June
2018

FIRE: WP7 Surface Deformation using Space-Geodesy

Rui Fernandes/Ana Flor

AL1: Volcanic structure

Nothing at the moment from geodetic data

AL2: Eruption dynamics

INSAR processing: Work in progress

Data: COSMO-SkyMed SAR data (X band) in ascending and descending configurations

Strategy: for both configurations, using 2 independant methods (SARPROZ & doris/StAMPS):

- **period prior and co-eruption**

→ capture the transient magma storage prior to (and during) the eruption and possibly identify eastward flank movement

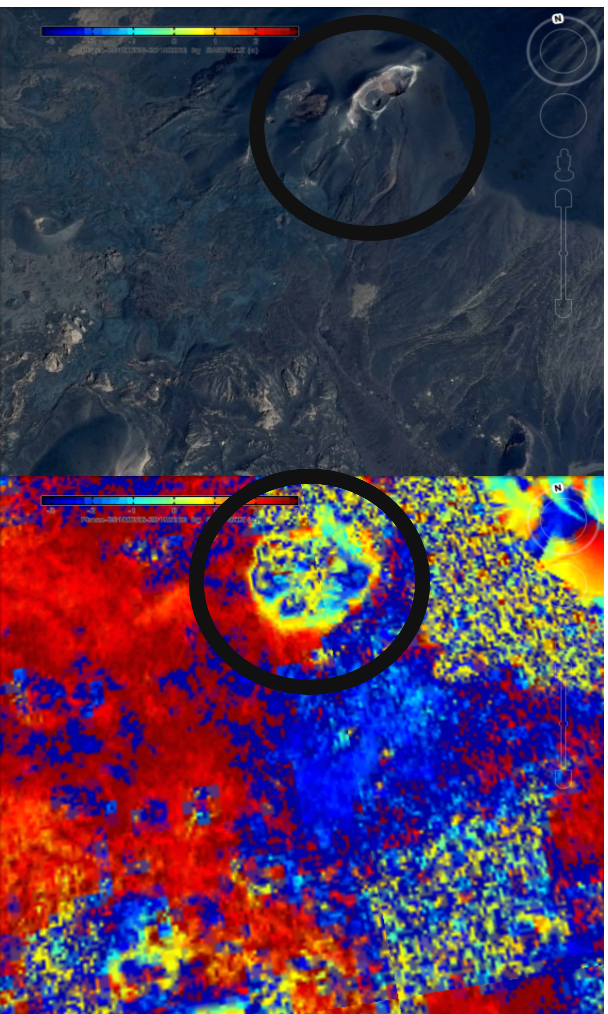
- **period post eruption**

→ characterize deformation induced by the lava field (cooling of the lava field, loading)

AL2: Eruption dynamics

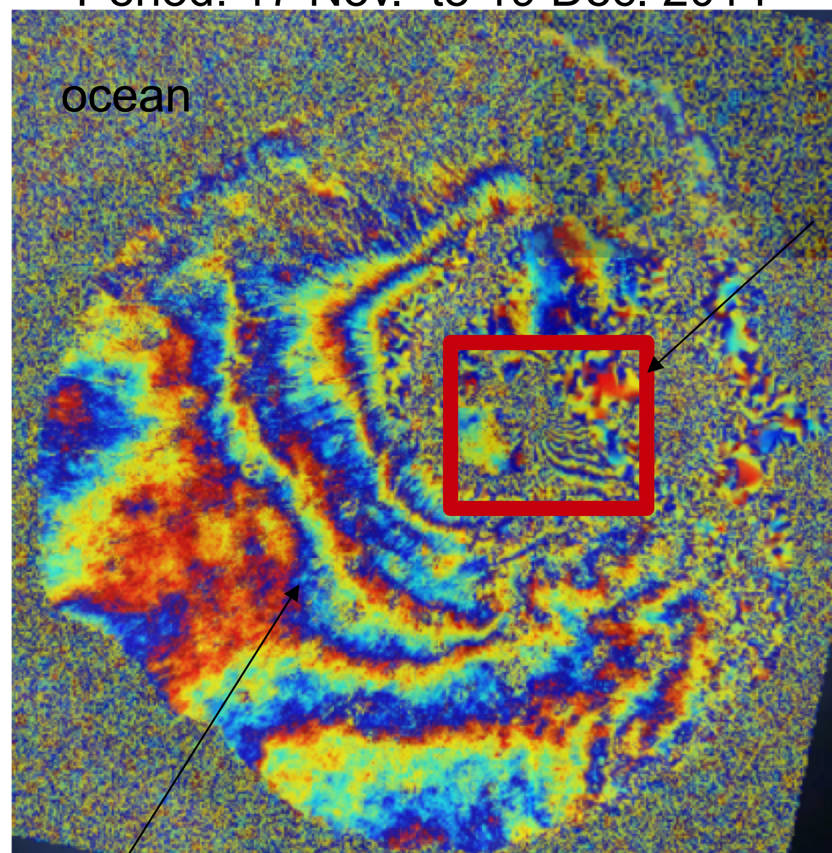
INSAR processing: **period prior and co-eruption**

Period: 6 Feb. to 13 Nov. 2014



Signal related to magma ascent prior to the eruption?

Period: 17 Nov. to 19 Dec. 2014



Signal due to dyke emplacement

Fringes of atmospheric origin

Interferograms processed using SARPROZ by D. Roque (IST)

AL2: Eruption dynamics

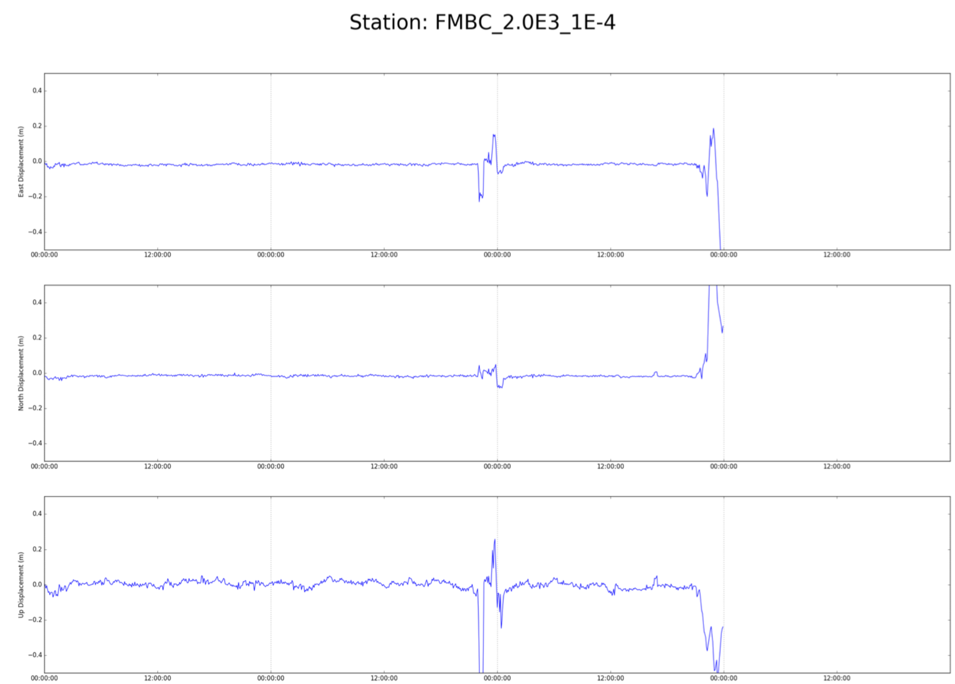
GPS processing: Most processing finalized, Analysis in progress

Strategy:

- co-eruptive deformation field: what can we learn on the volcanic plumbing system and eruption dynamics?

Processing:

5 min solution calculated
for the eruptive period



AL3: Strategies for risk mitigation

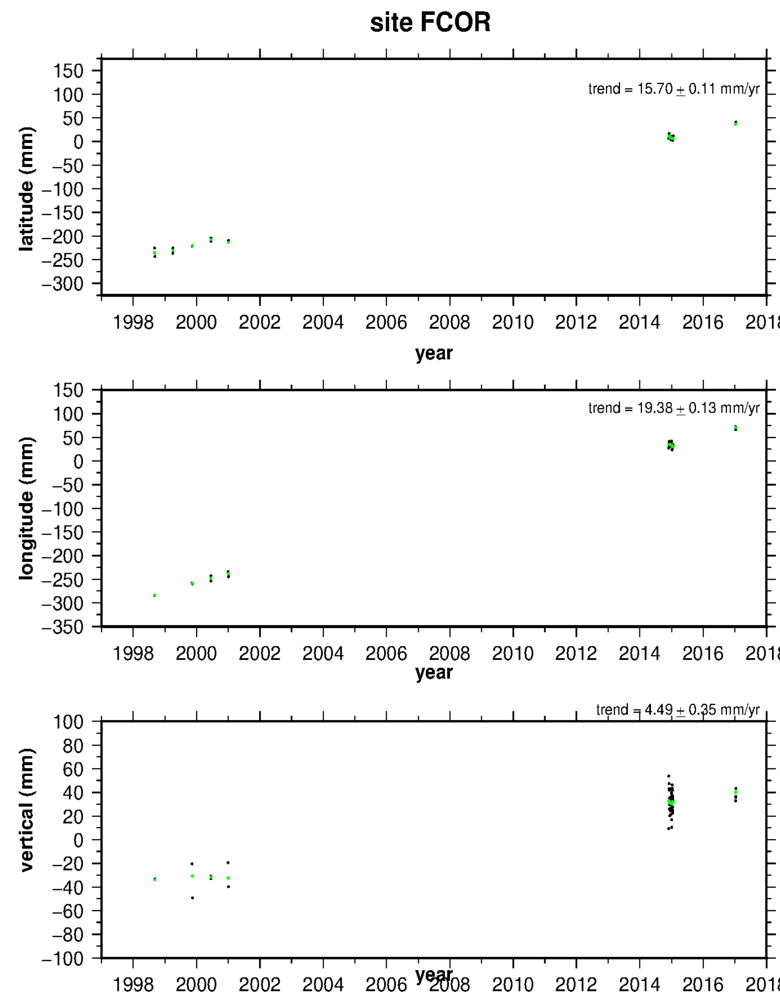
GPS processing: Most processing finalized, Analysis in progress

Strategy:

Long-term deformation field:
how the eastward flank motion is accomodated?

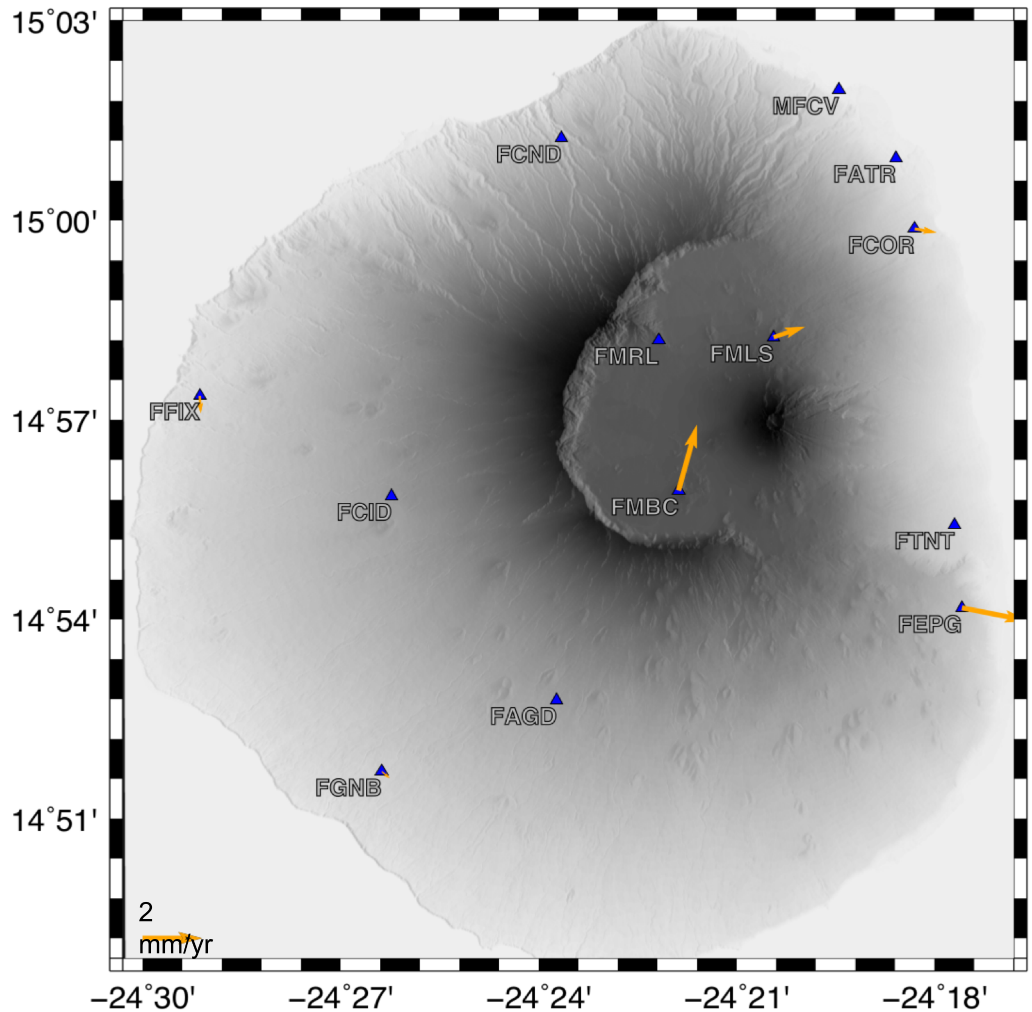
Processing:

daily solutions calculated for the
- 1998/1999/2000/2001 campaigns
- 2014-2015 eruption
- 2017 campaign

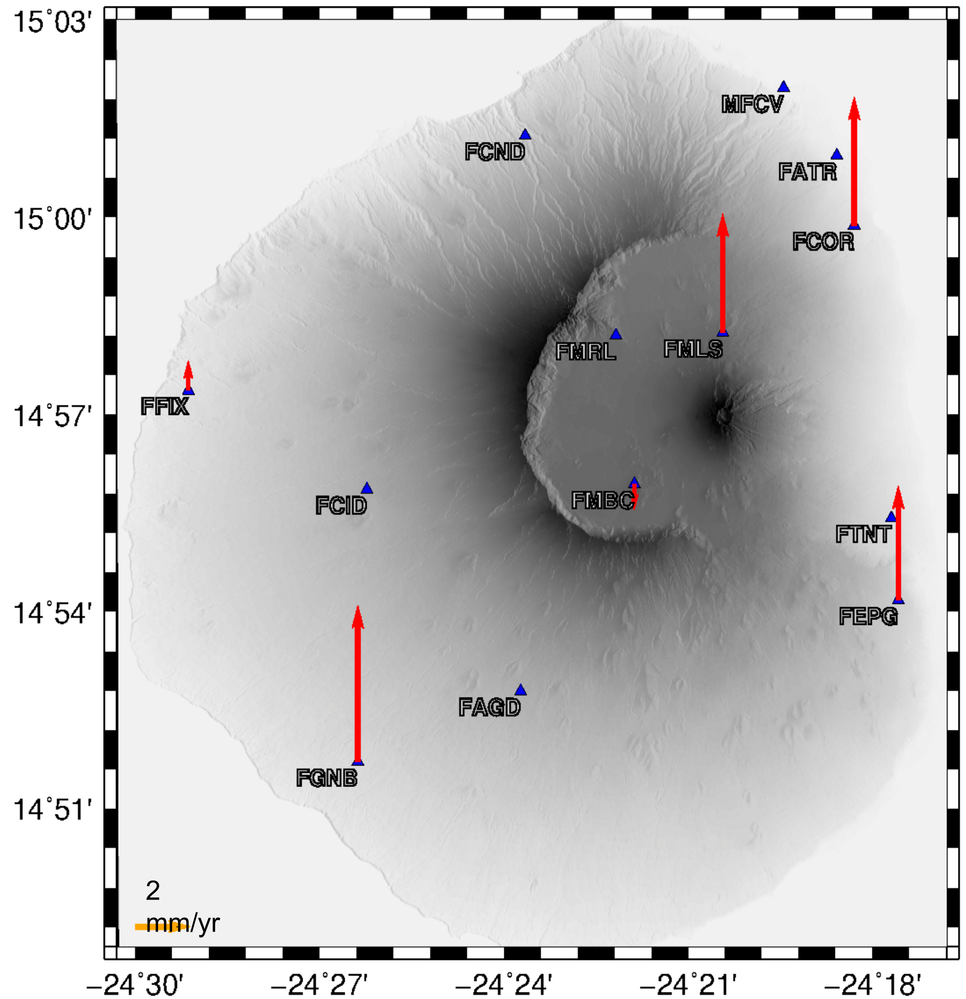


AL3: Strategies for risk mitigation

Horizontal displacement
from Sept. 1998 to Jan. 2017



Vertical displacement
from Sept. 1998 to Jan. 2017



AL3: Strategies for risk mitigation

Long-term horizontal displacement can help to better understand how the flank motion is accomodated

If surface deformation can be identified using InSAR data a few months prior to the onset of the 2014-15 eruption, it might be helpful for the long-term strategy of risk mitigation.

Similarly, quantifying the deformation post eruption migh help to provide recommendations for new settlement.

Summary

D7.1 – Eruptive surface deformation field from GNSS and InSAR (M12): delayed
→ ongoing

D7.2 – First posteruptive surface deformation field from GNSS and InSAR (M18): delayed
→ GPS processing finalized.
→ InSAR processing requires post-eruption high resolution DEM

D7.3 – Final posteruptive surface deformation field from GNSS and InSAR (M30)

D7.4 – Analysis of the coordinate (latitude, longitude, altitude) timeseries of the permanent GNSS stations (M33)

Challenges/issues encountered/anticipated

InSAR:

- Data only were obtained only this winter.
In addition a few technical have been encountered for one of the methods applied (doris/Stamps) that explain most of the delays

- atmospheric component is dominating all interferograms and is not straightforward to remove. To address this, GPS measurements will be considered despite a limited network and absence of data prior and after the eruption

GPS:

- find the good signal noise ratio for detecting co-eruptive signal.

Plans for coming months

InSAR:
- Formation of interferograms for the pre-eruption period along the ascending pass;

- Resolve DEM issues for doris/Stamps processing to produce a deformation timeseries

- Processing and analysis of the post-eruption period using the DEM that includes the 2014-15 lava field

GPS:

- propose the best approach for processing co-eruptive data with high rate solution

- study for another geodetic campaign

- analysis of long-term measurements