



Long range transport and air quality impacts of SO₂ emissions from Holuhraun (Bárdarbunga, Iceland)

Anja Schmidt (1), Claire Witham (2), Susan Leadbetter (2), Nicholas Theys (3), Matthew Hort (2), Thorvaldur Thordarson (4), John Stevenson (5), Janet Shepherd (6), Richard Sinnott (6), Patrick Kenny (7), and Sara Barsotti (8)

(1) School of Earth and Environment, University of Leeds, Leeds, UK, (2) Met Office, Exeter, UK, (3) Belgian Institute for Space Aeronomy (BIRA-IASB), Brussels, Belgium, (4) Faculty of Earth Sciences, University of Iceland, Reykjavik, Iceland, (5) School of GeoSciences, University of Edinburgh, UK, (6) Scottish Environment Protection Agency, Holytown, UK, (7) Environmental Protection Agency, Dublin, Republic of Ireland, (8) Icelandic Met Office, Reykjavik, Iceland

Gas emissions from the Holuhraun eruption site in Iceland resulted in increases in observed ground level concentrations of sulphur dioxide (SO₂) in the UK and Ireland during two occasions in September 2014. We present data from the Irish and UK monitoring networks along with satellite imagery which describes the temporal and spatial evolution of these pollution episodes. During both events increases in concentration were significant compared to ambient levels. The peaks were short lived, 6-12 hours, and below the World Health Organisation's 10-minute air quality standard for SO₂ of 500 µg/m³, but these events show that gas from relatively low altitude volcanic emissions in Iceland can pose a hazard to north west Europe.

The two pollution events serve as excellent case studies and observations from the events provide us with a unique dataset for the verification of atmospheric dispersion models. We use the atmospheric dispersion model NAME to simulate the long-range transport, removal and chemical conversion of the volcanic SO₂ during September 2014. We evaluate a range of model simulations, using varying model input and physical parameters, against ground based measurements and satellite retrievals of SO₂. Simulations demonstrate that the long-range ground concentrations are strongly dependent on the emission flux and the height of emission at source. This relationship is well known from similar studies of other pollution events. However this work also demonstrates a dependence on the model's vertical turbulence parameterisation and the height of the boundary layer determined from the input Numerical Weather Prediction meteorological data. For the pollution events in September 2014, we find that using a mass flux of 40 kilotons per day of SO₂ gives best agreement with vertical column retrievals of SO₂ from the Ozone Monitoring Instrument, which is in good agreement with initial estimates made by the Icelandic Meteorological Office.

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