Ground deformation in and around Sakurajima volcano: the data of precise leveling surveys and InSAR analysis

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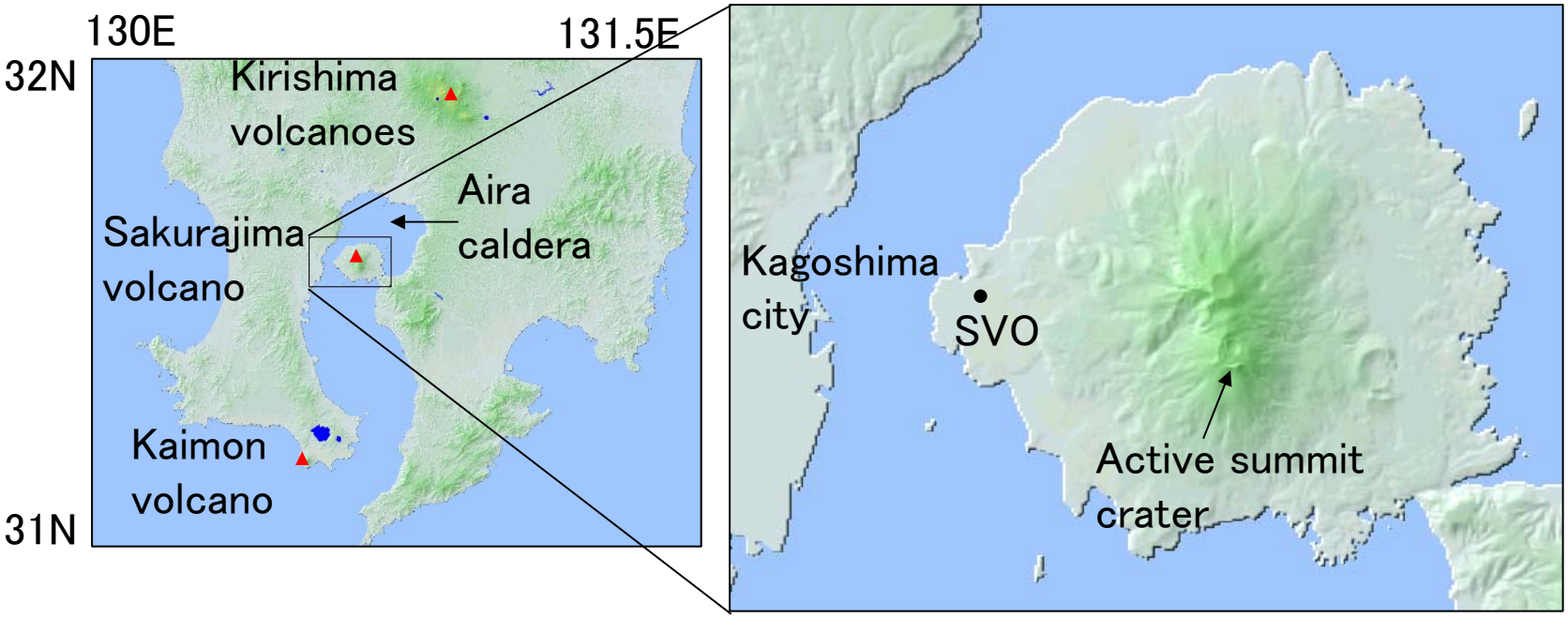
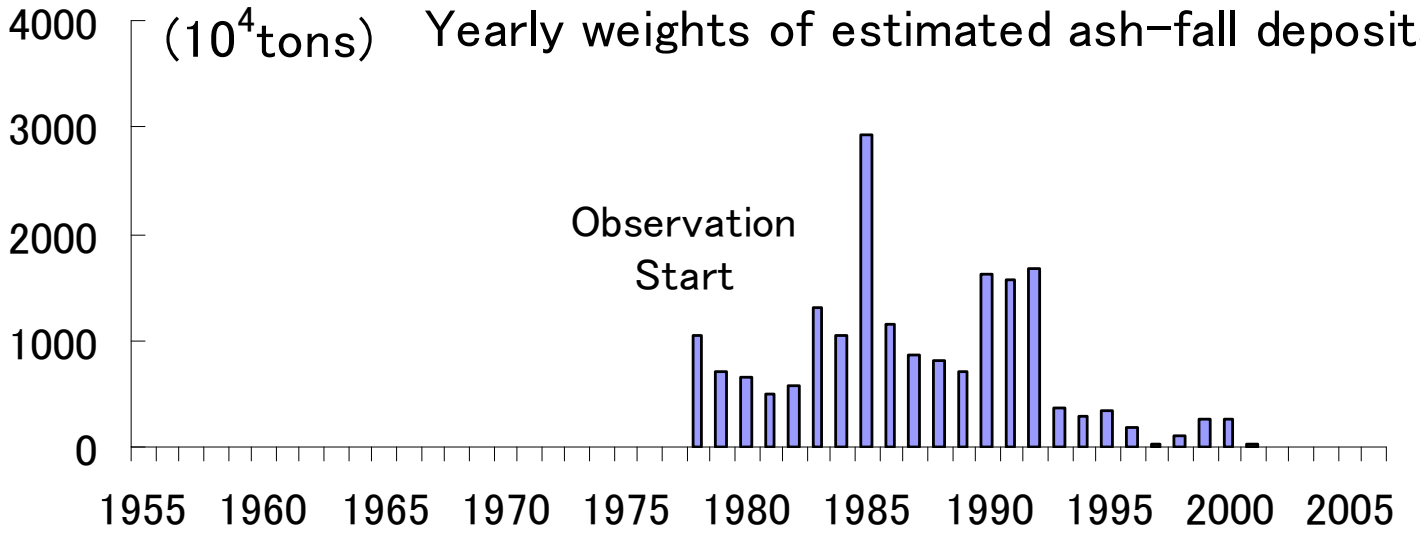
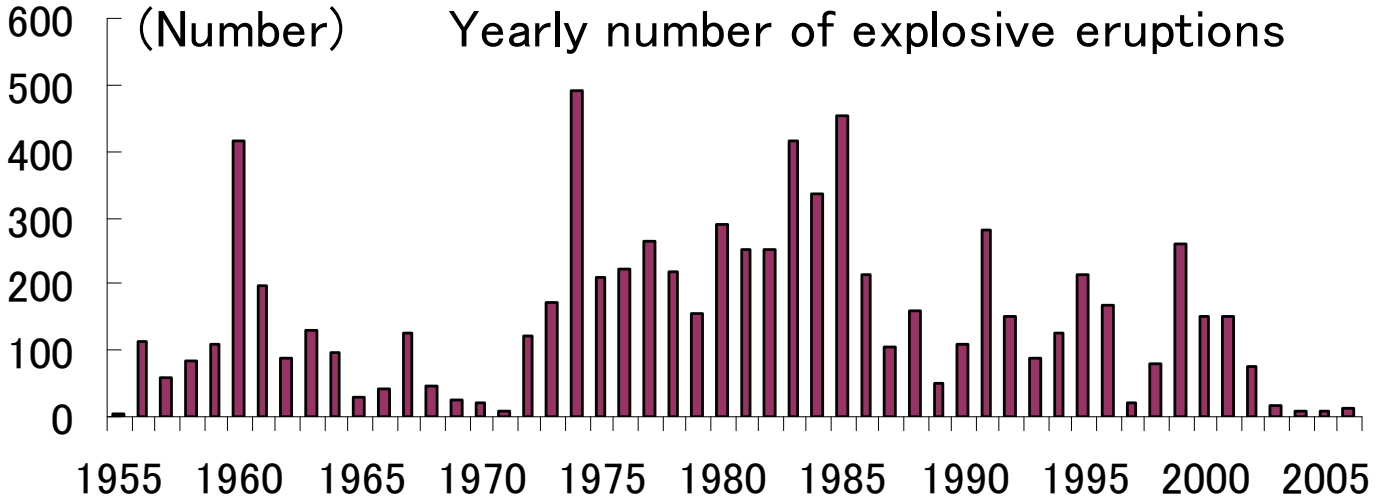


平成19年度京都大学防災研究所特別教育研究経費（拠点形成）研究集会
衛星搭載型合成開口レーダーを用いた地震・火山災害ポテンシャル評価手法の高度化・効率化

Explosive eruption at the active summit crater

Eruptive activities at the active summit crater of Sakurajima volcano since 1955





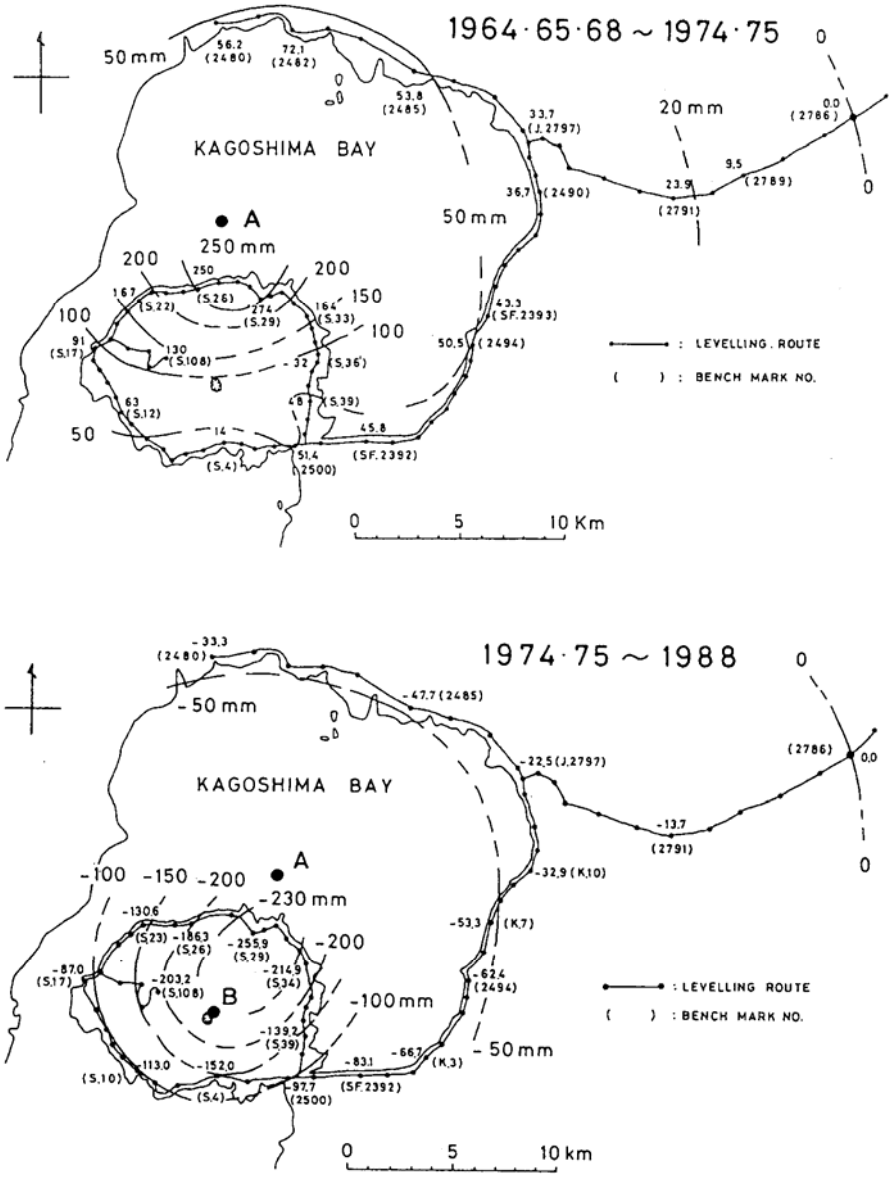


Fig. 2 Distribution of vertical displacements referred to BM.2786 during the period from 1964・65・68 to 1974・75 (upper) and during the period from 1974・75 to 1988 (lower).

Typical ground deformation patterns of Sakurajima volcano

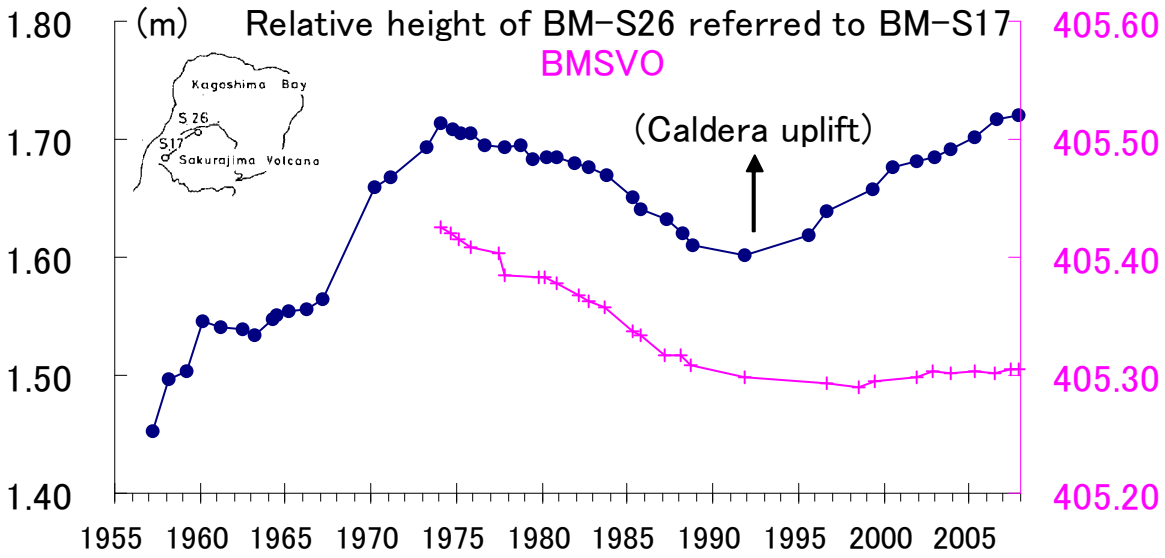
Inactive stage of summit eruption: inflation beneath Aira caldera (about 25cm uplift around northern part of Sakurajima)

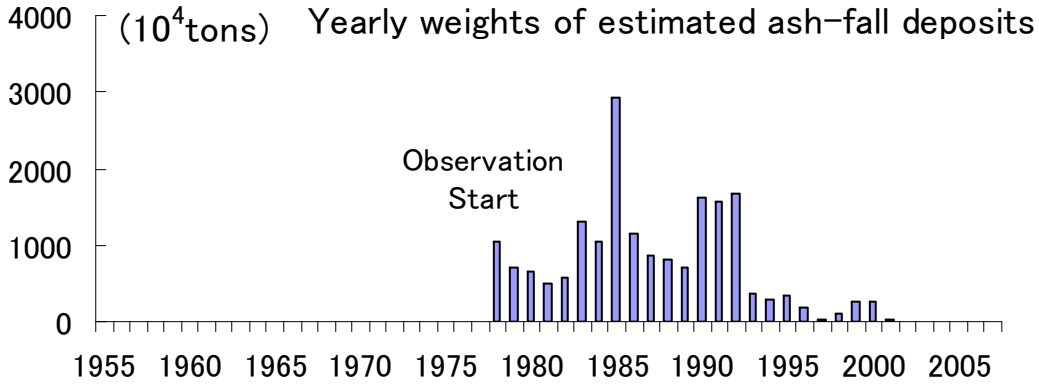
→ magma storage at the reservoir beneath Aira caldera

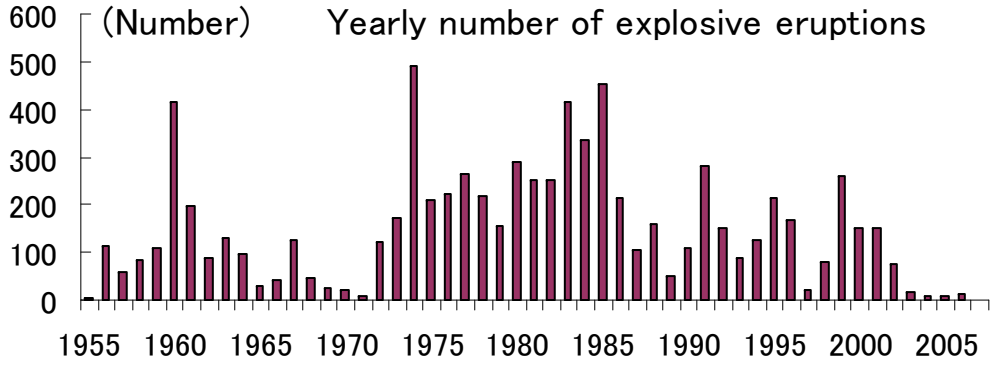
Active stage of summit eruption: deflation beneath Aira caldera and Sakurajima (about 23cm subsidence around northern and central part of Sakurajima)

→ pressure decrease at the reservoirs beneath Aira caldera and Sakurajima due to excess magma ejection

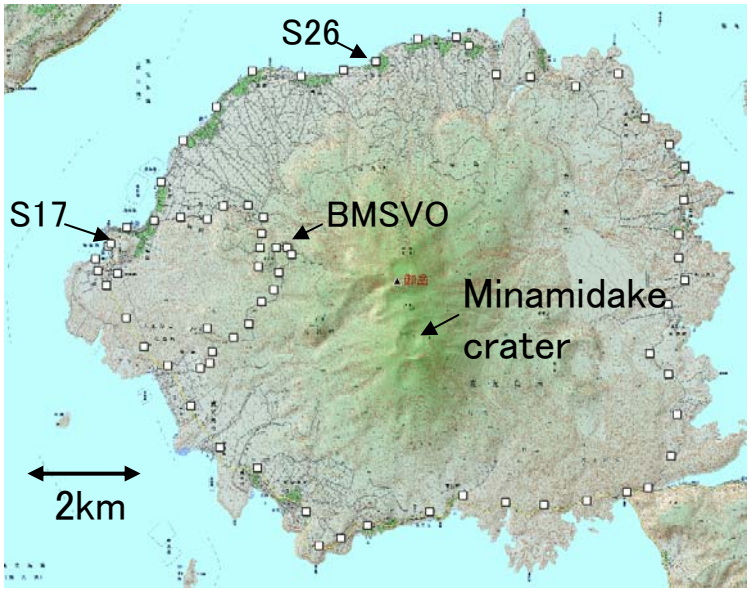
(after Eto et al., 1997)







Relations among secular changes of relative heights of BMs and eruptive activities at the active crater of Sakurajima volcano



InSAR results by using JERS-1 data

(after Okuyama et al., 2001)

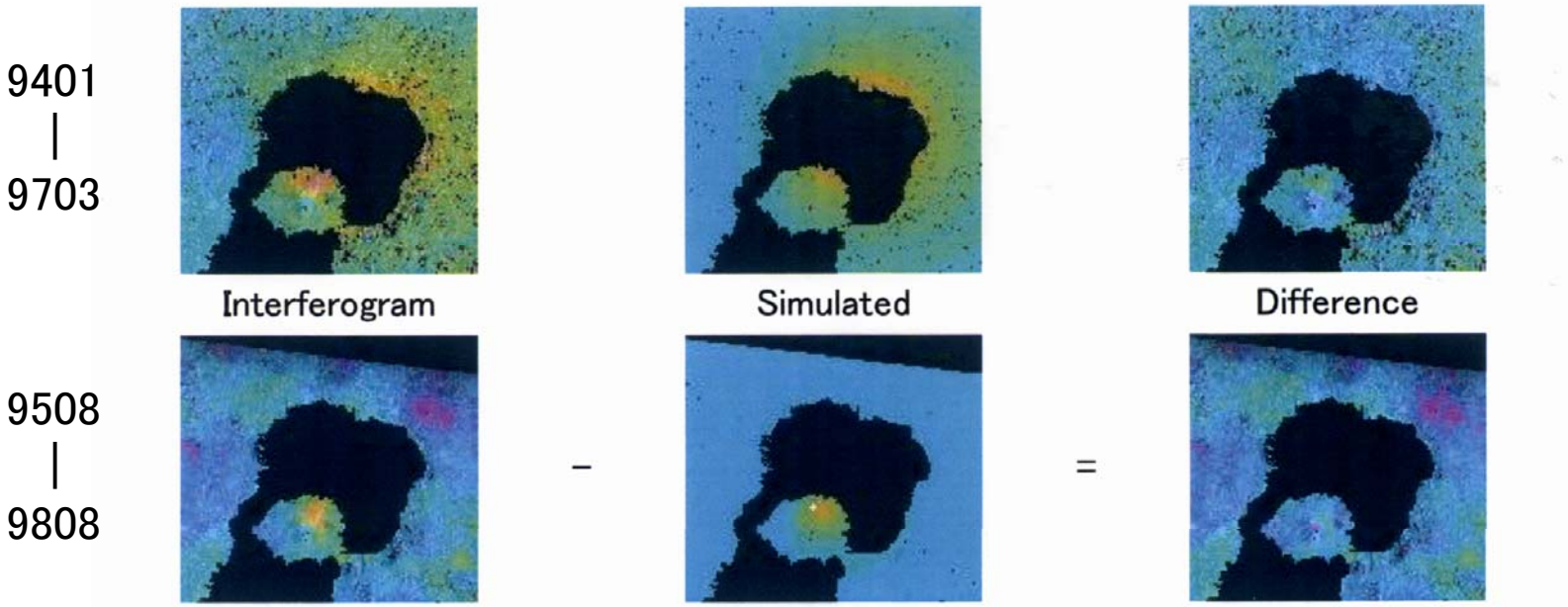
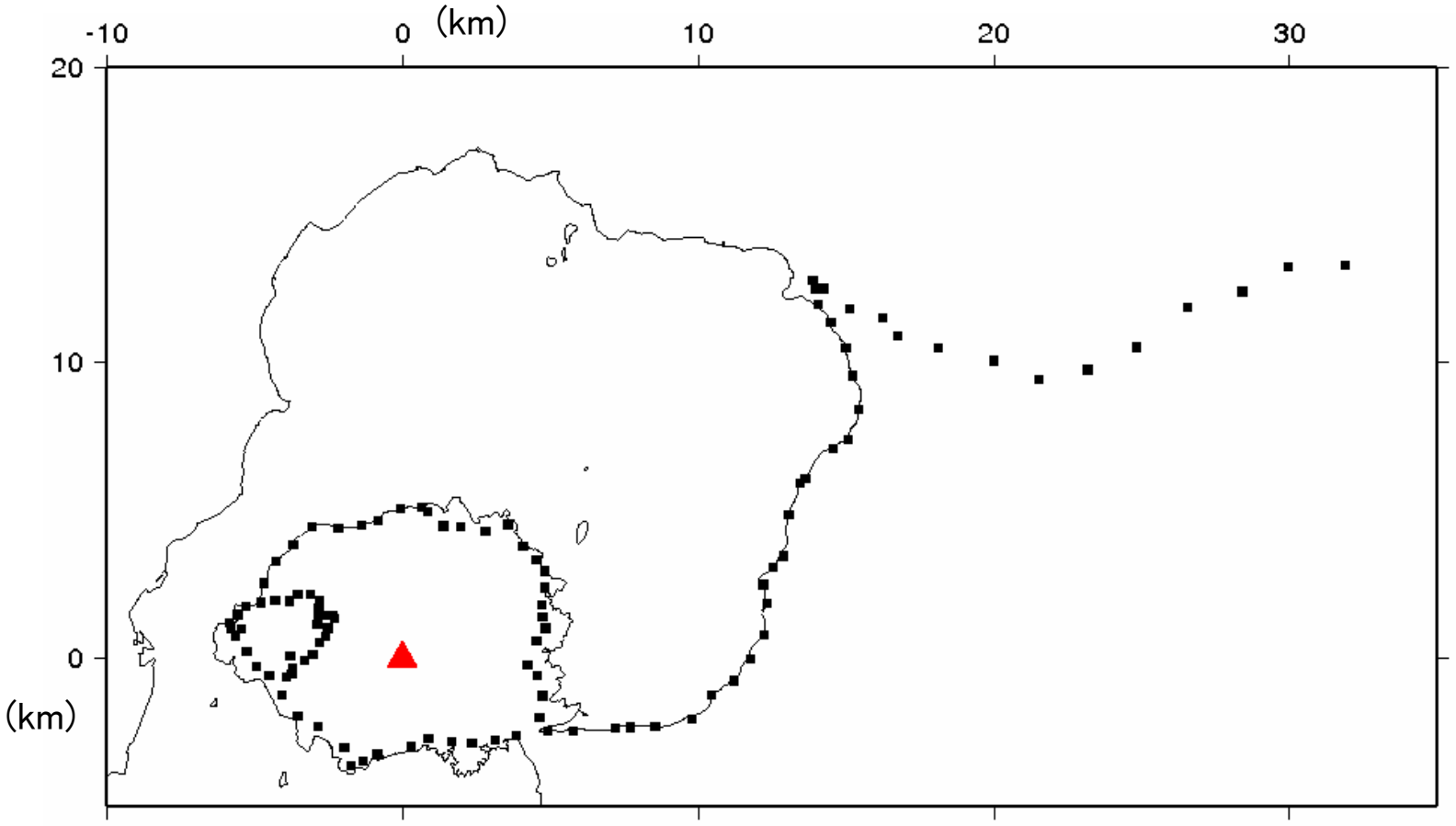


Fig.4 Interferogram, simulated image, and the difference. We assumed inflating source at 10km(top:94019703) and 4km(bottom:95089808) deep from white "+" in simulated image and calculated the maximum upheaval at white "+" (Uz0). Calculated Uz0 is 8.8cm for 94019703 pair, and 5.4cm for for 95089808 pair.

Leveling survey 2007

Observation period: 2007/10/01-11/06 (Geographical Survey Institute)
2007/12/03-12/11 (University group)

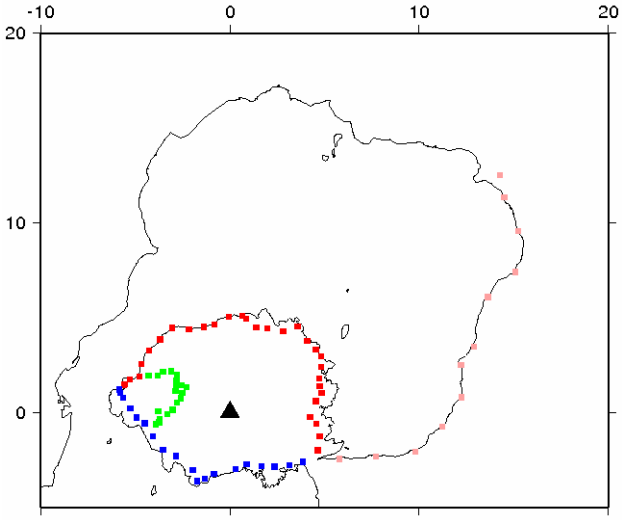


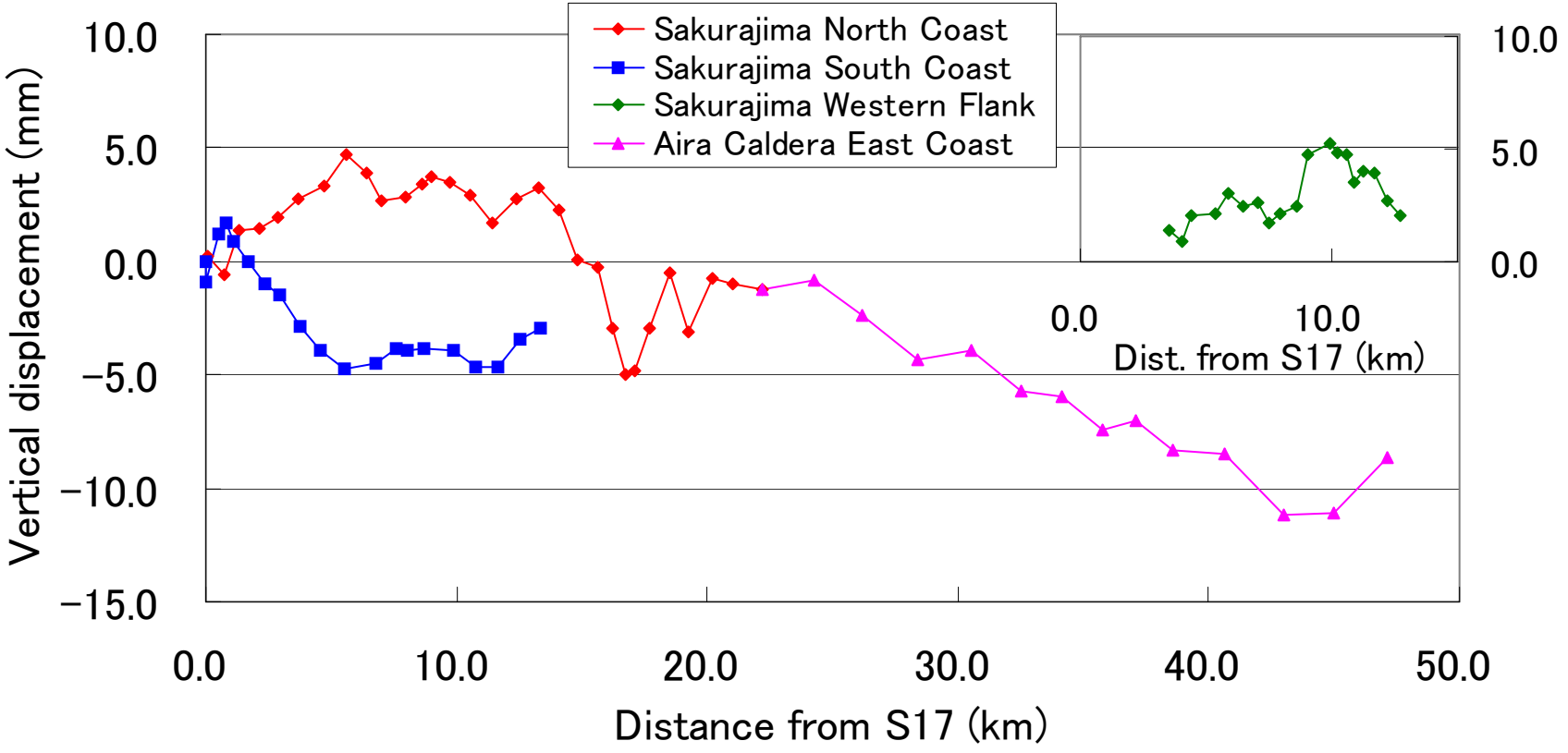
Leveling bench marks

Vertical displacement

Data: 2006/06, 09 ～ 2007/10-12
(University and GSI data)

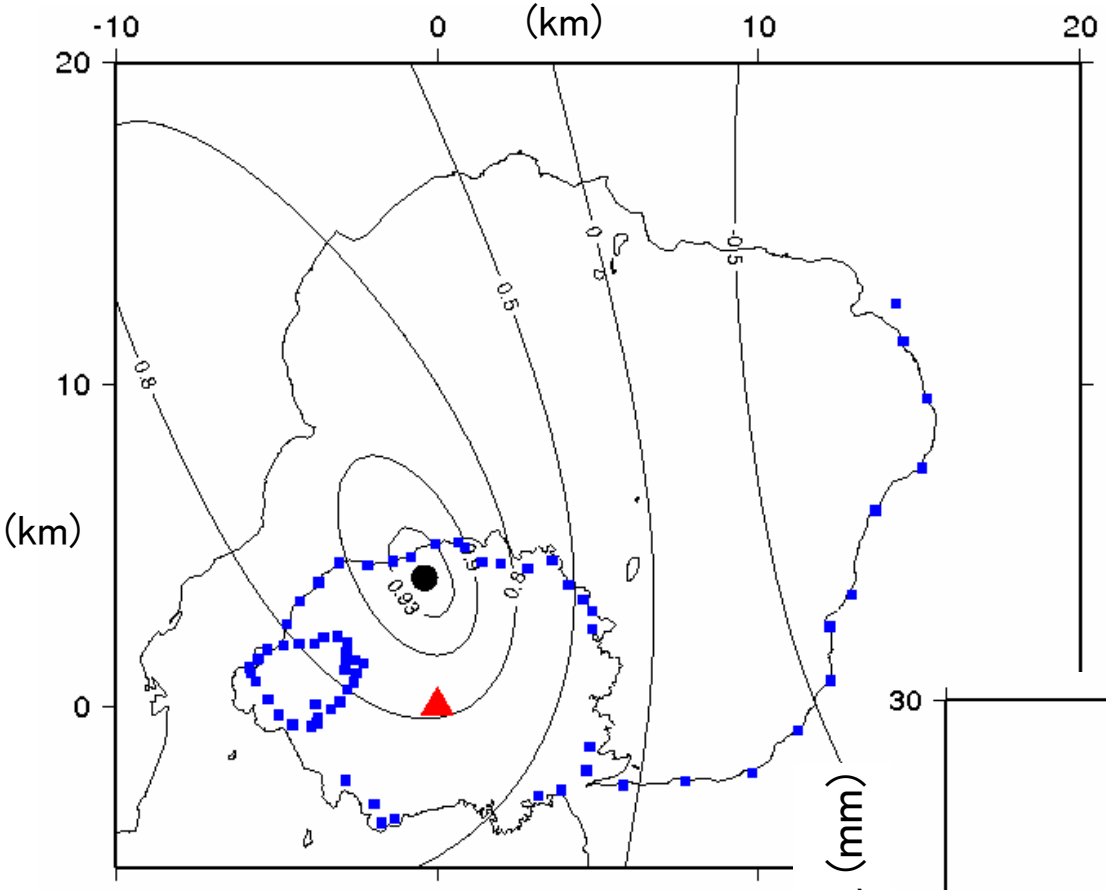
Reference bench mark: S.17



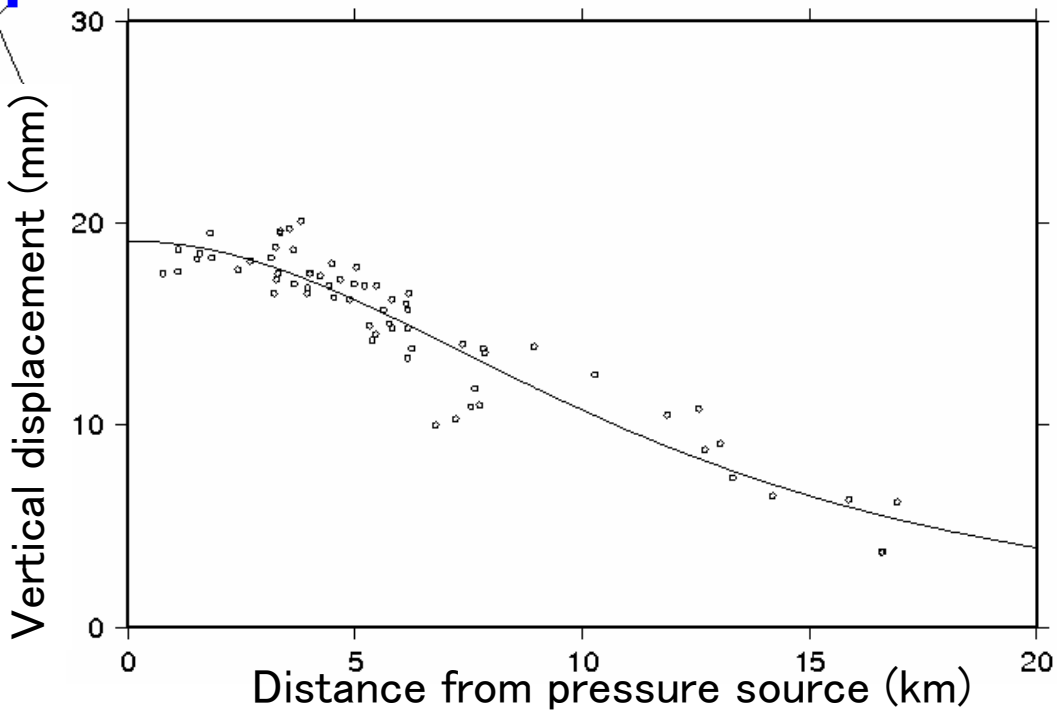


Pressure source (Mogi's model)

Depth = 14.6 km
Vertical displacement above the pressure source: +19.1 mm
Deformation volume at the pressure source: $+1.7 \times 10^7$ m^3
Correlation coefficient: 0.940



Pressure source location is shown by the solid circle. Contours are the correlation coefficients between data and theoretical curve at the depth of 14.6km.

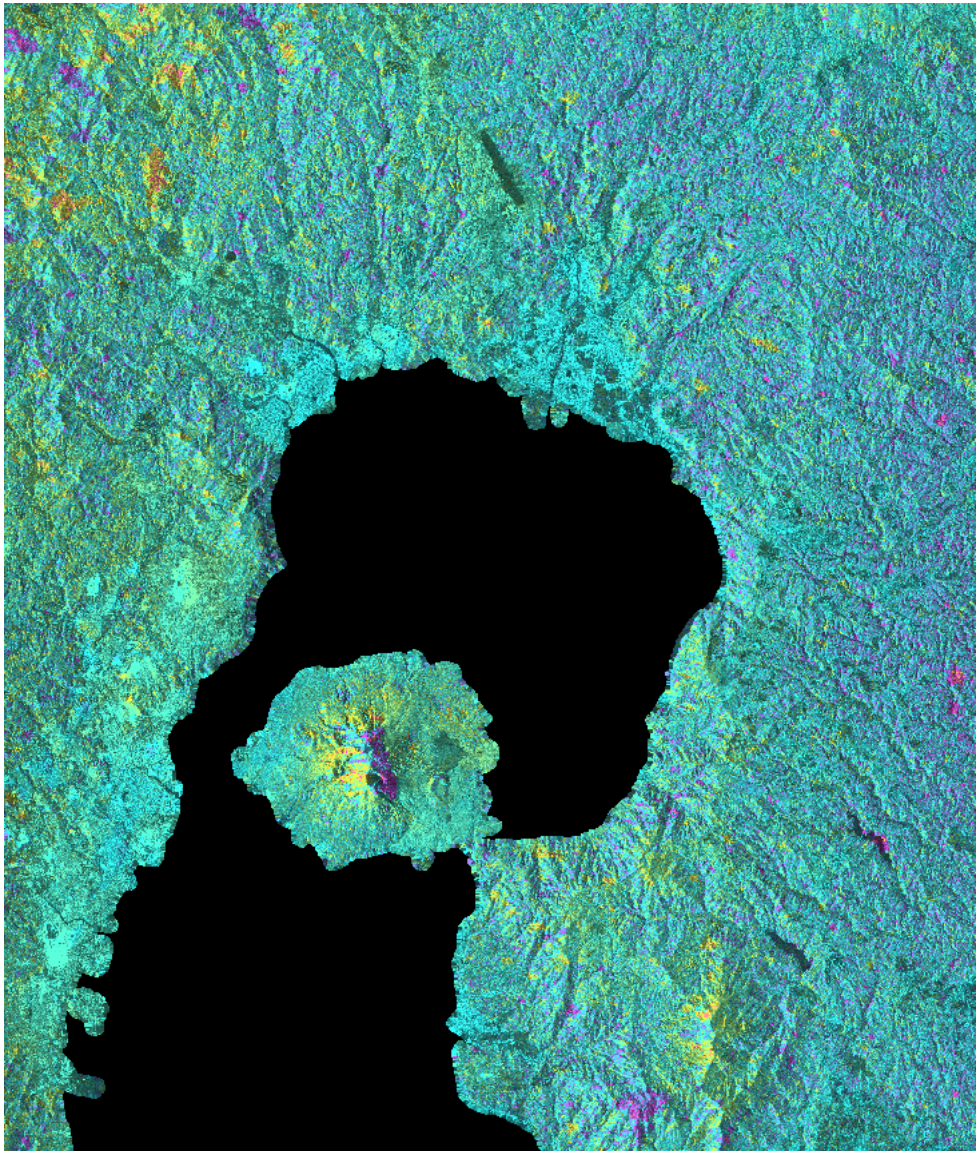


ALOS/PALSAR interferogram

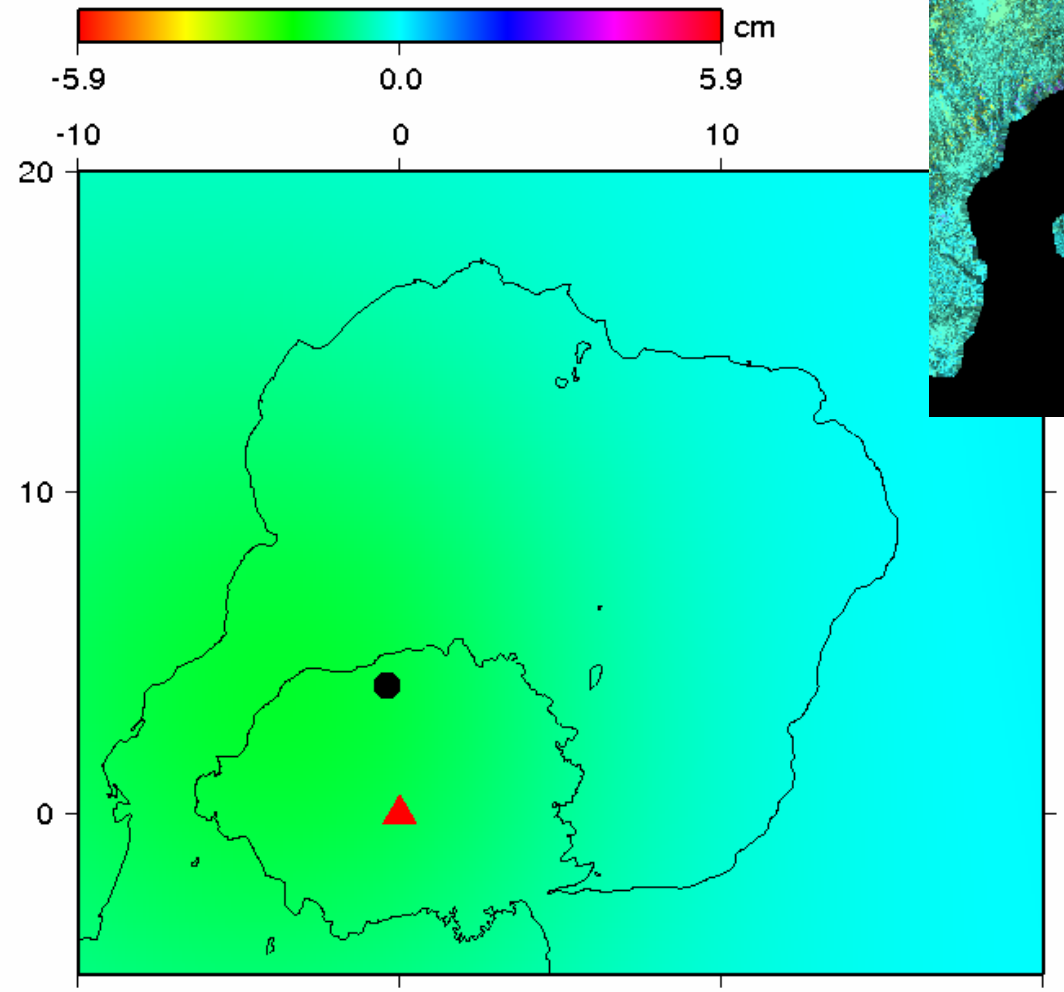
Data

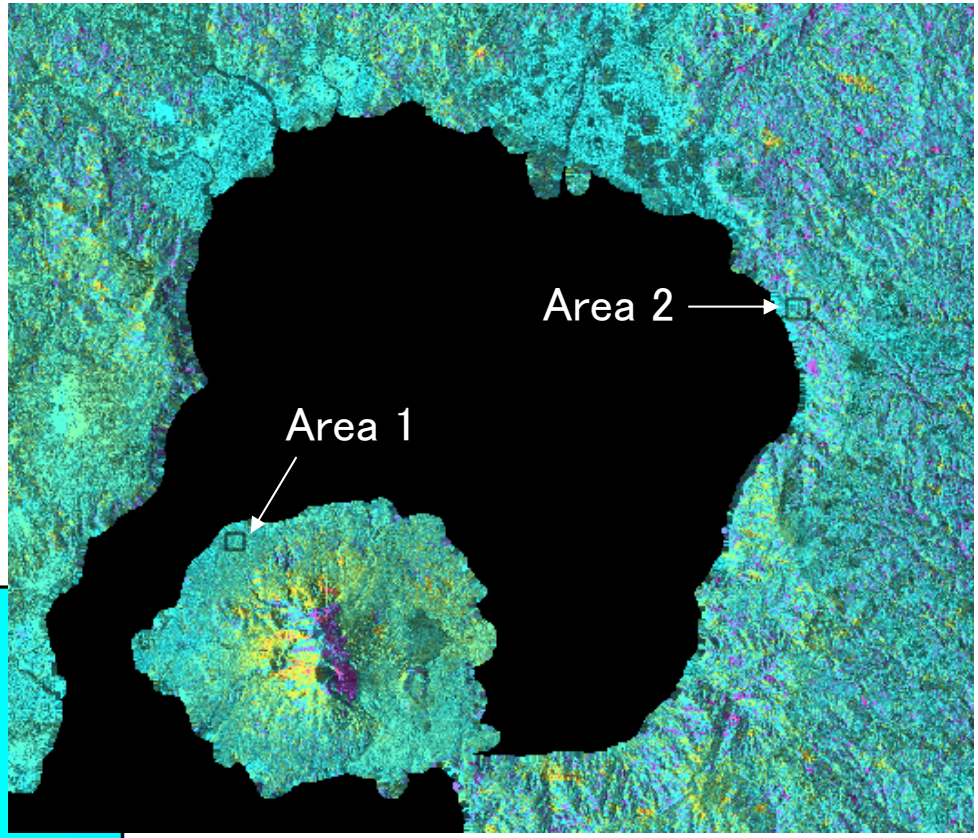
Master: 2007/11/12
Slave: 2006/09/24
(← nearly leveling period)

FBS mode
Ascending
Off nadir angle: 34.3 deg.
Bperp ~ -1700 m



Expected InSAR image calculated by using the pressure source from leveling data.





↓

Average pixels in 500m × 500m area:

Area 1 = −1.51 cm

Area 2 = −0.19 cm

↓

This preliminary result is consistent with the Mogi's model calculation.

Summary

We conducted the precise leveling survey in Sakurajima volcano and around the Aira caldera during the period from October to December 2007. The last survey had been conducted in June and September 2006.

The obtained survey data indicate the ground uplifts at the northern part of Sakurajima during the period from 2006 to 2007. From the analysis according to Mogi's the model, the inflation source is located beneath the northern flank of the volcano, suggesting that the magma storage at the deep magma reservoir is progressed during the study period.

ALOS/PALSAR image pair is selected to analyze so as to compare the ground deformation with that from the leveling data analysis. The resultant interferogram is seem to be consistent with the theoretical one that is calculated by using Mogi's source, although the ground deformation is minor during this study period.

Acknowledgement:
PALSAR level 1.0 data are shared among PIXEL (Palsar Interferometry Consortium to Study our Evolving Land surface), and providing from JAXA under a cooperative research contract with ERI, Univ, Tokyo. The ownership of PALSAR data belongs to METI and JAXA.