living planet symposium 2016

GEODETIC ANALYSIS AND MODELLING OF THE SANTORINI VOLCANO, GREECE, FOR THE PERIOD 2012-2015

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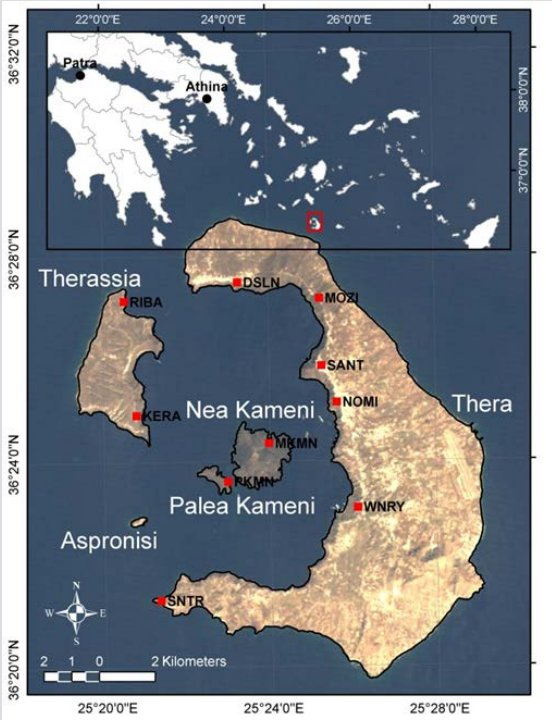
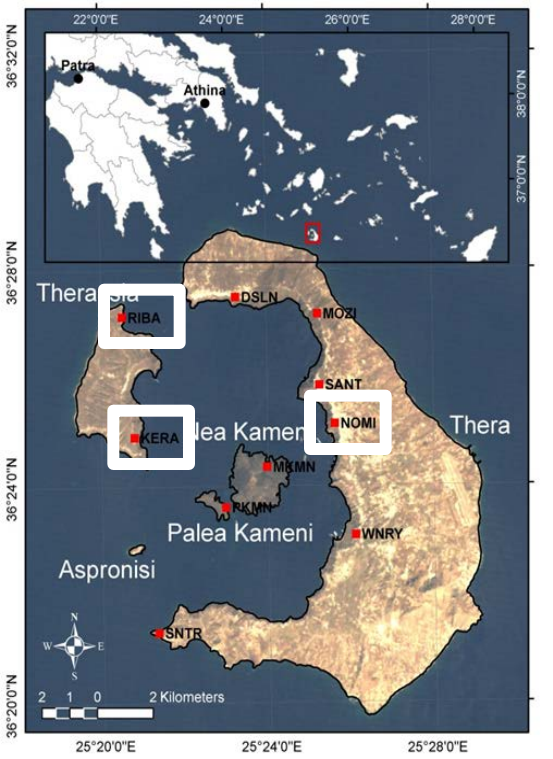
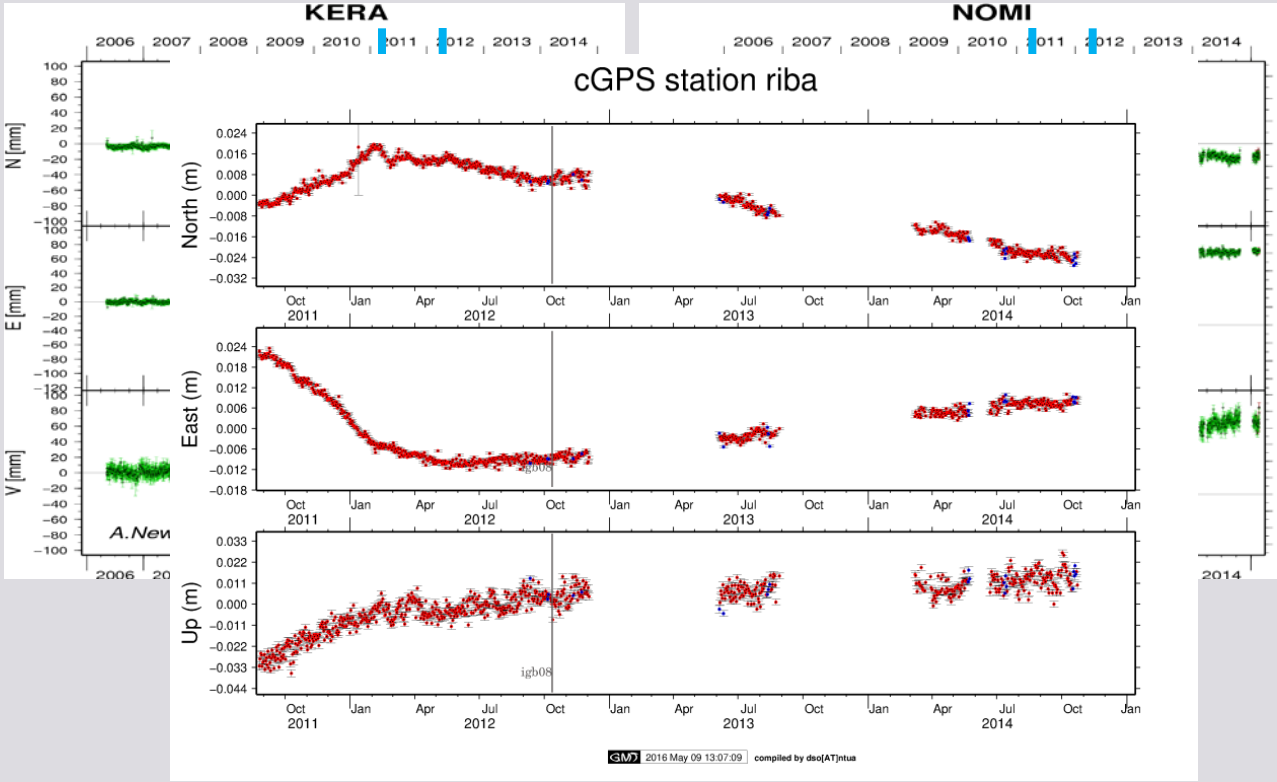
Background information on Santorini

- Santorini Volcanic Complex is the most active part of the South Aegean (Hellenic) Volcanic Arc.
- Most recent seismic sequence ended in 1950
- Since then, Santorini volcano has been in a ‘quite’ phase, with insignificant deformation (confirmed by GPS and InSAR)
- The SVC showed signs of unrest for the first time in over half a century back in January 2011, when a series of small earthquakes began beneath the islands



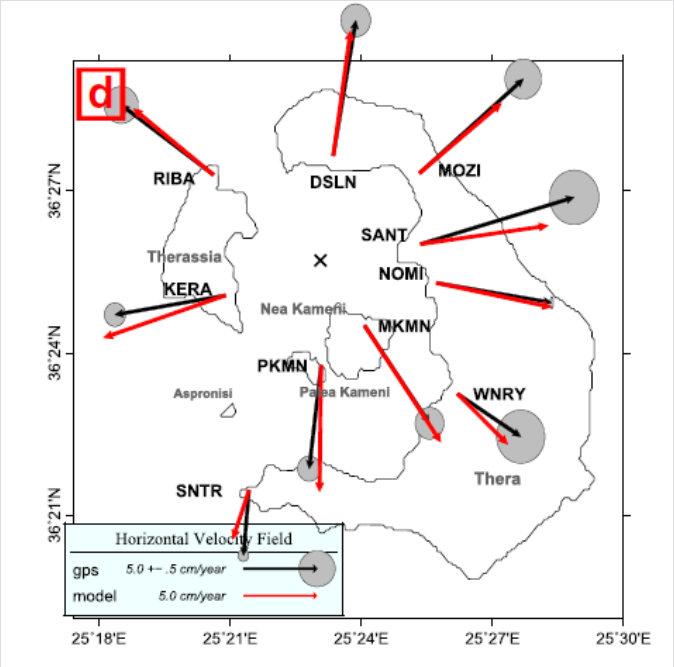
Deformation field - GPS



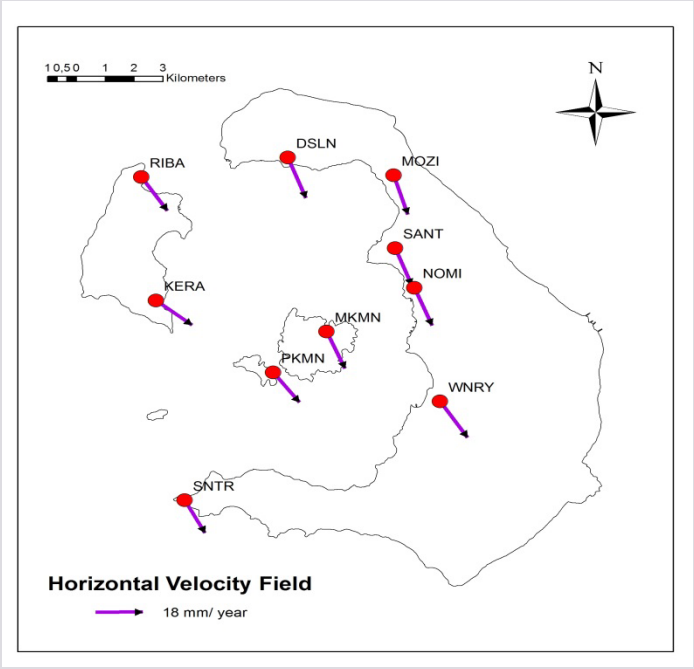


Deformation field - GPS

Inflation episode



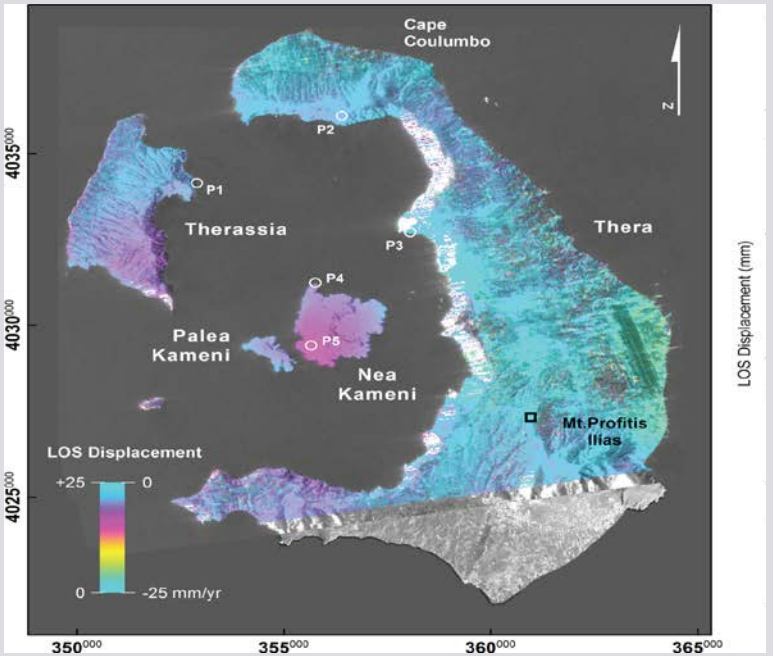
After Inflation episode (2012-2015)



- South-East movement of Santorini island
- Movement recovered to the pre-inflation motion

The 1992-2010 period (pre-inflation)

- ALOS PALSAR Ascending data
- December 2006 – December 2010
- A period of rather insignificant deformation
- A noticeable deformation was observed: the concentric deflation pattern centered at the southern part of Nea Kameni, demonstrating dominant subsidence of 5.2mm/year



Foumelis, M., Trasatti, E., Papageogiou, E., Stramondo, S., Parcharidis, I., (2013), Monitoring Santorini volcano (Greece) breathing from space.

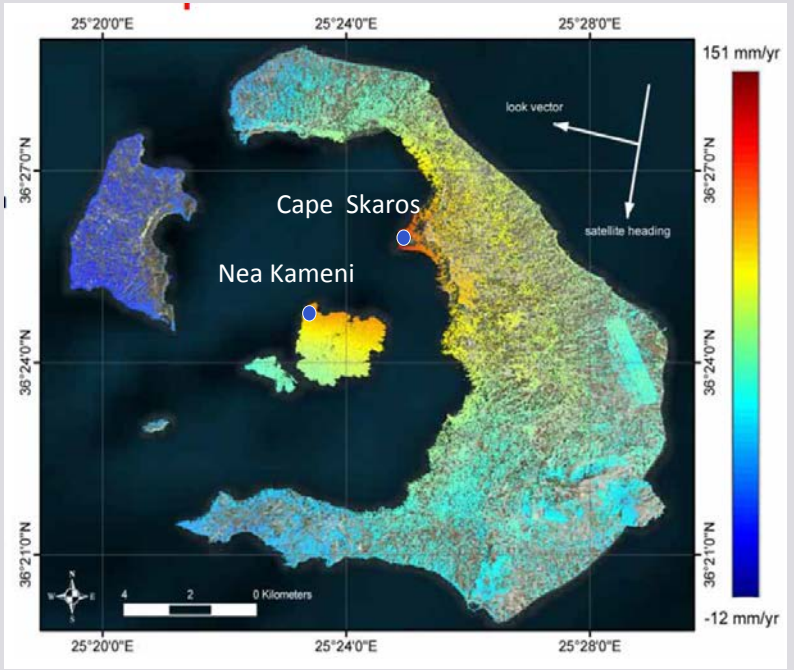
The 2011-2012 period (inflation episode)

- A special radial inflation pattern was observed declining towards the external side of the caldera, highlighting that the displacement was due to the volcano of Santorini

- Uplift with a radially decaying pattern in amplitude and velocity from the center of deformation

- 150 mm/year maximum deformation

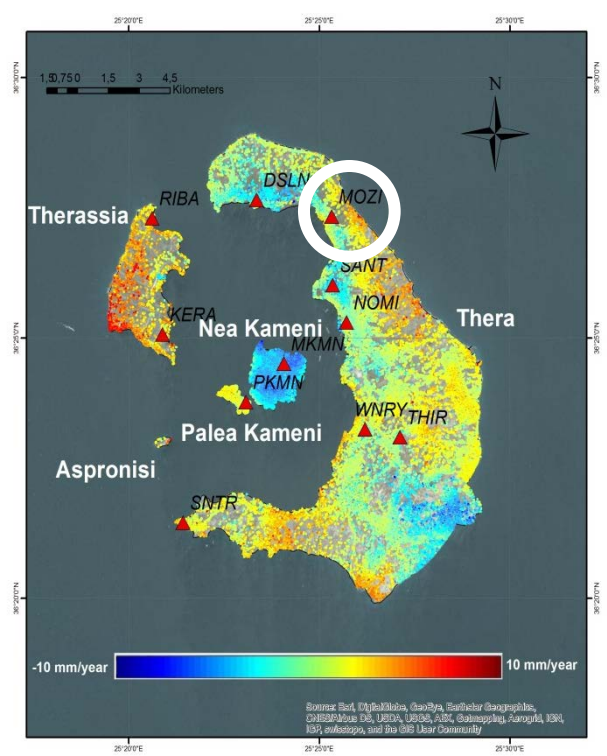
- Inflation has diminished since the end of February 2012



Papoutsis, I., X. Papanikolaou, M. Floyd, K. H. Ji, C. Kontoes, D. Paradissis, and V. Zacharis (2013). Mapping inflation at Santorini volcano, Greece, using GPS and InSAR.

After inflation period

The 2012-2013 period



28 TerraSAR-X

Descending orbit

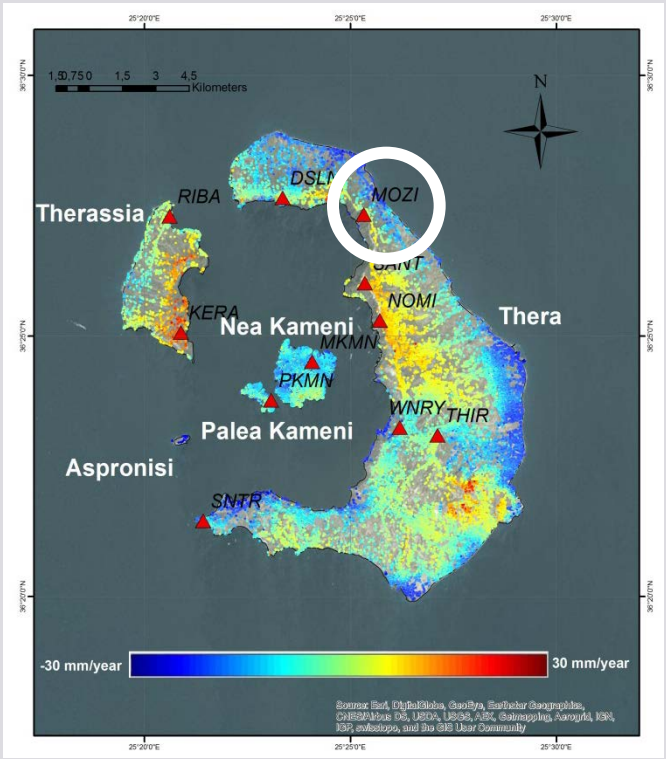
May 2012 to June 2013

30 COSMO-SkyMed

Ascending orbit

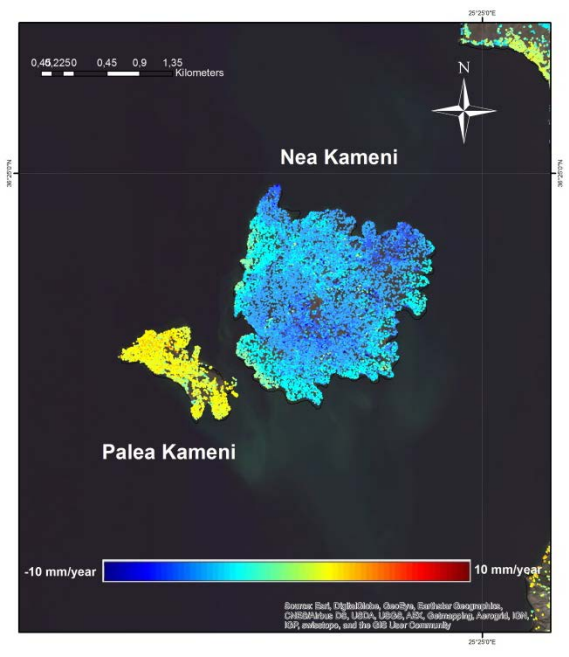
March 2015 to September 2015

The 2015 period



After inflation period – Nea Kameni

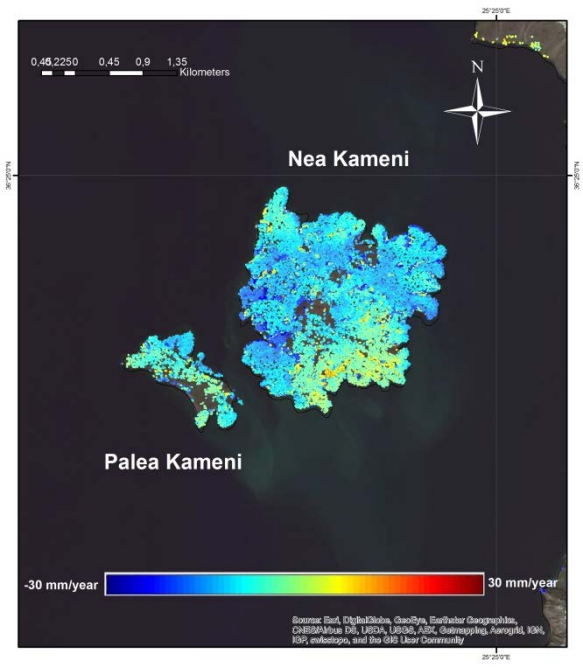
The 2012-2013 period



Negative rate to both datasets, ascending and descending.

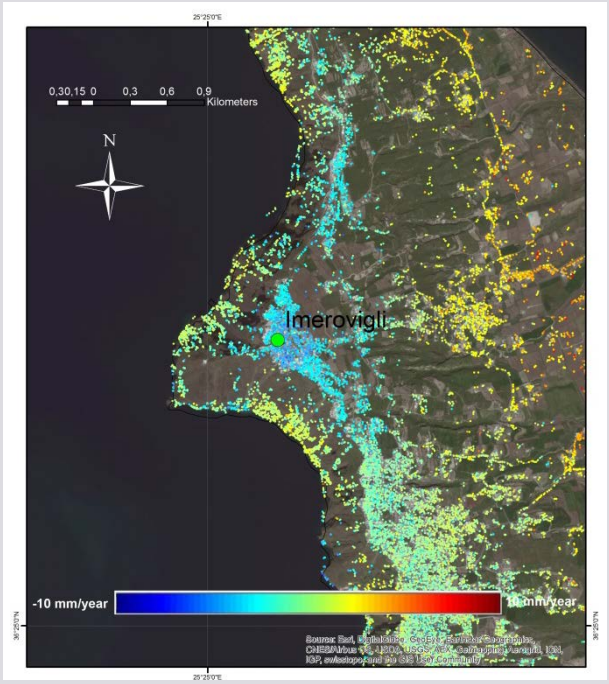
We assume that it is a **vertical subsidence** with respect to MOZI.

The 2015 period



After inflation period – Imerovigli

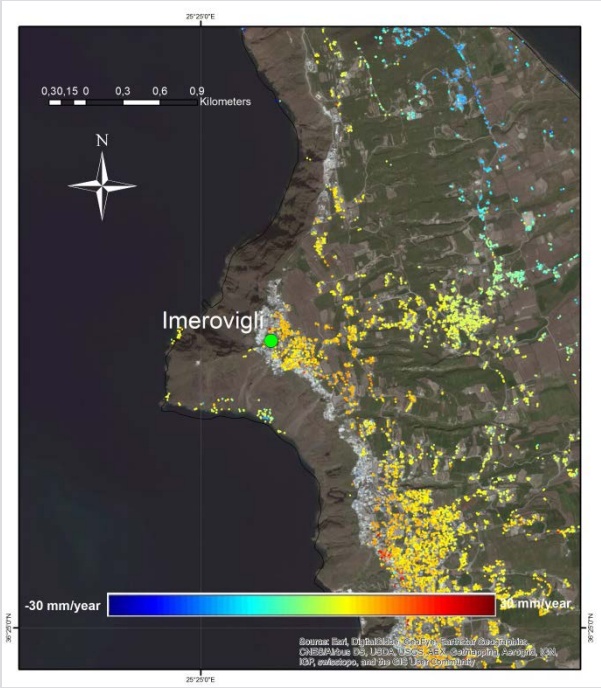
The 2012-2013 period



After the event CSK ascending frame shows an uplift (up and/or west) and TSX descending a subsidence (down and/or west).

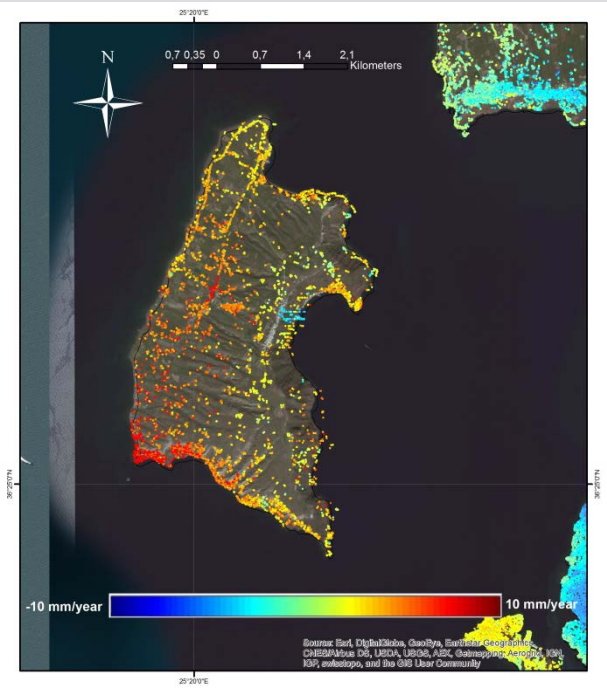
We assume that it is heading **to the West** but with much slower rate with respect to MOZI.

The 2015 period



After inflation period – Therassia

The 2012-2013 period

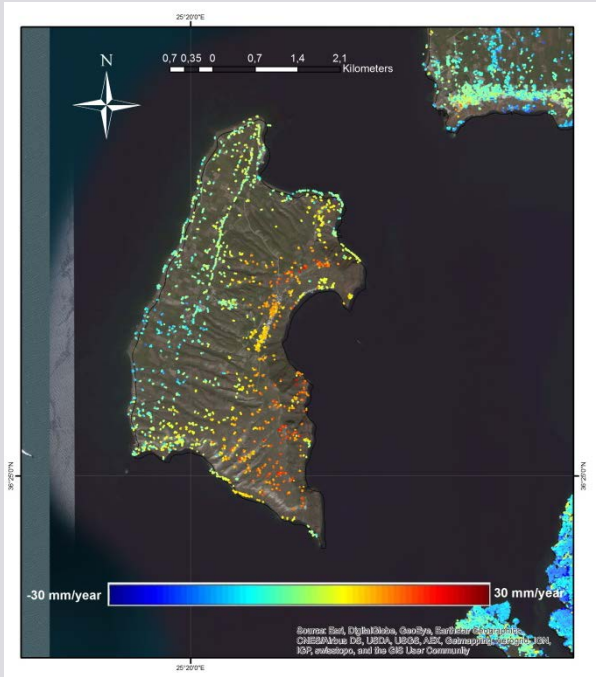


In May 2012-June 2013 period (descending) there is an uplift.

In the 2015 period with the ascending dataset, it is observed subsidence.

Therassia is mainly moving **to the East**, coming closer to Nea Kameni Island.

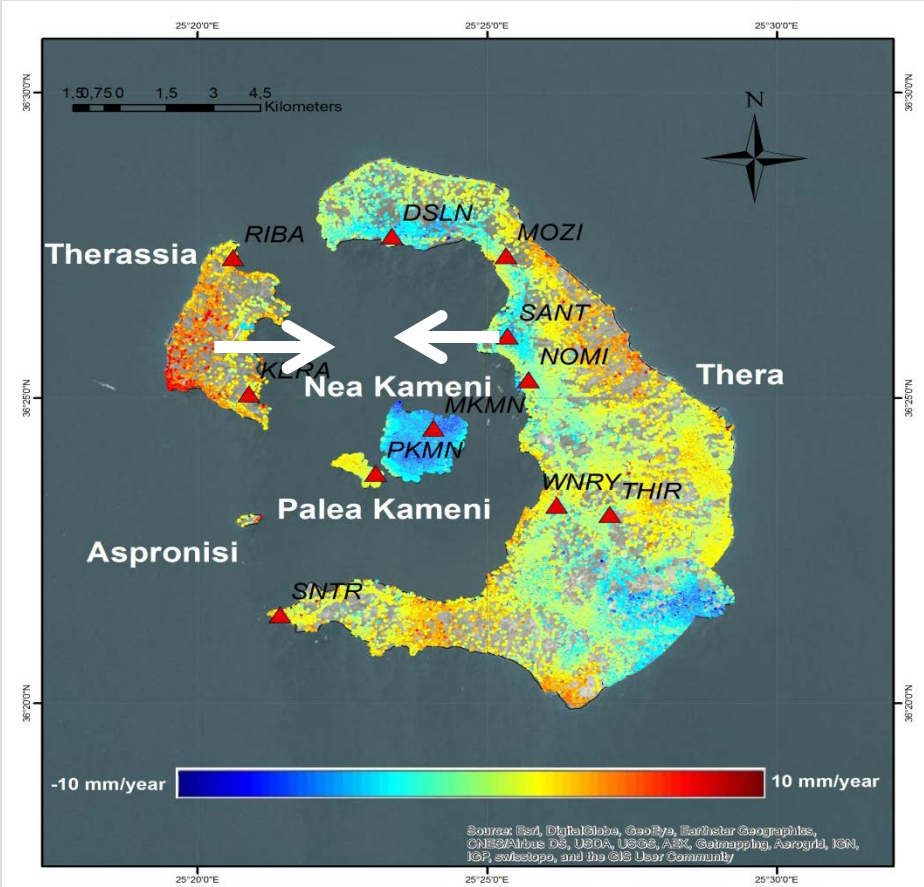
The 2015 period



Volcanic movement:

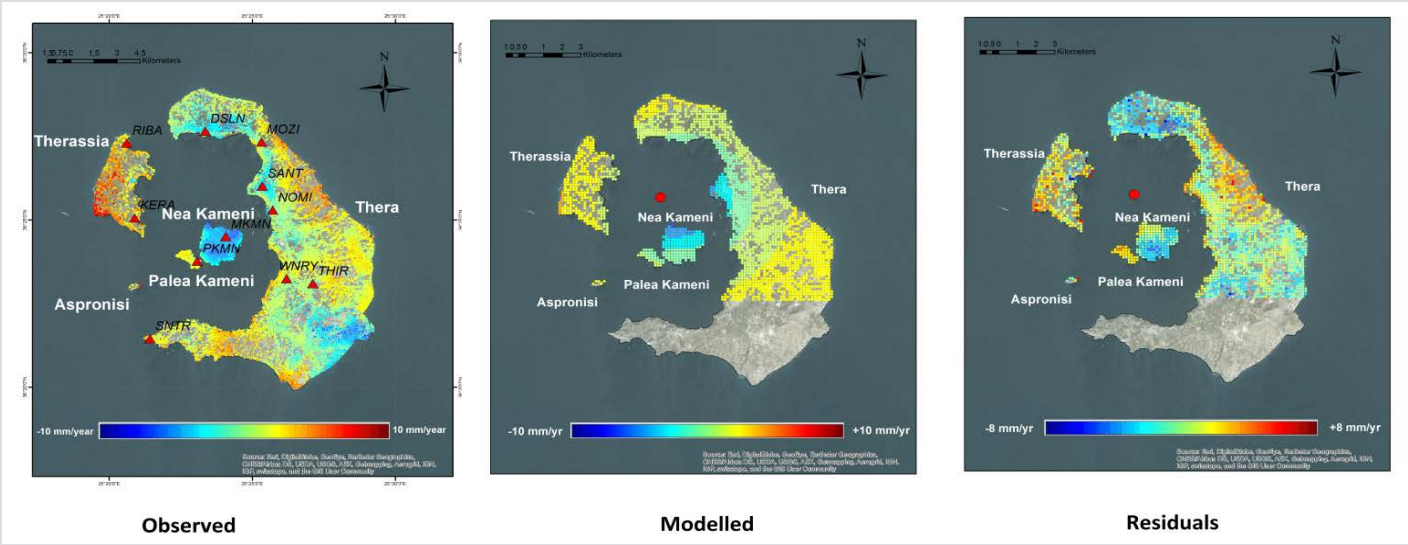
Nea Kameni: Vertical Subsidence
Imerovigli: West
Therassia: East

=> Caldera seems to be slowly recovering from the inflation episode



Modelling

Mogi model for TSX data



Data set	Longitude	Latitude	Depth/km	ΔV/10^6 m^3/yr	RMS mm/yr
TSX	25.3844	36.4286	3.48	-0,76	2,3

Conclusions

- SVC experiences two types of dominant movements:
  - Tectonic motion – large scale movement
  - Volcanic motion – small scale movement
- Inflation has been diminished since the end of February 2012
  - New phase of relative stability after 2012.
- Smooth deflation of the volcano
- Returned pre-inflation motion pattern
- Mogi model for inflation phase provides a good fit also for the post-inflation motion

Questions?

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Thank you!