



Transdisciplinary Tectonics The interplay of climate, surface processes, and deformation in the Himalayan-Tibetan orogenic system

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Roadmap

- Geomorphology, large and small
- The South Asian monsoon and storm paths
- Critical wedges and Archimedes principle
- Possible correlations and feedbacks
- Active structures and geomorphic signatures

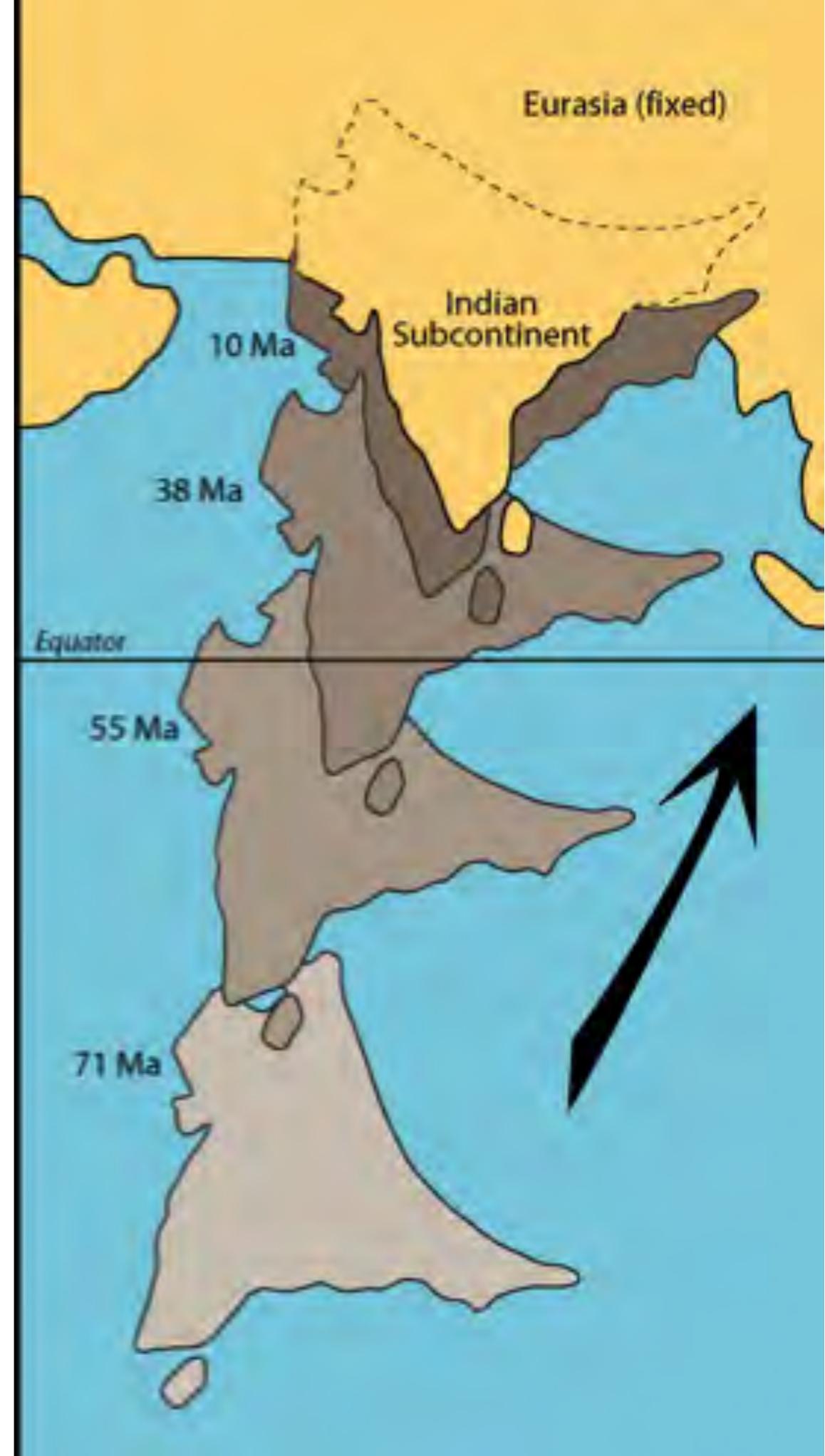


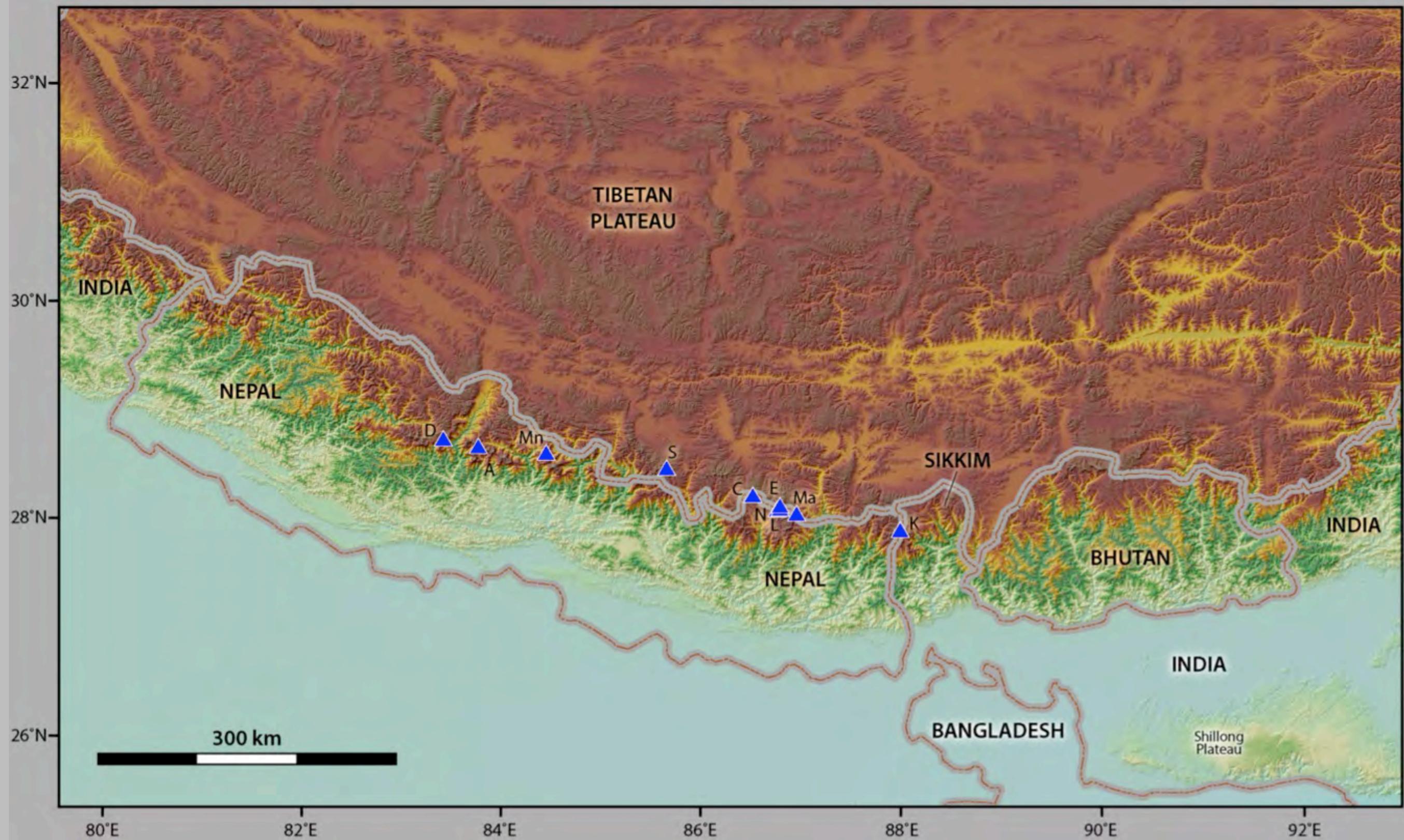
Himalayan-Tibetan Orogenic System



The Quintessential Collisional Orogen

- Collision between India and Eurasia ~ 50 Ma
- Himalayan realm includes shortened Indian Plate units
- Eurasian Plate units occur north of the Indus-Yarlung in southern Tibet
- Convergence continues today





8000 m Peaks

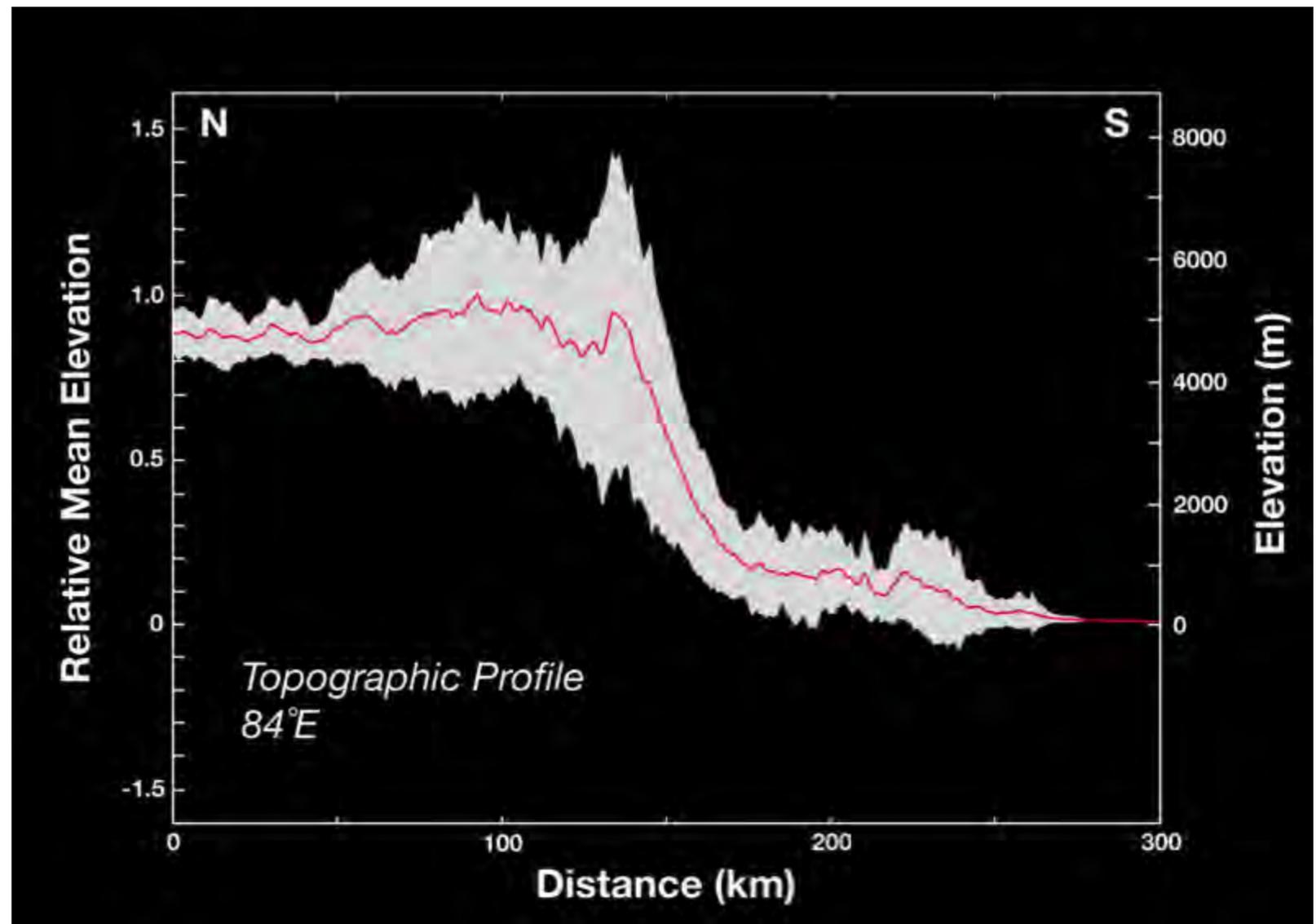


WorldSat International/SPL

Mountain Ranges
Orogenic Plateaus

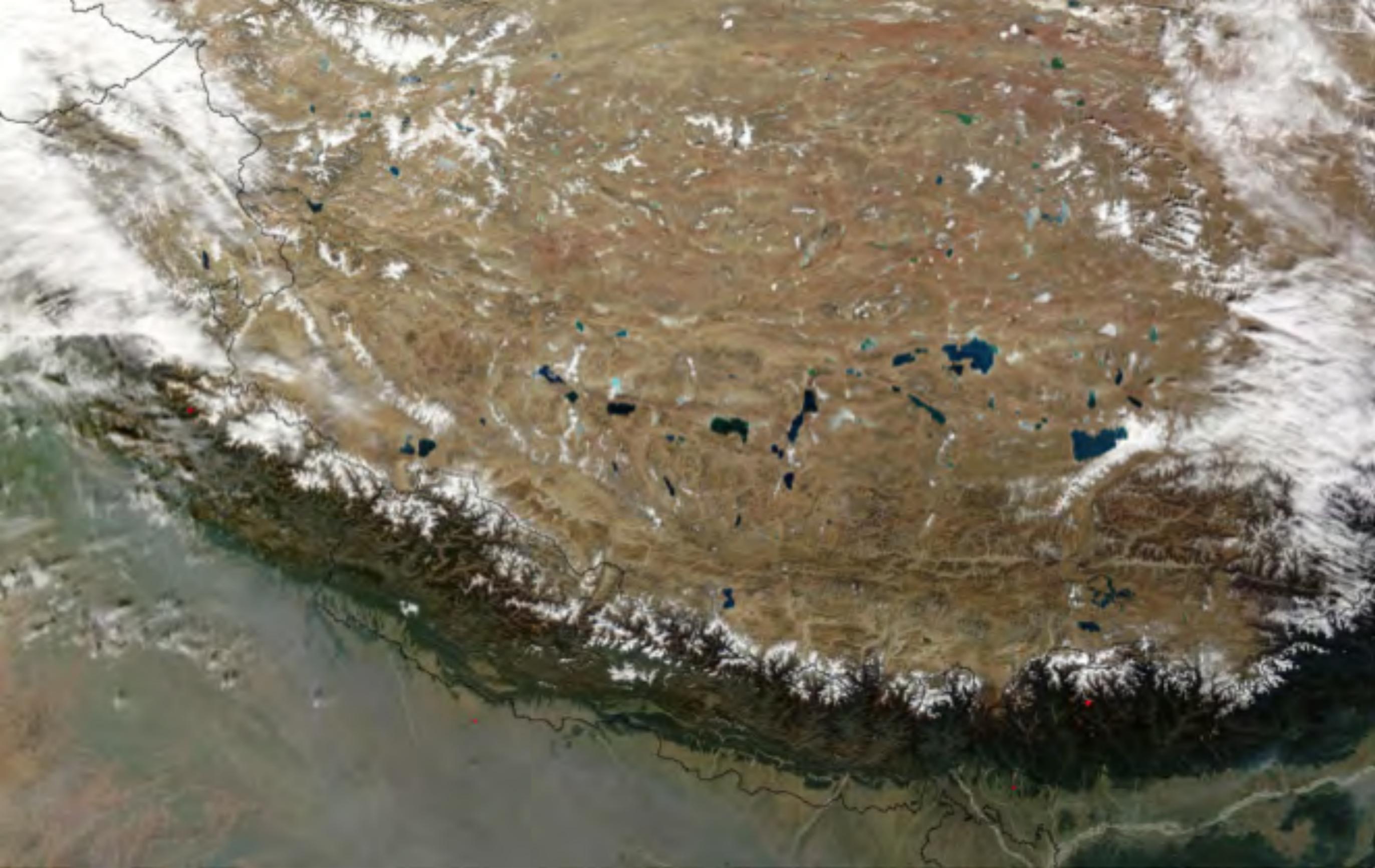


Adjacent, yet worlds apart...

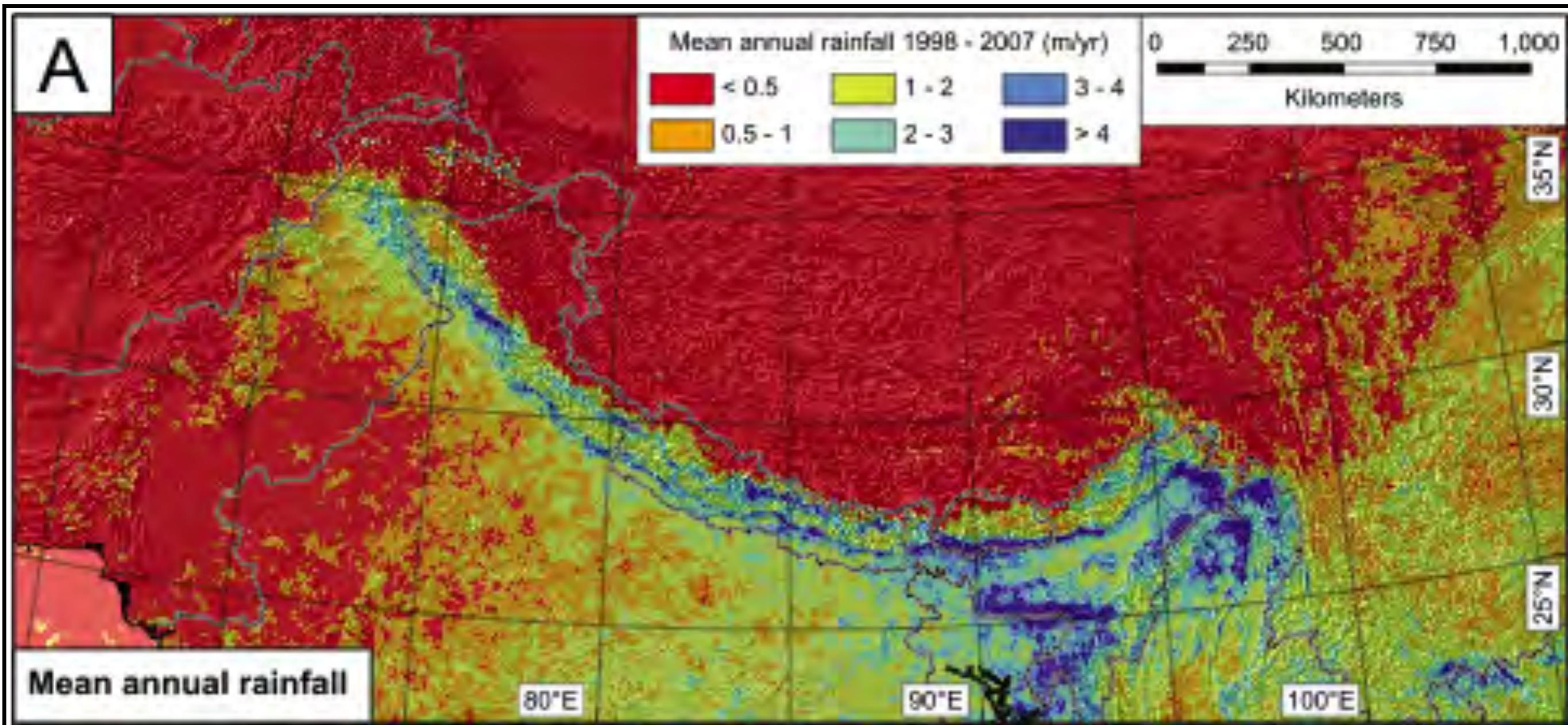


The South Asian Monsoon



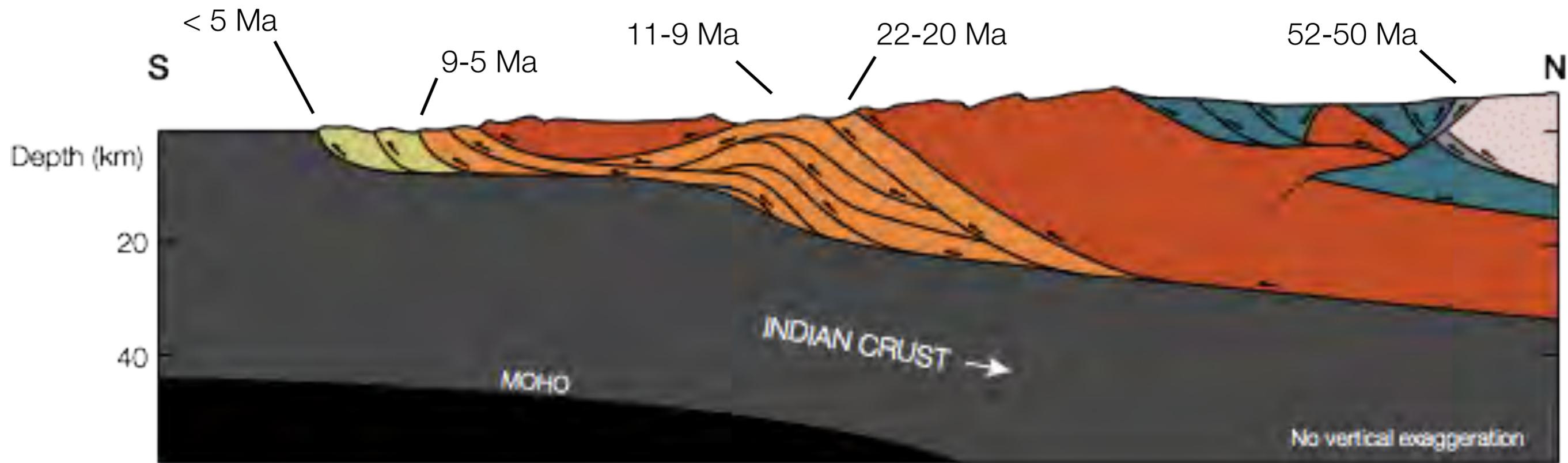


MODIS (Moderate Resolution Imaging Spectroradiometer) – True Color



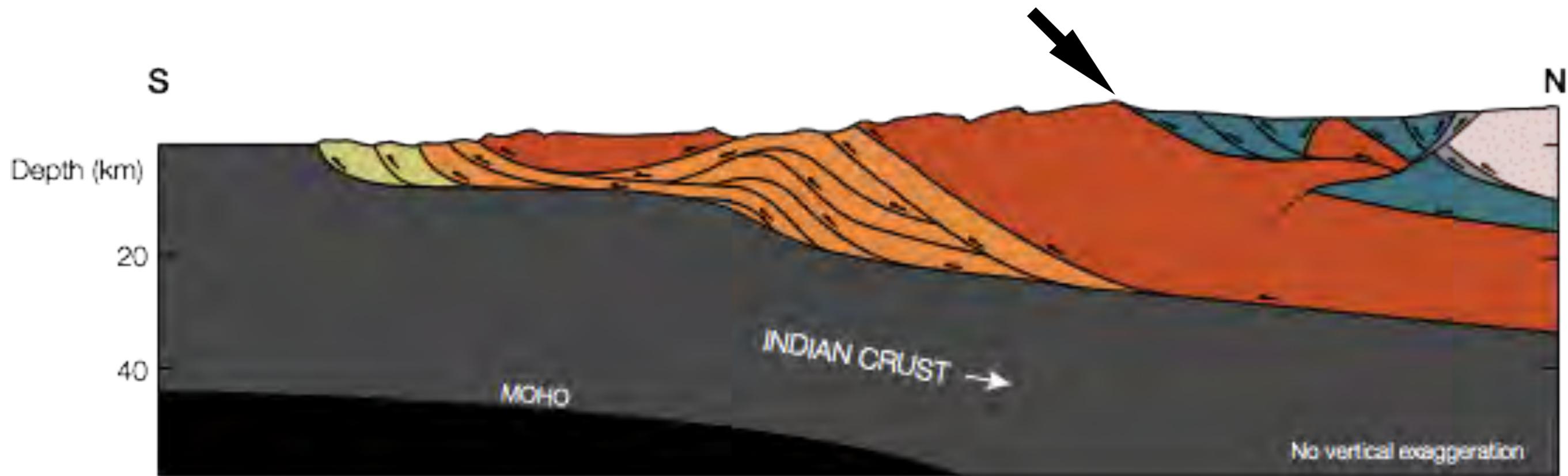
Bookhagen and Burbank (2010, GRL)

TRMM (Tropical Rainfall Measurement Mission)



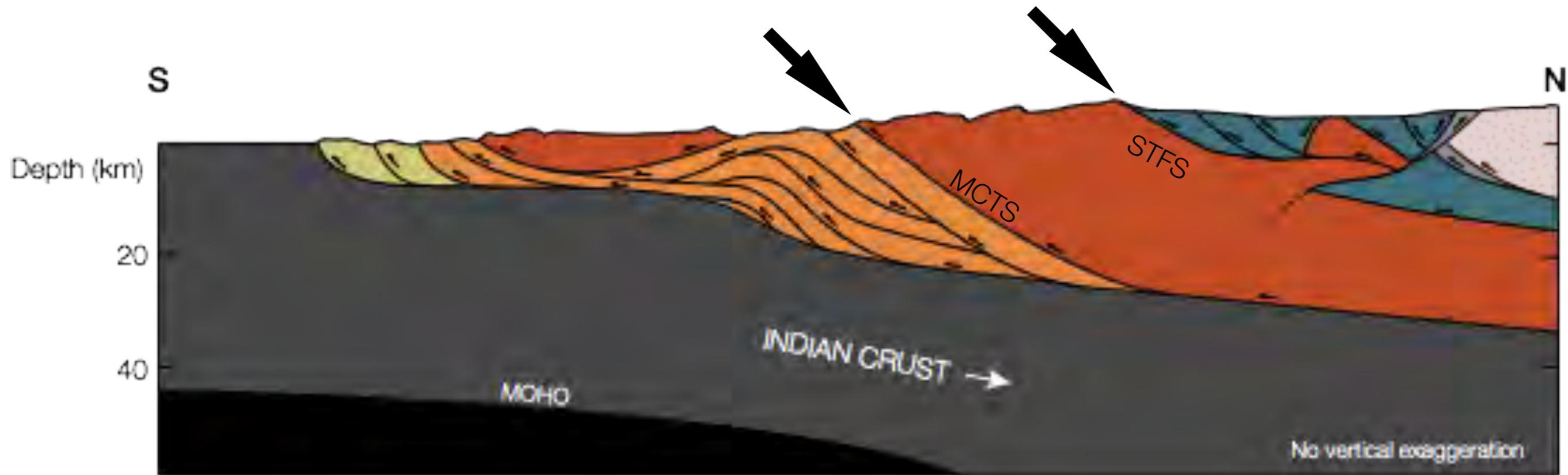
Southward Propagation of Thrust Initiation

- Classic orogenic wedge evolution - right?



South Tibetan Fault System (STFS)

- Early Miocene (ca. 22-20 Ma) initiation
- North-directed detachments and related transcurrent structures
- Marks the top of the “metamorphic core” of the Himalaya



Coeval Slip on MCTS and STFS in Early Miocene

- Gave rise to “channel flow” models of Himalaya evolution
- Implies sufficiently high melt content for low-viscosity fluid behavior of the Greater Himalayan sequence
- Viable channel flow models must honor the Indian provenance of the Greater Himalayan sequence (requiring underplating and counter-flow of India)

Archimedes Principle



A body immersed in a fluid is buoyed up by a force equal to the weight of the fluid it displaces

The Excess Gravitational Potential Energy of Overthickened Crust



Unless balanced by a thickened lithospheric root, thick crust like that in a plateau region has a tendency to flow laterally (if sufficiently weak)

An Analogy....

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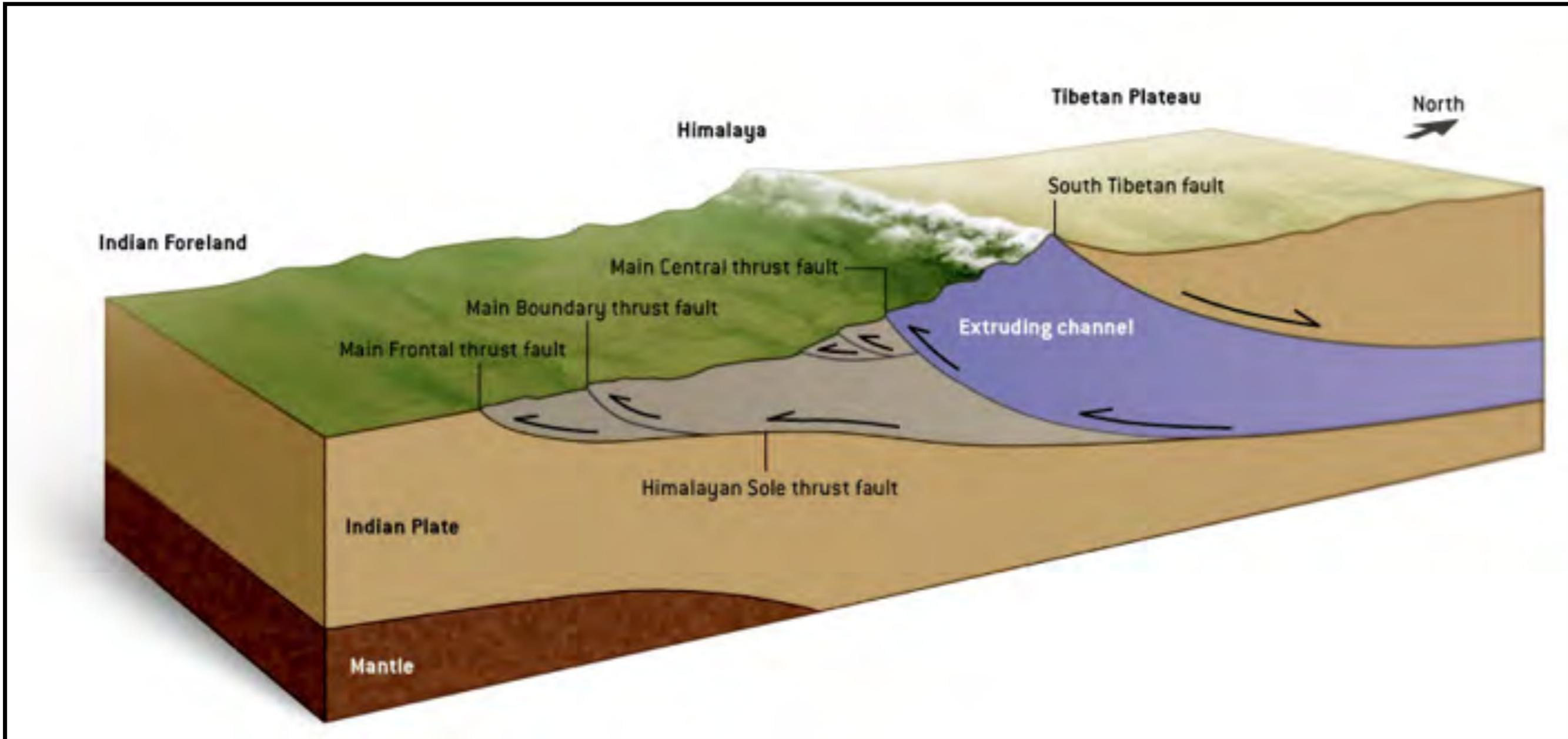
Ice cream sandwich in your refrigerator

An Analogy....



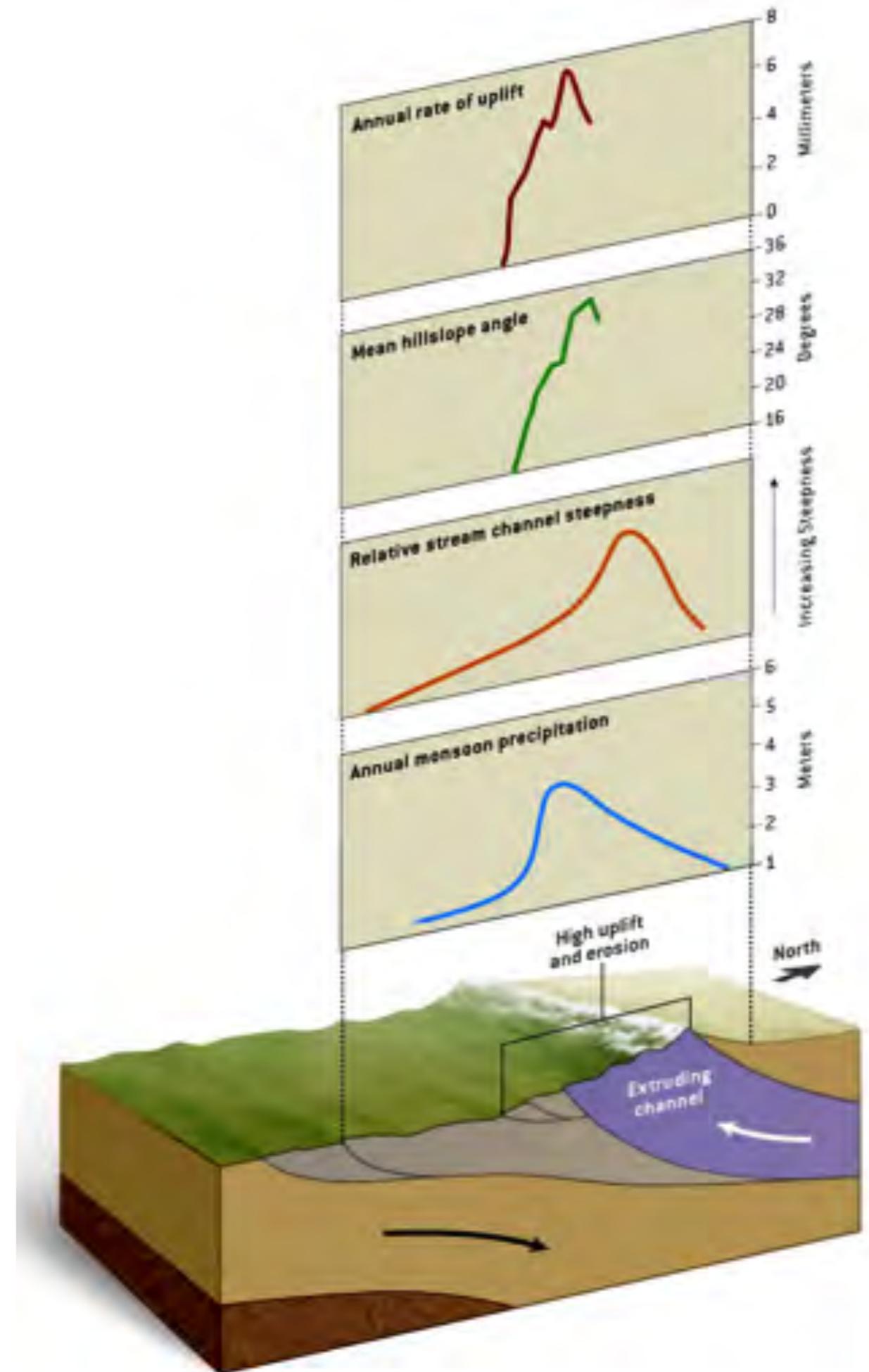
Ice cream sandwich in Knoxville in July....

Lower Crustal Flow?

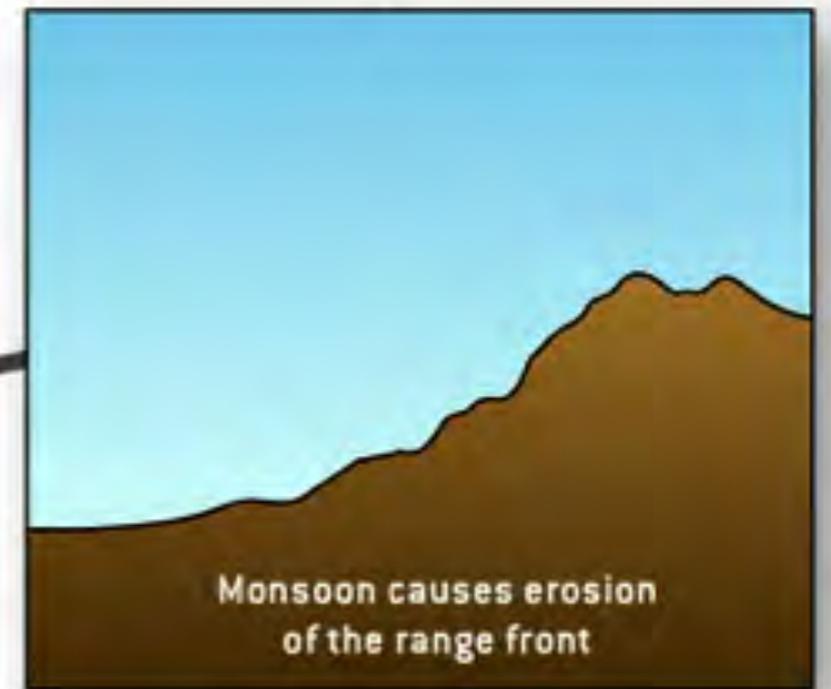
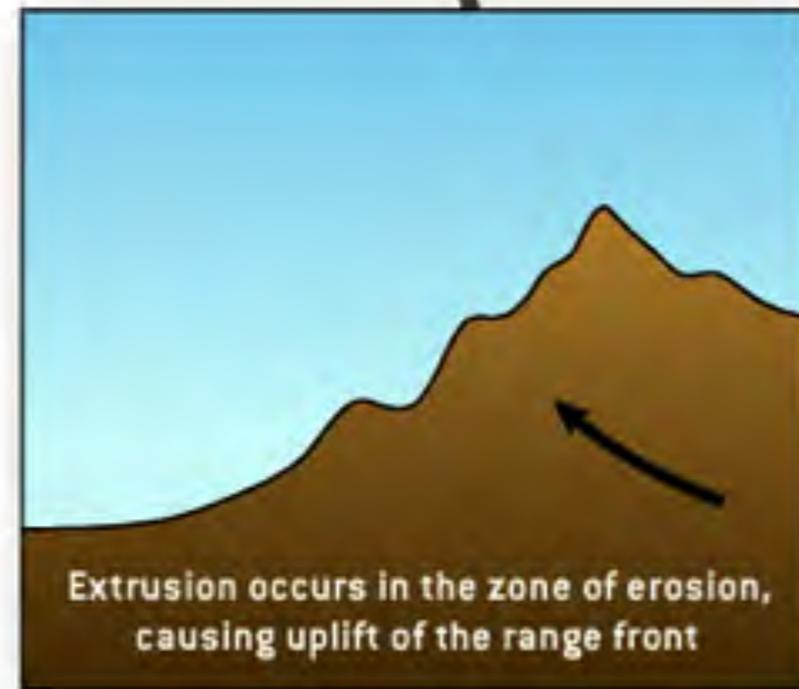
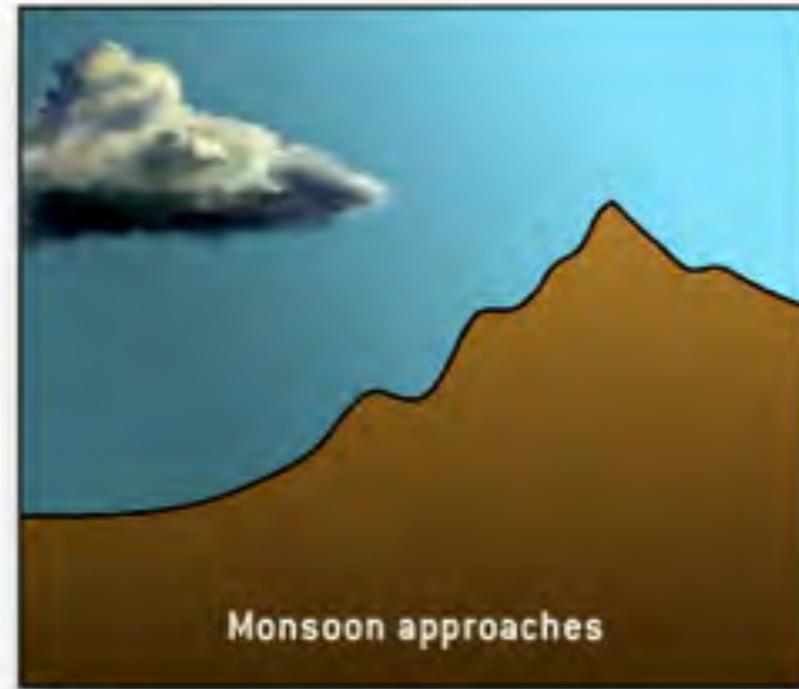


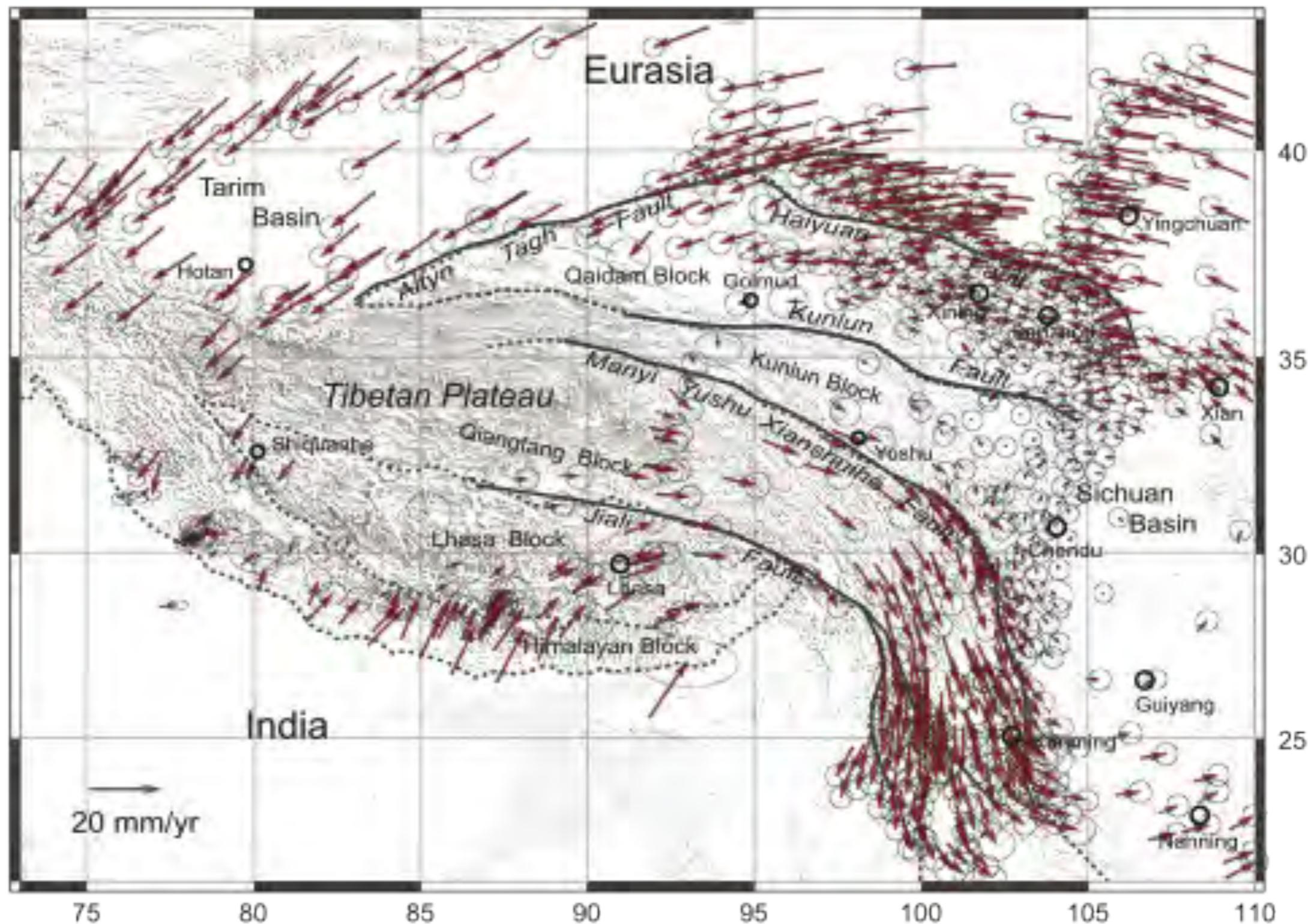
Hodges (2006, Scientific American)

Correlations, if not causality...



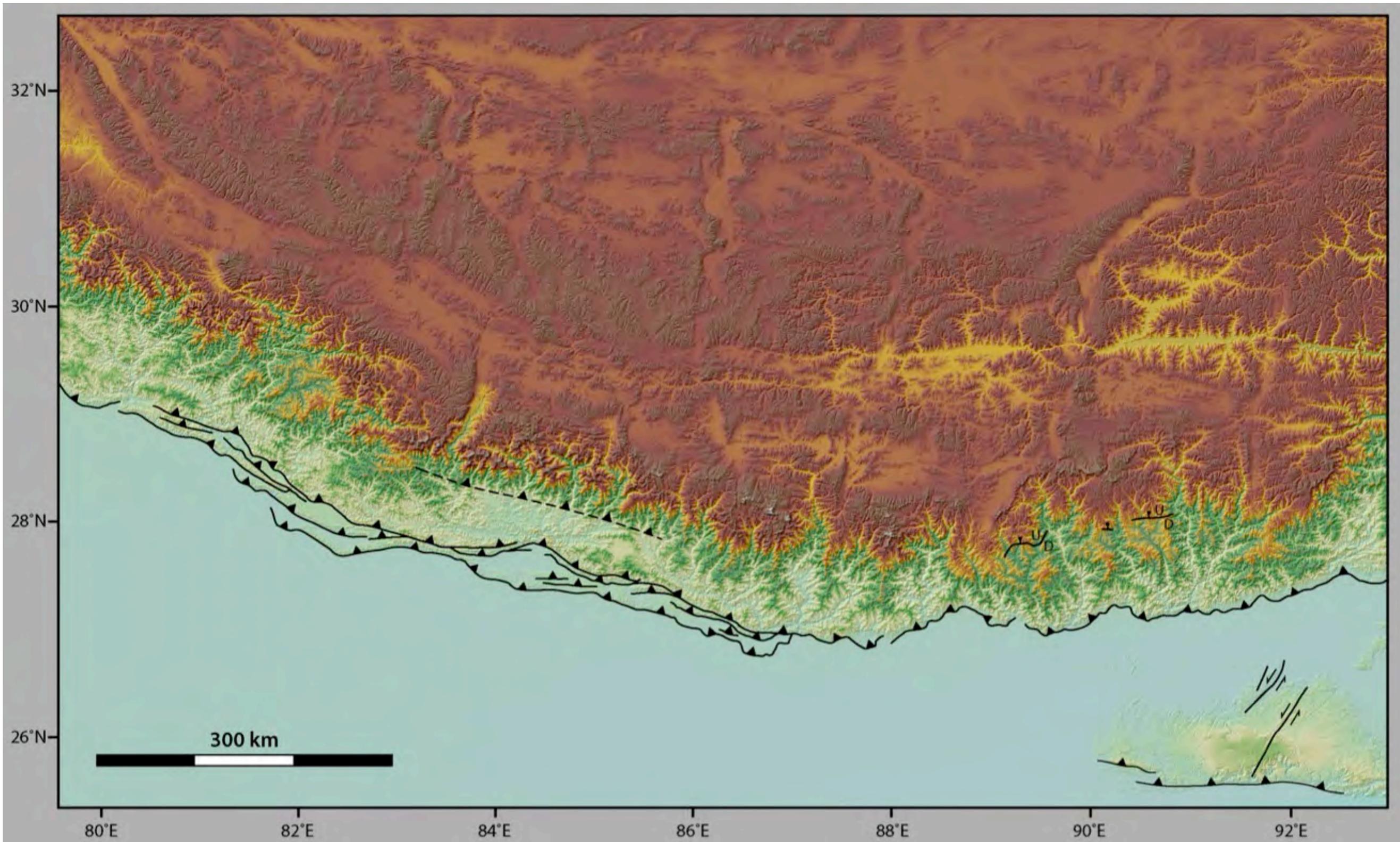
A Possible Linkage...



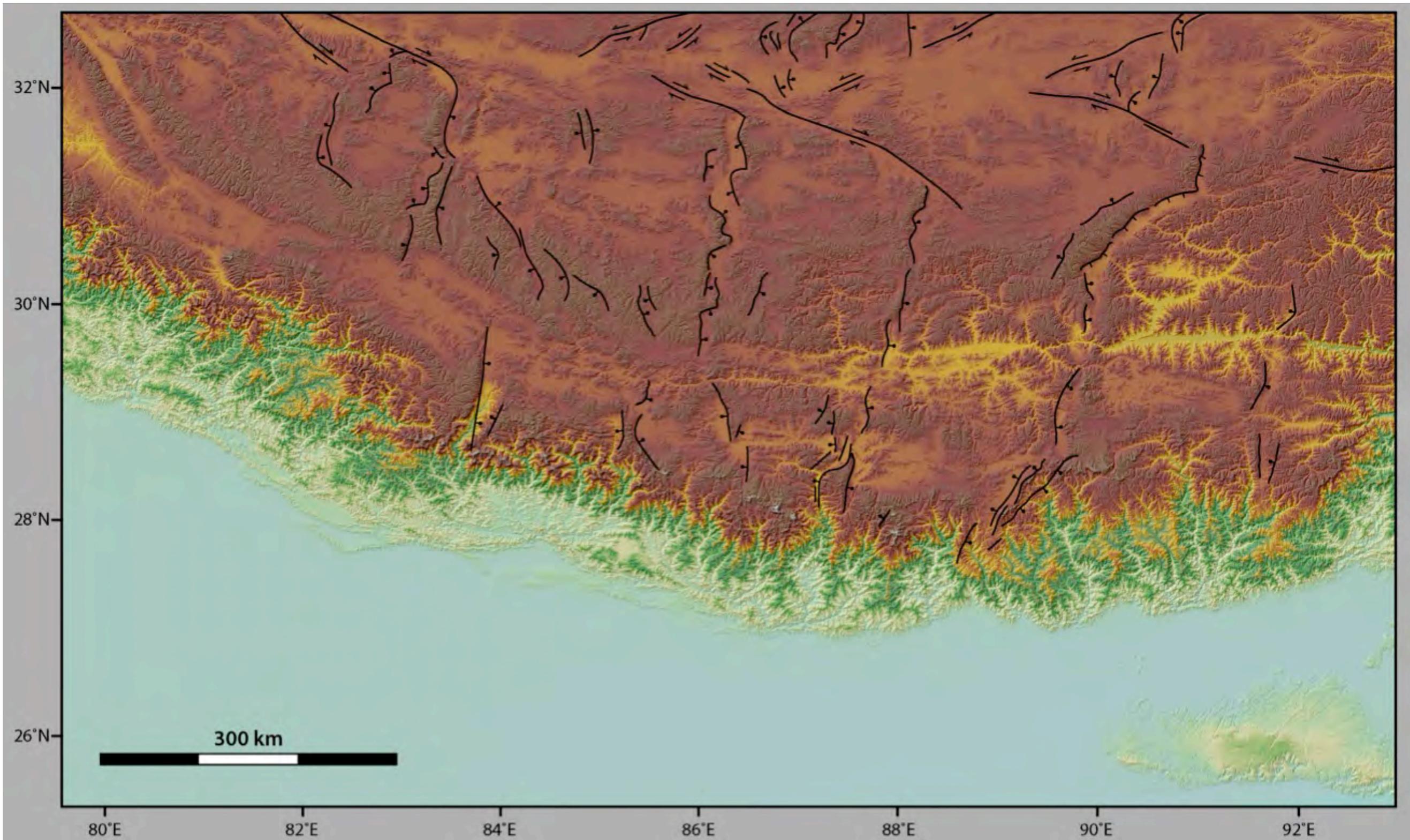


Gan et al. (2007, *JGR*)

Modern Kinematics Lhasa Fixed, Rigid
Body Rotation Removed

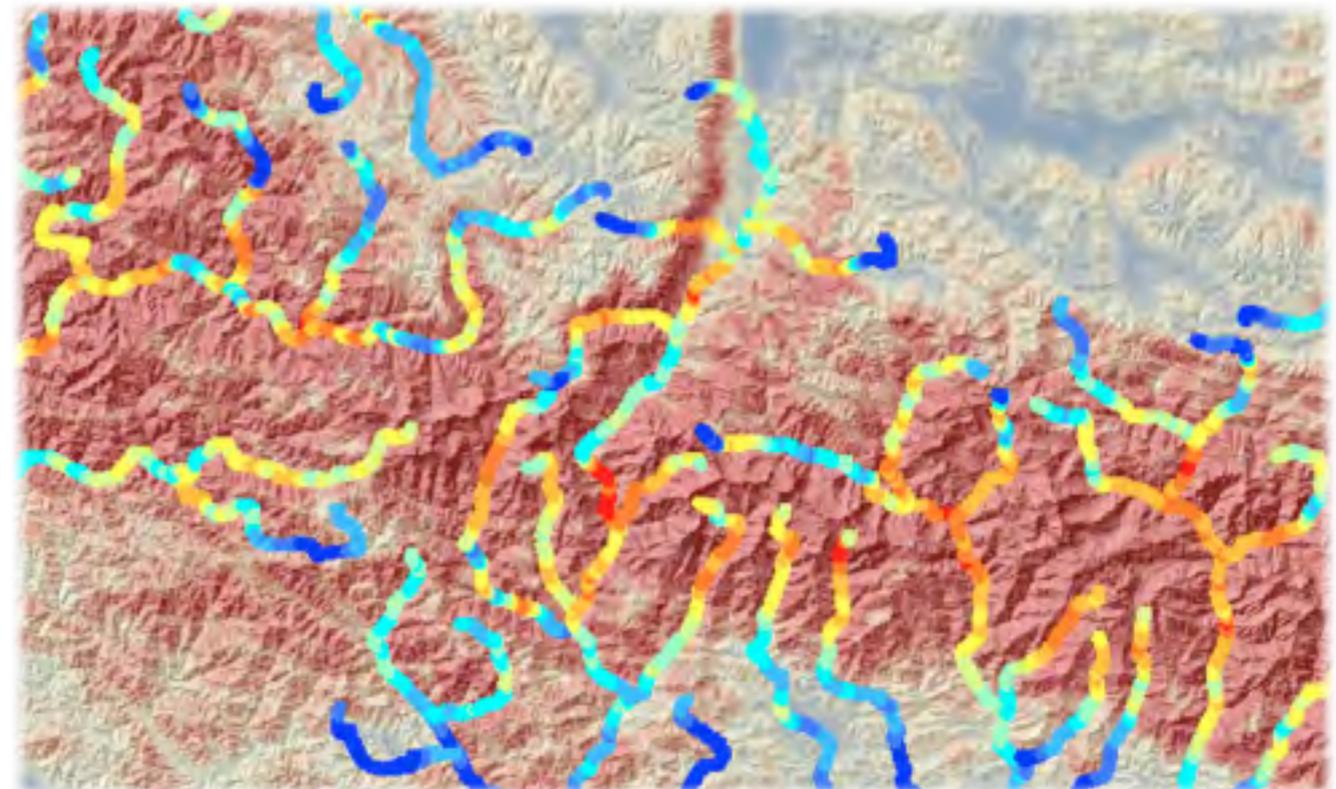


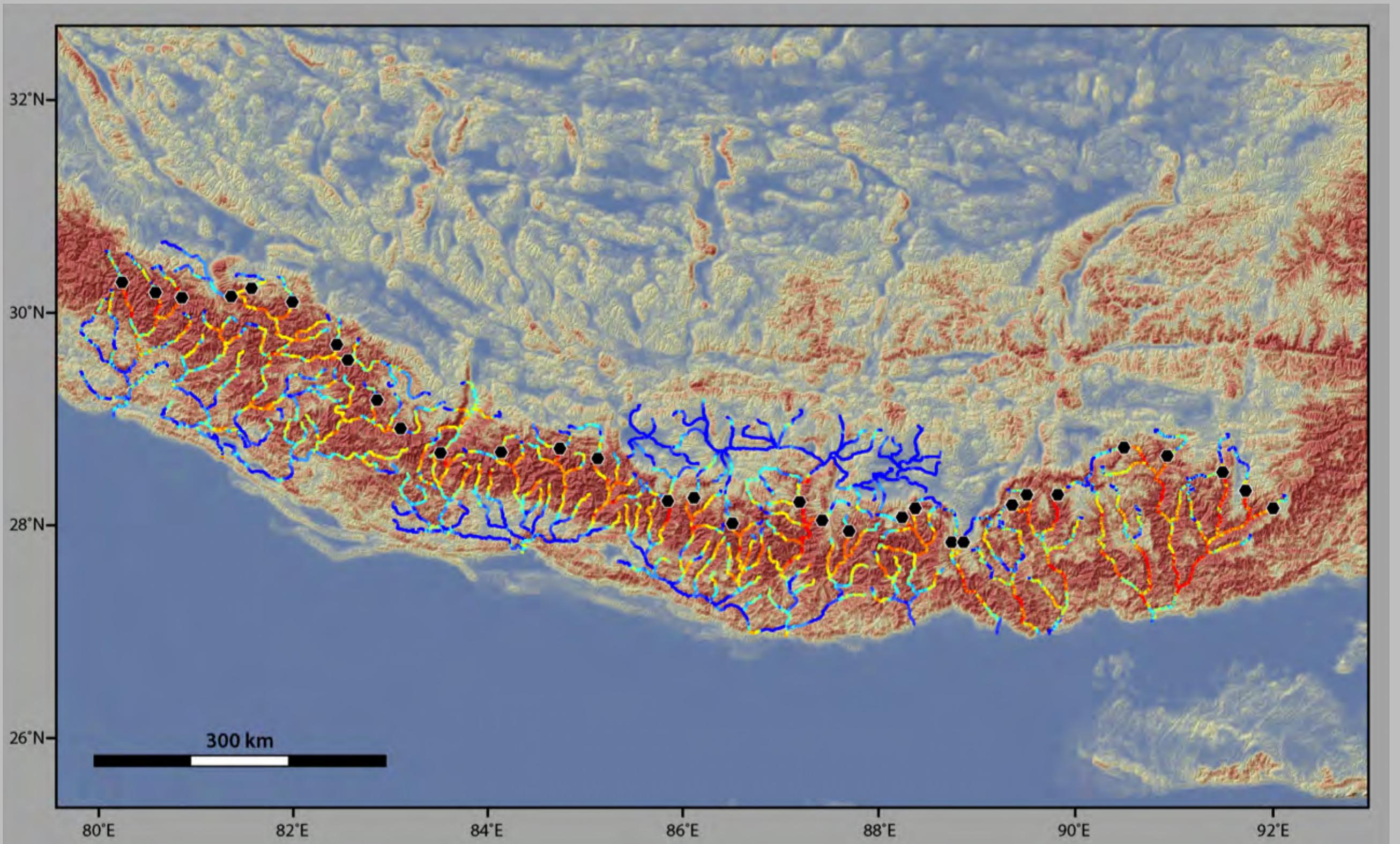
The Himalayan Domain (Active Structures)



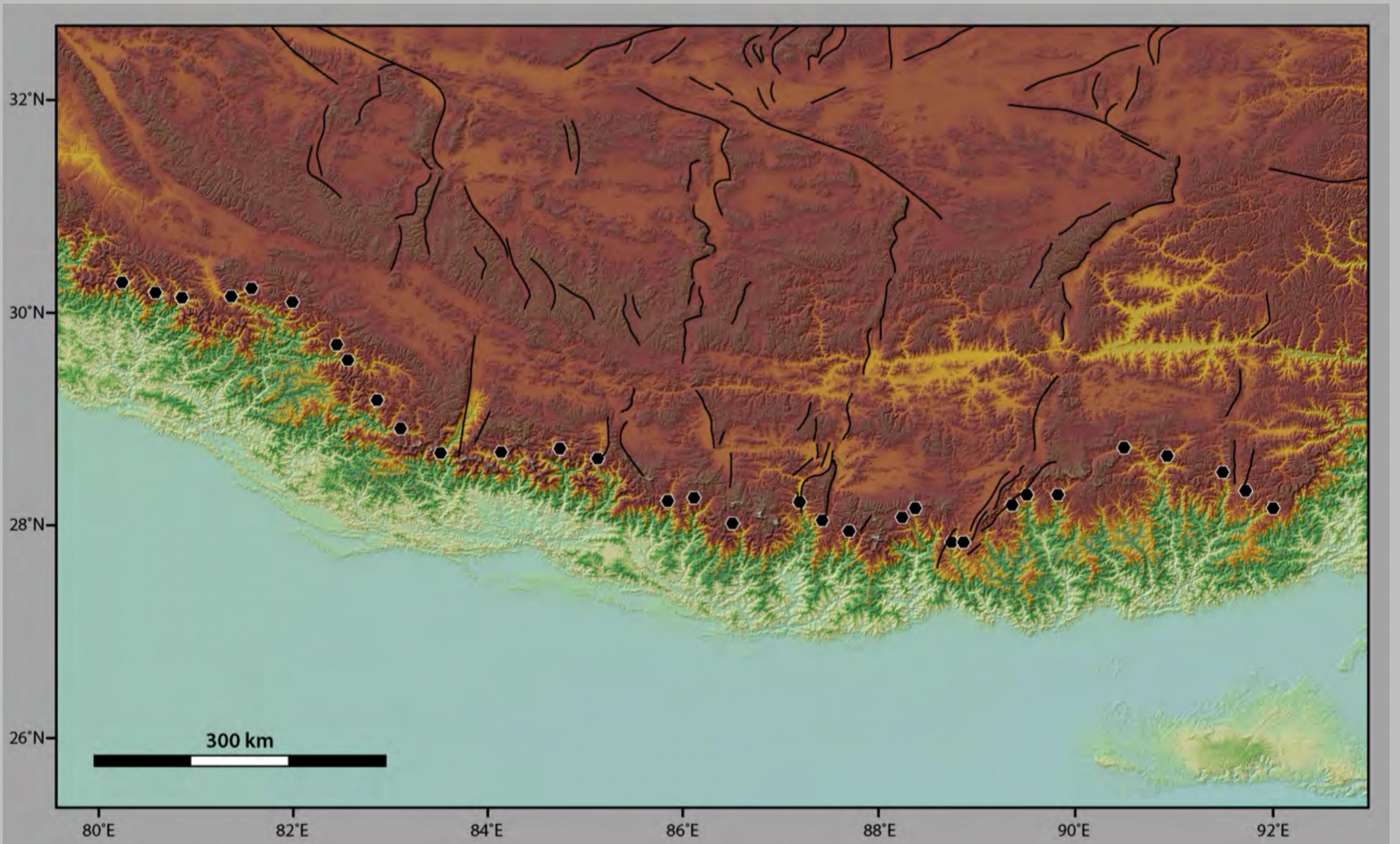
The Tibetan Domain (Active Structures)

River Channel Steepness





Upper Knickpoints on “Transhimalayan” Rivers



Knickpoints and the Edge of the Tibetan Domain

