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The 2017-2018 uplift episode in the Hengill volcanic system, SW Iceland

Cécile Ducrocq (1), Halldór Geirsson (1), Thóra Árnadóttir (1), Daniel Juncu (2), Vincent Drouin (1,3), Sigrún Hreinsdóttir (4), Hanna Blanck (1,5), Bjarni Reyr Kristjánsson (6), Gunnar Gunnarsson (6), and Benedikt G. Ófeigsson (7)

(1) Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland, Reykjavík, Iceland (cad7@hi.is), (2) COMET, School of Earth and Environment, University of Leeds, Leeds, UK, (3) National Land Survey of Iceland, Iceland, (4) GNS Science, New Zealand, (5) Iceland GeoSurvey, Iceland, (6) OR - Reykjavík Energy, Reykjavík, Iceland, (7) Icelandic Meteorological Office, Iceland

Many volcanoes and high-temperature geothermal systems around the world display recurrent temporal episodes of uplift and subsidence, e.g. Etna, Campi Flegrei, and Yellowstone. The link between magmatic and hydrothermal dynamics of those episodes and the observed crustal deformation is debated. Our focus is Hengill, a volcanic system in SW Iceland whose last eruption was estimated to be ∼2000 years ago. The temporal and spatial crustal deformation as seen by geodetic data sets (GPS and InSAR) is complex. The central volcano is located at a triple junction between the Eurasian, North-American and Hreppar plates, cumulating a total spreading rate of ∼18 mm/yr. The enhanced permeability of the Hengill central volcano and young cooling intrusions at depth in this area are ideal for efficient geothermal production. Currently, the two power plants Nesjavellir and Hellisheiði, which are located North and South-west of the volcanic system, supply the capital city Reykjavík with electricity and hot water. The extraction of water in the geothermal production fields causes localized subsidence up to approximately 27 mm/yr. Additionally, a broad scale subsidence has taken place in the Eastern part of the volcanic complex since ∼2006 (Juncu et al., 2017). From the end of 2017 until spring 2018, geodetic data showed a reversal of motion, indicating a widespread uplift. Simple elastic half-space models suggest similar location of the source of this recent uplift episode and the source of the subsidence as estimated by Juncu et al. (2017). Intriguingly, a source of a longer uplift episode in the Hengill area -between 1994 and 1999- was estimated 3-4 kilometers SE of the source of the 2017-2018 episode. These three deep sources have estimated depths of ∼5-7 kilometers, which is near the brittle-ductile transition zone in this area. Possible explanations for the 2017-2018 uplift include magmatic intrusion or processes linked to hydrothermal fluids. Here, we focus on spatially and temporally defining the 2017-2018 uplift episode in the Hengill area using geodetic data. Additional geothermal and geophysical knowledge of this area provides clues to the processes causing this uplift and its relation to previous episodes in this area. Our work at Hengill volcano is likely to contribute to ongoing discussions of the complex temporal variations of deformation at volcanoes and high-temperature geothermal systems around the world.