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Dynamic magmatic processes at a continental rift caldera, observed using satellite geodesy

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Large silicic calderas are a key feature of developing continental rifts, such as the Main Ethiopian Rift (MER), and are often observed to be deforming. Corbetti is one such example of a Holocene caldera in the MER that is undergoing deformation.
However, the cause of the unrest, and the relationship to rift processes such as magma storage, transport and extension remain poorly understood. To investigate, we use InSAR (ascending and descending Cosmo-SkyMed data) and continuous GPS to observe the temporal and spatial evolution of sustained uplift at the Corbetti Caldera. Within the caldera, which was thought to have formed ∼200 ka, there is evidence for numerous periods of resurgent volcanism in the form of plinian eruptions as well as effusive obsidian flows. How the sources of these varying styles of volcanism are reconciled at depth and in time is currently poorly constrained. Previous research has shown that pre-rift structures have a significant influence on the strain field, and hence on the magmatic and hydrothermal processes which drive it.
The Cosmo-SkyMed data used in this study was specifically chosen such that each ascending image has a corresponding descending image acquired as contemporaneously as possible. This is necessary, given the rate of uplift, so as to reduce the number of assumptions when constructing time-series from multiple look directions, and when incorporating GPS data. We decompose the ascending and descending line-of-site deformation signals into vertical and east-west components and use finite source modeling to constrain the depth and geometry of the source of deformation.
These results are then compared to available seismic, dynamic microgravity and magnetotelluric data to better understand this system, and how it is related to the volcanic hazard and local geothermal resources.