Geophysical Research Abstracts
Vol. 18, EGU2016-17005, 2016
EGU General Assembly 2016

A multidisciplinary study of the 2014-2015 Bárðarbunga caldera collapse, Iceland

Magnus Tumi Gudmundsson (1), Kristin Jonsdóttir (2), Andy Hooper (3), Eoghan Holohan (4), Saemundur Halldorsson (1), and the Bardarbunga Team

(1) University of Iceland, Institute of Earth Sciences, Nordic Volcanological Center, Reykjavik, Iceland (mtg@hi.is), (2) Icelandic Meteorological Office, (3) University of Leeds, (4) GFZ, Potsdam

The collapse of the ice-filled Bárðarbunga caldera in central Iceland occurred in autumn and winter, when weather was highly unsettled and conditions for monitoring in many ways difficult. Nevertheless several detailed time series could be obtained on the collapse and to a degree the associated flood-basalt eruption in Holuhraun. This was achieved through applying an array of sensors, that were ground, air and satellite based, partly made possible through the EU-funded FUTUREVOLC supersite project. This slow caldera collapse lasted six months, ending in February 2015. The array of sensors used, coupled with the long duration of the event, allowed unprecedented detail in observing a caldera collapse. The deciphering of the course of events required the use of aircraft altimeter surveys of the ice surface, seismic and GPS monitoring, the installation of a GPS station on the glacier surface in the centre of the caldera that continuously recorded the subsidence. Full Stokes 3-D modelling of the 700-800 m thick ice in the caldera, constrained by observations, was applied to remove the component of ice deformation that had a minor effect on the measured subsidence. The maximum subsidence of the subglacial caldera floor was about 65 meters. The combined interpretation of geochemical geobarometers, subsidence geometry with GPS and InSAR deformation signals, seismicity and distinct element deformation modelling of the subsidence provided unprecedented detail of the process and mechanism of caldera collapse. The collapse involved the re-activation of pre-existing ring faults, and was initiated a few days after magma started to drain from underneath the caldera towards the eventual eruption site in Holuhraun, 45 km to the northeast. The caldera collapse was slow and gradual, and the flow rate from underneath the caldera correlates well with the lava flow rate in Holuhraun, both in terms of total volume and variations in time.