Geodetic data shed light on ongoing caldera subsidence at Askja, Iceland

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Subsidence within the main caldera of Askja volcano in the North of Iceland has been in progress since 1983. Here, we present new ground and satellite based deformation data, which we interpret together with new and existing micro-gravity data, to help understand which processes may be responsible for the unrest. From 2003-2007 we observe a net micro-gravity decrease combined with subsidence and from 2007-2009 we observe a net micro-gravity increase while the subsidence continues. We infer subsidence is caused by a combination of a cooling and contracting magma chamber at a divergent plate boundary. Mass movements at active volcanoes can be caused by several processes, including water table/lake level movements, hydrothermal activity and magma movements. We suggest that here, magma movement and/or a steam cap in the geothermal system of Askja at depth, are responsible for the observed micro-gravity variations. In this respect, we rule out the possibility of a shallow intrusion as an explanation for the observed micro-gravity increase but suggest magma may have flowed into the residing shallow magma chamber at Askja despite continued subsidence. In particular variable compressibility of magma residing in the magma chamber, but also compressibility of the surrounding rock may be the reason why this additional magma did not create any detectable surface deformation.