



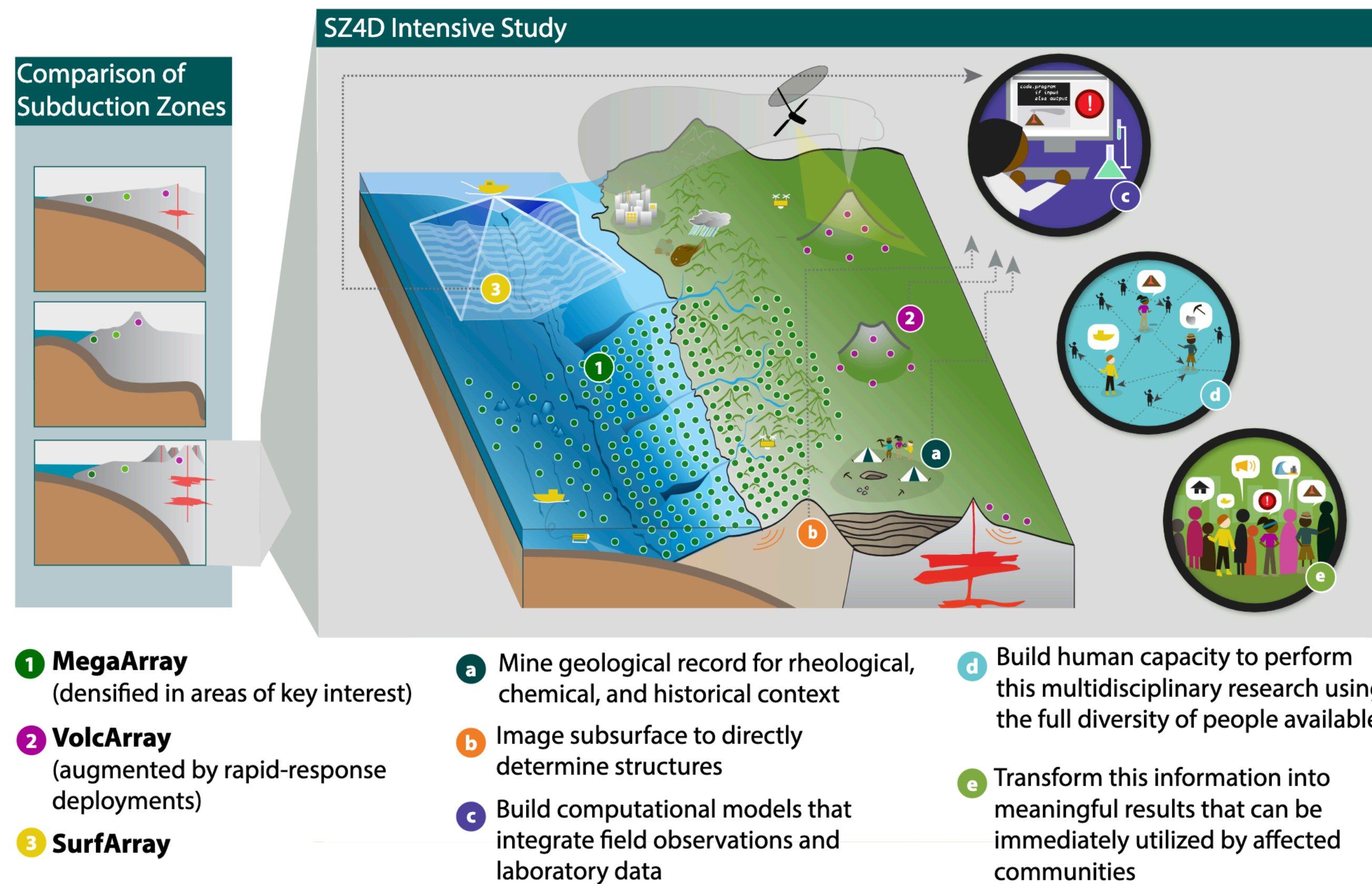
# **SEISMOLOGY AT SUBDUCTION ZONES**

**HELEN JANISZEWSKI, DEPT. OF EARTH SCIENCES, UNIVERSITY OF HAWAI'I AT MĀNOA**

**SZ4D COMMUNITY MEETING - EARLY CAREER SESSION  
NOVEMBER 13, 2022**

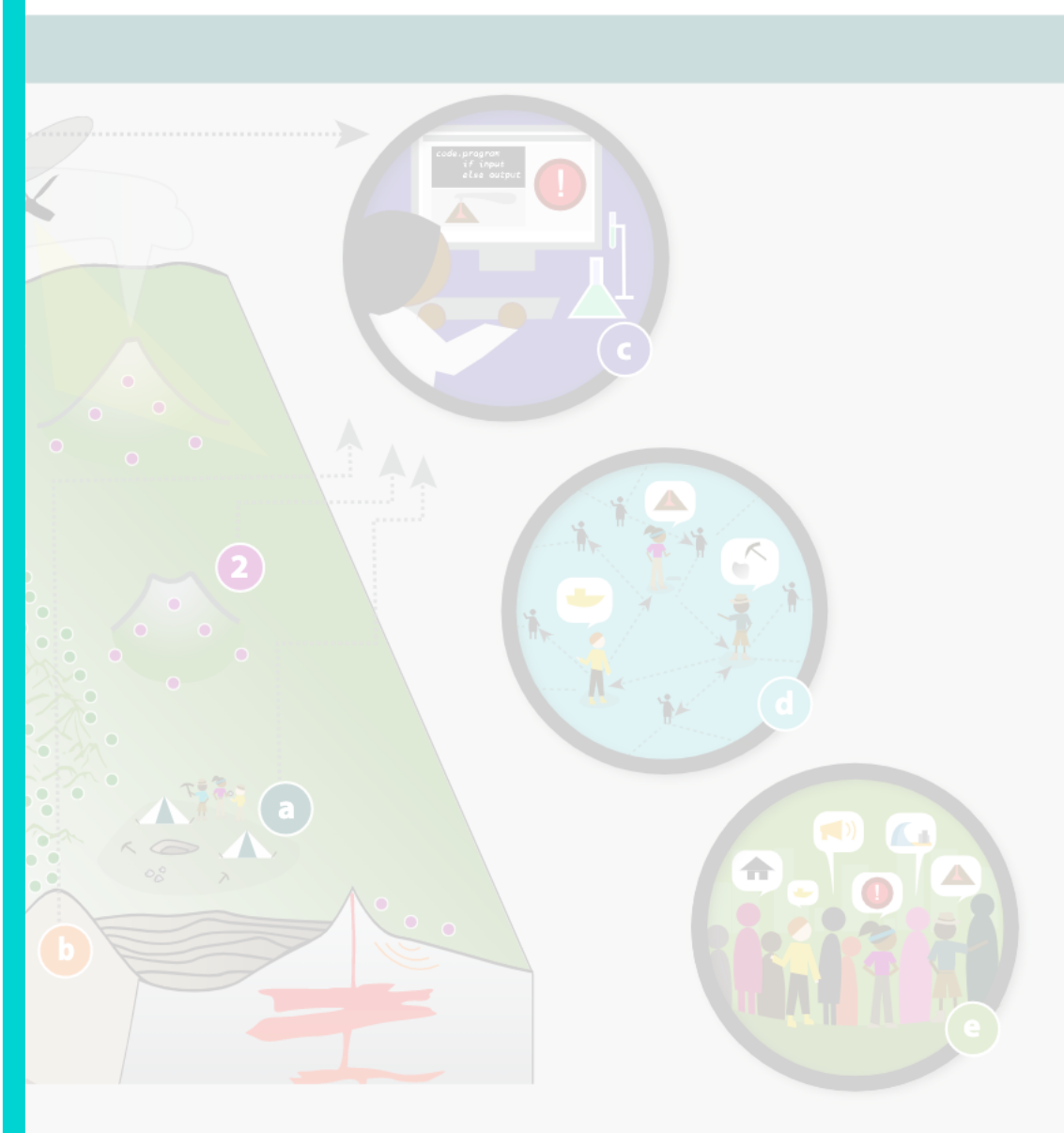
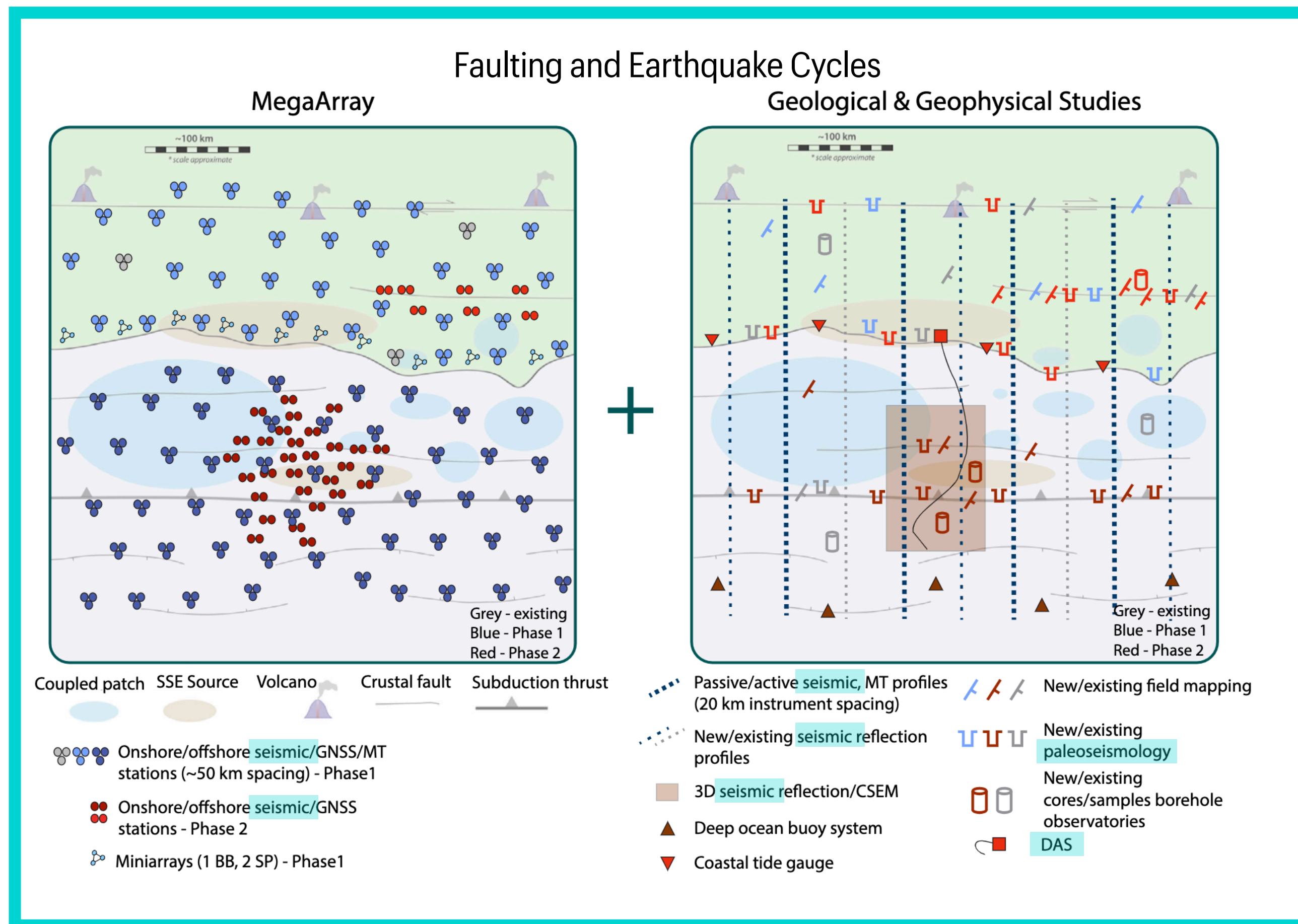
# SZ4D IMPLEMENTATION PLAN

## RELEVANCE OF SEISMOLOGY



# SZ4D IMPLEMENTATION PLAN

## RELEVANCE OF SEISMOLOGY



rheological,  
context

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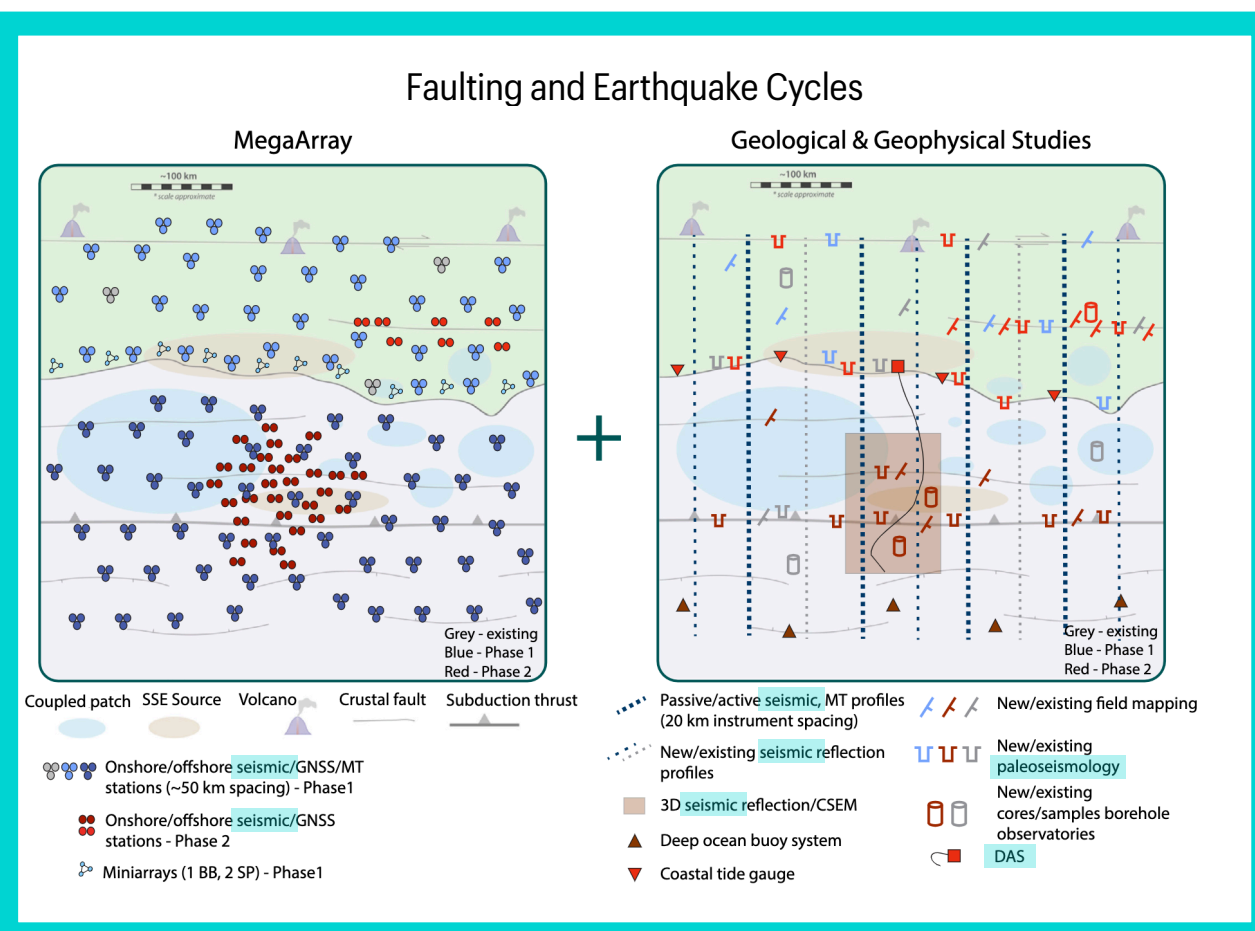
s that  
and

d Build human capacity to perform this multidisciplinary research using the full diversity of people available

e Transform this information into meaningful results that can be immediately utilized by affected communities

# SZ4D IMPLEMENTATION PLAN

## RELEVANCE OF SEISMOLOGY



Comparison  
Subduction

- 1 MegaA (densifi
- 2 VolcAr (augme deploy
- 3 SurfAr

### Magmatic Drivers of Eruptions

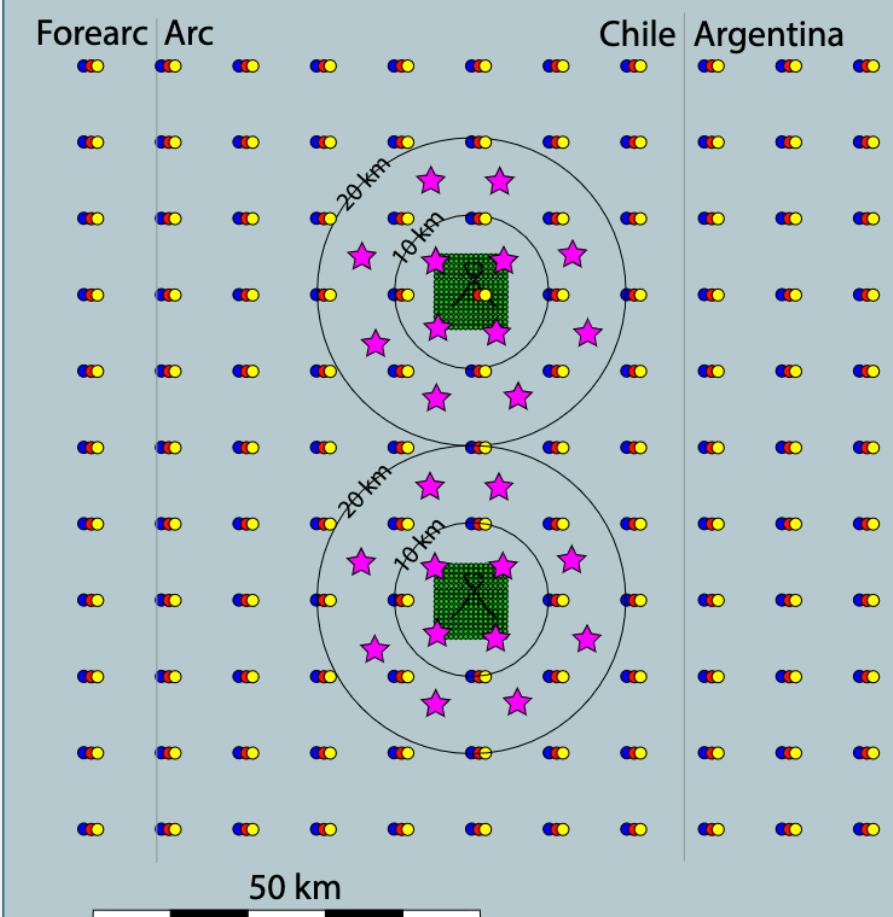
#### A - Volcano Sensor Arrays (30-50 volcanoes, 10-year telemetered deployments)



(not to scale, instrument locations are schematic only)

- ★ Ash Analyzer (4)
- ★ Seismometer (6)
- ★ Infrasound (2\*3)
- ★ Tiltmeter (3)
- ★ GNSS (6)
- ★ Webcam (2)
- ★ FLIR (1)
- ★ ScanDOAS (3)
- ★ UV cam (2)
- ★ MultiGAS/Weather (2)

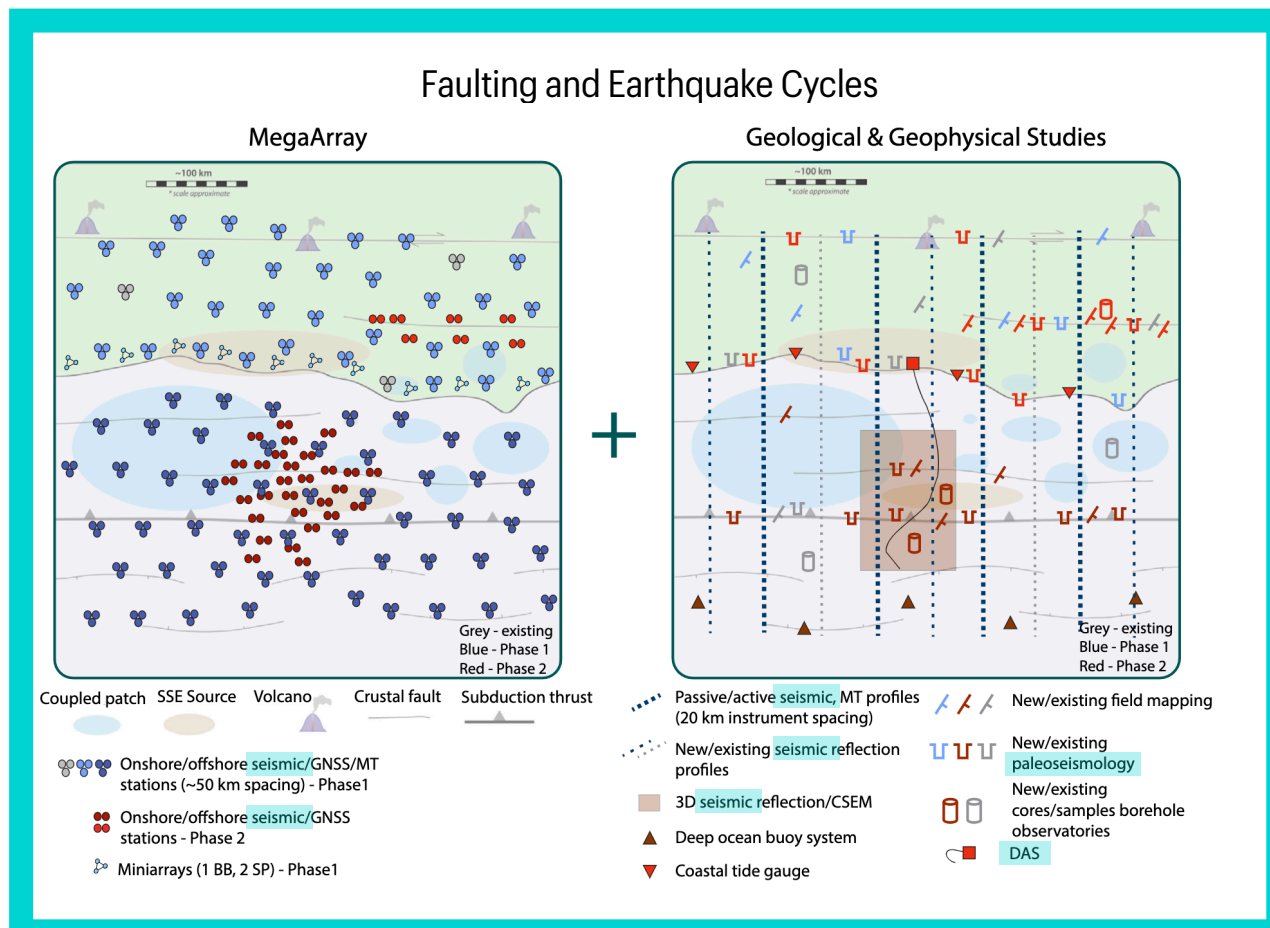
#### B - Volcano Imaging Arrays (3 pairs of neighboring volcanoes, campaign/non-telemetered)



- BB seismic (~10 km spacing, 2 years, integrate with MultiArray)
- Nodal seismic (~1.5 km spacing, 2 months)
- MT (~10 km spacing, ~1 week/point)
- Bouguer gravity survey point
- ★ Volcano Sensor Array instrument (10 years, within ~20 km of vent, see VSA diagram for details)

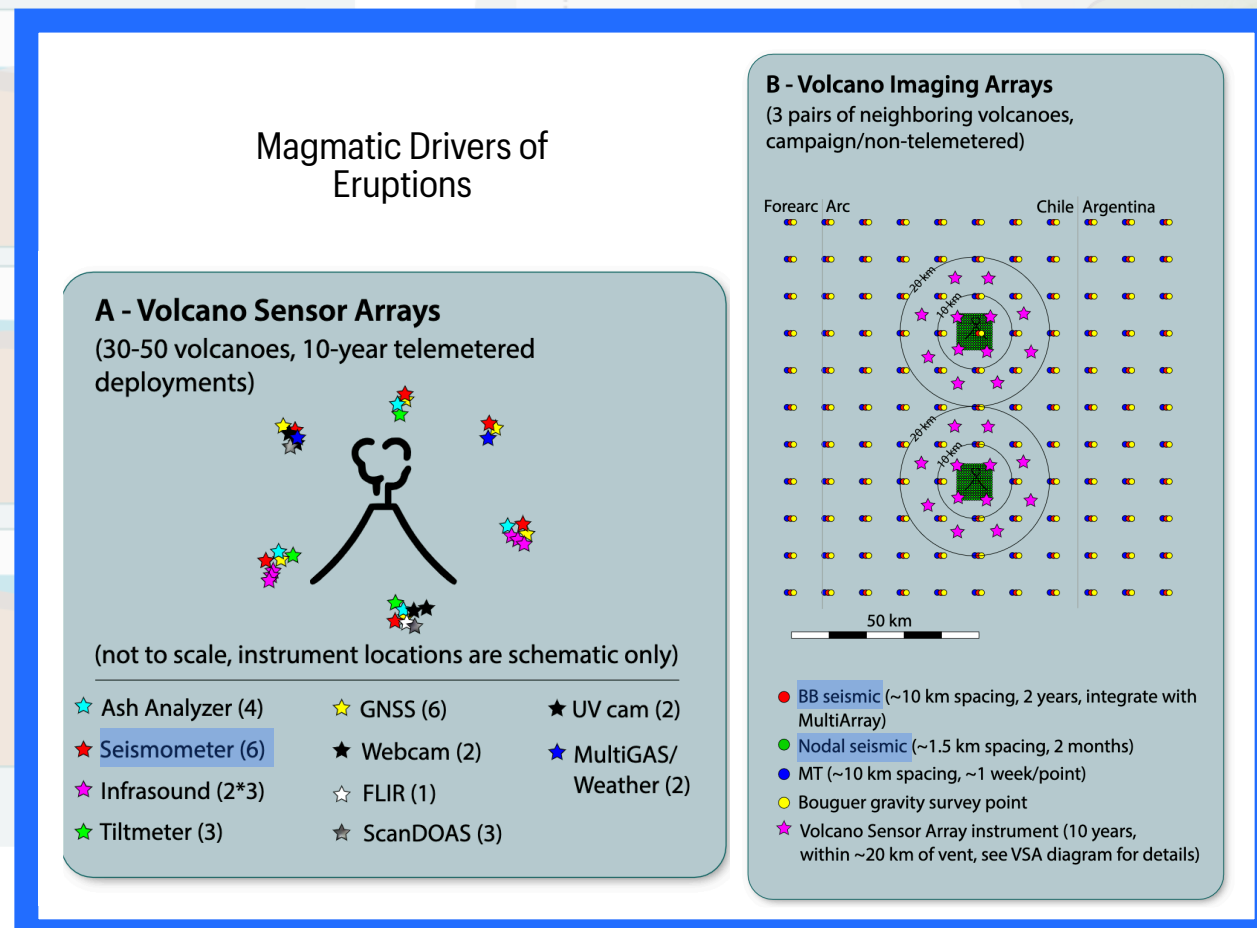
# SZ4D IMPLEMENTATION PLAN

## RELEVANCE OF SEISMOLOGY



### Comparison of Subduction Zones

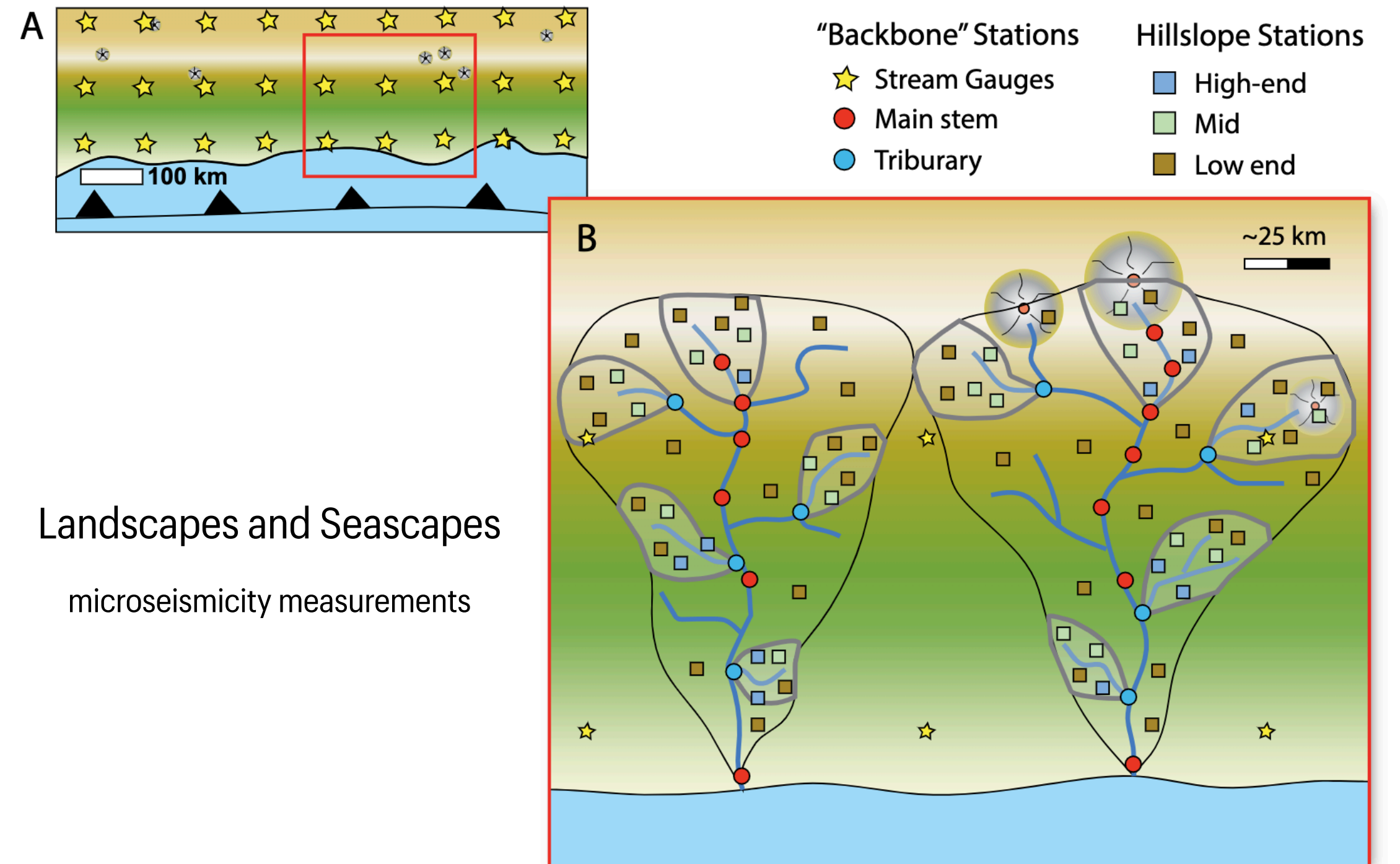
### SZ4D Intensive Study



- 1 MegaArray**  
(densified in areas of key interest)
- 2 VolcArray**  
(augmented by rapid-response deployments)
- 3 SurfArray**

- a** Mine geological record, chemical, and historical data
- b** Image subsurface to determine structures
- c** Build computational models to integrate field observations with laboratory data

### Example SurfArray Environmental Sensor Network Layout

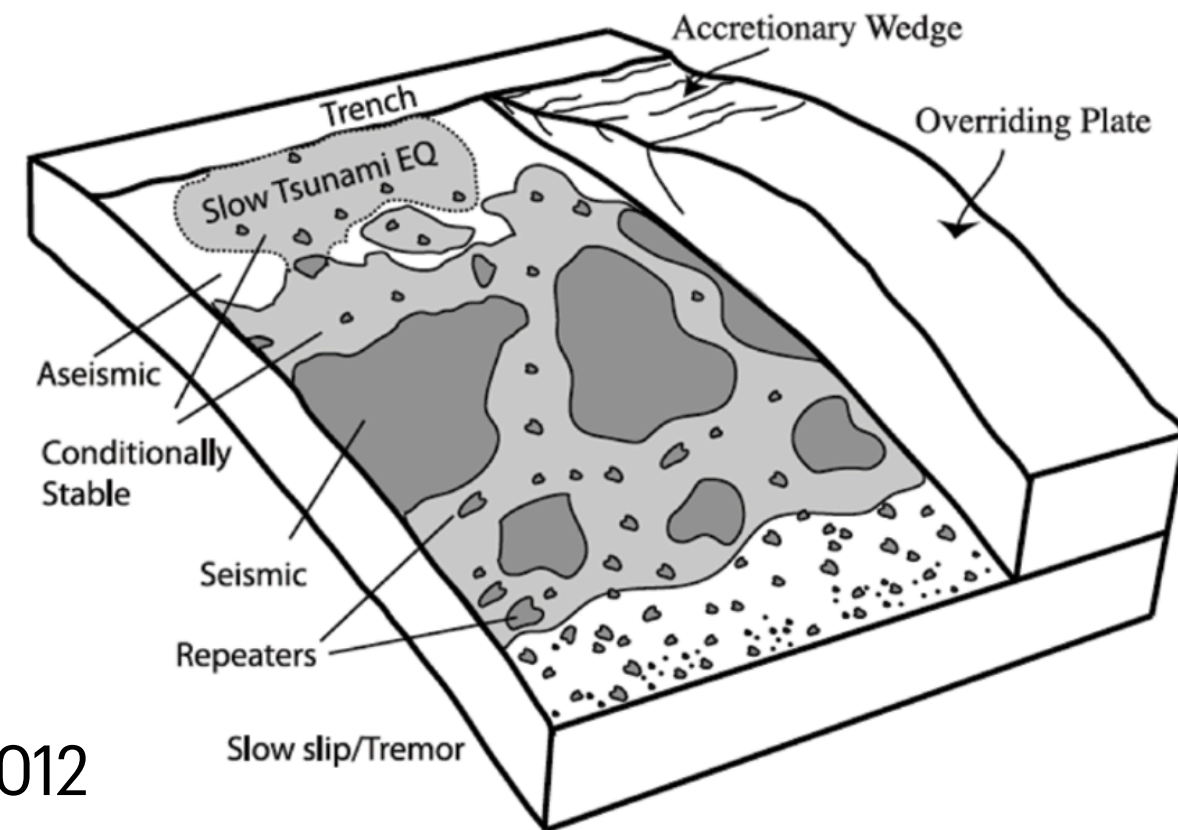


# WHY SEISMOLOGY?

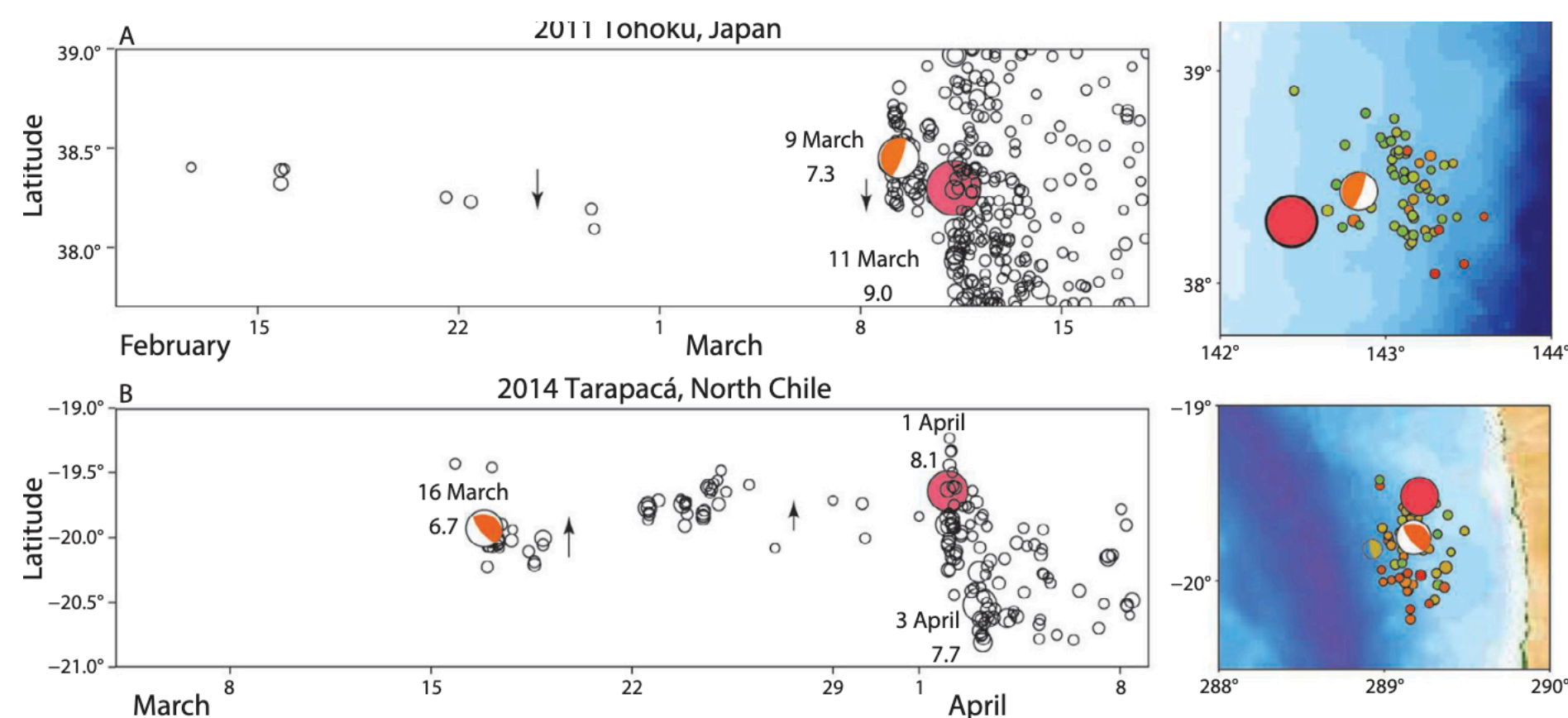


# EARTHQUAKES AND SEISMICITY

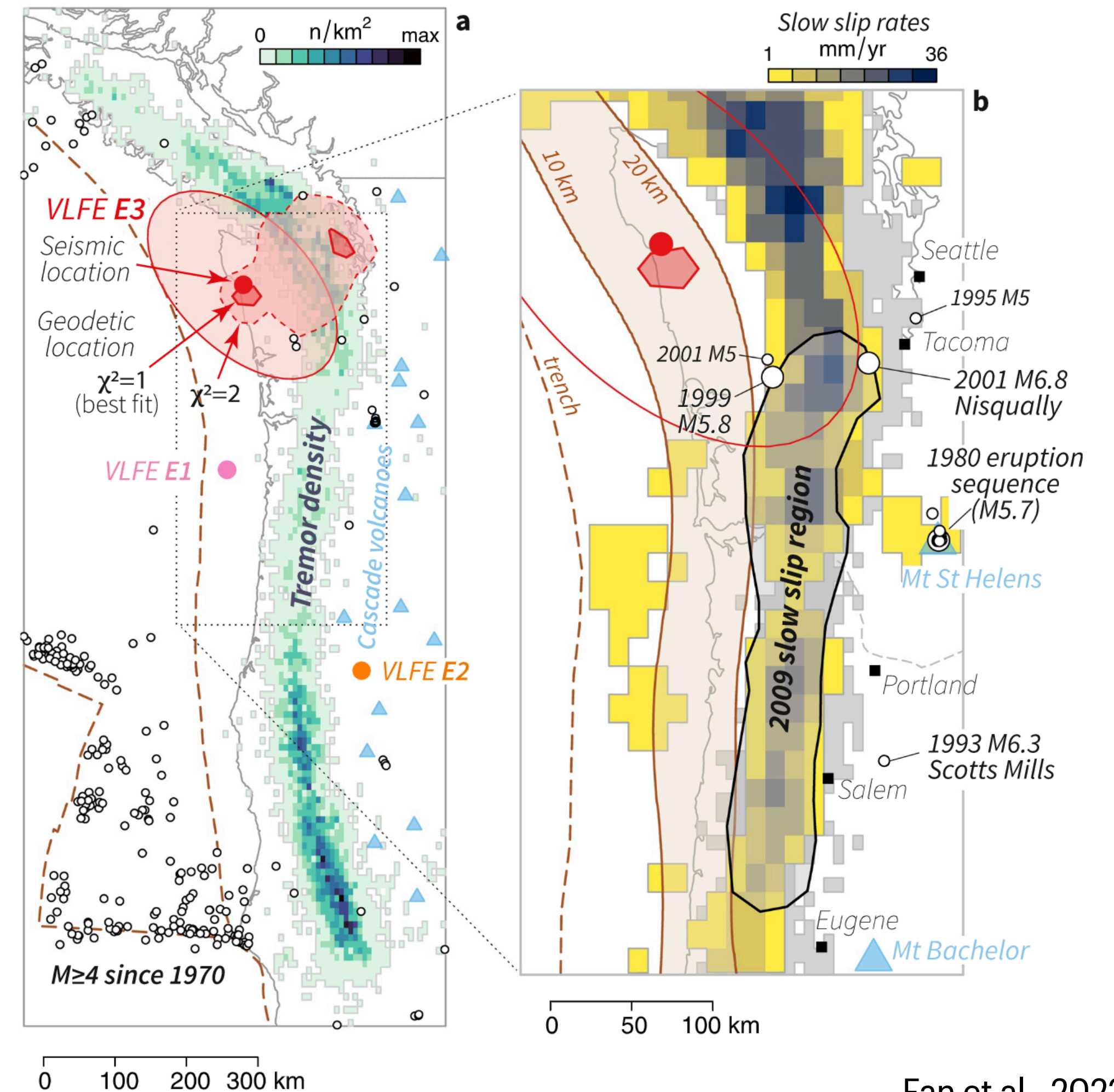
## FAULTS AND THE MEGATHRUST



Lay et al., 2012



Brodsky & Lay., 2014



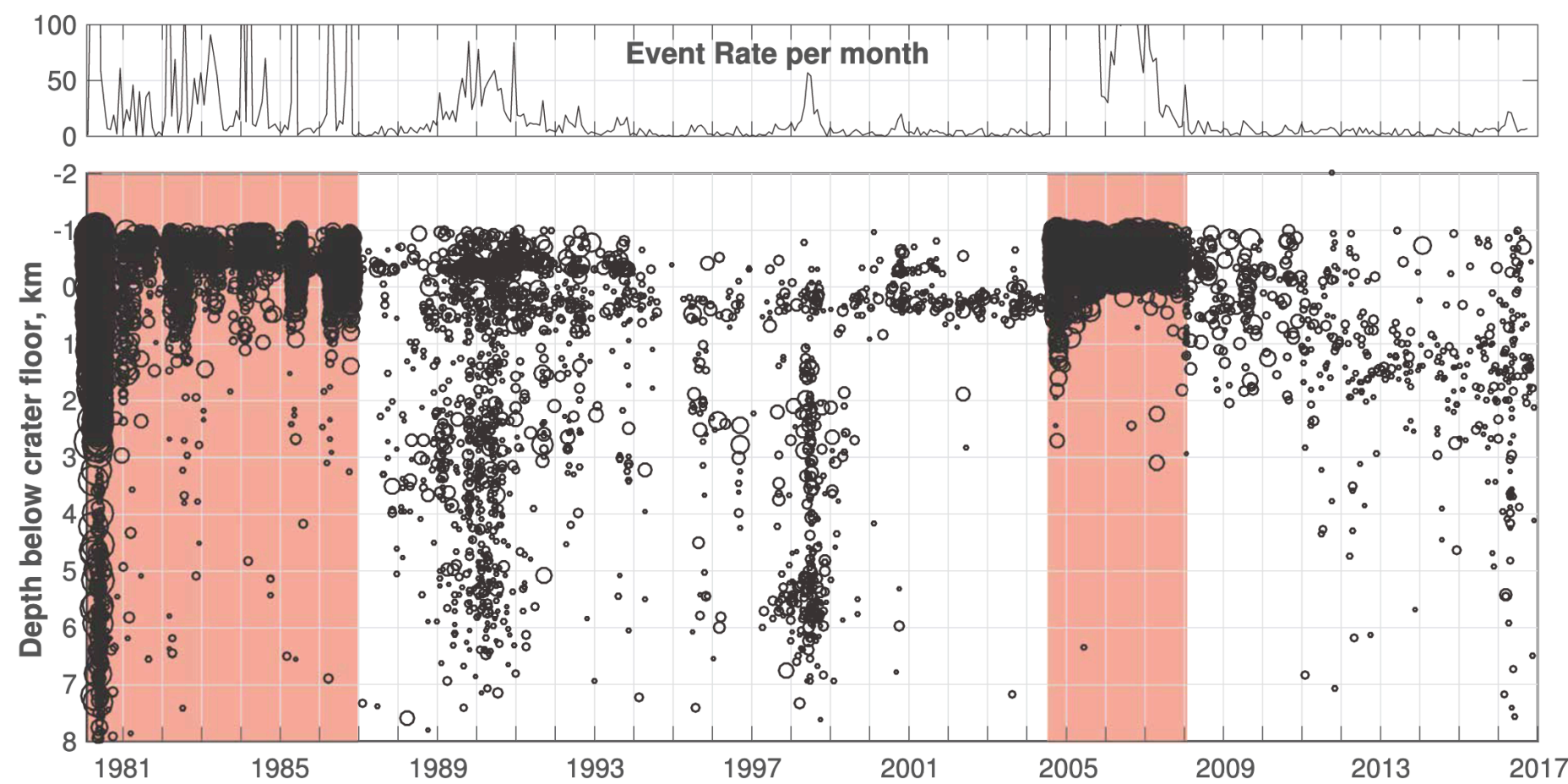
Fan et al., 2022

# EARTHQUAKES AND SEISMICITY

## VOLCANOES

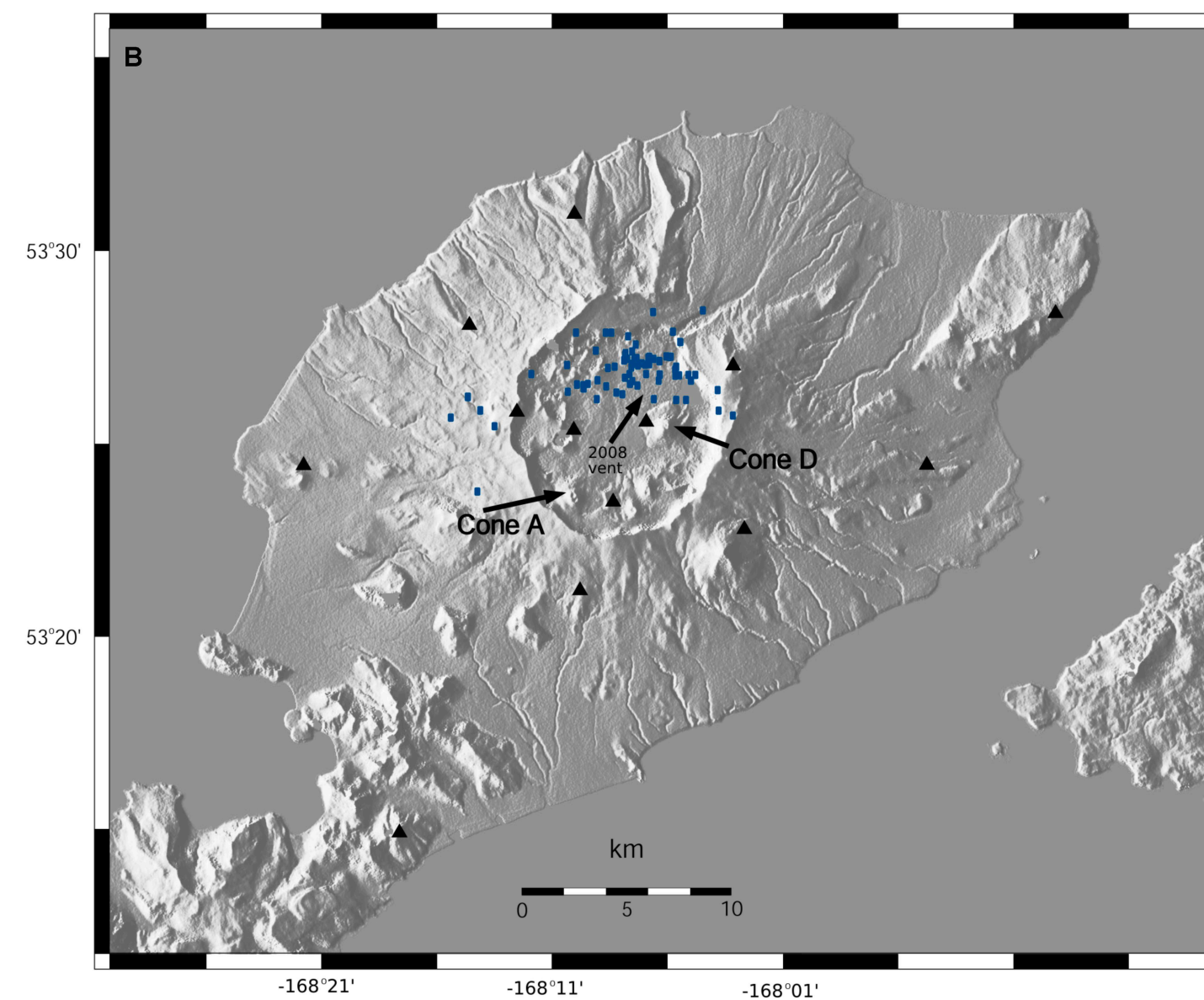
...For Forecasting

Seismicity in Time...

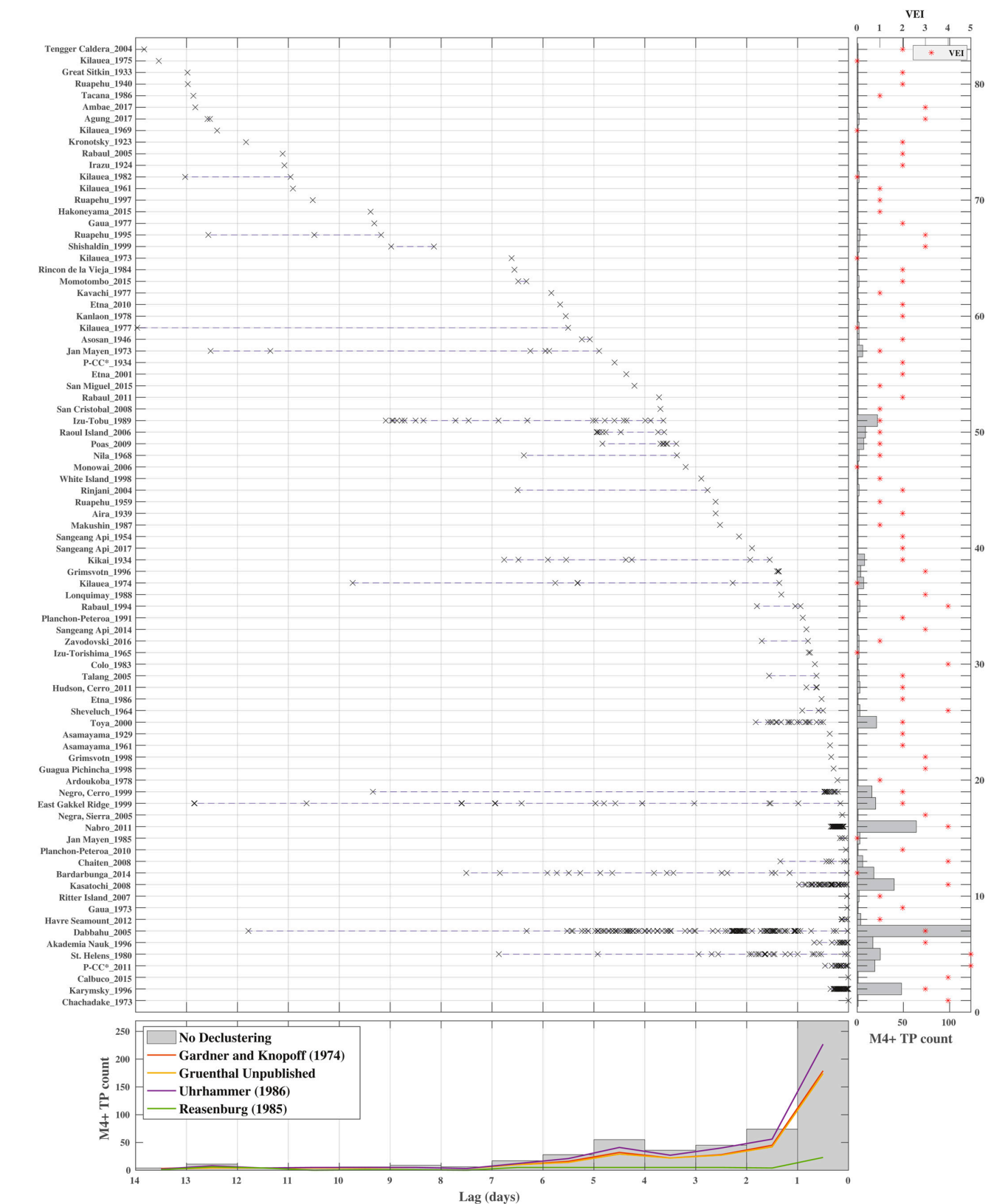


Thelen, USGS

...In Space...



Roman & Cashman, 2018



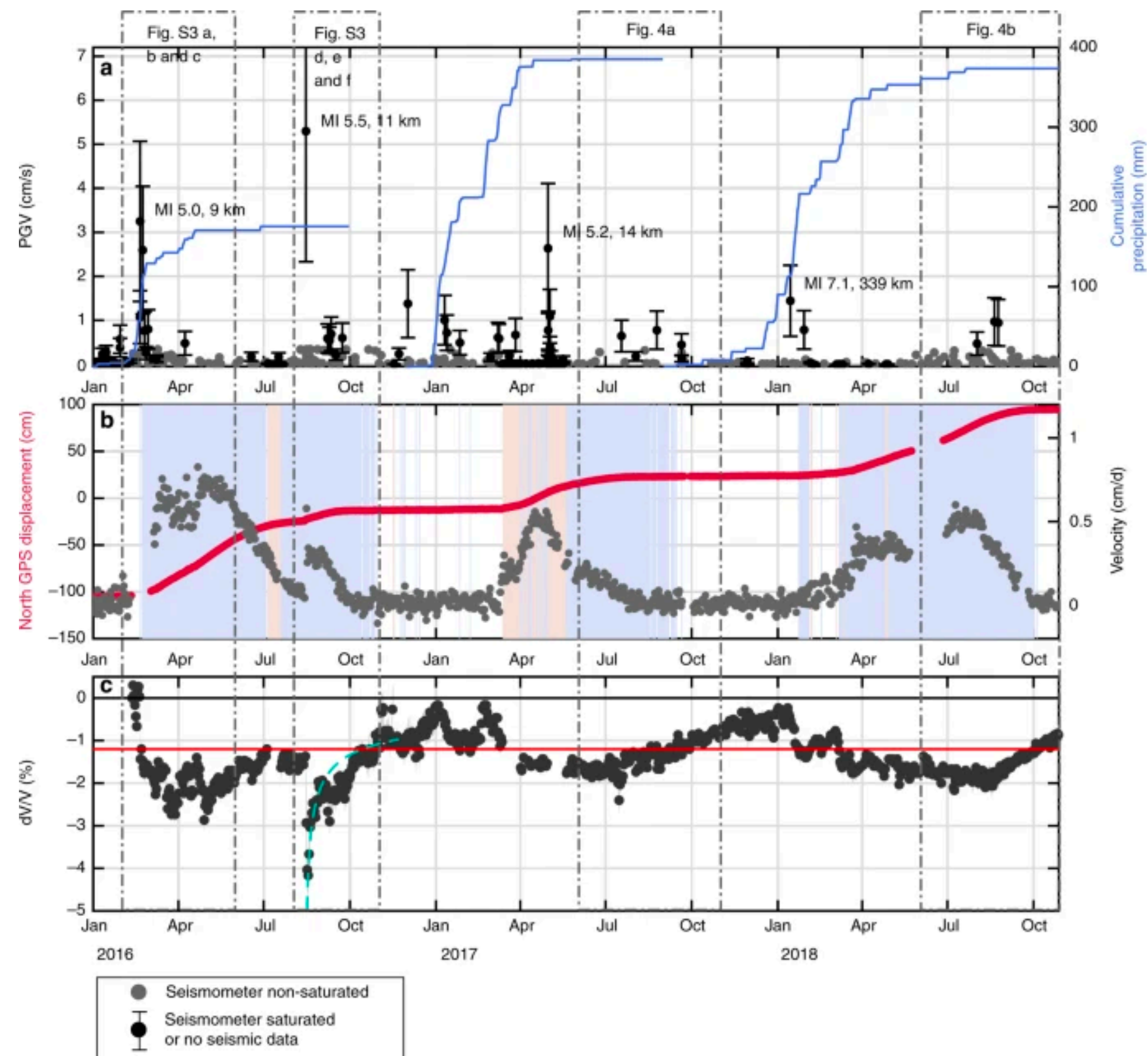
Pesicek et al., 2018



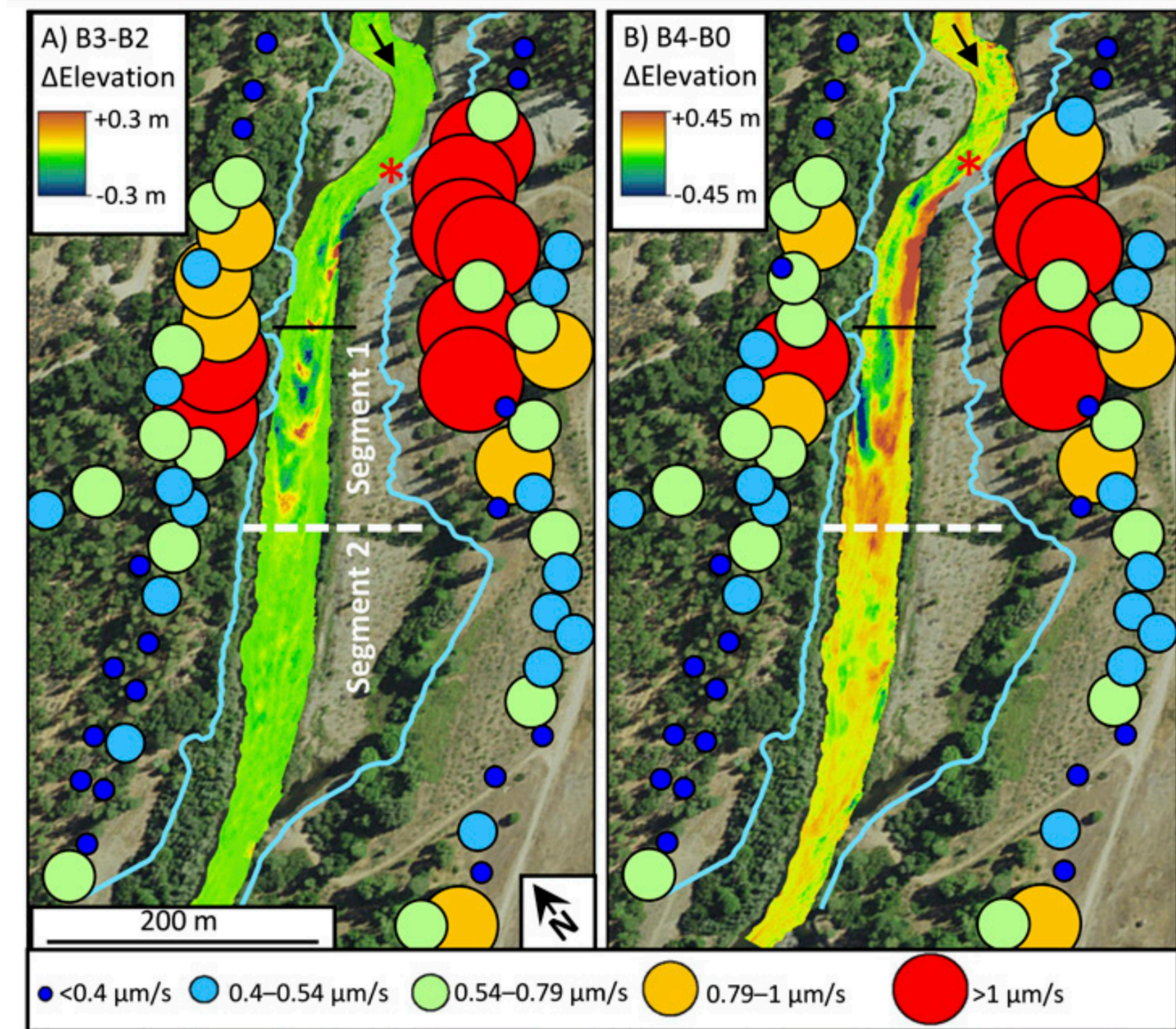
# EARTHQUAKES AND SEISMICITY

## SURFACE PROCESSES

### Seismicity, Ground Properties, Landslides

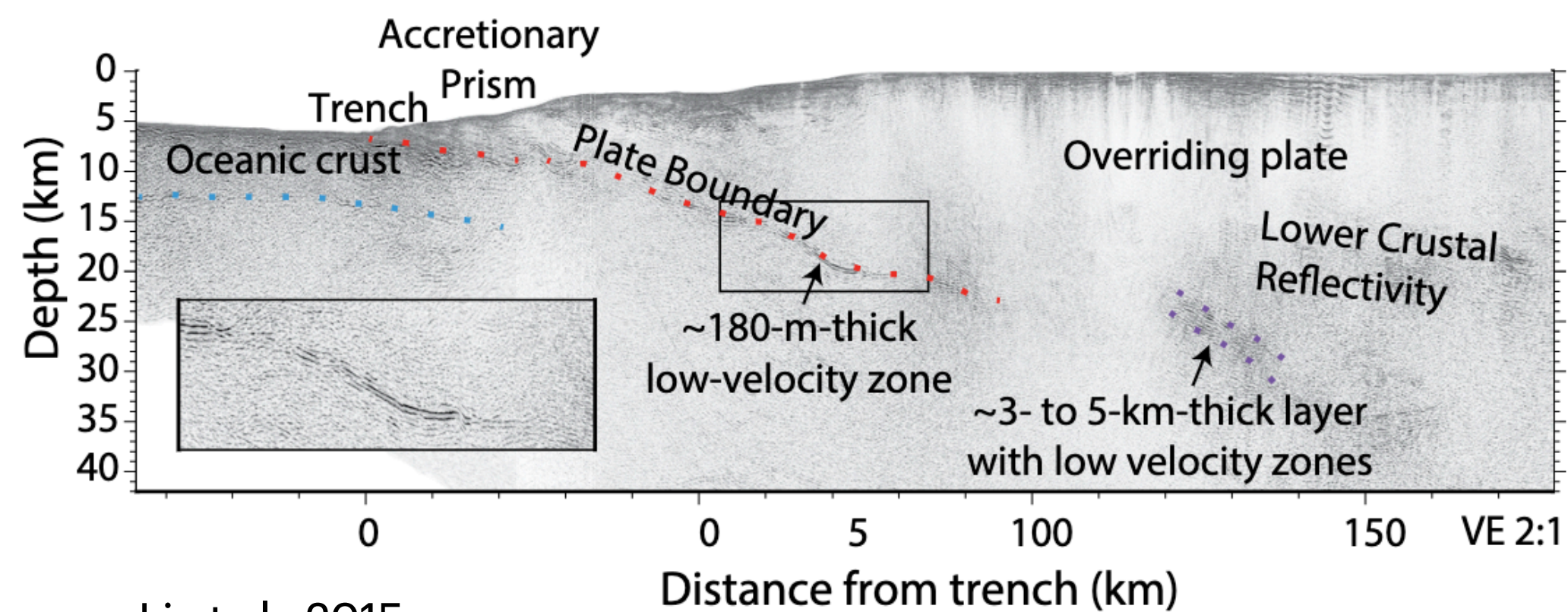


### Tool to Estimate Material Transport

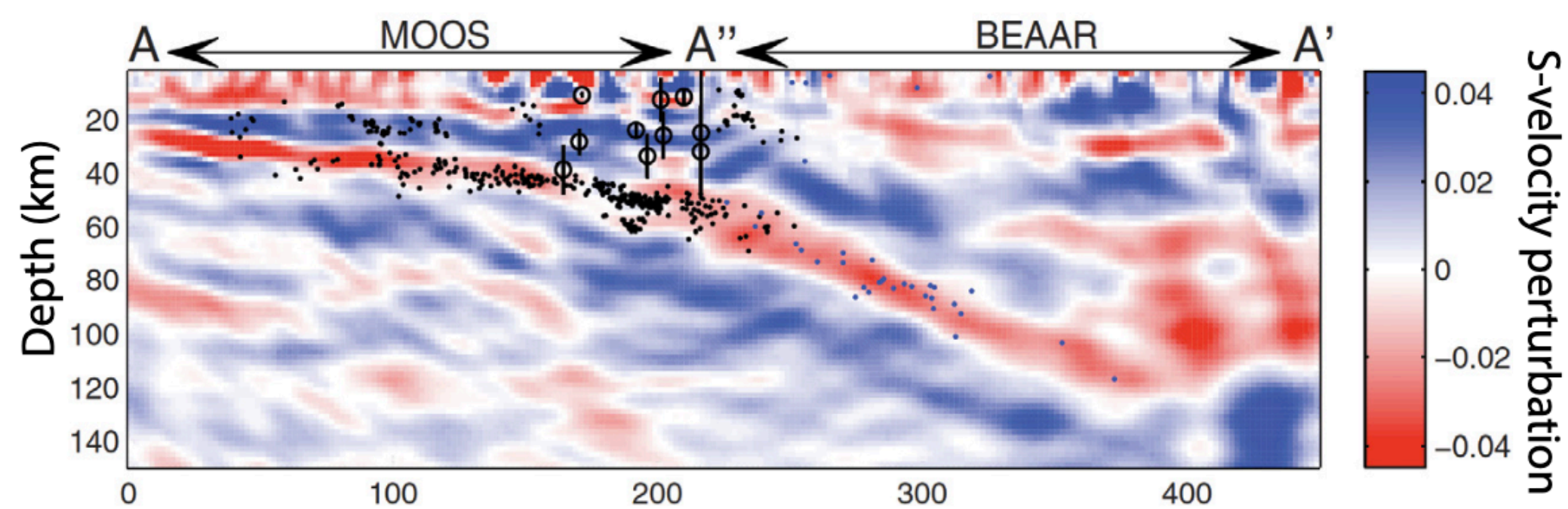


# SEISMIC IMAGING

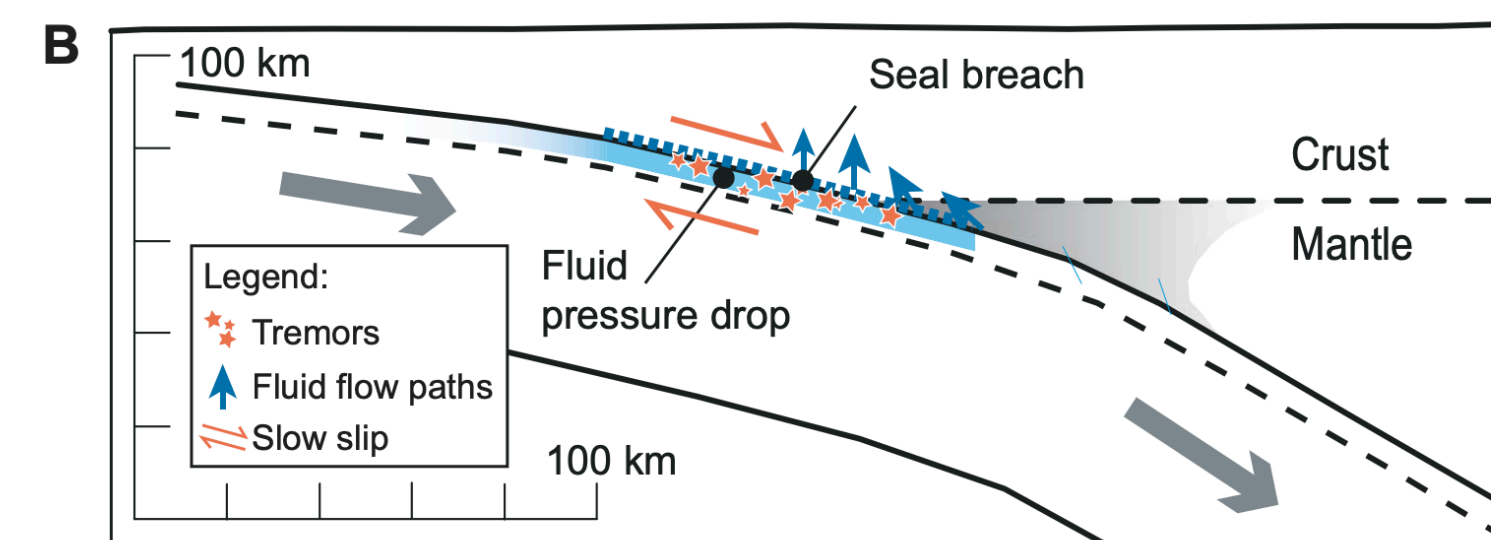
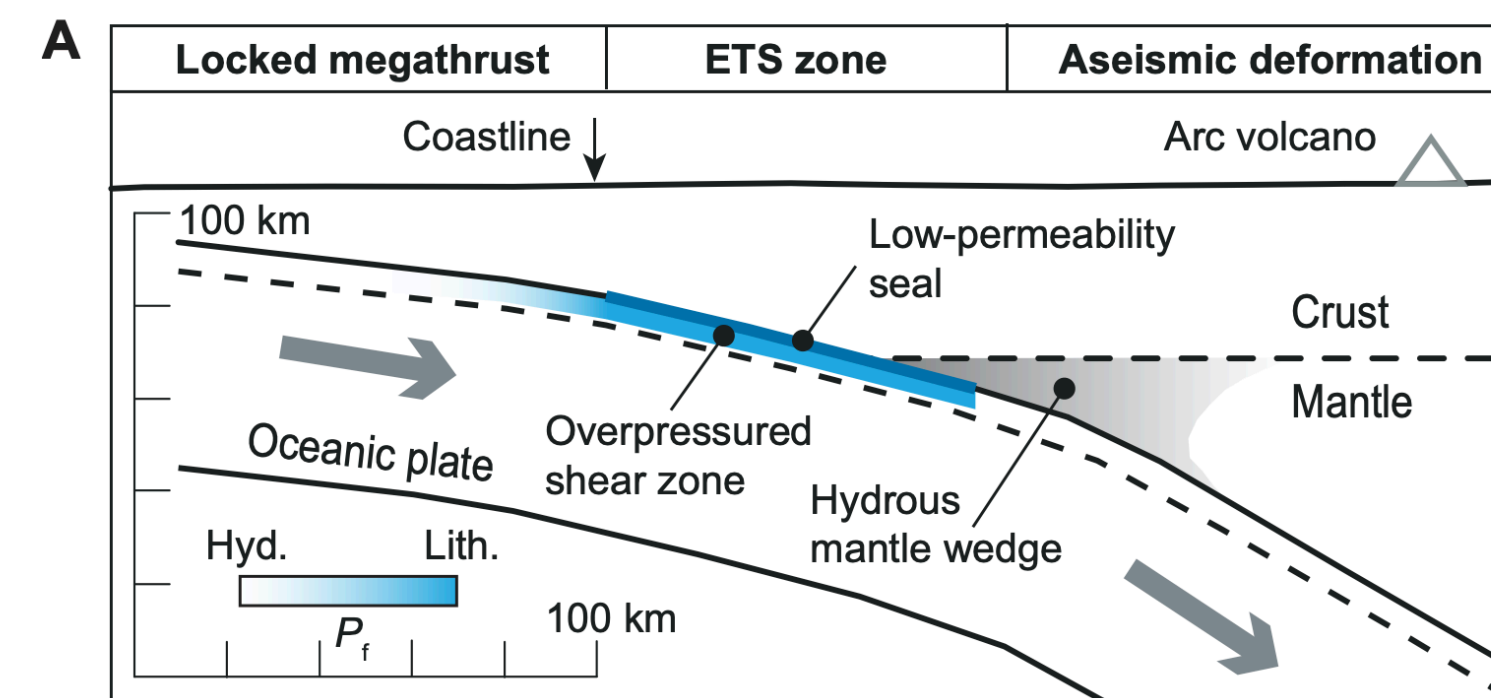
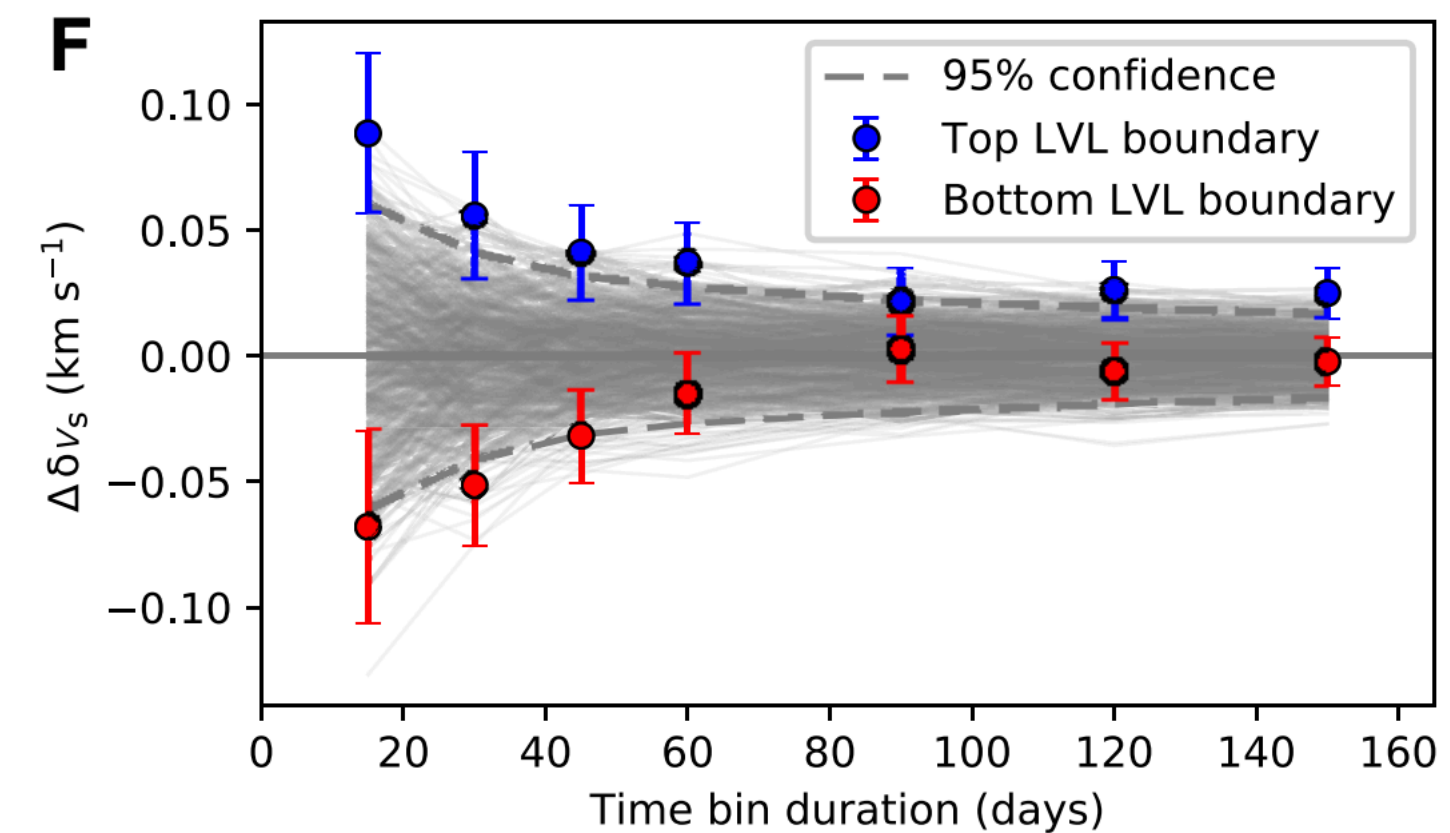
## FAULTS AND THE MEGATHRUST



Li et al., 2015



Kim et al., 2014

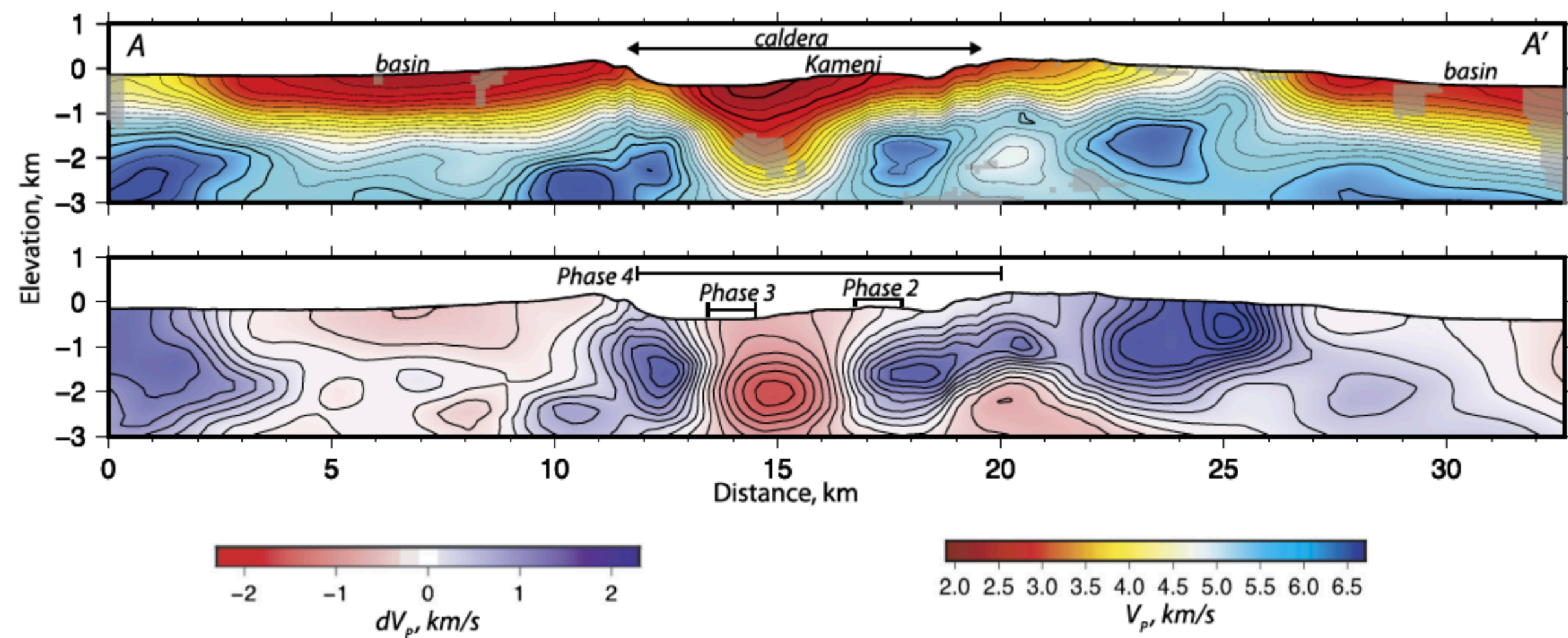


Gosselin et al., 2020

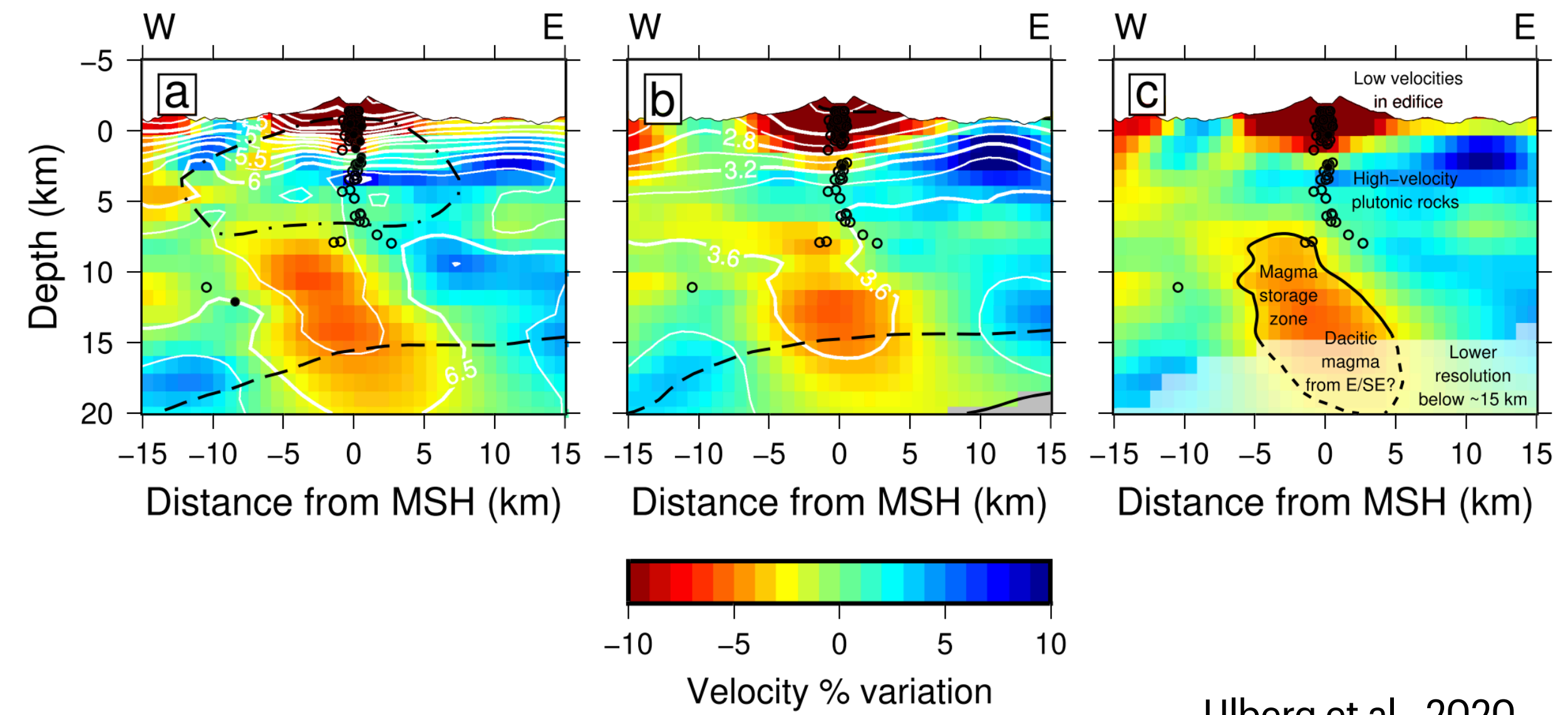
# SEISMIC IMAGING

## VOLCANOES

Santorini



Mt. St. Helens

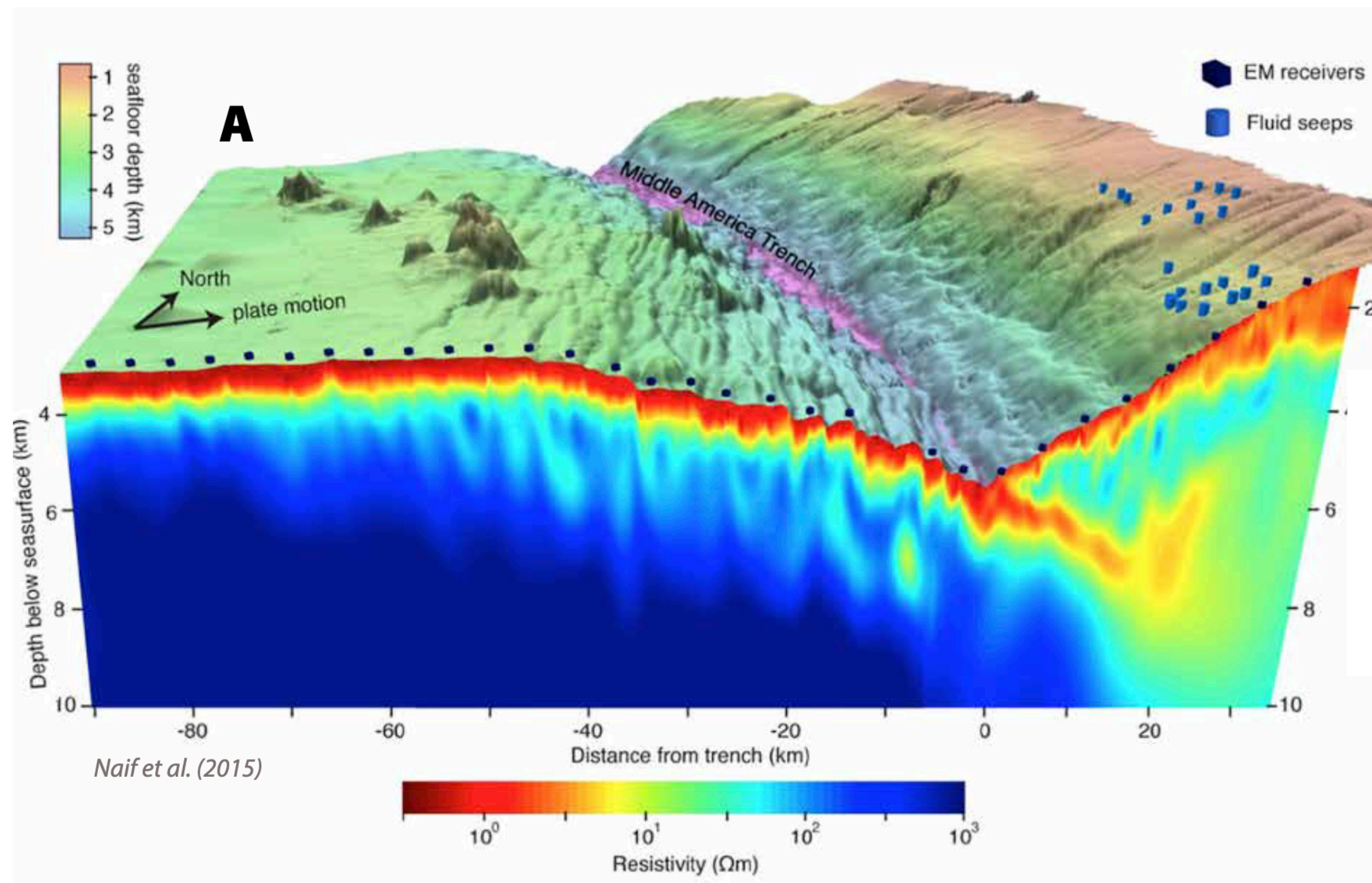


Hooft et al., 2019

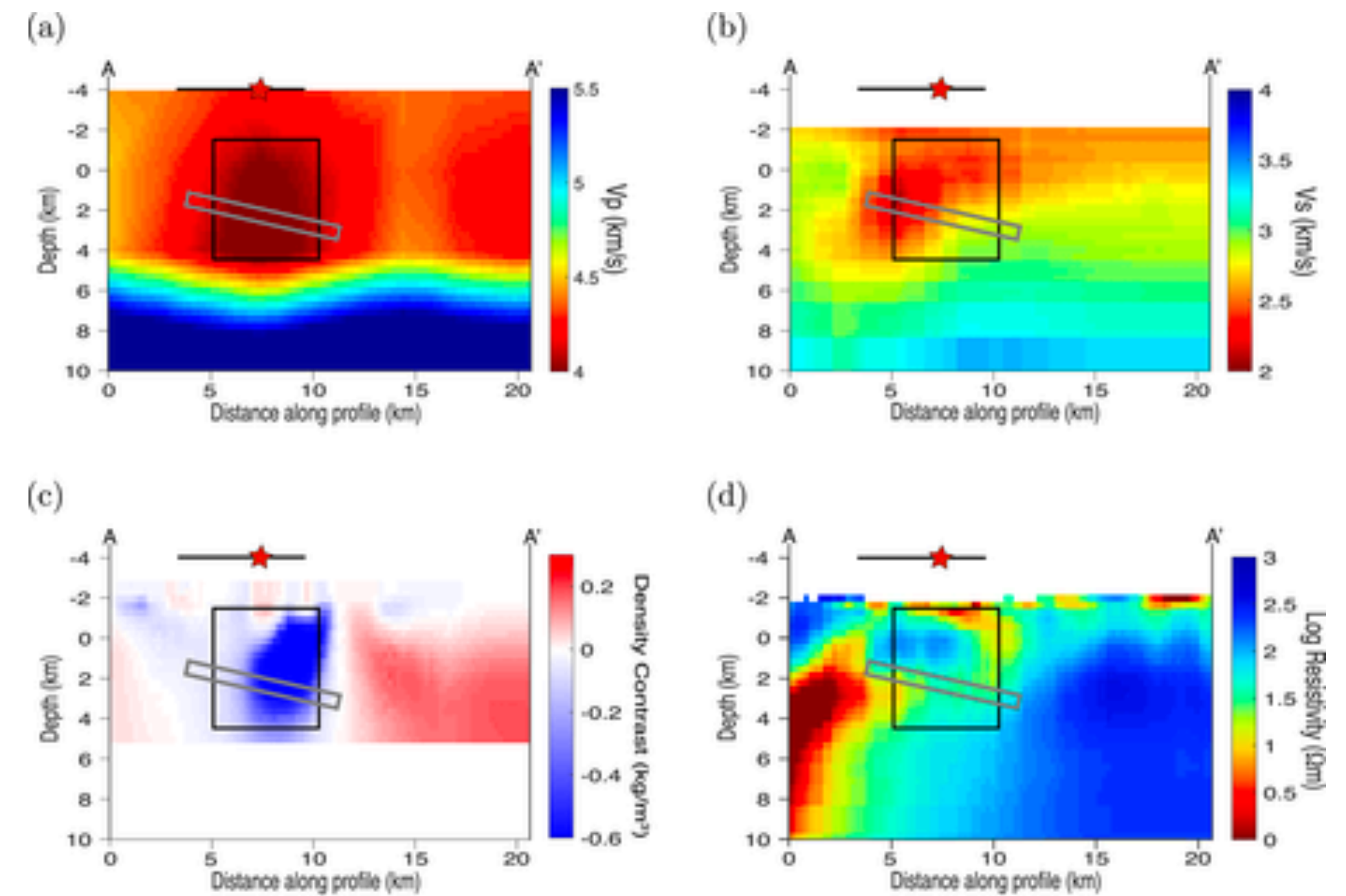
Ulberg et al., 2020

# SEISMIC IMAGING

## INTEGRATIONS & INTERPRETATIONS

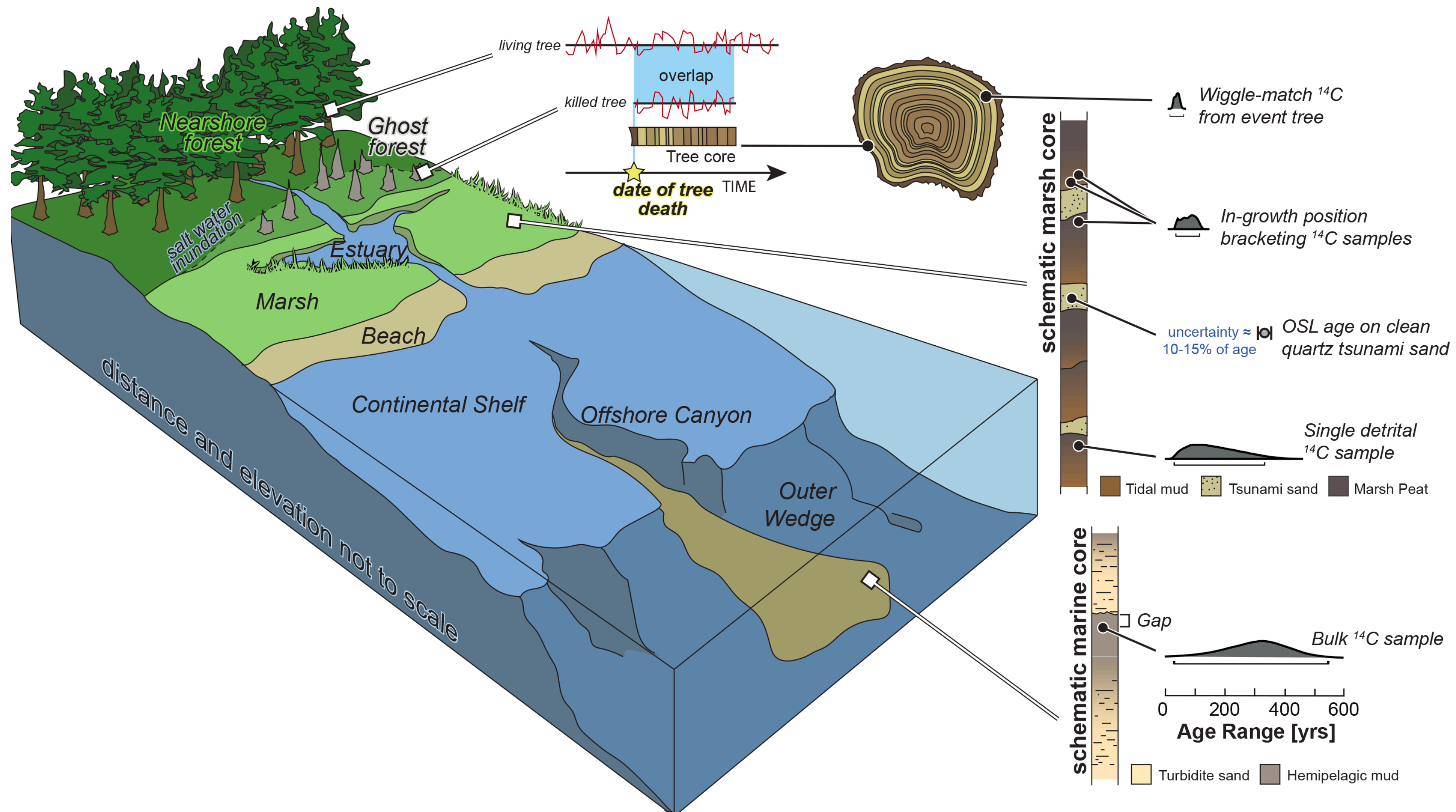


Naif et al., 2015



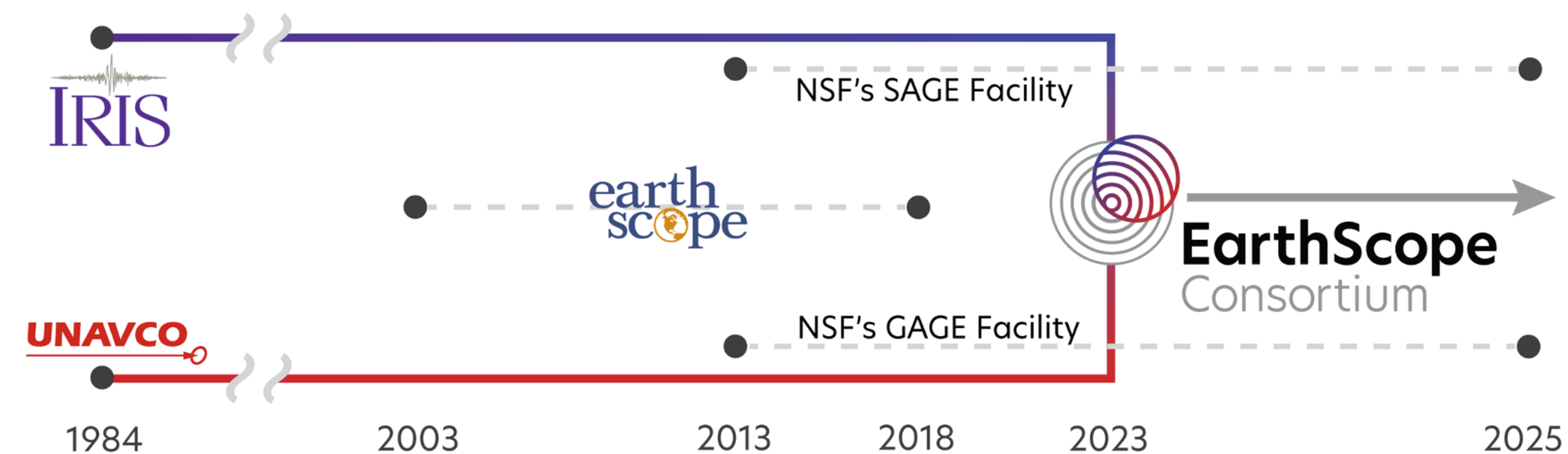
Bai et al., 2020

# PALEOSEISMOLOGY





# COMMUNITY RESOURCES



## Board of Directors



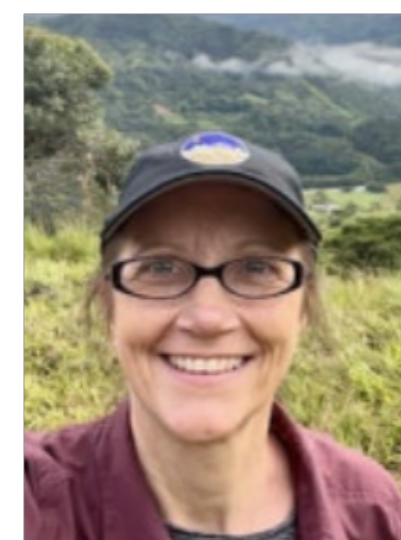
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C.U. Boulder



Tonie van Dam  
U. Utah



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Carnegie Science



Kristel Charad  
IPGP



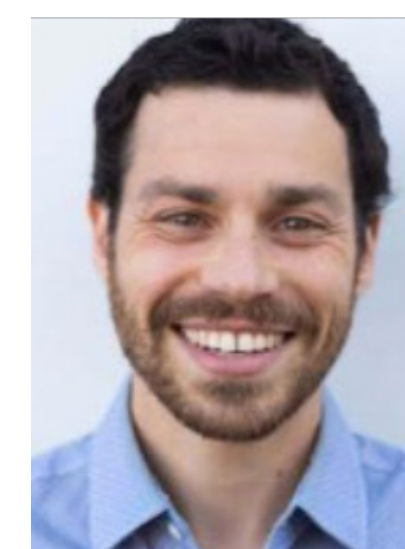
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UC Riverside



Zach Eilon  
UCSB



Beatrice Magnani  
SMU



Brandon Schmandt  
UNM



# EarthScope @ AGU!

Consortium



Please join us for the

## EarthScope Consortium Reception

- When.** Monday, December 12, 6:30-8:00 pm
- Where.** Hyatt Regency McCormick Place  
Prairie Room (2<sup>nd</sup> floor)  
2233 S Martin Luther King Dr, Chicago, IL 60616
- What.** Remarks at 7:00 pm followed by a raffle of EarthScope Consortium gear

Come visit the  
EarthScope Booth

Exhibit Hall Booth  
# 1413





# Ocean Bottom Seismometer Instrument Center (OBSIC)

## Welcome to Ocean Bottom Seismic Instrument Center

REQUEST INSTRUMENTATION

### Operations Subcommittee



Jim Gaherty  
NAU (Chair)



Kasey Aderhold  
IRIS



Helen Janiszewski  
U. Hawai'i



Lindsay Worthington  
U. New Mexico



Emilie Hooft  
U. Oregon



Ross Parnell-Turner  
SIO



Susan Schwartz  
UCSC