

Probing the deep Rheology of Tibet: Constraints from the 2008 M_w 7.9 Wenchuan, China Earthquake

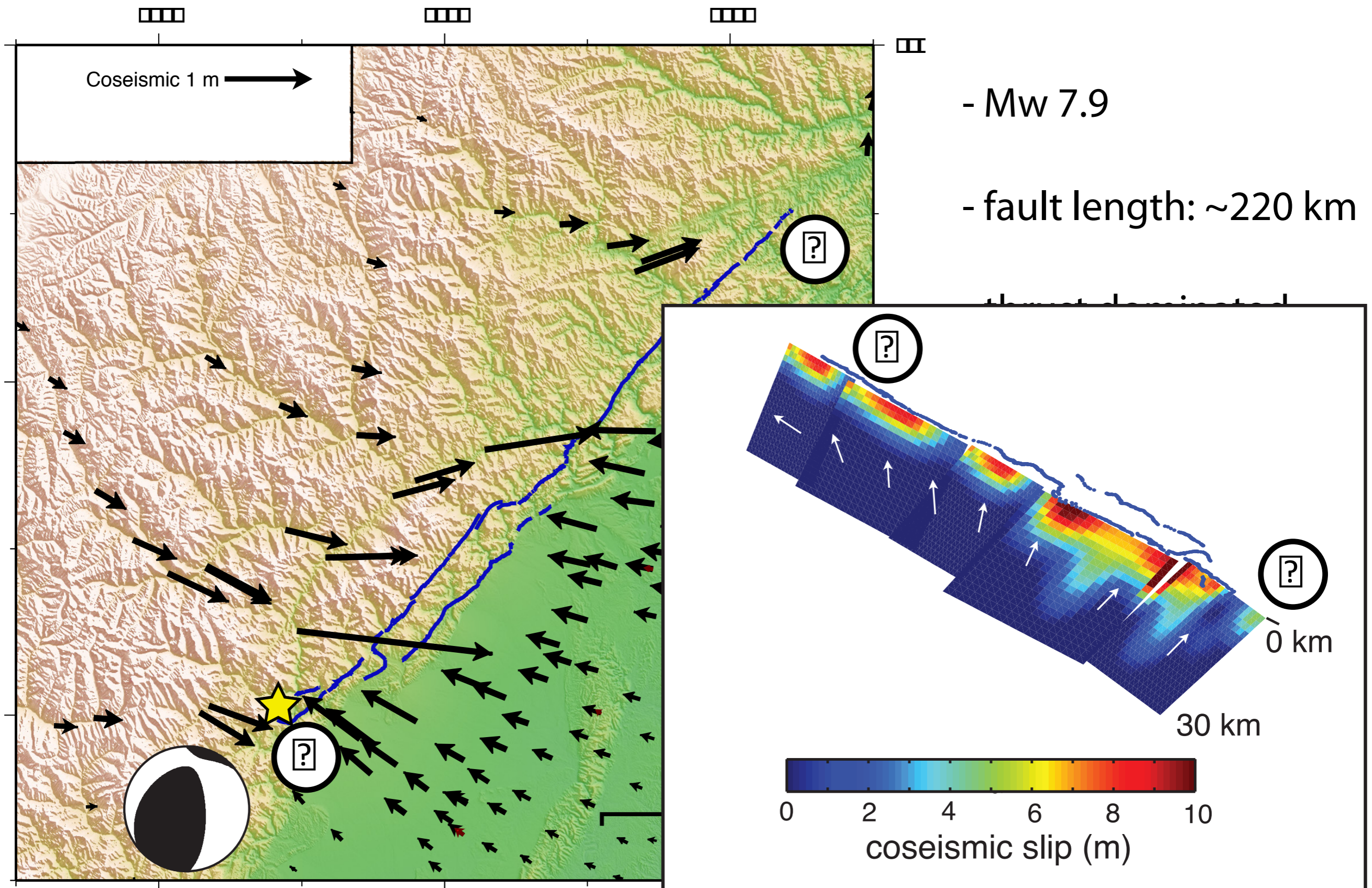
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Andrew Freed²

¹Earth and Planetary Science, UC Berkeley, California, USA.

²Earth and Atmospheric Sciences, Purdue University, Indiana, USA.

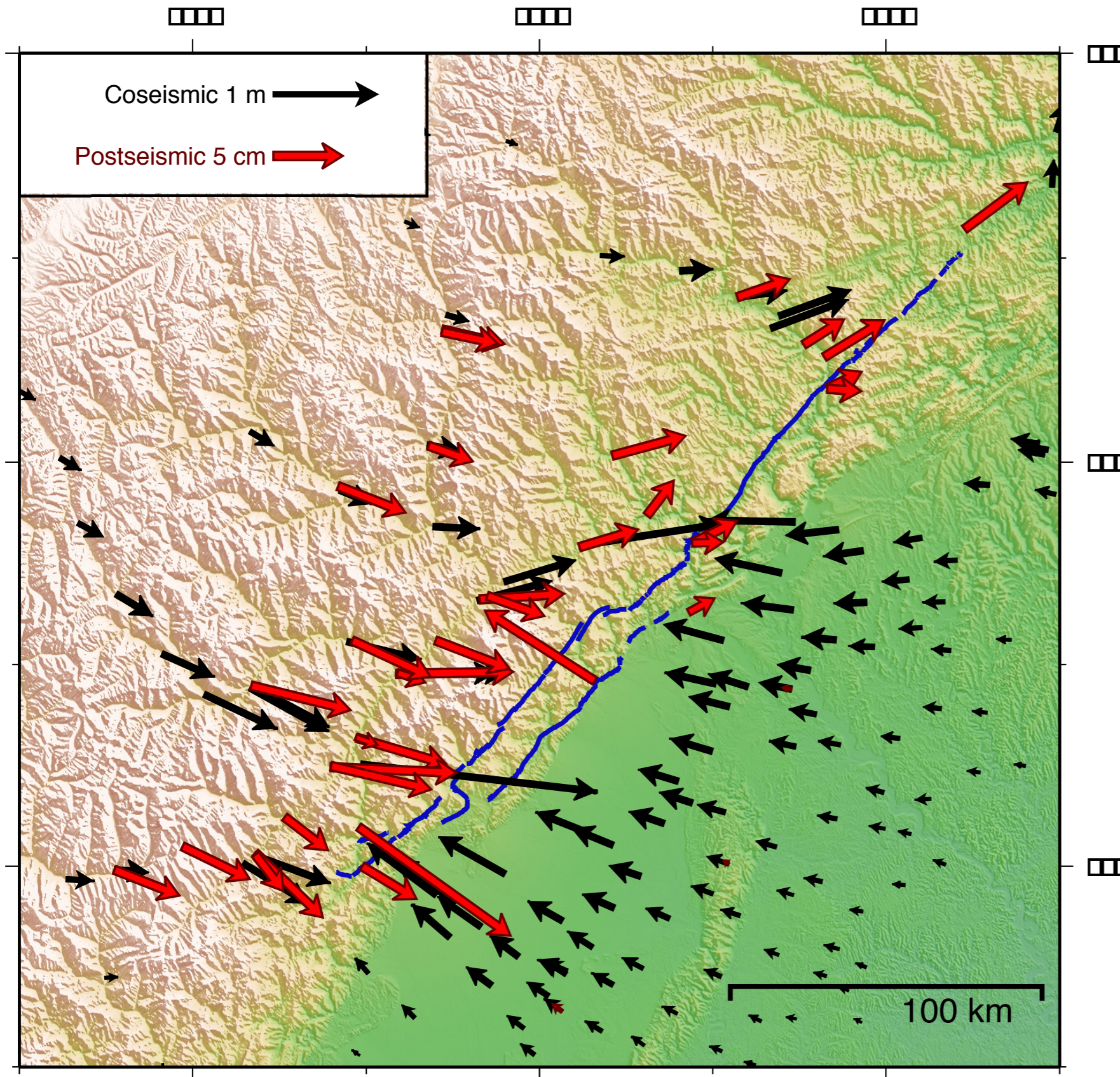


Wenchuan earthquake



coseismic GPS data from Wang et al., Nature Geo, 2011

Wenchuan earthquake - Postseismic displacement



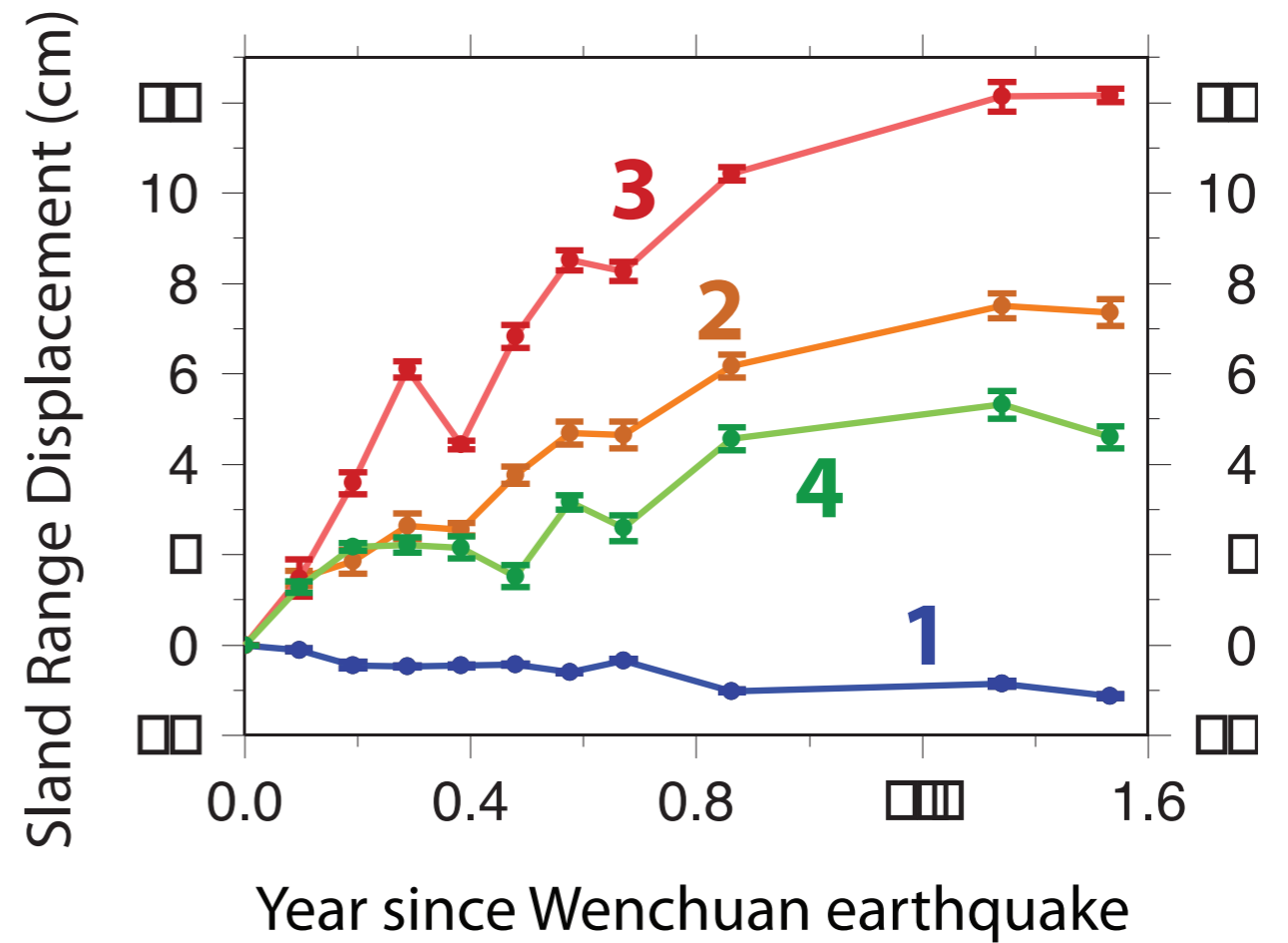
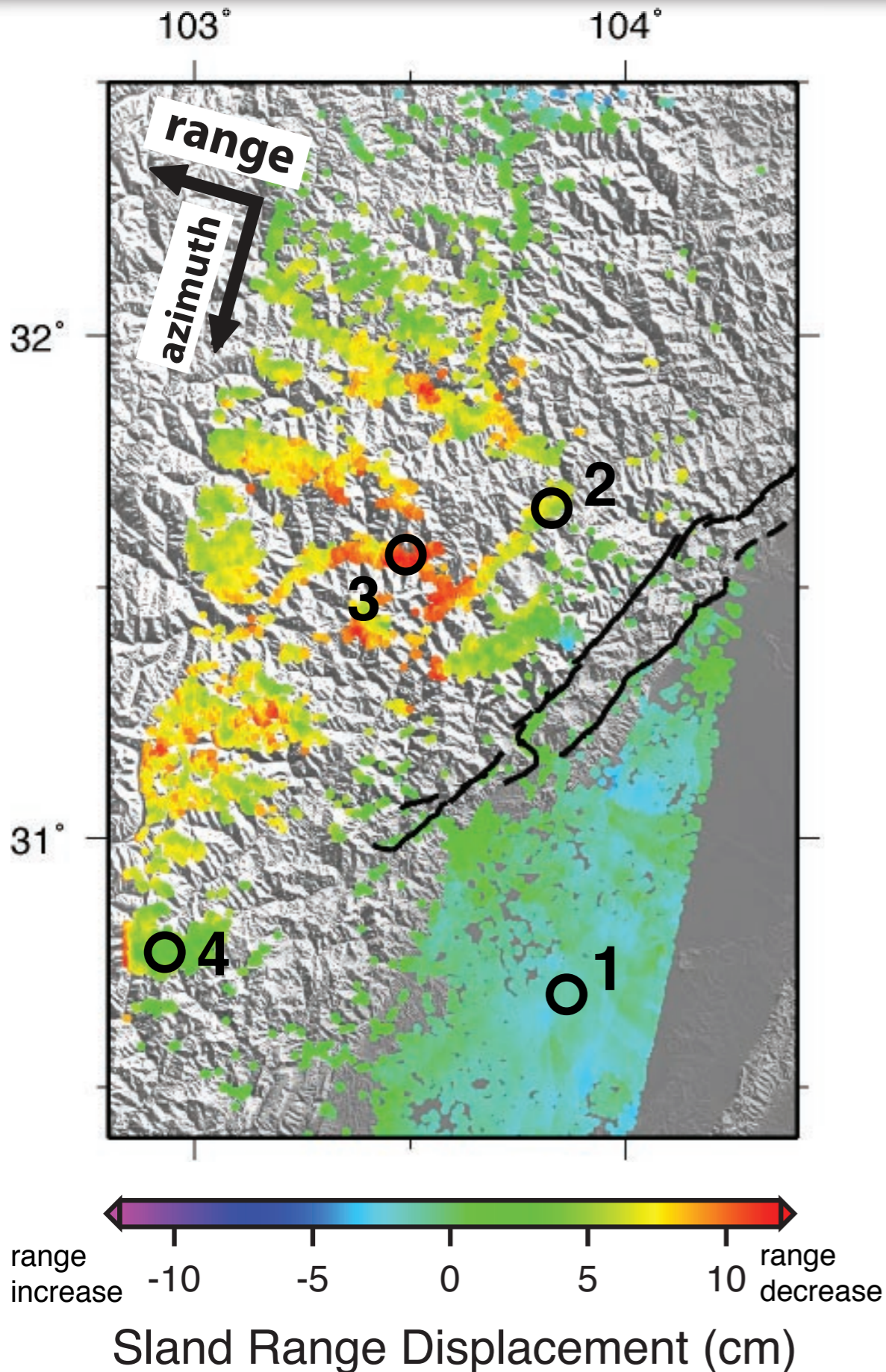
☐☐☐ - 4-7 weeks after the main shock.

- Logarithmic functions to fit GPS time series for 1 year displacement.

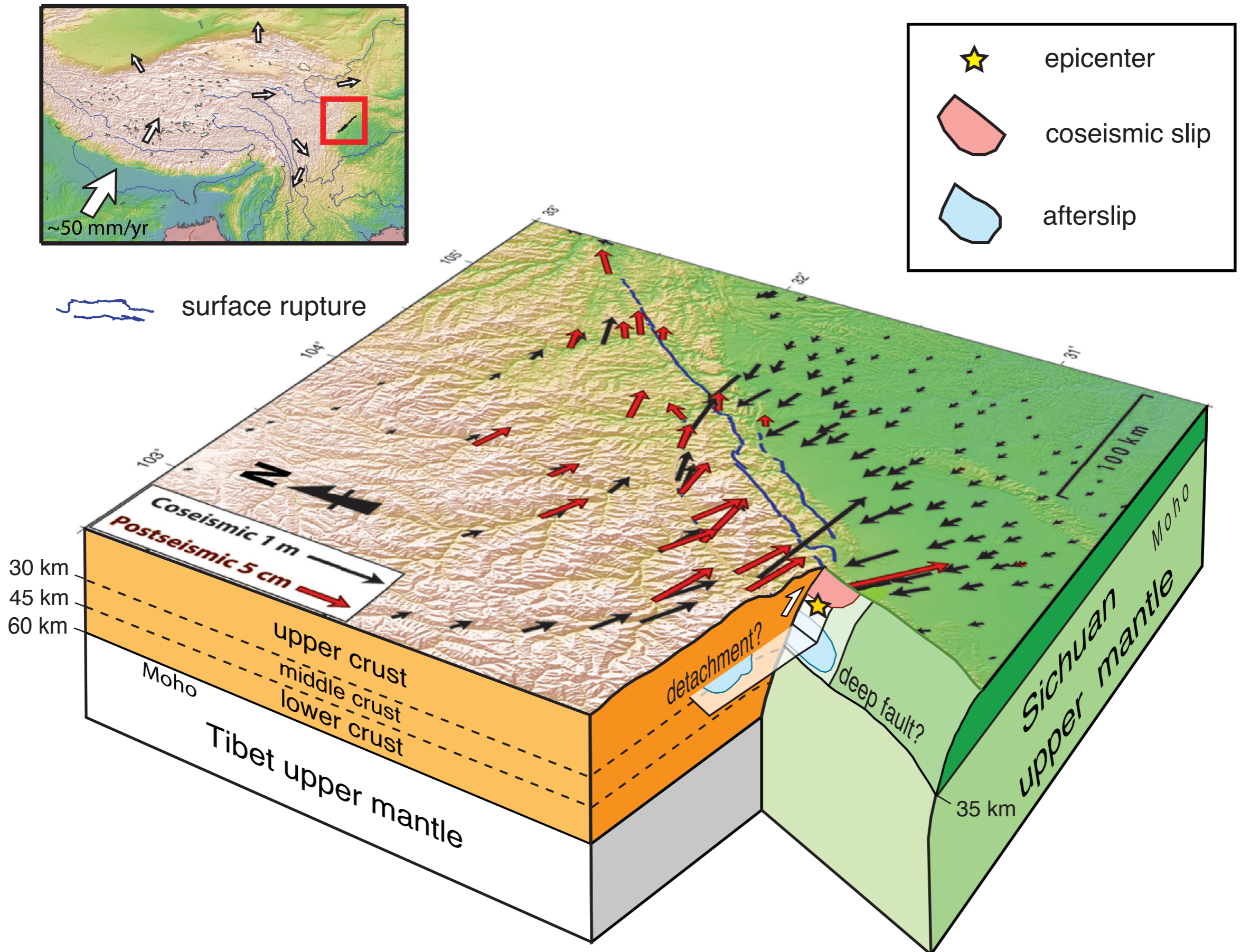
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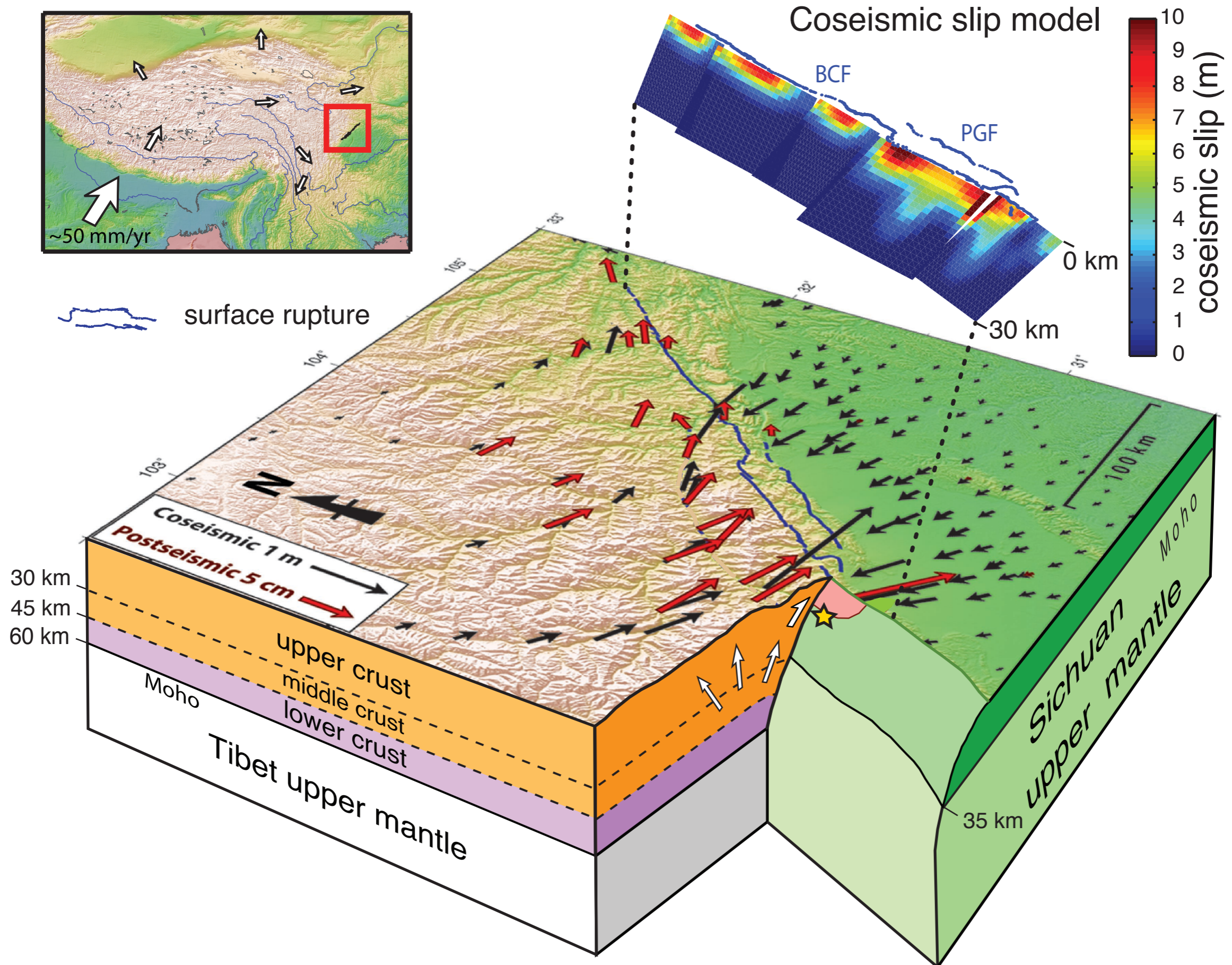
Wenchuan earthquake - Postseismic displacement



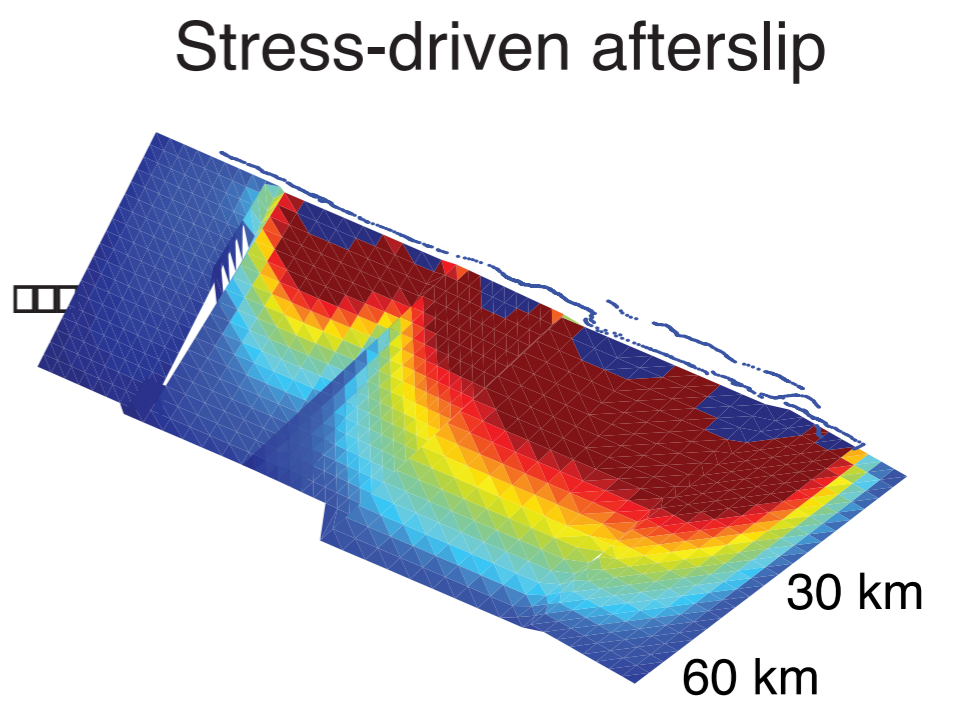
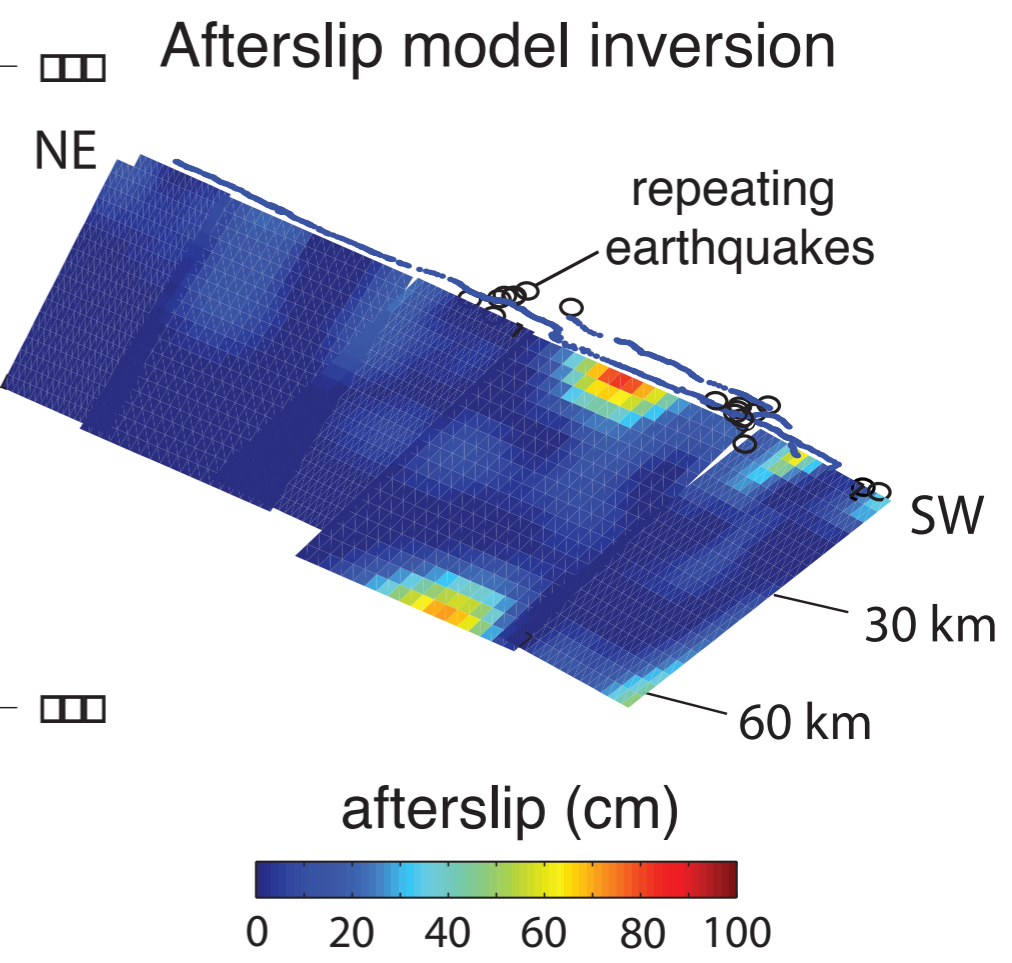
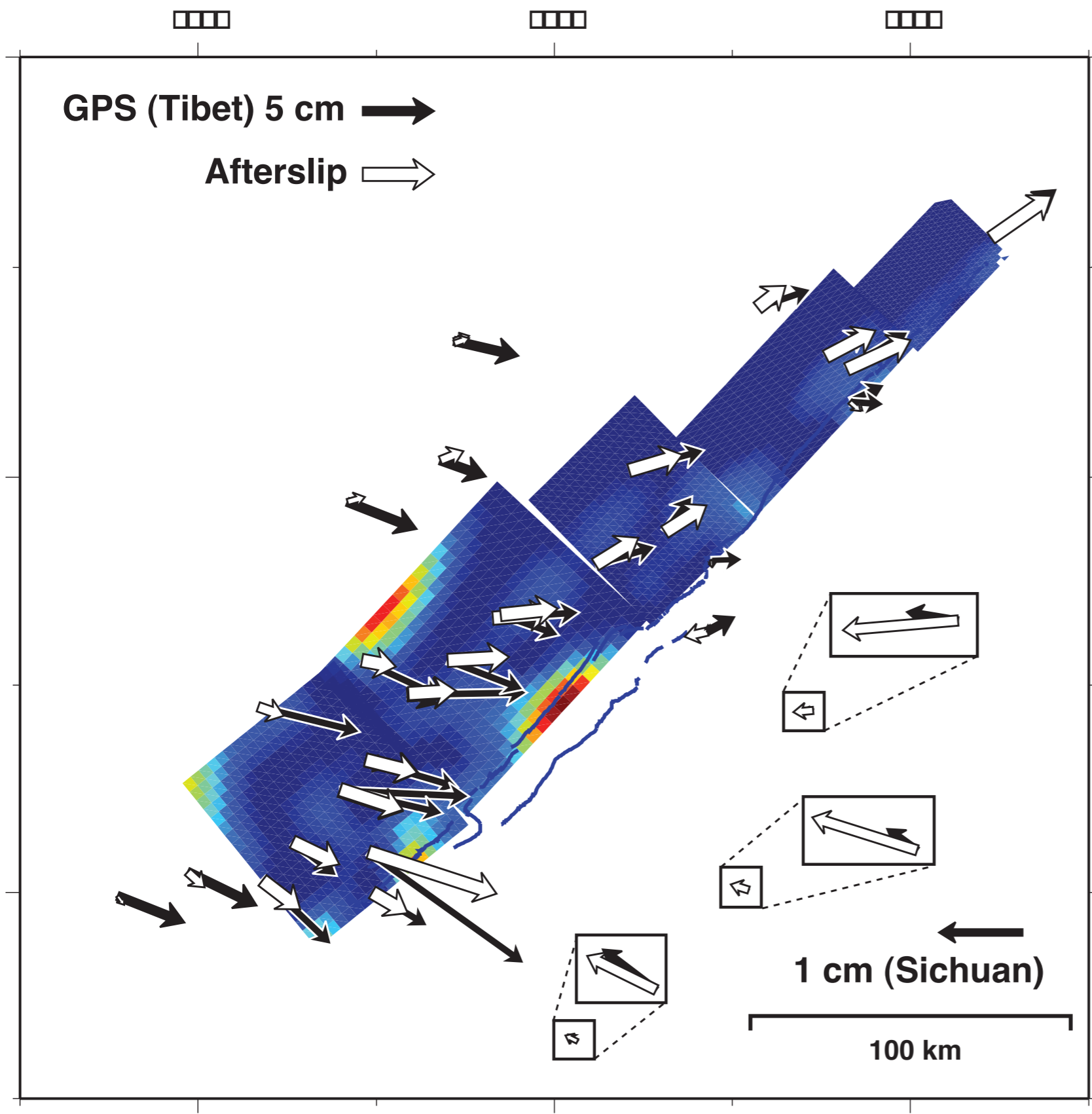
Tibetan Plateau: Brittle Thickening or Ductile Flow?



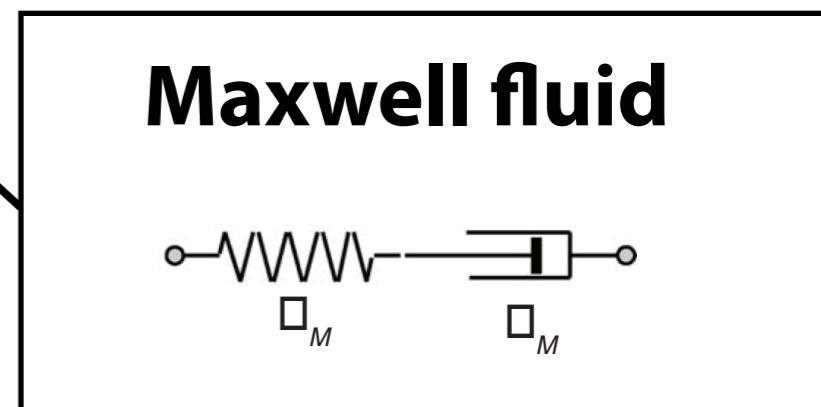
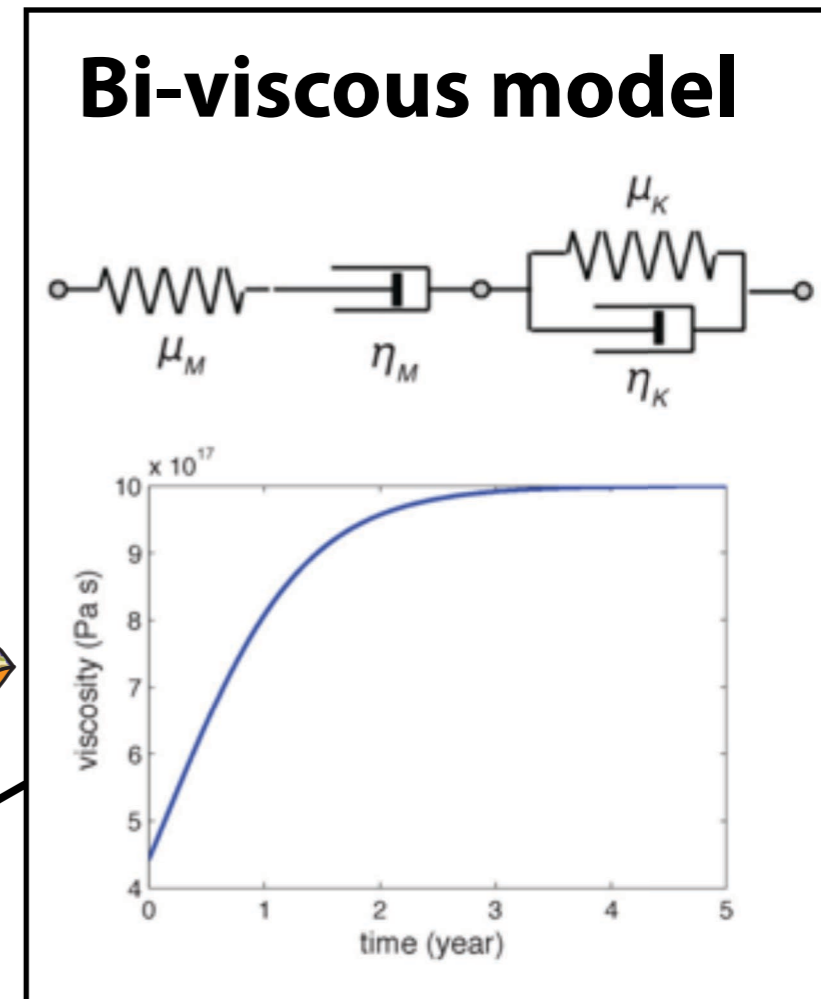
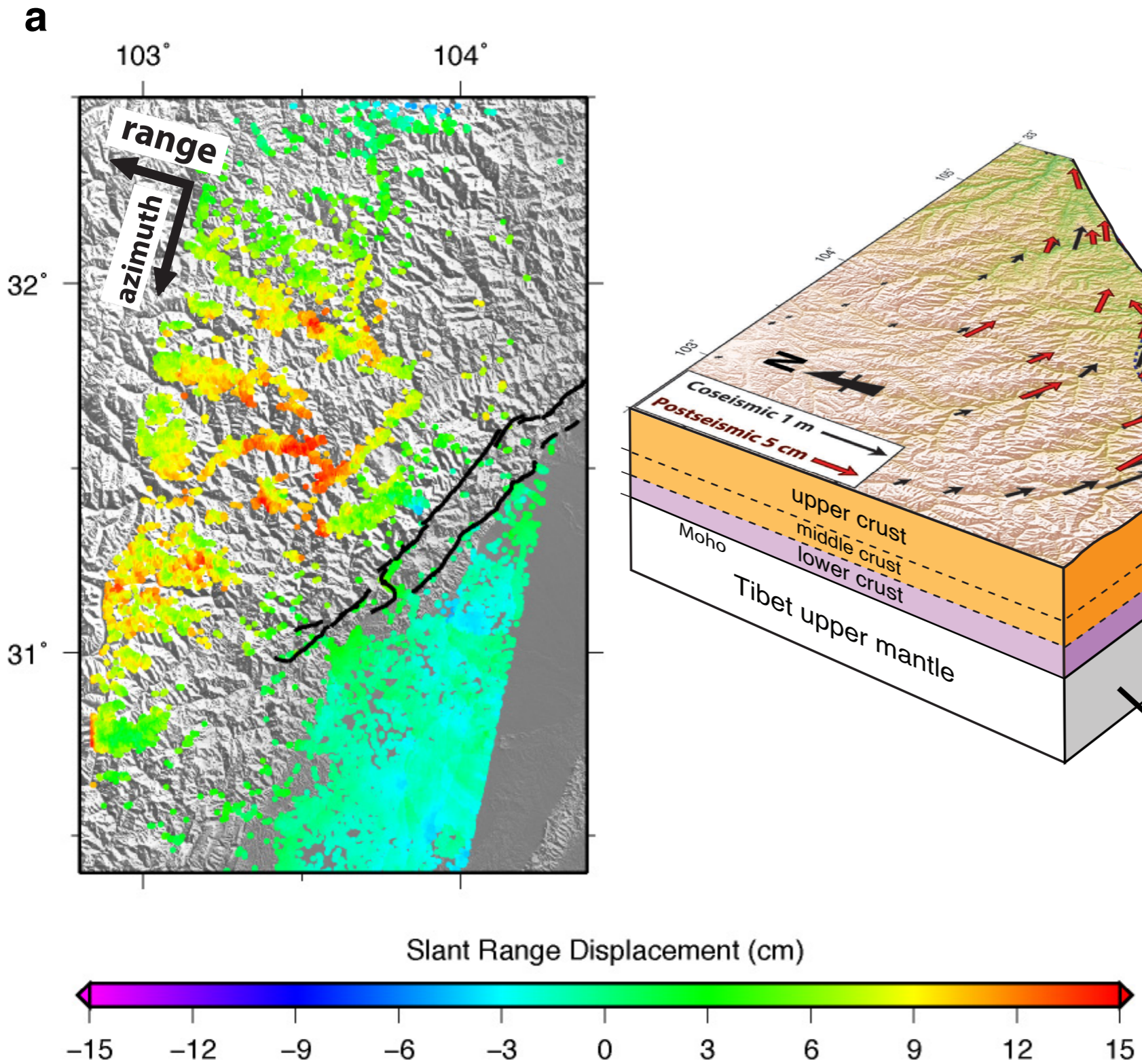
Tibetan Plateau: Brittle Thickening or Ductile Flow?



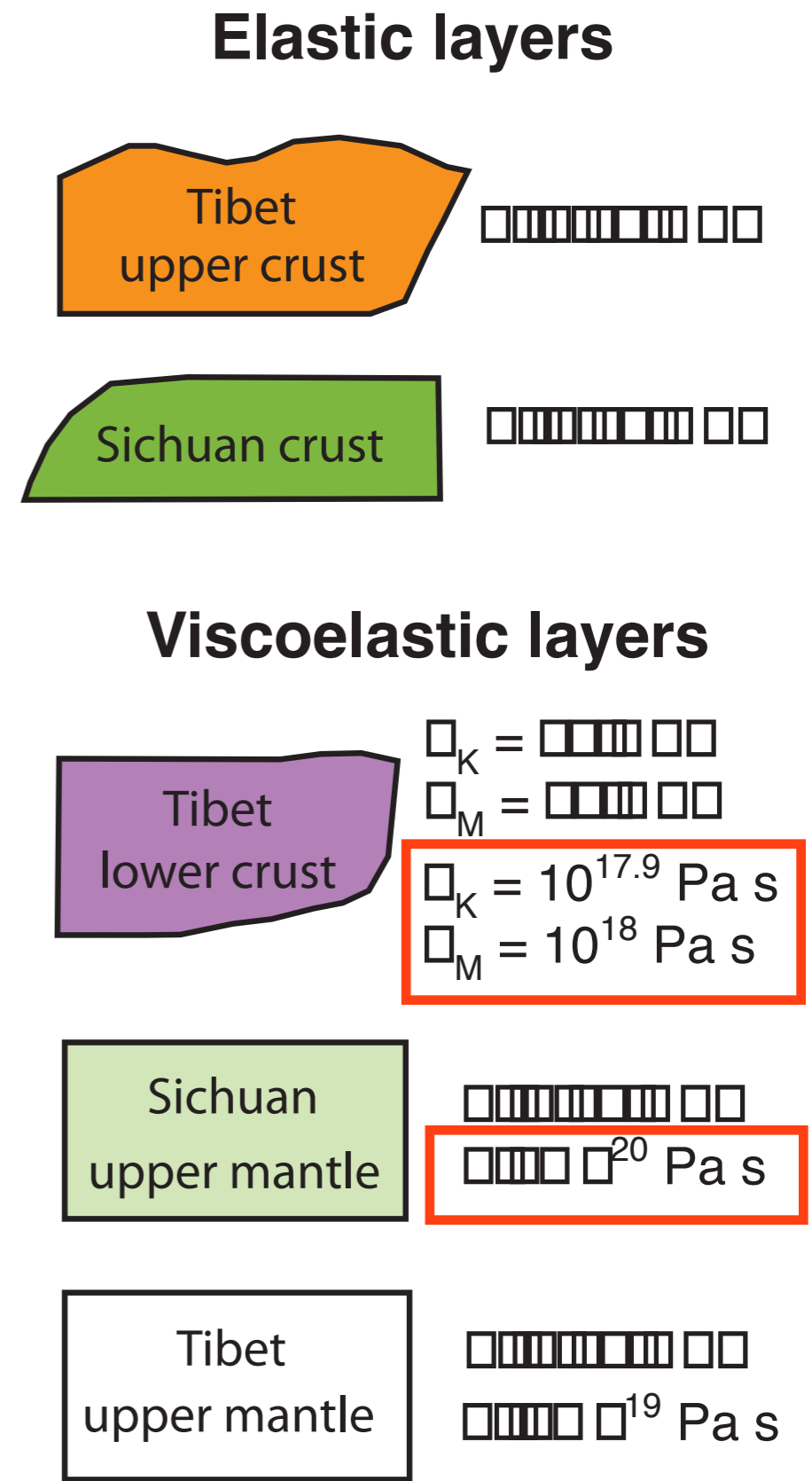
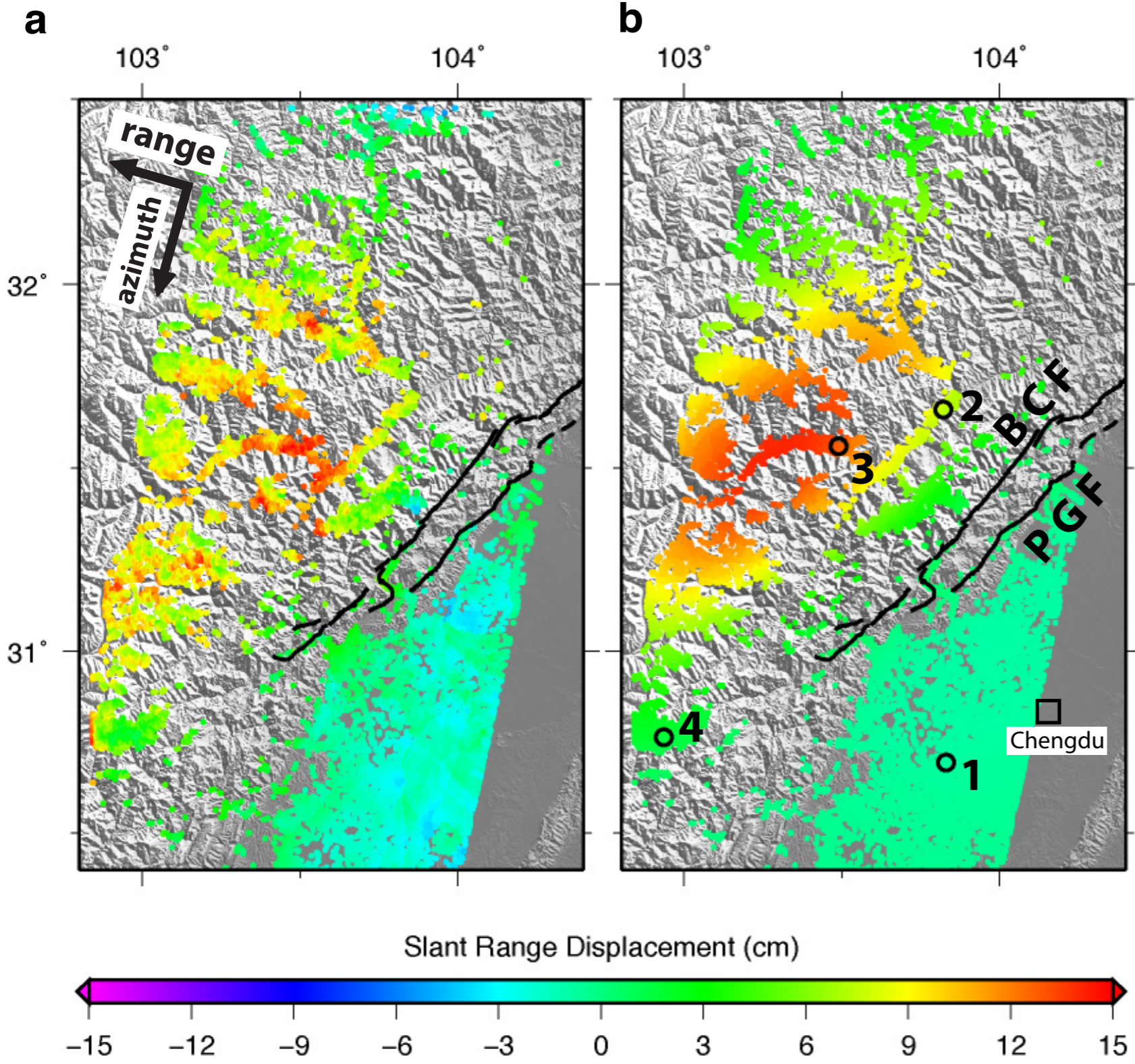
One year Postseismic: Afterslip only



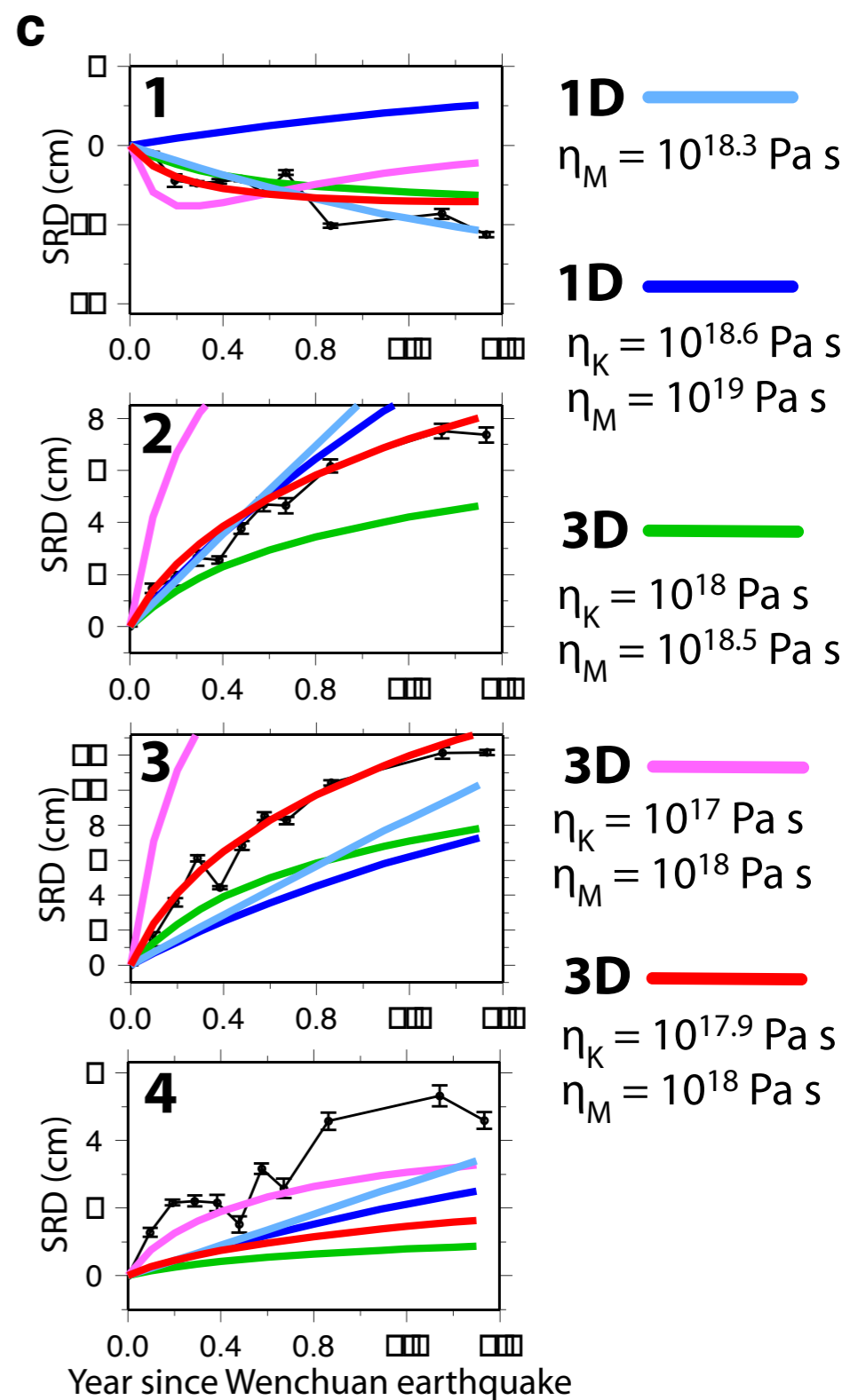
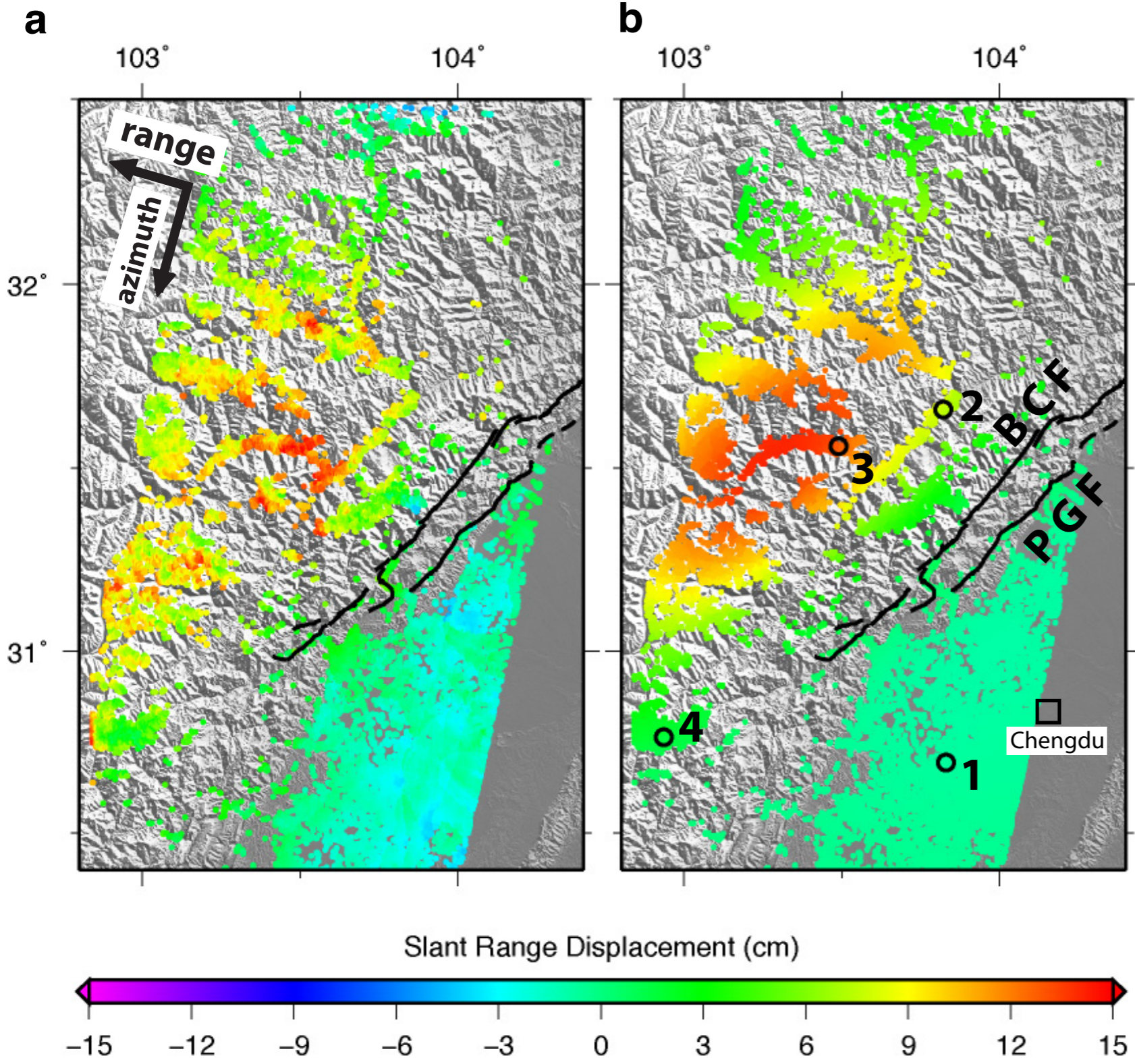
Postseismic: Viscoelastic Relaxation



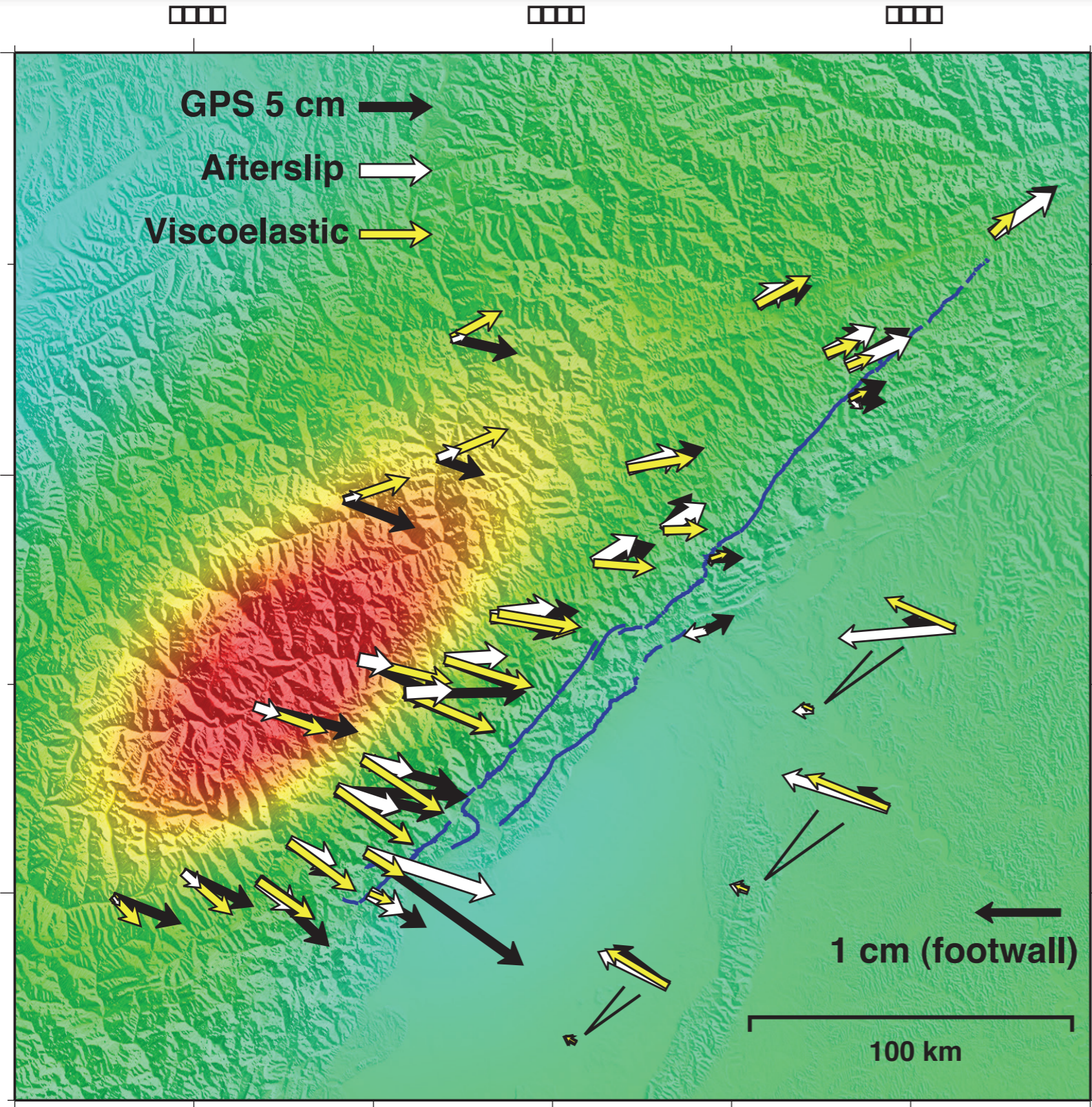
Postseismic: Viscoelastic Relaxation



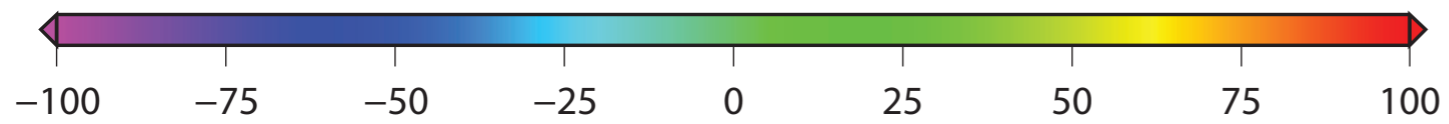
Postseismic: Viscoelastic Relaxation



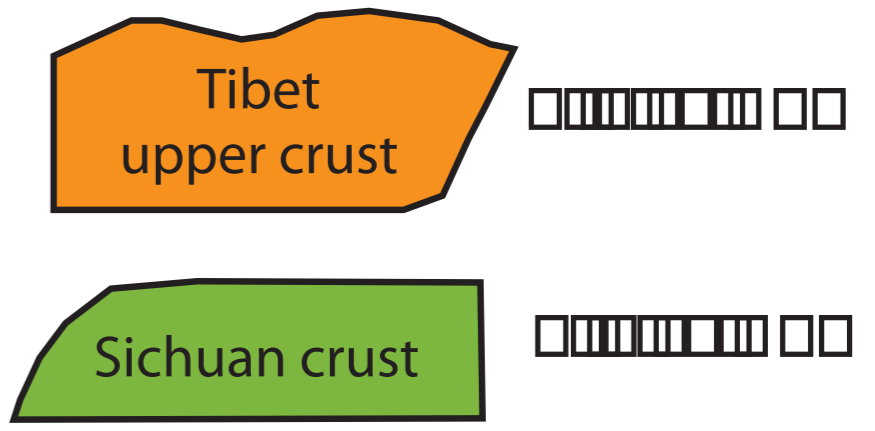
Postseismic: Viscoelastic relaxation



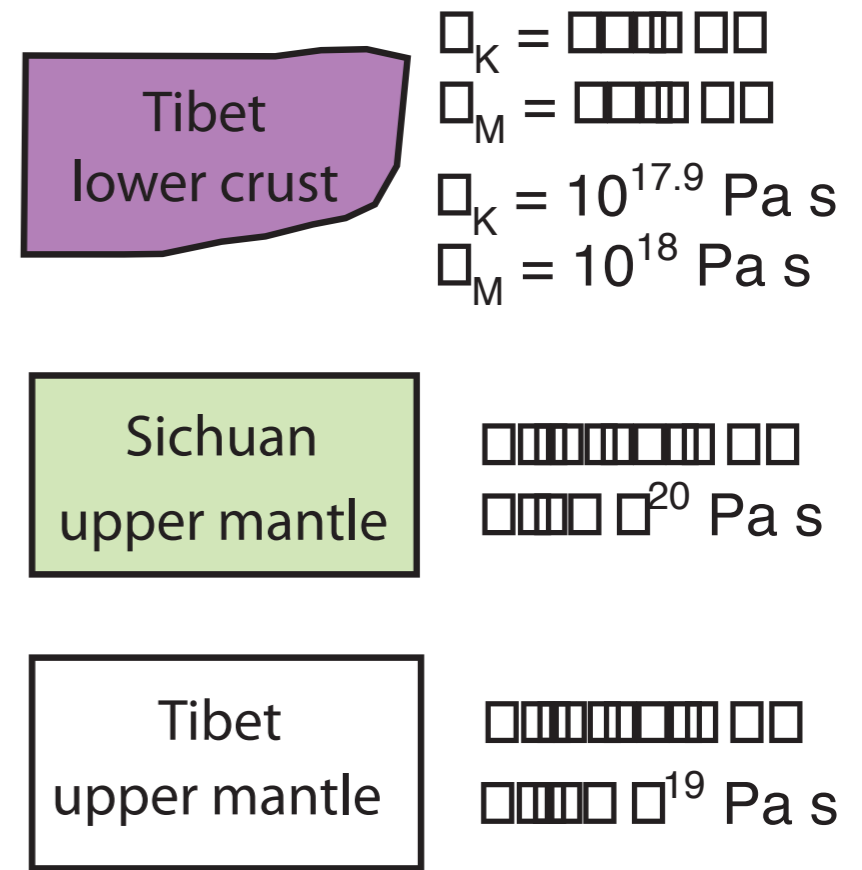
Vertical displacement from viscoelastic model (mm)



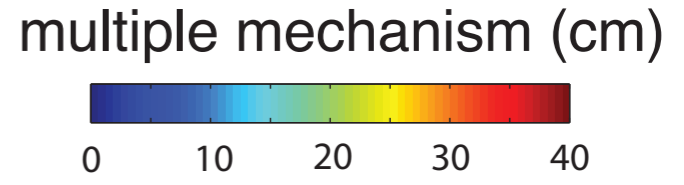
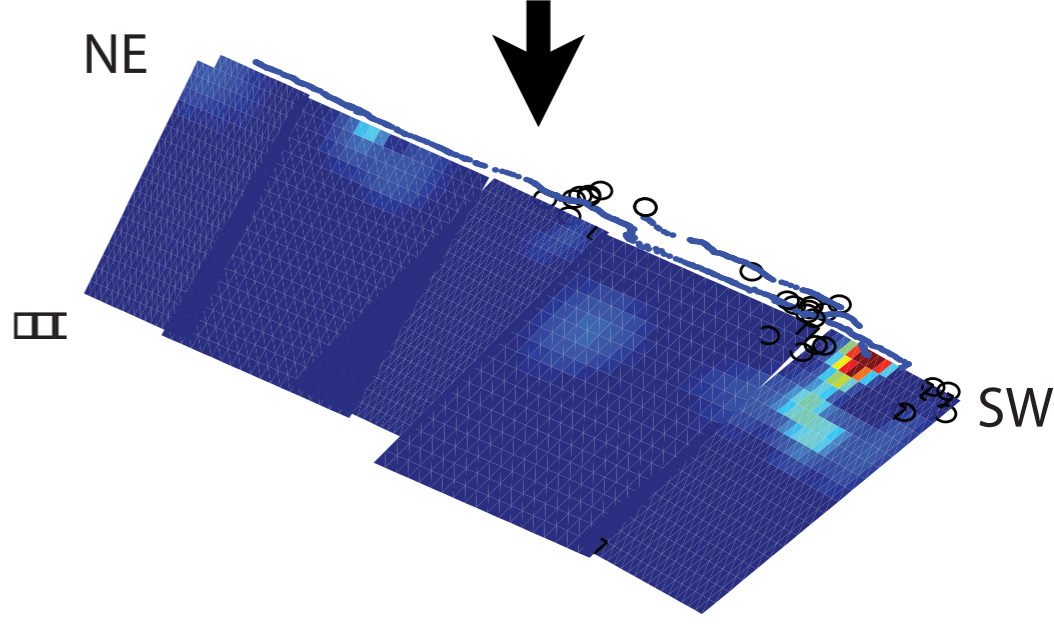
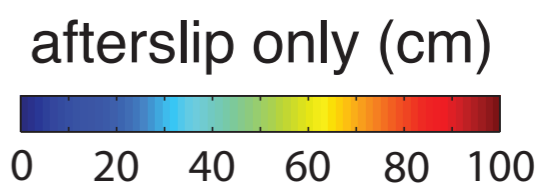
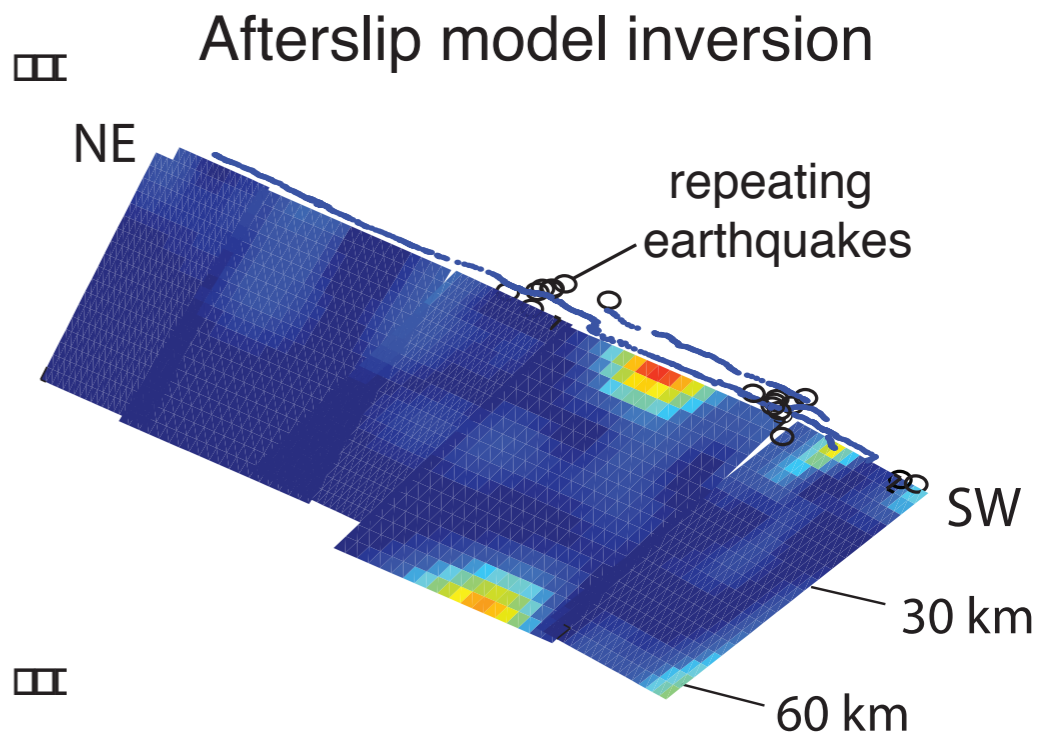
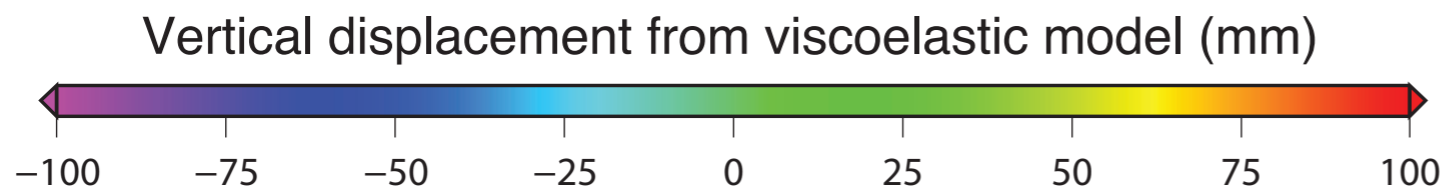
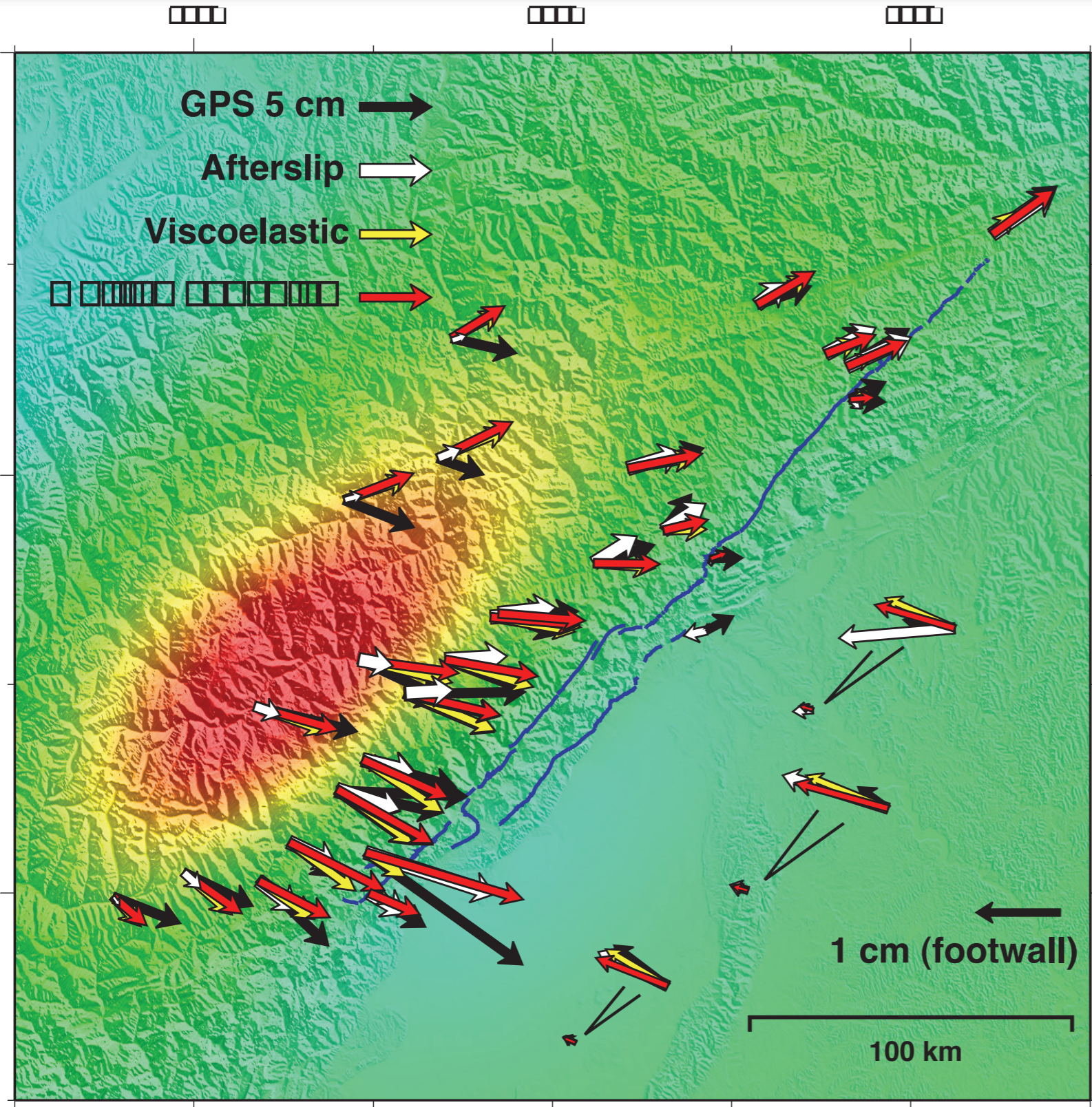
Elastic layers



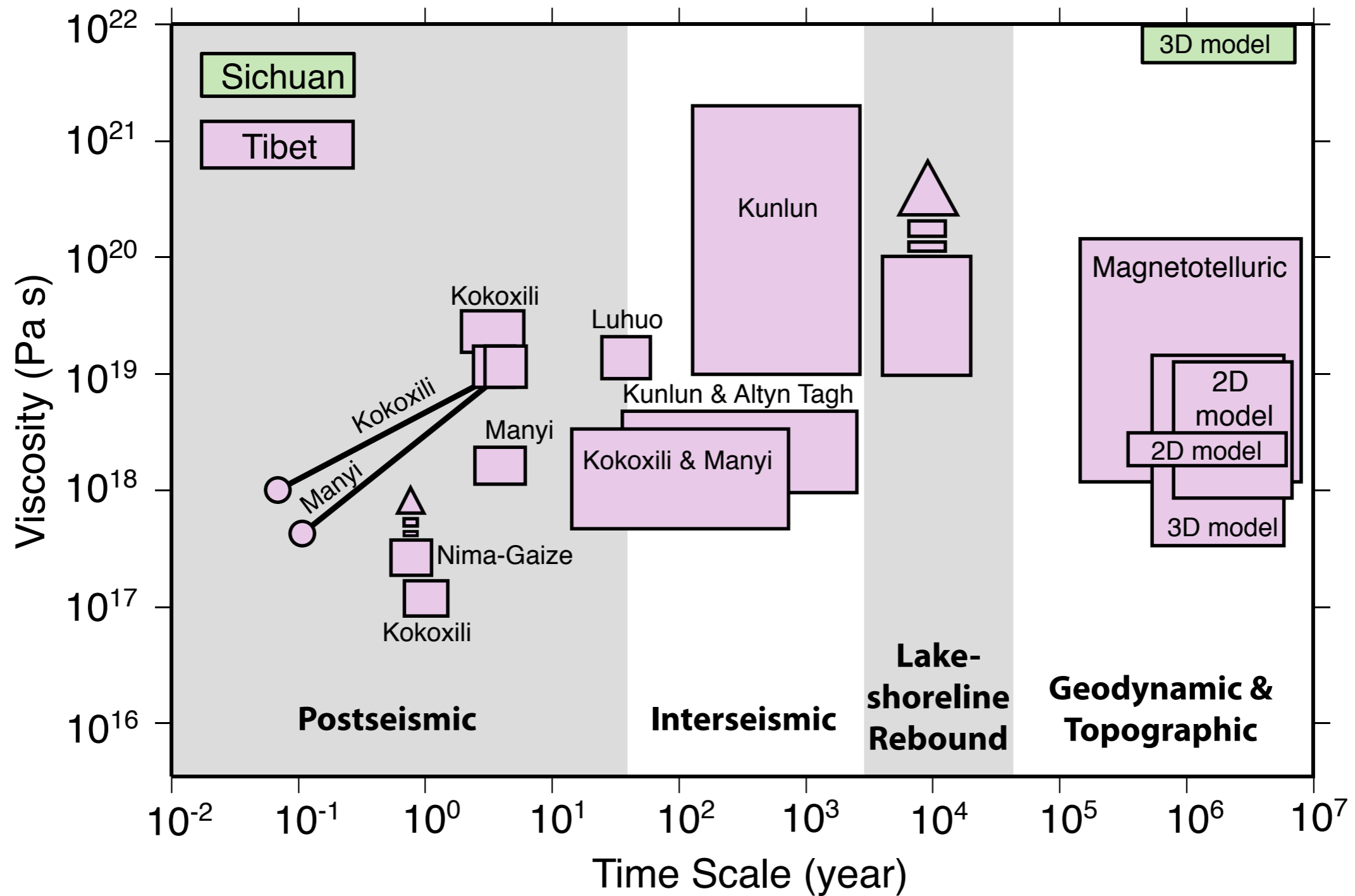
Viscoelastic layers



Postseismic: Multiple mechanism



Viscosity of Tibet over different time scales



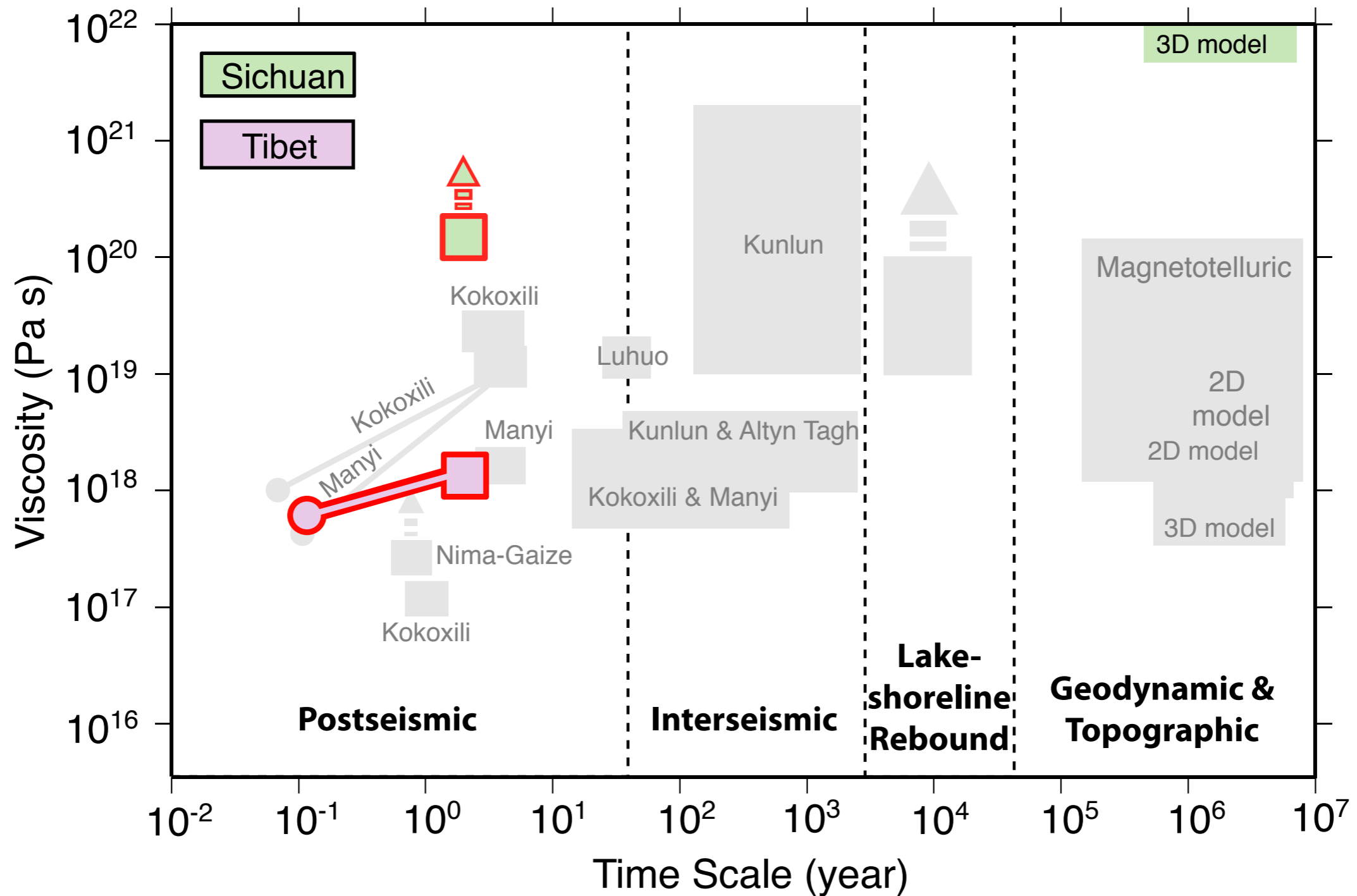
Geodynamic & Topographic: Beaumont et al. (2001); Clark et al. (2005); Cook & Royden (2008); Rippe et al. (2010)

Lakeshoreline Rebound: England et al. (2013)

Interseismic: Hiley et al. (2005; 2009); Zhang et al. (2009); DeVries & Meade (2013)

Postseismic: Ryder et al. (2010); Ryder et al. (2011); Wen et al. (2012); Yamasaki & Houseman (2012)

Viscosity of Tibet over different time scales



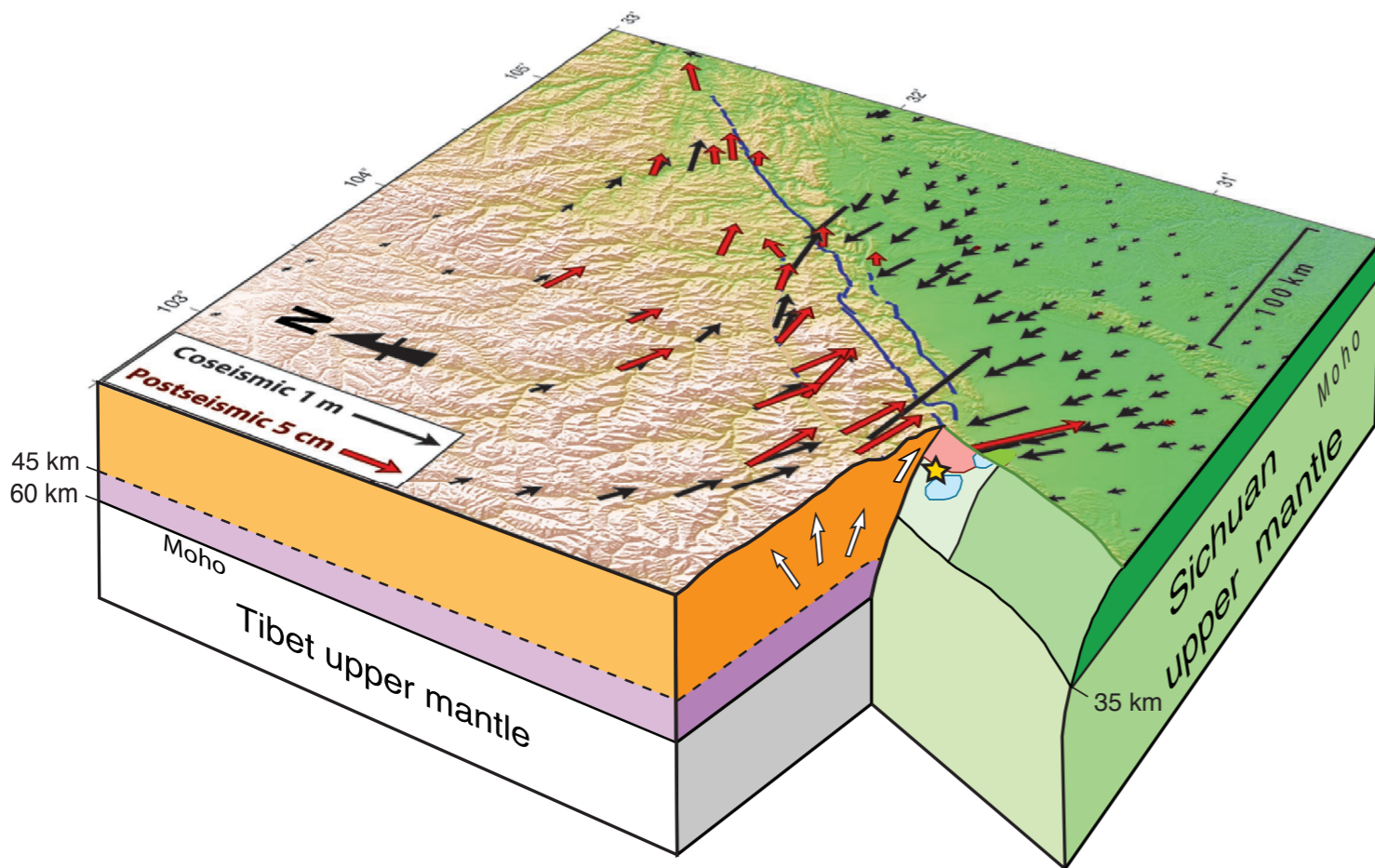
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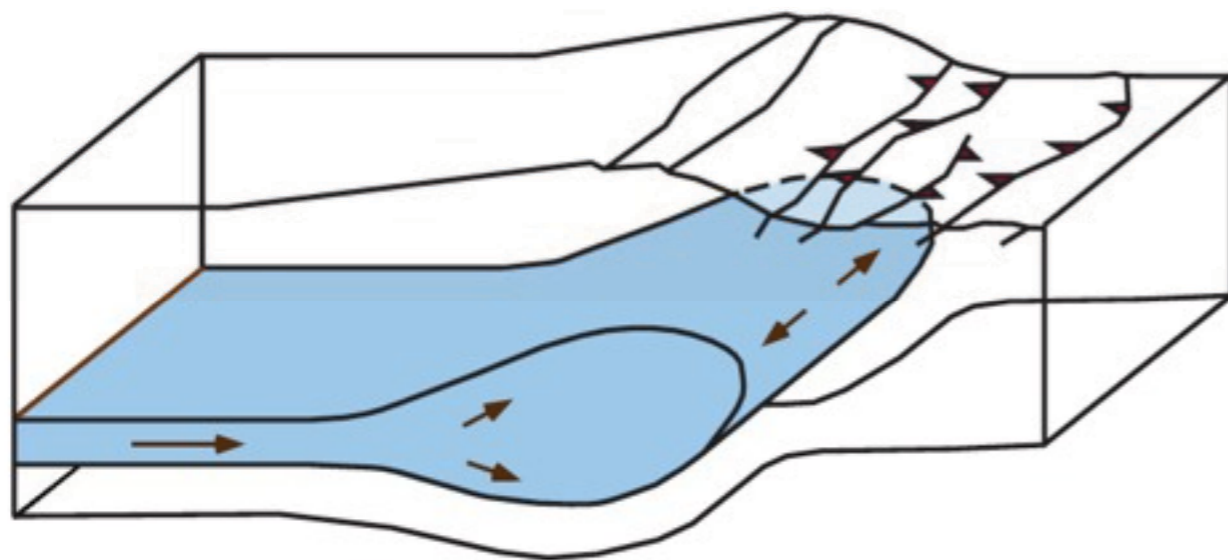
Summary



- A multiple mechanism model explains the postseismic displacement

- Contrasting rheology between Tibet and the Sichuan Basin

- Supports the lower crustal flow model



Lower Crustal Flow

Thank you

