

The eruption in Holuhraun, NE Iceland 2014-2015: Real-time monitoring and influence of landscape on lava flow

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The largest eruption in Iceland since the Laki 1783-84 event began in Holuhraun, NE Iceland, on 31 August 2014, producing a lava flow field which, by the end of the eruption on February 27th 2015, covered 84,5 km² with volume of 1,44 km³. Throughout the event, various satellite images (NOAA AVHRR, MODIS, SUOMI NPP VIIRS, ASTER, LANDSAT7&8, EO-1 ALI & HYPERION, RADARSAT-2, SENTINEL-1, COSMO SKYMED, TERRASAR X) were analysed to monitor the development of activity, identify active flow fronts and channels, and map the lava extent in close collaboration with the on-site field group. Aerial photographs and radar images from the Icelandic Coast Guard Dash 8 aircraft supported this effort. By the end of 2015, Loftmyndir ehf had produced a detailed 3D model of the lava using aerial photographs from 2013 and 2015.

The importance of carrying out real-time monitoring of a volcanic eruption is: i) to locate sites of elevated temperature that may be registering new areas of activity within the lava or opening of vents or fissures. ii) To establish and verify timing of events at the vents and within the lava. iii) To identify potential volcanic hazard that can be caused by lava movements, eruption-induced flash flooding, tephra fallout or gas pollution. iv) to provide up-to-date regional information to field groups concerning safety as well as to locate sites for sampling lava, tephra and polluted water. v) to produce quantitative information on magma discharge and lava flow advance, map the lava extent, document the flow morphology and plume/tephra dispersal.

During the eruption, these efforts supported mapping of the extent of the lava every 3-4 days on average underpinning the time series of magma discharge calculations.

Digital elevation models from before and after the event, combined with the real-time data series, supports detailed analysis of how landscape affects lava flow in a flat terrain (<0,4°), and provides important input to further developing lava flow models within the EU VETOOLS project, aiming to improve response to future events.

Monitoring the site was carried out throughout 2015, including the cooling of the lava in relation to thickness and inflation history. This also included mapping of hydrology in the Dyngjujökull outwash plane, development of ponds where the lava blocked previous river channels.