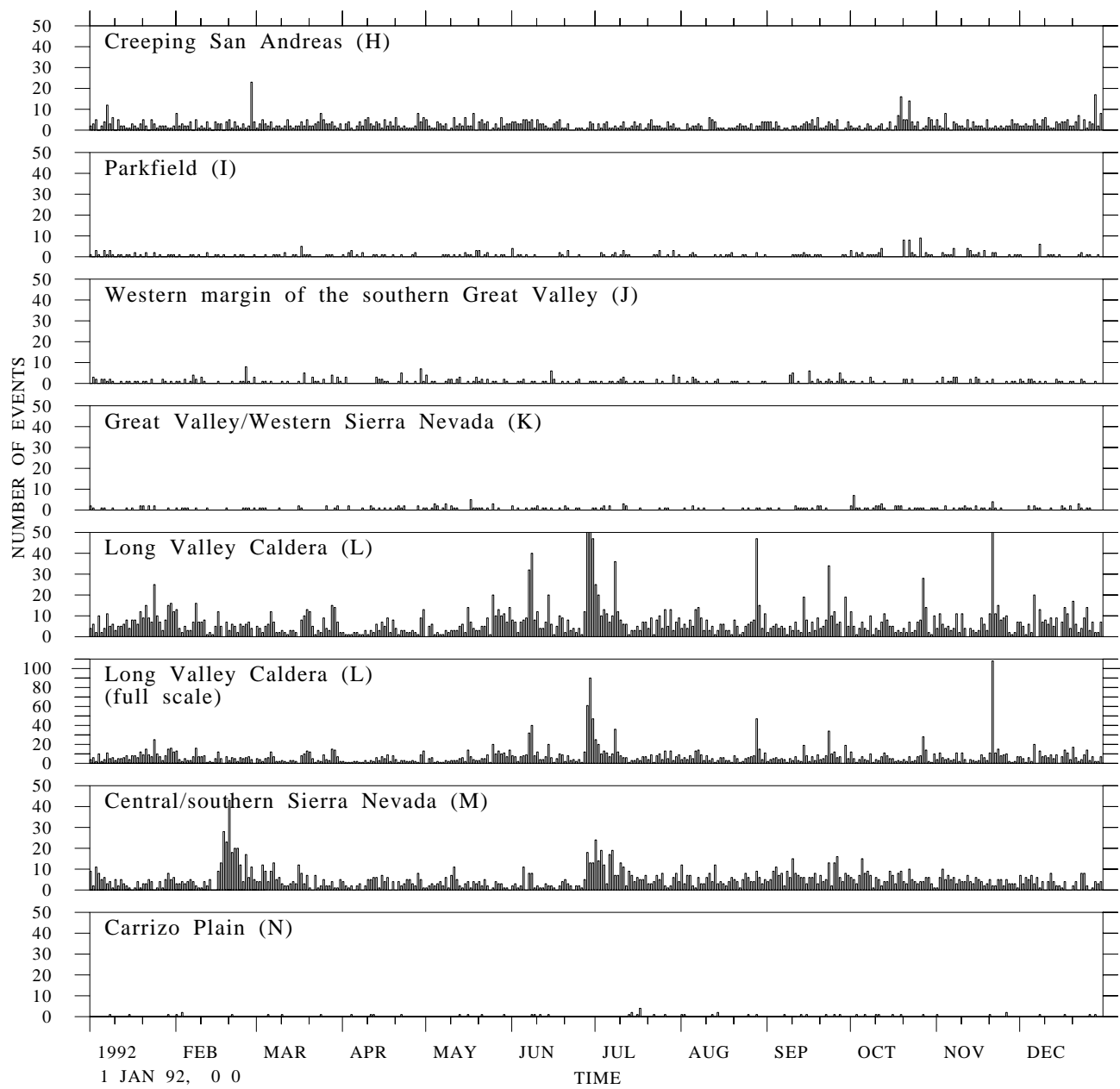


Figure 7 (cont.).

Table 7. M&gt;3.5 Earthquakes Recorded during 1992 by the U.S.G.S. in Menlo Park

| DATE      | TIME       | LATITUDE<br>(NORTH) | LONGITUDE<br>(WEST) | DEPTH<br>(KM) | GEOGRAPHIC<br>LOCATION | M <sub>D</sub> | #<br>M <sub>D</sub> | MAD<br>M <sub>D</sub> | M <sub>X</sub> | #<br>M <sub>X</sub> | MAD<br>M <sub>X</sub> | #<br>P+S | #<br>S | #<br>VR | #<br>FM | RMS<br>(SEC) | ERH<br>(KM) | ERZ<br>(KM) | AZM-GAP<br>(DEG) | DMIN<br>(KM) | VEL<br>MODEL | SOURCE<br>PDX |
|-----------|------------|---------------------|---------------------|---------------|------------------------|----------------|---------------------|-----------------------|----------------|---------------------|-----------------------|----------|--------|---------|---------|--------------|-------------|-------------|------------------|--------------|--------------|---------------|
| 92 JAN 15 | 458 50.36  | 36 18.03            | 120 27.32           | 12.63         | COA                    | 3.8            | 99                  | .11                   | 3.6            | 13                  | .15                   | 53       | 2      | 110     | 99      | .13          | .2          | .5          | 84               | 9            | COA          | 222           |
| 92 JAN 24 | 2026 55.04 | 40 17.65            | 124 28.88           | 21.04         | MEN                    | 3.7            | 99                  | .15                   | 3.6            | 14                  | .13                   | 25       | 2      | 103     | 99      | .09          | .9          | .3          | 230              | 24           | MEN          | 222           |
| 92 JAN 26 | 1820 37.51 | 35 53.12            | 117 37.25           | 58.07         | IWV                    | 3.6            | 14                  | .31                   |                |                     |                       | 4        | 0      | 13      | 6       | .01          | 1.8         | 2.2         | 221              | 30           | WAL          | 22            |
| 92 FEB 10 | 1829 41.88 | 38 50.47            | 122 52.26           | 2.86          | GEY                    | 3.8            | 99                  | .18                   | 3.8            | 26                  | .16                   | 47       | 1      | 215     | 99      | .08          | .1          | .6          | 28               | 4            | GEY          | 222           |
| 92 FEB 15 | 1436 19.66 | 37 40.60            | 121 36.67           | 16.60         | HAM                    | 4.0            | 99                  | .12                   | 4.0            | 15                  | .22                   | 94       | 7      | 294     | 99      | .19          | .2          | .3          | 85               | 9            | LIV          | 222           |
| 92 FEB 19 | 1119 24.73 | 36 1.41             | 117 53.24           | 6.61          | COS                    | 4.1            | 99                  | .14                   | 4.5            | 14                  | .16                   | 11       | 0      | 132     | 99      | .05          | .5          | 1.0         | 179              | 10           | WAL          | 222           |
| 92 FEB 19 | 1224 39.77 | 36 1.72             | 117 53.14           | 6.84          | COS                    | 3.6            | 99                  | .13                   | 3.8            | 22                  | .27                   | 11       | 0      | 110     | 99      | .07          | .6          | 1.3         | 182              | 11           | WAL          | 222           |
| 92 FEB 21 | 417 54.63  | 36 1.03             | 117 53.33           | 6.53          | COS                    | 3.7            | 99                  | .14                   | 3.8            | 11                  | .18                   | 11       | 0      | 111     | 99      | .05          | .5          | 1.0         | 176              | 10           | WAL          | 222           |
| 92 FEB 21 | 1459 44.63 | 36 1.47             | 117 53.31           | 6.97          | COS                    | 3.5            | 99                  | .14                   | 3.2            | 6                   | .31                   | 14       | 0      | 82      | 78      | .06          | .5          | .9          | 127              | 11           | WAL          | 222           |
| 92 FEB 21 | 1919 42.08 | 34 57.38            | 119 6.42            | 20.77         | WWF                    | 3.6            | 99                  | .15                   | 3.4            | 10                  | .12                   | 11       | 0      | 109     | 99      | .09          | .6          | .9          | 111              | 4            | TRA          | 222           |
| 92 FEB 22 | 332 20.51  | 36 1.63             | 117 53.36           | 6.01          | COS                    | 3.7            | 99                  | .14                   | 3.8            | 15                  | .33                   | 11       | 0      | 128     | 99      | .06          | .6          | 1.2         | 180              | 11           | WAL          | 222           |
| 92 FEB 23 | 103 12.29  | 37 31.77            | 118 25.78           | 8.73          | CHV                    | 3.6            | 99                  | .11                   | 3.3            | 6                   | .33                   | 34       | 0      | 109     | 99      | .05          | .3          | .6          | 94               | 2            | MAM          | 222           |
| 92 FEB 27 | 2203 0.74  | 36 46.07            | 121 28.76           | 8.60          | SJB                    | 3.5            | 99                  | .13                   | 3.6            | 23                  | .16                   | 85       | 7      | 211     | 99      | .23          | .2          | .5          | 35               | 2            | LOM          | 222           |
| 92 FEB 28 | 329 20.48  | 36 13.22            | 120 47.18           | 5.83          | BIT                    | 3.7            | 99                  | .15                   | 3.2            | 10                  | .12                   | 48       | 1      | 52      | 49      | .31          | .5          | 1.8         | 65               | 1            | PMM          | 222           |
| 92 MAR 3  | 807 49.33  | 35 45.60            | 118 1.60            | 7.82          | WWF                    | 3.8            | 99                  | .15                   |                |                     |                       | 11       | 0      | 121     | 99      | .06          | .3          | 1.2         | 97               | 14           | WAL          | 22            |
| 92 MAR 5  | 1824 22.31 | 35 12.63            | 119 22.67           | 25.21         | BAK                    | 3.8            | 99                  | .15                   | 3.1            | 15                  | .10                   | 35       | 0      | 123     | 99      | .24          | .4          | .9          | 86               | 20           | TRA          | 222           |
| 92 MAR 8  | 343 4.45   | 40 15.49            | 124 13.82           | 10.74         | MEN                    | 5.3            | 99                  | .34                   | 5.3            | 30                  | .15                   | 15       | 1      | 284     | 99      | .15          | .7          | .4          | 191              | 9            | MEN          | 222           |
| 92 MAR 9  | 451 15.82  | 40 34.39            | 123 22.42           | 35.63         | KLA                    | 4.4            | 99                  | .18                   | 4.1            | 10                  | .14                   | 42       | 3      | 198     | 99      | .10          | .2          | .8          | 50               | 16           | MEN          | 222           |
| 92 MAR 16 | 1208 6.39  | 40 19.46            | 124 36.06           | 18.56         | MEN                    | 3.7            | 99                  | .15                   | 3.7            | 16                  | .12                   | 48       | 2      | 164     | 99      | .10          | .6          | .5          | 226              | 39           | MEN          | 222           |
| 92 MAR 16 | 1920 22.18 | 36 0.15             | 117 52.73           | 5.51          | COS                    | 3.6            | 99                  | .12                   | 3.5            | 8                   | .30                   | 11       | 0      | 131     | 99      | .04          | .5          | 1.0         | 171              | 8            | WAL          | 222           |
| 92 MAR 17 | 1156 35.71 | 36 0.26             | 117 52.58           | 5.29          | COS                    | 3.8            | 99                  | .14                   | 4.1            | 30                  | .18                   | 11       | 0      | 141     | 99      | .05          | .5          | 1.1         | 173              | 8            | WAL          | 222           |
| 92 MAR 24 | 1427 6.12  | 38 50.63            | 122 47.86           | 1.71          | GEY                    | 3.7            | 99                  | .20                   |                |                     |                       | 38       | 0      | 94      | 94      | .07          | .2          | .7          | 35               | 4            | GEY          | 22            |
| 92 MAR 24 | 1428 28.45 | 38 50.20            | 122 48.31           | 1.55          | GEY                    | 3.6            | 99                  | .27                   |                |                     |                       | 28       | 0      | 41      | 41      | .07          | .2          | .6          | 39               | 3            | GEY          | 22            |
| 92 APR 22 | 1652 54.89 | 36 9.97             | 120 14.48           | 11.01         | COA                    | 3.7            | 99                  | .10                   | 3.7            | 28                  | .12                   | 42       | 1      | 167     | 99      | .08          | .2          | .4          | 129              | 13           | COA          | 222           |
| 92 APR 25 | 1501 48.16 | 40 18.18            | 124 31.84           | 21.28         | MEN                    | 3.5            | 99                  | .13                   | 3.4            | 17                  | .14                   | 16       | 1      | 97      | 79      | .08          | 1.0         | .4          | 254              | 20           | MEN          | 222           |
| 92 APR 25 | 1806 5.18  | 40 19.96            | 124 13.77           | 10.21         | MEN                    | 6.5            | 99                  | .27                   | 6.1            | 27                  | .22                   | 9        | 0      | 346     | 99      | .06          | .3          | .7          | 116              | 12           | MEN          | 222           |
| 92 APR 25 | 1820 14.20 | 40 27.36            | 124 23.00           | 6.91          | MEN                    | 4.4            | 9                   | .49                   |                |                     |                       | 14       | 0      | 15      | 15      | .07          | 1.1         | 2.5         | 237              | 69           | MEN          | PP            |
| 92 APR 25 | 1825 18.21 | 40 25.68            | 124 31.62           | 7.46          | MEN                    | 3.6            | 7                   | .12                   |                |                     |                       | 11       | 0      | 13      | 13      | .08          | 3.6         | 2.8         | 278              | 59           | MEN          | PP            |
| 92 APR 25 | 1827 35.32 | 40 15.93            | 124 26.23           | 0.76          | MEN                    | 3.6            | 16                  | .46                   |                |                     |                       | 22       | 0      | 26      | 26      | .15          | 1.5         | 4.9         | 235              | 50           | MEN          | PP            |
| 92 APR 25 | 1828 58.08 | 40 22.61            | 124 25.55           | 12.27         | MEN                    | 4.2            | 15                  | .21                   |                |                     |                       | 13       | 0      | 15      | 15      | .07          | 2.9         | 2.4         | 284              | 56           | MEN          | PP            |
| 92 APR 25 | 1831 51.54 | 40 18.77            | 124 31.49           | 5.96          | MEN                    | 4.3            | 15                  | .20                   |                |                     |                       | 17       | 0      | 22      | 22      | .07          | 1.5         | 2.0         | 239              | 36           | MEN          | PP            |
| 92 APR 25 | 1832 58.06 | 40 19.36            | 124 47.20           | 5.02          | MEN                    | 3.9            | 14                  | .32                   |                |                     |                       | 51       | 0      | 56      | 56      | .32          | 3.8         | 21.6        | 267              | 125          | MEN          | PP            |
| 92 APR 25 | 1842 15.13 | 40 18.74            | 124 32.32           | 5.10          | MEN                    | 4.0            | 26                  | .28                   |                |                     |                       | 23       | 0      | 84      | 84      | .04          | .8          | 1.7         | 235              | 68           | MEN          | PP            |
| 92 APR 25 | 1845 19.10 | 40 19.09            | 124 25.21           | 8.23          | MEN                    | 3.7            | 61                  | .27                   | 3.5            | 6                   | .13                   | 10       | 0      | 50      | 29      | .11          | 1.8         | .7          | 253              | 12           | MEN          | 222           |
| 92 APR 25 | 1848 8.76  | 40 17.20            | 124 24.32           | 6.62          | MEN                    | 3.6            | 14                  | .28                   | 3.1            | 3                   | .34                   | 15       | 1      | 16      | 6       | .10          | 1.2         | .5          | 242              | 9            | MEN          | 222           |
| 92 APR 25 | 1848 47.84 | 40 19.14            | 124 30.86           | 5.31          | MEN                    | 3.8            | 9                   | .10                   | 3.6            | 2                   | .07                   | 14       | 2      | 19      | 13      | .08          | .7          | .4          | 248              | 19           | MEN          | 222           |
| 92 APR 25 | 1853 18.01 | 40 16.76            | 124 27.57           | 6.44          | MEN                    | 4.0            | 36                  | .22                   | 3.2            | 5                   | .21                   | 19       | 0      | 19      | 9       | .08          | 1.2         | 2.3         | 238              | 66           | MEN          | 222           |
| 92 APR 25 | 1853 32.20 | 40 14.75            | 124 21.04           | 8.53          | MEN                    | 4.1            | 27                  | .21                   | 4.0            | 2                   | .05                   | 6        | 2      | 7       | 1       | .09          | 1.9         | 1.0         | 260              | 27           | MEN          | 222           |
| 92 APR 25 | 1909 27.43 | 40 20.07            | 124 22.54           | 5.53          | MEN                    | 3.7            | 16                  | .32                   |                |                     |                       | 8        | 0      | 20      | 20      | .05          | .8          | .6          | 223              | 11           | MEN          | PP            |
| 92 APR 25 | 1910 2.13  | 40 17.59            | 124 21.24           | 8.88          | MEN                    | 3.5            | 26                  | .30                   | 3.6            | 2                   | .24                   | 18       | 1      | 36      | 31      | .10          | .5          | .3          | 223              | 6            | MEN          | 222           |
| 92 APR 25 | 1914 51.74 | 40 18.81            | 124 32.62           | 2.82          | MEN                    | 4.7            | 15                  | .14                   |                |                     |                       | 25       | 0      | 31      | 31      | .11          | 1.4         | 2.4         | 232              | 38           | MEN          | PP            |
| 92 APR 25 | 1915 31.76 | 40 18.31            | 124 31.17           | 6.94          | MEN                    | 4.0            | 99                  | .28                   | 4.2            | 10                  | .12                   | 19       | 1      | 80      | 42      | .13          | 1.3         | .7          | 246              | 19           | MEN          | 222           |
| 92 APR 25 | 1921 41.38 | 40 21.52            | 124 27.75           | 6.64          | MEN                    | 3.5            | 9                   | .11                   |                |                     |                       | 8        | 0      | 15      | 15      | .05          | 1.7         | .7          | 266              | 17           | MEN          | PP            |
| 92 APR 25 | 1922 58.99 | 40 24.19            | 124 6.99            | 9.23          | MEN                    | 3.5            | 11                  | .10                   |                |                     |                       | 8        | 0      | 10      | 10      | .17          | 2.9         | 1.3         | 214              | 2            | MEN          | PP            |
| 92 APR 25 | 1930 44.26 | 40 17.84            | 124 24.30           | 8.49          | MEN                    | 3.8            | 17                  | .19                   |                |                     |                       | 17       | 0      | 25      | 25      | .05          | 1.2         | .7          | 223              | 23           | MEN          | PP            |



| DATE      | TIME       | LATITUDE<br>(NORTH) | LONGITUDE<br>(WEST) | DEPTH<br>(KM) | GEOGRAPHIC<br>LOCATION | M <sub>D</sub> | #<br>M <sub>D</sub> | MAD<br>M <sub>D</sub> | M <sub>X</sub> | #<br>M <sub>X</sub> | MAD<br>M <sub>X</sub> | #<br>P+S | #<br>S | #<br>VR | #<br>FM | RMS<br>(SEC) | ERH<br>(KM) | ERZ<br>(KM) | AZM-GAP<br>(DEG) | DMIN<br>(KM) | VEL<br>MODEL | SOURCE<br>PDX |
|-----------|------------|---------------------|---------------------|---------------|------------------------|----------------|---------------------|-----------------------|----------------|---------------------|-----------------------|----------|--------|---------|---------|--------------|-------------|-------------|------------------|--------------|--------------|---------------|
| 92 APR 25 | 1939 30.39 | 40 24.62            | 124 21.10           | 9.64          | MEN                    | 3.6            | 90                  | .22                   | 3.8            | 8                   | .09                   | 17       | 1      | 74      | 61      | .09          | .5          | .3          | 202              | 7            | MEN          | 222           |
| 92 APR 25 | 1941 59.31 | 40 19.93            | 124 24.90           | 6.25          | MEN                    | 4.0            | 22                  | .19                   |                |                     |                       | 11       | 0      | 33      | 33      | .15          | 2.0         | .7          | 244              | 13           | MEN          | PP            |
| 92 APR 25 | 1942 46.83 | 40 17.73            | 124 24.63           | 7.31          | MEN                    | 3.8            | 34                  | .20                   | 3.8            | 5                   | .15                   | 21       | 2      | 52      | 43      | .09          | .6          | .4          | 239              | 21           | MEN          | 222           |
| 92 APR 25 | 1950 42.24 | 40 17.87            | 124 25.97           | 7.83          | MEN                    | 3.9            | 99                  | .18                   | 4.1            | 14                  | .16                   | 25       | 1      | 134     | 99      | .07          | .8          | .5          | 237              | 25           | MEN          | 222           |
| 92 APR 25 | 1955 6.57  | 40 25.94            | 124 24.53           | 9.86          | MEN                    | 3.6            | 45                  | .19                   | 3.4            | 5                   | .07                   | 21       | 2      | 60      | 58      | .06          | .5          | .2          | 222              | 8            | MEN          | 222           |
| 92 APR 25 | 2000 7.65  | 40 29.44            | 124 28.04           | 26.68         | EUR                    | 3.6            | 83                  | .19                   | 3.7            | 10                  | .22                   | 13       | 2      | 109     | 87      | .09          | 1.2         | .8          | 233              | 11           | MEN          | 222           |
| 92 APR 25 | 2012 35.82 | 40 25.34            | 124 25.99           | 9.46          | MEN                    | 3.9            | 99                  | .33                   | 3.9            | 12                  | .14                   | 15       | 1      | 76      | 62      | .09          | .6          | .3          | 250              | 10           | MEN          | 222           |
| 92 APR 25 | 2029 17.10 | 40 24.52            | 124 22.00           | 10.36         | MEN                    | 3.7            | 94                  | .26                   | 3.9            | 7                   | .12                   | 18       | 2      | 106     | 88      | .07          | .6          | .2          | 214              | 8            | MEN          | 222           |
| 92 APR 25 | 2109 13.64 | 40 22.90            | 124 13.18           | 10.44         | MEN                    | 3.5            | 43                  | .14                   |                |                     |                       | 15       | 0      | 49      | 49      | .05          | .3          | .3          | 110              | 9            | MEN          | PP            |
| 92 APR 25 | 2126 9.77  | 40 22.03            | 124 33.03           | 2.25          | MEN                    | 3.8            | 92                  | .29                   | 3.8            | 6                   | .07                   | 17       | 0      | 55      | 41      | .13          | 1.4         | 1.6         | 247              | 22           | MEN          | 222           |
| 92 APR 25 | 2136 49.44 | 40 20.90            | 124 26.77           | 19.41         | MEN                    | 3.6            | 99                  | .17                   | 3.7            | 12                  | .16                   | 13       | 1      | 45      | 30      | .06          | .9          | .2          | 246              | 16           | MEN          | 222           |
| 92 APR 25 | 2225 25.87 | 40 19.80            | 124 24.69           | 5.55          | MEN                    | 3.9            | 99                  | .21                   | 4.2            | 16                  | .09                   | 11       | 1      | 179     | 99      | .13          | 1.6         | .7          | 246              | 13           | MEN          | 222           |
| 92 APR 26 | 40 26.01   | 40 17.97            | 124 23.48           | 8.46          | MEN                    | 3.5            | 95                  | .18                   | 3.8            | 10                  | .11                   | 12       | 1      | 65      | 56      | .06          | .7          | .3          | 245              | 9            | MEN          | 222           |
| 92 APR 26 | 49 17.42   | 40 21.40            | 124 26.36           | 7.07          | MEN                    | 3.5            | 73                  | .14                   | 3.6            | 11                  | .15                   | 10       | 0      | 53      | 40      | .07          | 1.0         | .5          | 256              | 16           | MEN          | 222           |
| 92 APR 26 | 100 57.88  | 40 21.82            | 124 30.47           | 6.33          | MEN                    | 3.9            | 99                  | .23                   | 4.2            | 7                   | .19                   | 16       | 1      | 88      | 75      | .11          | 1.1         | .5          | 251              | 19           | MEN          | 222           |
| 92 APR 26 | 127 14.56  | 40 18.50            | 124 28.16           | 8.63          | MEN                    | 3.6            | 71                  | .18                   | 3.6            | 10                  | .12                   | 10       | 0      | 44      | 41      | .05          | 1.2         | .4          | 271              | 15           | MEN          | 222           |
| 92 APR 26 | 132 15.10  | 40 18.25            | 124 24.72           | 19.20         | MEN                    | 3.7            | 99                  | .19                   | 3.5            | 9                   | .21                   | 12       | 2      | 78      | 72      | .05          | .8          | .3          | 253              | 11           | MEN          | 222           |
| 92 APR 26 | 133 36.28  | 40 19.00            | 124 25.25           | 17.41         | MEN                    | 3.9            | 99                  | .23                   | 3.9            | 8                   | .14                   | 14       | 1      | 62      | 47      | .09          | 1.1         | .3          | 251              | 12           | MEN          | 222           |
| 92 APR 26 | 207 6.04   | 40 18.22            | 124 24.67           | 19.07         | MEN                    | 3.9            | 99                  | .28                   | 3.9            | 7                   | .15                   | 12       | 1      | 84      | 81      | .05          | .9          | .3          | 253              | 11           | MEN          | 222           |
| 92 APR 26 | 208 9.33   | 40 17.83            | 124 24.42           | 18.62         | MEN                    | 4.0            | 33                  | .26                   | 3.5            | 5                   | .22                   | 14       | 2      | 26      | 13      | .09          | .8          | .3          | 245              | 10           | MEN          | 222           |
| 92 APR 26 | 450 17.19  | 40 25.34            | 124 22.22           | 10.14         | MEN                    | 3.5            | 99                  | .14                   | 3.7            | 10                  | .16                   | 12       | 1      | 68      | 61      | .09          | .8          | .3          | 221              | 7            | MEN          | 222           |
| 92 APR 26 | 741 39.76  | 40 25.63            | 124 35.79           | 19.42         | MEN                    | 6.3            | 99                  | .38                   | 6.1            | 28                  | .25                   | 17       | 0      | 362     | 99      | .15          | 2.2         | .6          | 253              | 23           | MEN          | 222           |
| 92 APR 26 | 749 52.12  | 40 24.48            | 124 33.98           | 17.85         | MEN                    | 4.0            | 27                  | .23                   | 3.5            | 6                   | .08                   | 15       | 2      | 36      | 23      | .08          | .5          | .6          | 257              | 21           | MEN          | 222           |
| 92 APR 26 | 752 3.44   | 40 24.94            | 124 40.18           | 0.08          | MEN                    | 3.8            | 65                  | .27                   | 3.9            | 7                   | .15                   | 30       | 0      | 54      | 31      | .47          | 2.7         | 5.9         | 233              | 36           | MEN          | 222           |
| 92 APR 26 | 821 9.49   | 40 23.05            | 124 33.28           | 22.66         | MEN                    | 3.7            | 93                  | .26                   | 3.8            | 10                  | .09                   | 16       | 0      | 64      | 60      | .15          | 2.4         | .7          | 250              | 21           | MEN          | 222           |
| 92 APR 26 | 843 28.57  | 40 19.89            | 124 33.99           | 18.80         | MEN                    | 3.5            | 64                  | .16                   | 3.4            | 7                   | .14                   | 20       | 1      | 31      | 18      | .12          | 1.1         | .3          | 247              | 24           | MEN          | 222           |
| 92 APR 26 | 924 21.96  | 40 25.36            | 124 22.45           | 9.91          | MEN                    | 3.7            | 99                  | .19                   | 4.0            | 9                   | .10                   | 21       | 2      | 110     | 99      | .05          | .5          | .2          | 216              | 7            | MEN          | 222           |
| 92 APR 26 | 941 2.62   | 40 26.01            | 124 26.29           | 9.76          | MEN                    | 3.5            | 54                  | .31                   | 2.8            | 2                   | .17                   | 13       | 2      | 41      | 35      | .08          | .8          | .5          | 232              | 10           | MEN          | 222           |
| 92 APR 26 | 941 44.79  | 40 20.26            | 124 21.43           | 11.18         | MEN                    | 3.6            | 37                  | .16                   | 3.6            | 6                   | .07                   | 12       | 2      | 49      | 37      | .07          | .4          | .3          | 210              | 11           | MEN          | 222           |
| 92 APR 26 | 1118 25.66 | 40 22.52            | 124 35.12           | 22.63         | MEN                    | 5.9            | 49                  | .46                   | 6.2            | 7                   | .15                   | 12       | 0      | 329     | 99      | .07          | 2.4         | .6          | 263              | 24           | MEN          | 202           |
| 92 APR 26 | 1128 50.85 | 40 22.95            | 124 31.47           | 14.15         | MEN                    | 4.1            | 50                  | .30                   | 2.2            | 3                   | .16                   | 16       | 1      | 21      | 13      | .08          | 1.0         | .6          | 251              | 24           | MEN          | 222           |
| 92 APR 26 | 1129 7.58  | 40 26.27            | 124 35.33           | 10.78         | MEN                    | 4.1            | 53                  | .25                   | 4.0            | 5                   | .11                   | 24       | 1      | 46      | 26      | .12          | .8          | .8          | 240              | 32           | MEN          | 222           |
| 92 APR 26 | 1204 29.98 | 40 24.44            | 124 24.52           | 10.71         | MEN                    | 4.1            | 77                  | .23                   | 4.1            | 4                   | .06                   | 12       | 0      | 98      | 80      | .06          | .8          | .3          | 227              | 10           | MEN          | 222           |
| 92 APR 26 | 1428 23.77 | 40 21.84            | 124 27.50           | 18.93         | MEN                    | 3.7            | 38                  | .10                   |                |                     |                       | 11       | 0      | 32      | 32      | .10          | 1.7         | .3          | 264              | 16           | MEN          | PP            |
| 92 APR 26 | 2040 55.33 | 40 18.43            | 124 31.05           | 16.35         | MEN                    | 3.5            | 69                  | .19                   | 3.4            | 8                   | .15                   | 18       | 2      | 56      | 45      | .06          | .9          | .2          | 264              | 19           | MEN          | 222           |
| 92 APR 26 | 2118 4.95  | 40 23.90            | 124 35.40           | 18.50         | MEN                    | 4.0            | 99                  | .15                   | 4.1            | 8                   | .18                   | 33       | 1      | 152     | 99      | .12          | 1.0         | .4          | 240              | 23           | MEN          | 222           |
| 92 APR 26 | 2208 0.30  | 40 21.39            | 124 31.94           | 18.03         | MEN                    | 3.8            | 99                  | .15                   | 3.9            | 5                   | .17                   | 17       | 1      | 102     | 97      | .08          | 1.1         | .3          | 249              | 21           | MEN          | 222           |
| 92 APR 26 | 2225 52.97 | 40 19.29            | 124 32.84           | 9.76          | MEN                    | 4.2            | 99                  | .20                   | 4.2            | 18                  | .20                   | 18       | 0      | 173     | 99      | .13          | 1.9         | .7          | 250              | 22           | MEN          | 222           |
| 92 APR 26 | 2339 15.61 | 40 19.53            | 124 37.02           | 6.02          | MEN                    | 4.0            | 99                  | .23                   | 4.2            | 24                  | .18                   | 30       | 2      | 144     | 99      | .09          | .8          | .6          | 242              | 28           | MEN          | 222           |
| 92 APR 27 | 6 23.80    | 40 19.29            | 124 37.09           | 5.53          | MEN                    | 3.5            | 87                  | .22                   | 3.6            | 11                  | .20                   | 24       | 2      | 70      | 63      | .08          | .9          | .7          | 247              | 28           | MEN          | 222           |
| 92 APR 27 | 33 34.42   | 40 20.62            | 124 28.35           | 18.53         | MEN                    | 3.6            | 99                  | .13                   | 3.6            | 9                   | .16                   | 15       | 1      | 111     | 99      | .07          | 1.0         | .3          | 248              | 18           | MEN          | 222           |
| 92 APR 27 | 228 18.40  | 40 19.21            | 124 37.19           | 7.83          | MEN                    | 4.0            | 99                  | .19                   | 4.2            | 15                  | .17                   | 28       | 0      | 151     | 99      | .15          | 1.5         | 1.0         | 247              | 28           | MEN          | 222           |
| 92 APR 27 | 235 36.65  | 40 19.17            | 124 29.10           | 19.77         | MEN                    | 3.6            | 96                  | .16                   | 3.6            | 11                  | .18                   | 14       | 1      | 91      | 87      | .05          | .7          | .2          | 250              | 17           | MEN          | 222           |
| 92 APR 27 | 247 21.08  | 40 19.76            | 124 38.95           | 4.12          | MEN                    | 4.2            | 99                  | .27                   | 4.4            | 12                  | .21                   | 31       | 0      | 174     | 99      | .10          | 1.0         | 1.1         | 240              | 30           | MEN          | 222           |
| 92 APR 27 | 631 24.34  | 40 19.87            | 124 33.51           | 22.92         | MEN                    | 3.5            | 99                  | .12                   | 3.3            | 12                  | .19                   | 21       | 1      | 101     | 89      | .11          | 1.5         | .6          | 247              | 23           | MEN          | 222           |
| 92 APR 27 | 907 10.92  | 40 22.89            | 124 35.34           | 23.36         | MEN                    | 3.5            | 99                  | .15                   | 3.5            | 10                  | .20                   | 22       | 1      | 115     | 99      | .11          | 1.5         | .8          | 248              | 24           | MEN          | 222           |
| 92 APR 27 | 1537 57.10 | 40 18.90            | 124 32.96           | 8.59          | MEN                    | 3.7            | 99                  | .22                   | 3.7            | 6                   | .16                   | 18       | 1      | 57      | 52      | .14          | 1.3         | .7          | 251              | 22           | MEN          | 222           |
| 92 APR 30 | 840 20.57  | 40 22.29            | 124 34.64           | 26.14         | MEN                    | 3.5            | 99                  | .15                   | 3.5            | 11                  | .17                   | 25       | 1      | 144     | 99      | .10          | 1.2         | 1.0         | 243              | 23           | MEN          | 222           |
| 92 APR 30 | 953 26.57  | 40 17.04            | 124 22.38           | 22.79         | MEN                    | 4.0            | 99                  | .19                   | 3.9            | 11                  | .15                   | 13       | 0      | 178     | 99      | .09          | 1.4         | .6          | 234              | 7            | MEN          | 222           |

| DATE      | TIME       | LATITUDE | LONGITUDE | DEPTH | GEOGRAPHIC | M <sub>D</sub> | #              | MAD            | M <sub>X</sub> | #              | MAD            | #   | # | #   | #  | RMS   | ERH  | ERZ  | AZM-GAP | DMIN | VEL   | SOURCE |
|-----------|------------|----------|-----------|-------|------------|----------------|----------------|----------------|----------------|----------------|----------------|-----|---|-----|----|-------|------|------|---------|------|-------|--------|
|           |            | (NORTH)  | (WEST)    | (KM)  | LOCATION   | M <sub>D</sub> | M <sub>D</sub> | M <sub>D</sub> | M <sub>X</sub> | M <sub>X</sub> | M <sub>X</sub> | P+S | S | VR  | FM | (SEC) | (KM) | (KM) | (DEG)   | (KM) | MODEL | PDX    |
| 92 MAY 1  | 102 28.83  | 37 6.19  | 121 0.79  | 1.07  | JQN        | 3.5            | 99             | .16            | 3.4            | 18             | .18            | 73  | 3 | 190 | 99 | .16   | .4   | 1.4  | 184     | 11   | NCG   | 222    |
| 92 MAY 1  | 1542 56.79 | 40 21.00 | 124 31.63 | 26.19 | MEN        | 3.6            | 98             | .14            | 3.6            | 9              | .24            | 21  | 1 | 120 | 99 | .12   | 1.3  | .8   | 249     | 21   | MEN   | 222    |
| 92 MAY 1  | 2241 52.53 | 40 19.24 | 124 34.21 | 8.57  | MEN        | 3.6            | 79             | .16            | 3.6            | 12             | .23            | 25  | 0 | 78  | 69 | .13   | 1.3  | .7   | 235     | 24   | MEN   | 222    |
| 92 MAY 2  | 1130 31.38 | 40 17.90 | 124 27.35 | 22.04 | MEN        | 3.9            | 99             | .11            | 3.9            | 16             | .14            | 13  | 1 | 197 | 99 | .08   | 1.1  | .3   | 267     | 14   | MEN   | 222    |
| 92 MAY 4  | 13 27.93   | 40 20.44 | 124 27.95 | 20.18 | MEN        | 3.5            | 84             | .20            | 3.5            | 10             | .12            | 14  | 0 | 67  | 62 | .07   | 1.5  | .2   | 248     | 17   | MEN   | 222    |
| 92 MAY 4  | 708 19.14  | 40 17.59 | 124 23.39 | 22.79 | MEN        | 3.7            | 99             | .12            | 3.6            | 9              | .12            | 14  | 1 | 141 | 99 | .08   | 1.1  | .4   | 238     | 9    | MEN   | 222    |
| 92 MAY 4  | 744 42.61  | 40 17.61 | 124 23.12 | 22.61 | MEN        | 3.5            | 99             | .14            | 3.6            | 9              | .16            | 13  | 1 | 135 | 99 | .09   | 1.1  | .4   | 237     | 21   | MEN   | 222    |
| 92 MAY 5  | 1046 17.24 | 40 17.36 | 124 19.77 | 7.55  | MEN        | 4.3            | 99             | .14            | 4.5            | 33             | .16            | 13  | 1 | 238 | 99 | .10   | .7   | .4   | 202     | 5    | MEN   | 222    |
| 92 MAY 10 | 1758 3.17  | 40 26.01 | 124 25.73 | 10.44 | MEN        | 4.1            | 99             | .19            | 4.3            | 14             | .12            | 13  | 0 | 107 | 86 | .08   | 1.0  | .5   | 230     | 9    | MEN   | 222    |
| 92 MAY 11 | 249 23.65  | 40 17.71 | 124 26.63 | 22.41 | MEN        | 3.5            | 99             | .12            | 3.4            | 10             | .10            | 13  | 1 | 101 | 97 | .07   | .8   | .3   | 264     | 13   | MEN   | 222    |
| 92 MAY 12 | 1217 20.93 | 40 18.46 | 124 27.72 | 8.07  | MEN        | 3.6            | 99             | .16            | 3.6            | 7              | .16            | 12  | 0 | 79  | 66 | .05   | 1.1  | .5   | 269     | 15   | MEN   | 222    |
| 92 MAY 18 | 742 31.43  | 40 21.54 | 124 45.95 | 13.92 | MEN        | 3.8            | 99             | .25            | 3.8            | 14             | .23            | 54  | 1 | 162 | 99 | .12   | .6   | .9   | 237     | 39   | MEN   | 222    |
| 92 MAY 20 | 230 50.53  | 40 18.42 | 124 22.84 | 7.14  | MEN        | 3.7            | 99             | .17            | 3.9            | 20             | .16            | 12  | 1 | 138 | 99 | .08   | .9   | .4   | 235     | 9    | MEN   | 222    |
| 92 MAY 21 | 338 0.88   | 40 18.75 | 124 25.39 | 20.64 | MEN        | 3.9            | 99             | .18            | 3.9            | 13             | .16            | 12  | 1 | 105 | 92 | .06   | .9   | .2   | 256     | 12   | MEN   | 222    |
| 92 MAY 27 | 1532 38.38 | 40 17.85 | 124 20.67 | 8.41  | MEN        | 3.5            | 87             | .15            | 3.6            | 8              | .18            | 12  | 1 | 62  | 57 | .07   | .4   | .3   | 212     | 6    | MEN   | 222    |
| 92 JUN 5  | 2146 42.98 | 40 18.66 | 124 24.80 | 20.41 | MEN        | 4.8            | 99             | .17            | 4.8            | 16             | .21            | 10  | 0 | 201 | 99 | .05   | 1.2  | .3   | 252     | 11   | MEN   | 222    |
| 92 JUN 16 | 345 8.44   | 40 27.99 | 124 35.70 | 23.44 | MEN        | 3.5            | 85             | .17            | 3.8            | 2              | .04            | 17  | 1 | 105 | 99 | .08   | .7   | .7   | 251     | 22   | MEN   | 222    |
| 92 JUN 24 | 725 28.50  | 40 20.80 | 124 30.57 | 23.27 | MEN        | 3.7            | 99             | .15            | 3.7            | 10             | .16            | 19  | 1 | 180 | 99 | .12   | 1.4  | .6   | 247     | 20   | MEN   | 222    |
| 92 JUN 28 | 1210 42.44 | 40 27.77 | 121 32.73 | 4.40  | LAS        | 3.5            | 28             | .59            | 1.7            | 1              | .00            | 13  | 1 | 13  | 9  | .03   | .3   | .5   | 60      | 3    | LAS   | FFF    |
| 92 JUN 29 | 537 45.89  | 37 34.60 | 118 49.67 | 12.37 | MOR        | 3.8            | 99             | .21            | 3.7            | 2              | .29            | 34  | 0 | 72  | 69 | .07   | .3   | .6   | 77      | 2    | MAM   | 222    |
| 92 JUN 30 | 1305 36.04 | 35 40.61 | 117 36.52 | 9.81  | IWV        | 4.5            | 67             | .16            |                |                |                | 11  | 0 | 83  | 83 | .06   | .7   | 1.5  | 145     | 12   | WAL   | RR     |
| 92 JUL 1  | 616 56.39  | 35 40.62 | 117 36.71 | 8.65  | IWV        | 4.4            | 99             | .18            | 4.5            | 25             | .16            | 10  | 0 | 130 | 99 | .05   | .5   | 1.7  | 136     | 12   | WAL   | 222    |
| 92 JUL 2  | 701 10.51  | 35 37.41 | 118 3.63  | 13.54 | WWF        | 3.9            | 89             | .12            |                |                |                | 17  | 0 | 77  | 77 | .22   | 2.3  | .5   | 285     | 18   | WAL   | RR     |
| 92 JUL 2  | 1359 20.49 | 35 36.31 | 121 12.58 | 3.02  | SSM        | 4.1            | 99             | .13            | 4.4            | 22             | .35            | 40  | 0 | 137 | 99 | .09   | .3   | .6   | 183     | 10   | CST   | 222    |
| 92 JUL 3  | 1322 38.06 | 35 51.46 | 117 51.29 | 11.65 | IWV        | 3.8            | 99             | .14            | 3.9            | 13             | .13            | 7   | 0 | 72  | 41 | .03   | .5   | 2.9  | 178     | 39   | WAL   | 222    |
| 92 JUL 6  | 1949 10.78 | 36 38.75 | 118 1.87  | 0.31  | OWV        | 3.9            | 99             | .13            | 4.3            | 13             | .10            | 69  | 0 | 74  | 60 | .19   | .7   | 2.9  | 170     | 60   | WAL   | 222    |
| 92 JUL 11 | 1814 15.85 | 35 12.82 | 118 4.66  | 16.02 | GAR        | 5.2            | 99             | .22            | 5.5            | 48             | .20            | 19  | 0 | 319 | 99 | .10   | .5   | 1.1  | 139     | 22   | WAL   | FFF    |
| 92 JUL 13 | 825 38.12  | 35 58.14 | 118 21.15 | 6.86  | WWF        | 3.5            | 99             | .13            | 3.5            | 15             | .34            | 60  | 0 | 113 | 99 | .15   | .4   | .7   | 107     | 32   | WAL   | 222    |
| 92 JUL 13 | 953 6.13   | 35 58.75 | 118 23.19 | 0.31  | WWF        | 4.1            | 99             | .21            | 4.2            | 6              | .08            | 72  | 0 | 124 | 99 | .41   | .7   | 4.3  | 105     | 31   | WAL   | O22    |
| 92 JUL 13 | 954 19.56  | 35 57.92 | 118 22.82 | 0.20  | WWF        | 4.0            | 56             | .28            | 3.4            | 4              | .23            | 7   | 0 | 9   | 3  | .05   | 2.2  | 6.7  | 269     | 32   | WAL   | 222    |
| 92 JUL 14 | 24 59.59   | 35 57.42 | 118 21.12 | 7.76  | WWF        | 3.6            | 99             | .13            | 3.7            | 10             | .21            | 53  | 0 | 107 | 99 | .19   | .3   | .6   | 105     | 31   | WAL   | 222    |
| 92 JUL 16 | 1538 0.19  | 40 19.43 | 122 9.73  | 18.86 | SHA        | 4.0            | 99             | .15            | 3.7            | 29             | .26            | 19  | 1 | 164 | 94 | .11   | .4   | 1.2  | 125     | 13   | LAS   | 222    |
| 92 JUL 18 | 658 39.52  | 37 29.34 | 118 56.94 | 2.87  | SIL        | 3.9            | 99             | .12            | 4.3            | 37             | .18            | 36  | 0 | 308 | 99 | .08   | .3   | 1.4  | 116     | 14   | MAM   | 222    |
| 92 JUL 27 | 2210 59.48 | 36 3.20  | 117 39.51 | 0.63  | COS        | 3.9            | 99             | .14            | 4.2            | 12             | .21            | 32  | 0 | 34  | 23 | .25   | 1.5  | 4.7  | 200     | 66   | WAL   | 222    |
| 92 AUG 13 | 133 10.72  | 40 24.39 | 124 25.67 | 9.70  | MEN        | 3.5            | 94             | .16            | 3.6            | 7              | .22            | 8   | 0 | 59  | 53 | .06   | 1.1  | .5   | 256     | 11   | MEN   | 222    |
| 92 AUG 14 | 2327 56.62 | 35 50.40 | 117 40.27 | 11.24 | IWV        | 3.7            | 99             | .14            | 3.8            | 11             | .19            | 10  | 0 | 94  | 75 | .12   | .5   | 1.1  | 135     | 9    | WAL   | 222    |
| 92 AUG 18 | 238 29.00  | 37 20.37 | 118 22.79 | 12.26 | OWV        | 3.7            | 99             | .20            | 3.8            | 8              | .33            | 28  | 0 | 51  | 43 | .05   | .4   | 1.1  | 148     | 10   | MAM   | 222    |
| 92 AUG 25 | 1742 18.50 | 40 17.94 | 124 26.11 | 22.31 | MEN        | 3.5            | 99             | .15            | 3.5            | 10             | .20            | 14  | 1 | 119 | 99 | .08   | .8   | .3   | 263     | 12   | MEN   | 222    |
| 92 SEP 4  | 1502 58.19 | 36 8.29  | 117 52.28 | 7.74  | COS        | 4.0            | 99             | .13            | 4.1            | 19             | .17            | 15  | 0 | 113 | 84 | .08   | .5   | 1.1  | 156     | 22   | WAL   | 222    |
| 92 SEP 5  | 2228 8.56  | 37 27.47 | 118 35.77 | 8.36  | RVL        | 3.5            | 99             | .16            | 3.7            | 10             | .19            | 32  | 0 | 138 | 99 | .10   | .3   | .7   | 81      | 4    | MAM   | 222    |
| 92 SEP 14 | 1246 53.70 | 37 34.23 | 118 52.07 | 7.57  | MOR        | 3.5            | 99             | .13            | 3.7            | 23             | .21            | 31  | 0 | 148 | 99 | .07   | .3   | .5   | 85      | 4    | MAM   | 222    |
| 92 SEP 16 | 614 33.28  | 36 0.00  | 119 54.66 | 10.55 | COA        | 4.3            | 99             | .16            | 4.3            | 28             | .17            | 41  | 3 | 259 | 99 | .17   | .5   | .7   | 216     | 16   | COA   | 222    |
| 92 SEP 19 | 2304 46.84 | 38 51.59 | 122 47.61 | 3.01  | GEY        | 4.3            | 99             | .18            | 4.4            | 19             | .15            | 49  | 0 | 322 | 99 | .11   | .2   | .7   | 32      | 6    | GEY   | 222    |
| 92 SEP 23 | 904 41.52  | 40 18.02 | 124 23.43 | 8.37  | MEN        | 3.7            | 99             | .15            | 4.0            | 13             | .09            | 12  | 0 | 109 | 99 | .06   | .9   | .4   | 244     | 9    | MEN   | 222    |
| 92 SEP 23 | 1110 31.09 | 40 18.06 | 124 23.49 | 8.18  | MEN        | 4.0            | 99             | .22            | 4.2            | 23             | .14            | 14  | 0 | 235 | 99 | .06   | .7   | .3   | 244     | 9    | MEN   | 222    |
| 92 SEP 27 | 1659 13.89 | 36 0.29  | 119 55.59 | 11.72 | COA        | 4.2            | 99             | .13            | 4.1            | 23             | .17            | 47  | 3 | 198 | 99 | .17   | .5   | 1.0  | 187     | 18   | COA   | 222    |
| 92 SEP 29 | 525 43.87  | 37 34.02 | 118 52.21 | 7.39  | MOR        | 3.7            | 99             | .15            | 3.9            | 17             | .22            | 32  | 0 | 96  | 88 | .07   | .3   | .5   | 86      | 5    | MAM   | 222    |
| 92 OCT 5  | 1140 28.50 | 37 27.28 | 118 50.32 | 7.64  | MOR        | 3.9            | 99             | .11            | 4.3            | 15             | .14            | 33  | 0 | 181 | 99 | .07   | .3   | .9   | 129     | 7    | MAM   | 222    |
| 92 OCT 8  | 1744 58.83 | 36 5.26  | 117 40.78 | 8.10  | COS        | 3.6            | 99             | .13            | 3.4            | 9              | .21            | 11  | 0 | 62  | 47 | .08   | .9   | 1.3  | 243     | 20   | WAL   | 222    |

| DATE      | TIME       | LATITUDE<br>(NORTH) | LONGITUDE<br>(WEST) | DEPTH<br>(KM) | GEOGRAPHIC<br>LOCATION | M <sub>D</sub> | #<br>M <sub>D</sub> | MAD<br>M <sub>D</sub> | M <sub>X</sub> | #<br>M <sub>X</sub> | MAD<br>M <sub>X</sub> | #<br>P+S | #<br>S | #<br>VR | #<br>FM | RMS<br>(SEC) | ERH<br>(KM) | ERZ<br>(KM) | AZM-GAP<br>(DEG) | DMIN<br>(KM) | VEL<br>MODEL | SOURCE<br>PDX |
|-----------|------------|---------------------|---------------------|---------------|------------------------|----------------|---------------------|-----------------------|----------------|---------------------|-----------------------|----------|--------|---------|---------|--------------|-------------|-------------|------------------|--------------|--------------|---------------|
| 92 OCT 9  | 223 48.67  | 40 27.33            | 124 16.74           | 19.38         | MEN                    | 3.7            | 99                  | .14                   | 3.7            | 9                   | .13                   | 16       | 1      | 101     | 93      | .06          | .5          | .3          | 109              | 5            | MEN          | 222           |
| 92 OCT 14 | 2208 47.31 | 39 43.29            | 122 5.73            | 15.75         | SAC                    | 3.5            | 99                  | .18                   | 3.3            | 28                  | .19                   | 104      | 0      | 139     | 99      | .38          | .3          | .7          | 36               | 34           | NCG          | 222           |
| 92 OCT 20 | 528 8.91   | 35 55.72            | 120 28.35           | 9.99          | MID                    | 4.3            | 99                  | .14                   | 4.5            | 46                  | .14                   | 56       | 1      | 329     | 99      | .10          | .2          | .3          | 31               | 2            | PMM          | 222           |
| 92 OCT 26 | 727 40.47  | 35 56.66            | 120 29.40           | 10.45         | MID                    | 3.6            | 99                  | .12                   | 3.7            | 6                   | .06                   | 52       | 1      | 94      | 89      | .09          | .2          | .3          | 40               | 2            | PMM          | 222           |
| 92 NOV 21 | 1511 42.36 | 35 19.04            | 118 36.11           | 9.12          | WWF                    | 3.7            | 99                  | .13                   | 3.8            | 20                  | .12                   | 20       | 0      | 78      | 63      | .16          | .4          | 1.0         | 72               | 15           | WAL          | 222           |
| 92 DEC 5  | 252 57.11  | 36 27.20            | 120 11.83           | 17.41         | JQN                    | 3.7            | 99                  | .14                   | 3.5            | 29                  | .29                   | 40       | 1      | 219     | 99      | .13          | .4          | .3          | 207              | 3            | COA          | 222           |
| 92 DEC 12 | 1553 46.17 | 36 51.26            | 121 35.06           | 4.85          | SJB                    | 3.7            | 99                  | .12                   | 3.7            | 23                  | .20                   | 79       | 1      | 152     | 99      | .18          | .2          | .4          | 41               | 3            | LOM          | 222           |
| 92 DEC 12 | 1558 52.47 | 36 51.18            | 121 34.83           | 4.46          | SJB                    | 3.7            | 99                  | .12                   | 3.6            | 21                  | .15                   | 79       | 0      | 130     | 99      | .19          | .2          | .4          | 39               | 3            | LOM          | 222           |
| 92 DEC 20 | 2105 20.79 | 37 44.92            | 122 8.99            | 4.23          | HAY                    | 3.6            | 99                  | .14                   | 3.5            | 30                  | .15                   | 75       | 2      | 185     | 99      | .14          | .2          | .4          | 31               | 4            | HAY          | 222           |
| 92 DEC 25 | 425 9.32   | 39 56.67            | 120 51.43           | 0.00          | WAK                    | 3.8            | 99                  | .14                   | 4.0            | 6                   | .14                   | 123      | 0      | 136     | 93      | .48          | .9          | 1.5         | 181              | 53           | LAS          | 222           |

## Notes to Table 7

|                      |   |                 |  |
|----------------------|---|-----------------|--|
| DATE TIME            | Origin Time (Universal Coordinated Time)                                  | ERH / (KM)      | Horizontal error (km).   |
| GEOGRAPHIC/ LOCATION | Event location remark. (See Figure 4 and table below).                    | ERZ / (KM)      | Vertical error (km).   |
| M <sub>D</sub>       | Coda duration magnitude (Eaton, 1991).                                    | AZM-GAP / (DEG) | Maximum azimuthal Gap  |
| # / M <sub>D</sub>   | Total of duration magnitude weights (does not exceed 99).                 | DMIN / (KM)     | Distance to nearest station (km).  |
| MAD / M <sub>D</sub> | Median-absolute-difference of coda magnitudes.                            | VEL / MODEL     | 3-letter code of crust and delay model. (See Table 4).                               |
| M <sub>X</sub>       | Primary amplitude magnitude (Eaton, 1991).                                | SOURCE / PDX    | Most common P & S (P), M <sub>D</sub> (D), and M <sub>X</sub> (X) data source codes. |
| # / M <sub>X</sub>   | Total of amplitude magnitude weights (does not exceed 99).                |                 | where data source codes are as follows:  |
| MAD / M <sub>X</sub> | Median-absolute-difference of amplitude magnitudes                        |                 | R Main RTP   |
| # / P+S              | Number of P & S times with final weights > than 0.1 (does not exceed 99). |                 | P Prototype RTP  |
| # / S                | Number of S readings with weights > 0.1 (does not exceed 99).             |                 | O Motorola RTP   |
| # / VR               | Number of valid P & S readings with weight > 0 (does not exceed 99).      |                 | 2 CUSP Tustin A/D #2   |
| # / FM               | Number of P first motions (does not exceed 99).                           |                 | F Digitized event from FM tape   |
| RMS / (SEC)          | RMS travel time residual.   |                 |  |

## Hypoinverse Geographic Locations

|                            |                    |                        |                          |                        |                        |                       |
|----------------------------|--------------------|------------------------|--------------------------|------------------------|------------------------|-----------------------|
| ALM Lake Almanor           | CON Concord Fault  | GOL Gold Hill          | LOM Loma Prieta          | NMO North Moat         | RVL Round Valley       | SJB San Juan Bautista |
| ALU Alum Rock              | COS Coso Range     | GRN Greenville Fault   | MAA Maacama Fault        | ORE Oregon             | SAC Sacramento Valley  | SLA Slack Canyon      |
| ANN Anno Nuevo             | CRV Ciervo Hills   | GVL Green Valley Fault | MAM Mammoth Mtn.         | ORO Oroville           | SAL Salinas Valley     | SMO South Moat        |
| AUB Auburn                 | CYN Coyote North   | HAM Mt. Hamilton       | MAR Marin                | ORT Ortigaleta Fault   | SAR Sargent Fault      | SSM San Simeon        |
| BAK Bakersfield            | CYS Coyote South   | HAY Hayward Fault      | MCA Mono Caldera         | OWV Owens Valley       | SBA Santa Barbara      | STN Stone Canyon      |
| BAR Bartlett Springs Fault | DAN Danville       | HCF Hilton Crk. Flt.   | MEN Mendocino Escarpment | PAI Paicines           | SCA Southern Calif.    | SUN Sunol             |
| BIT Bitterwater Valley     | DEL Del Norte      | HOL Hollister          | MID Middle Mountain      | PAN Panoche Pass       | SCV Santa Clara Valley | SUR Big Sur           |
| BLM Black Mountain         | DEV Death Valley   | INC Inyo Craters       | MIS Mission Fault        | PAR Point Arena        | SFB South S.F. Bay     | WAK Walker Lane       |
| BUS Busch Fault            | DOM Resurgent Dome | IWV Indian Wells Val.  | MOD Modoc Plateau        | PIN Pinnacles          | SFL San Felipe         | WCN Wheeler Crest No. |
| BVL Bear Valley            | EMO East Moat      | JQN San Joaquin Valley | MOL Mono Lake            | PON Pacific Ocean N    | SFP S.F. Peninsula     | WCS Wheeler Crest So. |
| CAS Casa Diablo Mtn.       | EUR Eureka         | KAI Kaiser Peak        | MON Monterey Bay         | POS Pacific Ocean S    | SHA Shasta             | WHI White Mountains   |
| CHA Chalk Bluffs           | GAR Garlock Fault  | KLA Klamath Mountains  | MOR Mt. Morrison         | QUI Quiensabe          | SHE Sherwin Lakes      | WMO West Moat         |
| CHV Chalfant Valley        | GEY Geysers        | KON Konocti Bay        | NAP West Napa Fault      | ROB Paso Robles        | SIL Silver Peak        | WWF White Wolf Fault  |
| COA Coalinga               | GLA Glass Mtn.     | LAS Lassen             | NEV Nevada               | ROG Rogers Creek Fault | SIM Simmler            | YOS Yosemite          |

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### **Acknowledgments**

We thank Lisa Wald and Lind Gee for their careful reviews of this report, Paul Reasenber for his help in plotting the instrument response spectra, and the staff of the N.C.S.N. who maintained, operated, and processed the data recorded by the network.

## Appendix A. The UCB/USGS Seismology Data Center

The UCB/USGS Seismology Data Center is accessible via the Internet. As of the date of this publication, the data center is establishing individual accounts for each user accessing the data center. In the future we may migrate to a single publicly-accessible account similar to the IRIS bulletin board system. It is assumed that users are either familiar with or will obtain their own support on the use of the Unix operating system. The data center cannot provide consulting support on questions not directly related to the data center.

- Host Name: brkseis20.berkeley.edu
- Internet address: 128.32.146.106
- Computer: Sun SPARCstation 2
- Operating system: SunOS (Unix)

### To request an account at the data center:

1. Use telnet to connect to brkseis20.berkeley.edu. Depending on your local computer configuration, you may have to use the Internet address of the machine instead of the hostname:

```
telnet brkseis20.berkeley.edu
```

or

```
telnet 128.32.146.106
```

2. Login to special account “bulletin”, which has a password of “board”.
3. Select the option to request an account. It is currently the only option available, other than “quit”. You will be prompted for information such as your name, address, institutional affiliation, email address, and phone number.
4. You should be contacted within 2 working days with your account information. If you do not hear within this time period, please contact:  
Douglas Neuhauser  
Seismographic Station  
Earth Science Building  
University of California  
Berkeley CA 94720  
510-642-0931
5. This computer account is to be used strictly for accessing and retrieving data explicitly provided by the data center. Any other use constitutes fraud.

## Sample session to the UCB/USGS Seismology Data Center

telnet brkseis20.berkeley.edu  
Trying 128.32.146.106 ...  
Connected to brkseis20.berkeley.edu.  
Escape character is '^]'.

SunOS UNIX (brkseis20.berkeley.edu)

login: bulletin  
Password:  
Last login: Mon Dec 7 11:14:13 from brkseis10.berkeley.edu

```
*****
UCB/USGS Seismology Data Center
*****
Welcome to the UCB/USGS Northern California Seismology Data Center.
Your host is: brkseis20.berkeley.edu
```

Type "man info" to get more information about available resources.  
\*\*\*\*\*  
Welcome to the UCB/USGS Seismology Data Center

Enter 'a' to request an account  
      'n' to send a note to the data center staff.  
      'q' to QUIT

Enter your selection: a

UC Berkeley Seismographic Station / USGS  
Seismology Data Center

User ID request form:  
Please answer the following questions:  
(Terminate each reply with a 'return'.)  
(Type a control-D to abort account request.)

Full Name: Joe Smith  
Institution/Organization/Company: Podunk U, Dept of Seismology  
Full Address (1 line): 123 Earth Sciences Building, Podunk U, Podunk, NY 14882  
Office Phone #: 800-555-1212  
Internet/Bitnet address (0=none): joesmith@geo.podunk.edu  
preferred user ID name: joesmith

request logged...  
You will be contacted at the above address with information about your account. If you have not heard by the end of two working days, please resubmit your request, and if that does not work, please call 510-642-0931 or 510-642-3977  
Thank you.

Enter 'a' to request an account  
Enter 'q' to QUIT

Enter your selection: q  
Connection closed by foreign host.

## Help files at the data center

After you have been notified that your data center account is open, you may obtain more information about NCSN data by typing the following commands:

|  |  |
|--|--|
| man info                                 | ! General information on data available at the data center                                     |
| more /data/dc1/calnet/parameters/history | ! Documentation on date of significant changes in data at data center                          |
| man eqselect                             | ! Program documentation for obtaining earthquake location data                                 |
| man extract                              | ! Program documentation for obtaining earthquake phase data                                    |
|  |  |
| man calnet                               | ! Overview of types of NCSN data available at the data center                                  |
| man calnet.catalog                       | ! Format of NCSN earthquake location files   |
| man calnet.phase                         | ! Format of NCSN earthquake phase files  |
| man calnet.mech                          | ! Format of NCSN first motion focal mechanism files  |
| man ascii_mem                            | ! Format of ASCII representation of CUSP .mem files  |
| man getmem                               | ! Program documentation for obtaining CUSP .mem files  |
| man getseis                              | ! Program documentation for obtaining CUSP seismograms   |
| man cusp2ah                              | ! Program documentation for converting seismograms to ahxdr format                             |
|  |  |
| man ucb                                  | ! Overview of type of UCB data available at the data center                                    |
| man ucb.catalog                          | ! Format of UCB earthquake location files  |
| man ucb.phase                            | ! Format of UCB earthquake phase files   |
| man qdata                                | ! Program documentation for obtaining UCB waveform data as Steim-1<br>! compressed data blocks |
| man sdata                                | ! Program documentation for obtaining UCB waveform data as SEED<br>! volumes                   |