「だいち」で捉えた スマトラ－アンダマン弧の変動

Crustal Deformations in the Sumatra-Andaman Arc Detected by ALOS/PALSAR

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  - Department of Meteorology & Hydrology, Myanmar
  - Khon Kaen University, Thailand
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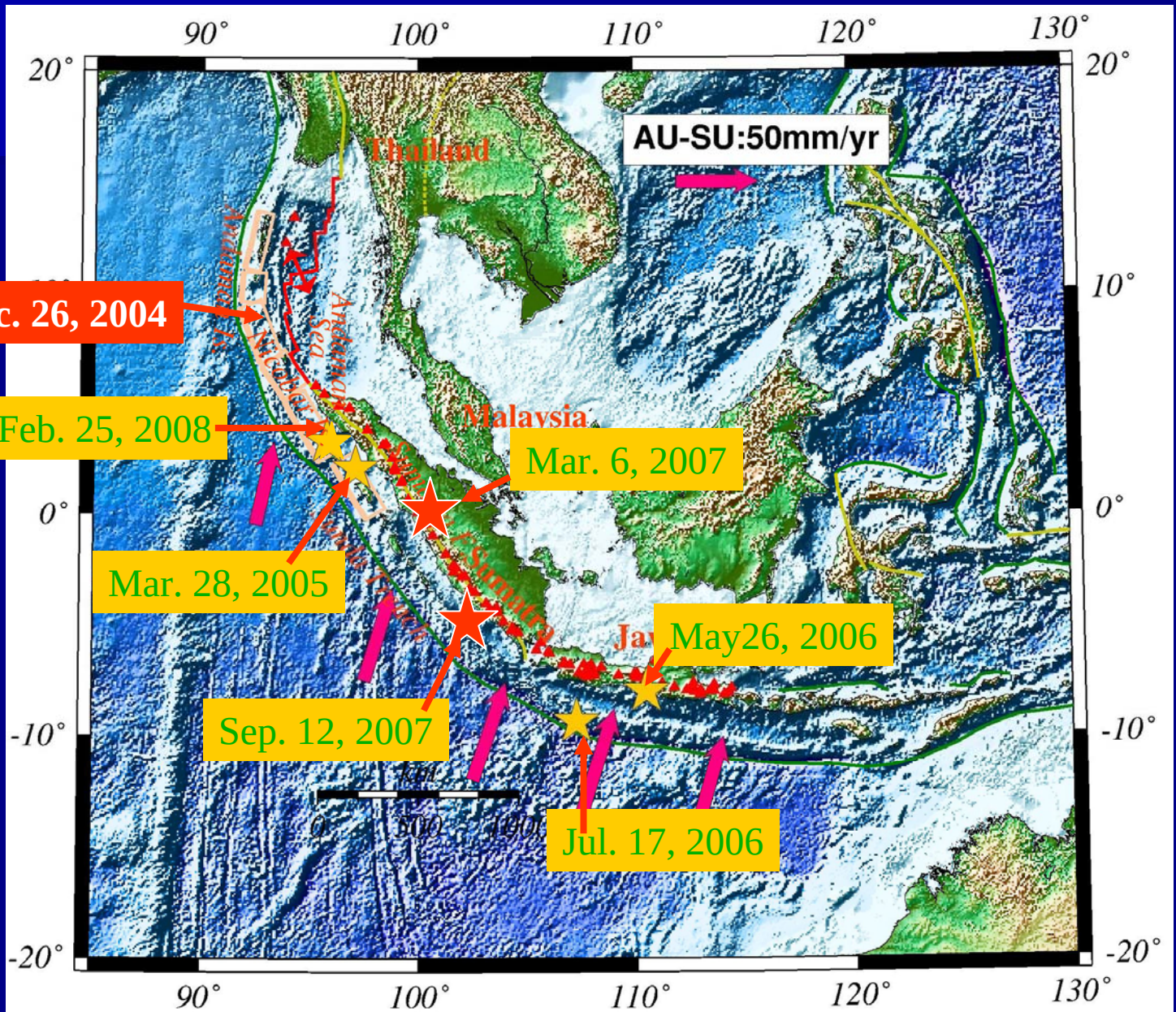
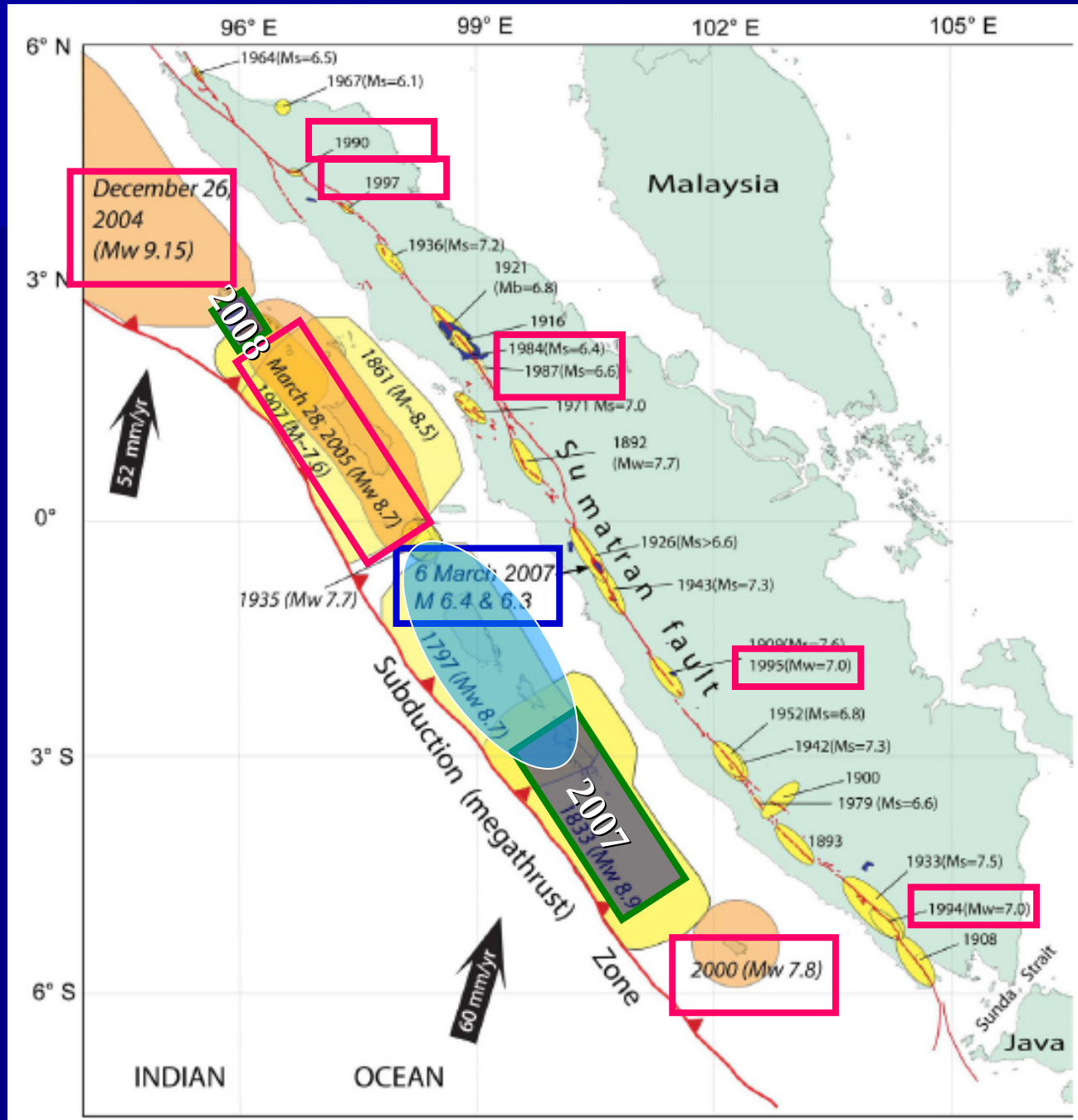
  - Chiang Mai University, Thailand.
- Global CGPS data are provided from IGS and SOPAC-CSAC archive.

Three Years after the Sumatra-Andaman EQ



Seismicity 1984~

- Recurrence of subduction zone EQs
- Seisimicity along the Sumatra fault
- Seismic gaps off Padang and along the Sumatra fault



(Natawidjaja et al., 2007)

Objectives and Strategy

- Monitoring with GPS and InSAR for the evaluation of stress transfer
  - Postseismic GPS displacements to estimate viscoelastic structure
    - 3D FEM modeling of postseismic displacements
  - InSAR images from recent events
    - Postseismic displacement in Andaman and Phuket Islands
      - To check if GPS displacements suffer from local motion
    - Coseismic displacements for events in 2007
      - Central Sumatra doublet on March 6
      - South off Sumatra on Sept. 12

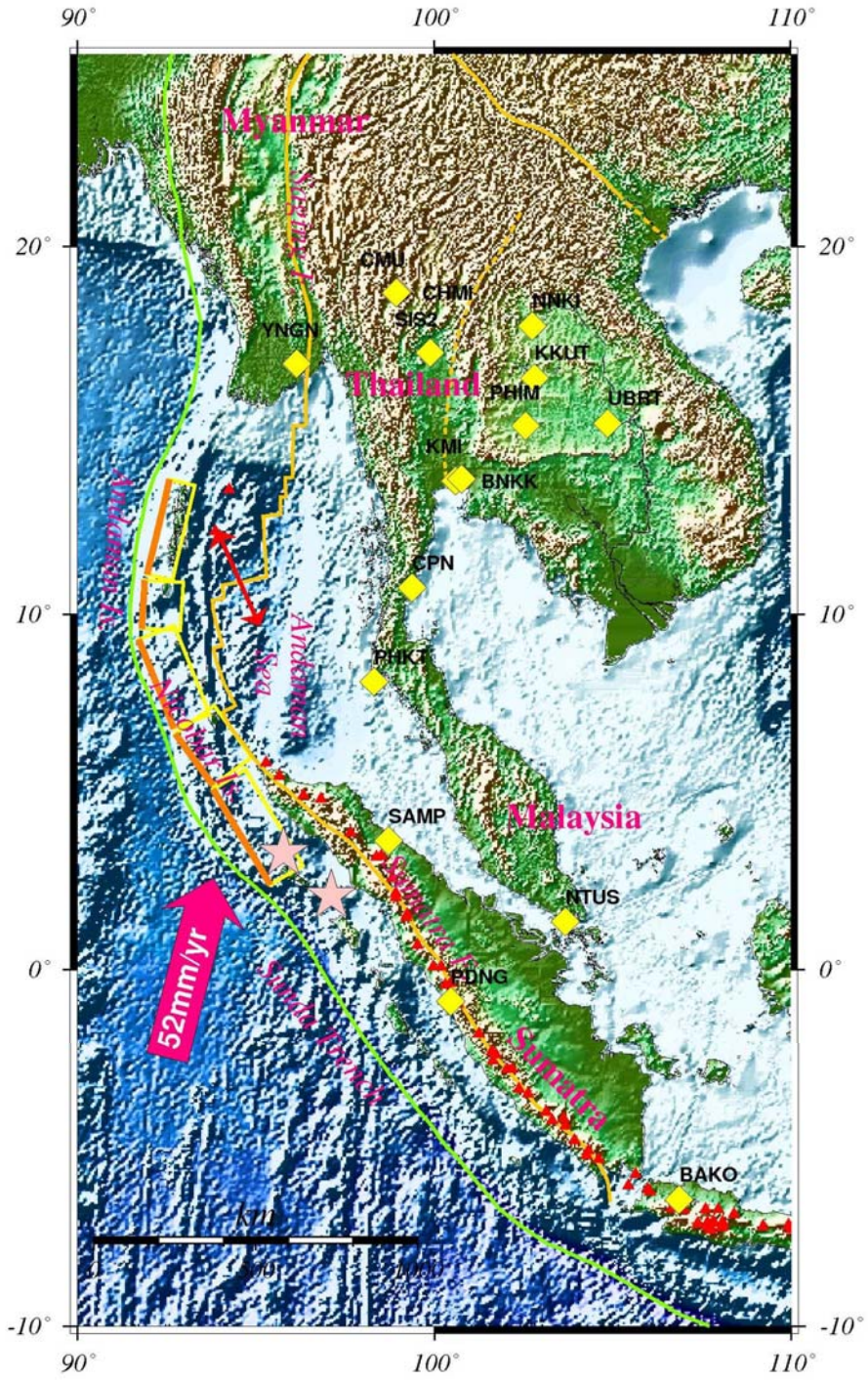
Outline

- Geophysical aspects
  - Postseismic deformation in Phuket and Andaman Islands
  - Co- and postseismic deformations following the 2007 S off Sumatra earthquake
- Technical aspects
  - RARR vs Precise orbit
  - Computation of orbit fringes

Postseismic Deformation Following the Sumatra-Andaman Earthquakes Detected by GPS and InSAR

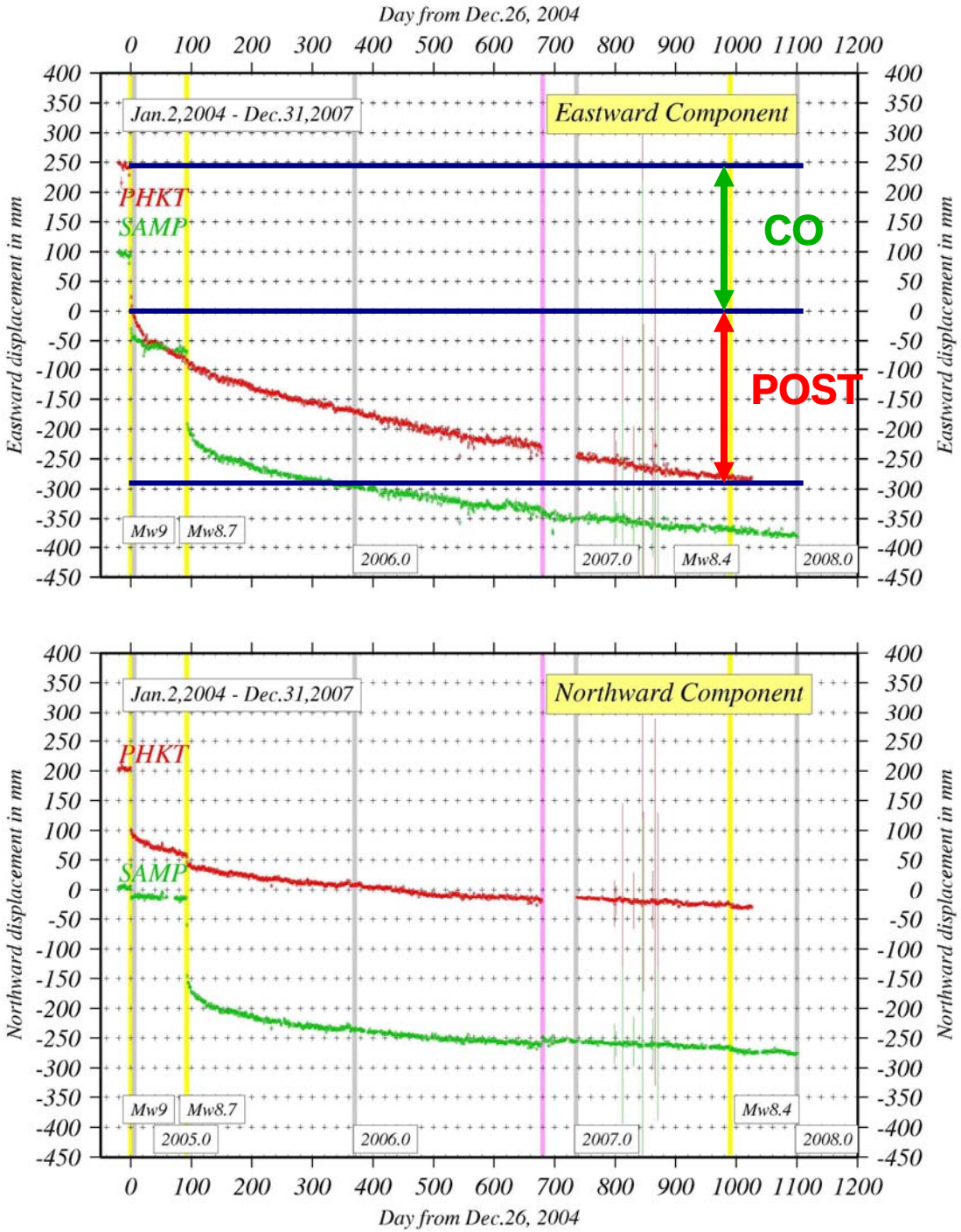
GPS Site Distribution

- 11 sites in Thailand
- 3 sites in Indonesia
- 1 site in Singapore and Myammar each
- Complex tectonics
  - Oblique subduction of Indo-Australia plate
  - Back-arc opening in Andaman Sea
  - Sumatra and Saging faults

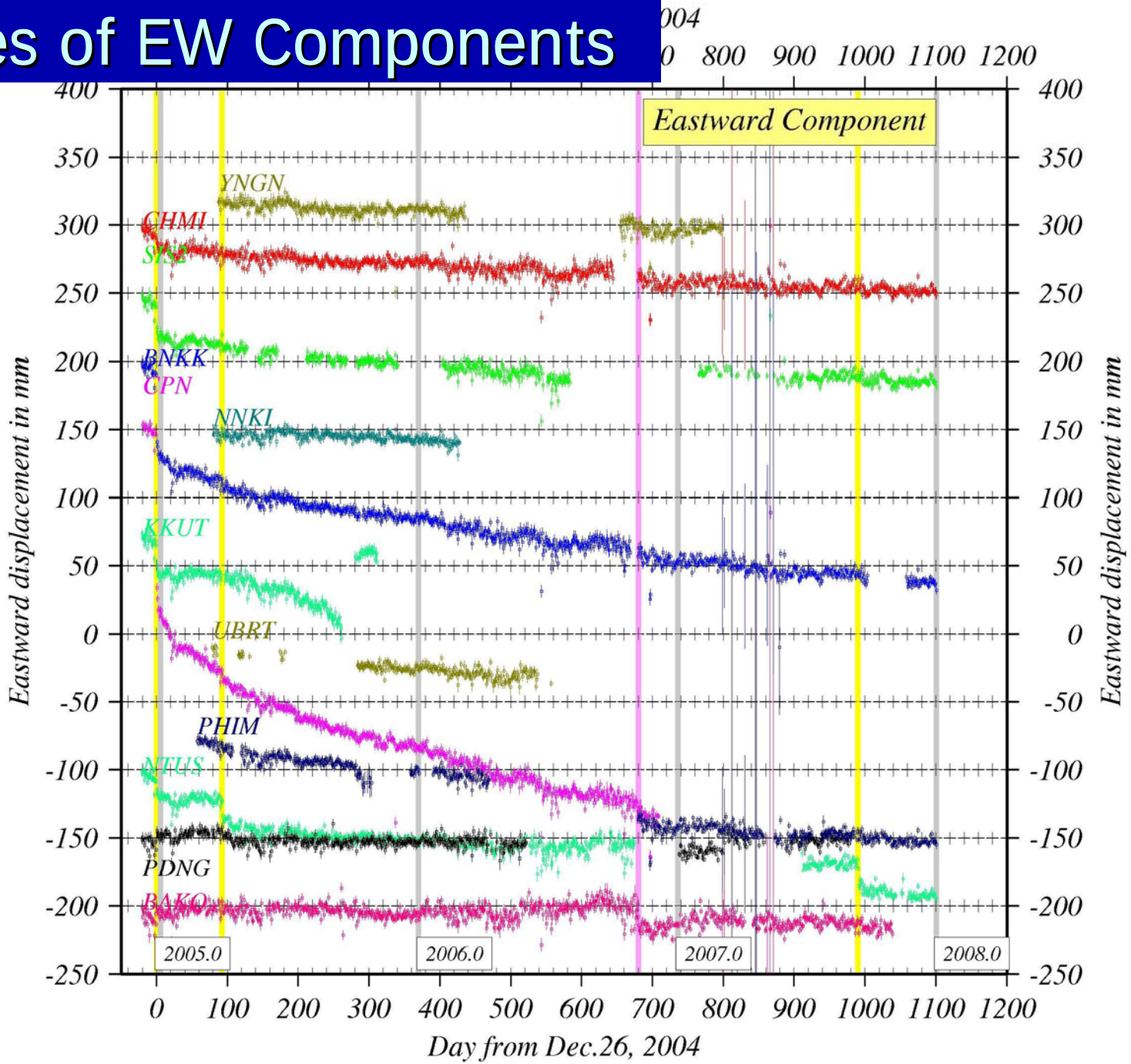


Postseismic Displacement at Phuket and Sampari

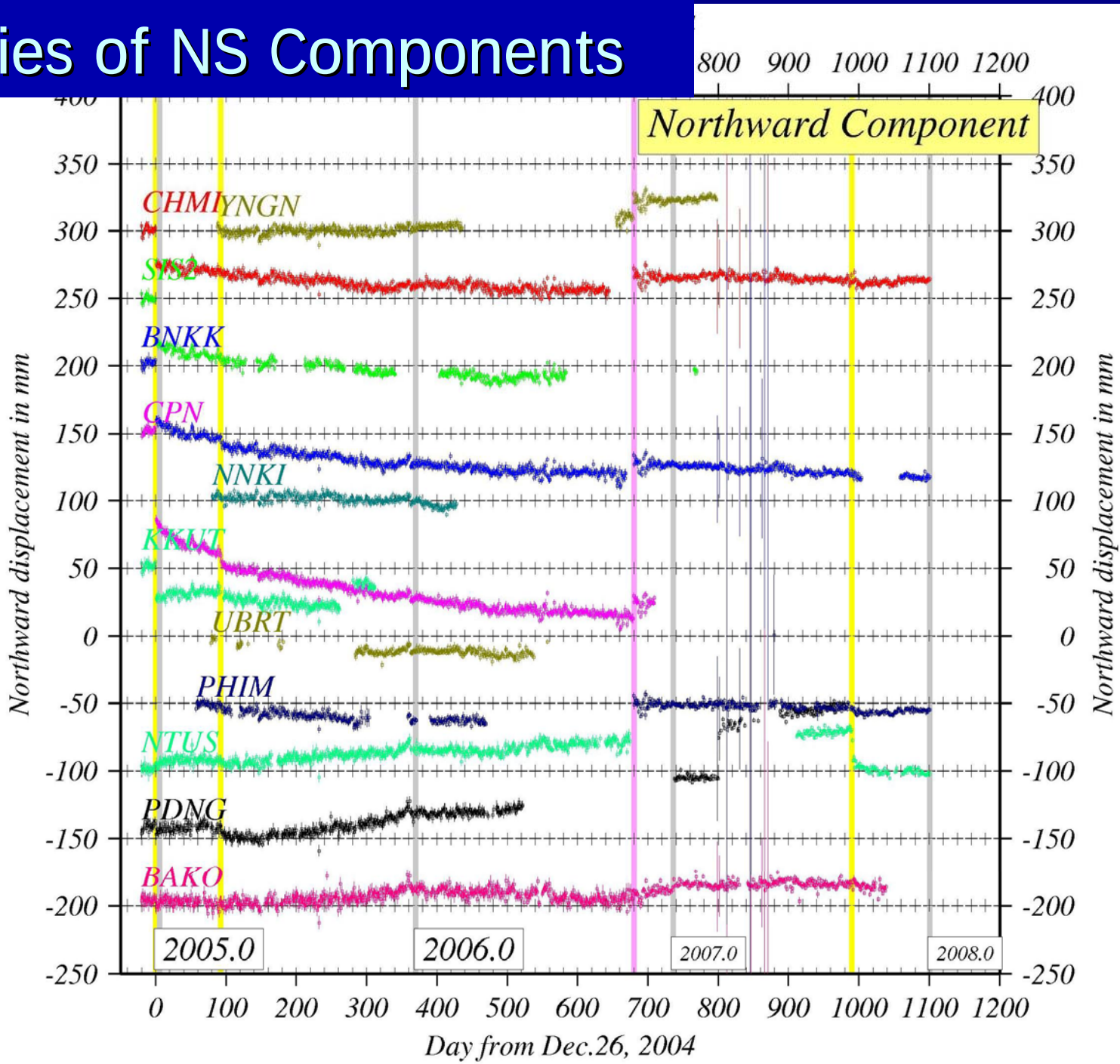
- Postseismic displacements still continue at the end of 2007.
- >= coseismic displacements



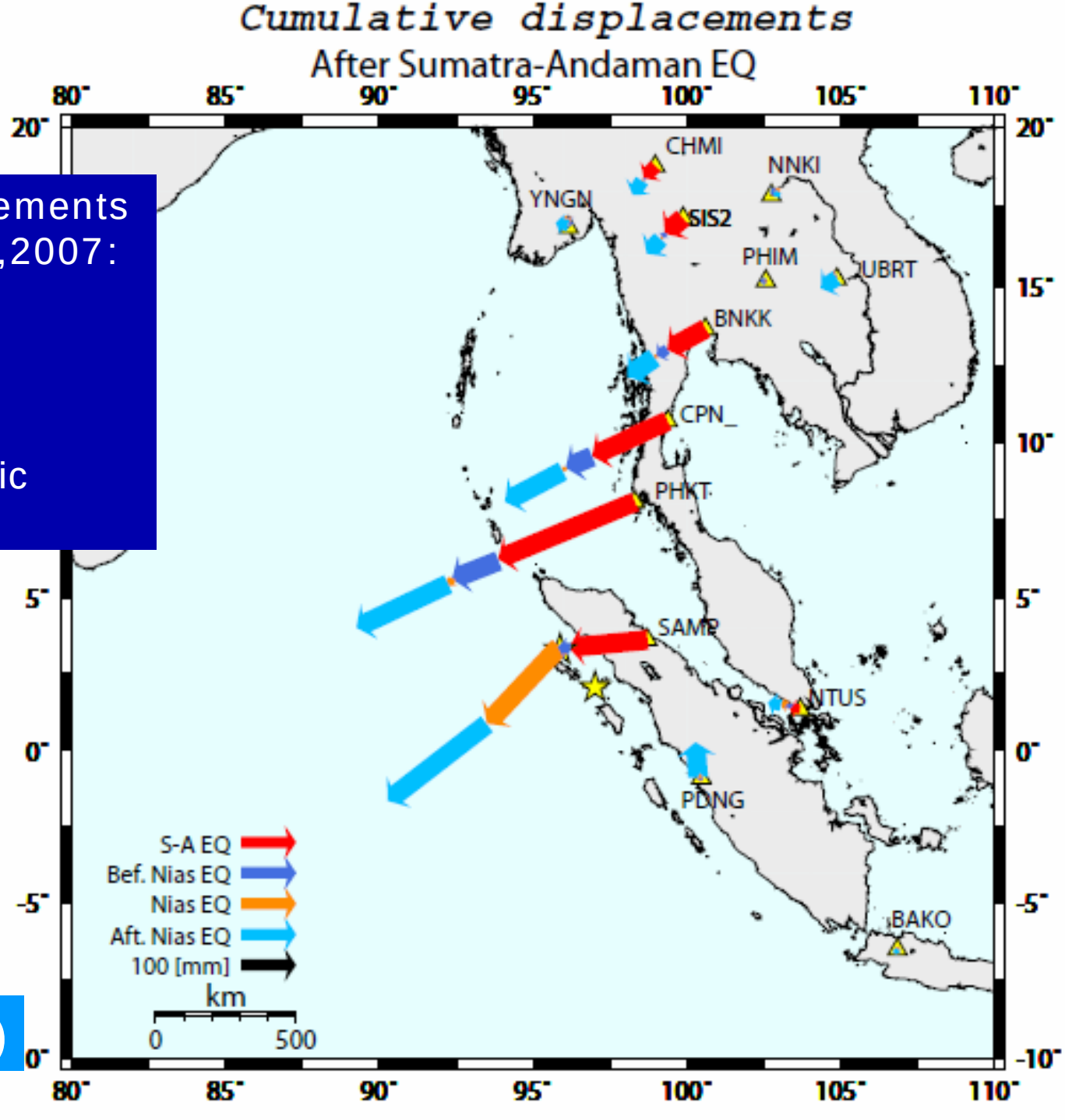
Time Series of EW Components



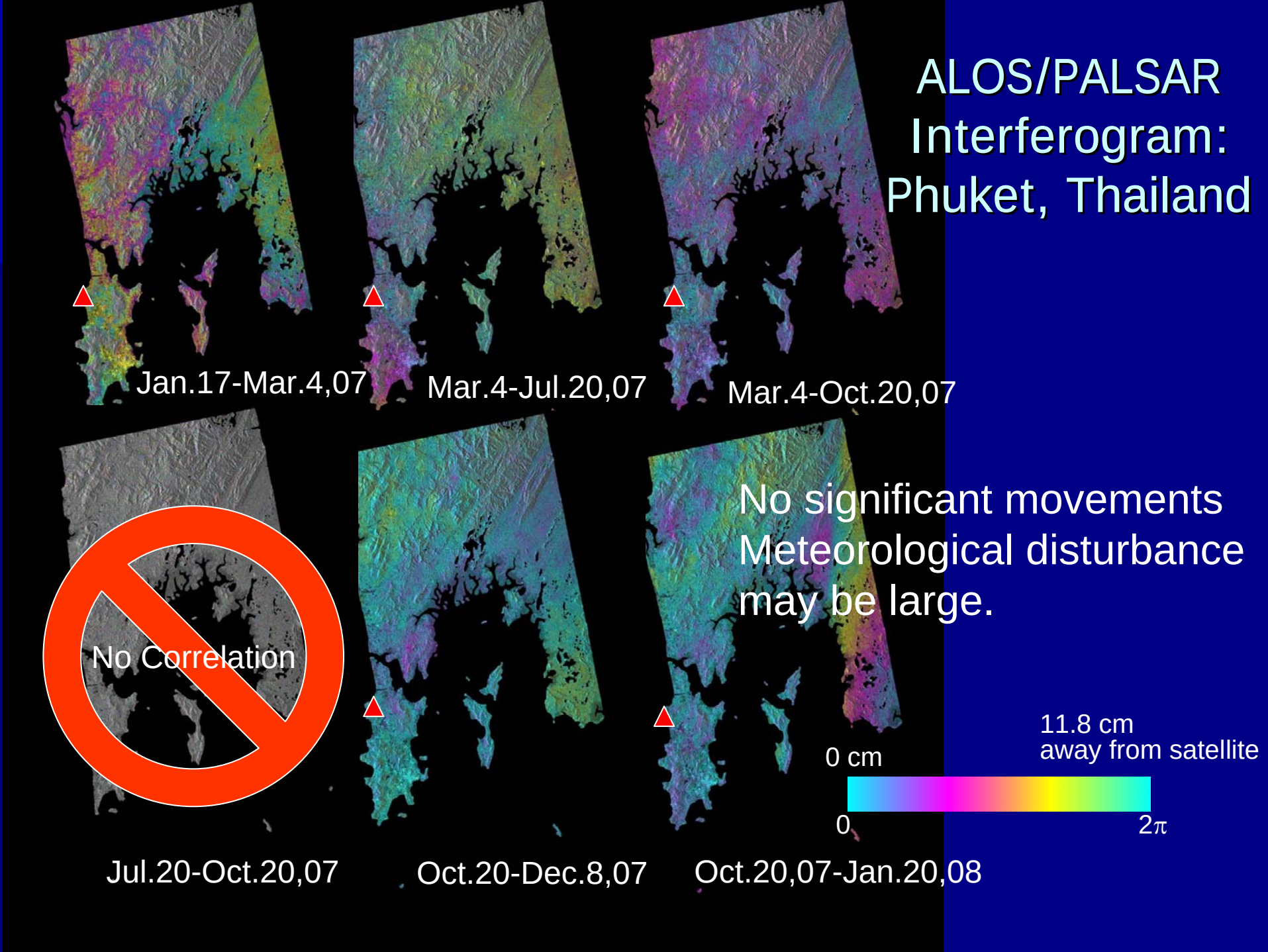
Time Series of NS Components



Postseismic displacements in Thailand till Aug.,2007:
27.5cm @PHKT
11.8cm @CPN
8.1cm @BNKK
3.4cm @CHMI
as large as coseismic displacements



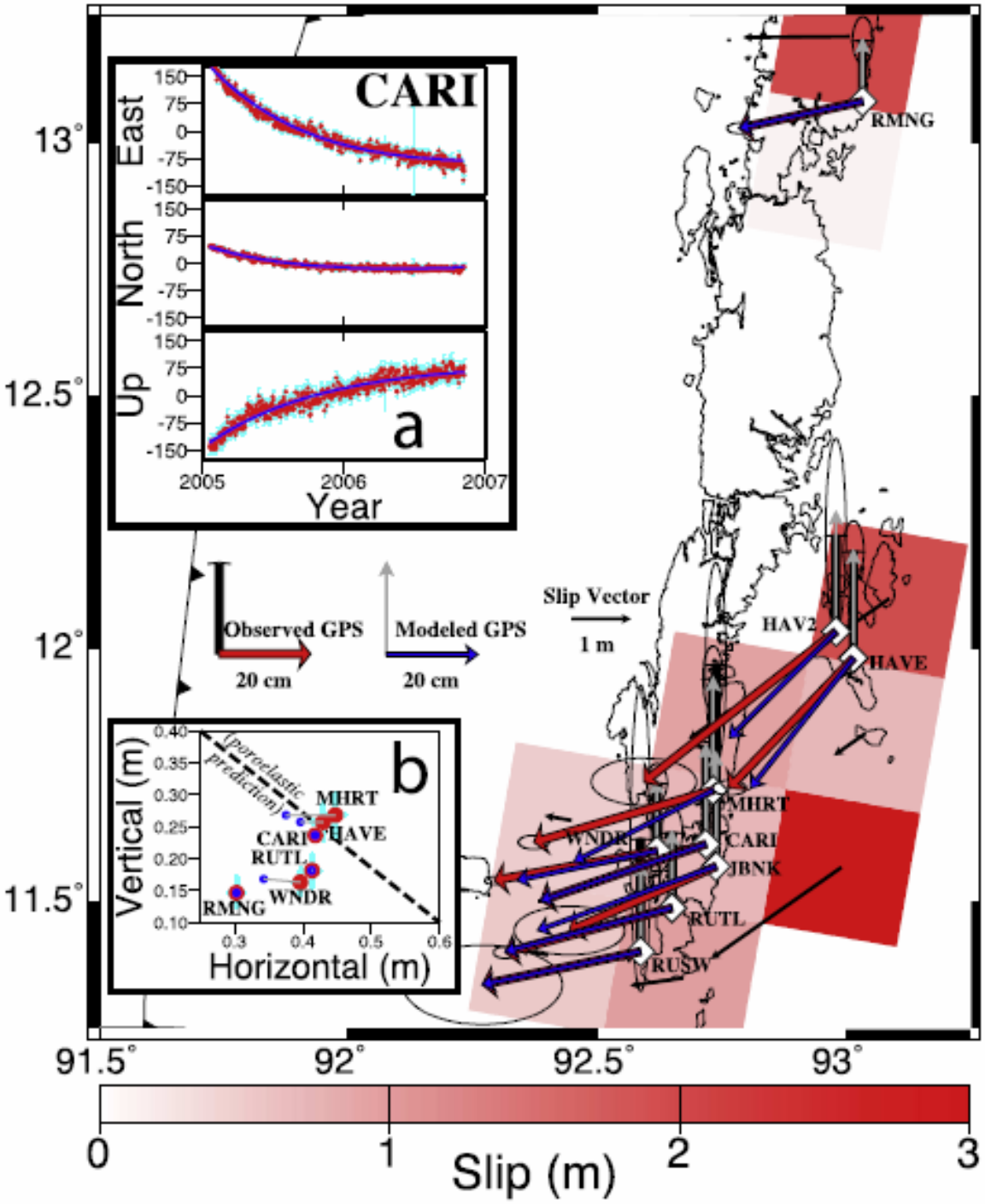
Katagi(2008)

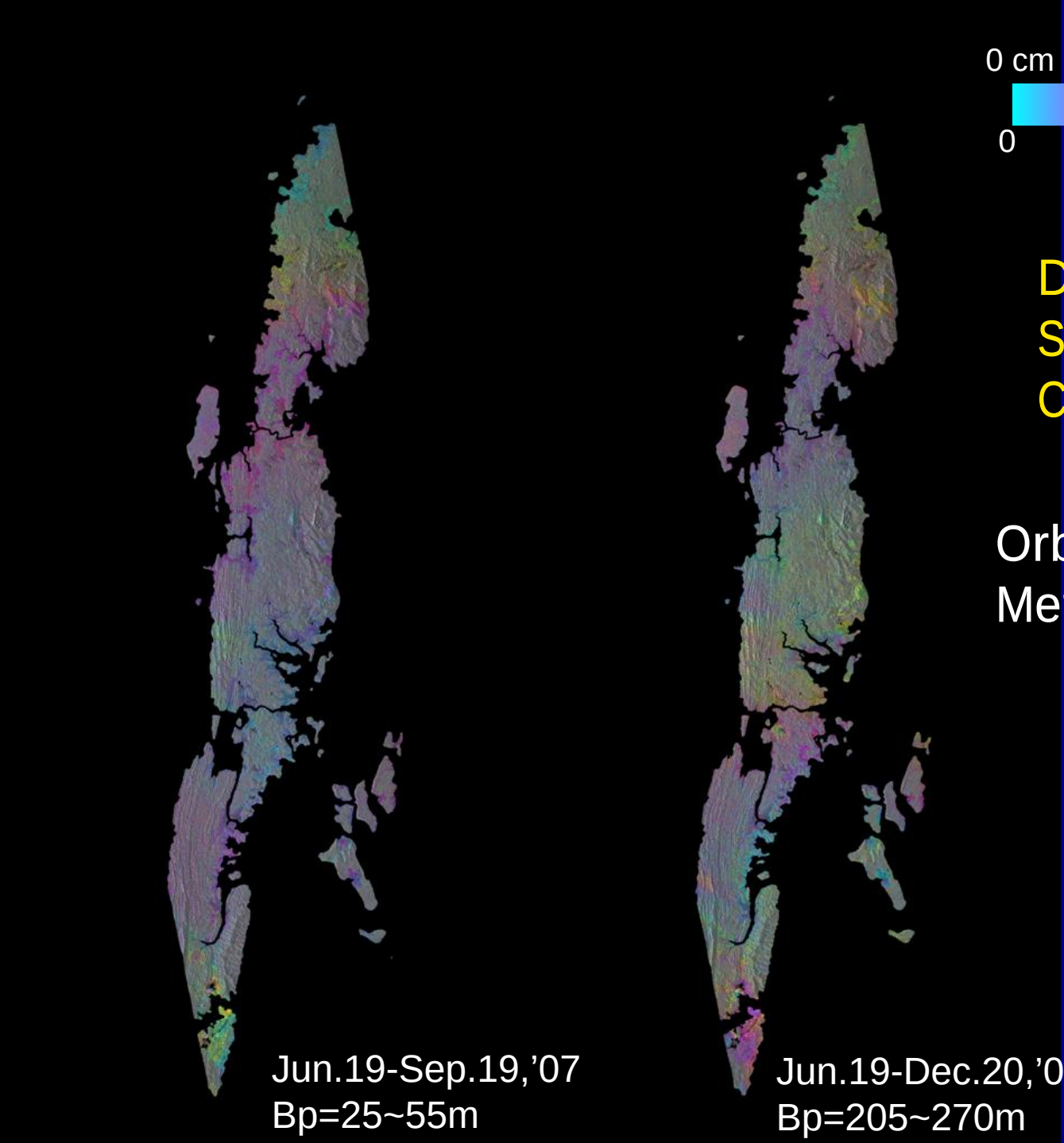

ALOS/PALSAR
Interferogram:
Phuket, Thailand
Jan.17-Mar.4,07
Mar.4-Jul.20,07
Mar.4-Oct.20,07
No Correlation
No significant movements
Meteorological disturbance
may be large.
11.8 cm
away from satellite
0 cm
0
2π
Jul.20-Oct.20,07
Oct.20-Dec.8,07
Oct.20,07-Jan.20,08

Postseismic Deformation in Andaman Islands

Spatial variation in magnitude and direction.
Larger deformation in Southern part.

Paul et al.(2007)





Difficulties
SLC
Coregistration

Orbital error?
Meteorological effects?

Postseismic Deformation after the Sumatra-Andaman EQ

- Postseismic displacements till Aug. 2007 are already as large as coseismic ones.
  - Long wave-length: hard to detect with SAR?
  - Deformation at Phuket may represent the regional deformation.
  - Postseismic deformation in Andaman Islands?

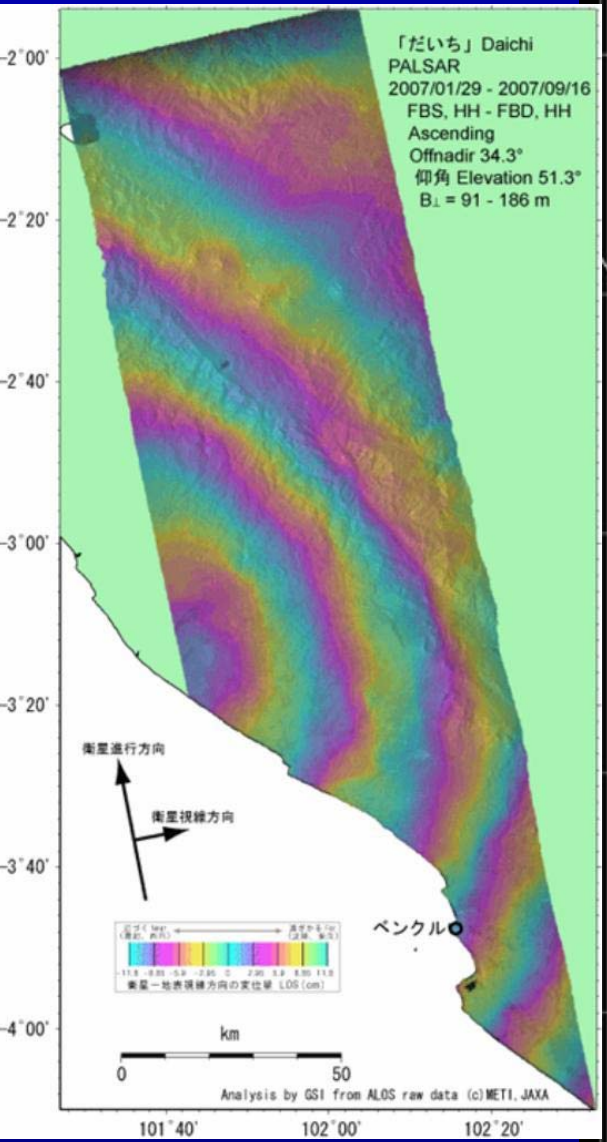
South off Sumatra EQ on Sept. 12, 2007

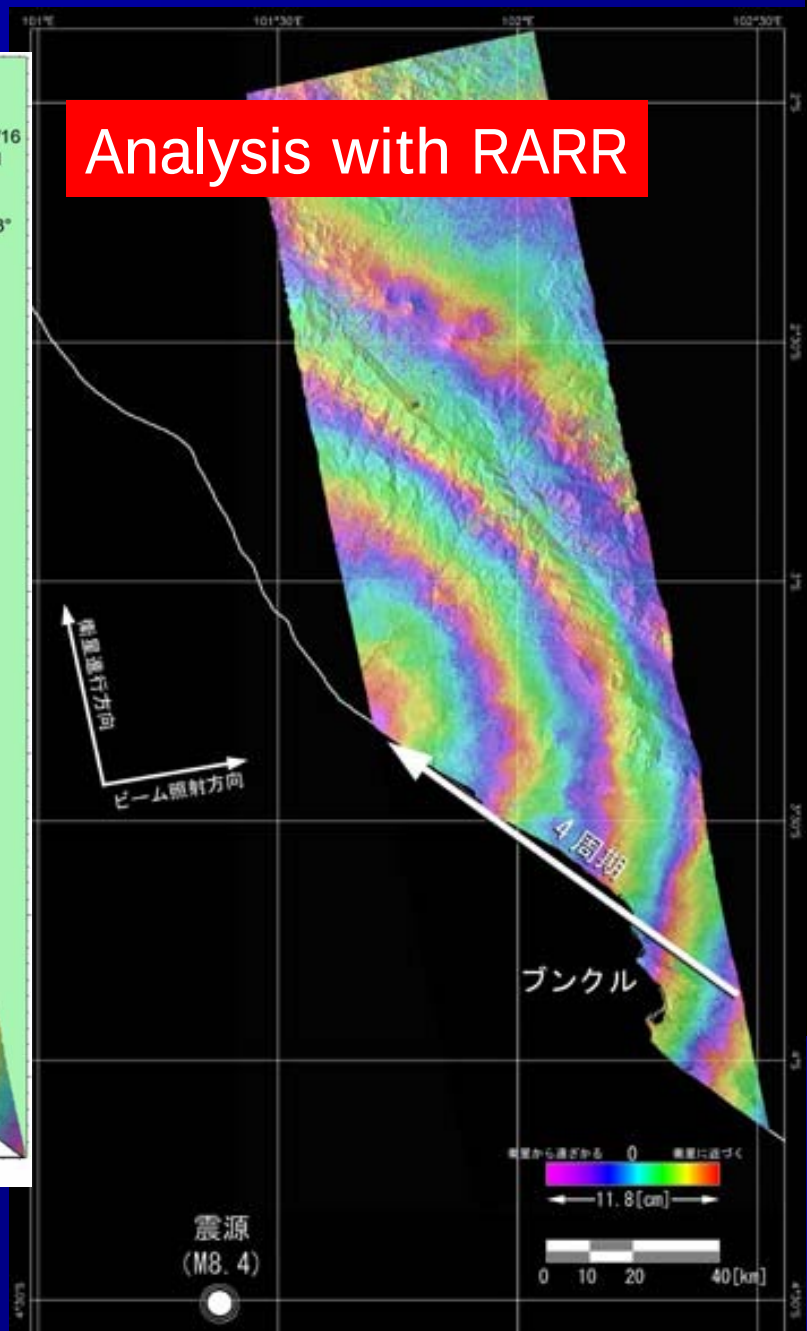
GSI

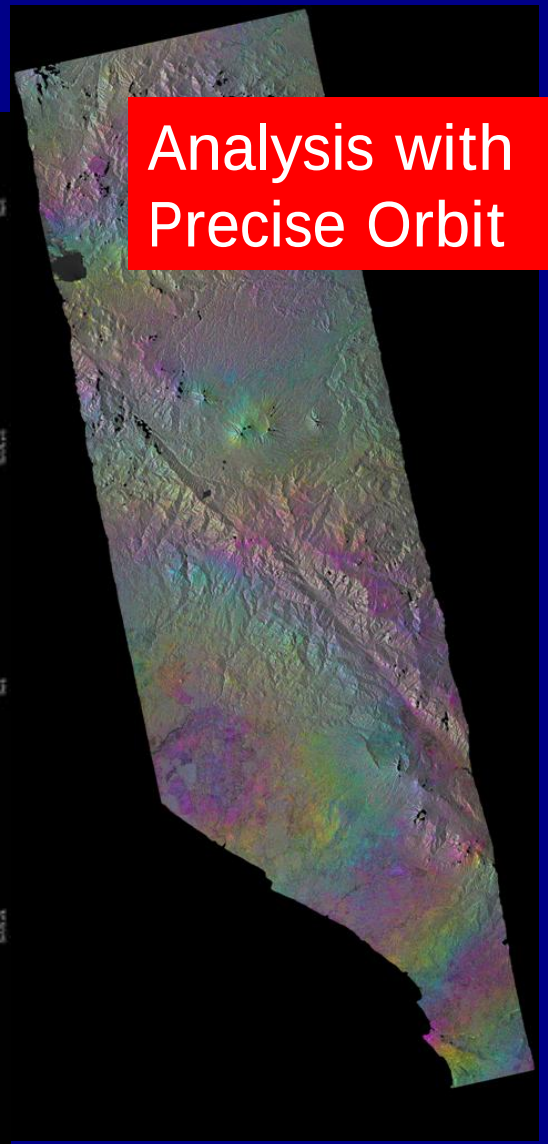
JAXA

Analysis with RARR

Analysis with Precise Orbit



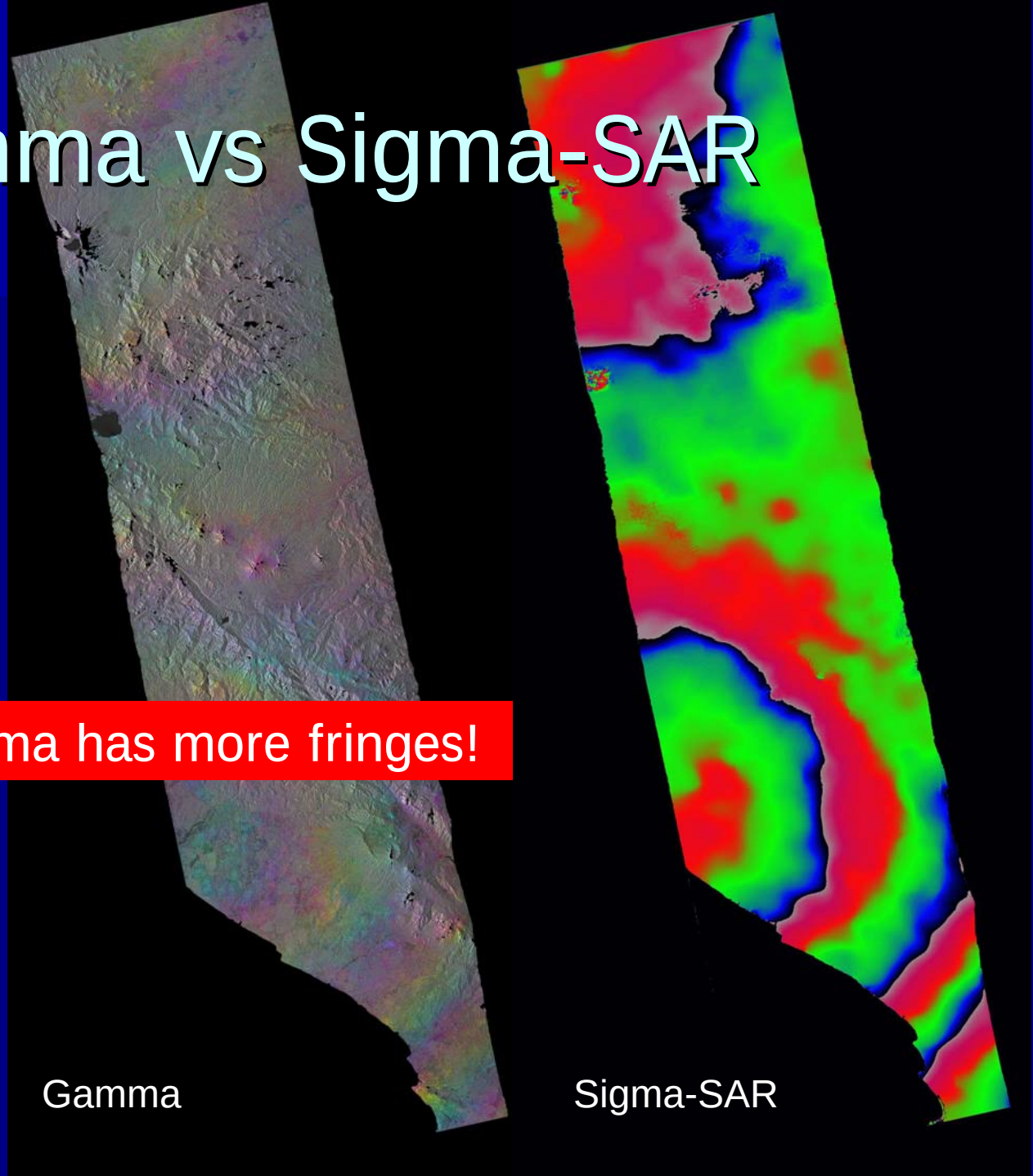




DPRI

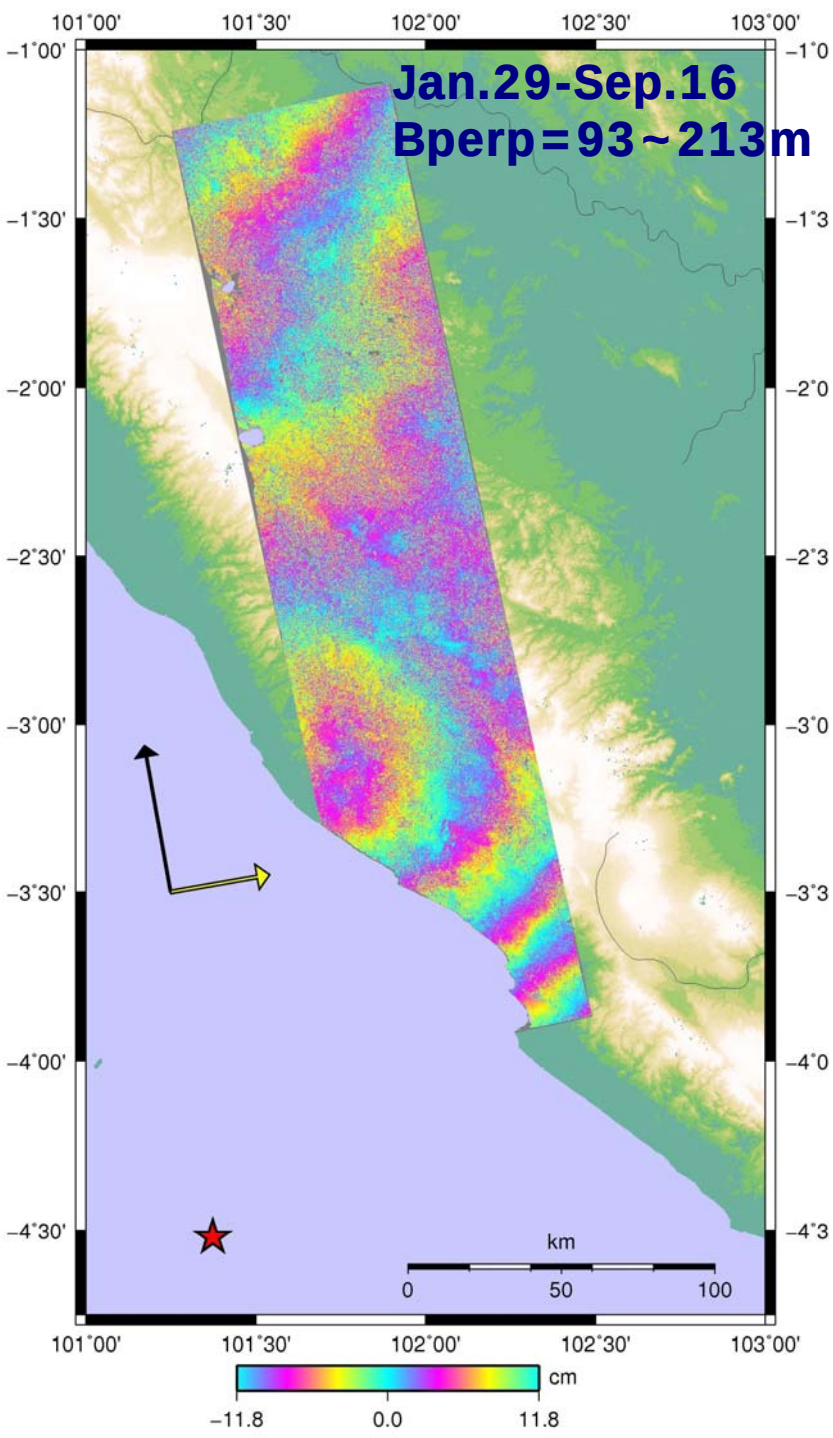
Gamma vs Sigma-SAR

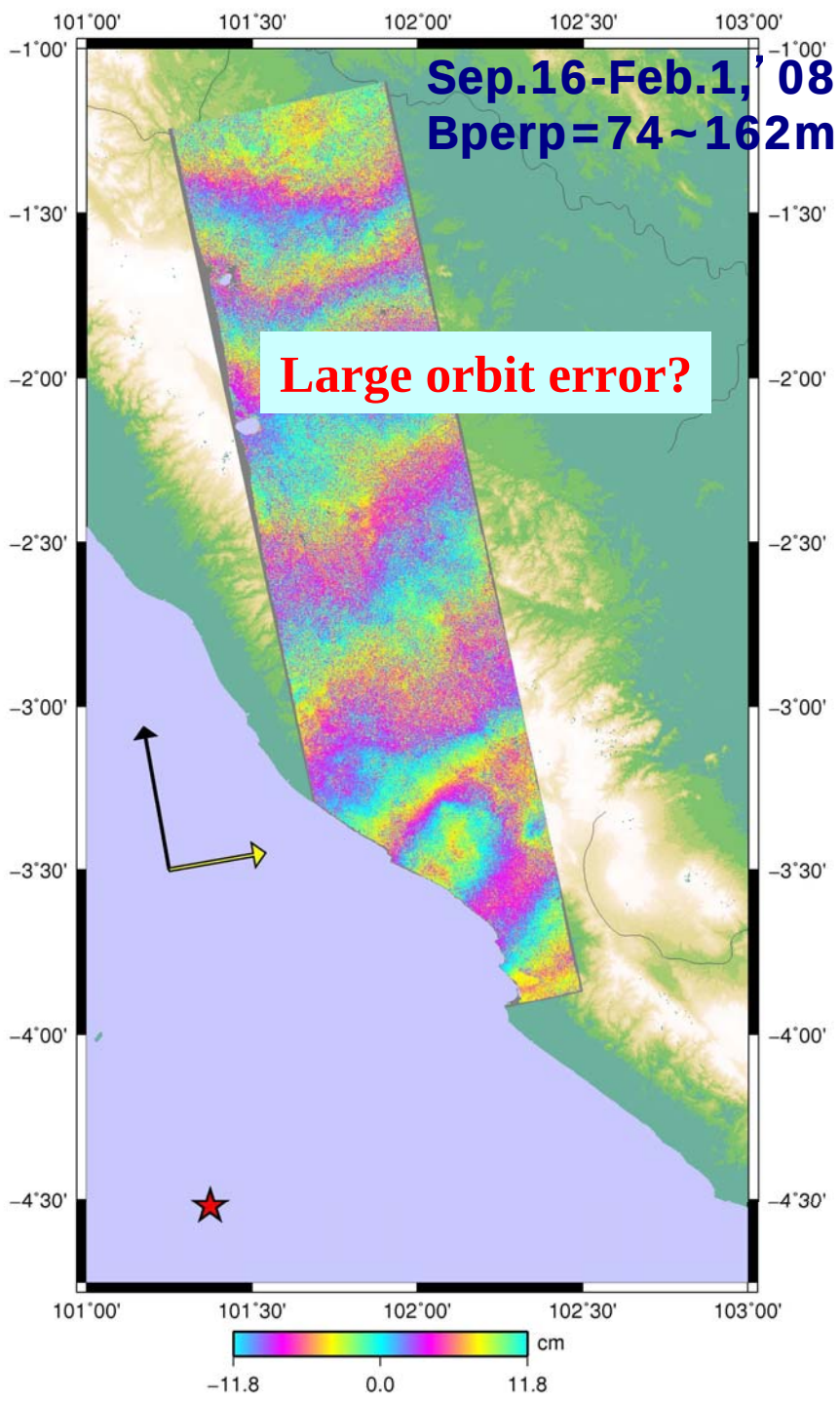
Result with Gamma has more fringes!

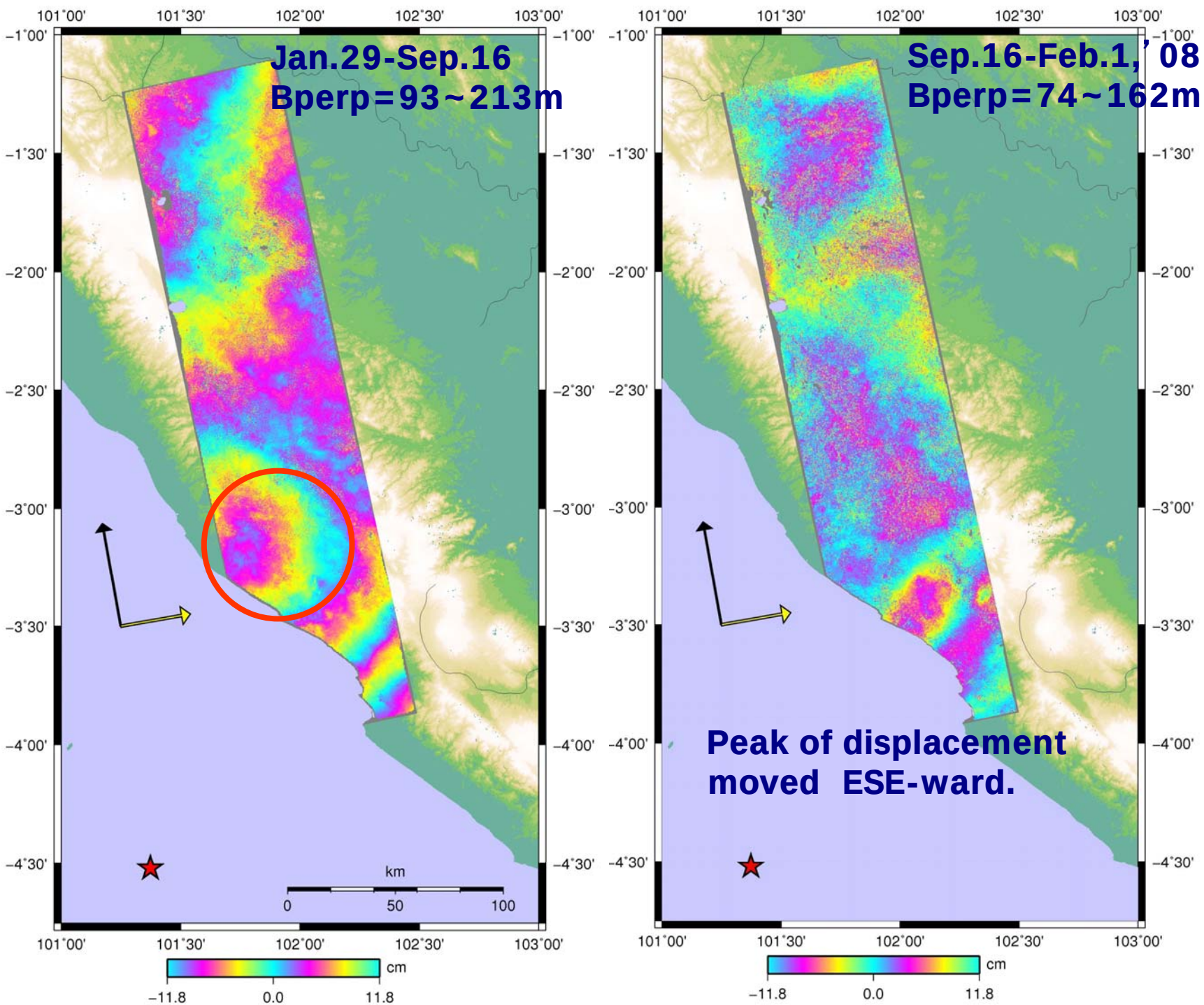


Difference between Gamma and Sigma-SAR

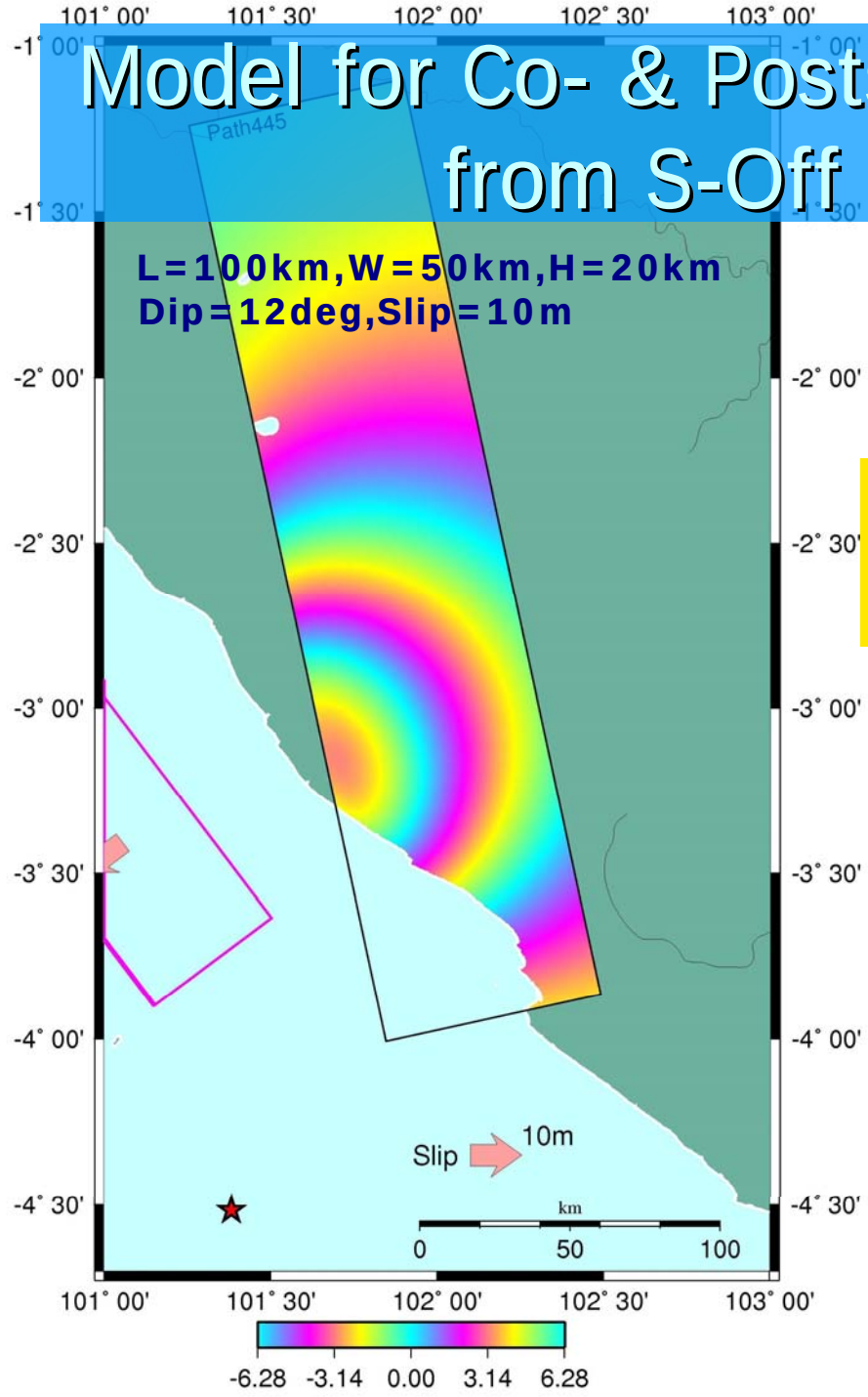
- Problems in computation of orbital fringes in Gamma
  - Especially in case of processing concatenated images
- 2008 version of Gamma
  - Function ***phase_sim_orb*** solved this problem.

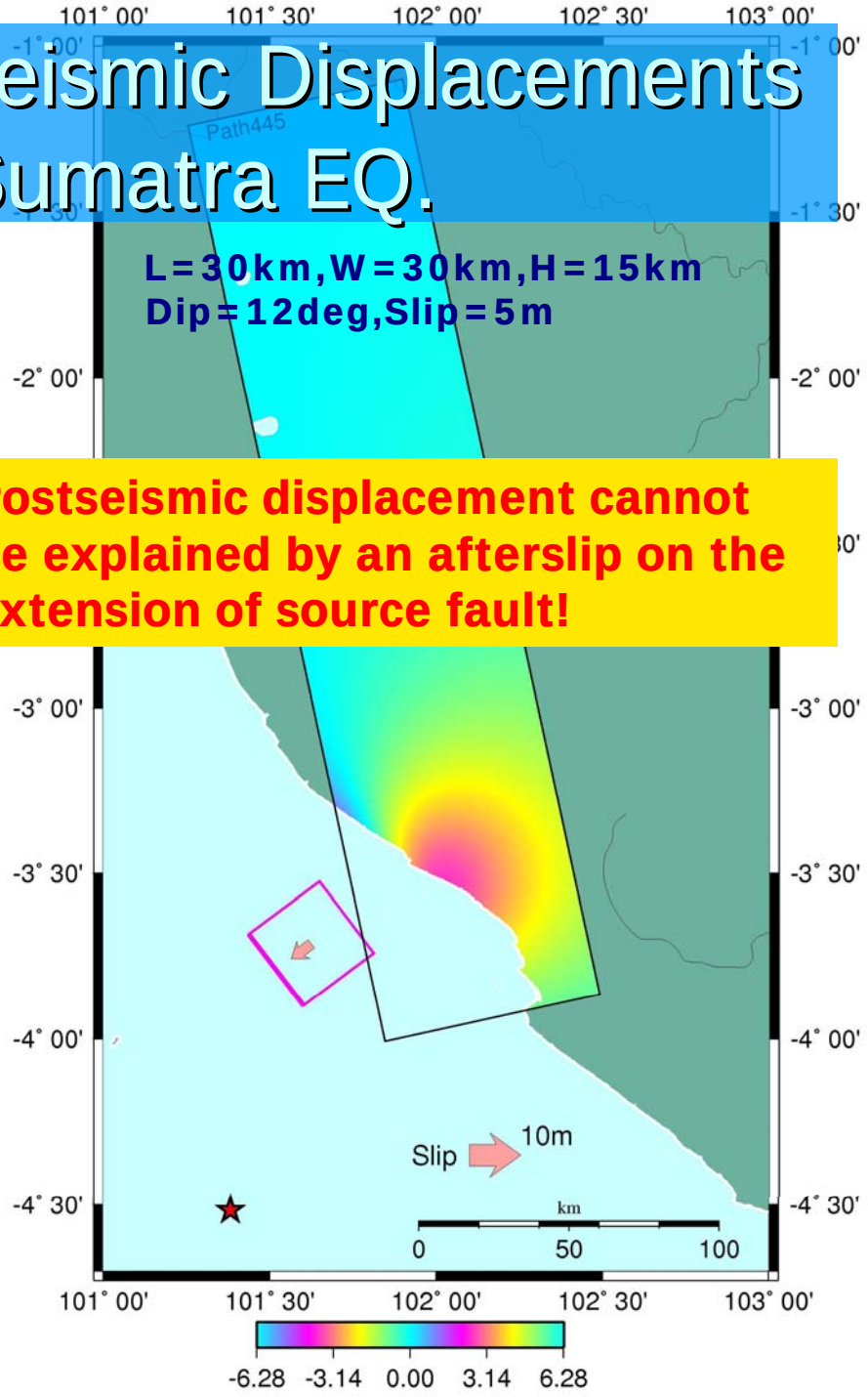

Jan.29-Sep.16
Bperp=93~213m
101°00'
101°30'
102°00'
102°30'
103°00'
-1°00'
-1°30'
-2°00'
-2°30'
-3°00'
-3°30'
-4°00'
-4°30'
km
0
50
100
cm
-11.8
0.0
11.8


Sep.16-Feb.1,' 08
Bperp=74~162m
Large orbit error?
101°00'
101°30'
102°00'
102°30'
103°00'
-1°00'
-1°30'
-2°00'
-2°30'
-3°00'
-3°30'
-4°00'
-4°30'
cm
-11.8
0.0
11.8


Jan.29-Sep.16
Bperp=93~213m
Sep.16-Feb.1, '08
Bperp=74~162m
Peak of displacement
moved ESE-ward.
km
0
50
100
cm
-11.8
0.0
11.8
101°00'
101°30'
102°00'
102°30'
103°00'
-1°00'
-1°30'
-2°00'
-2°30'
-3°00'
-3°30'
-4°00'
-4°30'

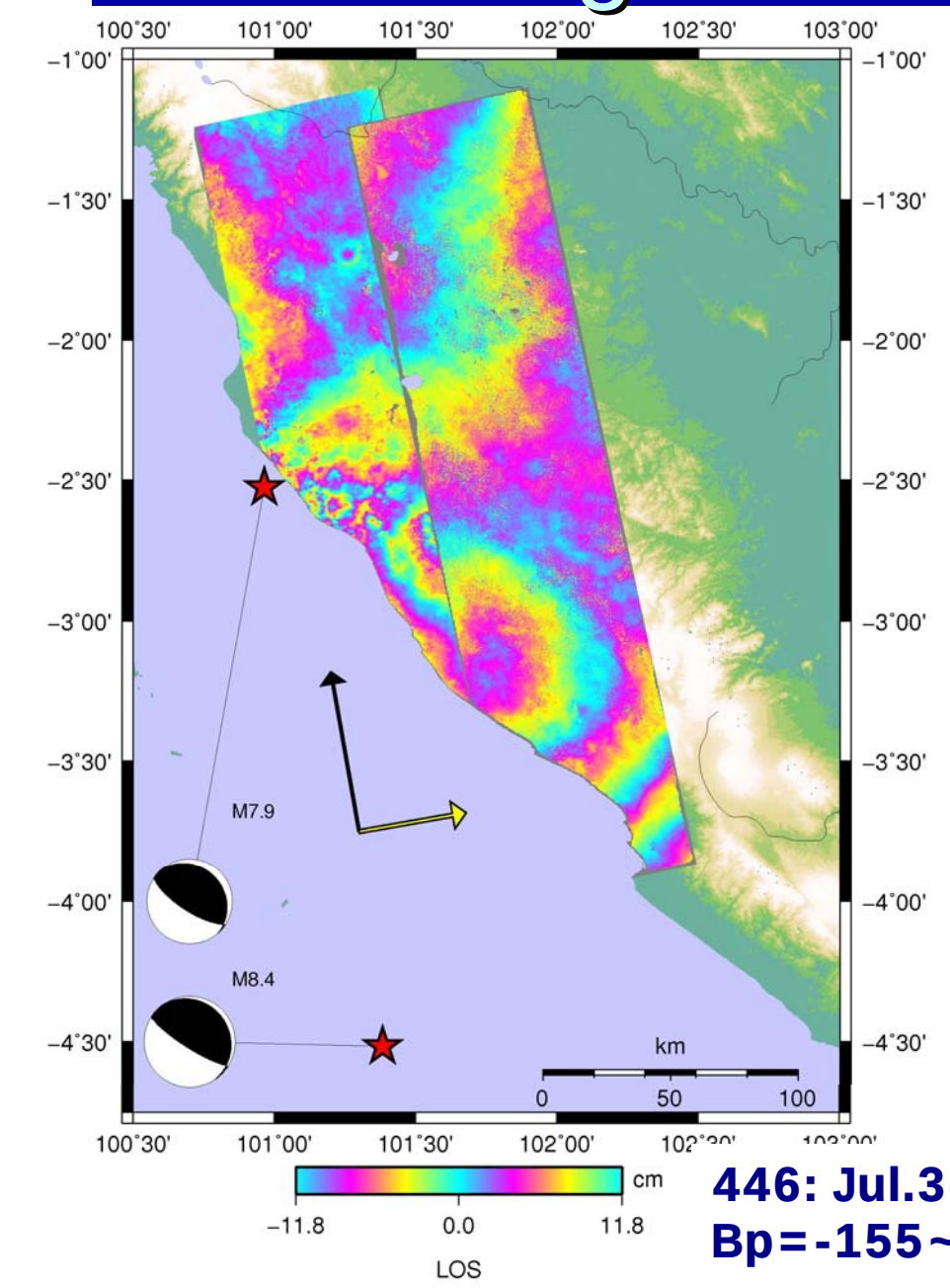
Model for Co- & Postseismic Displacements from S-Off Sumatra EQ.

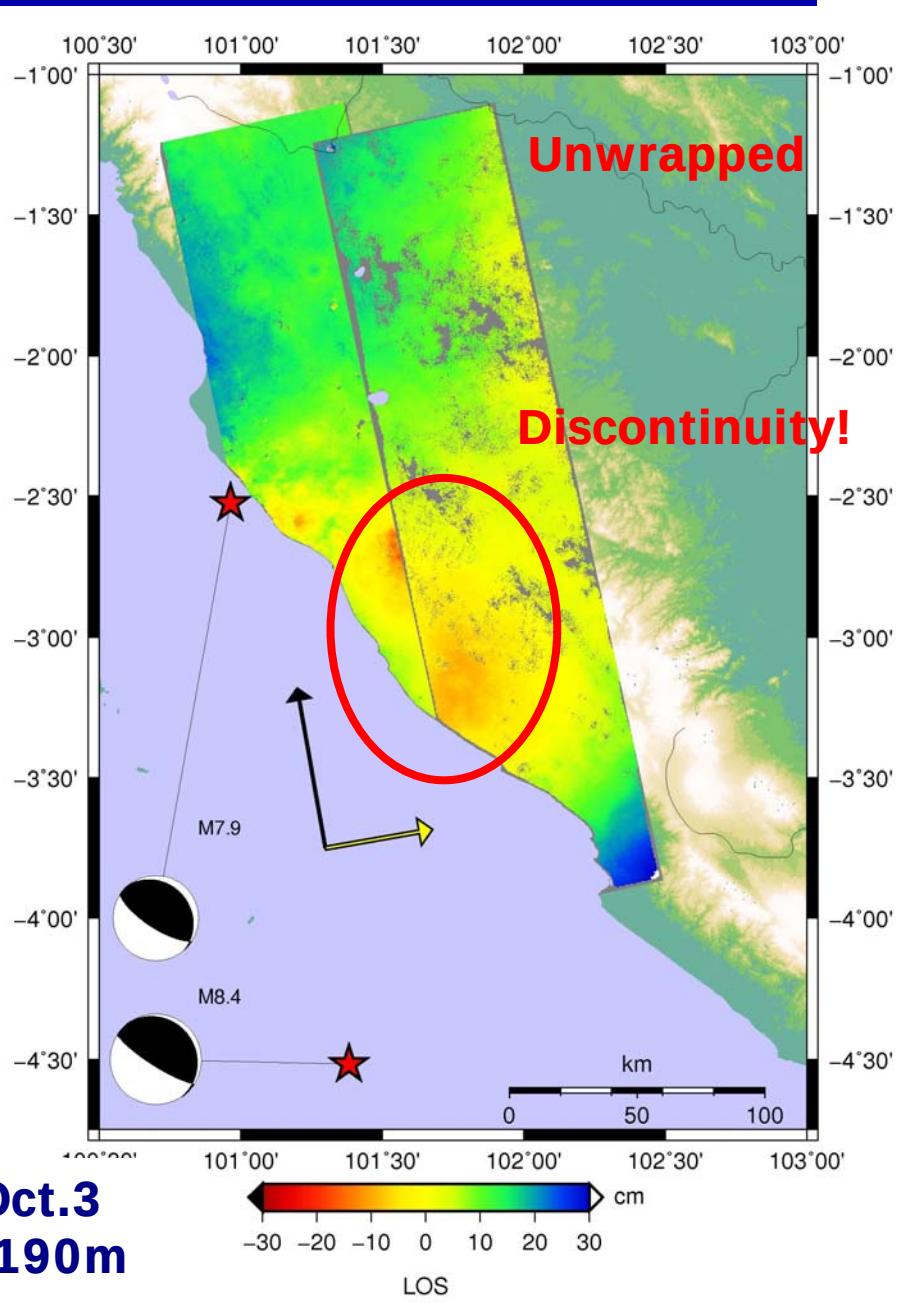




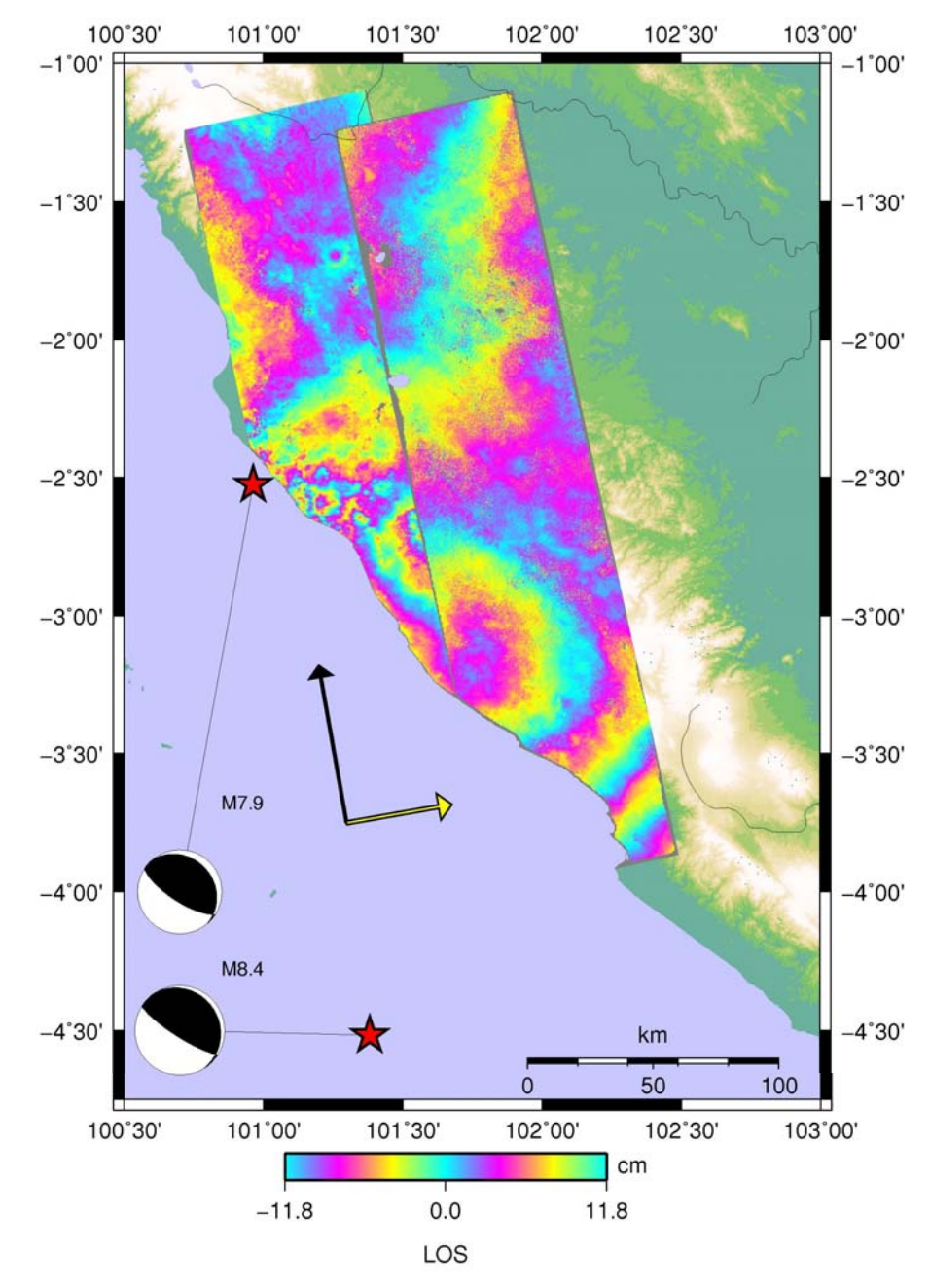
Postseismic displacement cannot be explained by an afterslip on the extension of source fault!

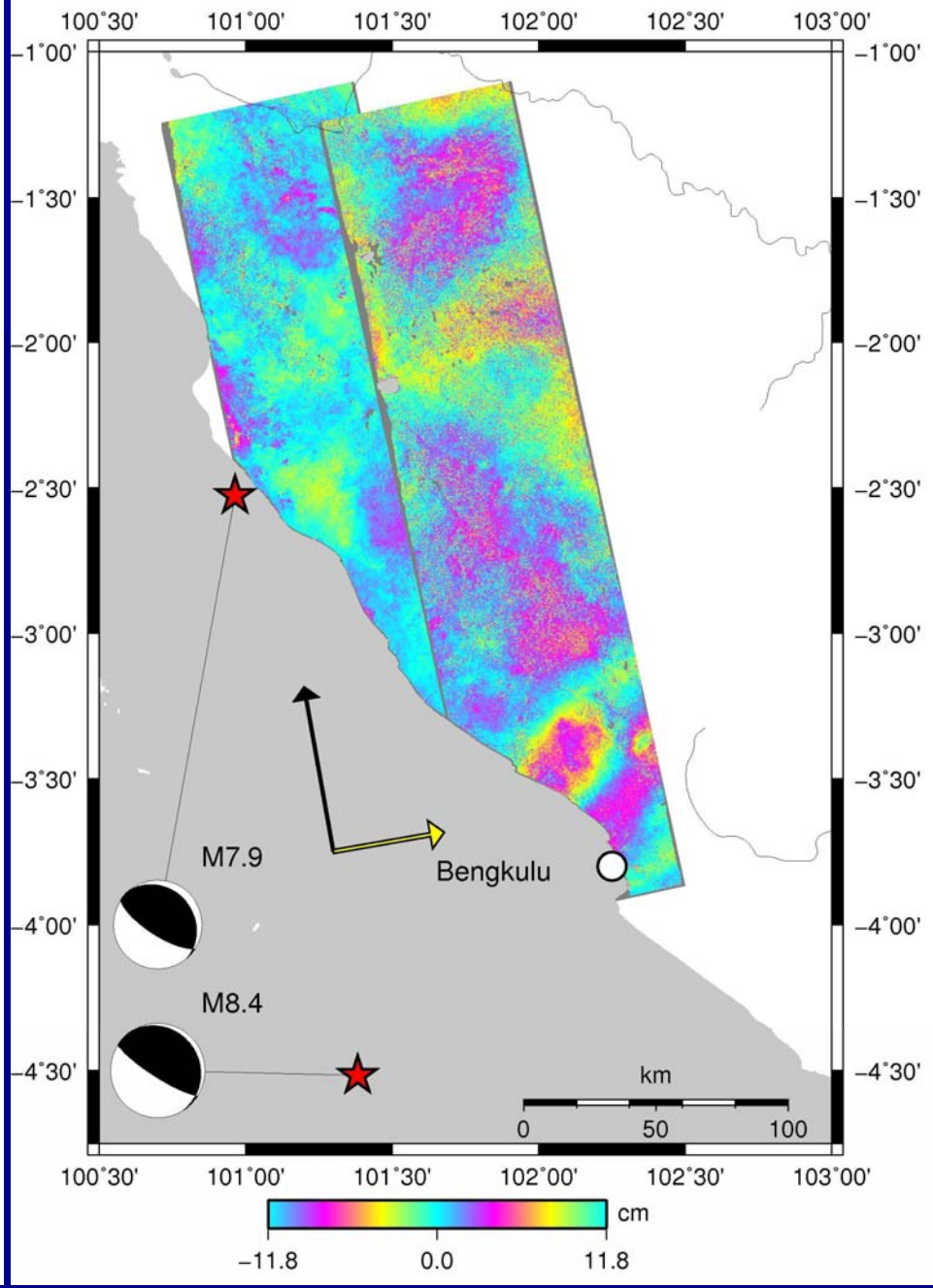
Interferograms for Paths 445-446





446: Jul.3-Oct.3
Bp=-155~-190m





Coseismic

Postseismic **446:Oct.3-Feb.18,Bp=176-245m**

Summary: S. off Sumatra EQ

- Technical aspects
  - Use of precise orbits
  - To Gamma user: Use of ***phase_sim_orb***
- Geophysical aspects
  - Peak of coseismic displacement of ~40cm 100km NNW of Bengkulu
  - There may be rapid postseismic deformation during September.
  - Change of pattern between co- and postseismic displacements
  - Afterslip model on the extension of source fault may not be applicable.