Motion and Deformation of the Indian Plate

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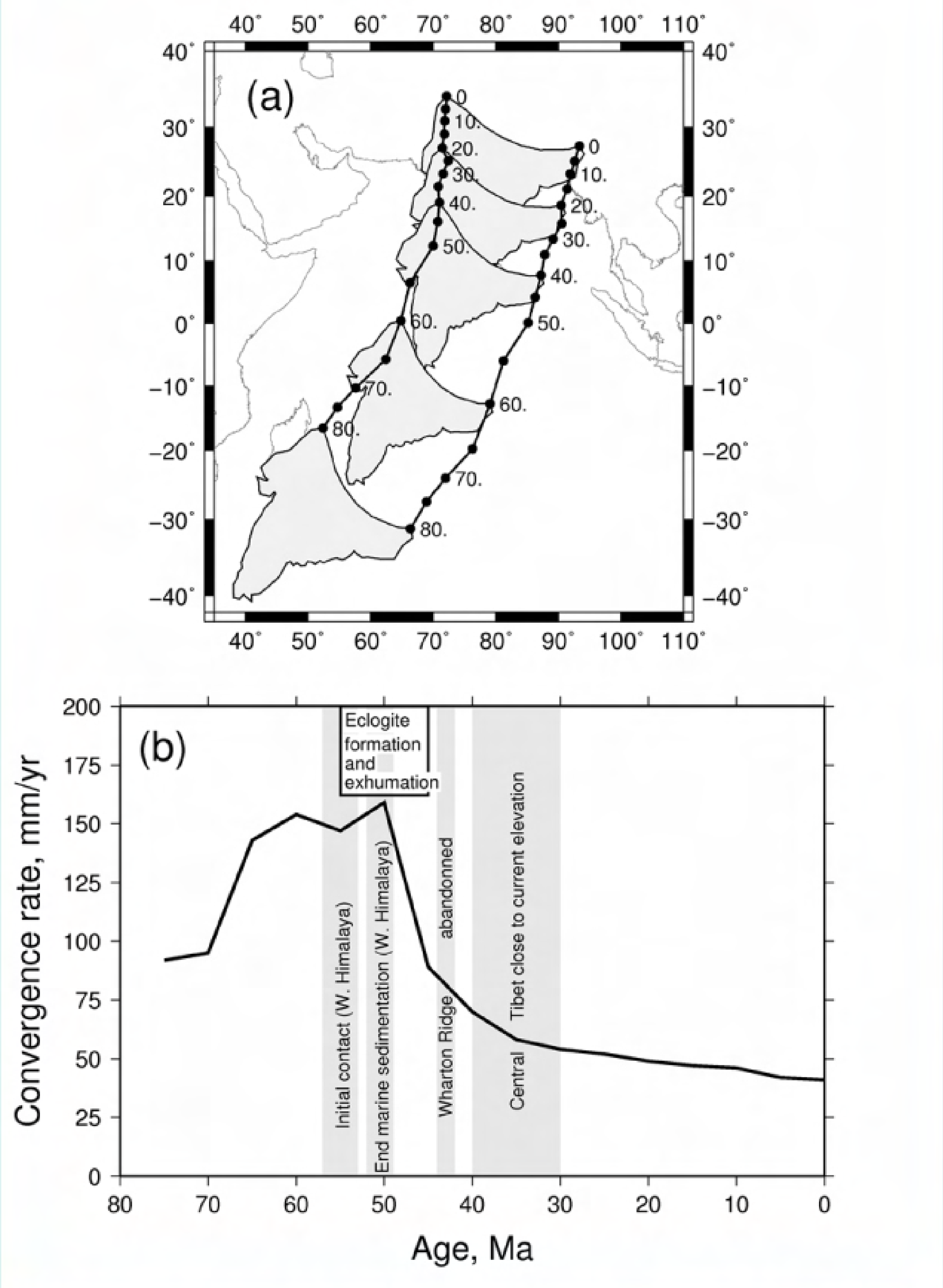
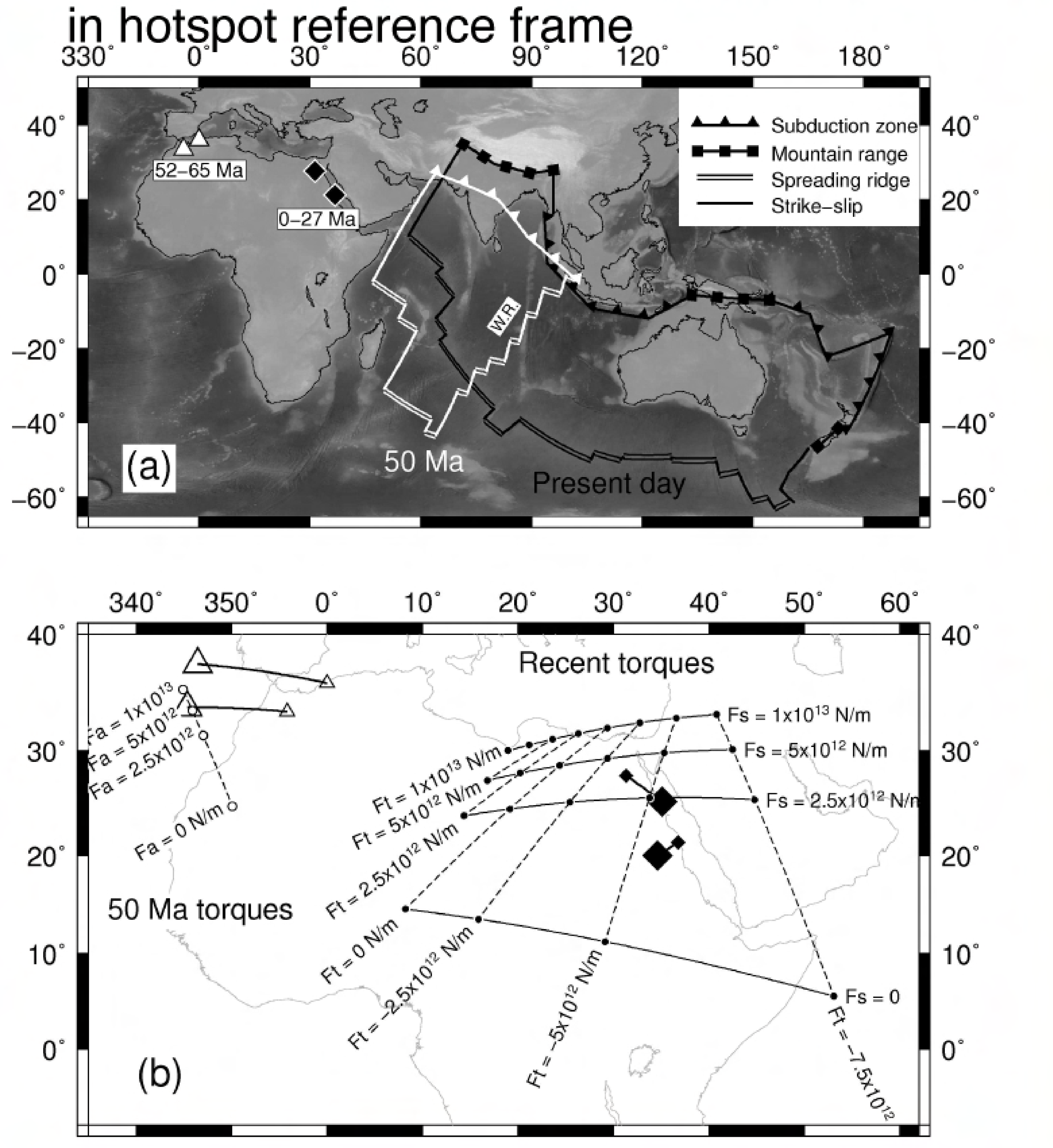
Part 1: Motion

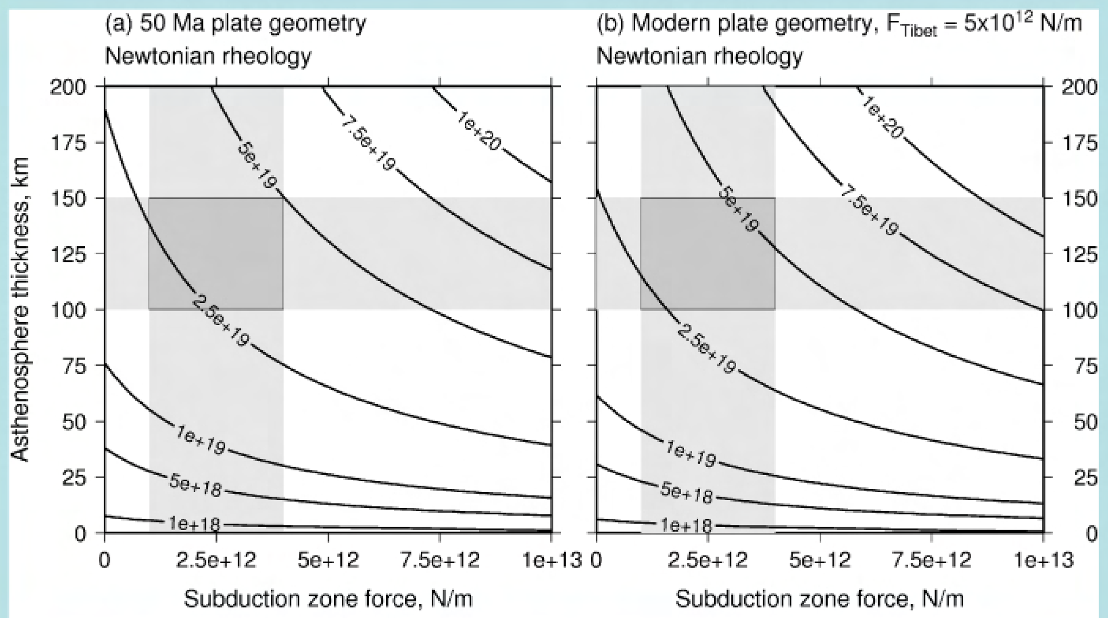


1.The motion of India changed dramatically in the Cenozoic, co-incident with the onset of mountain building in Tibet and a re-arrangement of plate boundaries in the Indian Ocean (see also 2a)

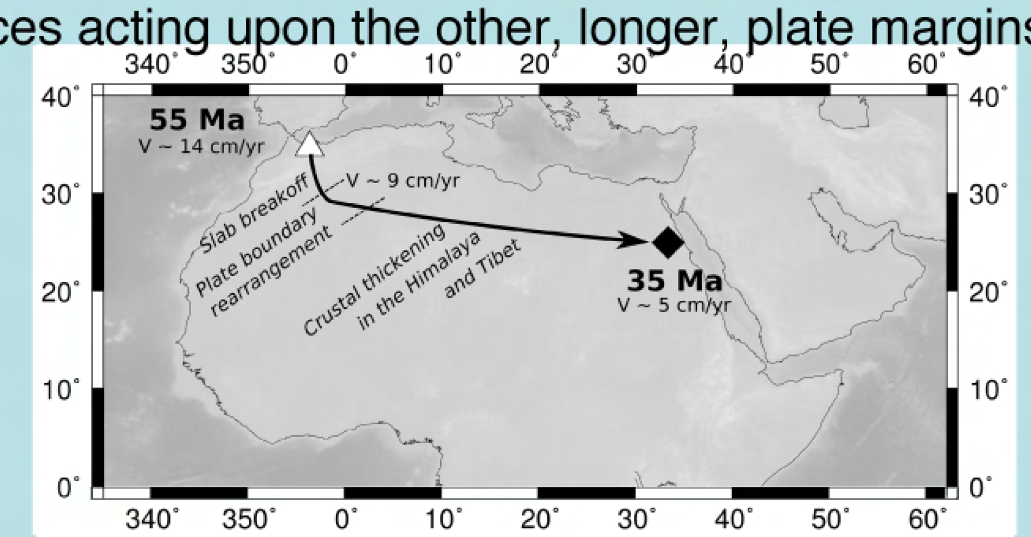
modern and 50 Ma geometry, and Euler poles in hotspot reference frame



2. Euler poles relative to underlying mantle can be used to calculate orientation of torque resulting from basal drag. The net force on a plate must be zero, so basal drag torque orientation constrains the magnitudes of the other forces acting upon the plate (which must result in a torque with the same orientation but opposite sign). The subduction zones exert roughly the same force per unit length as the mid-ocean ridges. The largest force per unit length is exerted by Tibet, but convergence continues because this is overwhelmed by the smaller forces acting upon the other, longer, plate margins.



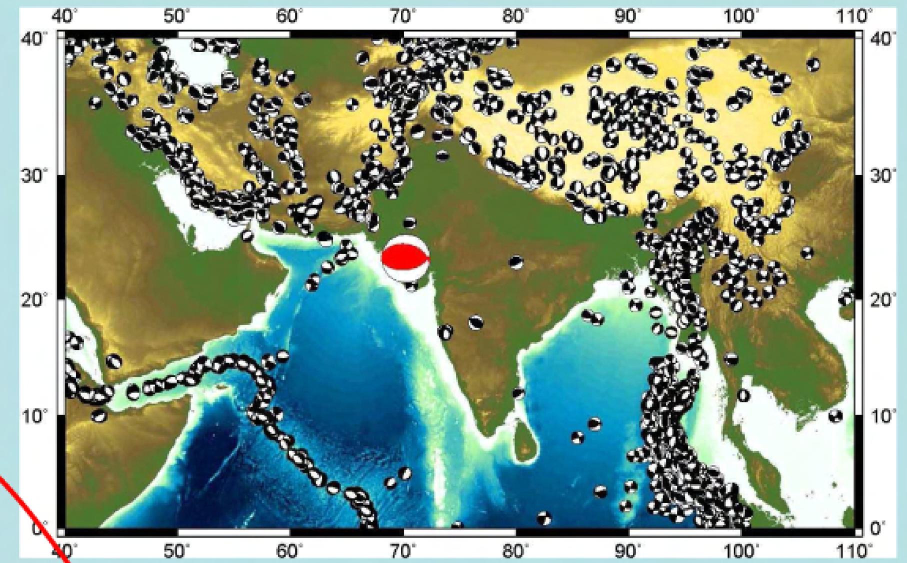
3. Requiring the magnitudes of the torques to balance, in addition to the orientations, allows us to use the calculated plate margin forces to constrain the rheology of the asthenosphere.

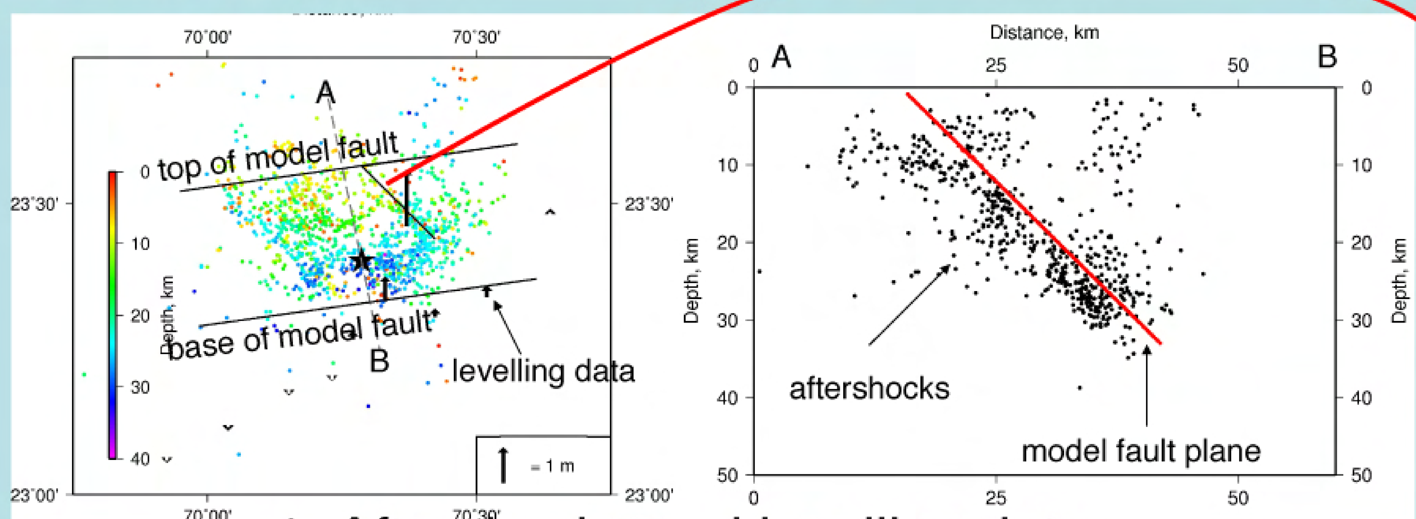


4. Schematic representation of the causes of the change in motion of the Indian plate

Part 2: Deformation

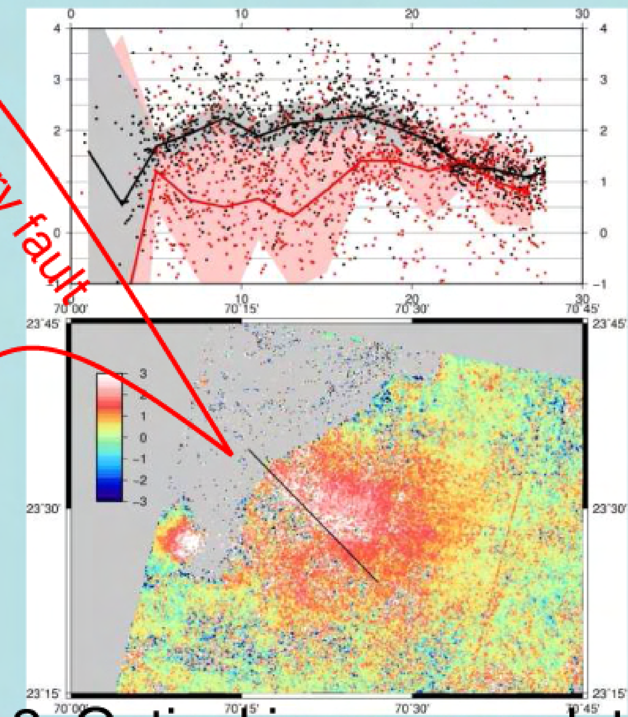
The 2001 Mw 7.6 Bhuj earthquake of NW India



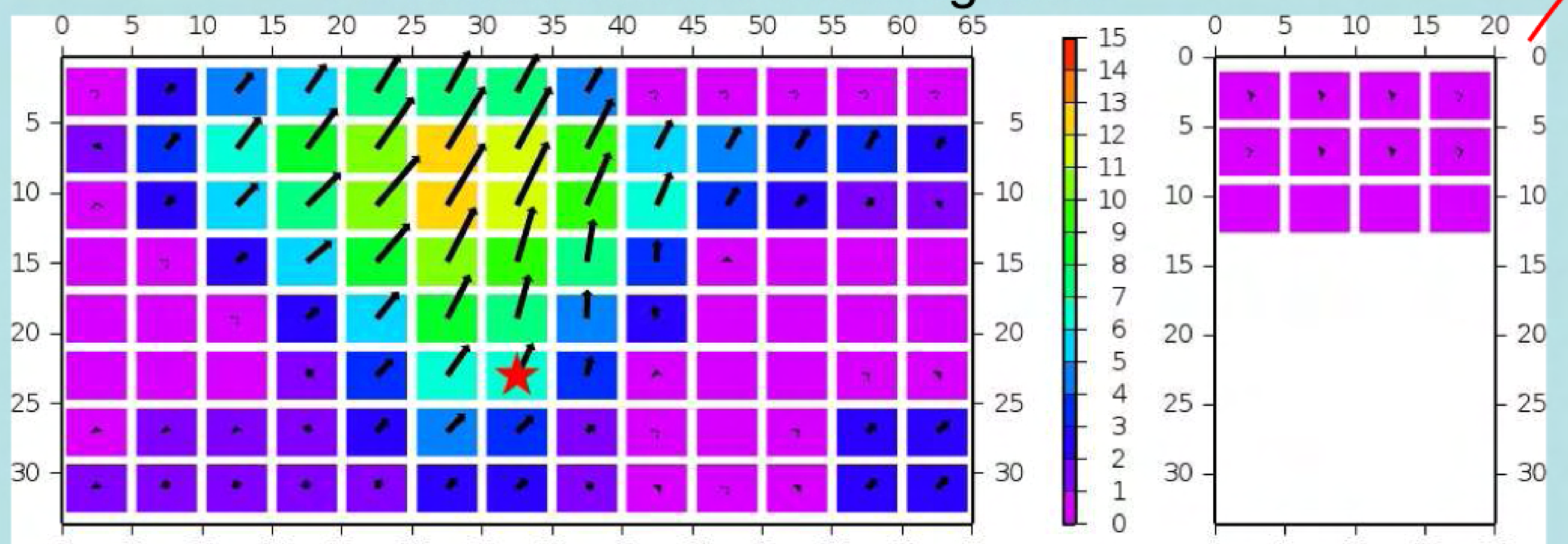


1. Aftershocks and levelling data

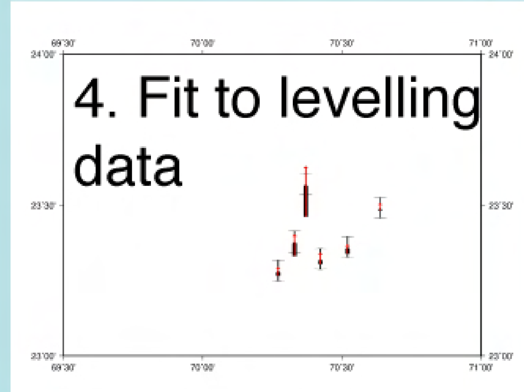
subsidiary fault



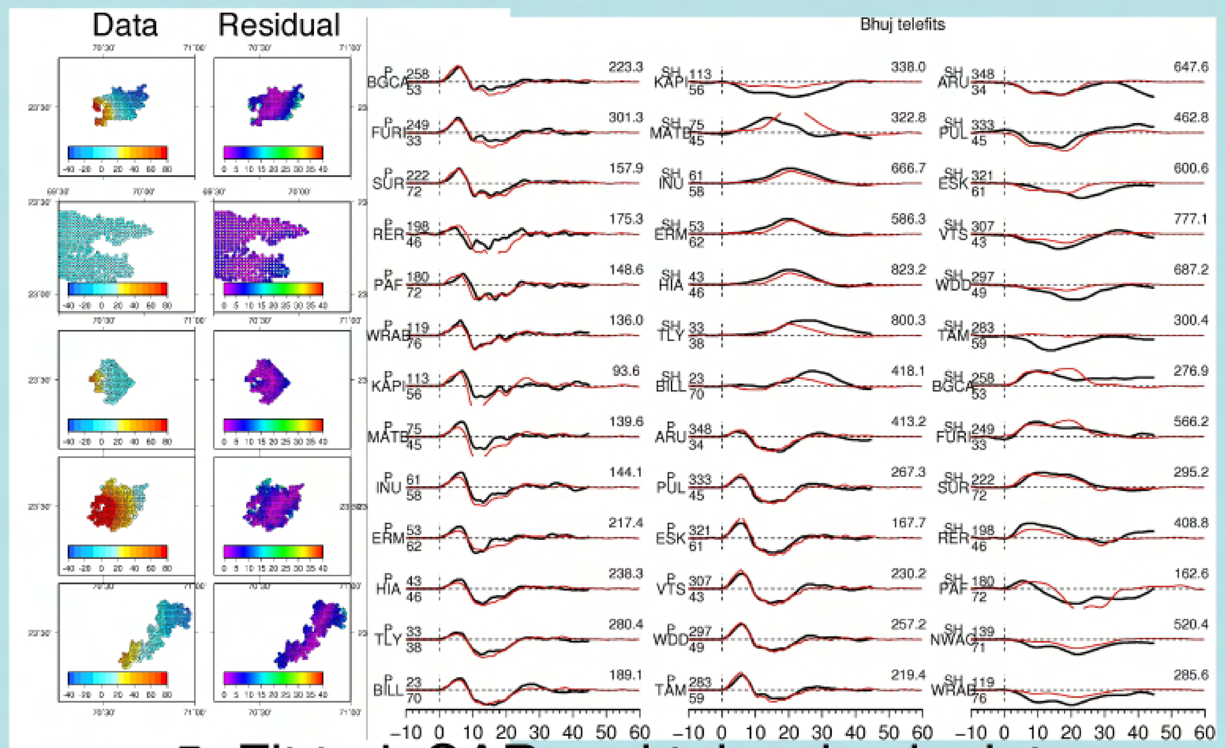
2. Optical image correlation (E-W and vertical signals)



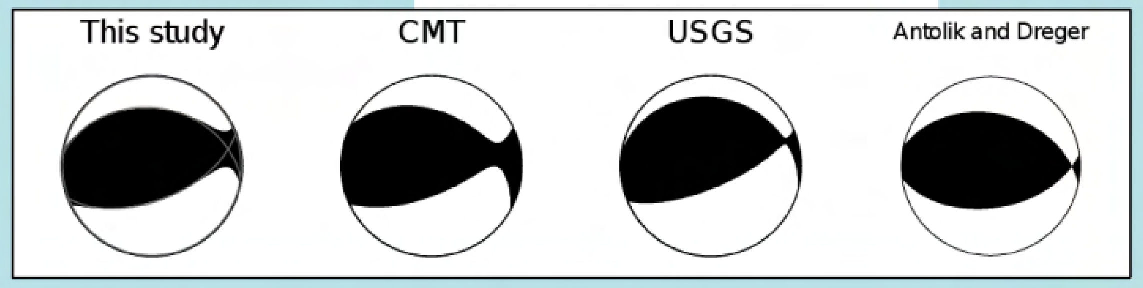
3. Slip model



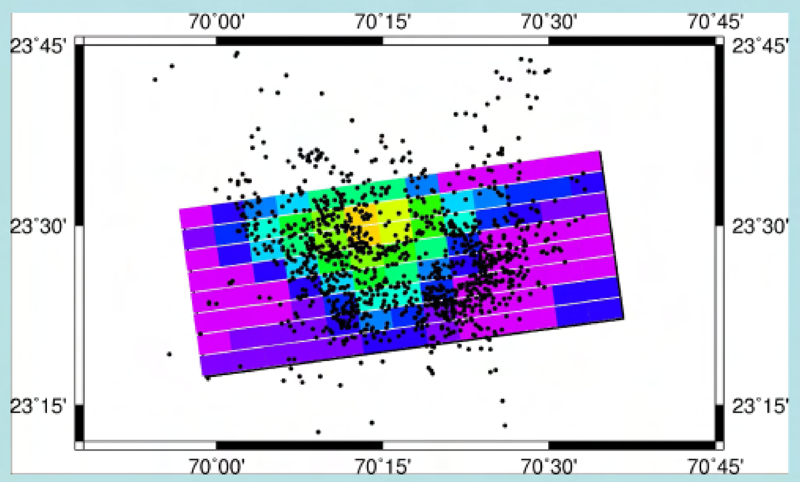
4. Fit to levelling data



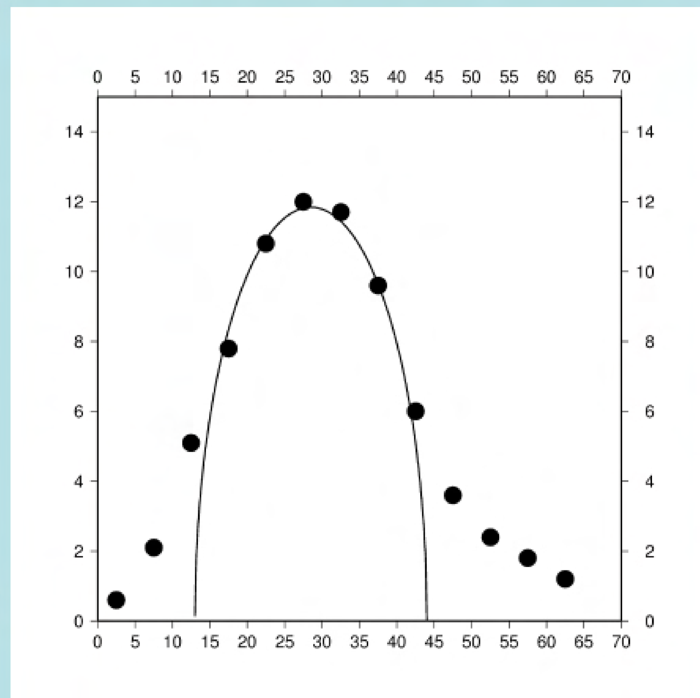
5. Fit to InSAR and teleseismic data



6. Moment tensor comparison



7. Comparison of aftershocks and slip model



8. Modelled stress-drop is ~30 MPa