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Volcano Deformation in the Main Ethiopian Rift

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Magmatism strongly influences continental rift development yet the mechanism, distribution and timescales on which melt is emplaced and erupted through the shallow crust are not well characterized. The Main Ethiopian Rift (MER) has experienced significant volcanism and the mantle beneath is characterized by high temperatures and partial melt. Despite its magma-rich geological record, only one eruption has been historically recorded and no dedicated monitoring networks exist. Consequently, the present-day magmatic processes in the region remain poorly documented, and the associated hazard neglected. We use satellite-based InSAR observations to demonstrate that significant deformation has occurring at 4 volcanic edifices in the MER (Alutu, Corbetti, Bora and Haledebi) from 1993-2010. This raises the number of volcanoes known to be deforming in East Africa beyond 12, comparable to many subduction arcs despite the smaller number of recorded eruptions. The largest displacements are at Alutu volcano, the site of a geothermal plant, which showed two pulses of rapid inflation (10-15 cm) in 2004 and 2008 separated by gradual subsidence. Our observations indicate a shallow (<10 km), frequently replenished zone of magma storage associated with volcanic edifices and add to the growing body of observations that indicate shallow magmatic processes operating on a decadal timescale are ubiquitous throughout the East African Rift. In the absence of detailed historical records of volcanic activity, satellite-based observations of monitoring parameters, such as deformation, could play an important role in assessing volcanic hazard.