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Volcano Deformation and Eruption Forecasting using Data Assimilation: Case of Grimsvötn volcano in Iceland

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The recent advances in Interferometric Synthetic Aperture Radar (InSAR) imaging and the increasing number of continuous Global Positioning System (GPS) networks recorded on volcanoes provide continuous and spatially extensive evolution of surface displacements during inter-eruptive periods. For basaltic volcanoes, these measurements combined with simple dynamical models (Lengliné et al. 2008 [1], Pinel et al, 2010 [2], Reverso et al, 2014 [3]) can be exploited to characterise and constrain parameters of one or several magmatic reservoirs using inversion methods.

On the other hand, data assimilation–a time-stepping process that best combines models and observations, sometimes a priori information based on error statistics to predict the state of a dynamical system–has gained popularity in various fields of geoscience (e.g. ocean-weather forecasting, geomagnetism and natural resources exploration). In this work, we aim to first test the applicability and benefit of data assimilation, in particular the Ensemble Kalman Filter [4], in the field of volcanology. We predict the temporal behaviors of the overpressures and deformations by applying the two-magma chamber model of Reverso et. al., 2014 [3] and by using synthetic deformation data in order to establish our forecasting strategy. GPS time-series data of the recent eruptions at Grimsvötn volcano is used for the real case applicability of the method.

[1] Lengliné, O., D Marsan, J Got, V. Pinel, V. Ferrazzini, P. Obuko, Seismicity and deformation induced by magma accumulation at three basaltic volcanoes, *J. Geophys. Res.*, *113*, B12305, 2008.

[2] V. Pinel, C. Jaupart and F. Albino, On the relationship between cycles of eruptive activity and volcanic edifice growth, *J. Volc. Geotherm. Res, 194*, 150-164, 2010

[3] T. Reverso, J. Vandemeulebrouck, F. Jouanne, V. Pinel, T. Villemin, E. Sturkell, A two-magma chamber as a source of deformation at Grimsvötn volcano, Iceland, *JGR*, 2014

[4] Evensen, G., The Ensemble Kalman Filter: theoretical formulation and practical implementation. *Ocean Dyn. 53*, 343-367, 2003