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Volcano deformation on a regional scale: insights from systematic InSAR surveys

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Space-based geodesy has allowed the measurement of volcano deformation on a regional scale through different stages of eruption cycles. This has included the detection of deformation at volcanoes too isolated or dangerous for ground based measurements, and at systems not previously thought to be active. The majority of InSAR volcano deformation events measured so far did not occur during eruptions. There are also a growing number of reports of a lack of deformation during volcanic eruption. A fair analysis of the relationship between deformation and volcanic unrest on a regional to global scale therefore requires a catalogue of when and where deformation does not occur as well as when it does. Reports of a lack of deformation during any stage of an eruption cycle are underrepresented in the published literature.

As the distribution of global measurements is uneven, it is crucial to consider the method limitations in InSAR measurements of volcano deformation. For example, InSAR measurement is limited by dense vegetation, frequent explosive activity, steep topography and periodic snow cover. It is easier to make InSAR deformation measurements at shield volcanoes than at young stratovolcanoes, especially in equatorial regions where water vapour concentrations are high and vegetation may be dense. Any comparison between the incidence of deformation measured with InSAR in different regions therefore requires quantification of method limitations.

We draw on systematic surveys of the Central American Volcanic Arc and the East African Rift as well as other published measurements to investigate commonalities and variations in volcano deformation and unrest.