A creeping anticline above the Rakhine-Bangladesh Megathrust:

InSAR observations of an aseismic fold accommodating geodetic shortening

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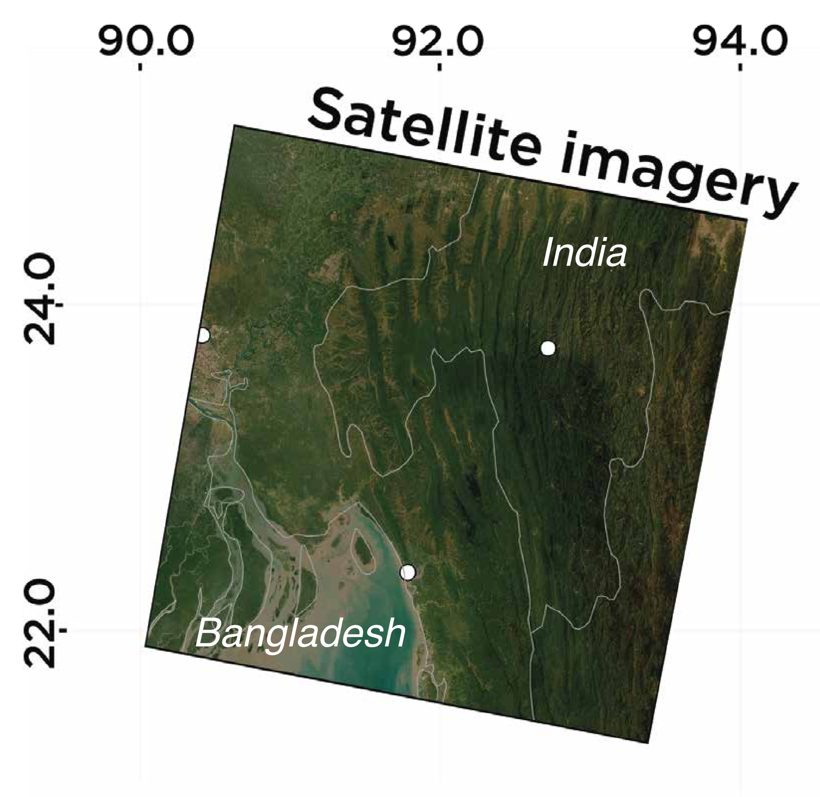
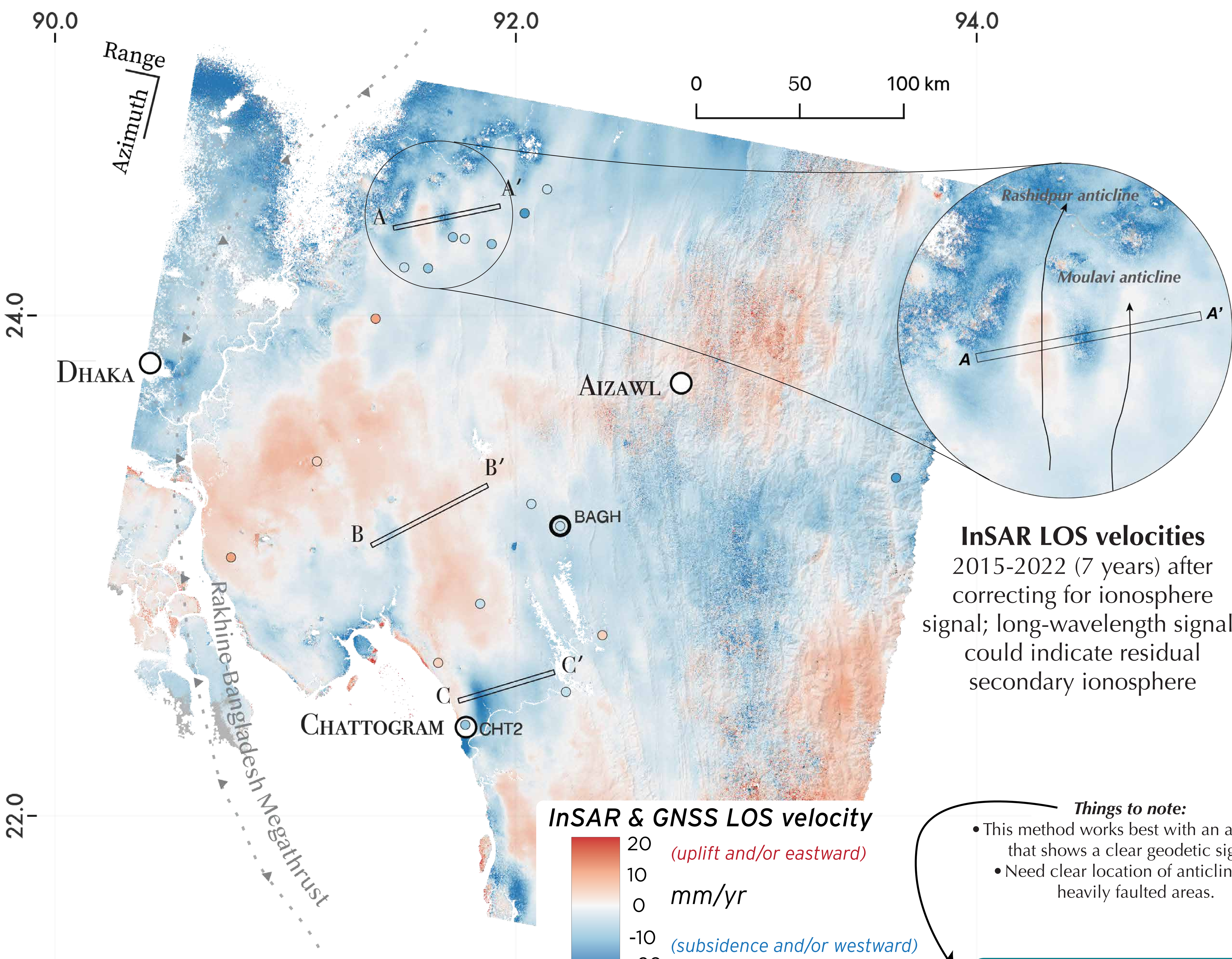
Summary

- The Rakhine-Bangladesh megathrust underlies a sediment-filled trench with strain partitioned across multiple active faults and folds on the hanging wall.
- We used **L-band ALOS-2** wide-swath imagery to perform **InSAR time-series** in the **highly vegetated** central Indoburman Ranges and Eastern Bangladesh.
- The observed deformation is consistent with aseismic ductile folding in the outer belt, but inconsistent with fault slip.
- We propose that a transition from ductile folding to faulting occurs across the fold belt and that anticlines become more faulted inland.
- By analogy, we estimate a range of plausible shortening rates of the Ventura anticline between ~0.7 mm/yr to 1.4 mm/yr due to viscous folding.



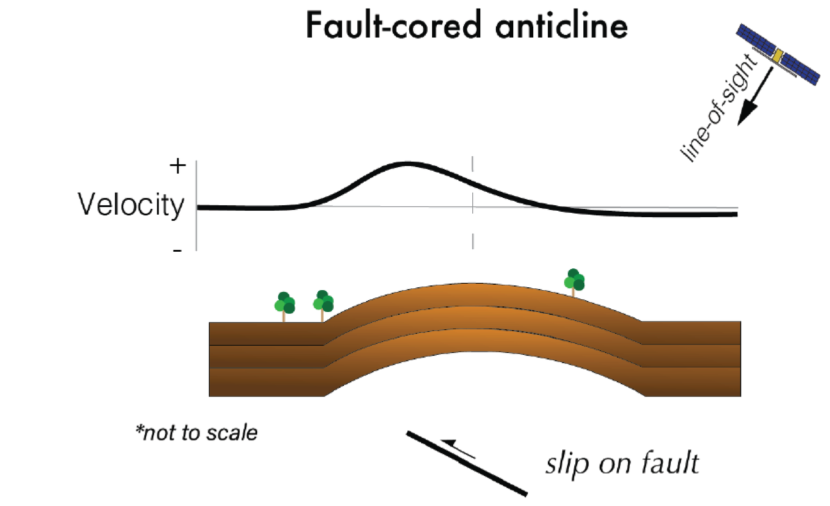


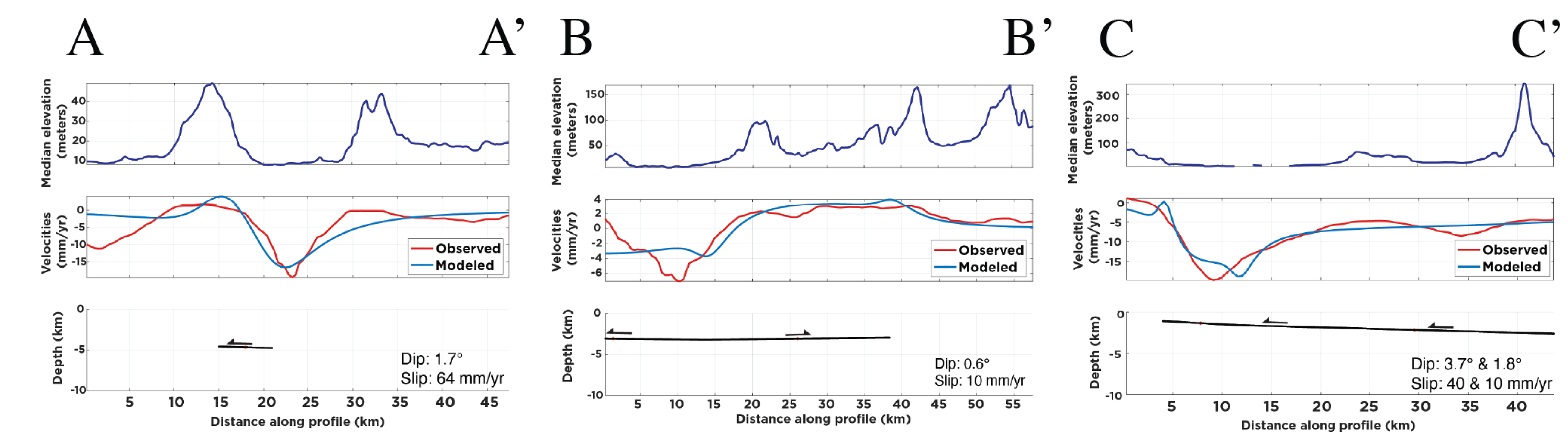
InSAR LOS velocities
2015-2022 (7 years) after correcting for ionosphere signal; long-wavelength signals could indicate residual secondary ionosphere

Modeling anticlines

Fault modeling

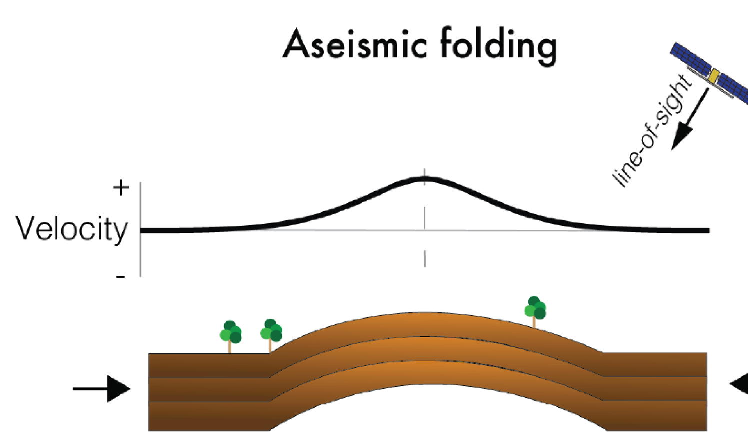
- Attempt a homogeneous half-space model (Okada, 1985) to fit the observed LOS velocities.
- **No fault models can fit the observed velocities** with *reasonable* slip rates and geometry.





Viscous modeling

- If uplift is due to folding instead of fault slip, uplift rates are more reasonable and symmetric above the anticline.
- Estimated decollement depths (*Biot 1957*) and uplift rates (*modified Li et al., 2018*).
- Our **analytical estimates** show **reasonable slip rates** and **decollement depths**.



$$H = \frac{L_d}{2\pi}\left(\frac{R}{6}\right)^{-\frac{1}{3}}$$

H = decollement depth; R = viscosity ratio; L_d = anticline spacing

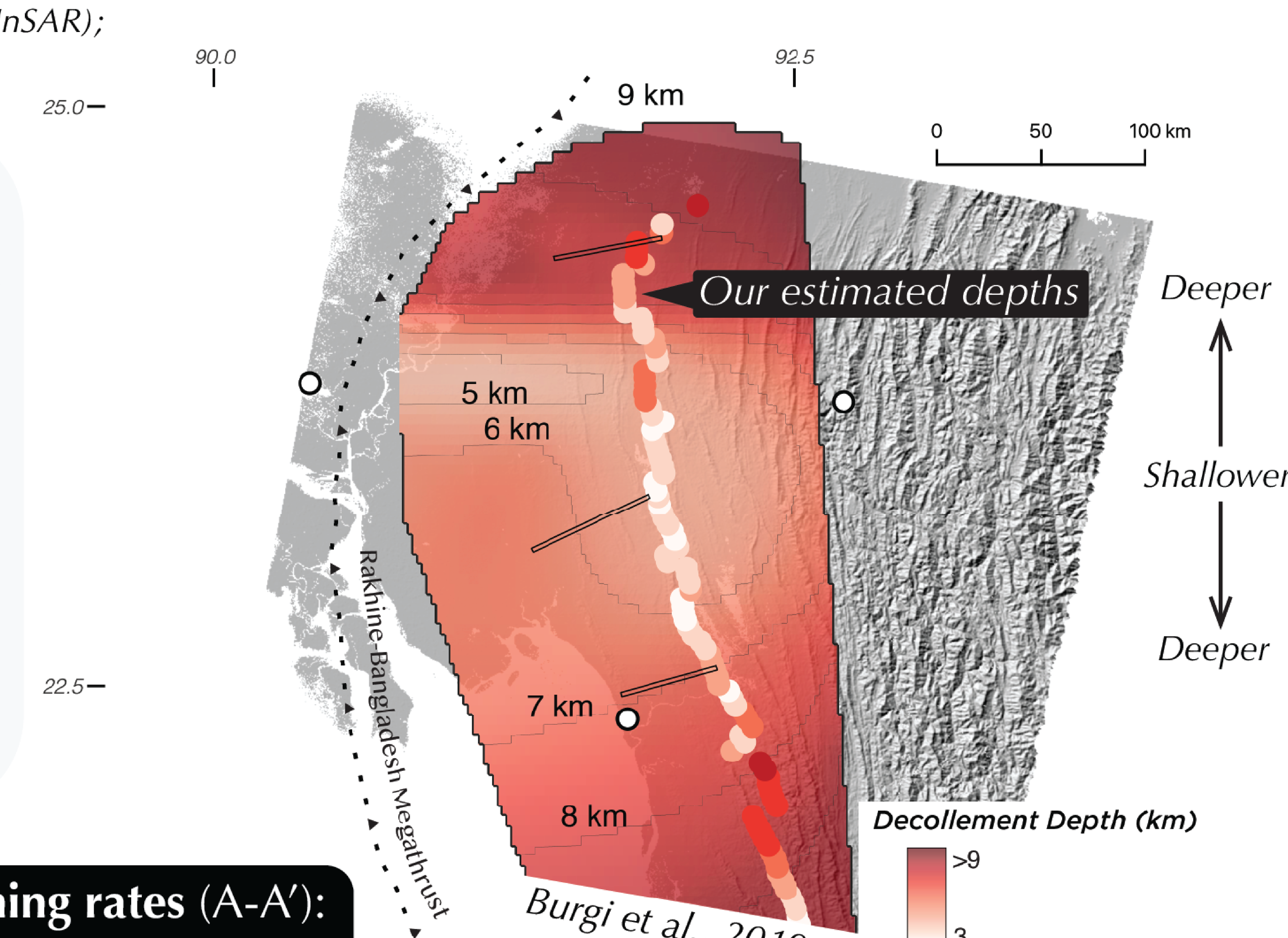
$$Sr = \frac{A}{H}$$

H = decollement depth; A = Uplift rate(from InSAR); Sr = Shortening rates

A-A' decollement depth
- **7-8 km** *This study*
- 7-8 km *Burgi et al., 2021*

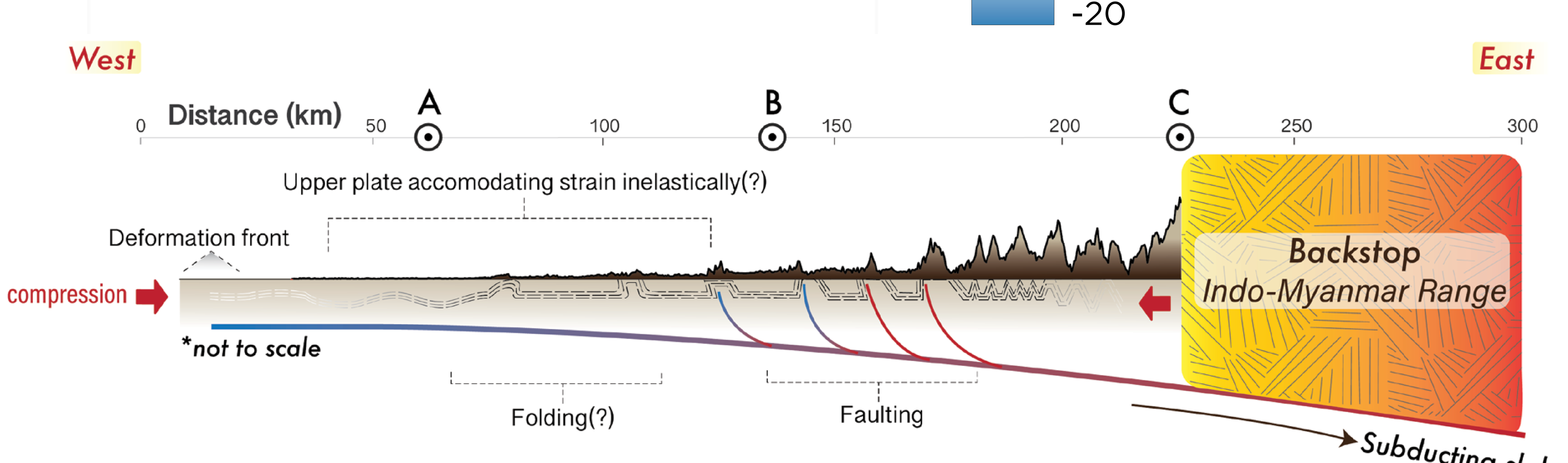
B-B' decollement depth
- **3-4 km**
- 5-6 km

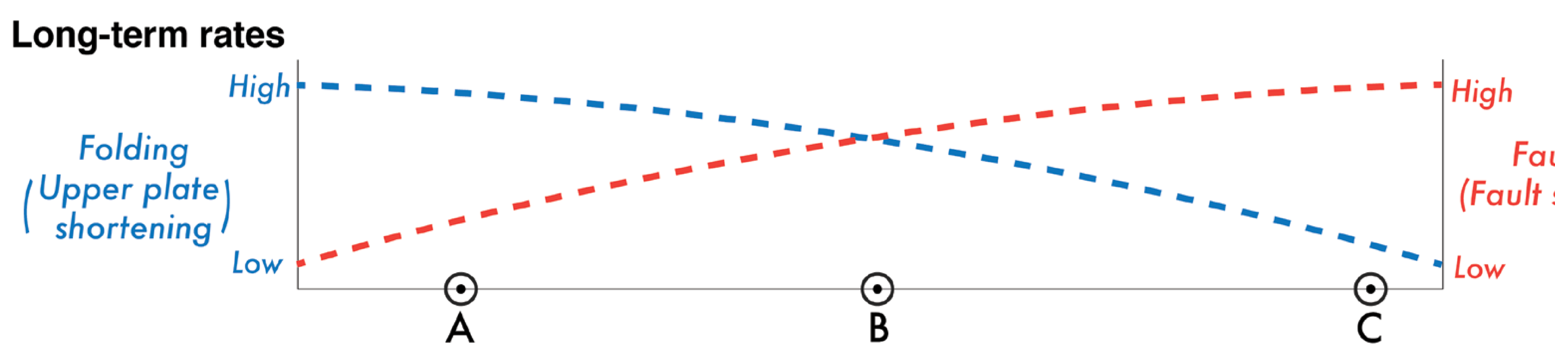
C-C' decollement depth
- **5-6 km**
- 6-7 km



Estimated folding related shortening rates (A-A'):
1 to 2.7 mm/yr (5% to 20% of total convergence)

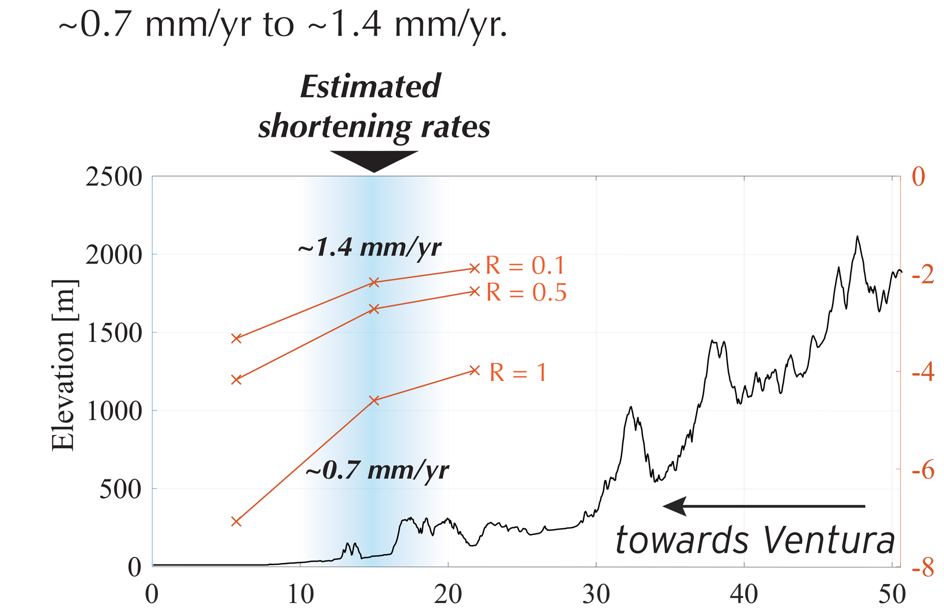
Things to note:
- This method works best with an anticline that shows a clear geodetic signal.
- Need clear location of anticlines in heavily faulted areas.

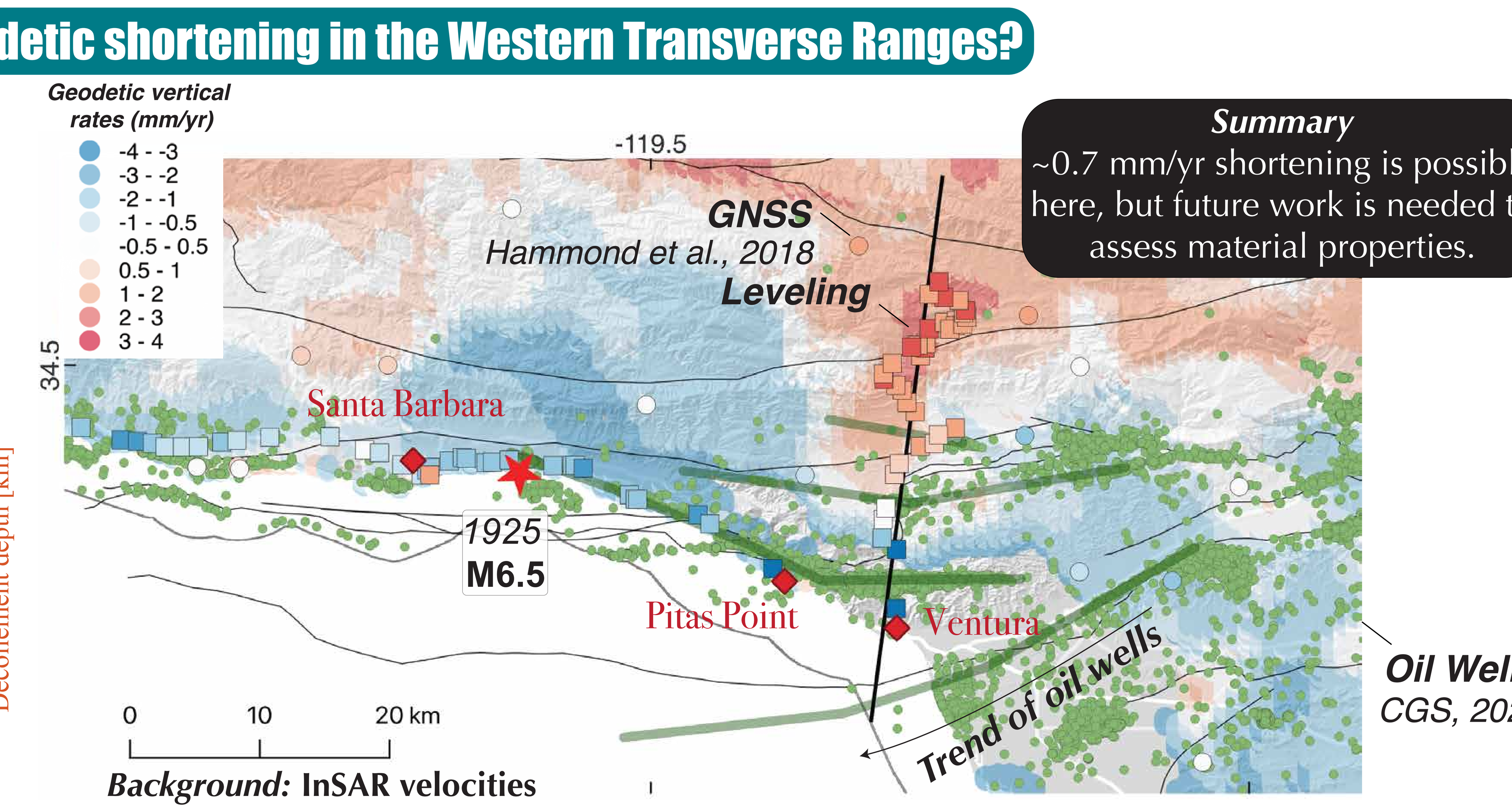




Could aseismic folding explain some geodetic shortening in the Western Transverse Ranges?

- Assuming oil wells are above anticlines.
- Decollement depth ranges between 2.1 to 4.5 km (depending on viscosity ratio).
- If vertical rate is 1 mm/yr, shortening rate is between ~0.7 mm/yr to ~1.4 mm/yr.





Summary
~0.7 mm/yr shortening is possible here, but future work is needed to assess material properties.