



Volcanic deformation sources associated with Fogo 2011-2012 unrest, Azores – The first modelling result

Jun Okada (1), João Araújo (2), Alessandro Bonforte (3), Francesco Guglielmino (3), Maria Lorenzo (2), and Teresa Ferreira (2)

(1) Meteorological Research Institute, Japan Meteorological Agency, Tsukuba, Japan (jun@mri-jma.go.jp), (2) Centro de Informação e Vigilância Sismovulcânica dos Açores (CIVISA), Ponta Delgada, Portugal, (3) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania - Osservatorio Etneo, Catania, Italy

Volcanic deformation is often observed at many active volcanoes in the world by using space geodesy techniques, namely GNSS and InSAR. More difficulties in judgement if eruptions are imminent or not arise when such phenomenon occurs at dormant volcanoes due to the lack of eruption experiences with monitoring data. The eruption triggering mechanism is still controversial at many cases, but many attempts to image deformation sources beneath volcanoes have been made using geophysical inversion techniques.

In this study, we show the case study of Fogo (Água de Pau) volcano, S. Miguel Island, Azores which represents over 450 years of eruption dormancy since 1563-1564. In the recent decades Fogo has exhibited three prominent unrest episodes (1989, 2003-2006, and 2011-2012). The lack of geochemical and hydrothermal evidences for a magmatic intrusion during those episodes does not encourage discussions on resuming volcanic activity of Fogo. However, the inflation/uplift are evident on the edifices at least for the last two unrest episodes based on GPS data by Trota et al. (2009) and Okada et al. (2015), respectively.

The preliminary deformation modelling based on repeated GPS campaign data suggested a shallow expanding spheroid (Trota et al. 2009) or a single Mogi sources beneath the summit caldera. We performed a more integrated inversion for the 2011-2012 episode using a genetic algorithm optimizing the source parameters. The best fit model agrees well with the regional/local tectonic lineament suggesting the close relation between the volcanic sources and the regional/local tectonics.

The regional extensional stress (between Eurasia and Nubia plates) may play important roles for the ascent of volcanic fluids at Fogo volcano. We do not discard the possibility that Fogo may have been preparing for eruptions by intermittent ascents of magma at shallow crust (i.e. experiencing “failed eruptions”) during the apparent dormant period.

As a local monitoring agency, CIVISA (Center for Information and Seismovolcanic Surveillance of the Azores) continues to monitor Fogo’s deformation in order to track changes in the source processes (source position and geometry, volume, pressure, etc.) as well as Fogo’s seismicity and geochemistry.