Repeating short- and long-term slow slip events with deep tremor activity around Bungo channel region, southwest Japan

Observational results of Crustal deformation

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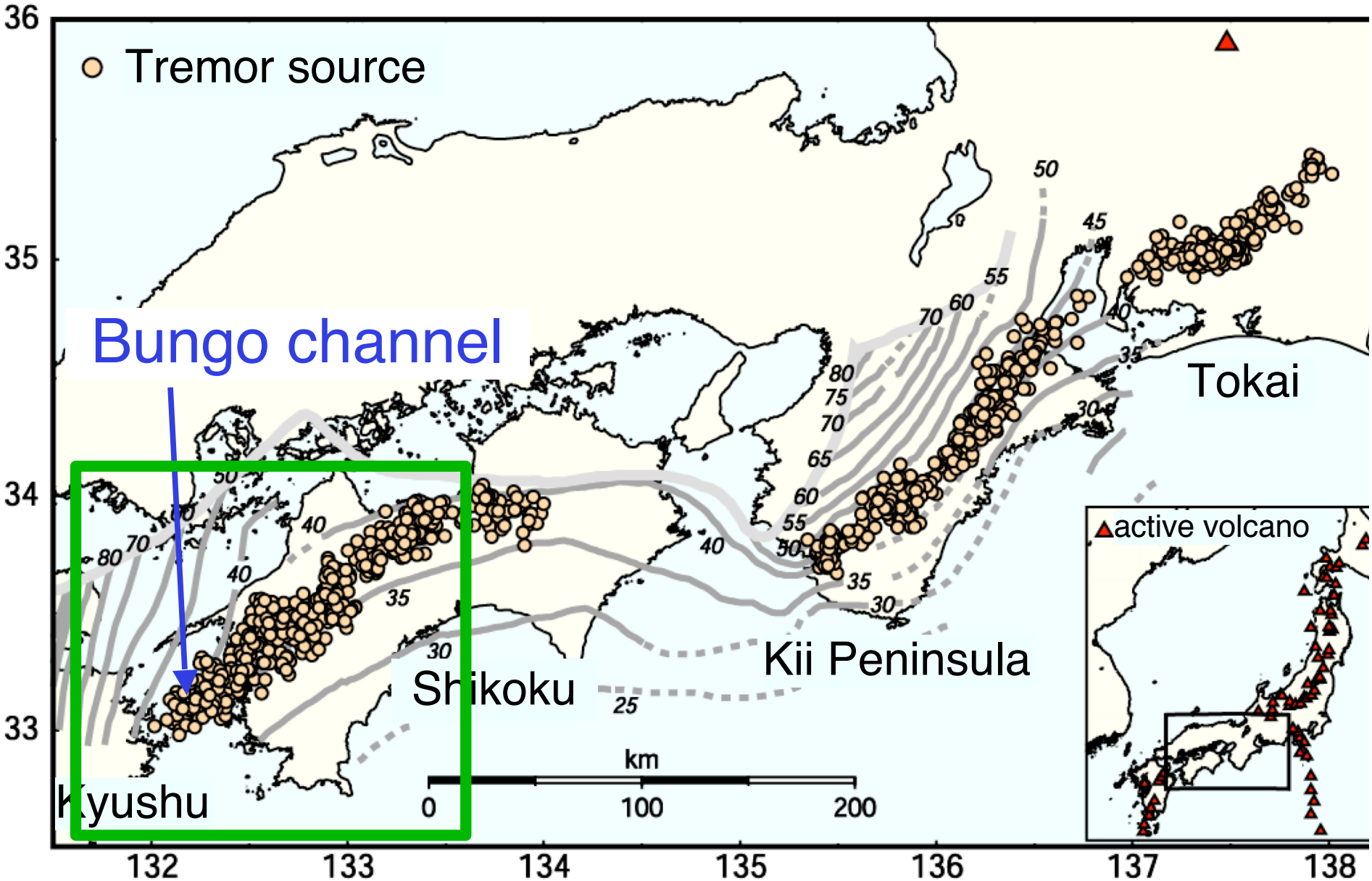
Outline

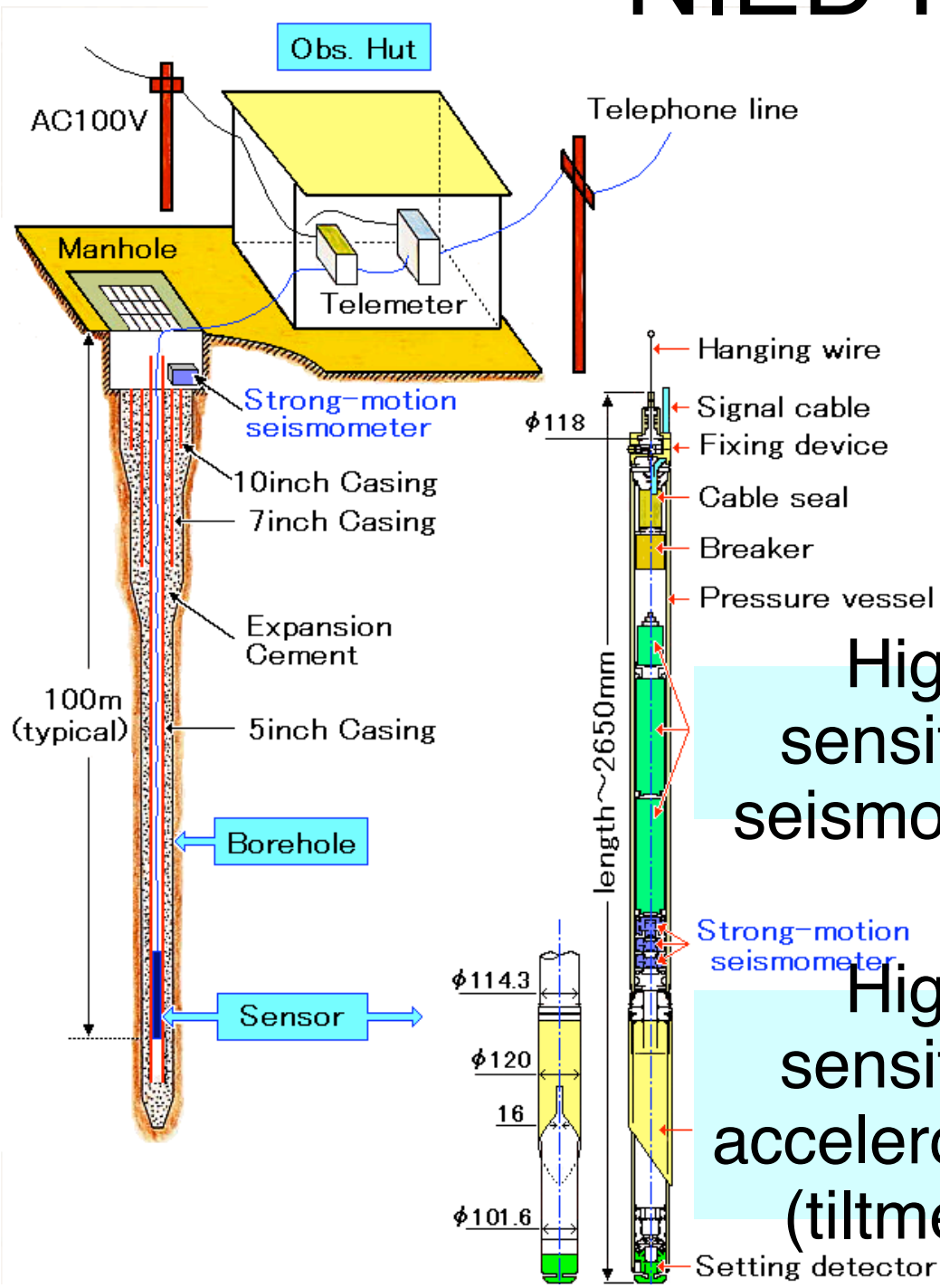
- Detection of crustal deformation due to a slow slip event with tremor (short-term / long-term) by tiltmeter and GPS
- Estimation of the slow slip fault parameters
- Discussion about:
  - Spatial and temporal relation between the slow slip event and the tremor activity
  - Relation between the short- and long-term slow slip events

Distribution of tremor sources



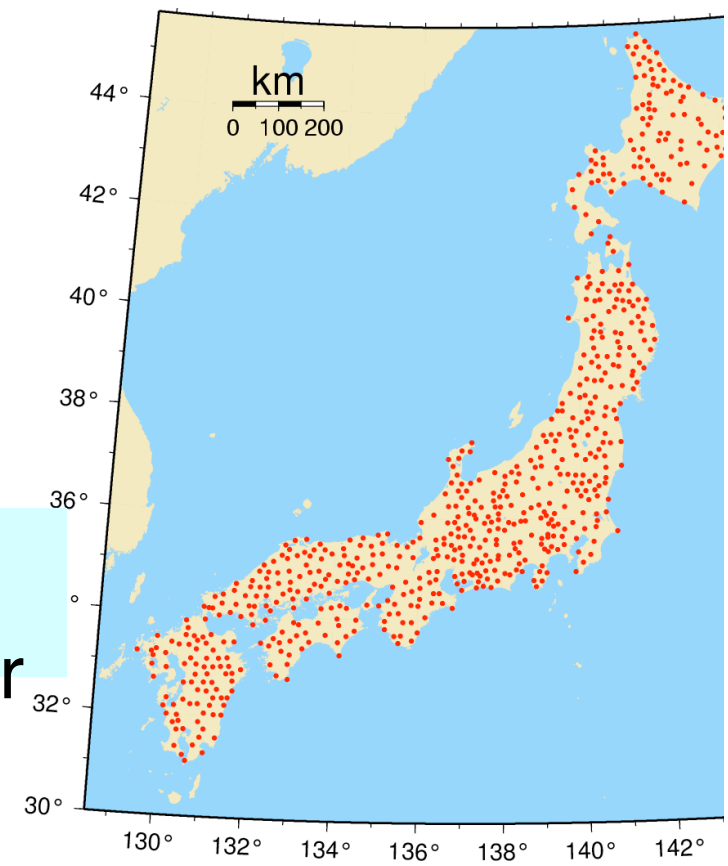
Obara (2002

NIED Hi-net



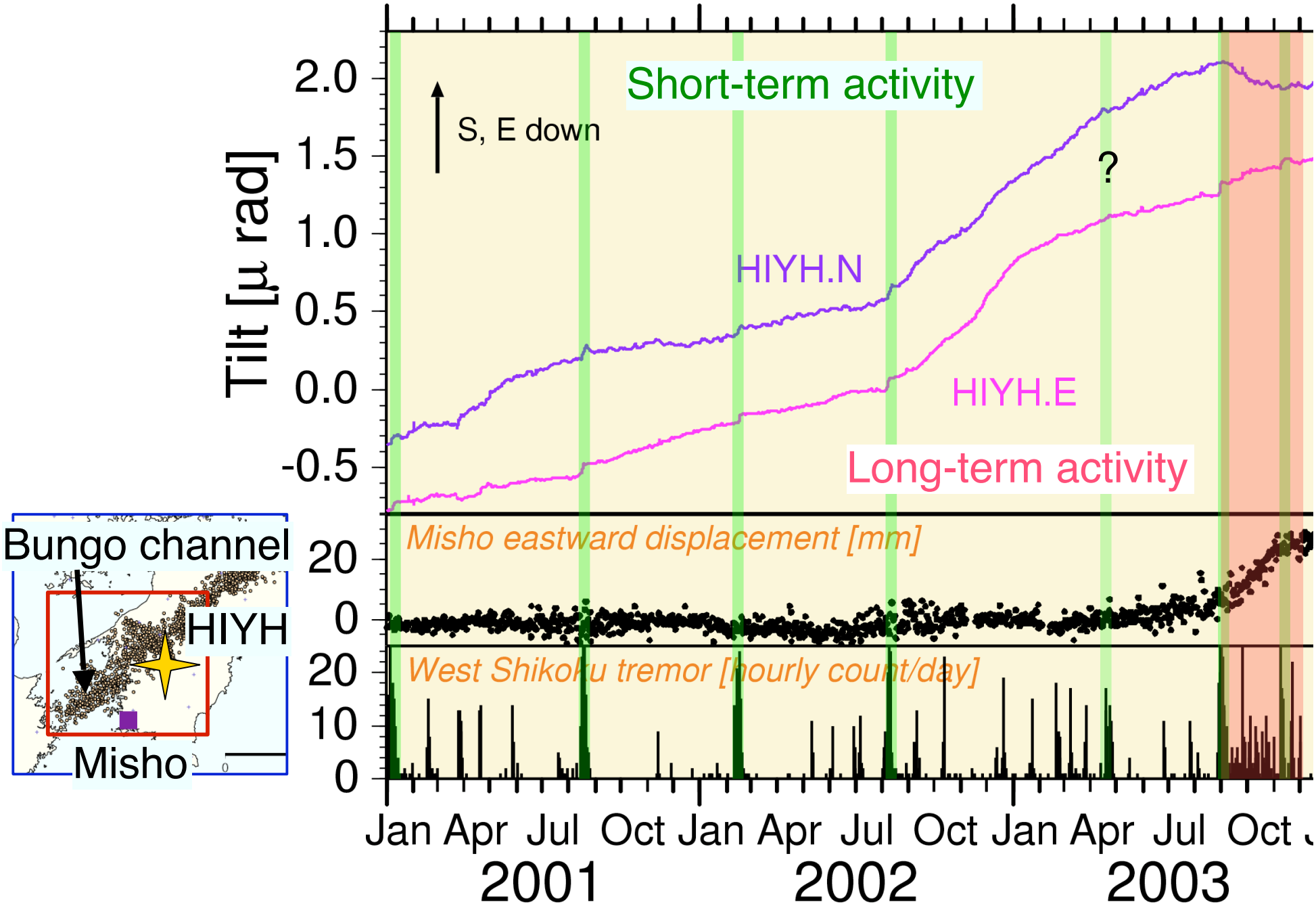
High-sensitivity seismometer

High-sensitivity accelerometer (tiltmeter)

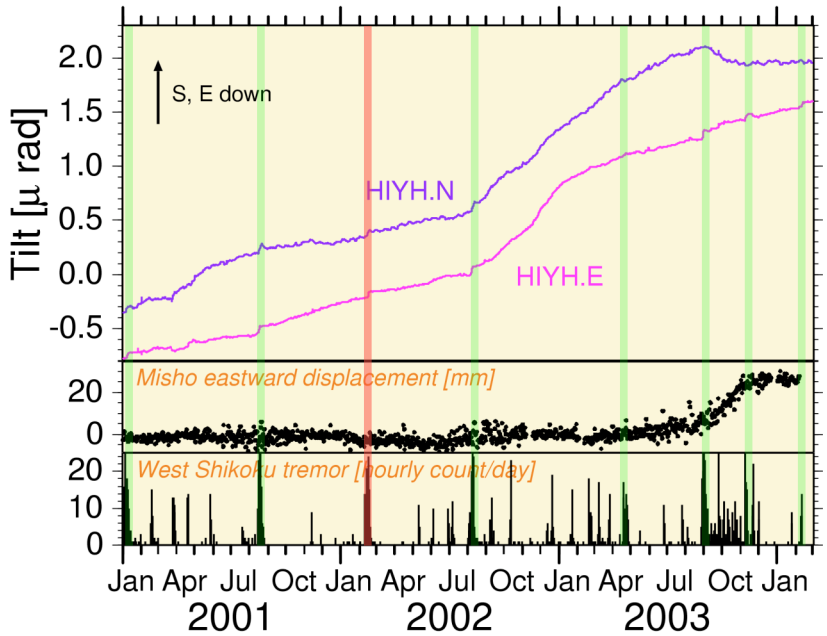


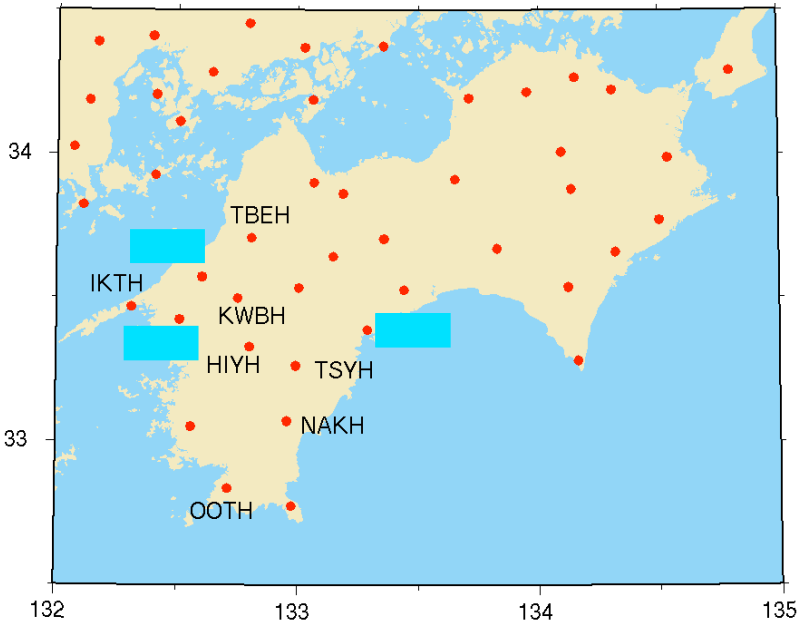
Over 600 station

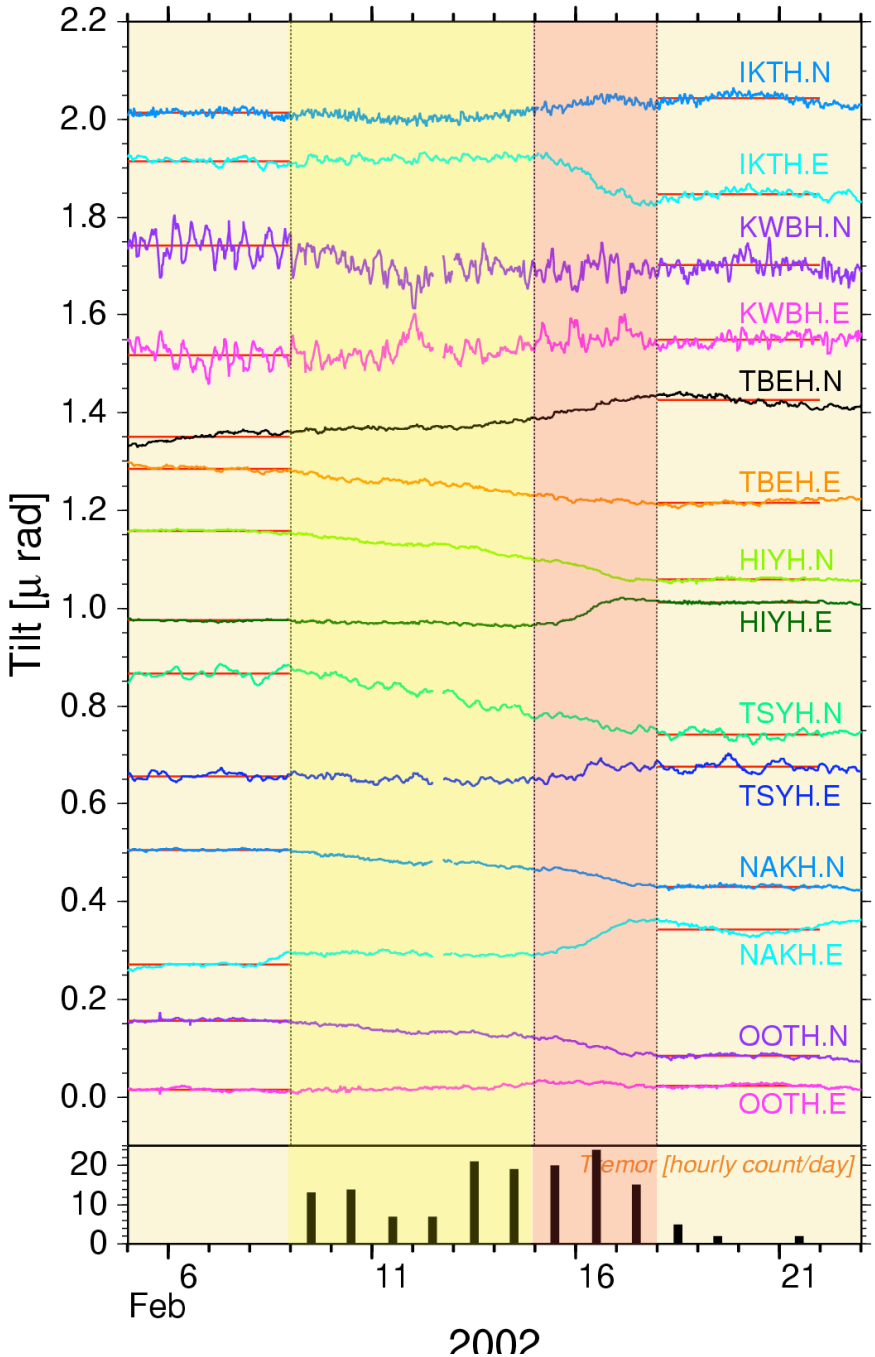
Tilt, GPS, and tremor in west Shikoku



Feb. 2002 episode: Tilt time series

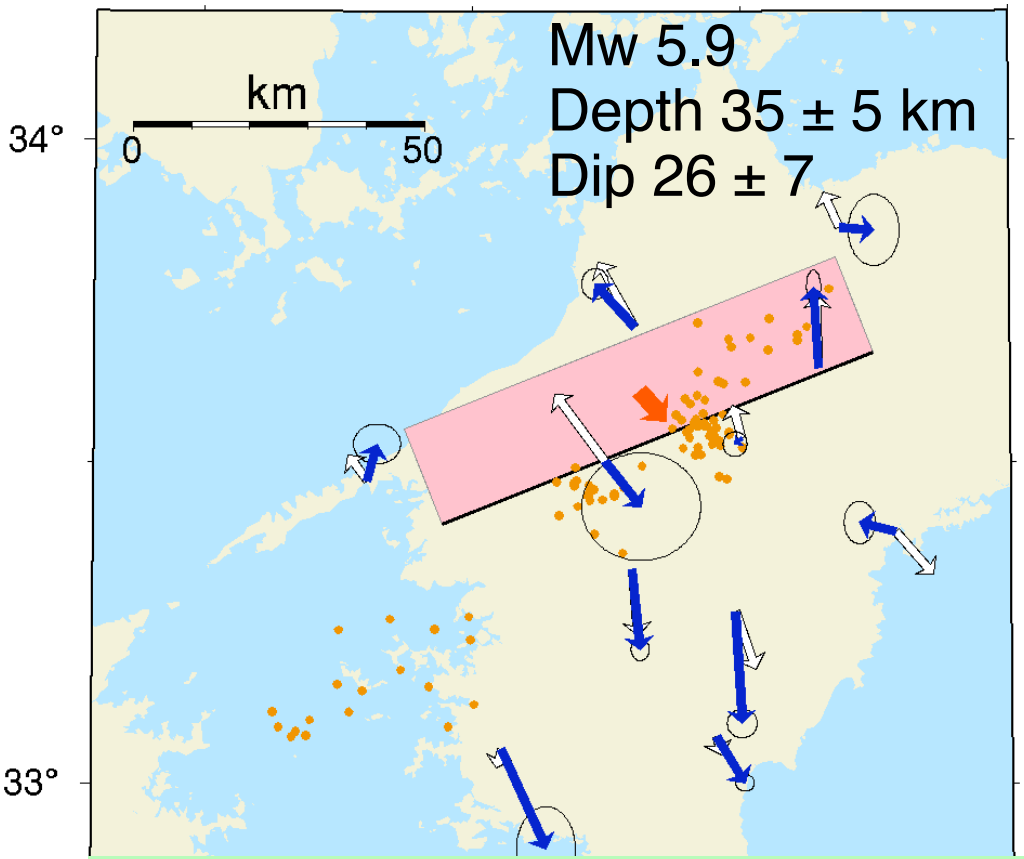




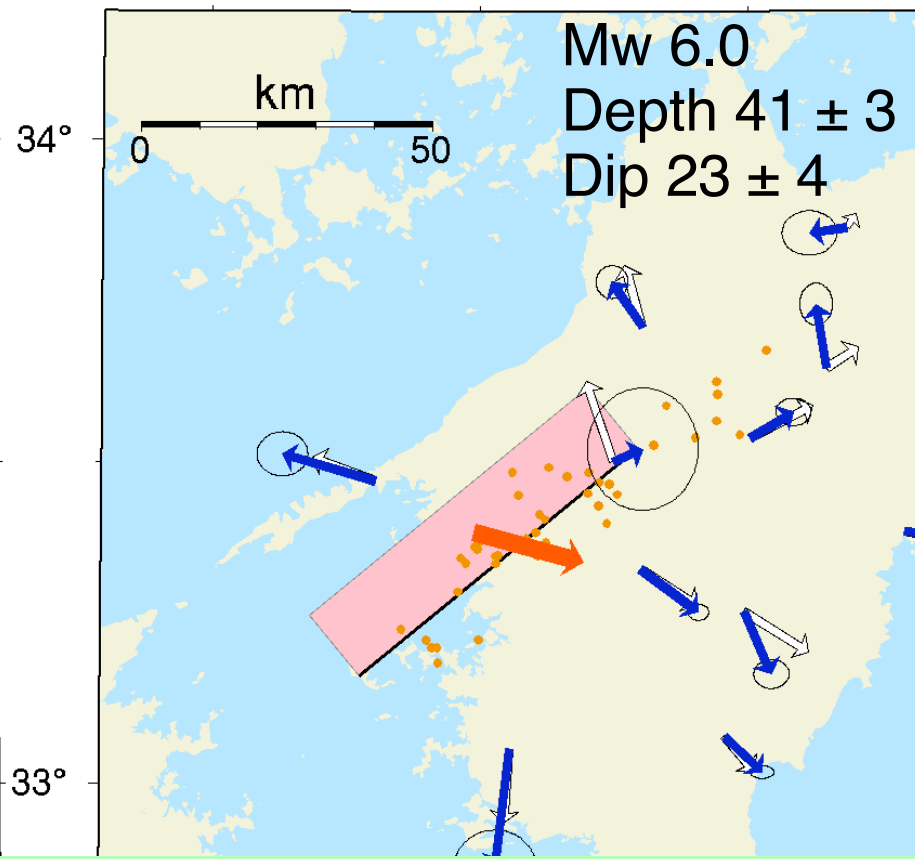


Feb. 2002 episode: Fault models

Feb. 9 – Feb. 15

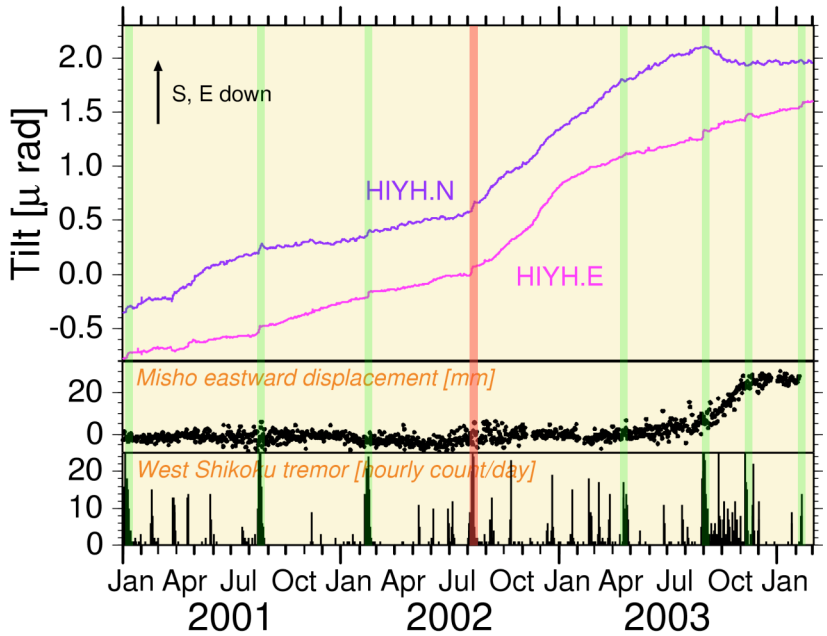


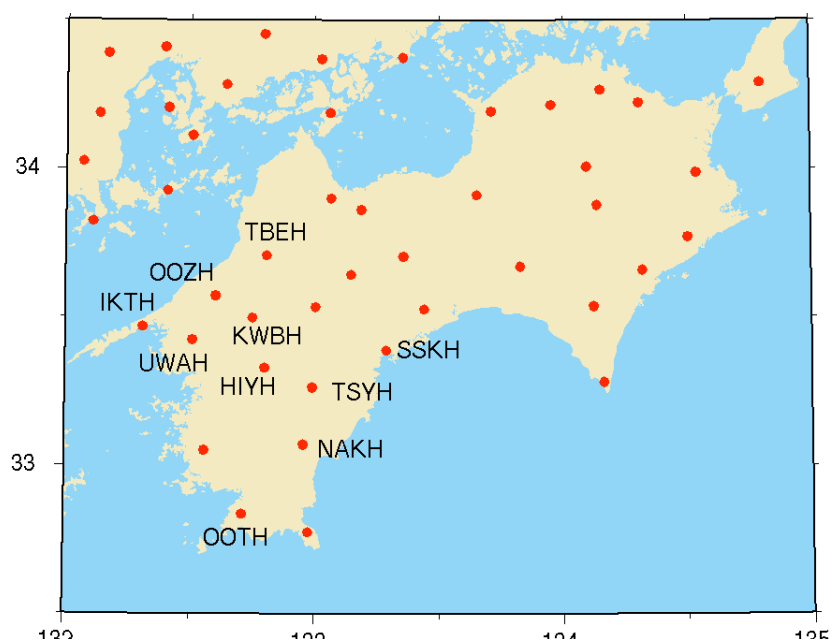
Feb. 15 – Feb. 17

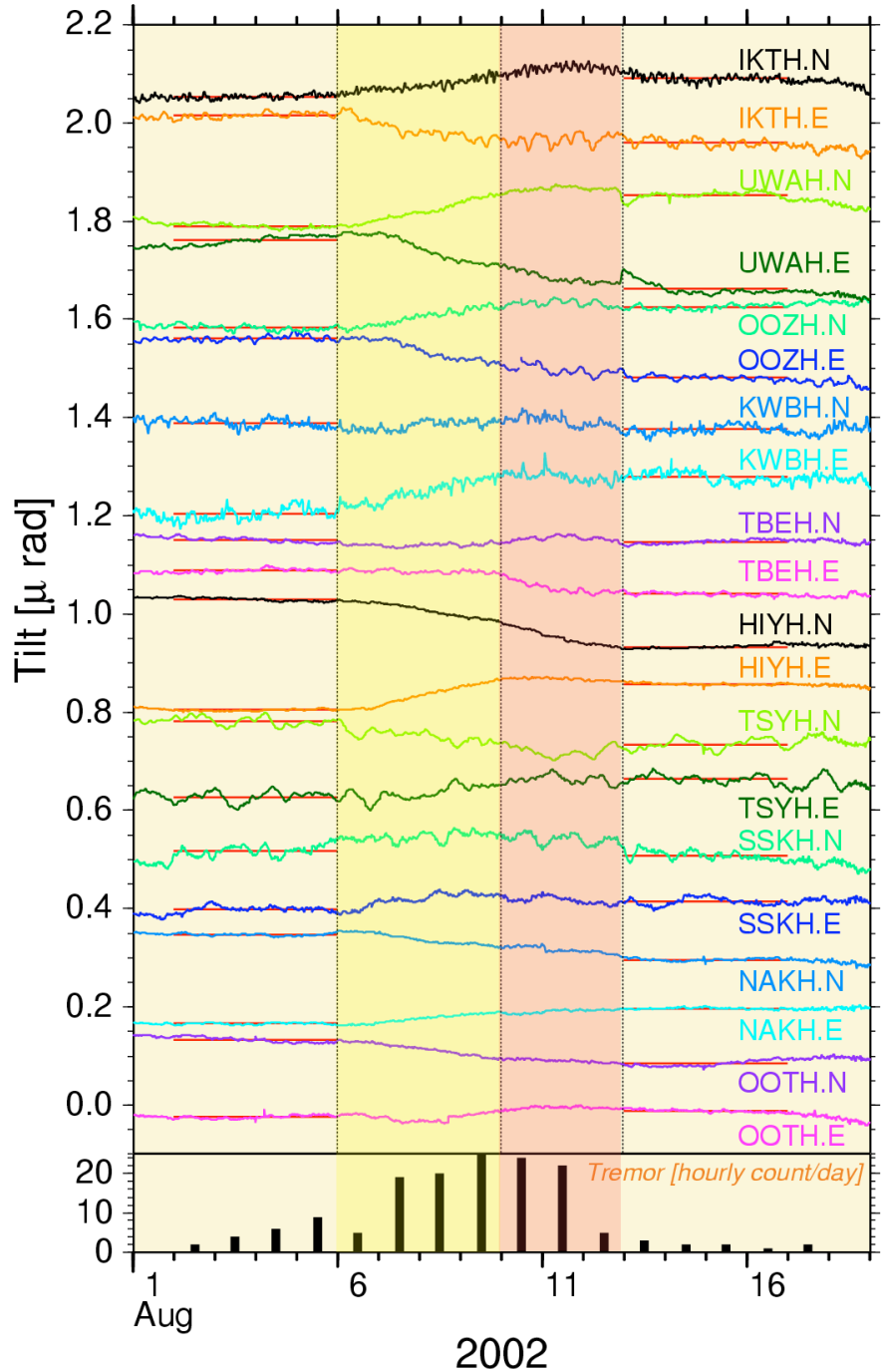


- Location of slow slip fault correlates with tremor sourc
- Mw ~ 6.1
- Source area migrates from NE to SW

Aug. 2002 episode

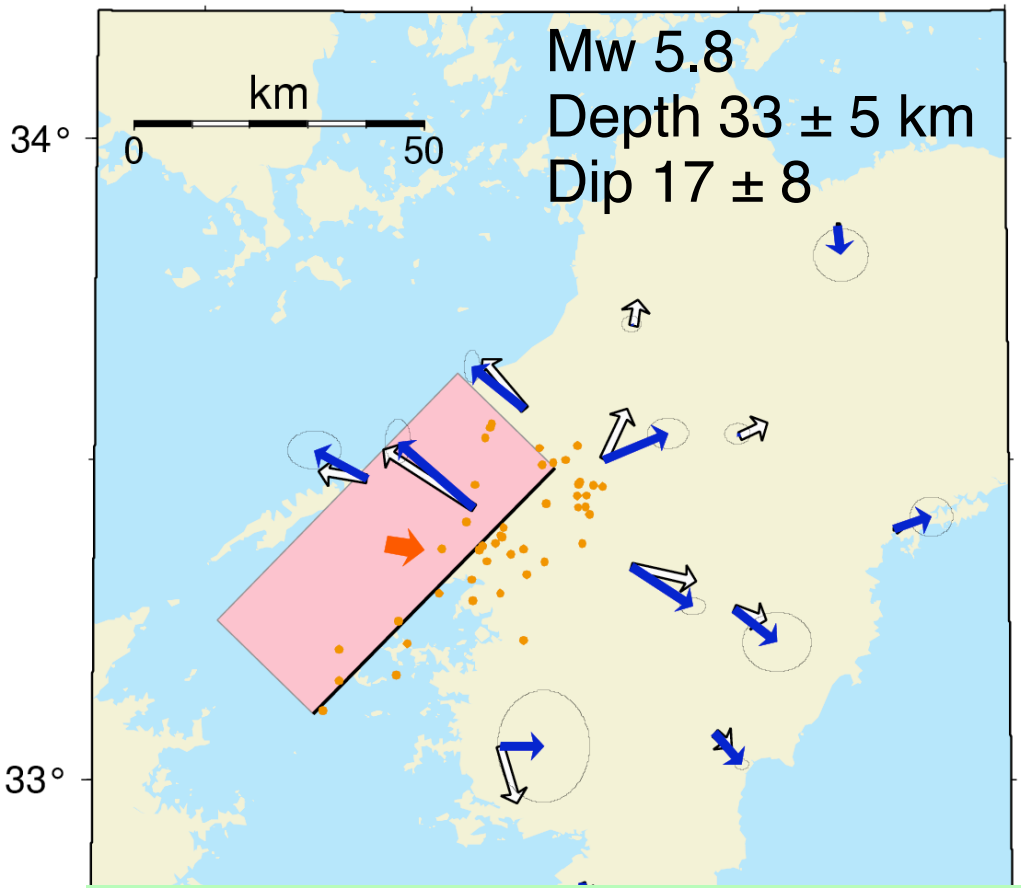




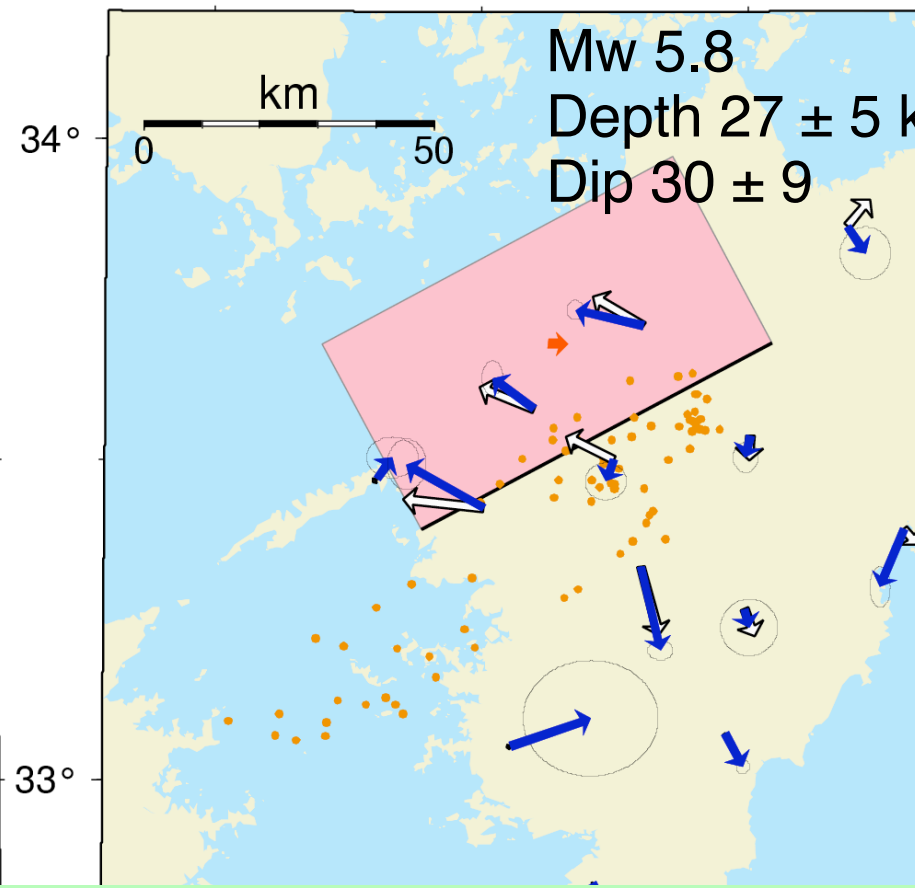


Aug. 2002 episode: fault models

Aug. 6 – Aug. 9



Aug. 9 – Aug. 12



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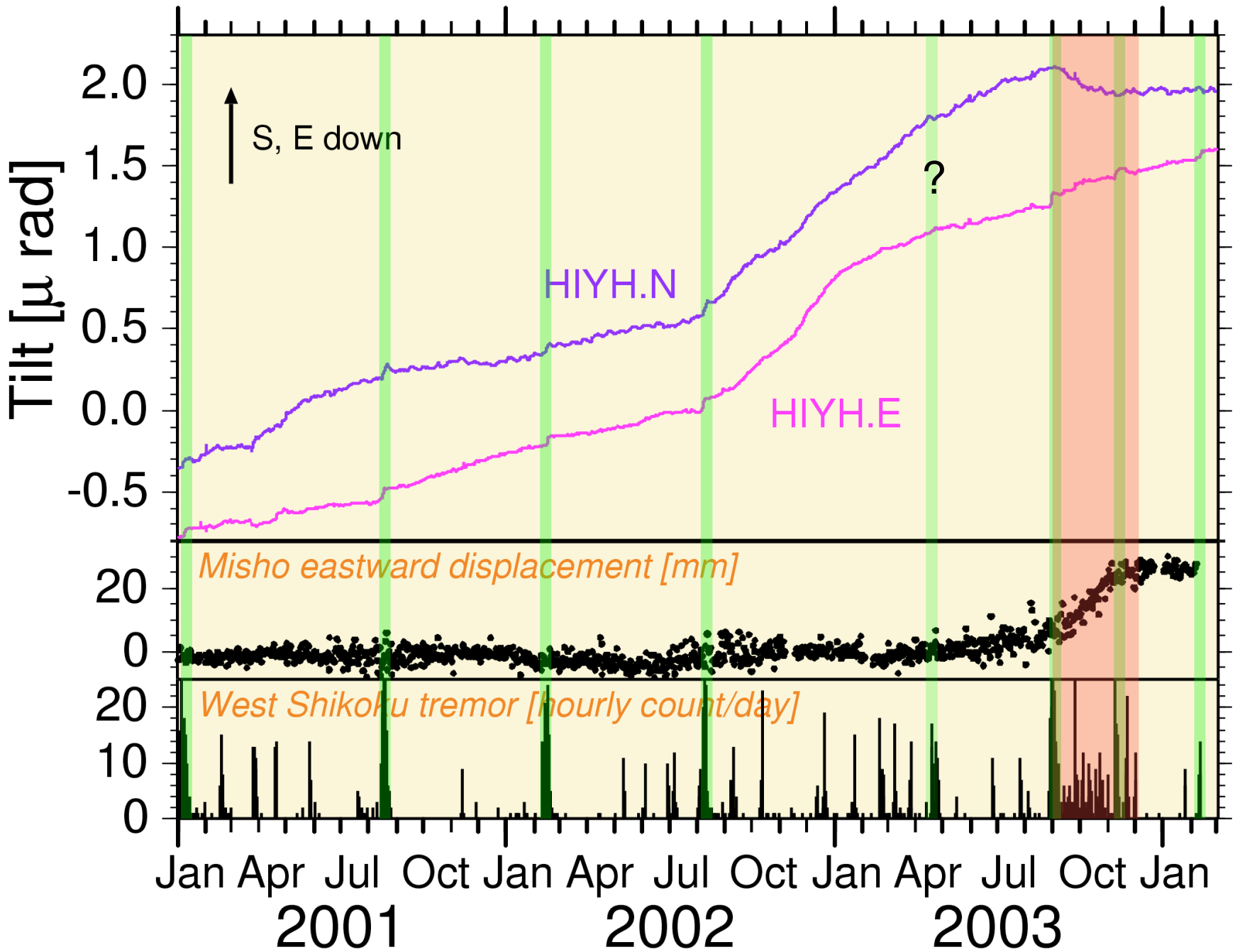
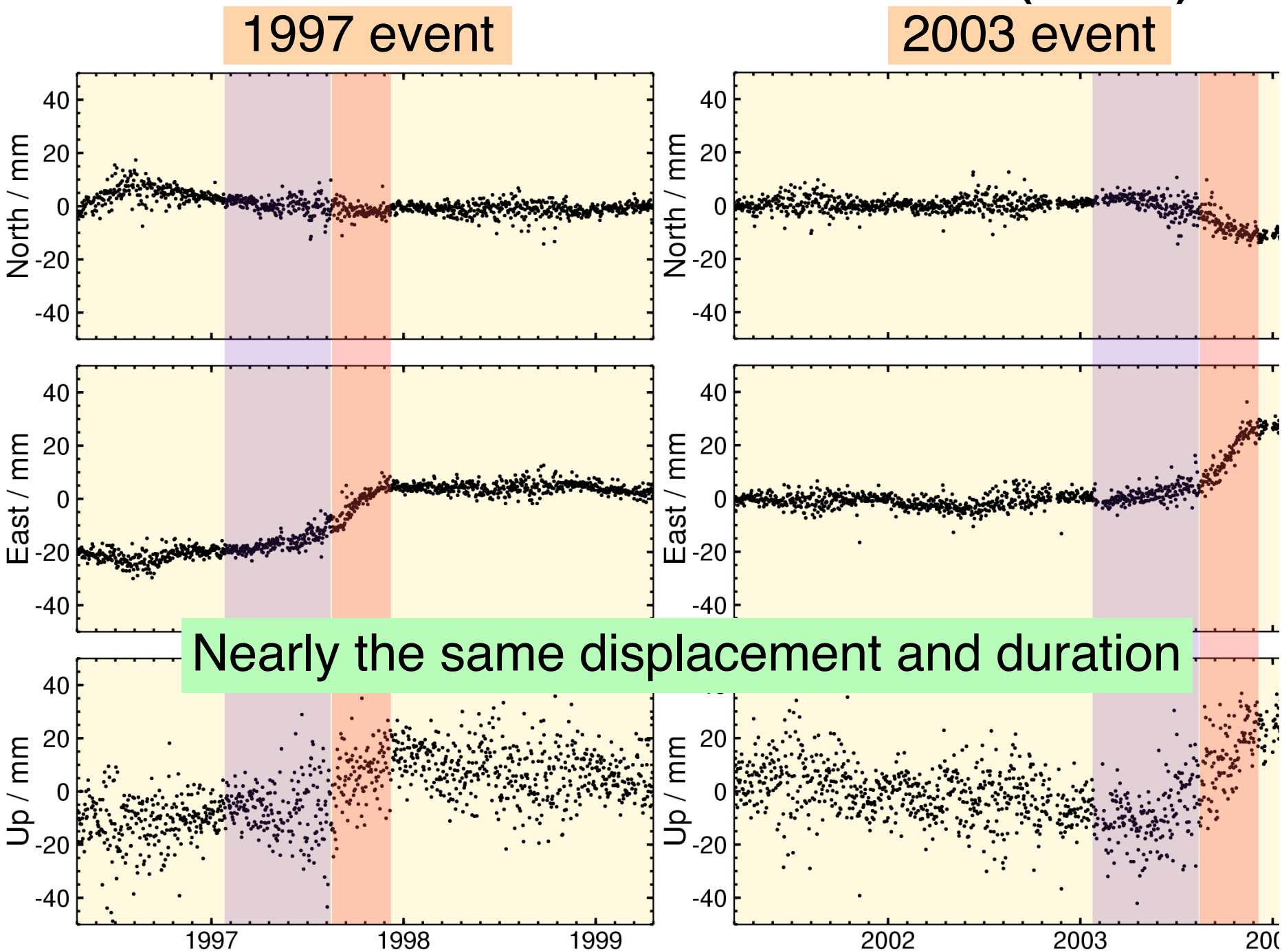
Long-term slow slip: Bungo Channe



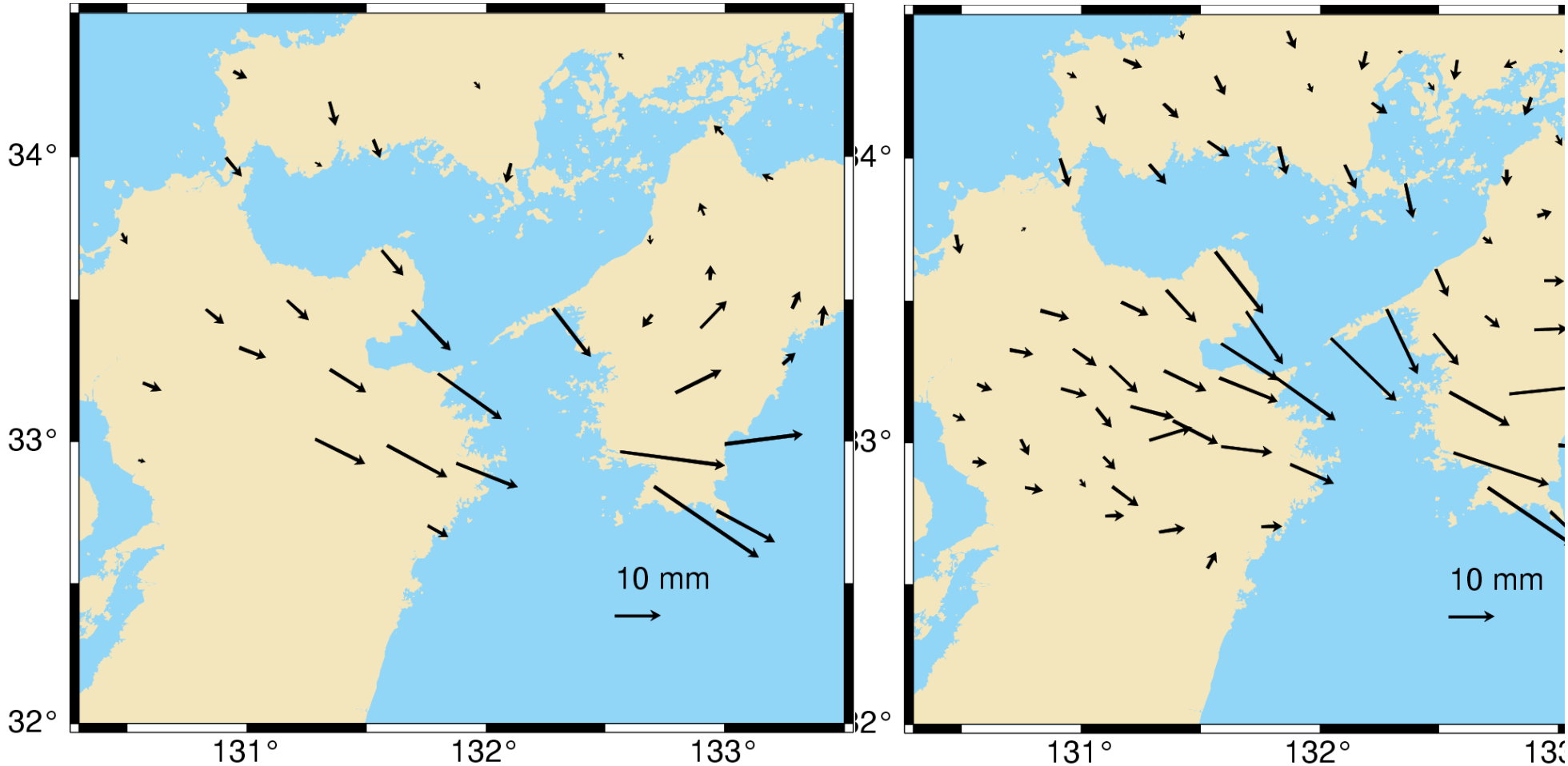
GPS time series at Misho (GSI)



Surface displacement fields

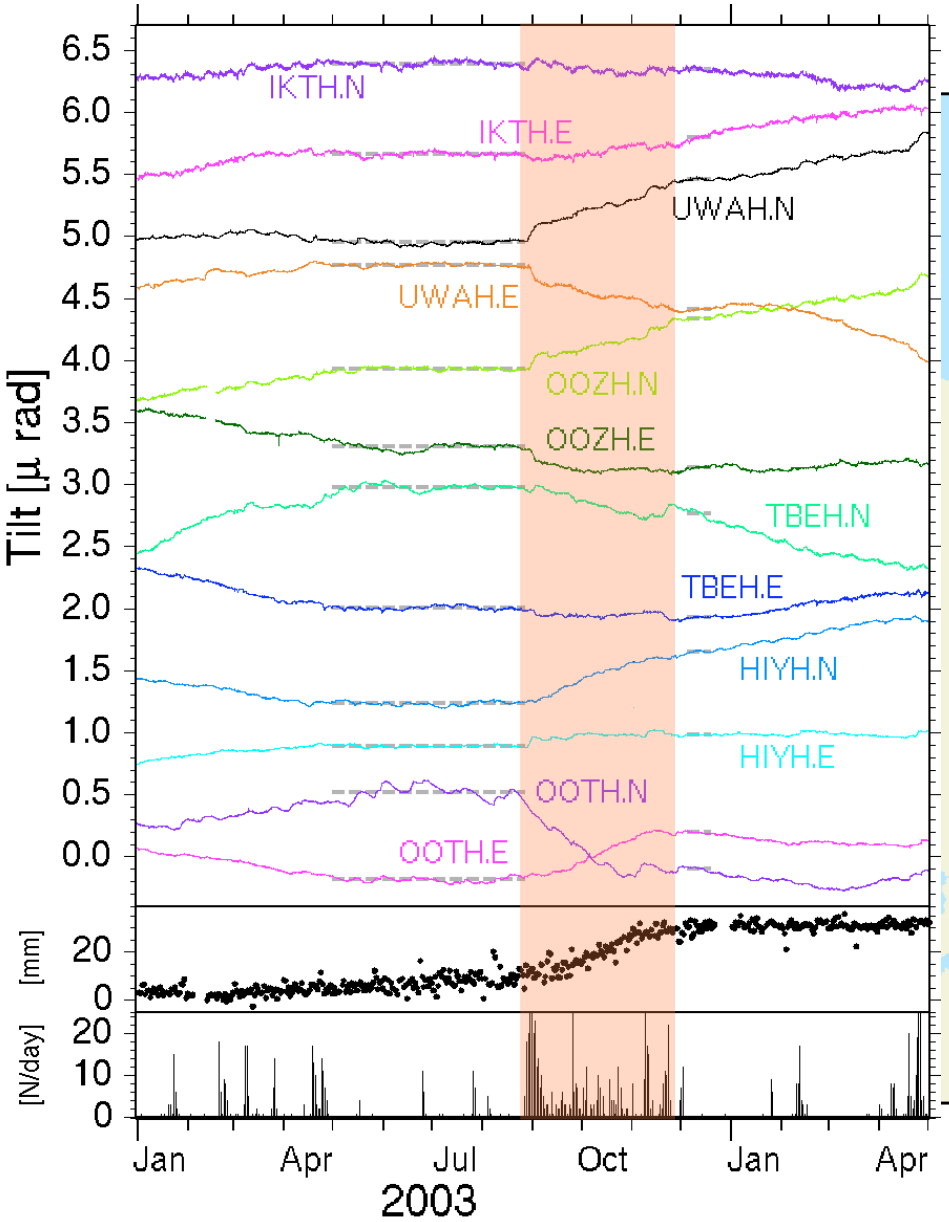
1997 event

2003 event

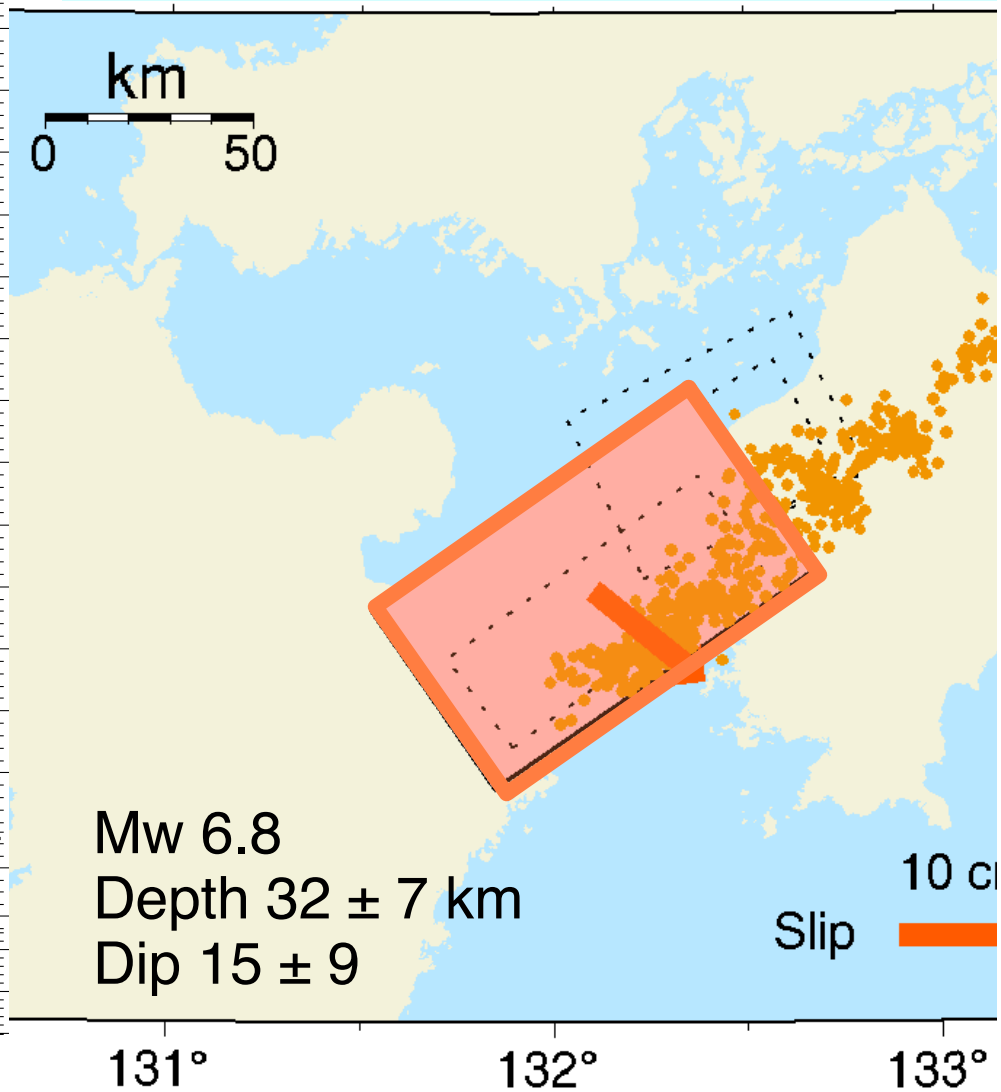


Similar displacement patterns suggest the same source area slips again

Long-term tilt changes

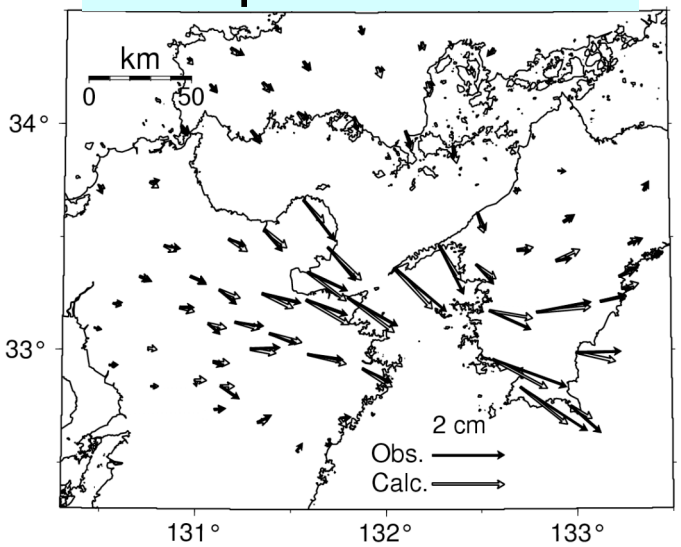


Fault model estimated from GP
and tilt data

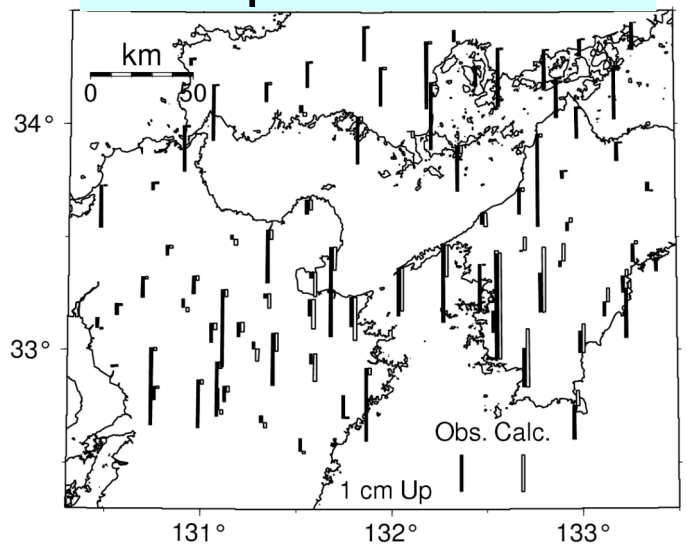


Comparison of observed and calculated data

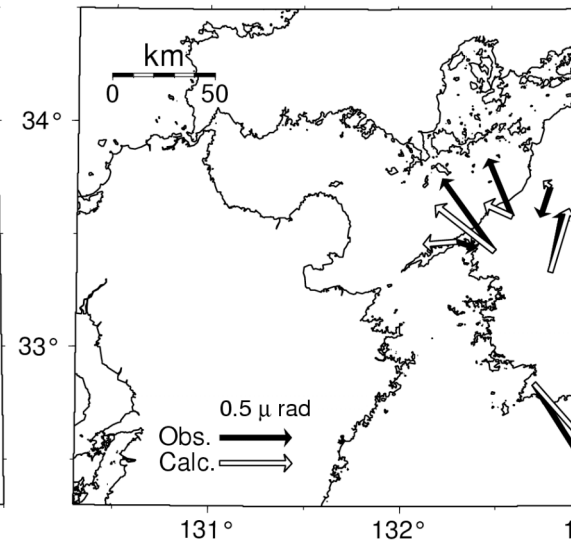
Horizontal displacements



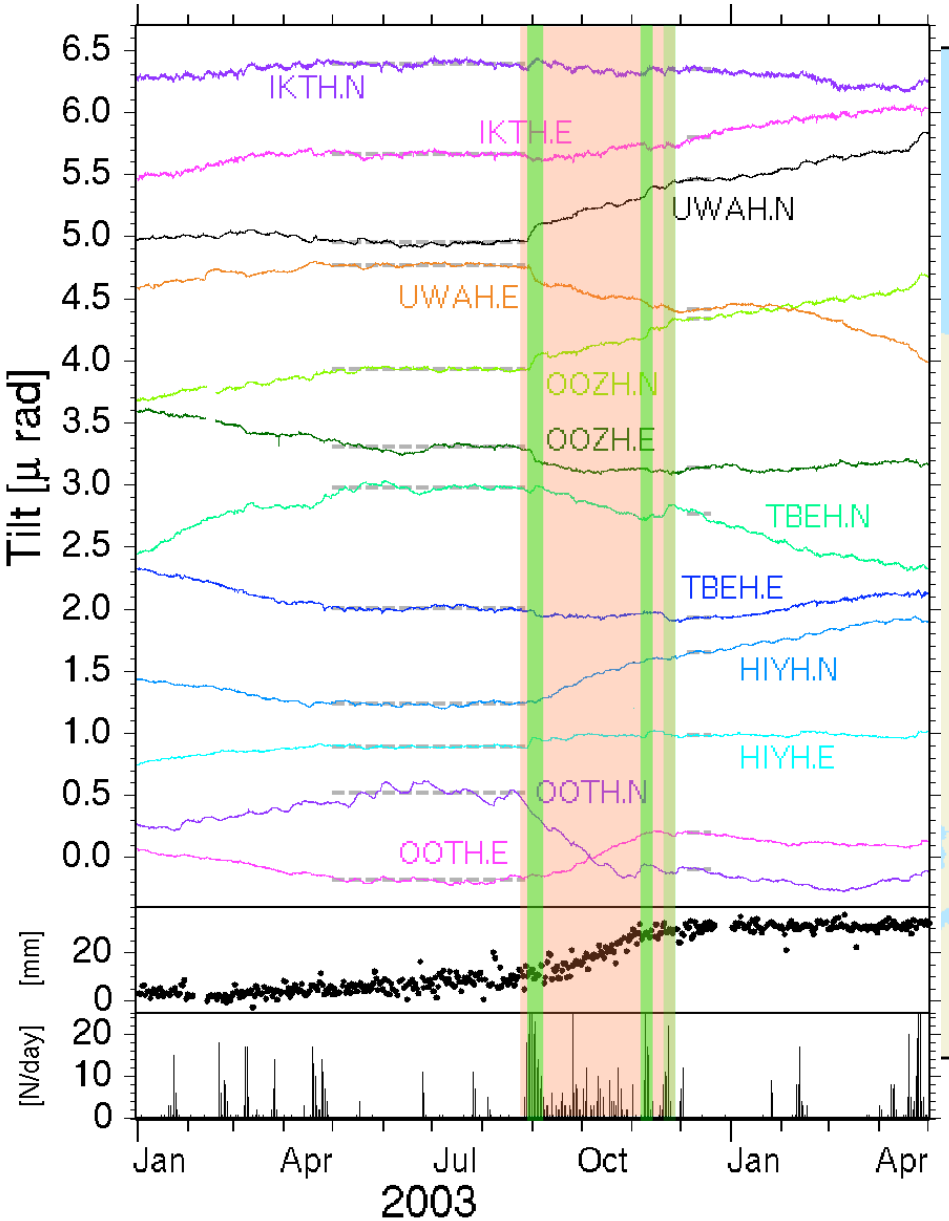
Vertical displacements

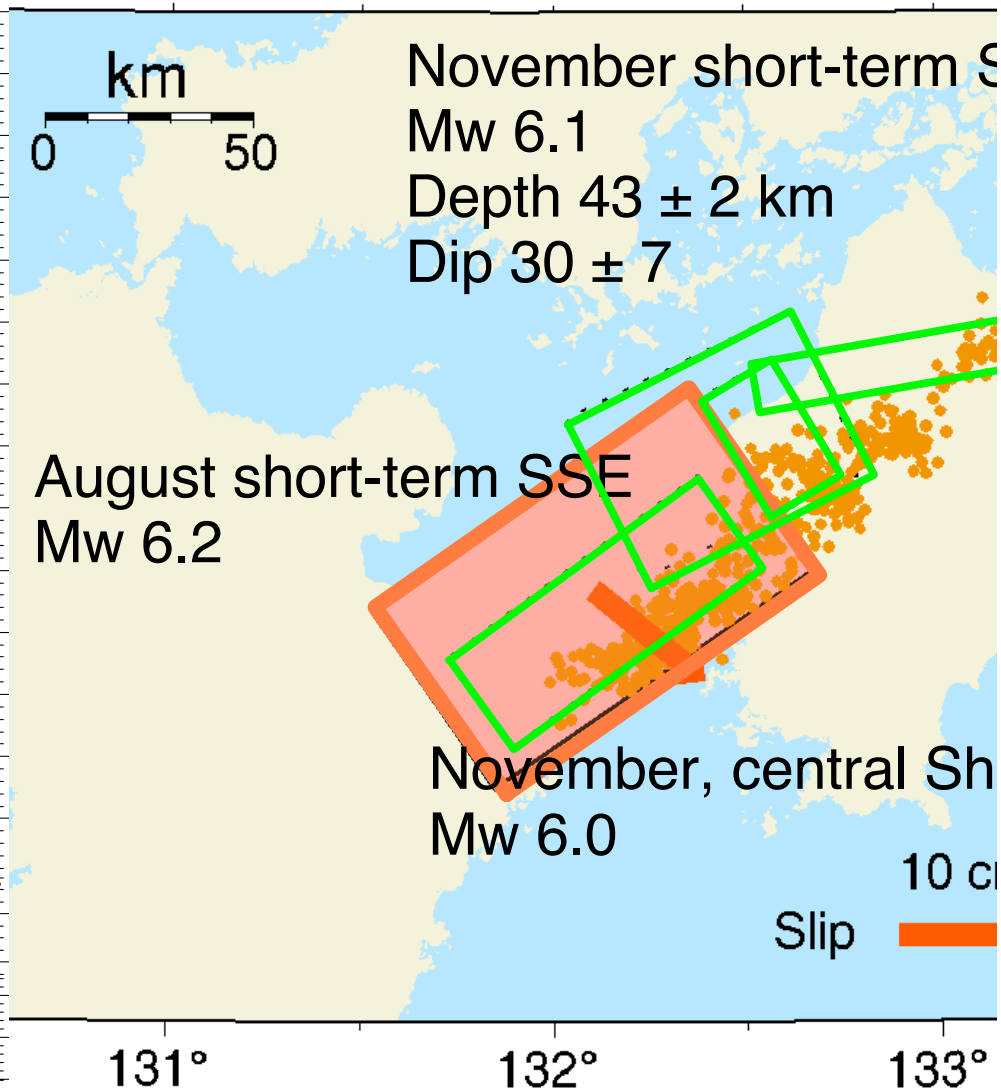


Tilt

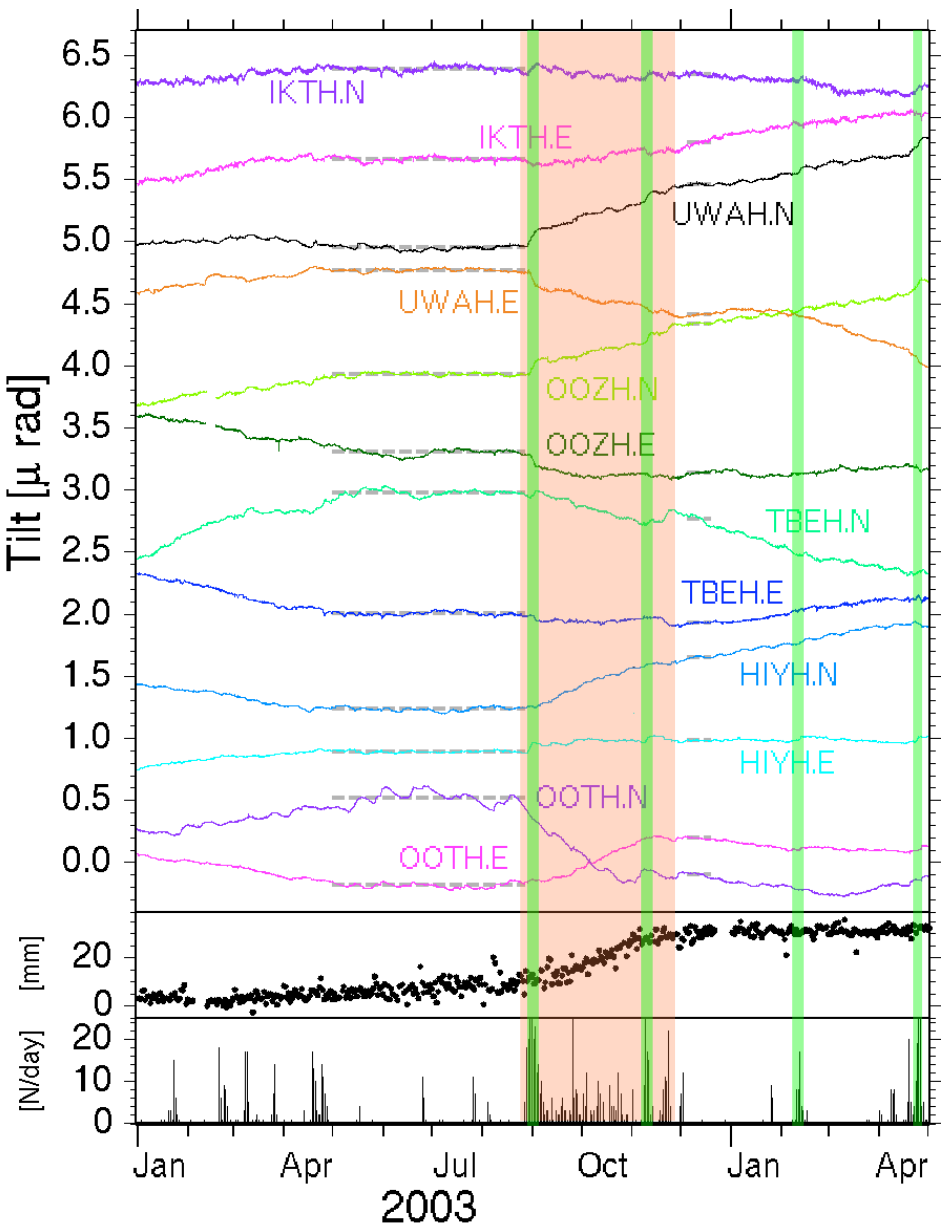


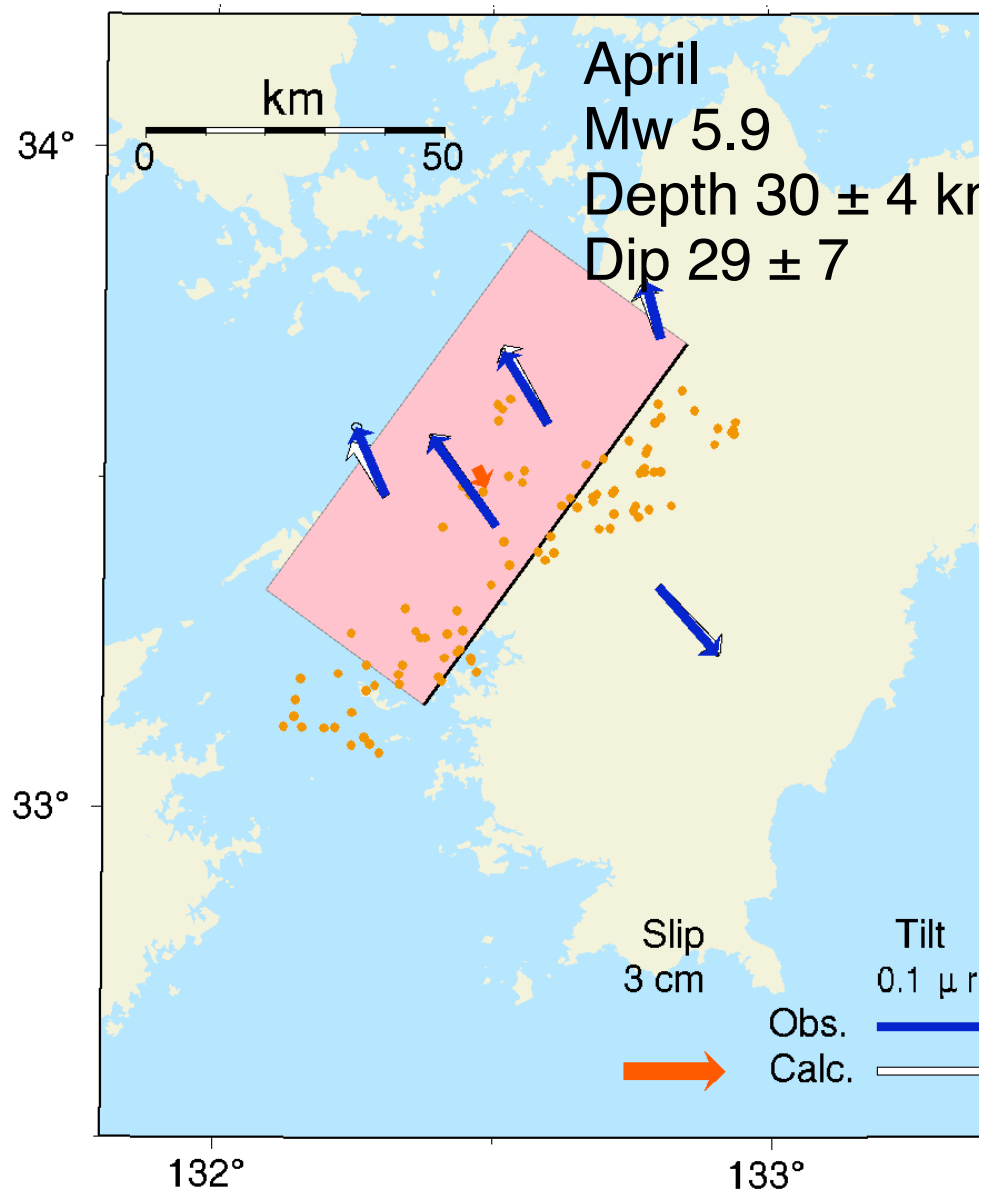
Short- and long-term SSEs in 2003





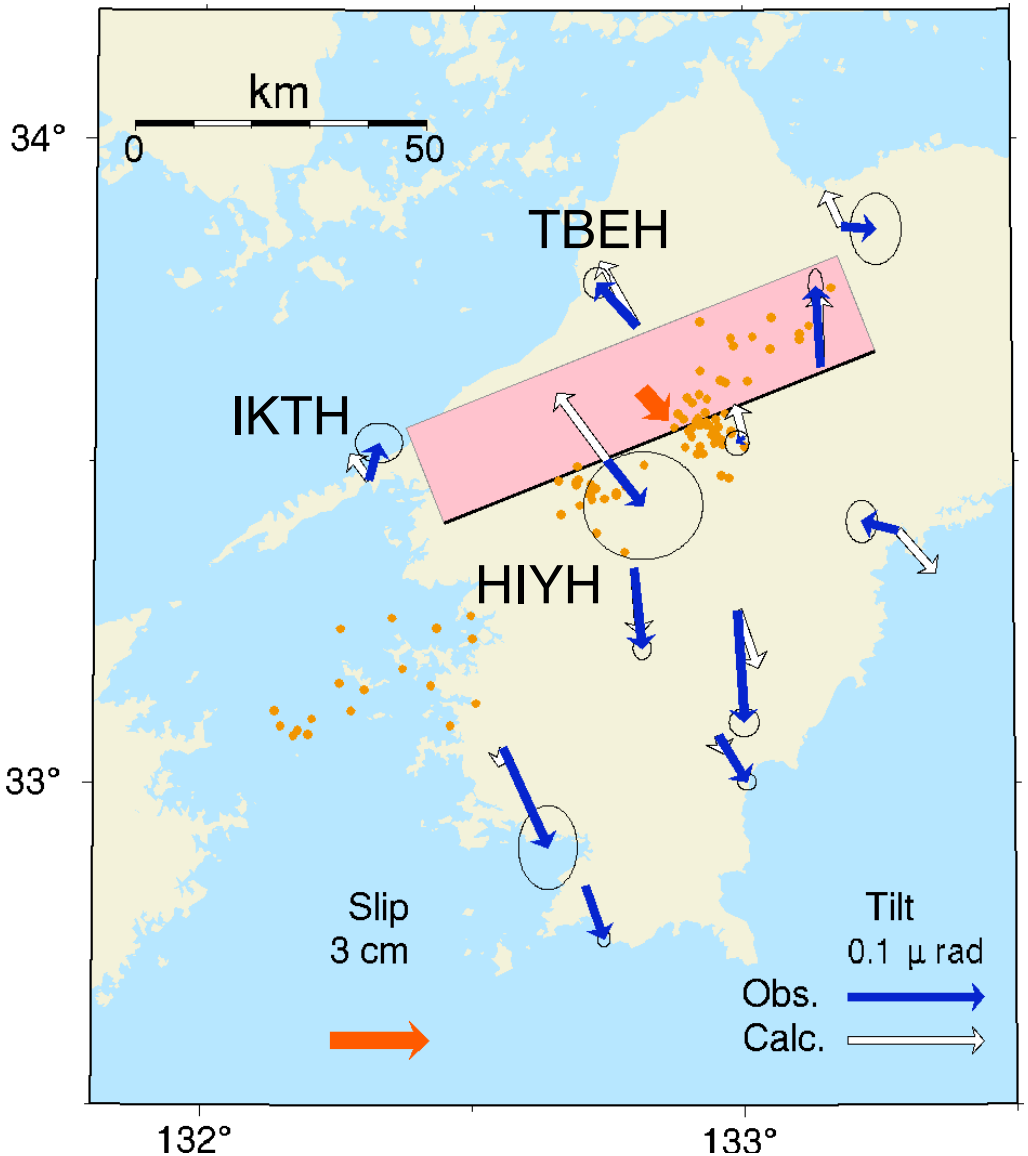
Short-term SSEs in 2004



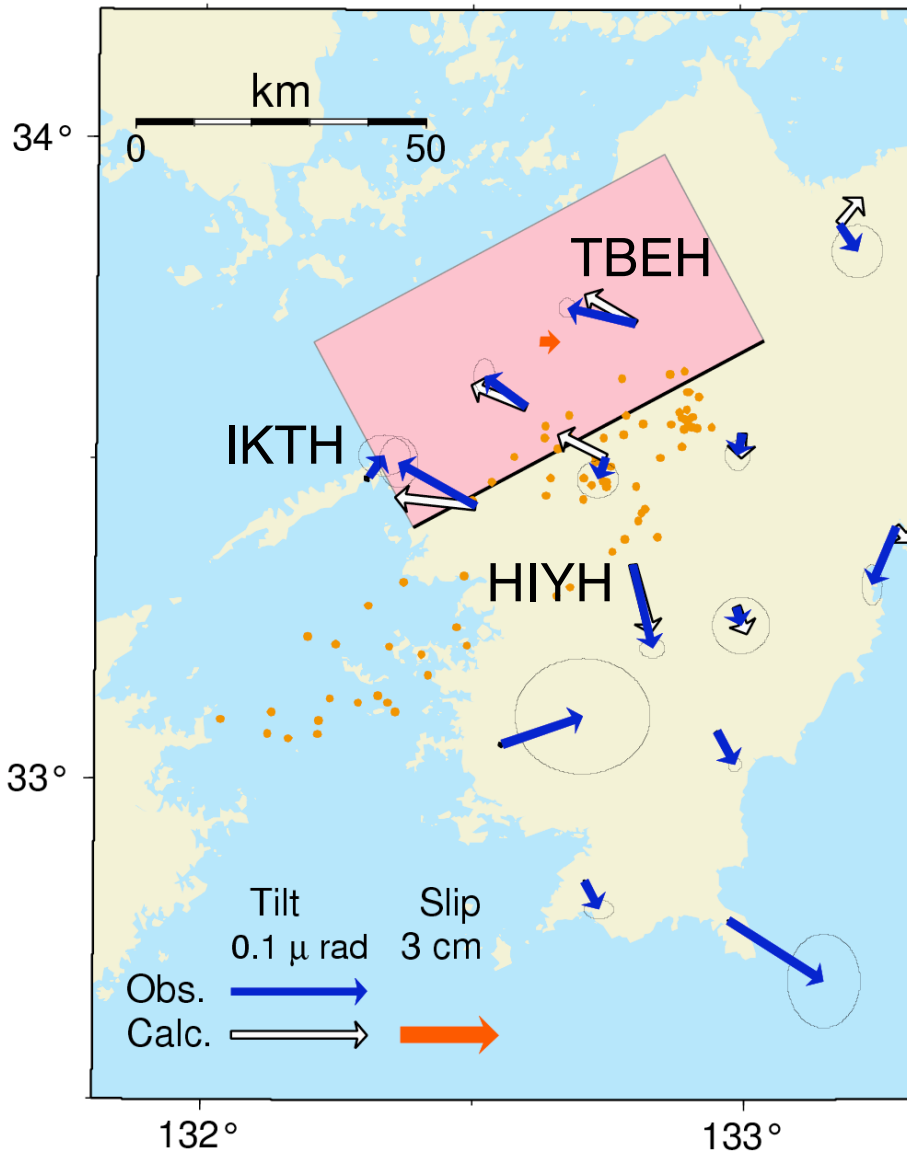


Comparison of observed tilt change and the estimated fault models

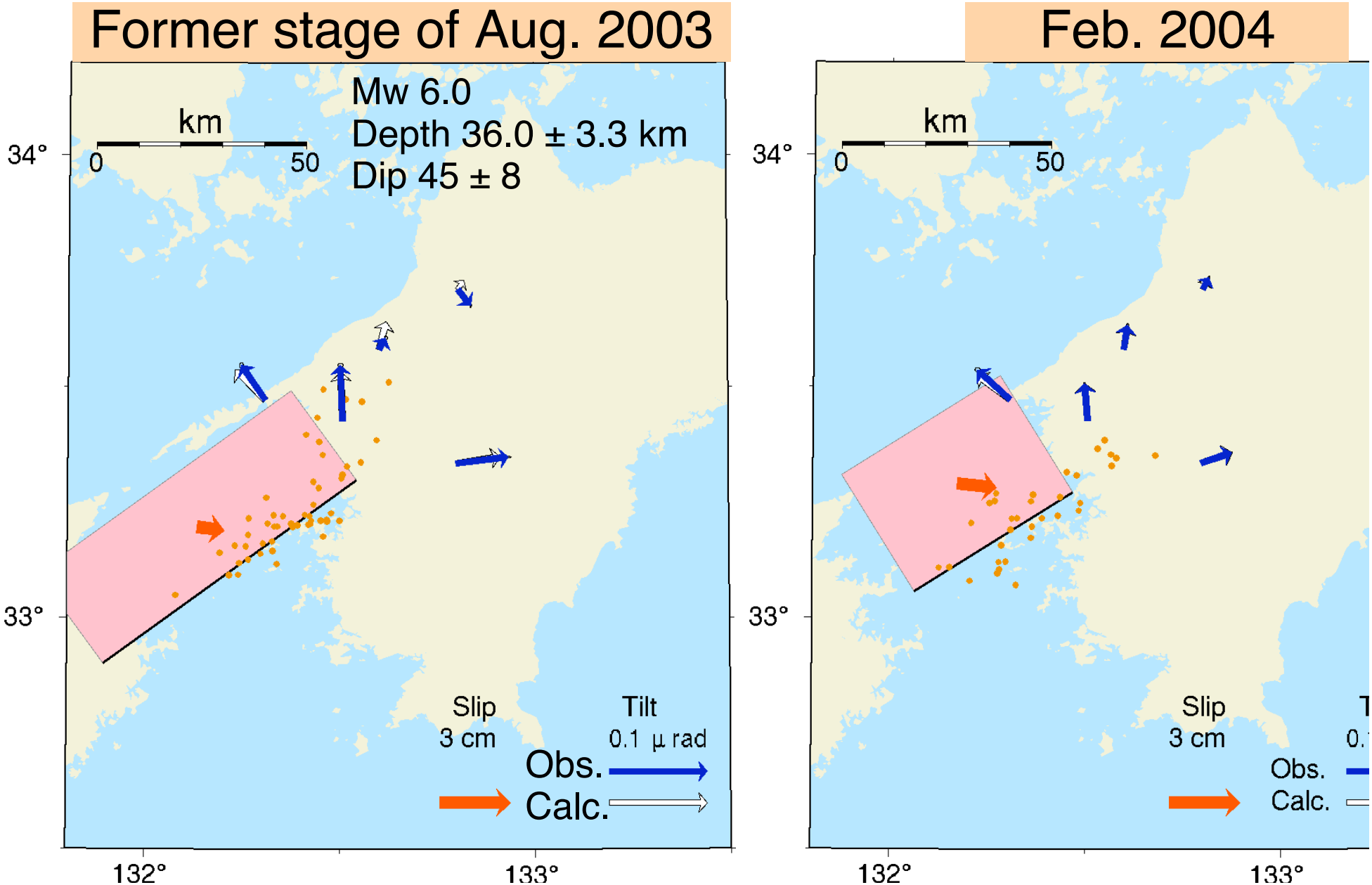
Former stage of Feb. 2002



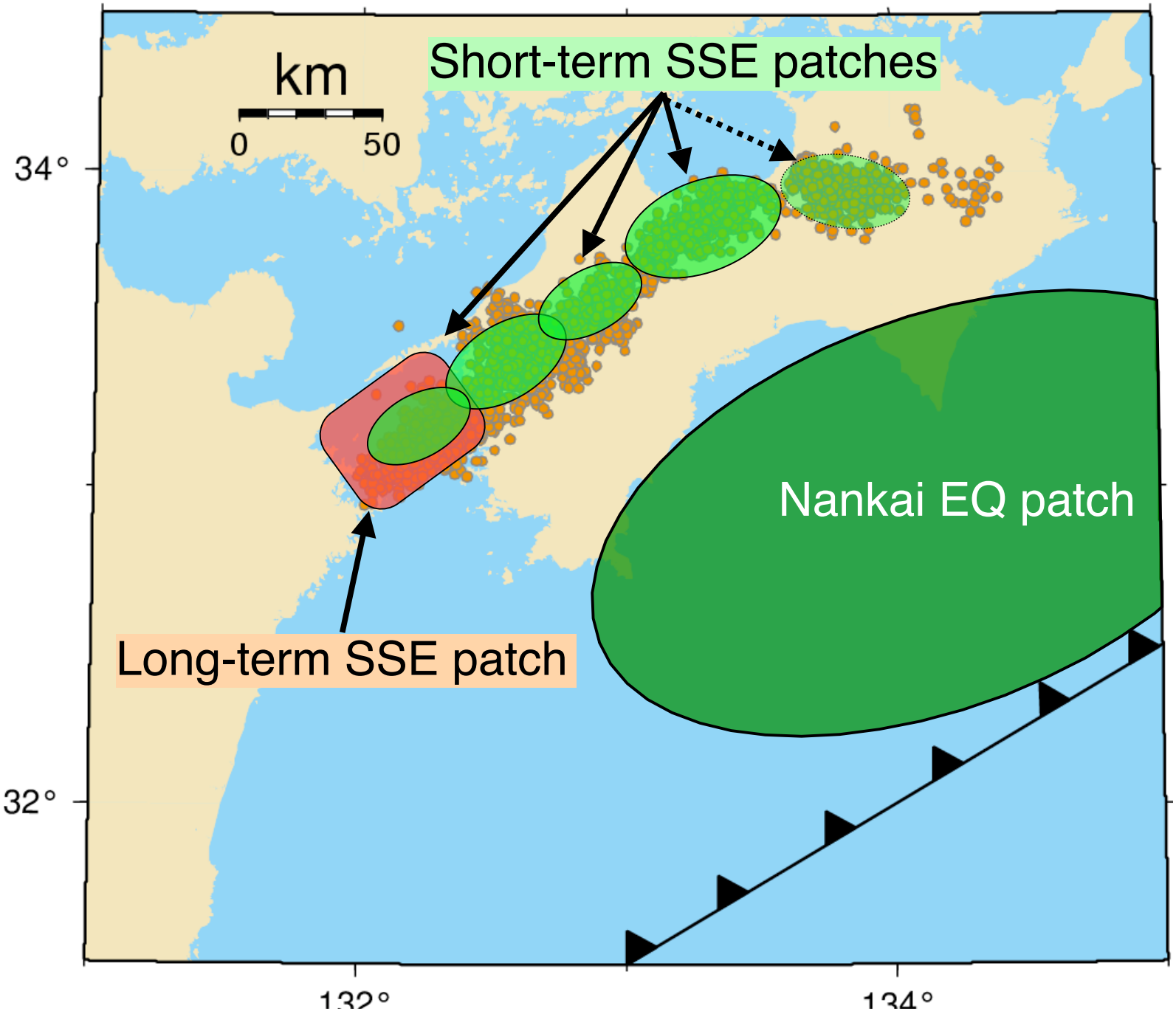
Latter stage of Aug. 200



Comparison of observed tilt changes and the estimated fault models



Concept of SSE patches



Summary

- Short-term SSE with tremor in west Shikoku
  - Quasi-periodic occurrence: ~ 6 months
  - Duration: ~ 1 week
  - Depth: 30 - 40 km
  - Mw: ~ 6.0
  - Source area migrates parallel to the subducting slab
- Long-term SSE with infrequent tremor in Bungo channel
  - Recurrence rate: 6 years ?
  - Duration: ~1 year (with active 3 months with tremor)
  - Depth: 30 - 40 km
  - Mw: 6.8
  - Affects the occurrence of adjacent short-term SSE
- Characteristic slip behavior at those regions
- Slow slip patches may exist