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Real-time satellite monitoring of Nornahraun lava flow NE Iceland

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An effusive eruption started in Holuhraun, NE Iceland, on 31 August 2014, producing the Nornahraun lava flow field which had, by the beginning of 2015, covered over 83 km2. Throughout this event, various satellite images have been analyzed to monitor the development, active areas and map the lava extent in close collaboration with the field group, which involved regular exchange of direct observations and satellite based data for ground truthing and suggesting possible sites for lava sampling. From the beginning, satellite images in low geometric but high temporal resolution (NOAA AVHRR, MODIS) were used to monitor main regions of activity and position new vents to within 1km accuracy. As they became available, multispectral images in higher resolution (LANDSAT 8, LANDSAT 7, ASTER, EO-1 ALI) were used to map the lava channels, study lava structures and classify regions of varying activity. Hyper spectral sensors (EO-1 HYPERION), though with limited area coverage, have given a good indication of vent and lava temperature and effusion rates. All available radar imagery (SENTINEL-1, RADARSAT, COSMO SKYMED, TERRASAR X) have been used for studying lava extent, landscape and roughness. The Icelandic Coast Guard has, on a number of occasions, provided high resolution radar and thermal images from reconnaissance flights. These data sources compliment each other well and have improved analysis of events. Whilst classical TIR channels were utilized to map the temperature history of the lava, SWIR and NIR channels caught regions of highest temperature, allowing an estimate of the most active lava channels and even indicating potential changes in channel structure. Combining thermal images and radar images took this prediction a step further, improving interpretation of both image types and studying the difference between open and closed lava channels. Efforts are underway of comparing different methods of estimating magma discharge and improving the process for use in real time as well as for understanding the different phases of the eruption. During the eruption, these efforts have supported mapping of the extent of the lava every 3-4 days on average and thus underpins the time series of magma discharge calculations. Emphasis has been on communicating all information to relevant authorities and the public. Geographic Information Systems (ArcGIS) have been important for comparing, storing and presenting data, but specialized image processing programs (ERDAS IMAGINE, ENVI) are crucial for analyzing image signatures. Collaboration with USGS and NASA proved essential for acquiring relevant data in real time.