Volcano deformation in Kyushu (SW Japan) through InSAR data

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Kyushu Island (SW Japan) hosts several active arc volcanoes. Despite being closely monitored, our knowledge on their deformation history with regard to their activity is poor. In order to improve our understanding, we use InSAR processing of ALOS, ERS, ENVISAT and COSMO−SkyMed images. We study the surface deformation of three of the most active volcanoes in Kyushu: Aso Caldera (between 1993−2011), Aira Caldera (2006−2011), Kirishima volcano (2006−2011). The SAR images have been processed to obtain time series through the SBAS technique.

Aso caldera has several vents in its central part. Of these, Naka Dake crater is the only currently active, erupting 7 times since 1993. Between January 1996 − November 1998, after the important 1994−1995 eruption, we observed a subsidence of ∼1.5 cm/yr in the central caldera. Analytical models suggest a deflating source (with various possible shapes) at 6−7 km of depth, implying a magmatic nature for the deformation. Inversion results are consistent with available seismic and GPS data.

Aira Caldera hosts Sakurajima volcano along its southern rim, with a persistent eruptive activity since 1950s. Between May 2007−January 2009, we observe a broad uplift of ∼1.5 cm on most of Aira Caldera, with the exception of the eastern part. A preliminary analytical inversion of these data suggests a deformation source in the Caldera center, at depth of 12−15 km, implying a magmatic nature of the deformation. Inversion results are in agreement with GPS and InSAR data inversions for other periods of activity.

Kirishima is a group of volcanoes, including the most active Shinmoedake, which lately erupted in 2008 and 2011; in particular, between January−September 2011 Shinmoedake erupted several times, with a peak of activity in February. InSAR data show an uplift of 2−4 cm in the Shinmoedake area between early 2010 − April 2011, immediately predating the onset of the latest eruptive sequence, and continuing also after the onset of the sequence.

Our preliminary results suggest that the minor deformation at these three volcanoes, related to deep or relatively deep magmatic sources, may be explained by their open system.

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