# The influence of the 2018 Lombok earthquake sequence, Indonesia on the unrest Rinjani volcanic complex inferred from InSAR time-series and Seismic Data analysis


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The Mw6.9 earthquake (05 August 2018) on the Island of Lombok

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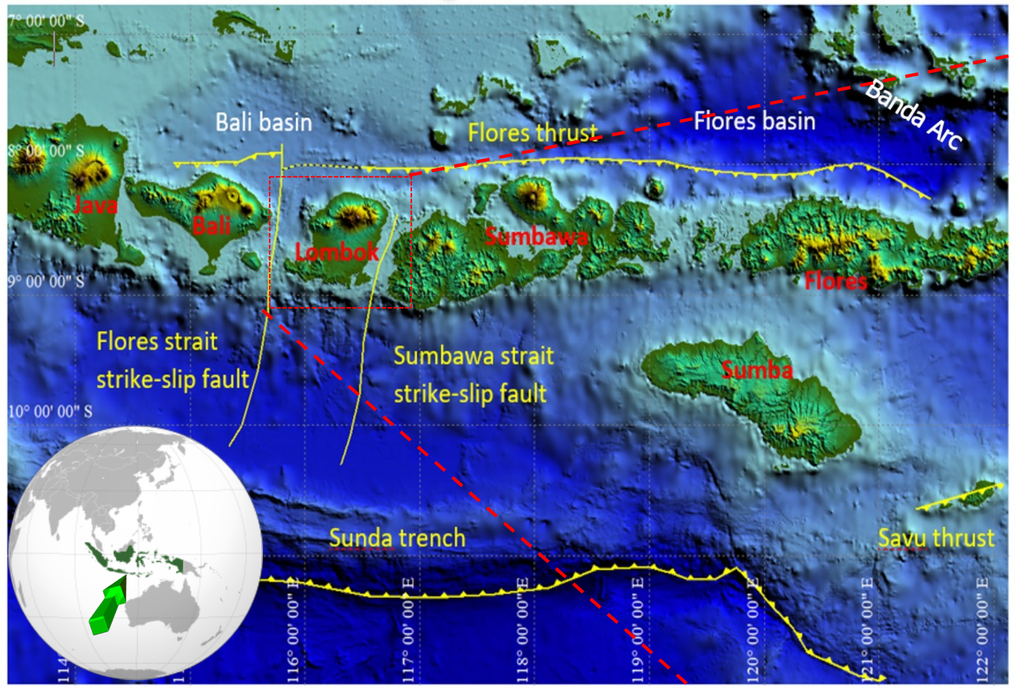
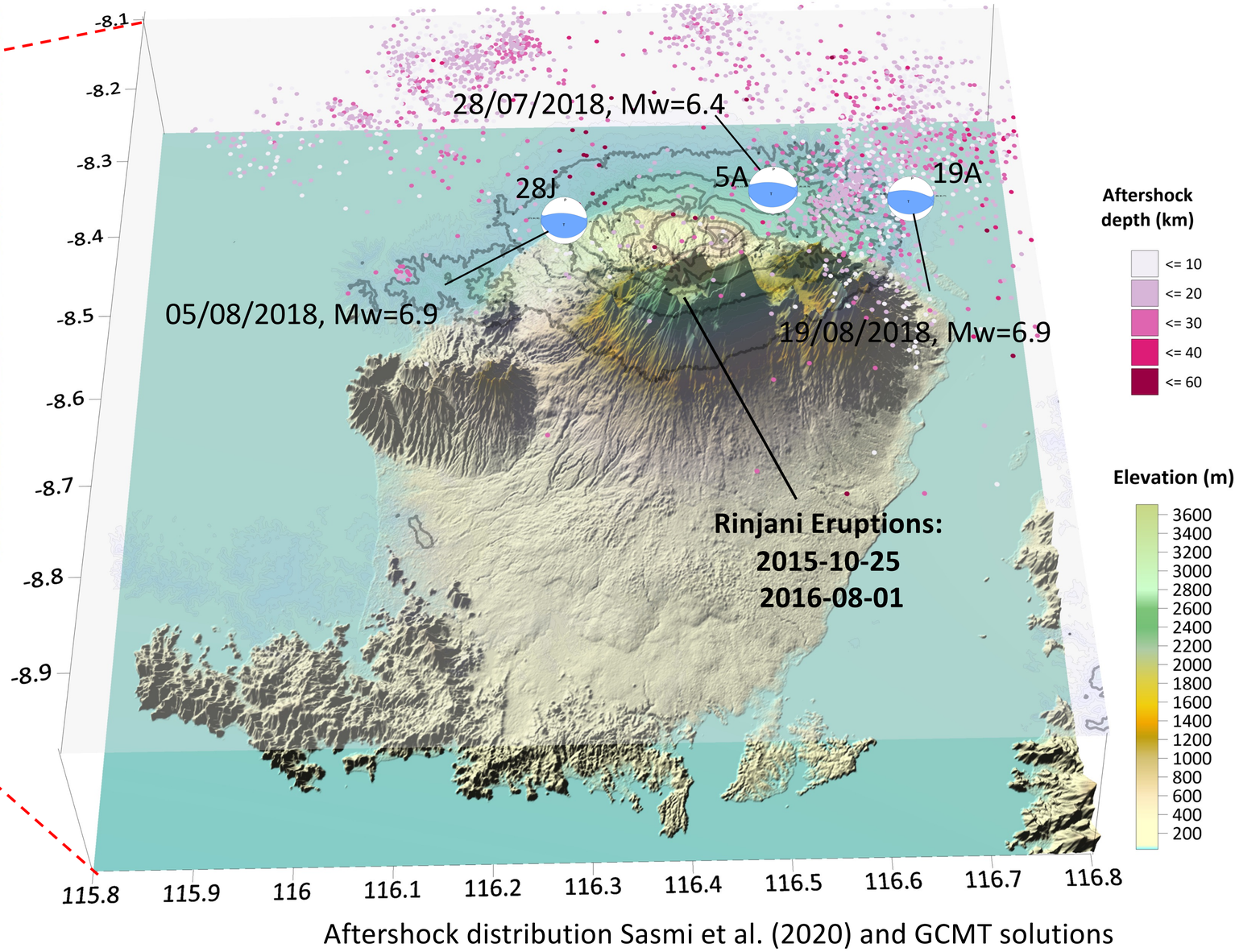



Aftershock distribution Sasmi et al. (2020) and GCMT solutions

## The characteristics of 2018 Lombok earthquake sequence:

- Short time span between each mainshock
- Located near Rinjani Volcano

# Dataset used for co-seismic analysis

## Wrapped interferograms

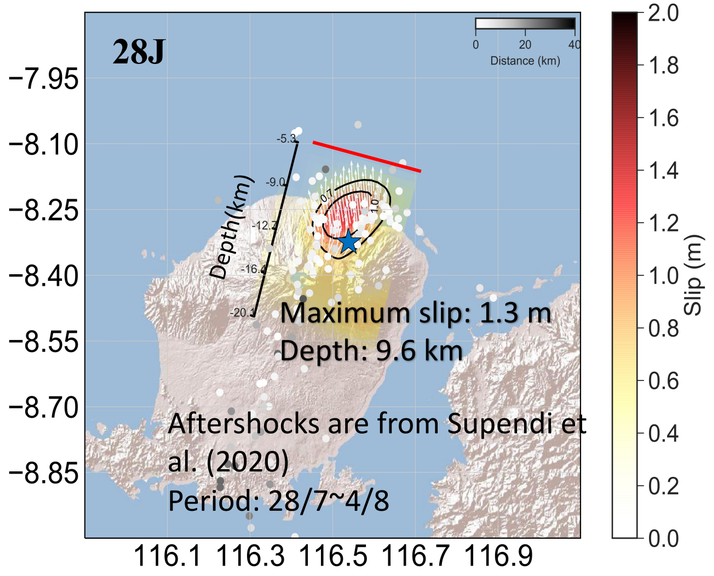
## Unwrapped interferograms

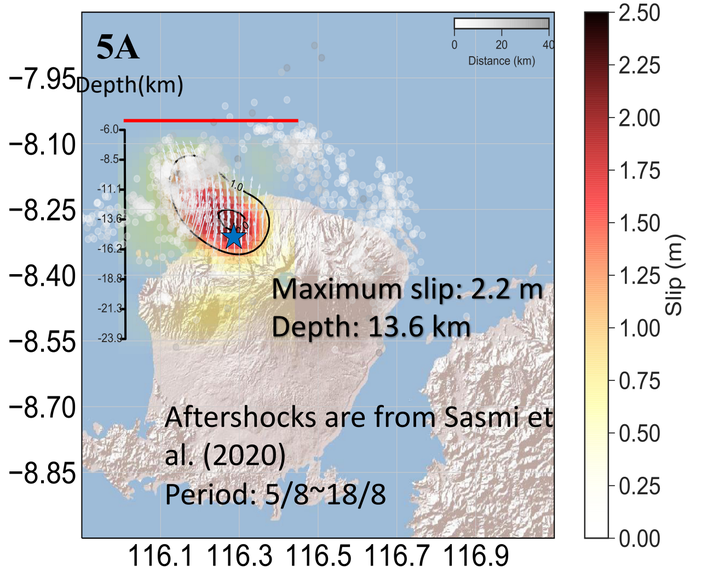
28J

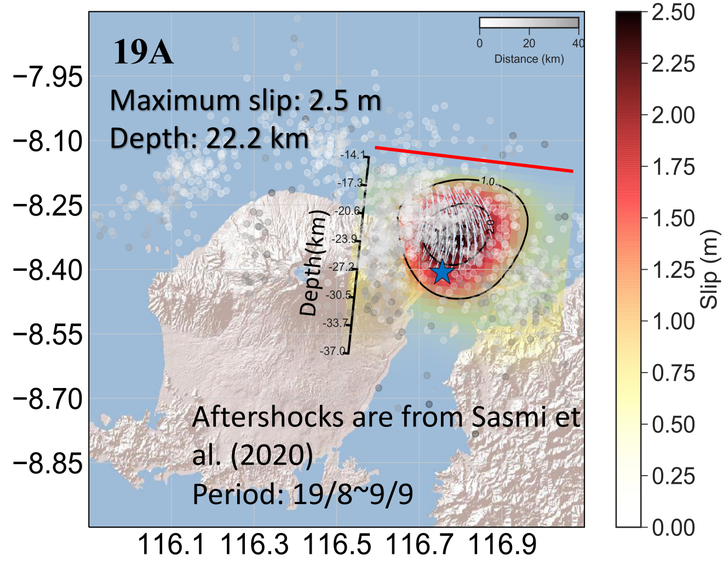
5A

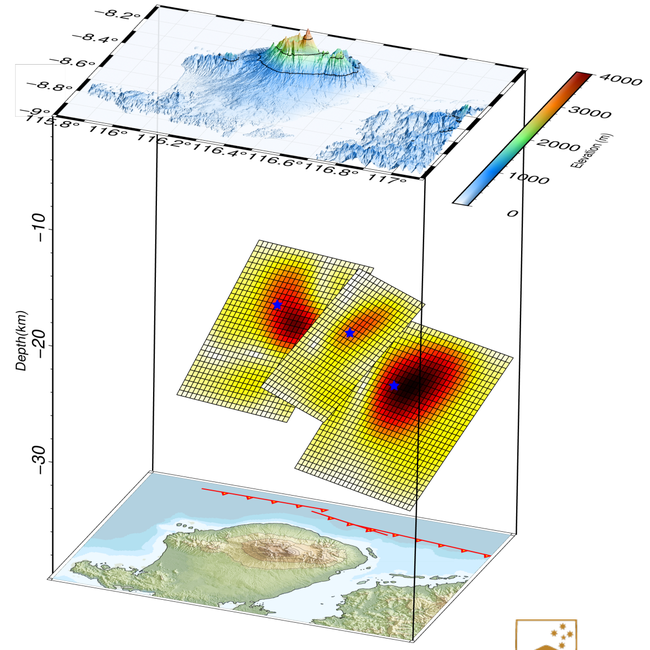
19A

# Co-seismic slip distribution

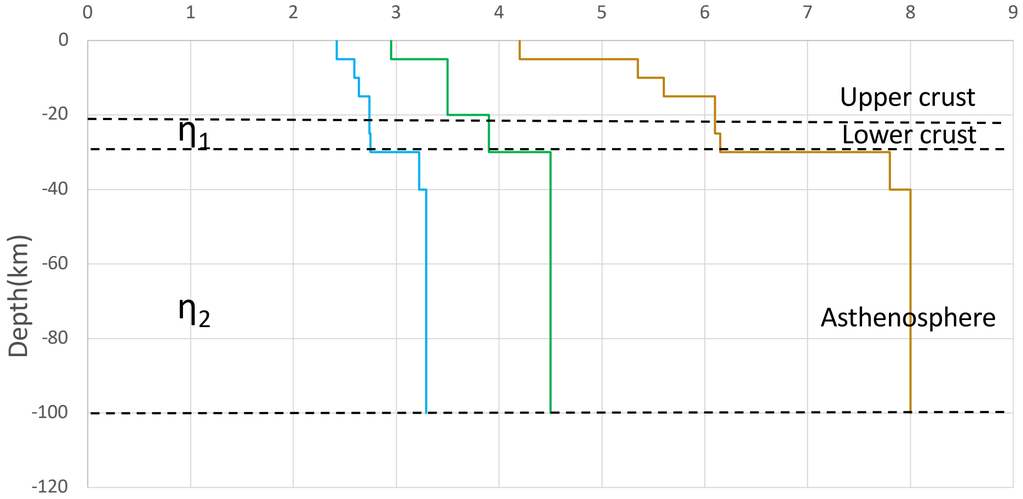


# Two possible mechanisms for post-seismic deformation:

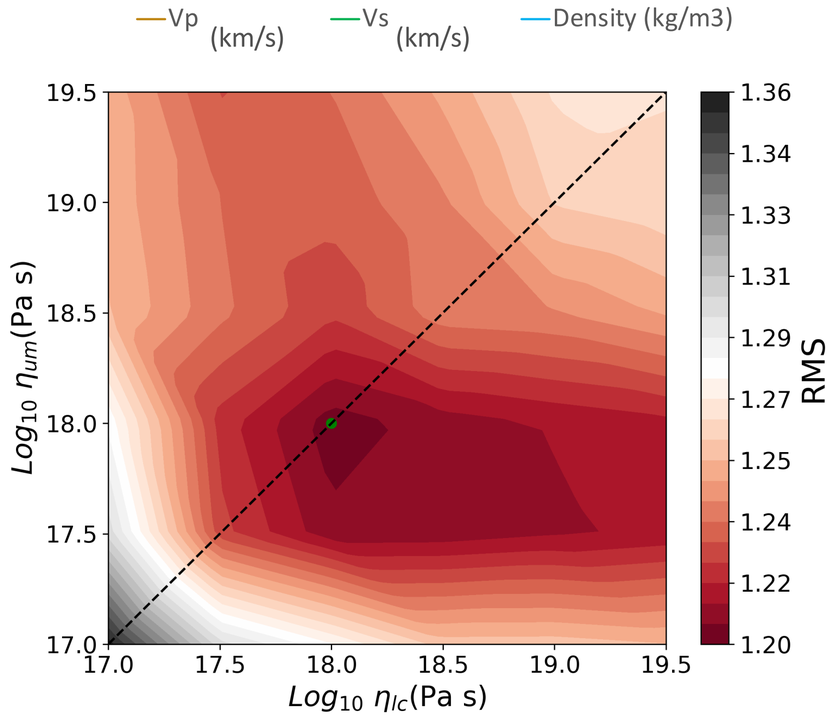



1. After-slip

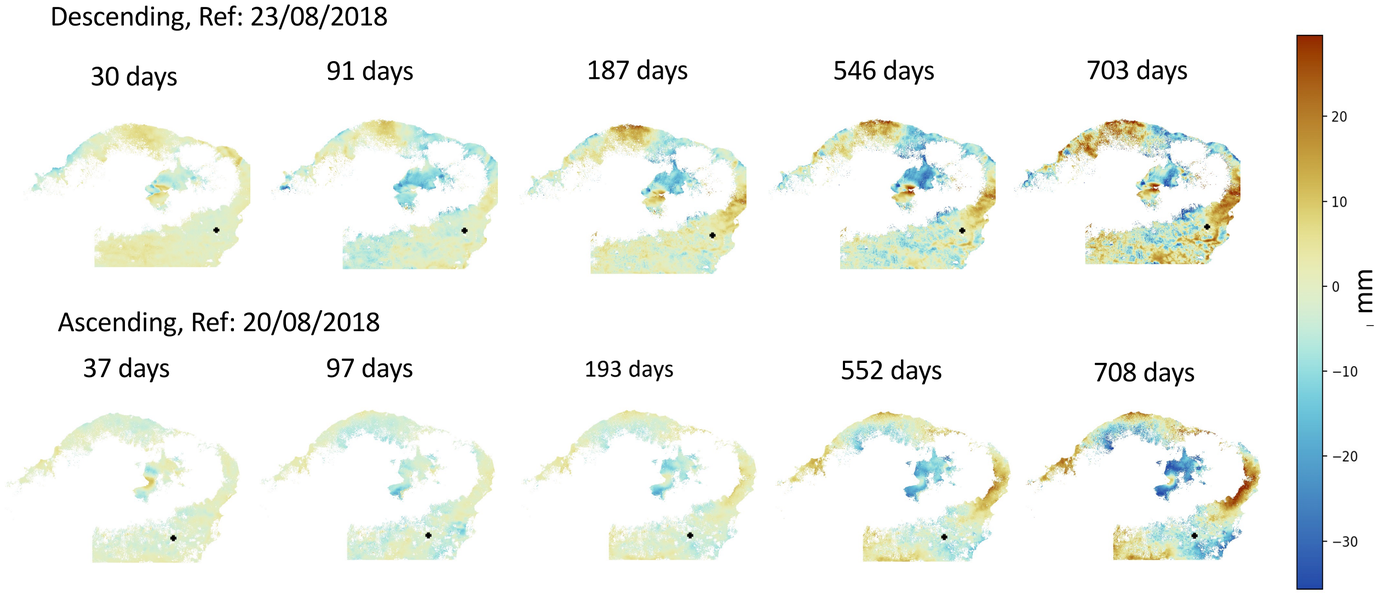
   Slow continuation of the rupture process after the earthquake, same deformation pattern as the co-seismic. Time scale: shortly after the earthquake

2. Viscoelastic relaxation

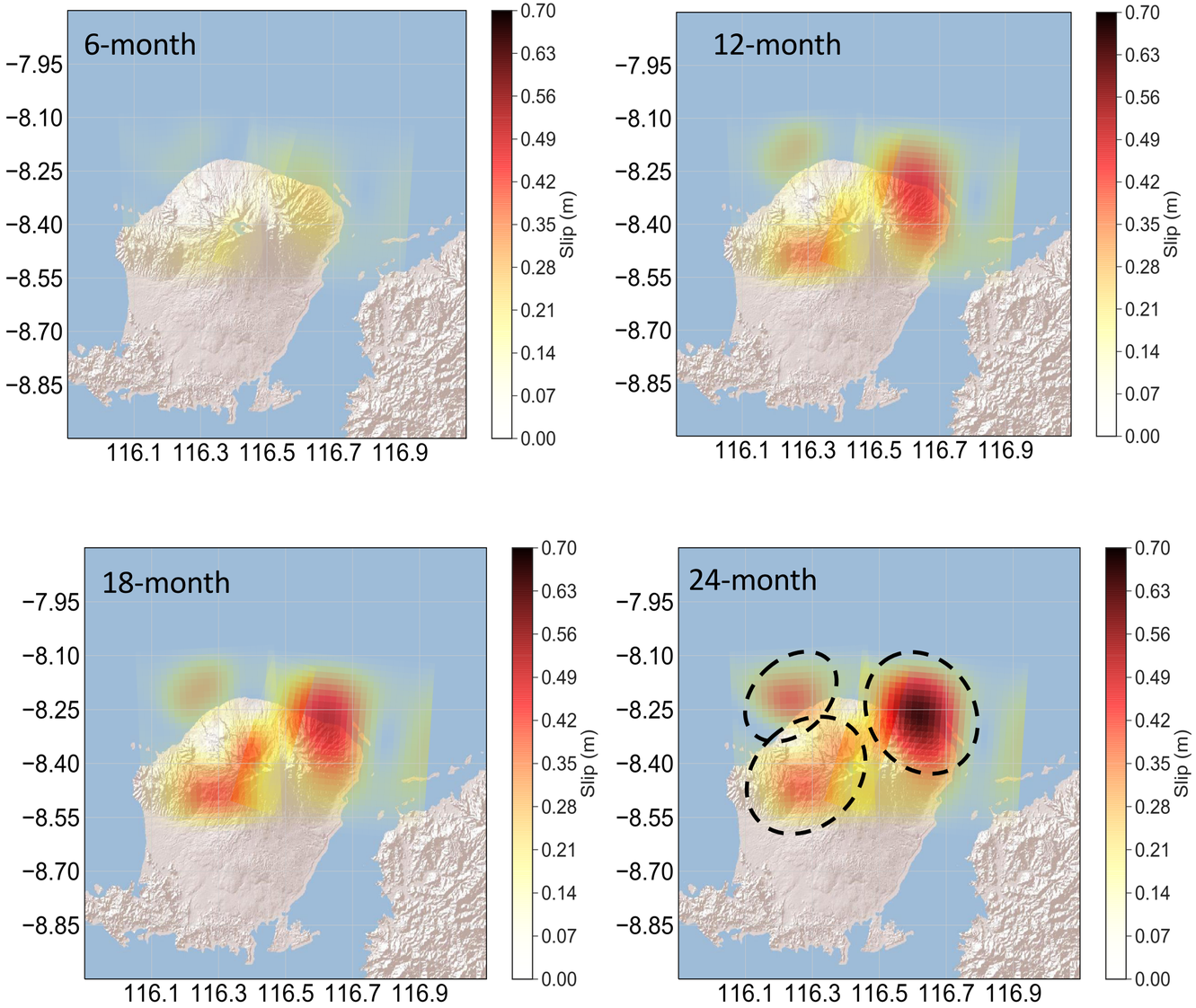
   Stress relaxation in the ductile lower crust and upper mantle, different deformation pattern but comparable magnitude as the co-seismic. Time scale: several decades or longer



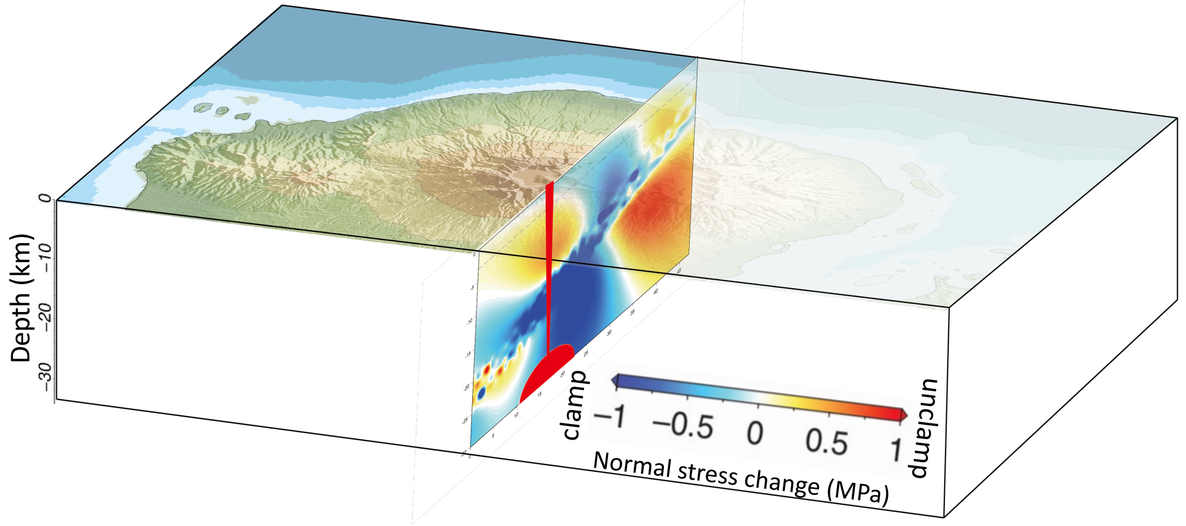

## Time dependent cumulative LOS displacement:



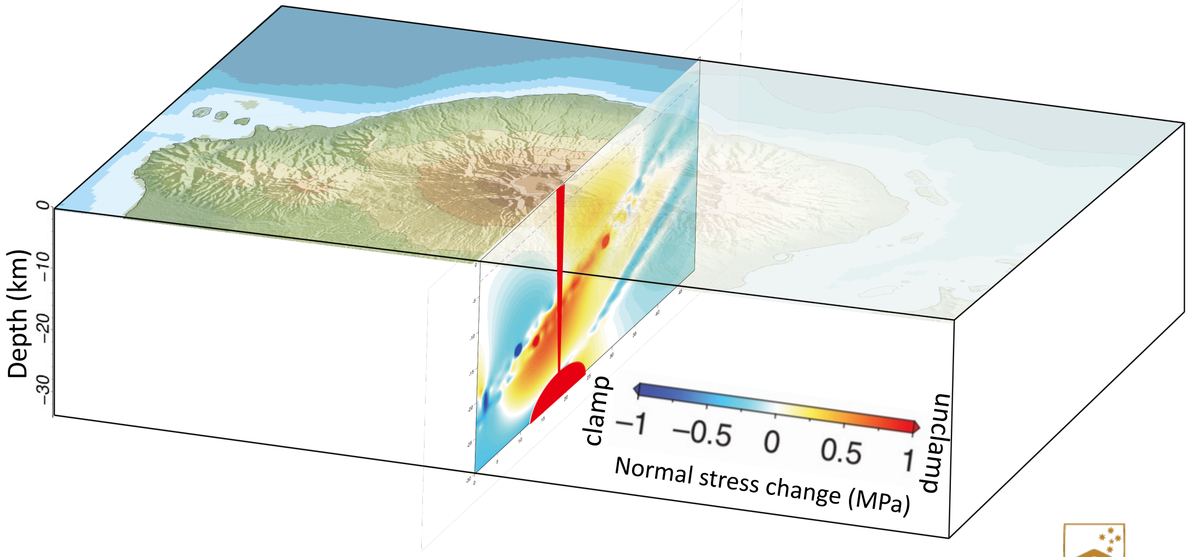
## Time dependent viscoelastic-afterslip combined model

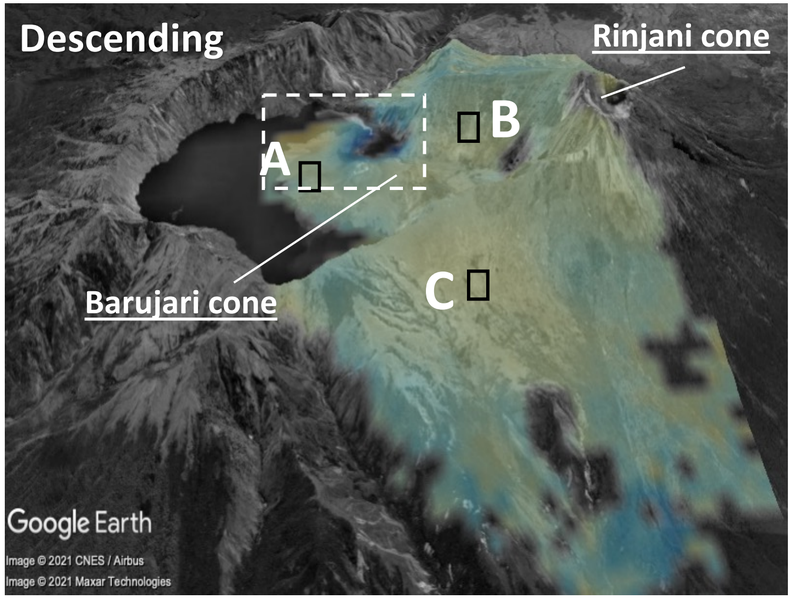


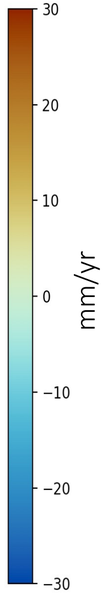

## Normal stress change based on the co-seismic rupture model

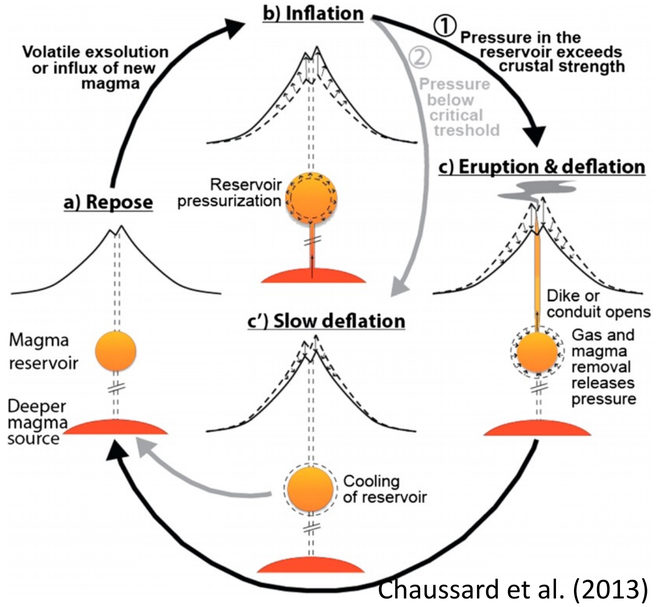



## Normal stress change based on the post-seismic rupture model

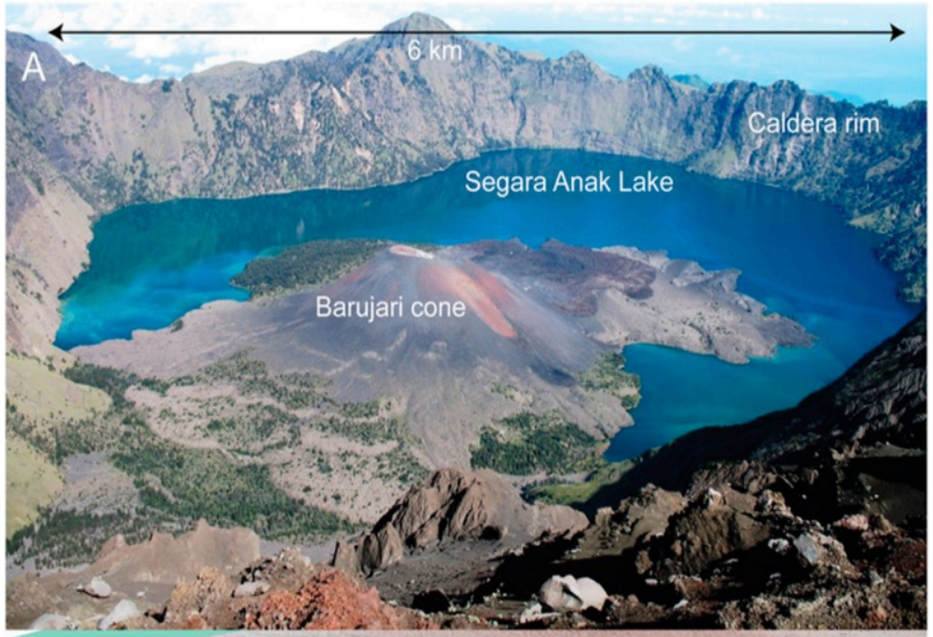


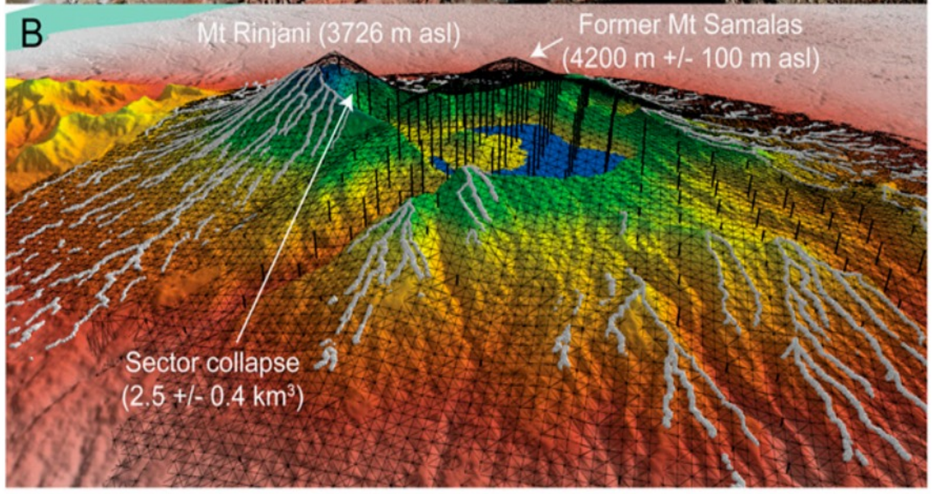


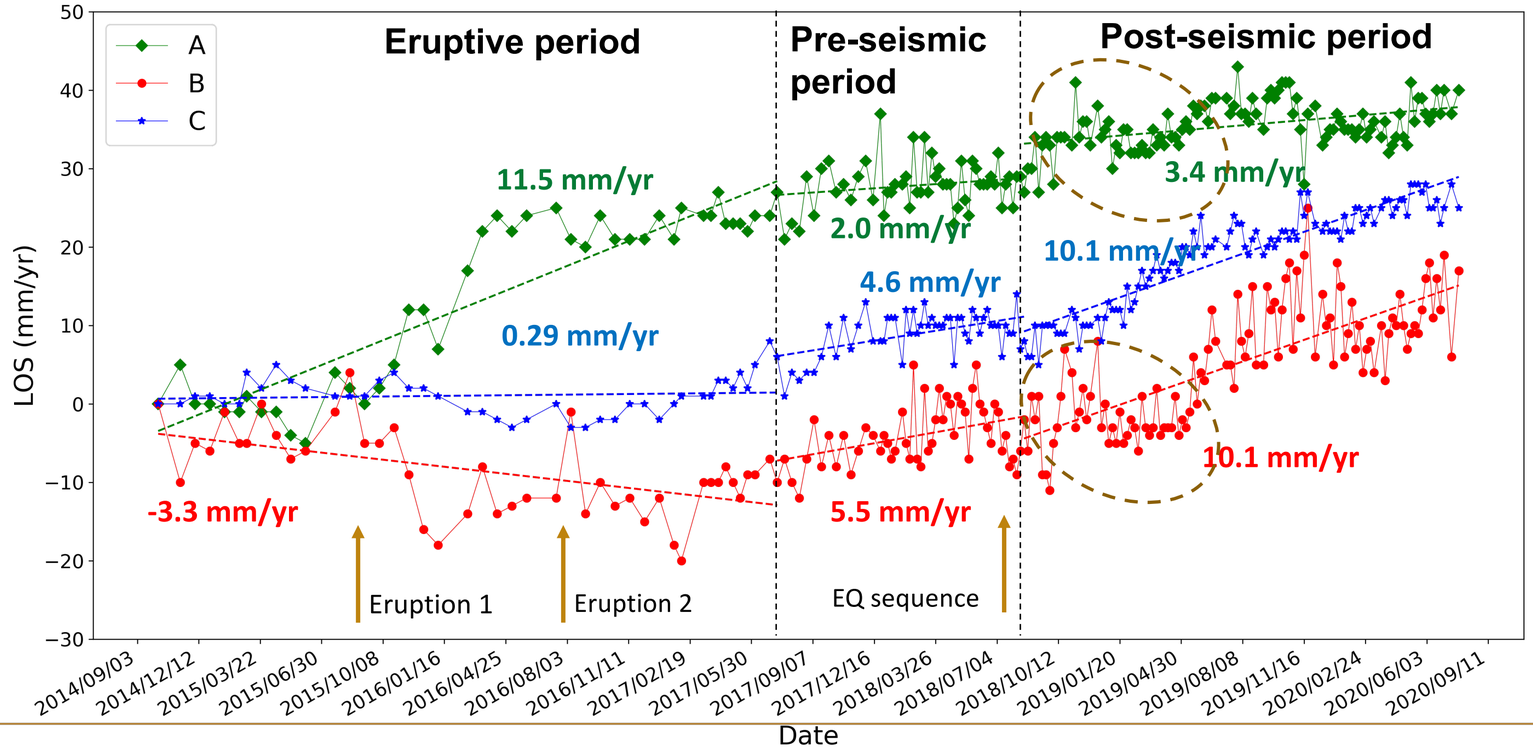




Chaussard et al. (2013)

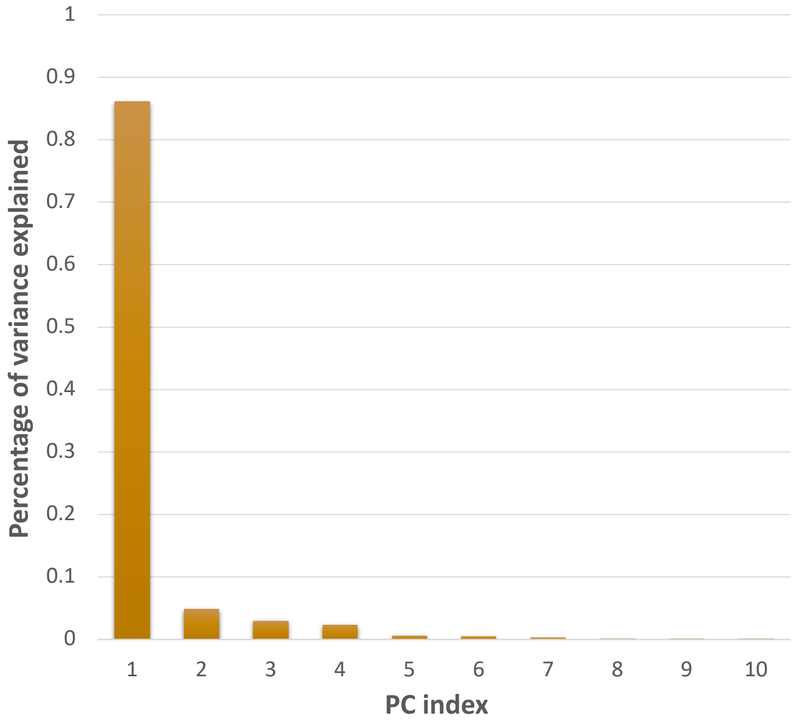



(Lavigne et al., 2013)



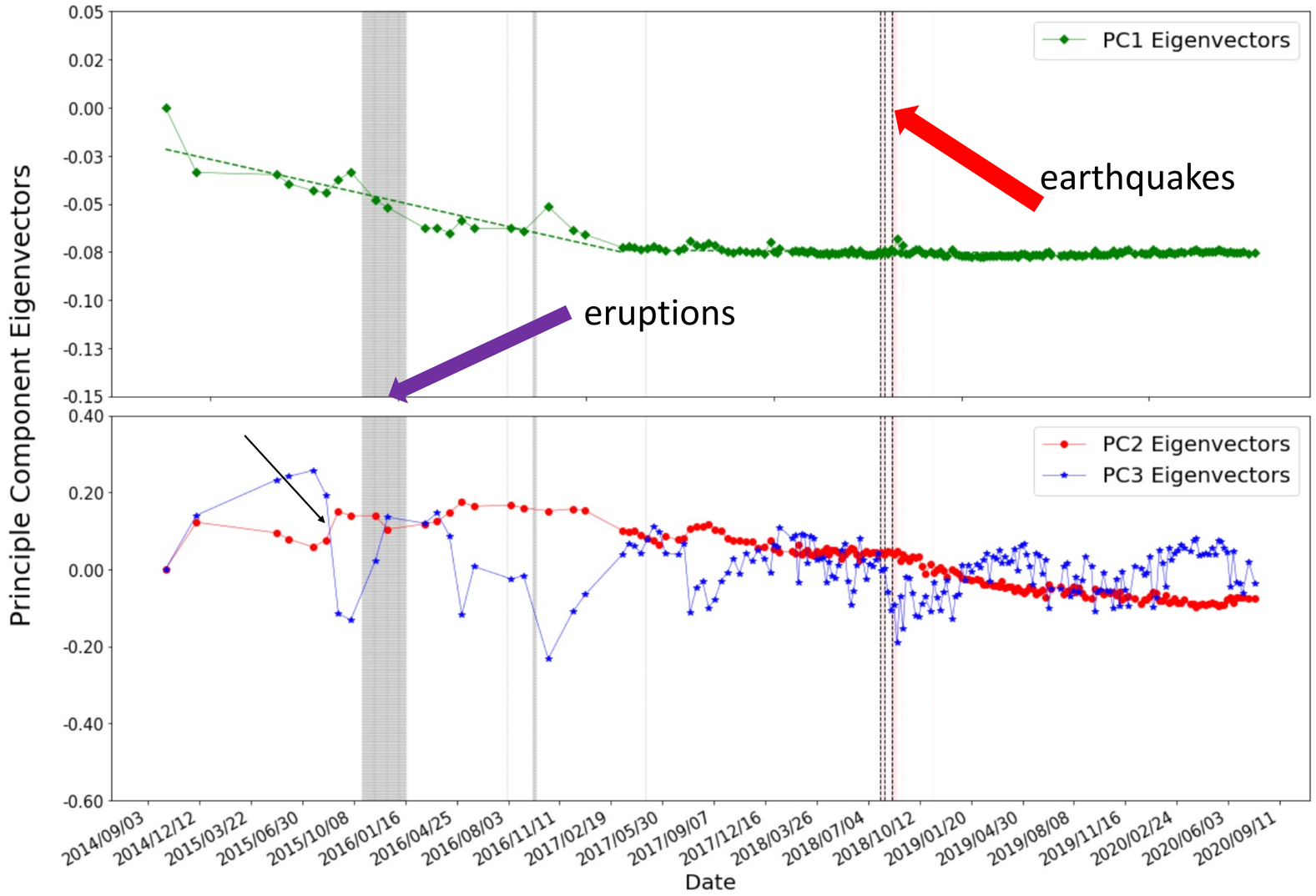
# T-mode Principal component analysis

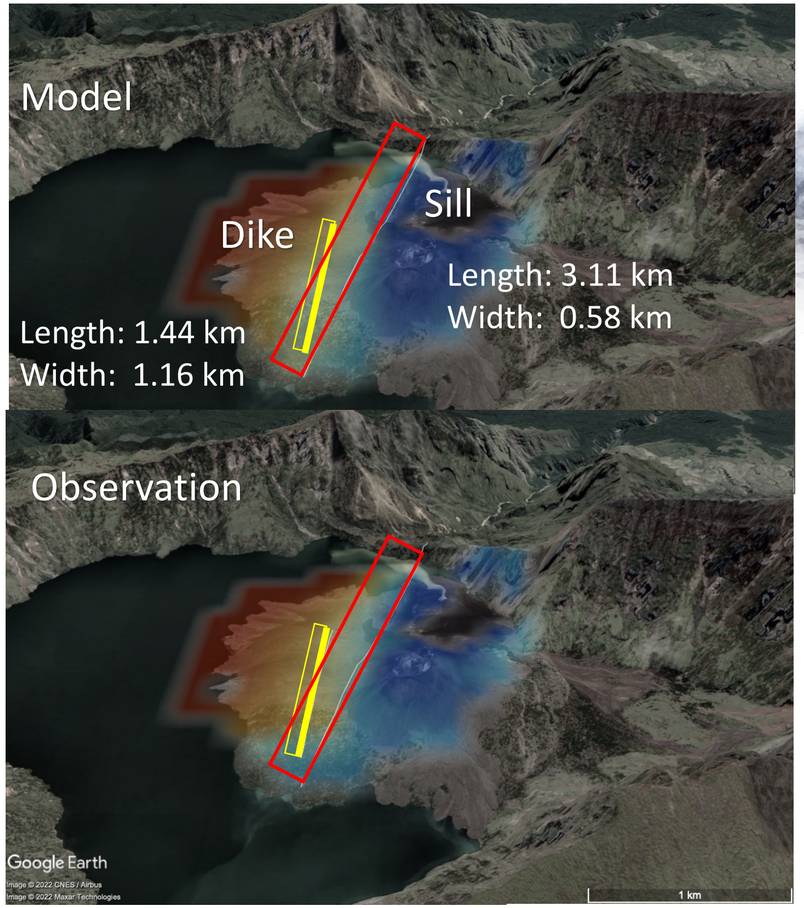


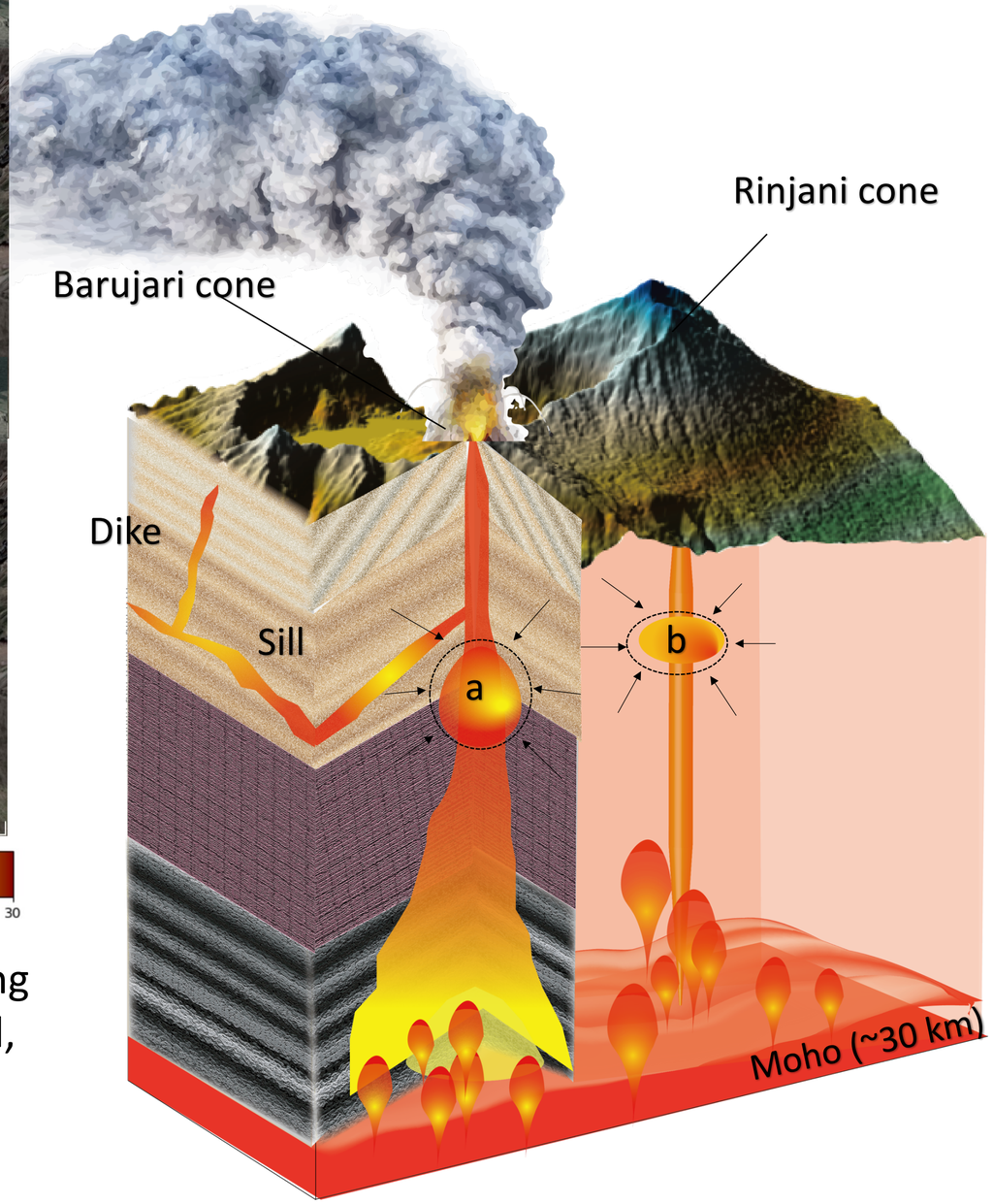

T-mode PCA to extract spatial patterns of deformation embedded in InSAR time series to evaluate evolution (Chaussard et al., 2014)

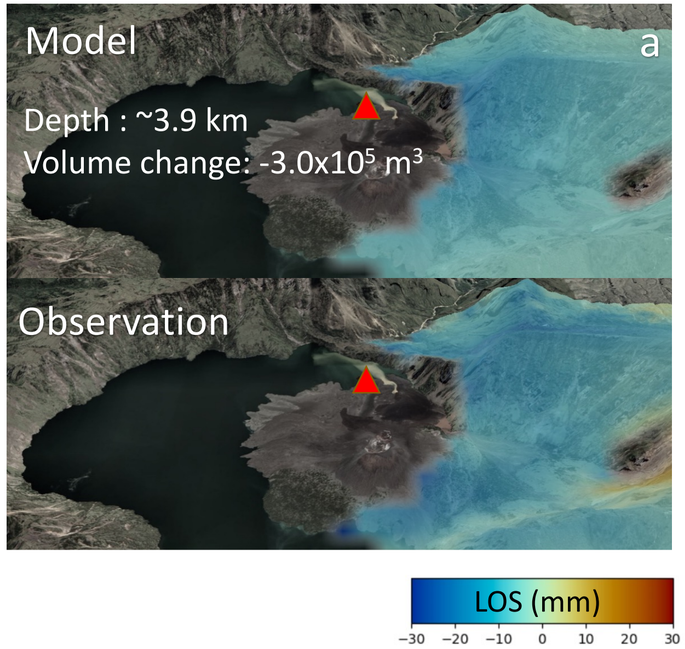
PC1 explains over 80% of variance corresponding to longer-term deformation.

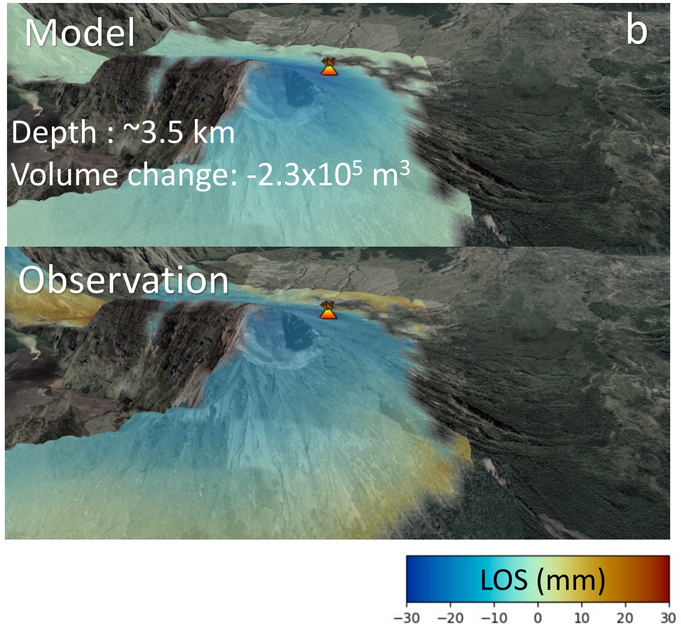
Eigenvector time series shows decrease 2014- 2017, then constant 2017–2020.






Our best-fit dike is nearly vertical, reaching a depth of up to 2 km below the sea level, opening of 8.5 cm, and the sill is at the depth of 3.1 km, contracting of 40 cm.

# Take-home messages:

- Observed ~1 MPa of extensional stress change at 10-20 km depth around the crater caused by the 3 mainshocks. Maximum normal stress change caused by the post-seismic behaviour is up to 0.5 MPa  concentrated at 15-25 km depth.

- Influence of the 2018 Lombok earthquake sequence on the volcanic edifice is  concentrated during 6 months after the events, contributing to the deflation of the volcano.

- A combined model of an open dike and a deflation sill explains the local deformation signal caused by the eruptive fissure. The estimated volume change of two Mogi source are $-3.0 \times 10^5$ $m^3$ (Barujari) and $-2.3 \times 10^5$ $m^3$ (Rinjani) respectively.

**Thank you**

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