3-6

L-band SAR を用いた沿岸域のモニタリング

Coastal Monitoring using L-band SAR image Data

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Akiko TANAKA (Geological Survey of Japan, AIST)

SAR is a powerful remote sensing system, and conventional InSAR and PSInSAR has found wide application in the study of Earth surface change. Some applications in coastal regions are introduced. Coastal geomorphology is highly variable as it is affected by sea-level changes and other naturally- and human-induced fluctuations. To effectively assess and monitor geomorphological changes in various time scales is thus critical for coastal management. Asian mega deltas are vulnerable to a sea-level rise due to its low-lying delta plain, and are dynamic region given a large amount of sediment supply. However, limited data availability and accessibility in the deltas have prevented establishment of systematic coastal monitoring. A variety of remote sensing systems can be used to monitor geomorphological changes in coastal areas as it has wide spatial coverage and high temporal repeatability. Especially, analysis using SAR data not affected by the cloud conditions offer potential for monitoring in the monsoon Asia region. I present that L-band SAR data are useful for monitoring coastal areas on a regional scale.

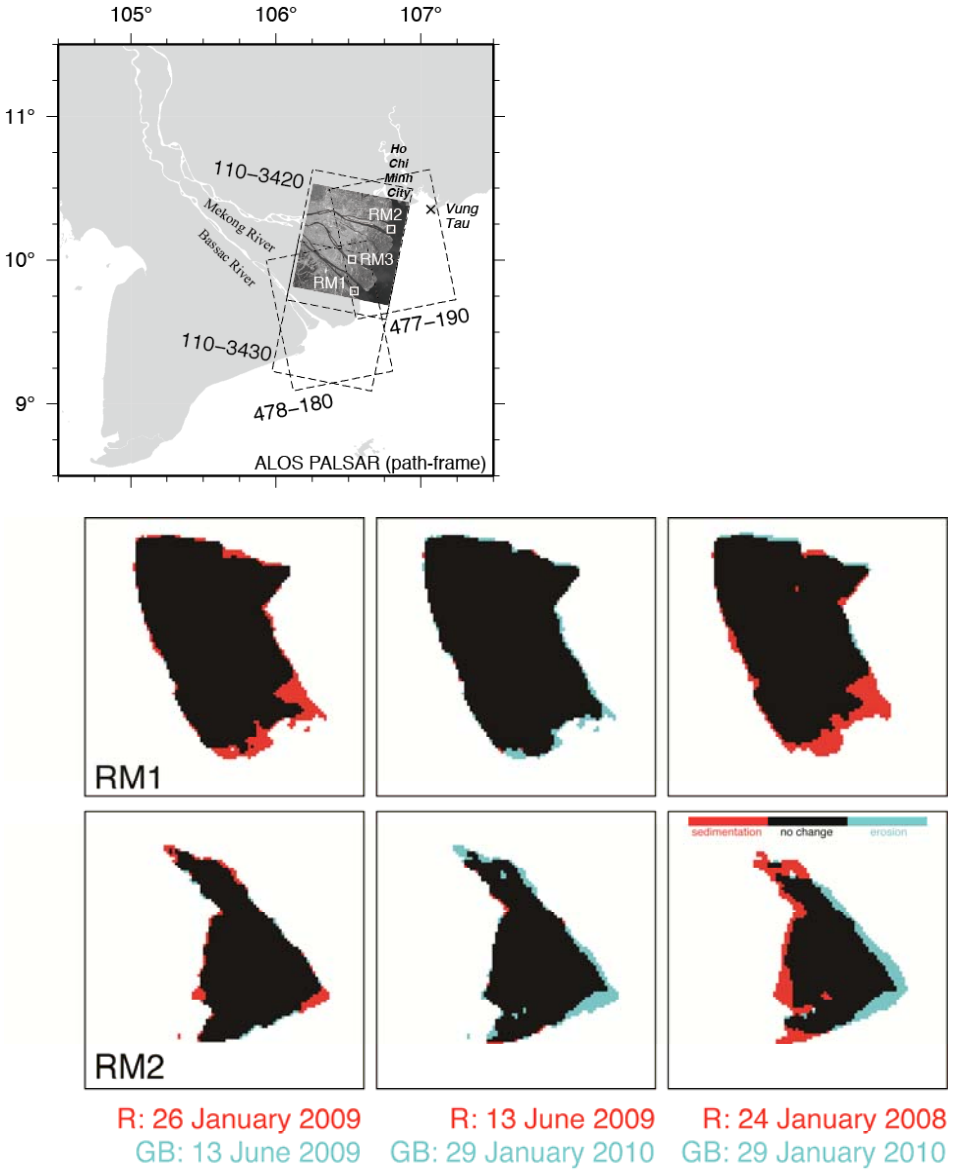

Figure caption: (upper) Map of the study area showing locations of the three river-mouth bars (RM hereafter, small white squares) investigated in this study. Dashed rectangles show the approximate areas of coverage of the ALOS PALSAR data used (path and frame numbers are annotated). (lower) Changes of areal extents of RM1 (upper panels) and RM2 (lower panels) derived by color additive analysis over three periods in this study.

National Institute of Advanced Industrial Science and Technology
AIST

京都大学 防災研究所
一般研究集会「SAR研究の新時代に向けて」
13 September, 2012

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Akiko TANAKA

Geological Survey of Japan, AIST

Outline

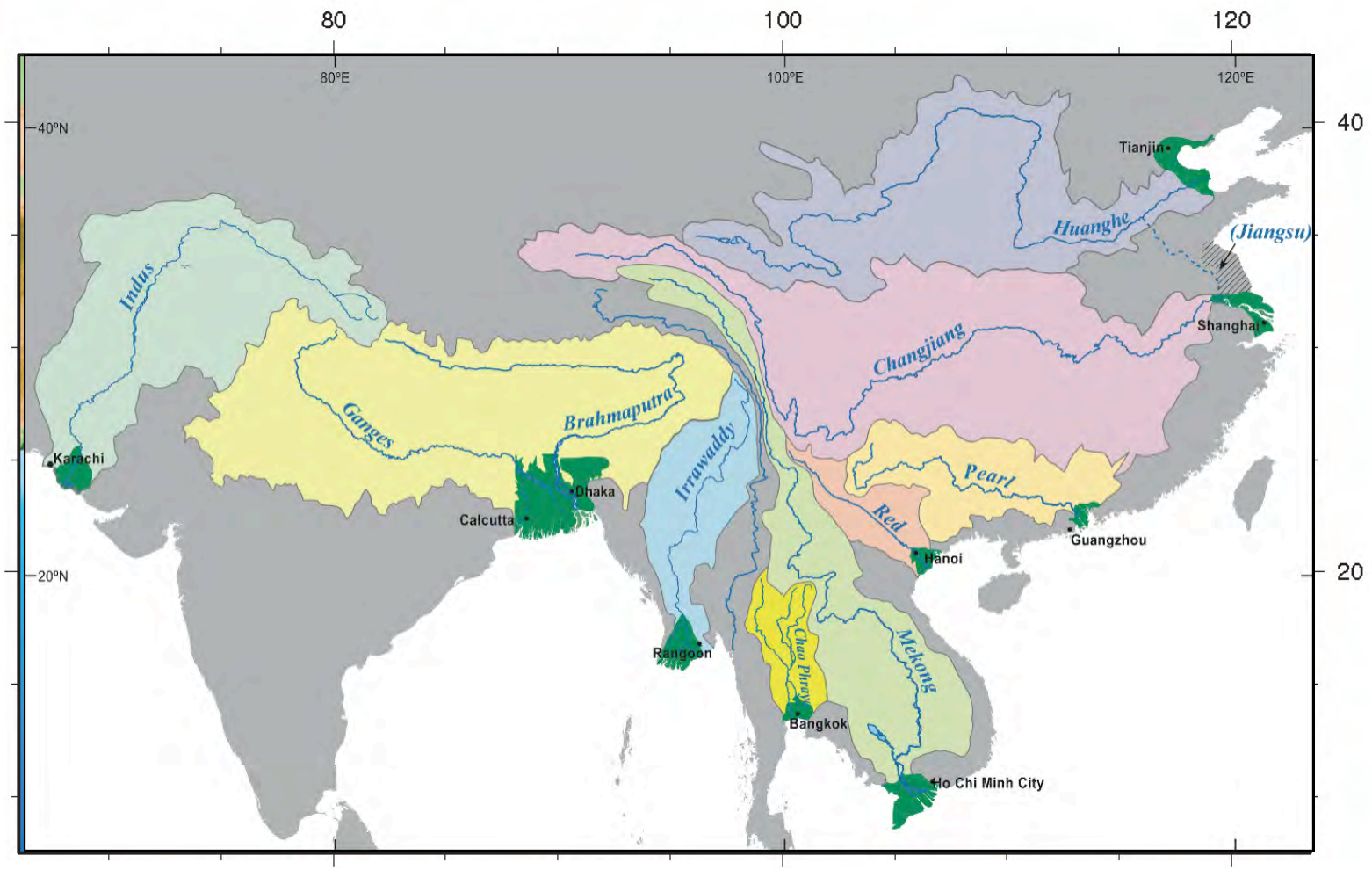
- Coastal monitoring by InSAR?

- Deltas are wet and flat where InSAR is difficult.

- Rapid (groundwater-related?) subsidence was detected by InSAR.

- However, ….

Asian Mega-Deltas



ETOPO1

Woodroffe *et al*. [2006]

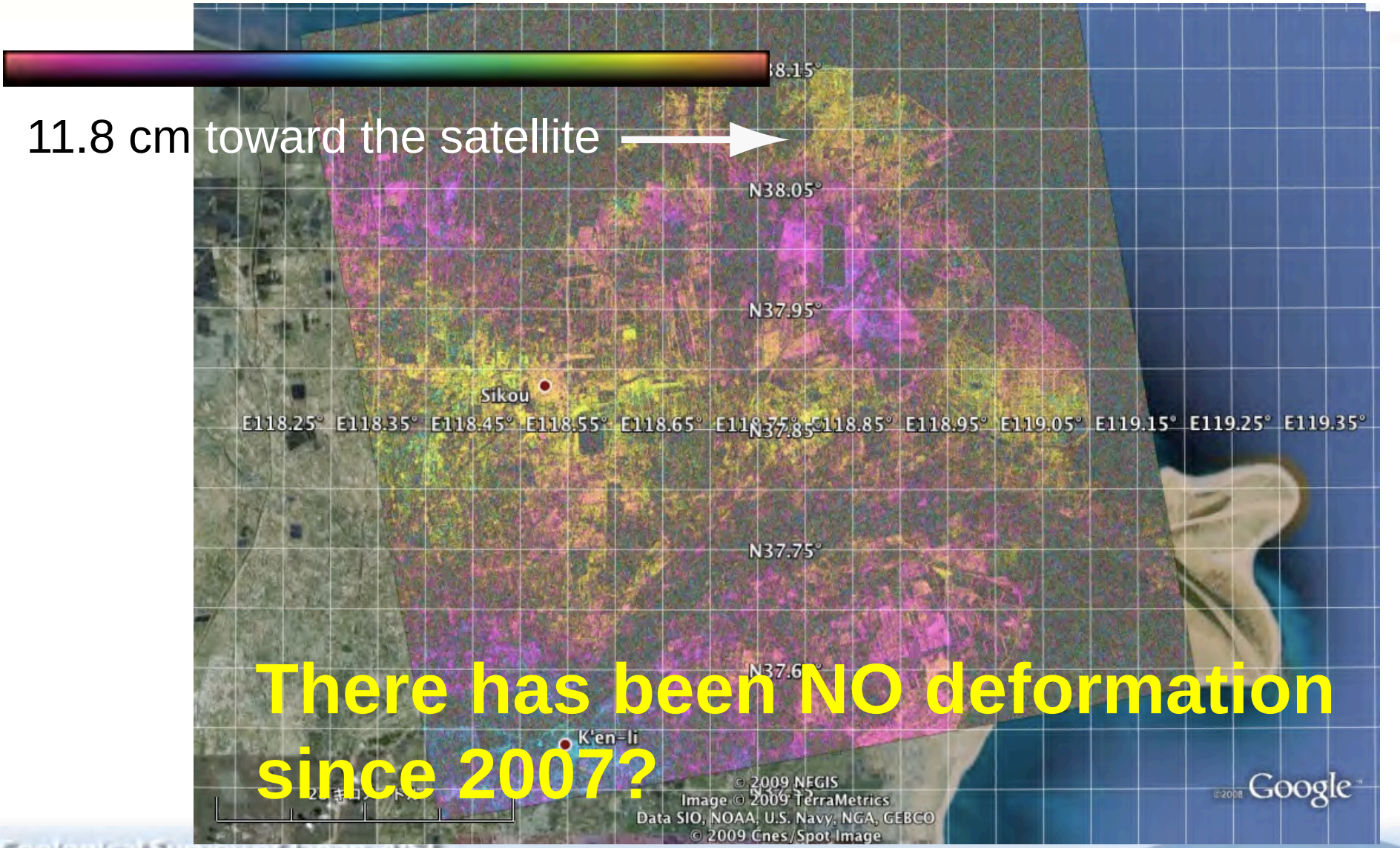
Yellow River Delta

Landsat 7/TM 2000/05/02

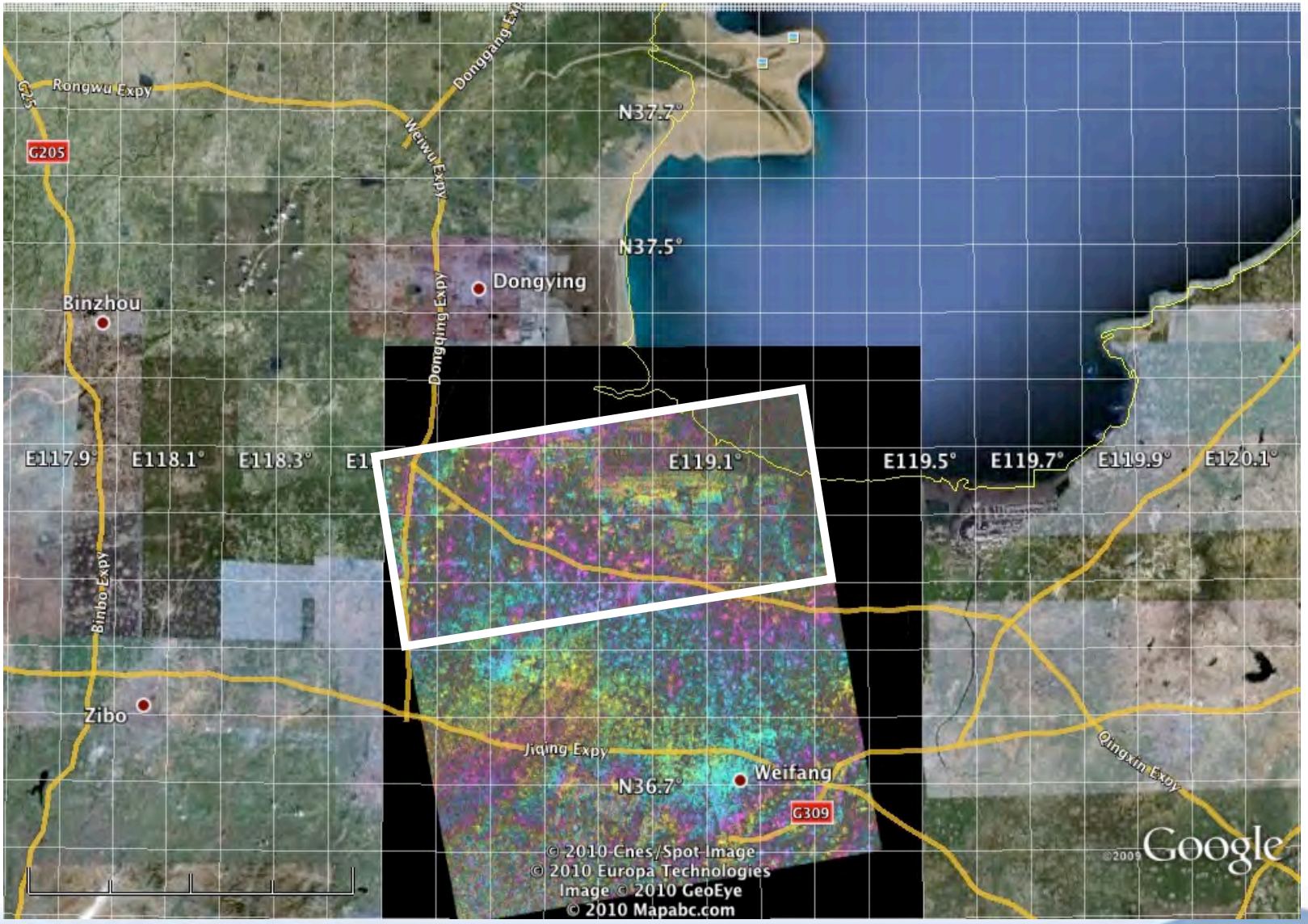
http://earthobservatory.nasa.gov

PALSAR Amplitude 2008/06/012

PALSAR Interferogram
Master: 2007/07/15; Slave: 2008/06/01

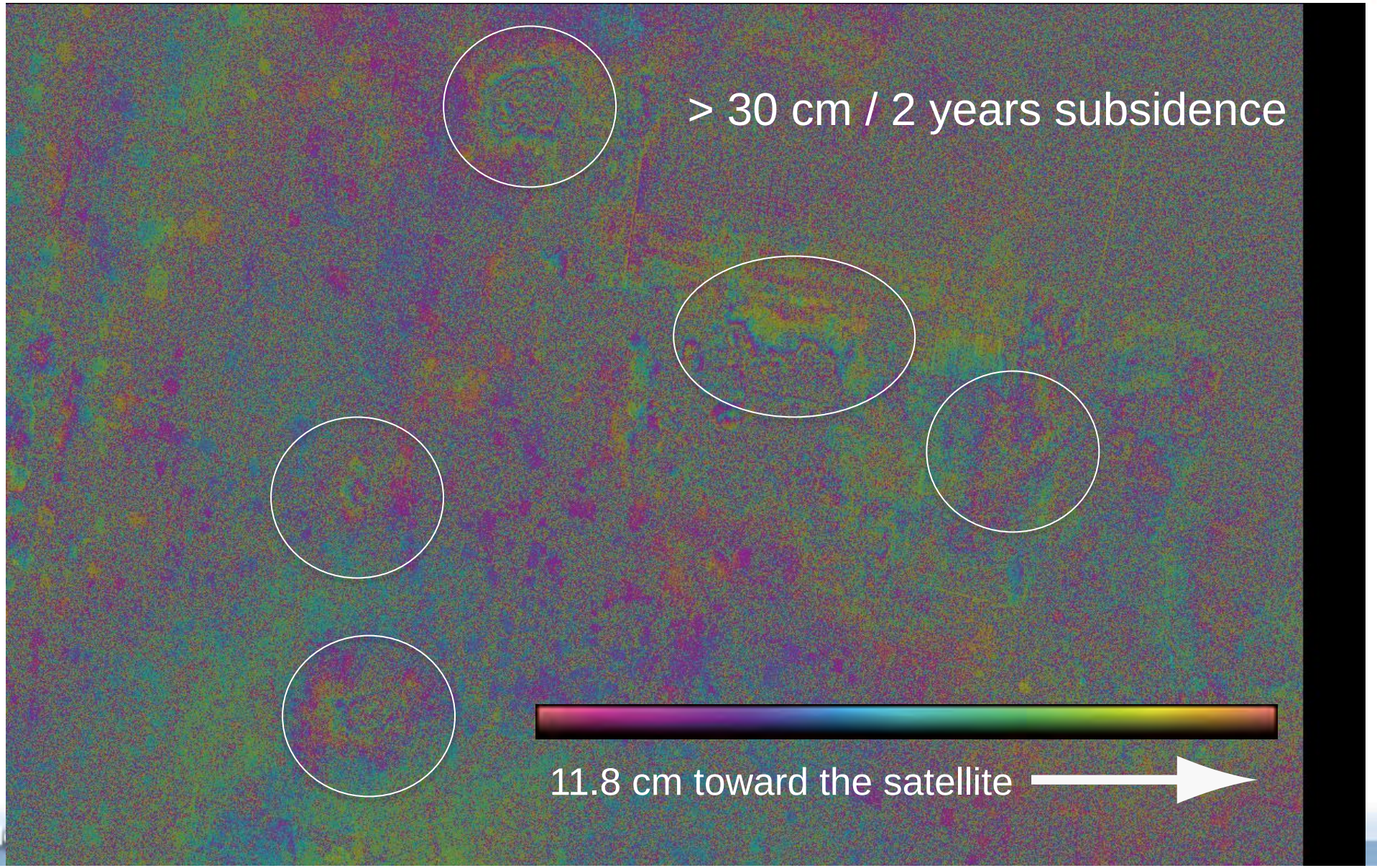


PALSAR Interferogram
Master: 2008/03/14; Slave: 2010/04/22

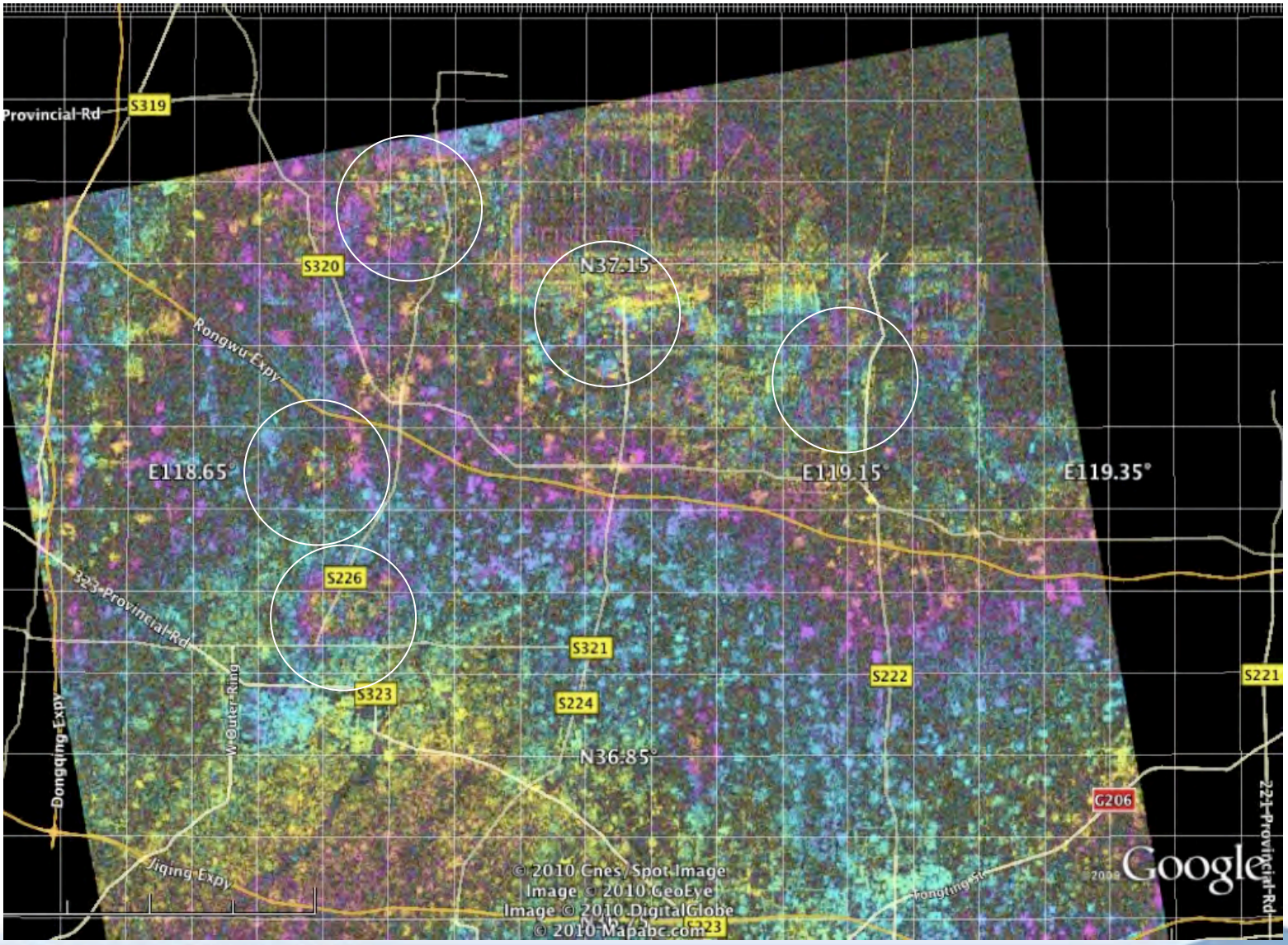


PALSAR Interferogram

Master: 2008/03/14; Slave: 2010/04/22



PALSAR Interferogram
Master: 2008/03/14; Slave: 2010/04/22



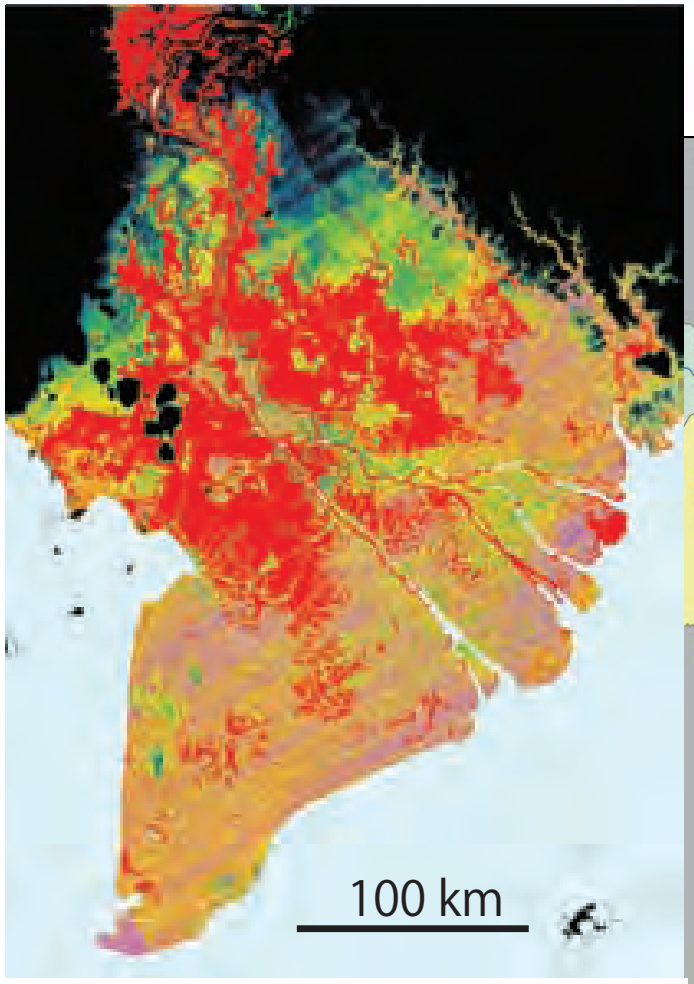
PALSAR Interferogram
Master: 2008/03/14; Slave: 2010/04/22

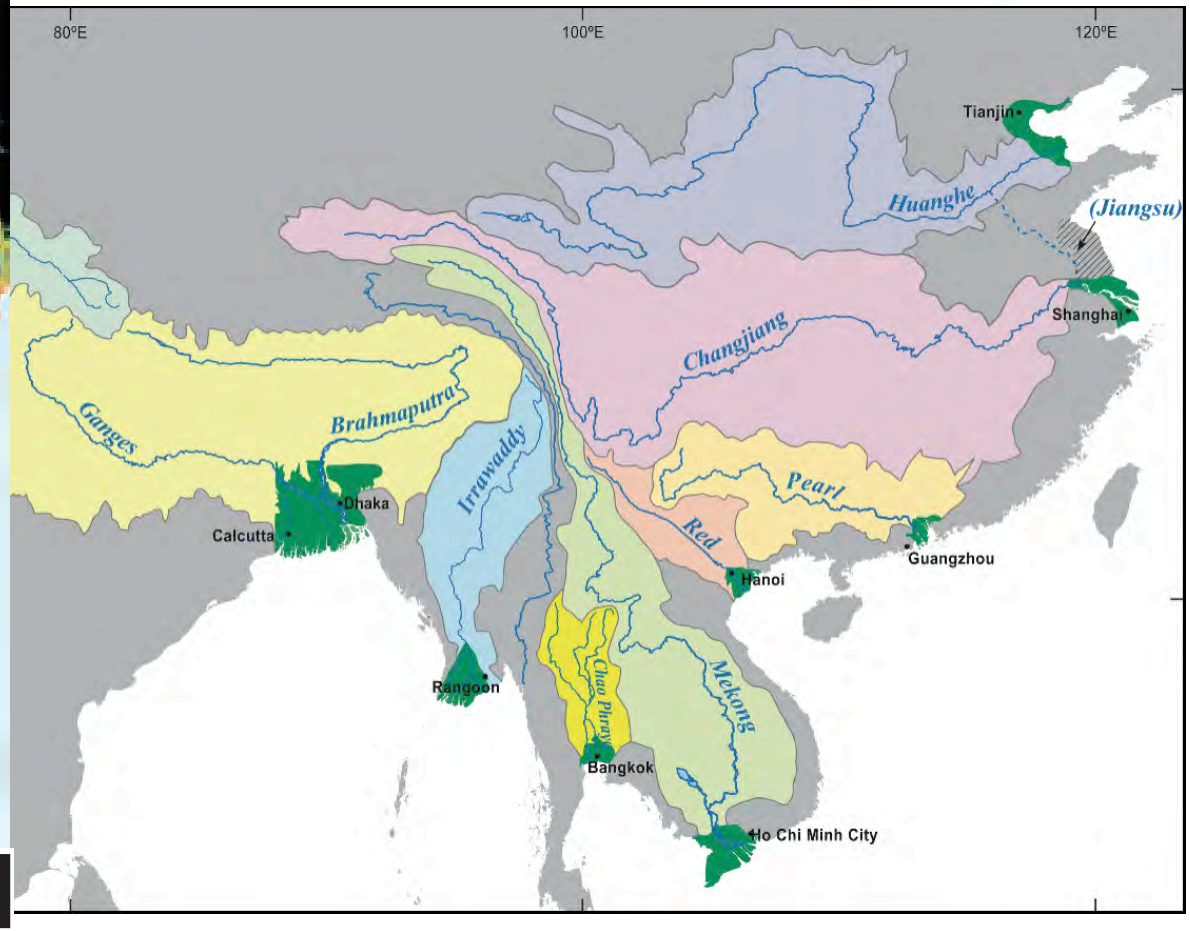
Outline

- Introduction
  - Asian Mega-Deltas, Mekong River Delta Area
- ALOS/PALSAR Data and Analysis (Histogram Thresholding Algorithm)
- Results and Discussion
  - Annual Changes of River-Mouth Bars (RM)
  - Seasonal Changes of RM
  - Relationship between area of RM and Tidal Height
- Conclusions

Quantification of Temporal Changes to River-Mouth Bars from L-band SAR Images: a Case Study in the Mekong River Delta

Mekong River Delta



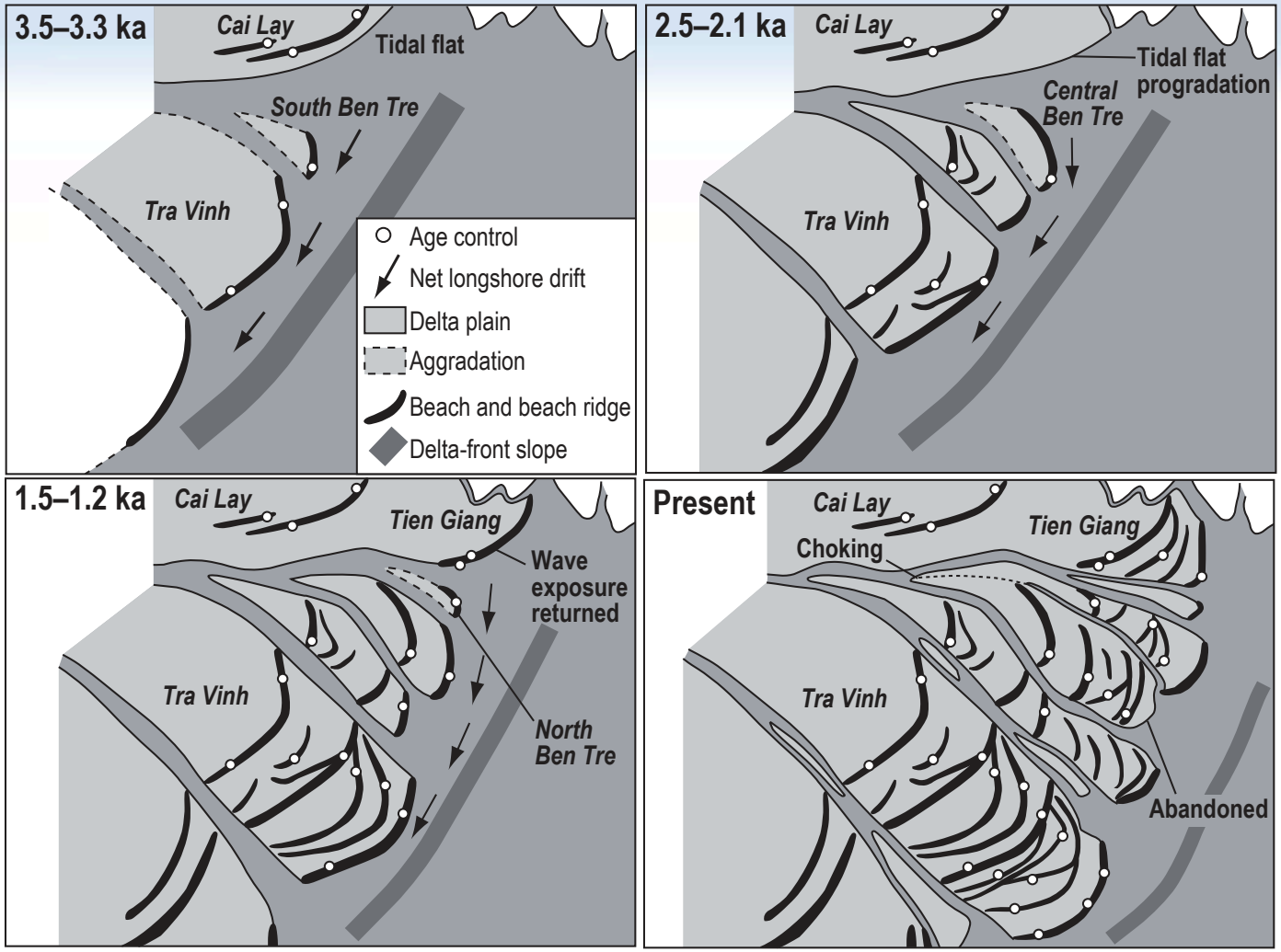


Flooded <–2 0 2 4 6 8 10 >

SRTM altimetry [m]

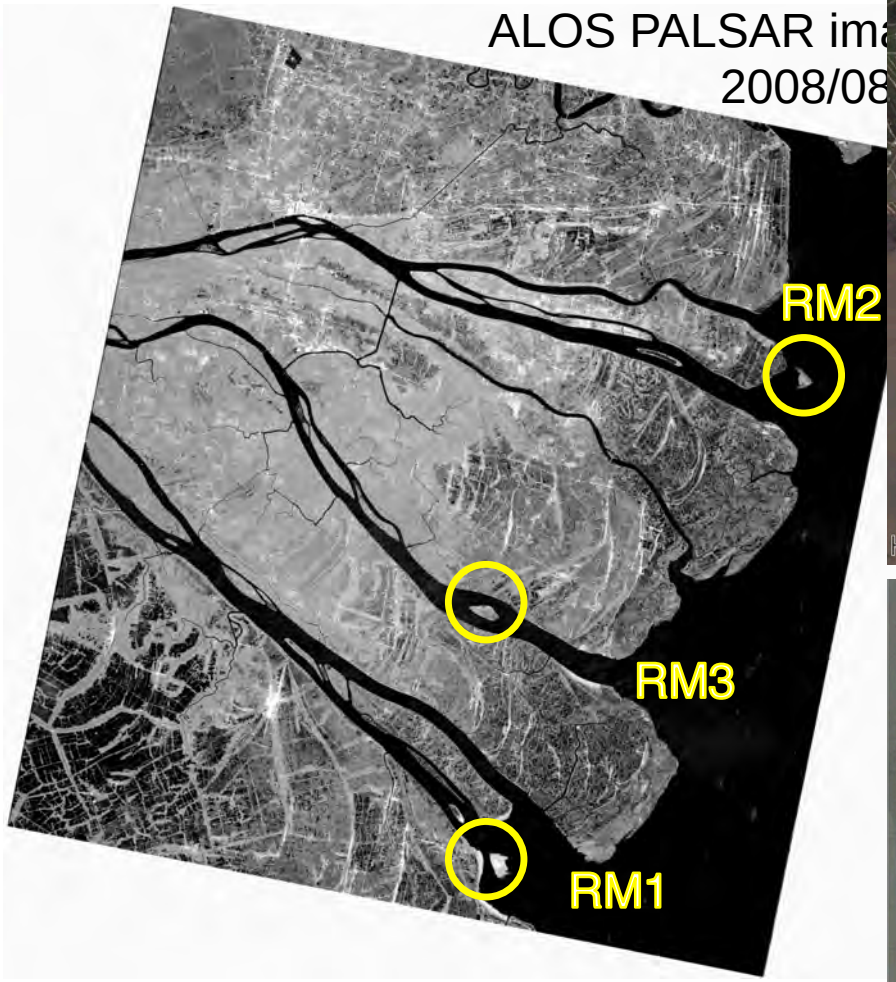
Delta Flooding on 8 November 2007

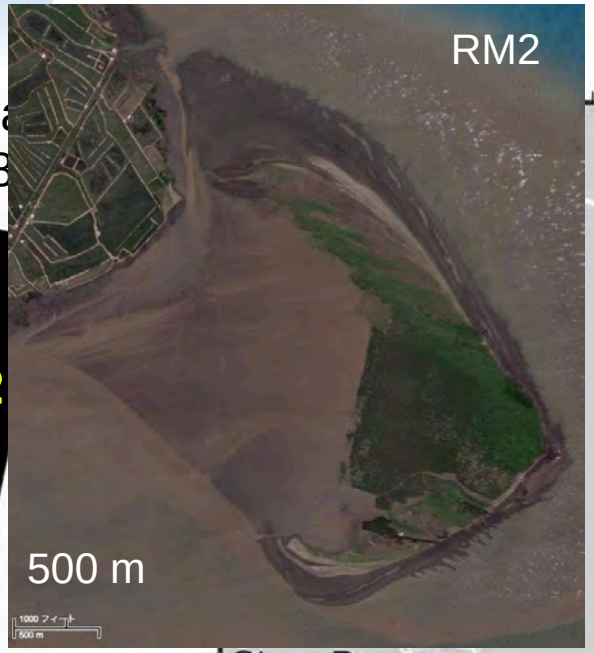
Woodroffe *et al*. [2006]

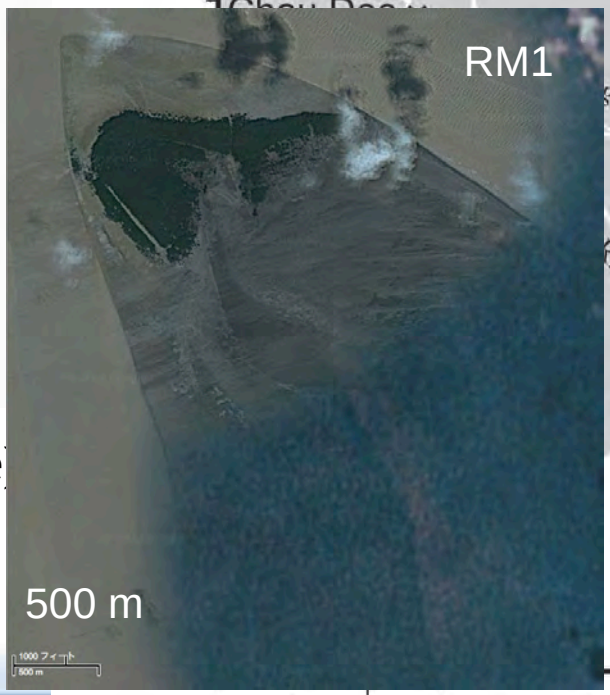


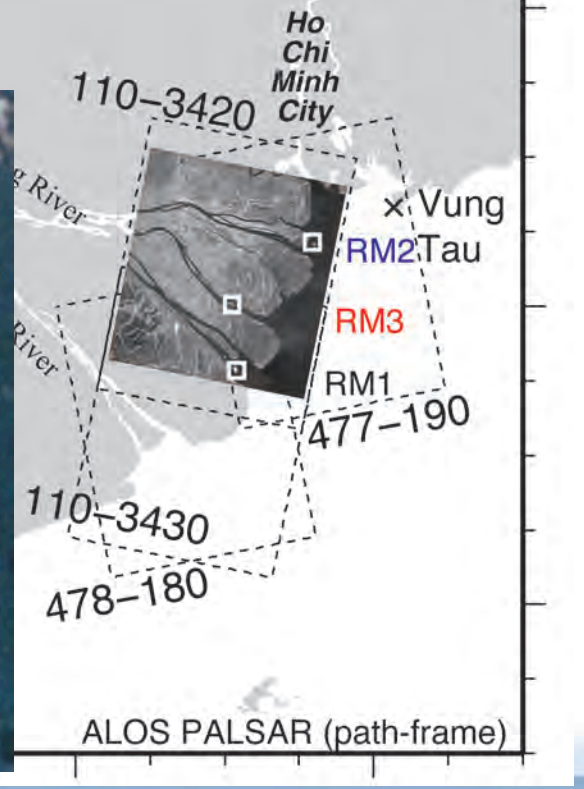
Schematic illustration showing evolution of Mekong River delta plains. River mouth at 3.3–3.5 ka reflects main incised valley of Mekong River delta. Longshore drift of sand is driven by dominant winter monsoon and associated waves and currents. [Tamura *et al.*, 2012]

Study Area

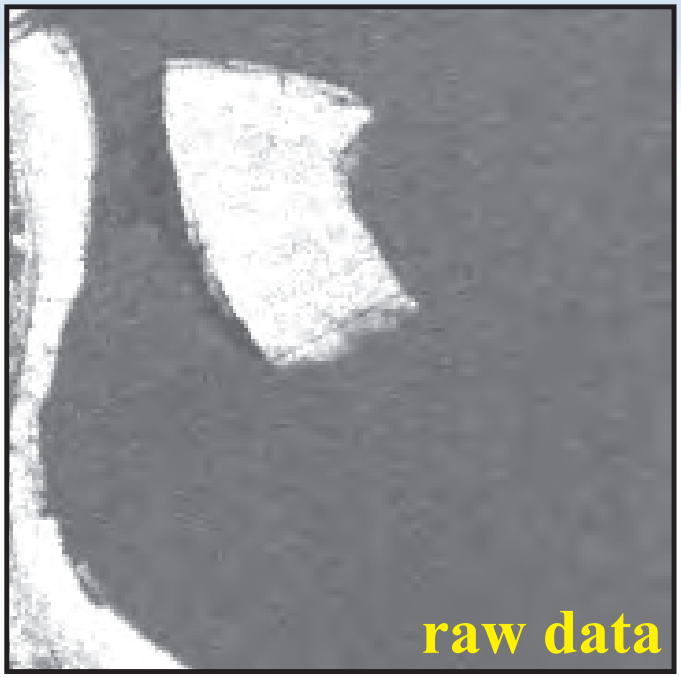


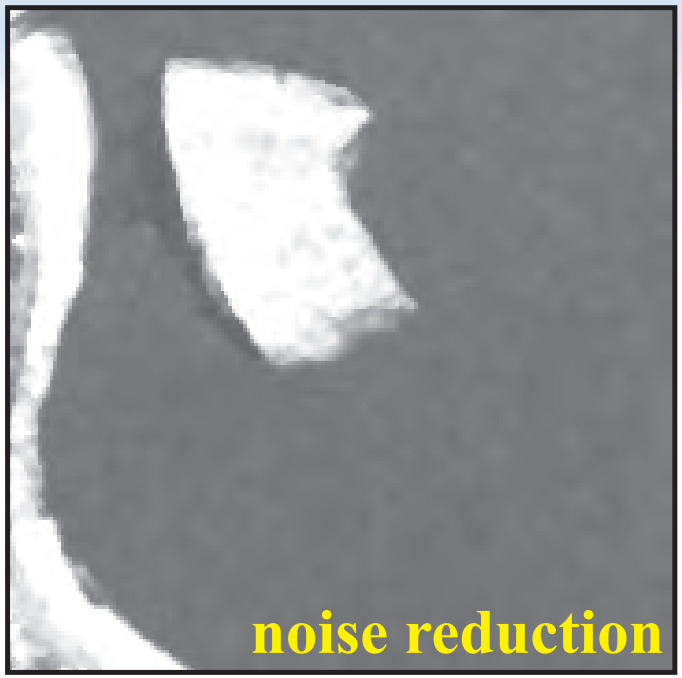




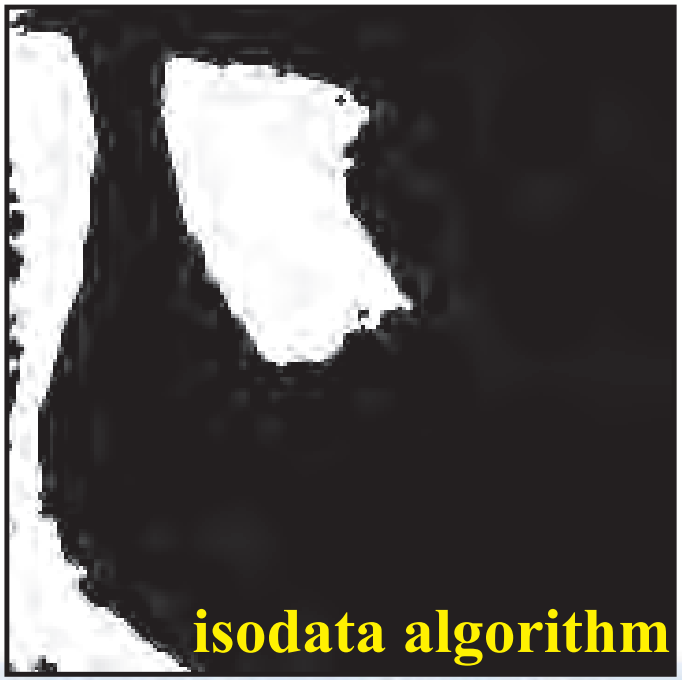


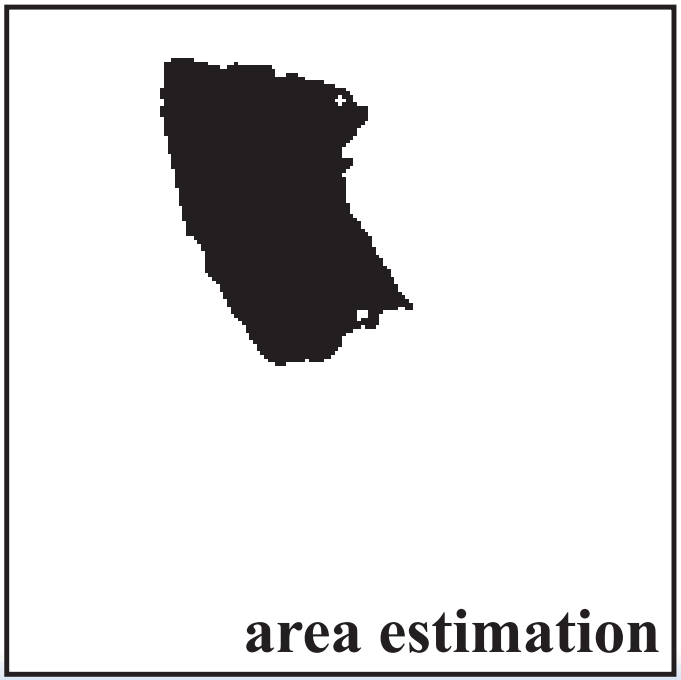
ALOS (Advanced Land Observing Satellite)
PALSAR (Phased Array type L-band SAR)
December 2006 - January 2011
FBS/FBD, off-nadir angle: 34.3°





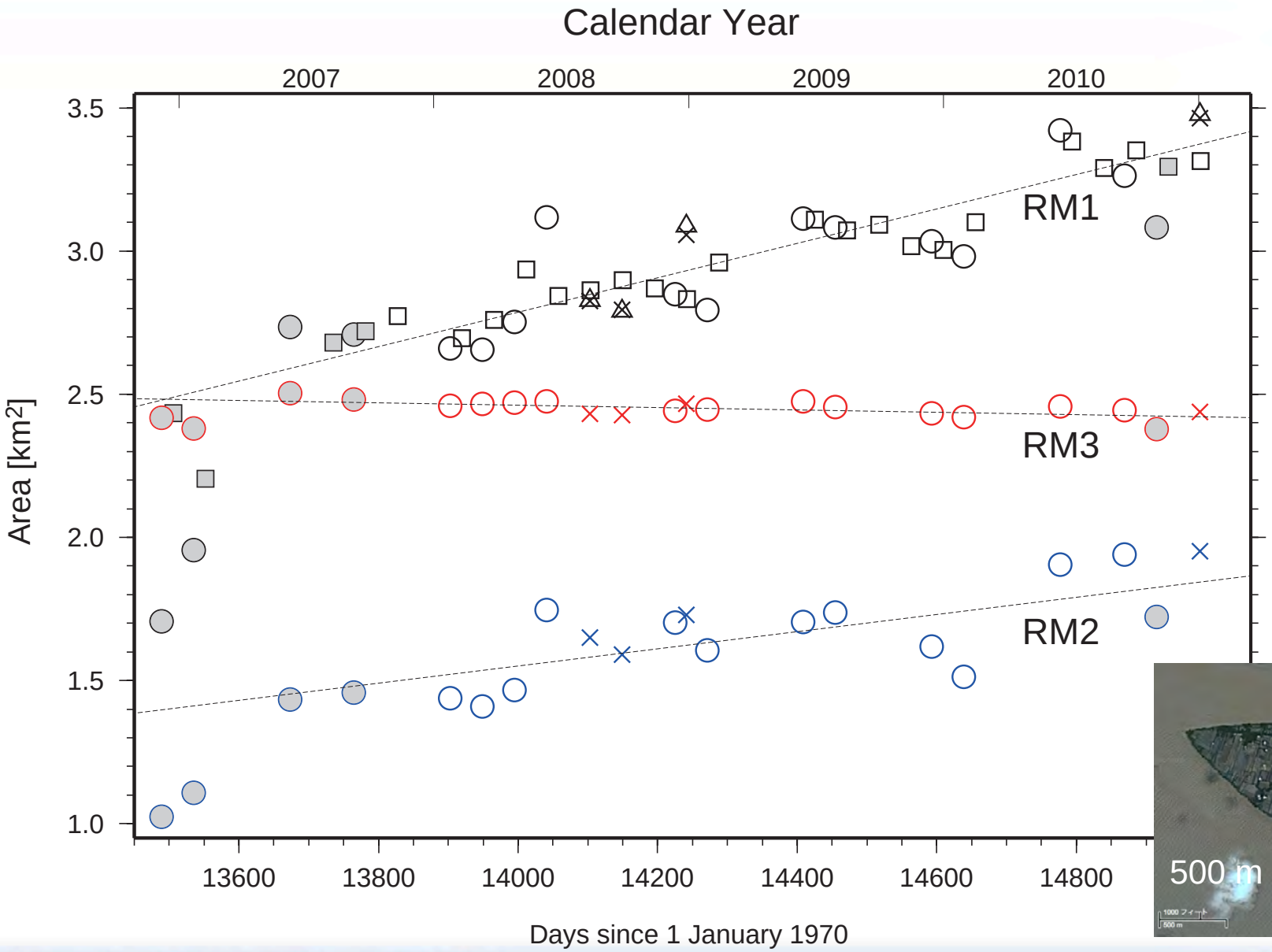
Thresholding Algorithm





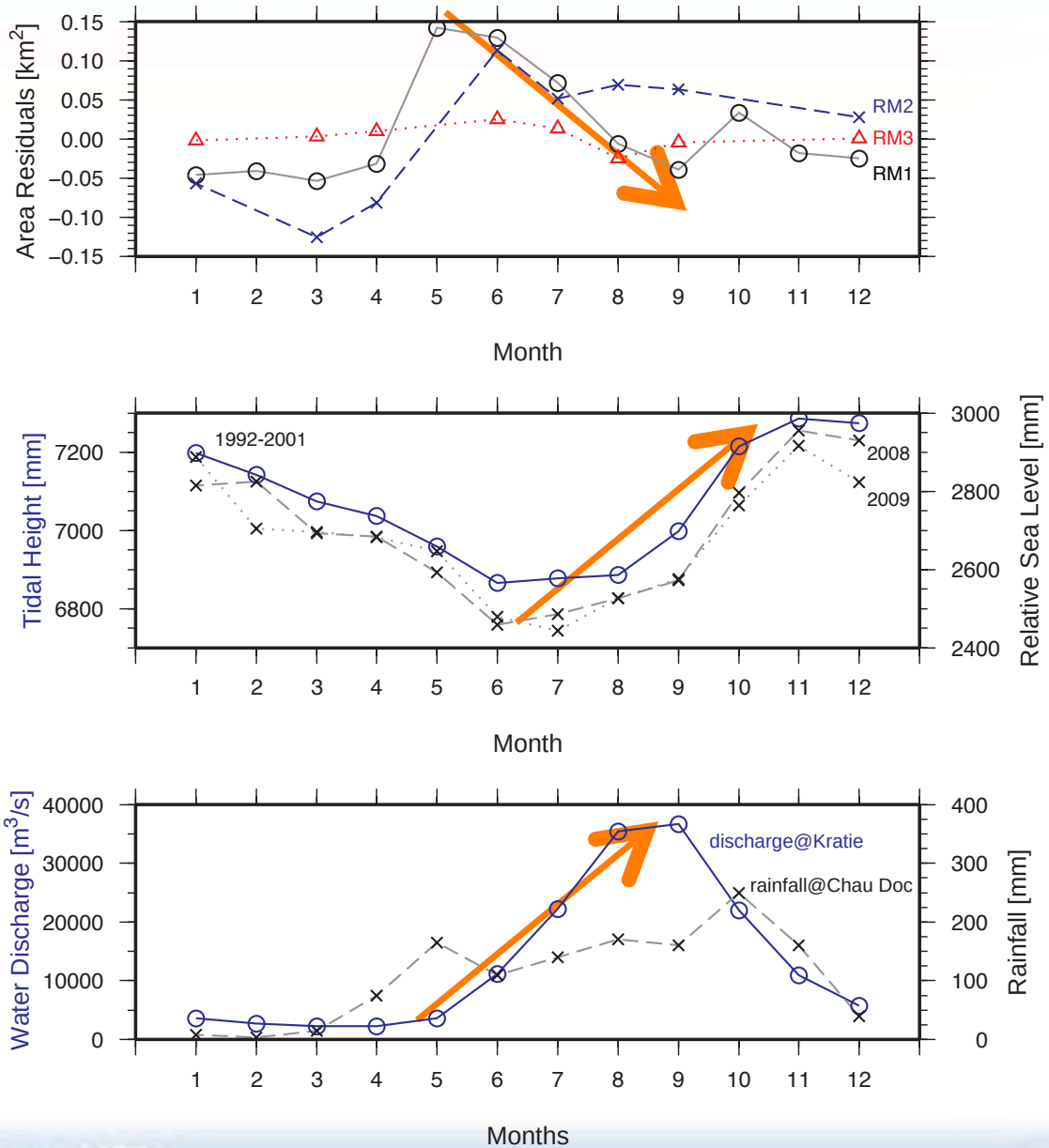
ALOS PALSAR Backscatter Intensity Image of RM1 Acquired on 3 January 2011

Annual Changes of River-Mouth Bars

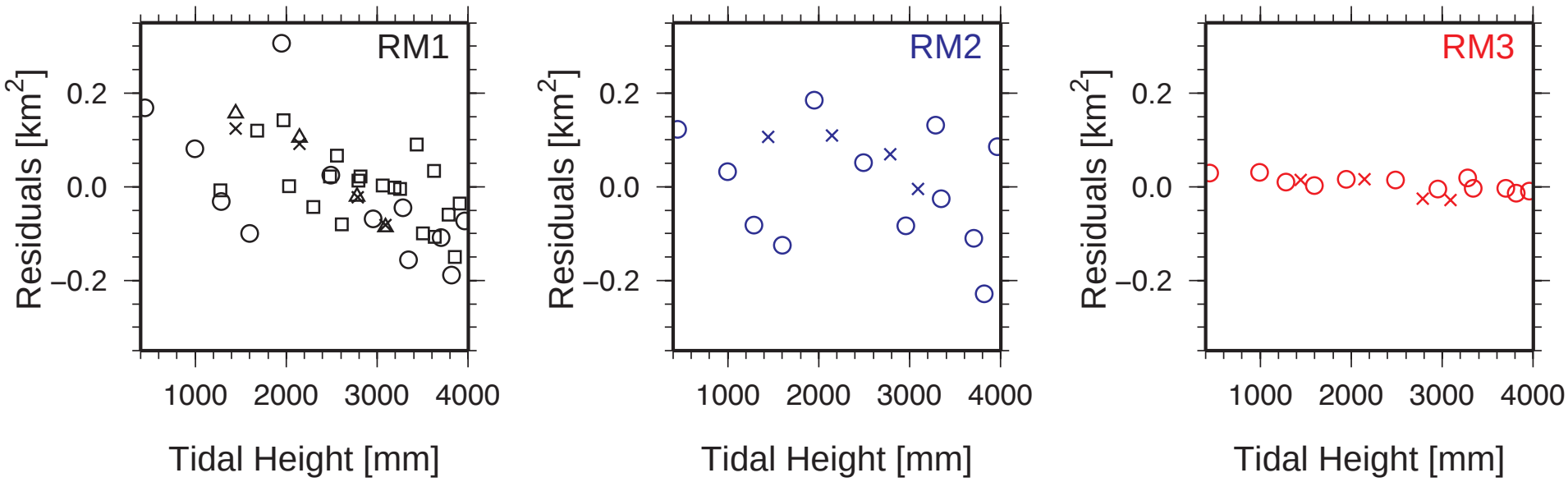


Ascending [Path-Frame: 477-190 (○), 478-180 (□)] Descending [Path-Frame: 110-3420 (x), 110-3430 (△)]

Seasonal Changes of River-Mouth Bars

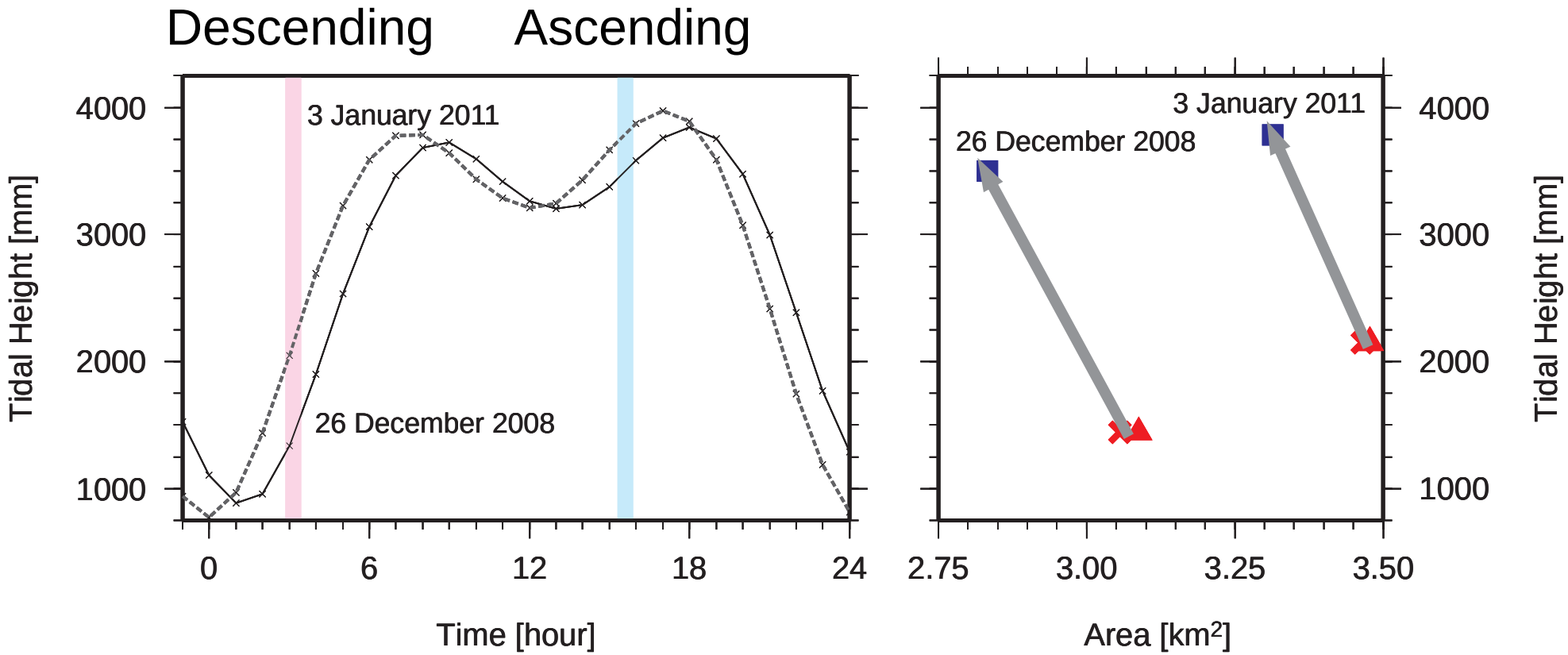


Area Residuals versus Tidal Heights



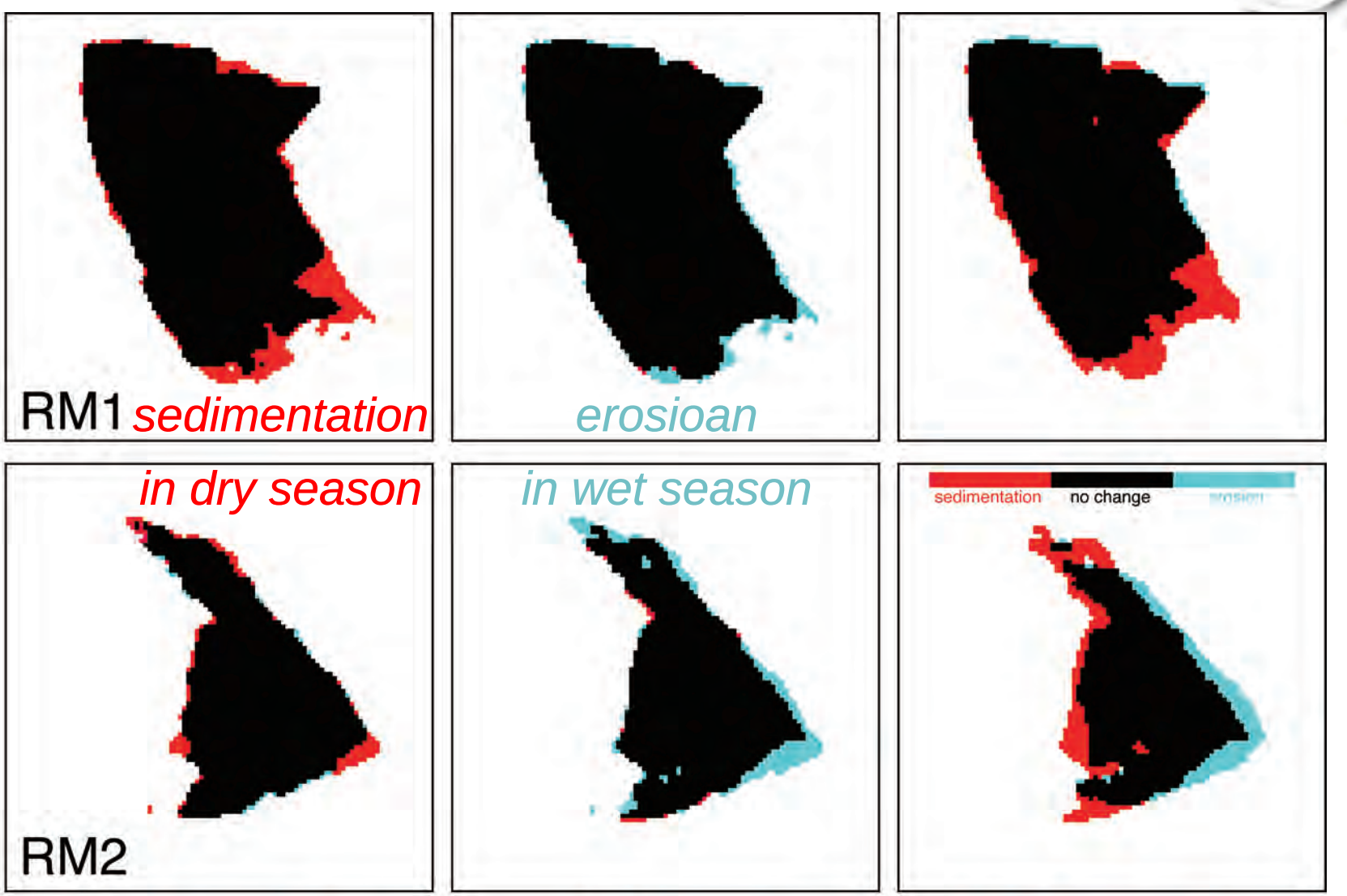
Tidal heights at the time of SAR data acquisition clearly correlated with the emergent areas of the RM bars.

Area of River-Mouth Bars versus Tidal Heights



Tidal heights at the time of SAR data acquisition clearly correlated with the emergent areas of the RM bars.

Sedimentation/Erosion Pattern



Conclusions

- Time-series analyses of ALOS PALSAR data show that radar backscatter images can be used to quantitatively delineate changes, spanning several years, of the areal extent of river-mouth bars in the Mekong River distributaries.

- Areal extents of three river-mouth bars revealed annual and seasonal variations.

- Tidal heights at the time of SAR data acquisition clearly correlated with the emergent areas of the river-mouth bars.

- Sequential SAR images of river-mouth bars can also provide an overview of patterns of sedimentation and erosion.