



Volcano deformation in central Main Ethiopian Rift system (Aluto Volcano) inferred from continuous GPS and dynamic gravity observations

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Silicic volcanic centres in the rift systems frequently experience unrest indicating long-term activity in the underlying magmatic system, but it is difficult to distinguish the contributions of hydrothermal fluids, magma or gasses. Aluto volcano which is located in the central MER system is situated between the Lakes Ziway and Langano in the north and south respectively. Continuous GPS installed from April 2013 to October 2015 shows subsidence initially, with the largest subsidence observed in the eastern part of the caldera (2 cm/yr). InSAR observations from TerraSAR-X show a radially-symmetric pattern of long-term subsidence. Dynamic gravity surveys carried out in October 2014 and 2015 showed that there is a net mass loss in the western and central part of the caldera and mass gain in the eastern and southern part of the caldera, with a sharp gradient between the two. This complex spatial pattern of gravity change is significantly different to the simple pattern of deformation indicating multiple sources of pressure and mass change exist within the caldera. We explain the ratio of gravity to height change (dg/dh) throughout the volcano by considering cooling and crystallisation of magma body, draining and precipitation of hydrothermal fluids and changes in the water table and lake levels.

Keywords: volcano deformation, dynamic gravity, continental rift