

Why Should I Care About Your Slop?

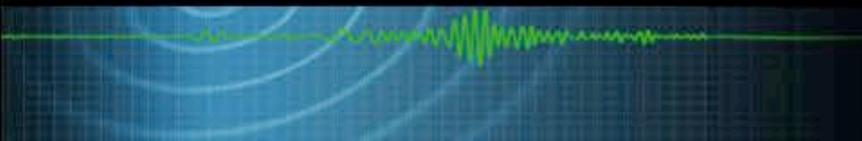
Linking Shallow Geologic Observations to Deeper Earth Processes



Rich Briggs

USGS Geologic Hazards Science Center

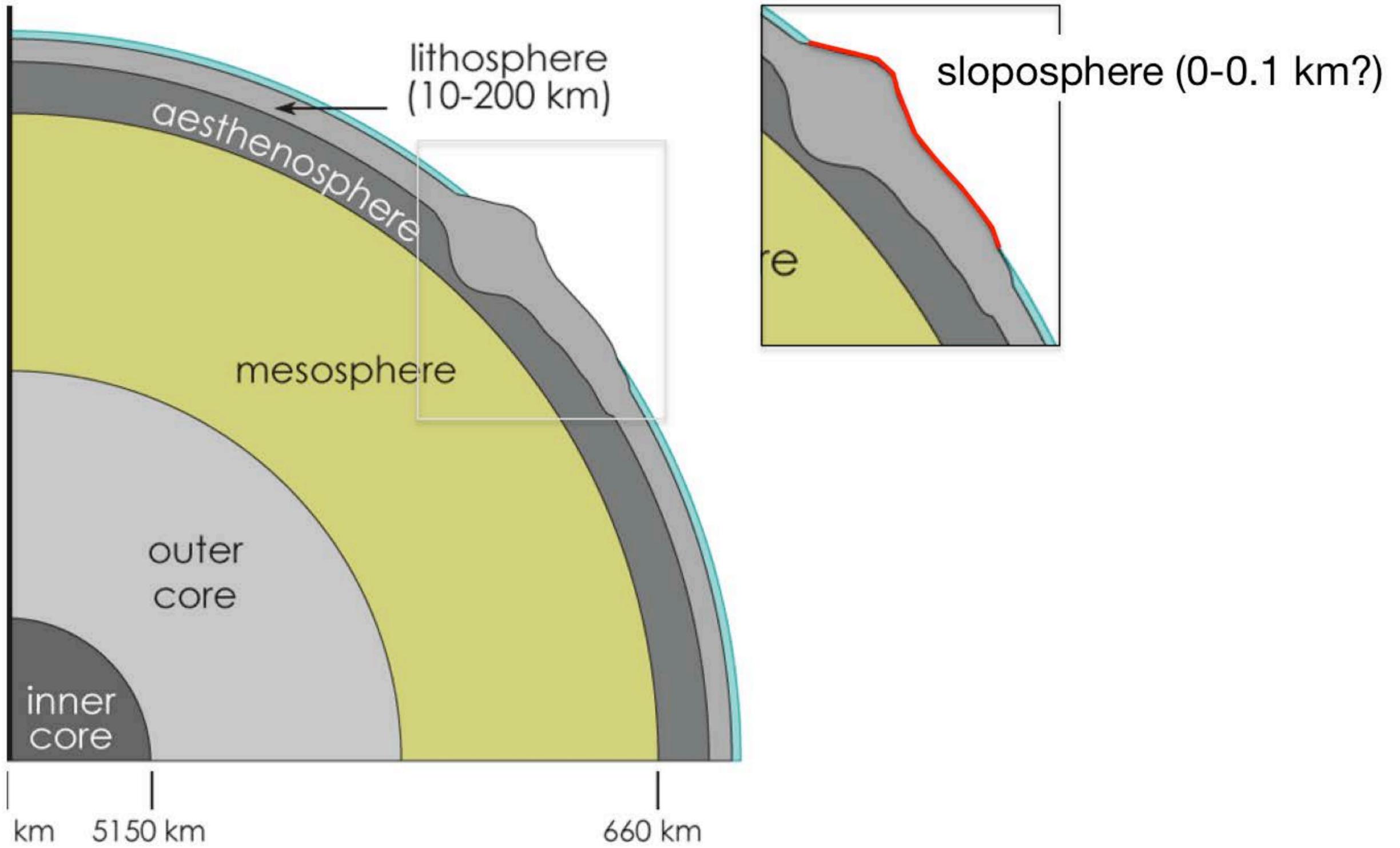
Golden, CO



“(So,) Why Should I Care About Your Slop?”



Where does the slop reside?



What is slop?

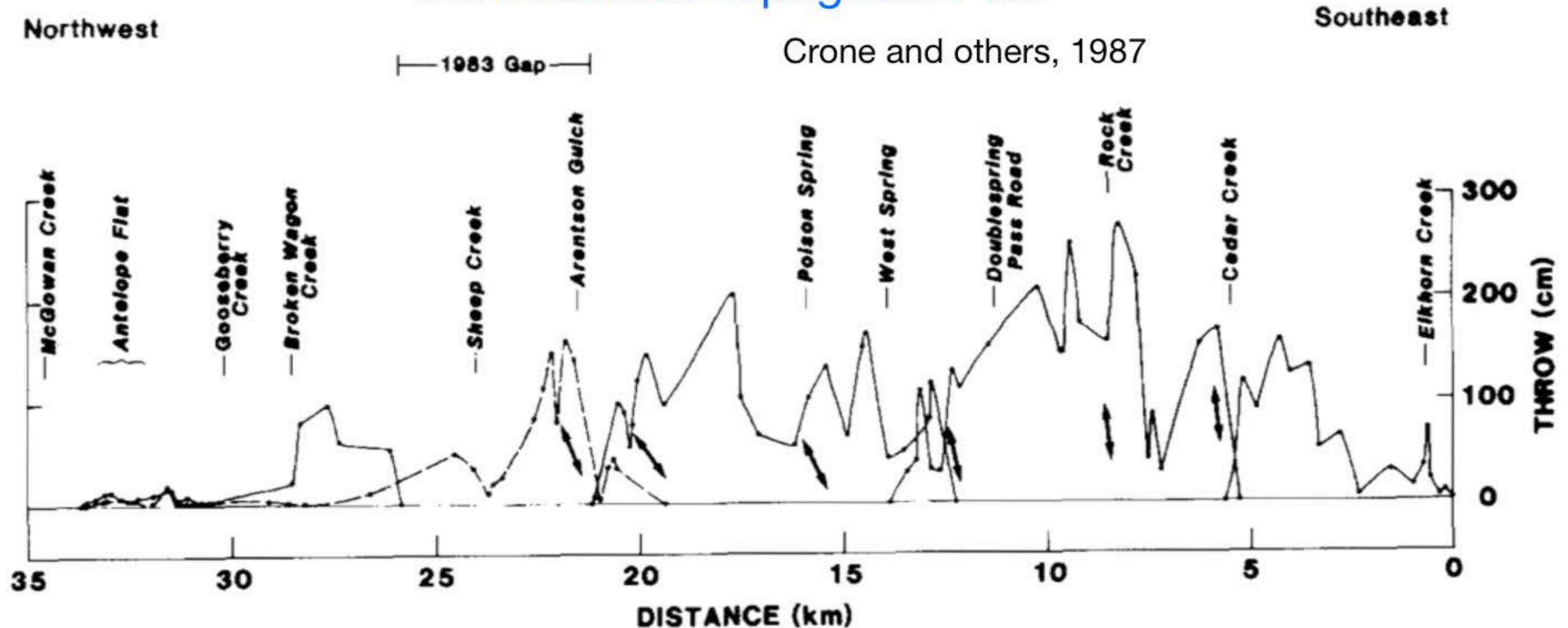
Field observations:

- Outcrops
- Surfaces
- Mapping

Often:

- Uncertain
- Contradictory
- Messy

For earthquake geologists, this is top-shelf slop:
Surface slip distribution of the 1983 M 7.3 Borah Peak rupture,
the infamous 'Spaghetti Plot'



Three case studies

Zero can be an important number:

Great subduction ruptures in Indonesia and the Solomon Islands, 2005 and 2007

Your data don't fit my model:

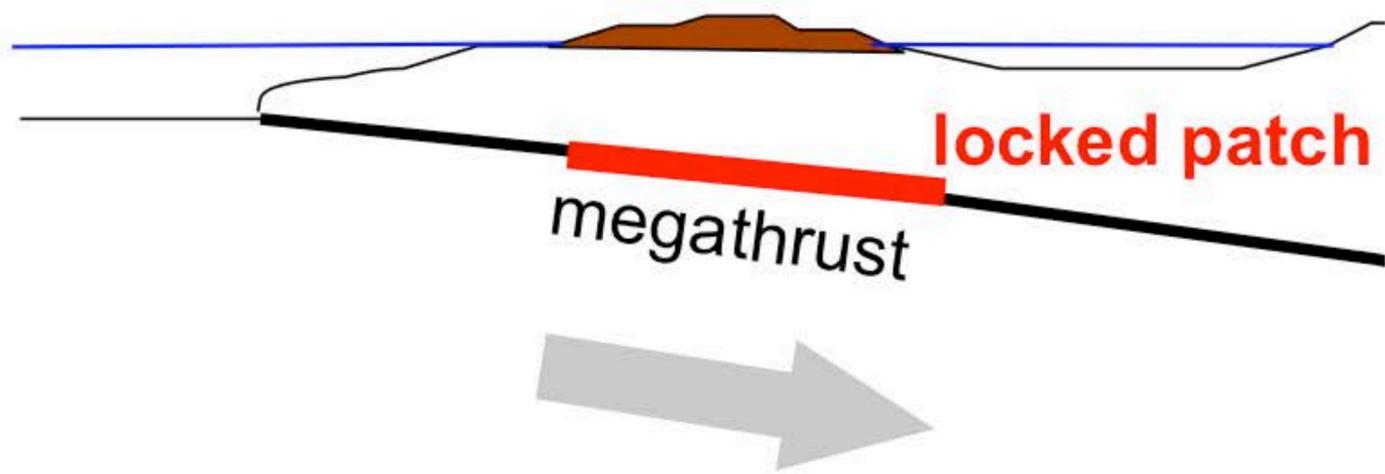
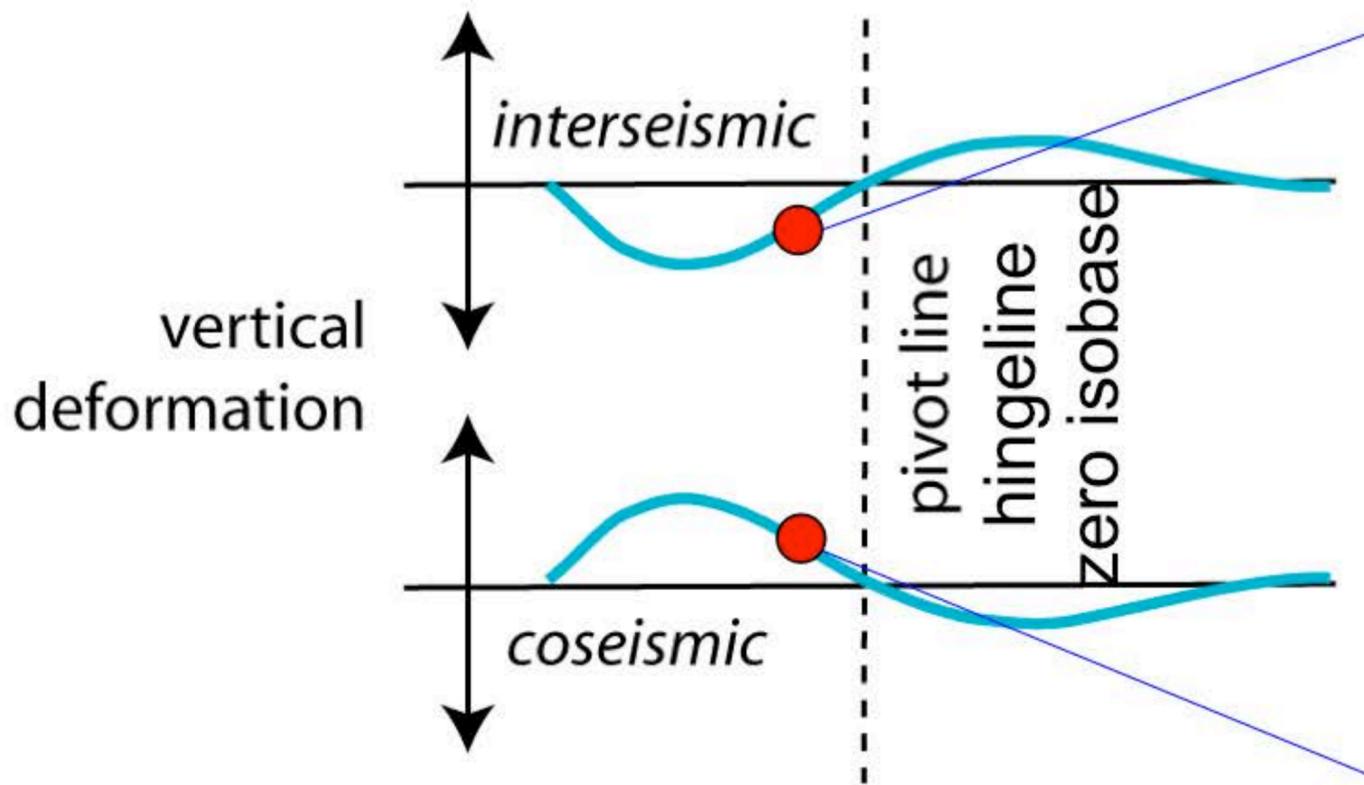
Haiti M 7.0 rupture, 2010

Embrace (and interrogate!) the slop:

Pakistan M 7.7 rupture, 2013

Underlying theme: We learn the most when field data and models interact vigorously, early, and often

Subduction cycle refresher



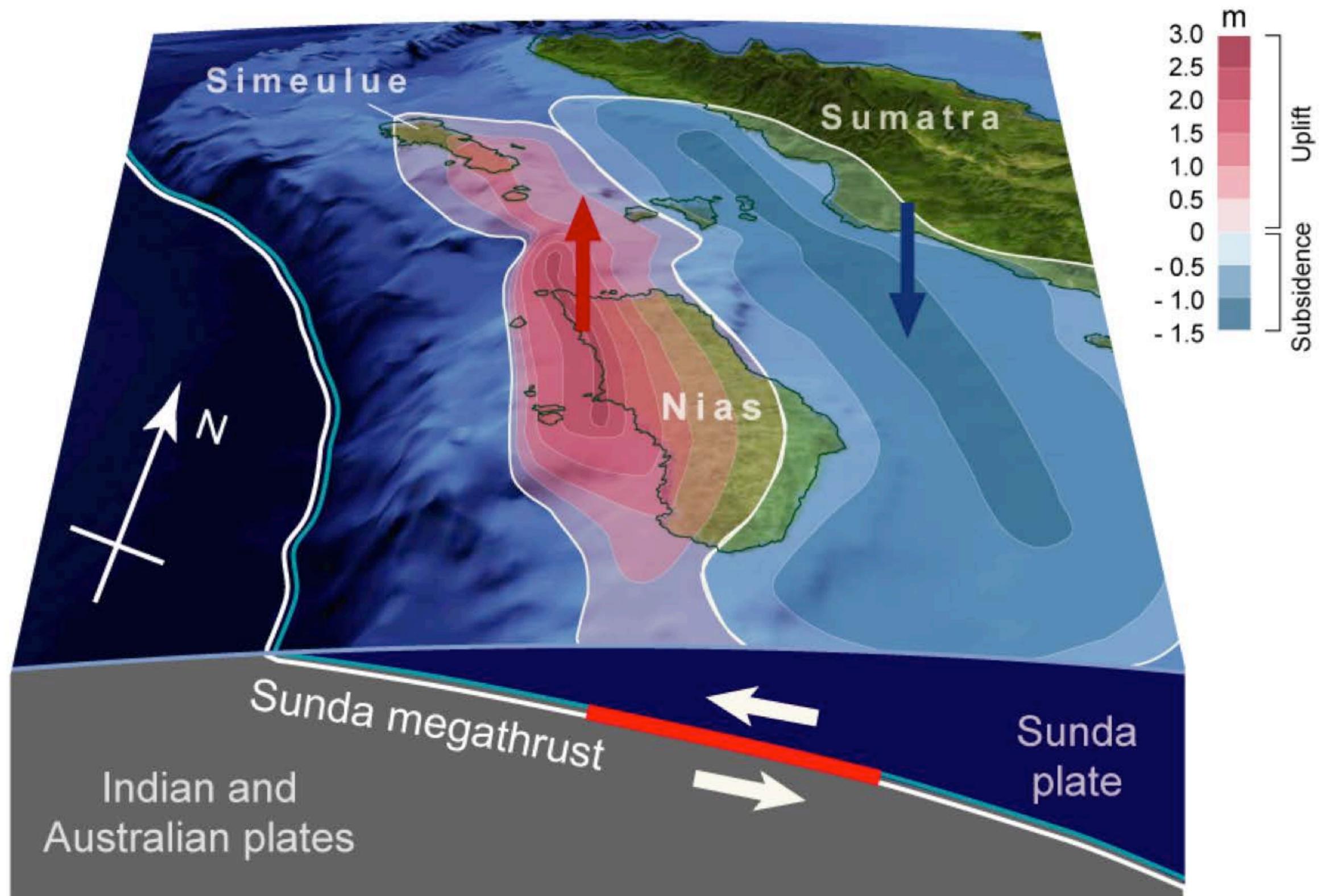
Before megathrust rupture



After megathrust rupture

K. Sieh

Coseismic vertical deformation field: 2005 M 8.6, Sumatra (Nias)





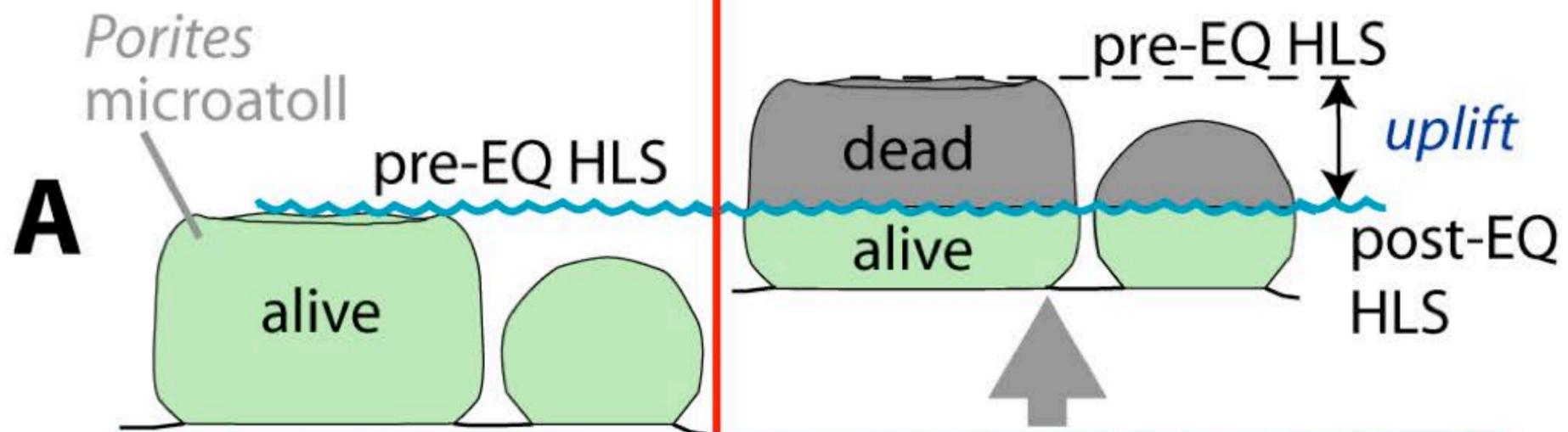
Coseismic uplift of the Hinako Islands, 2005

J. Galetzka

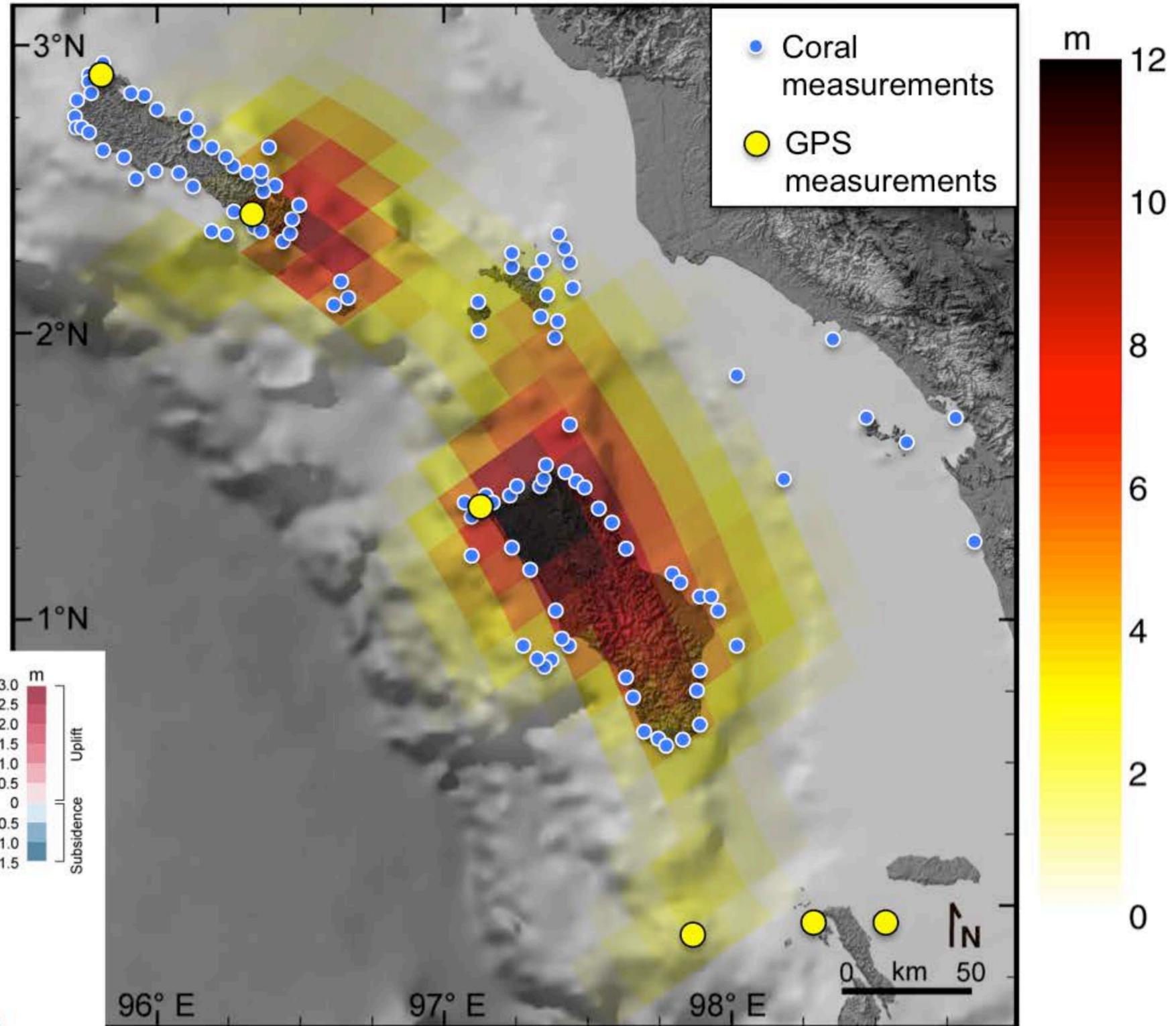
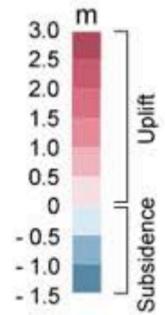
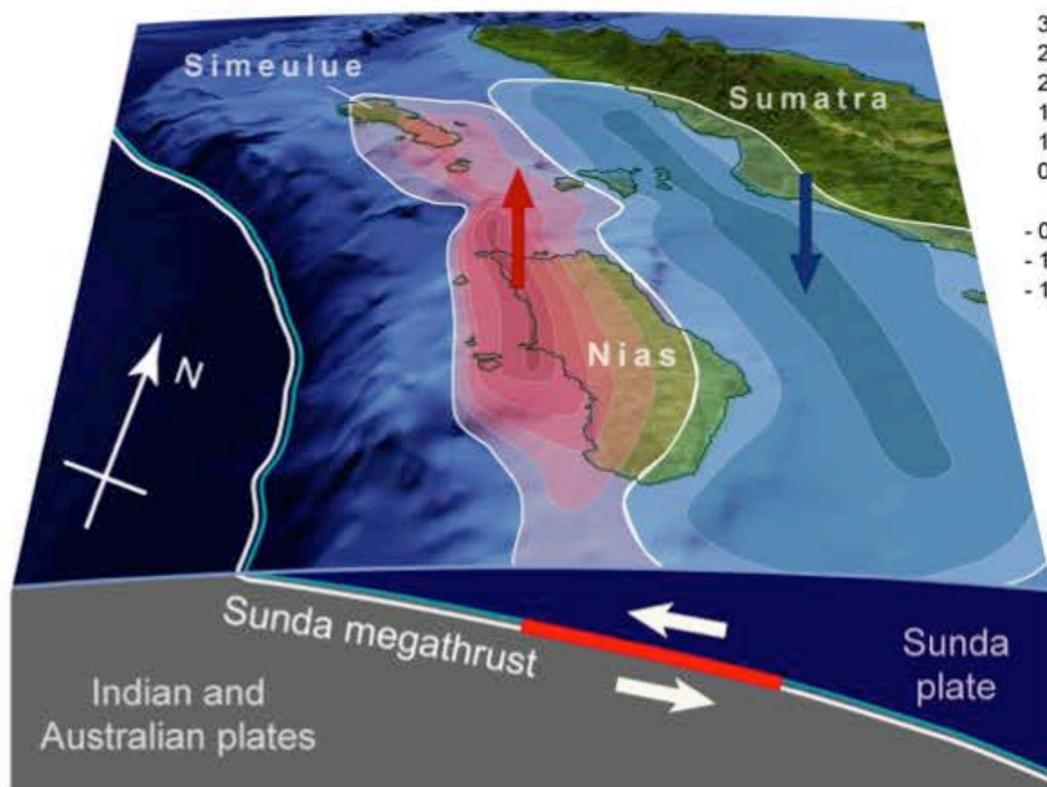
Coseismic uplift of Bugi Island, 2005



pre-earthquake → post-earthquake



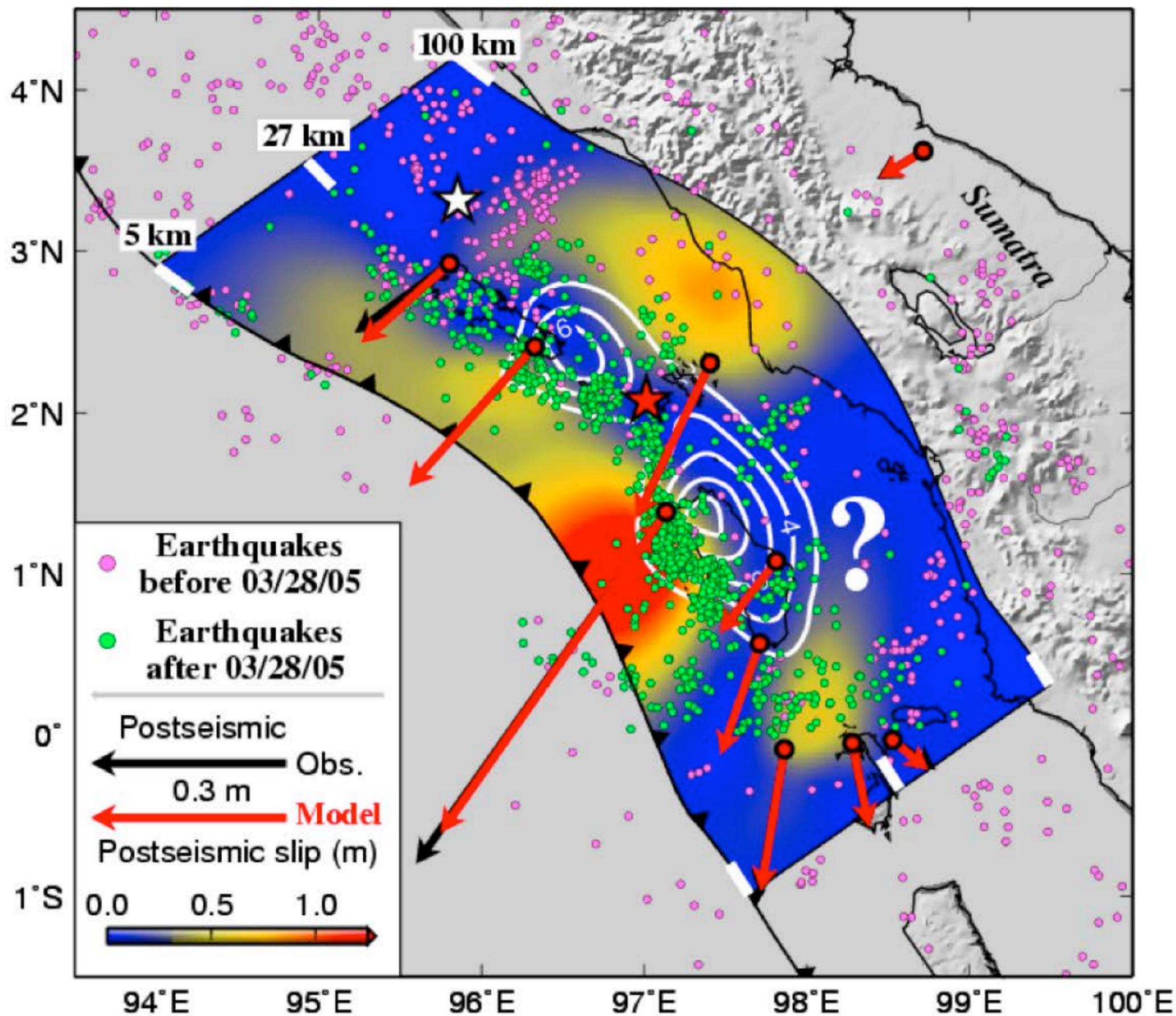
2005 coseismic slip model



Briggs and others 2006;
model by Ya-ju Hsu

2005 postseismic slip model

Slop plays a part
in illuminating an
important
constitutive law:
Frictional afterslip

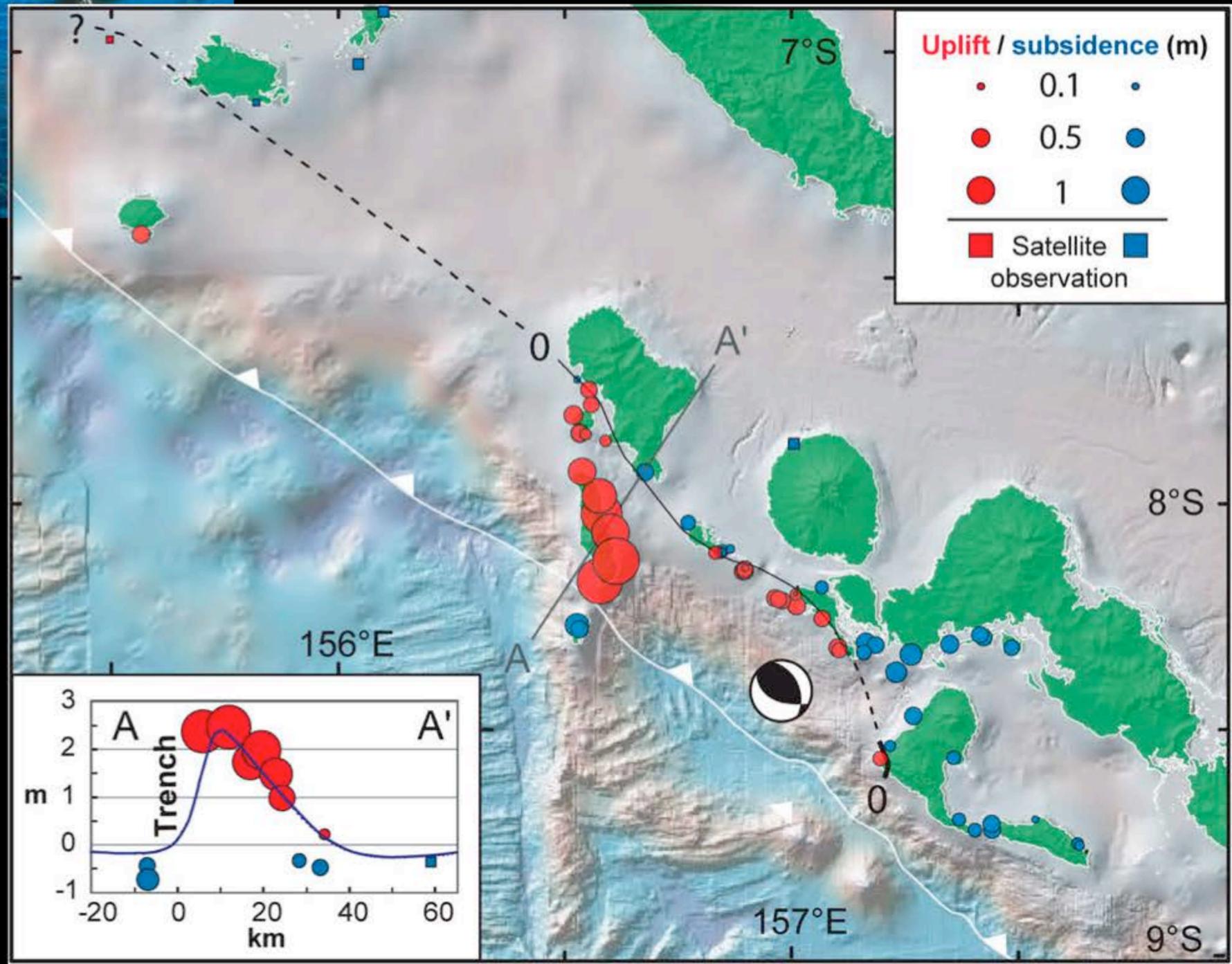


Hsu and others, 2006

Chasing zero: 2007 M 8.1, Solomon Islands

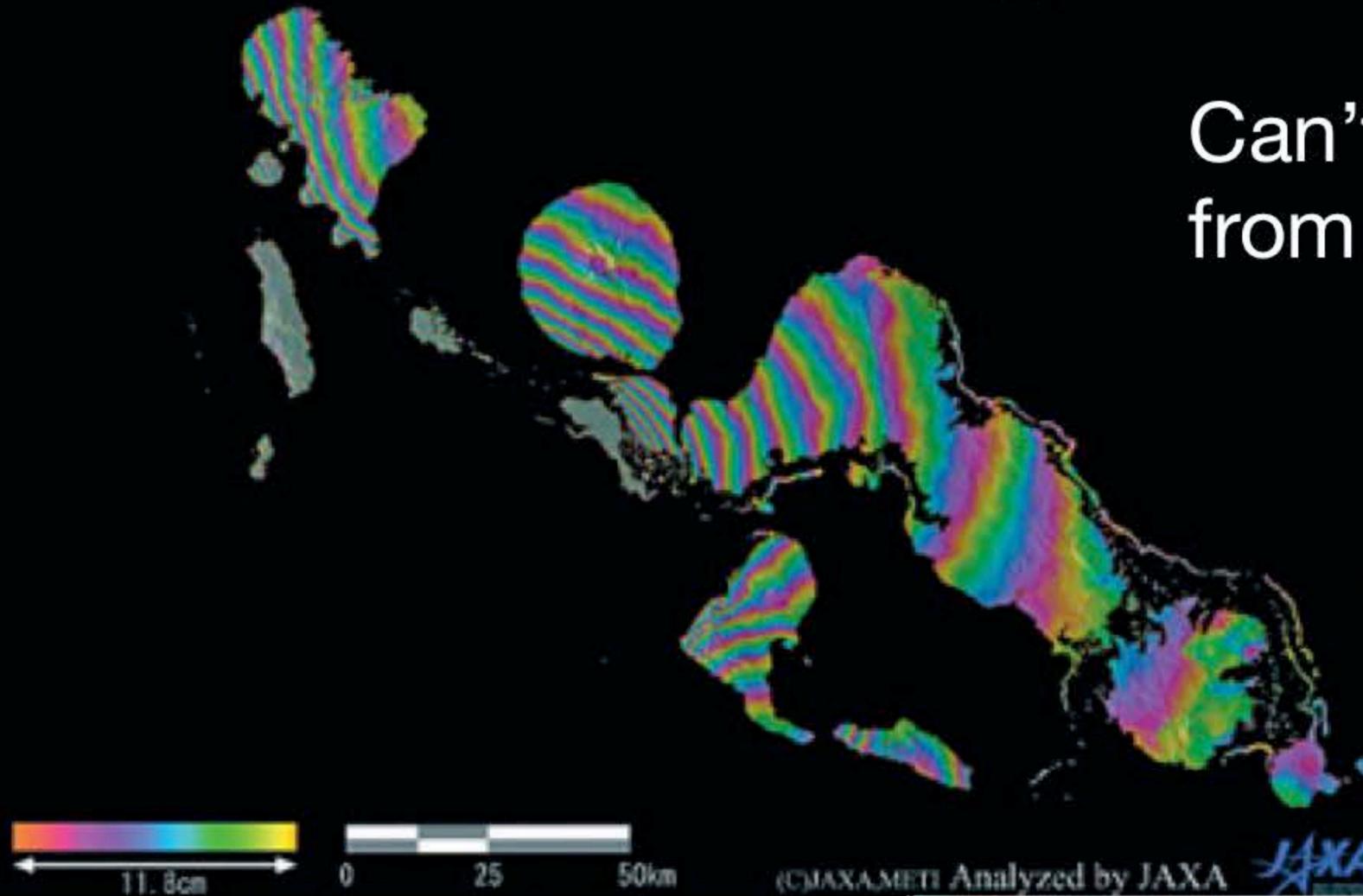


Coseismic uplift at
Ranongga Island

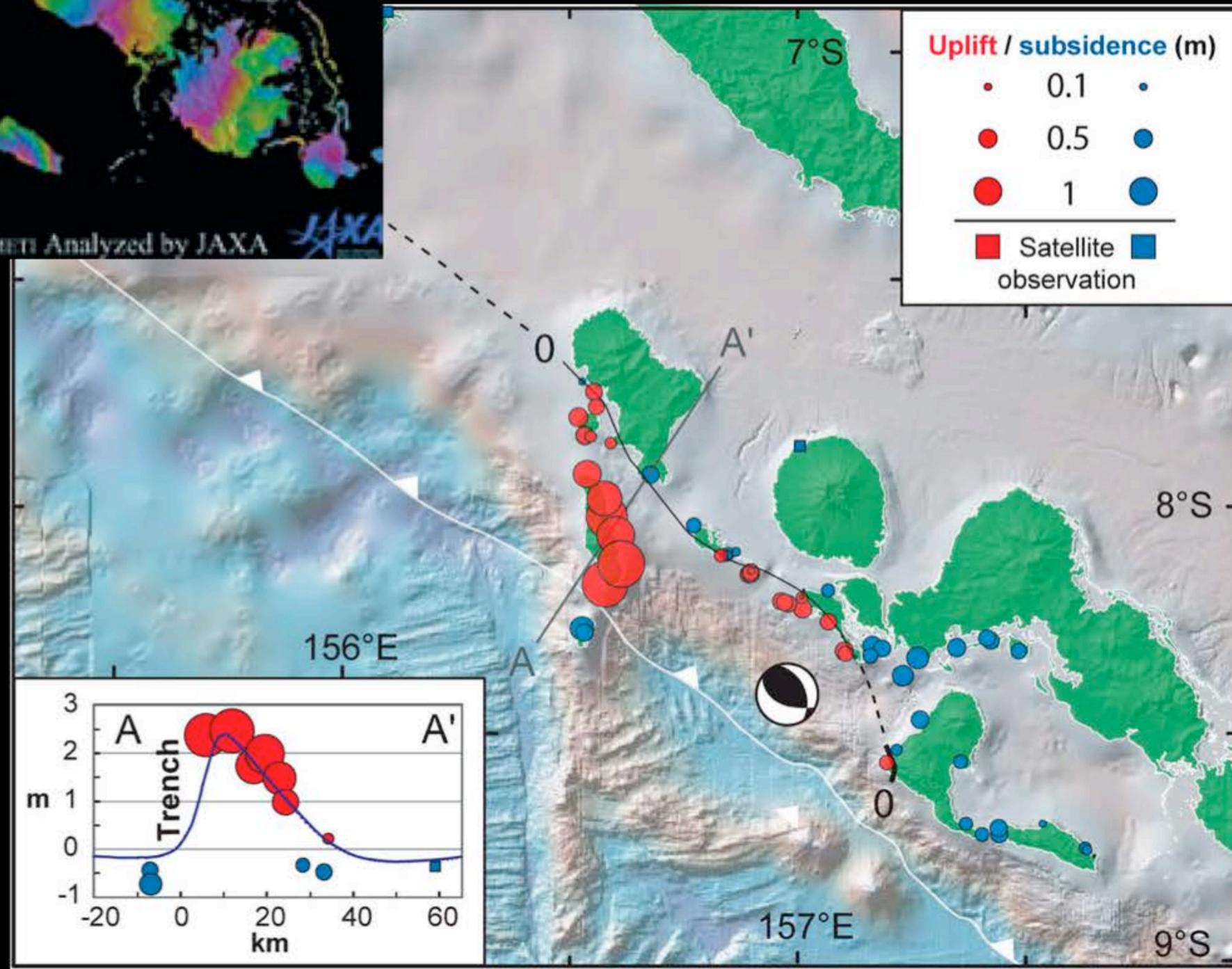


Taylor and others, 2010

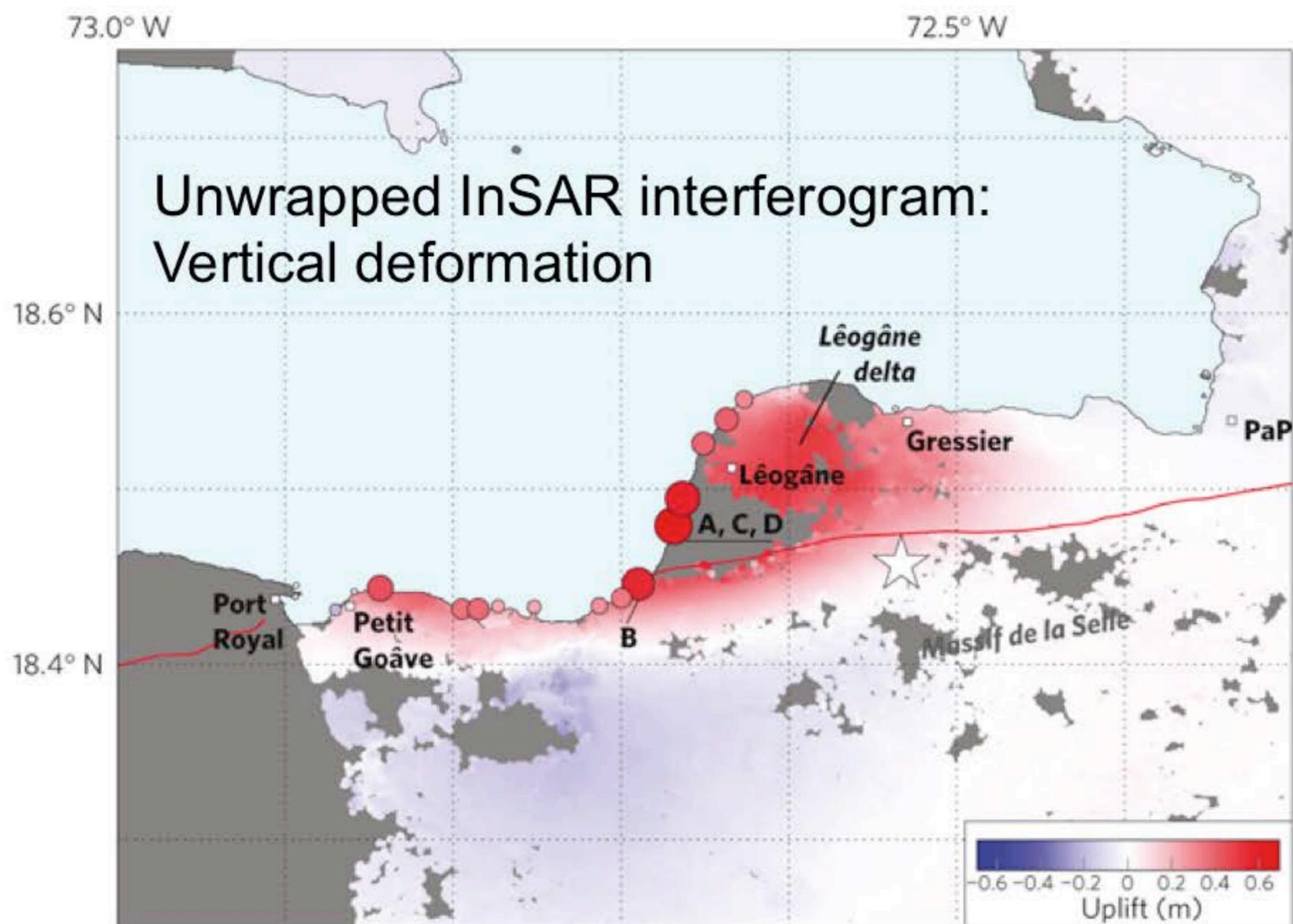
Can't everything just be done from space?



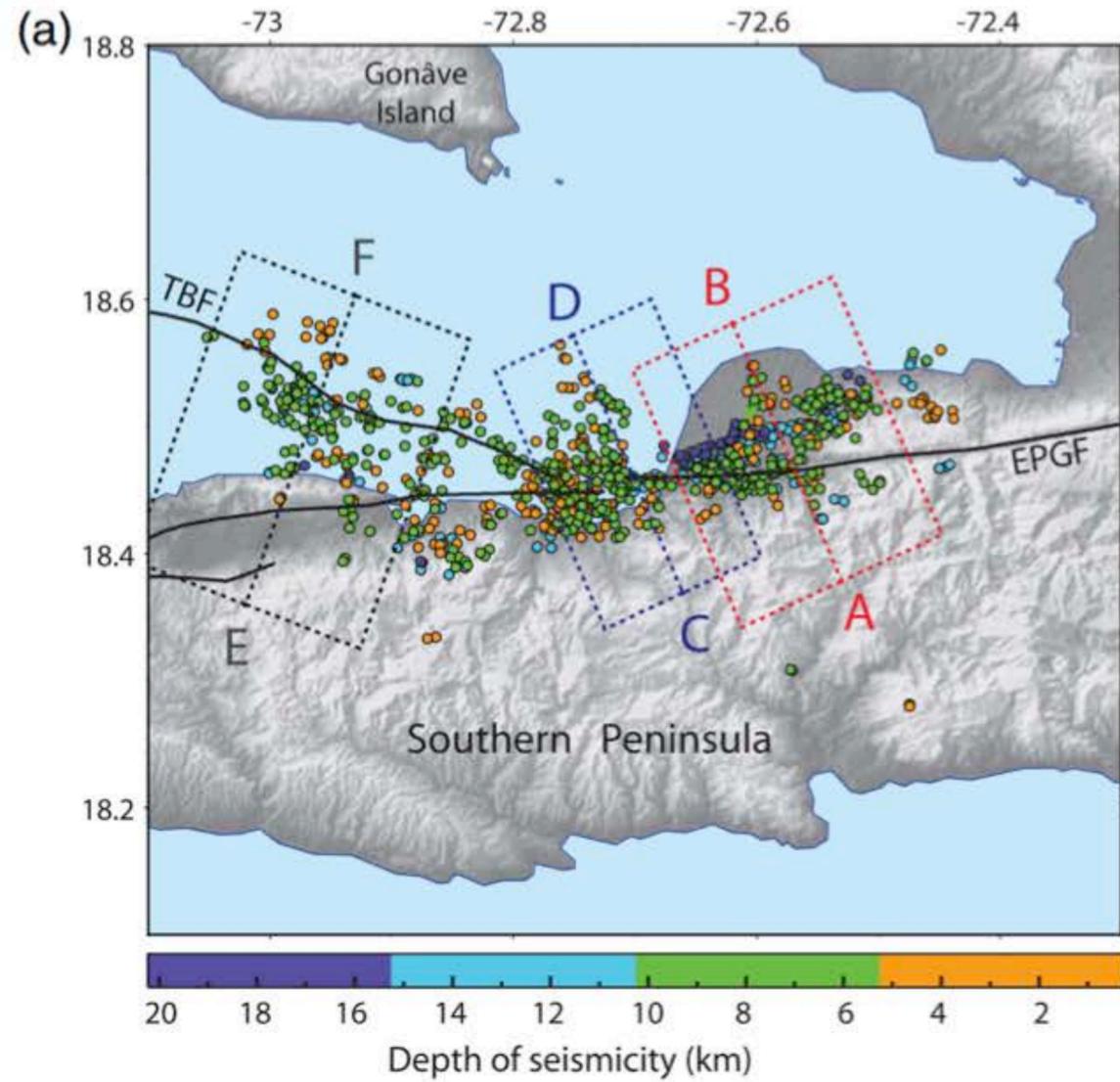
L-band interferogram (PALSAR) from JAXA



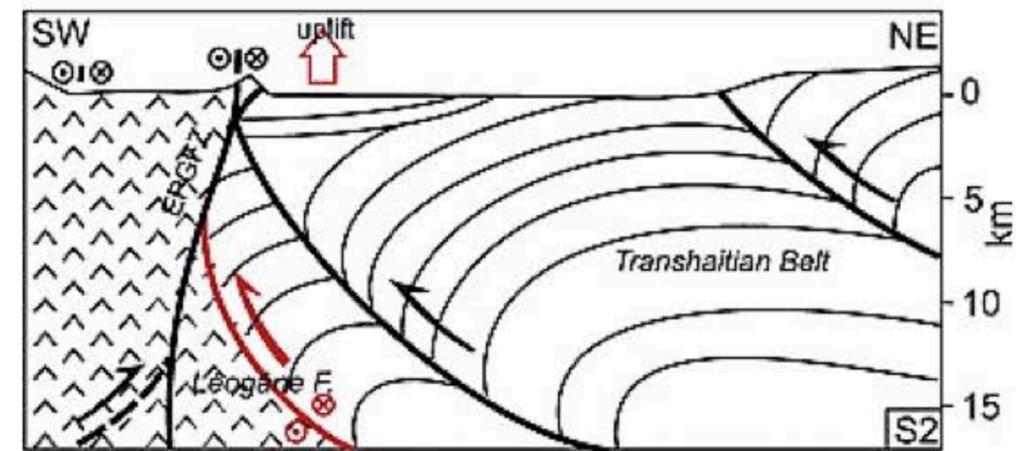
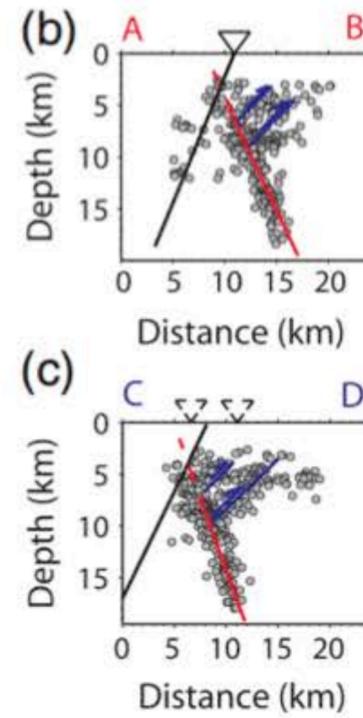
Your data don't fit my model: 2010 M 7.0, Haiti



Complex transpressional deformation, Haiti 2010



Symithe and others, 2013



de Lépinay and others, 2011

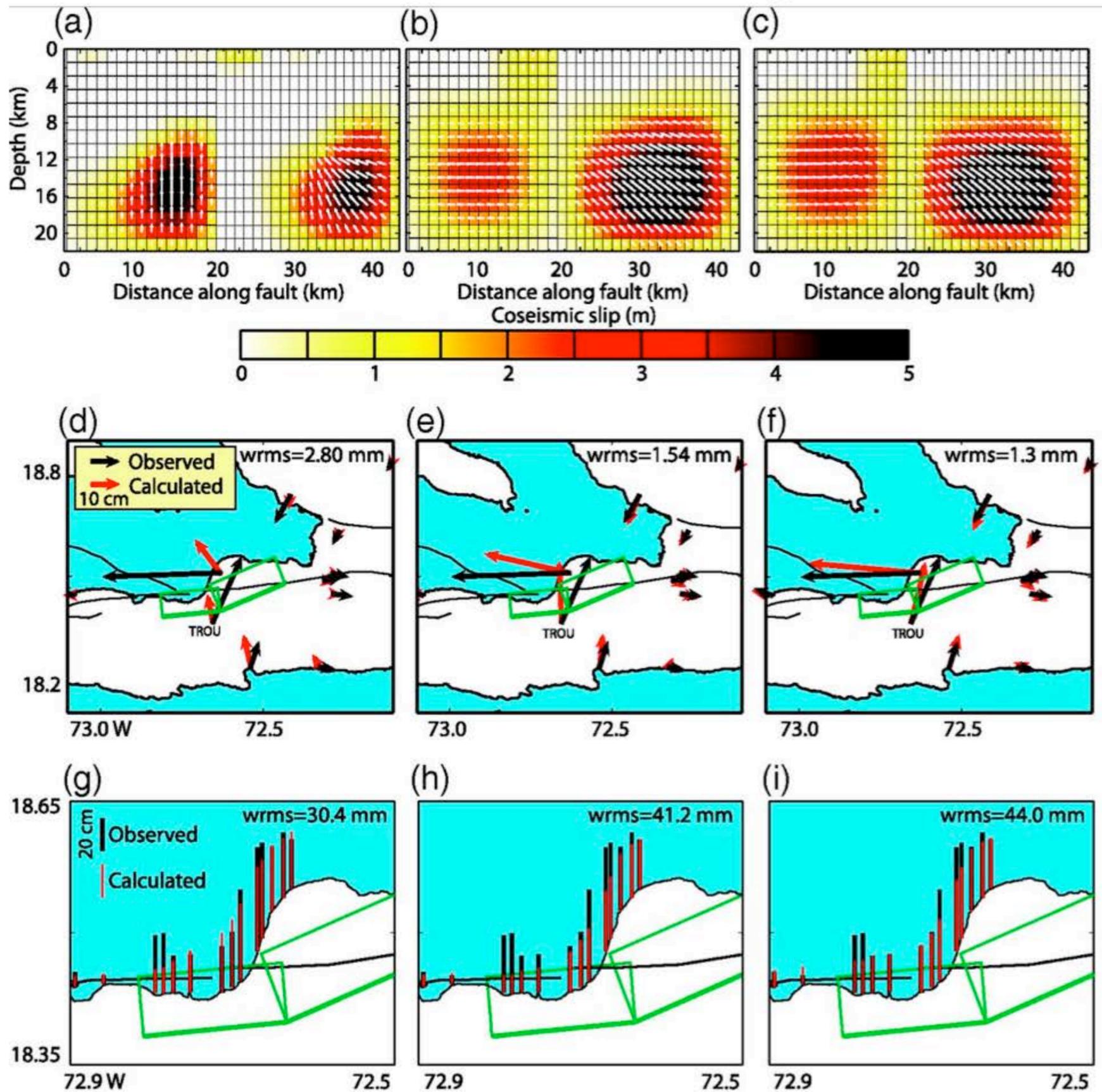


Blind faulting, coastal uplift Haiti 2010

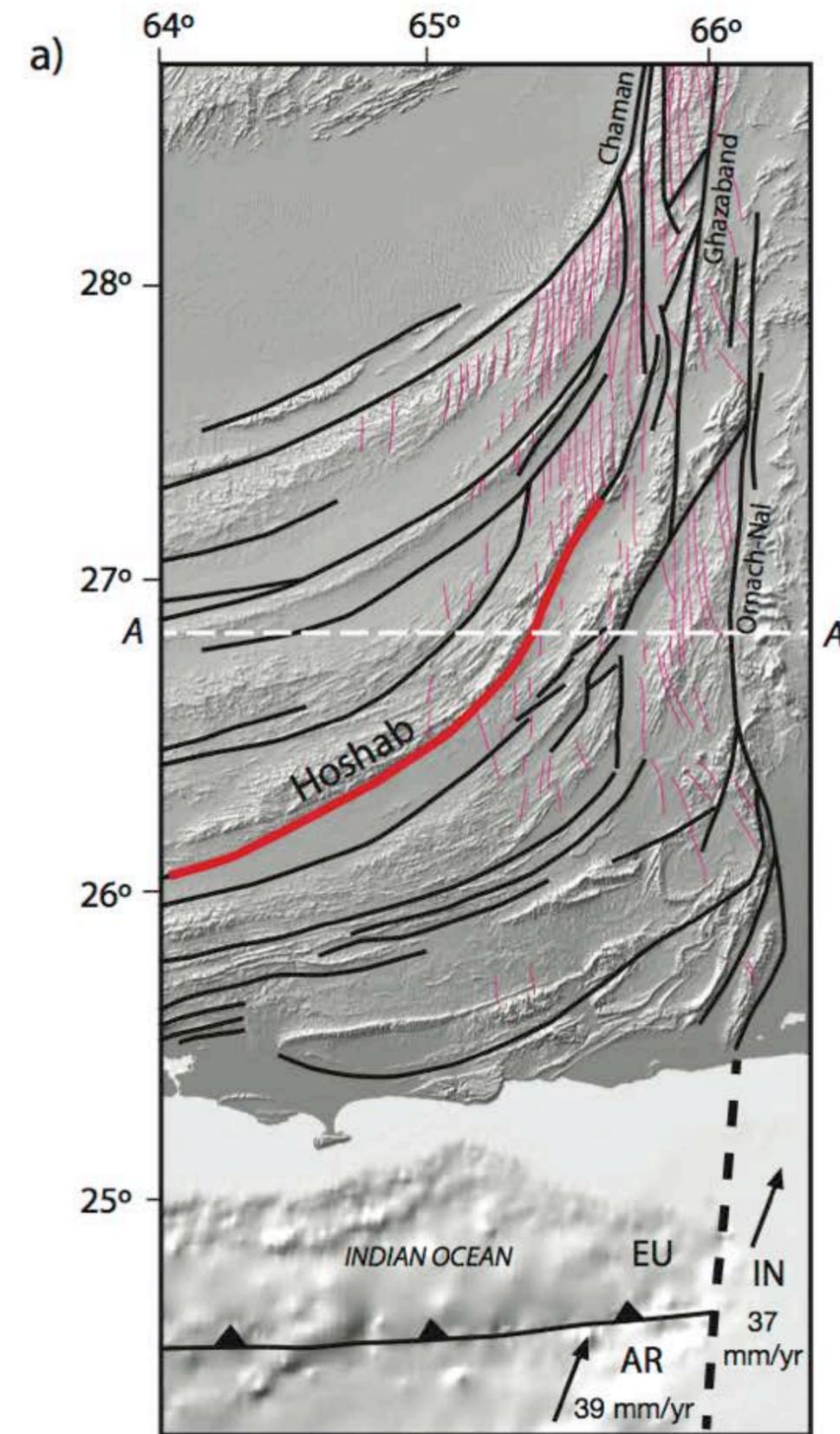
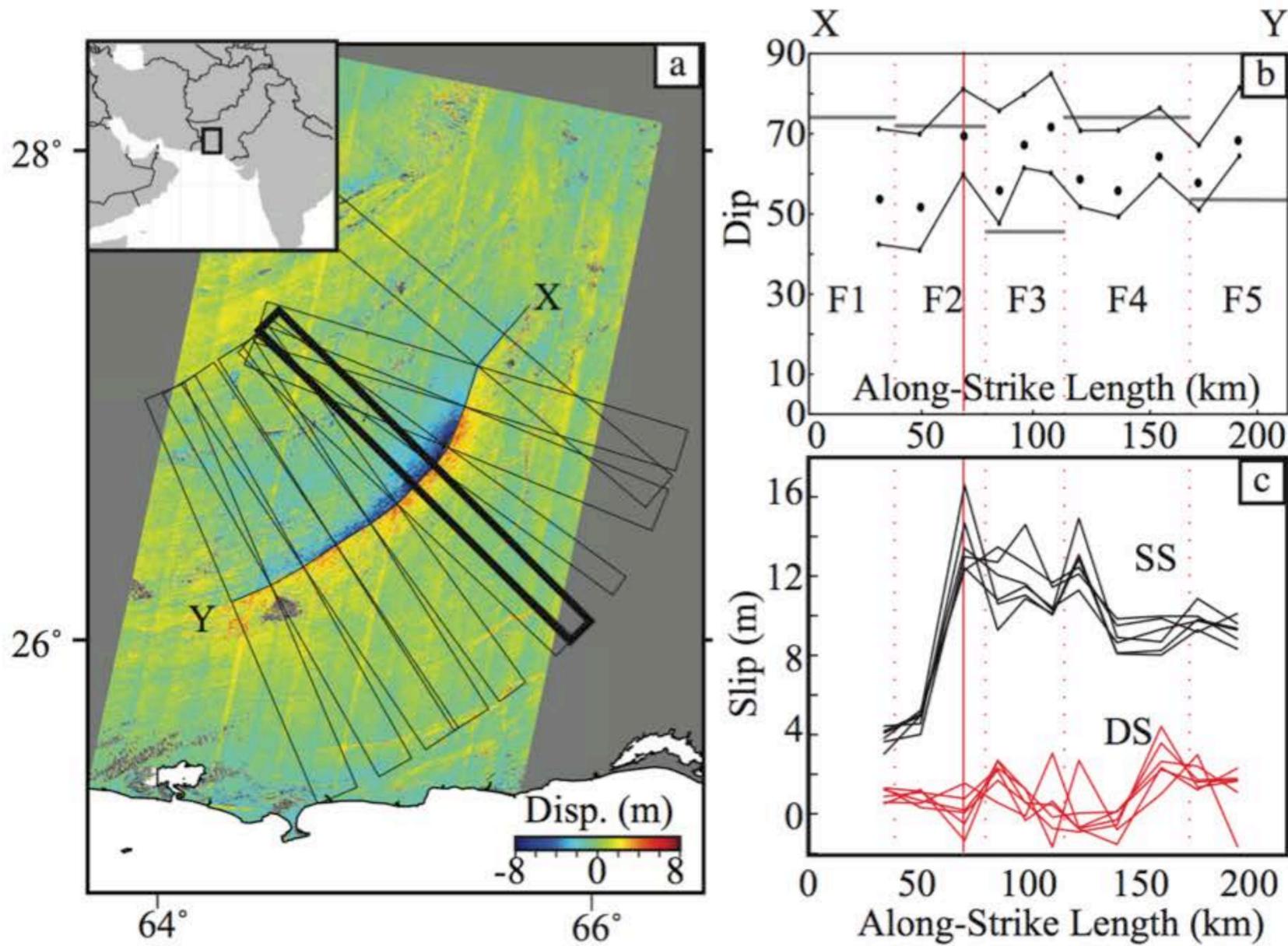
Google



Importance of relative weights in joint inversions: What are the Haiti corals telling us?



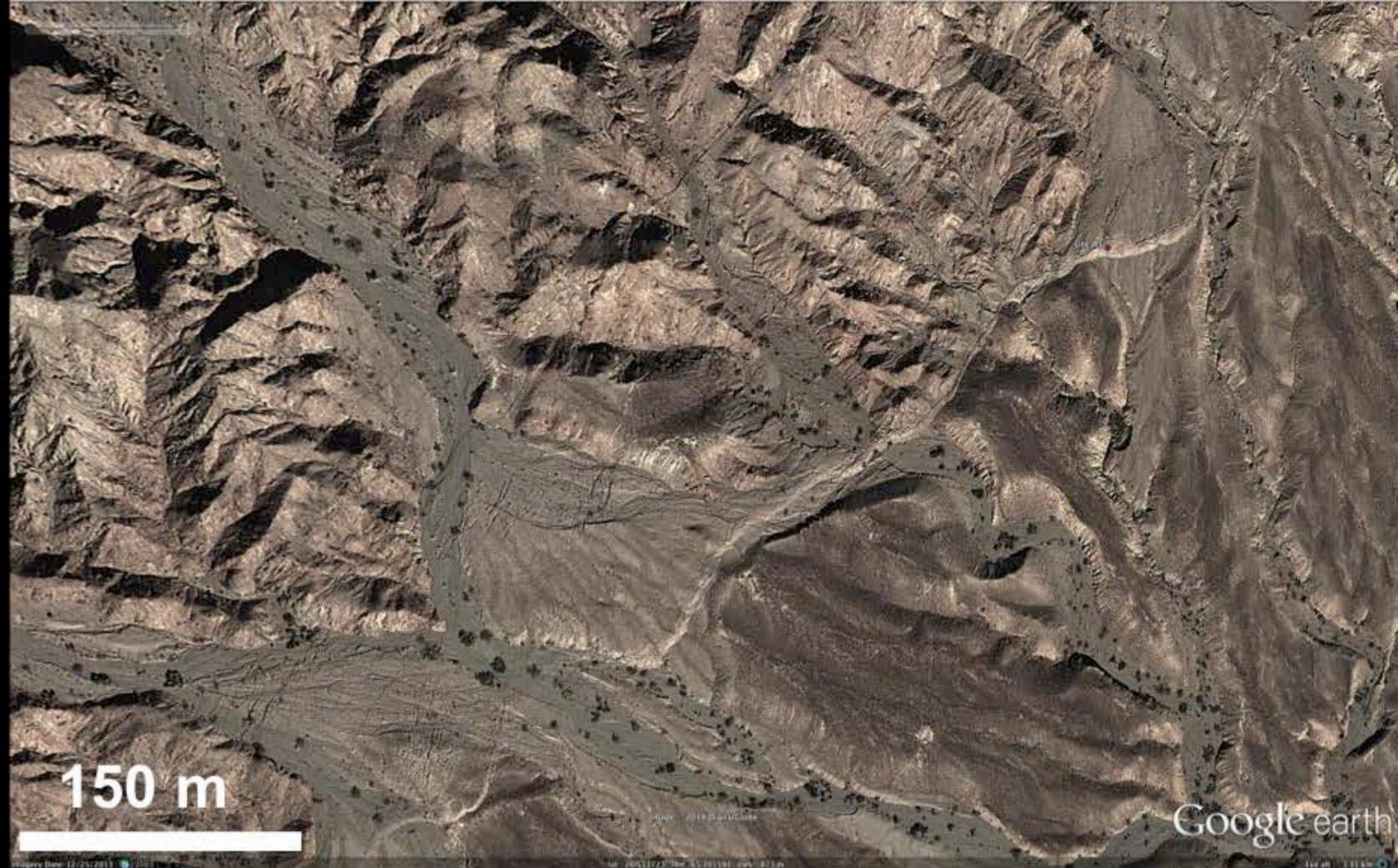
Pakistan 2013 M 7.7: Embrace (and interrogate!) the slop



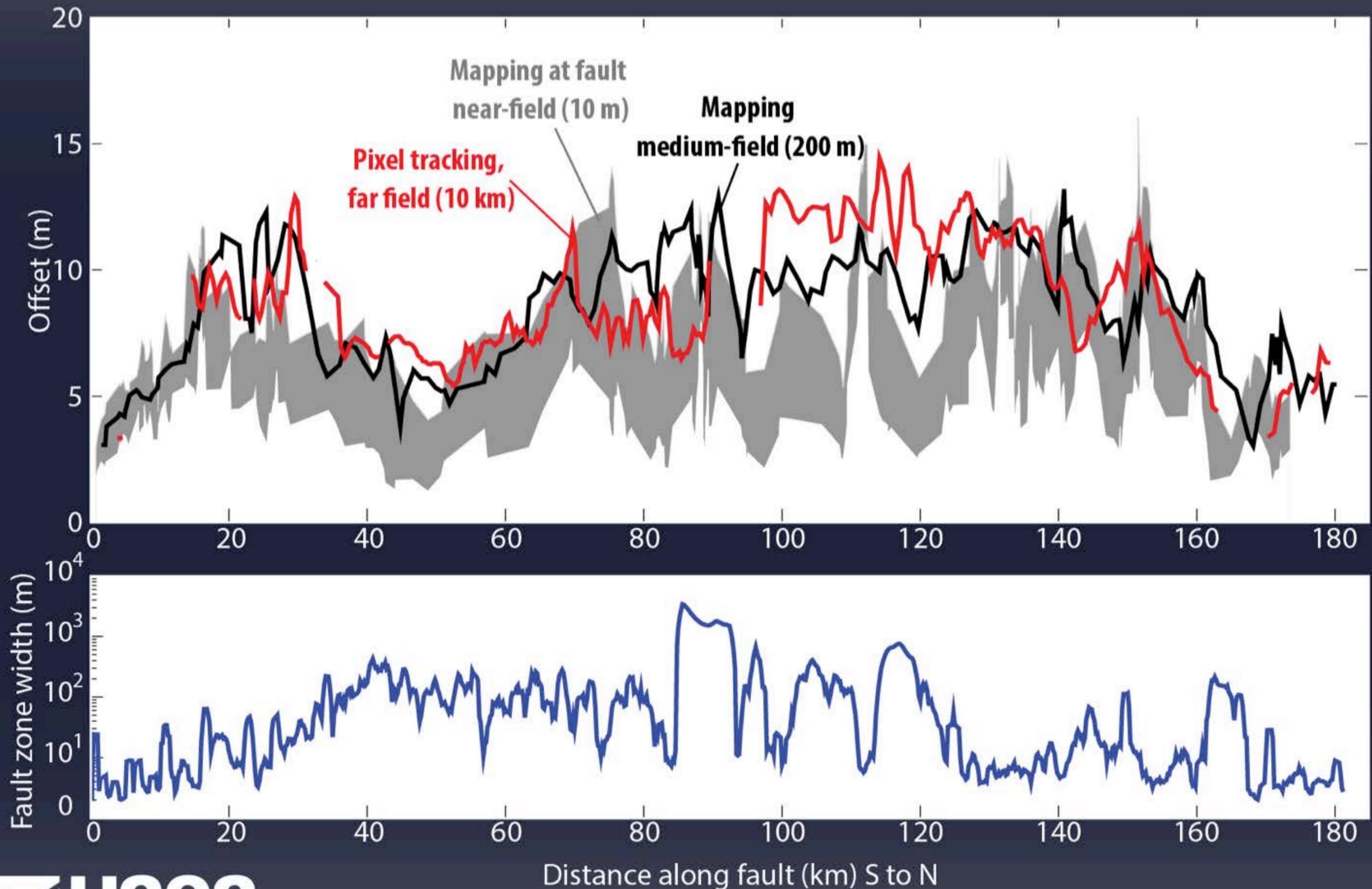
Optical image correlation techniques emerging as critical for fault rupture studies

Barnhart and others, in review

Pakistan 2013 M 7.7 surface rupture



Pakistan 2013 M 7.7 surface slip distribution: Slop is real



Finally: Why you should care about our slop

Your models may be better:

“Since the earth sciences deal with complex, messy systems, a large number of relatively imprecise data are often more useful than a few highly precise values.”

And your models may better describe reality:

“Nature can be a harsh critic, destroying elegant theoretical models with a few hard, cold facts.”

Robert Sharp, 1988