Global and regional patterns of volcanic deformation.

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A truly global dataset is required to characterise the global distribution and probability of volcanic unrest and identify the mechanisms responsible. The scope of satellite observations mean that it is now possible to study volcanoes on both regional and global scales and throughout their eruption cycles. Volcanic deformation is one of the a key parameters to understand in order to interogate the causes of volcanic unrest with the advent of satellite-based InSAR capabilities enabling regional-scale surveys of such deformation to be undertaken. These studies are beginning to hint at striking trends in the distribution of volcanic deformation.

A systematic InSAR survey of the Central American Volcanic Arc shows a significant lack of magmatic deformation, that may be indicative of differences in magma storage or degassing processes relative to other well-studied continental arcs. We expect that if magmatic volcano deformation were spread evenly across historically active volcanoes worldwide, there would be less than one percent probability of none of Central America's 26 volcanoes deforming. At the opposite extreme, the East African Rift has few historically recorded eruptions but >10 volcanoes are shown to be deforming.

Globally, InSAR has detected deformation at 140 volcanoes and counting. In this presentation, we will combine information from a series of systematic surveys, to produce a catalogue of volcanoes at which InSAR observations have been reported, including those at which measurements revealed no deformation. We then use these values to assign probabilities to a Bayesian Belief Network to allow satellite observations of deformation to be robustly included in probabilistic hazard assessments. Our preliminary findings are i) the most common observation is that the volcano showed no deformation and did not erupt (not surprising given the typically long repose periods); ii) Fourteen volcanic eruptions have been reported at which no deformation was observed; iii) For magmatic deformation, there are roughly twice as many records of deformation without eruption as those associated with eruptions; iv) a growing number of measurements indicate the prevalence of non-magmatic deformation. We will discuss the initial implications of these findings and develop a framework for the future interpretation of InSAR signals at volcanoes.