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Near-field monitoring of the Eyjafjallajökull eruption cloud

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When the ice capped Eyjafjallajökull volcano erupted in April 2010 the Icelandic Meteorological Office (IMO) employed range of observation systems to monitor the eruption cloud and the progress of the eruption.

The main tool for monitoring the volcanic cloud was a C-band weather radar located at Keflavik international airport, about 150 km from the volcano. Radar monitoring was supported by visual observations, on-site and from a network of web-cameras. Airborne observations allowed for detailed examination of the plume, and pilot reports proved to be an extremely useful aid in verifying the radar data. Furthermore, data from lightning sensors and radiosondes was used to supplement information on plume height. Satellite images, from several frequency bands and both polar as well as geostationary satellites were used to track the orientation of the eruption cloud, and brightness temperature difference was used to estimate far field ash dispersal. Ash fall monitoring and meteorological observations supplemented with atmospheric reanalysis and wind forecasts were used to track local ash dispersal.

Information from these data sources was combined with geophysical and hydrological measurements (seismic, GPS, strain and river flow gauges) made by the IMO, the Earth Institute of the University of Iceland and other institutions.

The data generated by these different observation types gives a consistent picture of the progression of the eruption and reveals interesting connections. For example, volcanic tremors tended to be inversly related to the eruption cloud height, increasing tremors were associated lower plume height and reduced eruption strength. Furthermore, the occurrence of lighting seems to be explained by both sufficiently strong plume and cold ambient air. Wind also had a clear effect on the eruption cloud height. In general, simple scaling laws for the relationship between the emission rate of the volcano, and the height of the eruption do not seem to explain all the height variations in the eruption cloud.