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The apparent lack of deformation at Central American Volcanoes: systematic arc-scale InSAR measurement

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We consider whether the lack of InSAR deformation measurements in the Central American Volcanic Arc can be explained by ambiguities inherent in using InSAR in the tropics or if it can be interpreted in terms of magmatic-tectonic processes. This apparent lack of magmatic deformation is striking in comparison to other volcanic arcs studied with InSAR of similar levels of activity. Arc-scale comparison of volcano deformation requires an understanding of both the limits of InSAR measurements,and consistent criteria for identifying volcano deformation caused by a range of magmatic and structural processes.

We apply a systematic approach to L-band data from Central America (2007-2009), using evidence from time series analysis, stacking and tests of phase measurement to distinguish between artefacts due to atmospheric water vapour, geometric factors and actual deformation of the ground. We expect to detect permanent deformation of a magnitude above 1-2 cm for most Central American volcanoes, corresponding to an average steady deformation rate of $\sim$0.7 cm/yr. Short-lived, transient deformation events, where the ground returns to its original position after movement, may have to be much larger to be detectable. Our results suggest that at least three quarters of InSAR volcano measurements made in the Aleutians and Andes would still have been measureable with the same limits as in Central America. This suggests that the apparent difference between deformation in Central America and other volcanic arcs may be the result of a real difference in volcanic processes. We also detected unusual deformation signals associated with surface processes at two persistently active volcanoes in Central America.