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Icelandic Volcanoes Geohazard Supersite and FUTUREVOLC: role of interferometric synthetic aperture radar to identify renewed unrest and track magma movement beneath the most active volcanoes in Iceland

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FUTUREVOLC is an integrated volcano monitoring project, funded by the European Commission (FP7) and led by the University of Iceland and the Icelandic Meteorological Office (IMO). The project is a European collaborative effort, comprising 26 partners, aimed at integrating ground based and satellite observations for improved monitoring and evaluation of volcanic hazards. Iceland has also recently been declared a Geohazard Supersite by the Committee on Earth Observation Satellites, based on its propensity for relatively frequent eruptions and their potentially hazardous, long ranging effects.

Generating a long-term time series of ground displacements is key to gaining a better understanding of sub-volcanic processes, including the detection of new melt and migration of magma within the crust. The focus of the FUTUREVOLC deformation team is to generate and interpret an extended time series of high resolution deformation measurements derived from InSAR observations, in the vicinity of the four most active volcanoes in Iceland: Grímsvötn, Katla, Hekla and Bárdarbunga. A comprehensive network of continuous deformation monitoring equipment, led by IMO and collaborators, is already deployed at these volcanoes, including GPS, tilt and borehole strainmeters. InSAR observations are complementary to field based measurements and their high spatial resolution assists in resolving the geometry and location of the source of the deformation. InSAR and tilt measurements at Hekla indicate renewed melt supply to a sub-volcanic reservoir after the last eruption in 2000. Recent deformation studies utilising data spanning this eruption, have provided insight into the shallow plumbing system which may explain the large reduction in eruption repose interval following the 1970 eruption. Although InSAR and GPS observations at Katla volcano (between 2001 and 2009) suggest no indication of magma induced deformation outside the ice-cap, it is possible that a small flood at Mýrdalsjökull in July 2011, followed by an increase in micro-seismic earthquakes, was related to magmatic activity. Future InSAR observations at these volcanoes are essential to assessing changes in their behaviour and associated hazards.

The recent Supersite award ensures a considerable amount of SAR data will be made available for both past and future satellite acquisitions. For these four volcanic areas we anticipate the delivery of $\sim$1200 historic X-band images (acquired by TerraSAR-X and Cosmo-SkyMed satellites), along with full access to the complete catalogue of ERS and ENVISAT SAR data. Rapid delivery of future TerraSAR-X, Cosmo-SkyMed and Radarsat-2 orders ($\sim$700 new acquisitions per year) has driven a strategy of near-real time SAR processing and analysis of ground deformation to facilitate rapid response in the event of renewed unrest/eruption. Several improved data processing initiatives are currently underway, including an InSAR near-real time processing workflow, based on fast coherence estimation and parallel processing. Semi-automated InSAR processing will facilitate the generation of an extended time series of deformation, which may be quickly updated in the event of renewed unrest. Rapid analysis of near-real time interferograms will assist in tracking the evolution of magmatic activity during the next episode of volcanic unrest/eruption, whilst rapid dissemination of this information to relevant parties may help mitigate the effects of volcanic hazards.