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*Supplement of*

## **Impacts of the 2014–2015 Holuhraun eruption on the UK atmosphere**

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### Detection of the volcanic plume

In order to further confirm the origins of the observed plume back trajectories were merged with the measured SO<sub>2</sub> data from the MARGA. The back trajectories and analysis was carried out using OpenAir software package (Carslaw and Ropkins, 2012), which calculates back trajectories with the HYSPLIT trajectory model (Hybrids Single Lagrangian Integrated Trajectory Mode,(Draxler and Hess, 1997)) using the global NOAA-NCEP/NCAR reanalysis data. For Auchencorth Moss the plume peaked on the 21/09/14 and is shown in FigS1 to originate from Iceland. The main trajectory, is over the highlands of Scotland, which does not have any known large sources of SO<sub>2</sub>. At Harwell, the peak of the plume was on the 22/09/14 and again can be clearly seen to originate from Iceland (FigS2).

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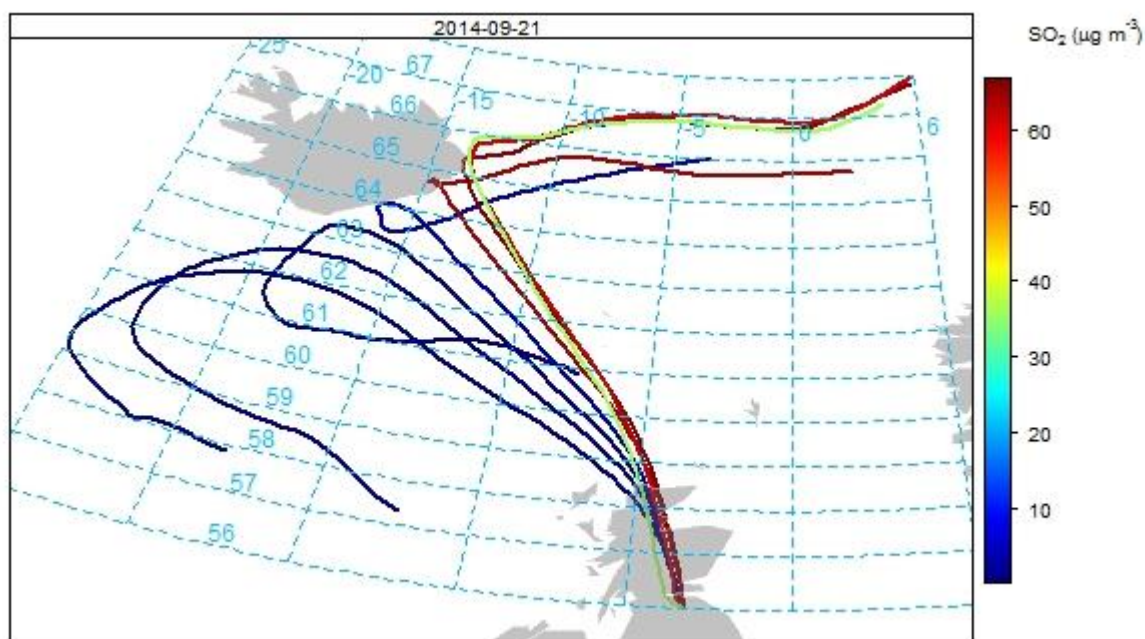
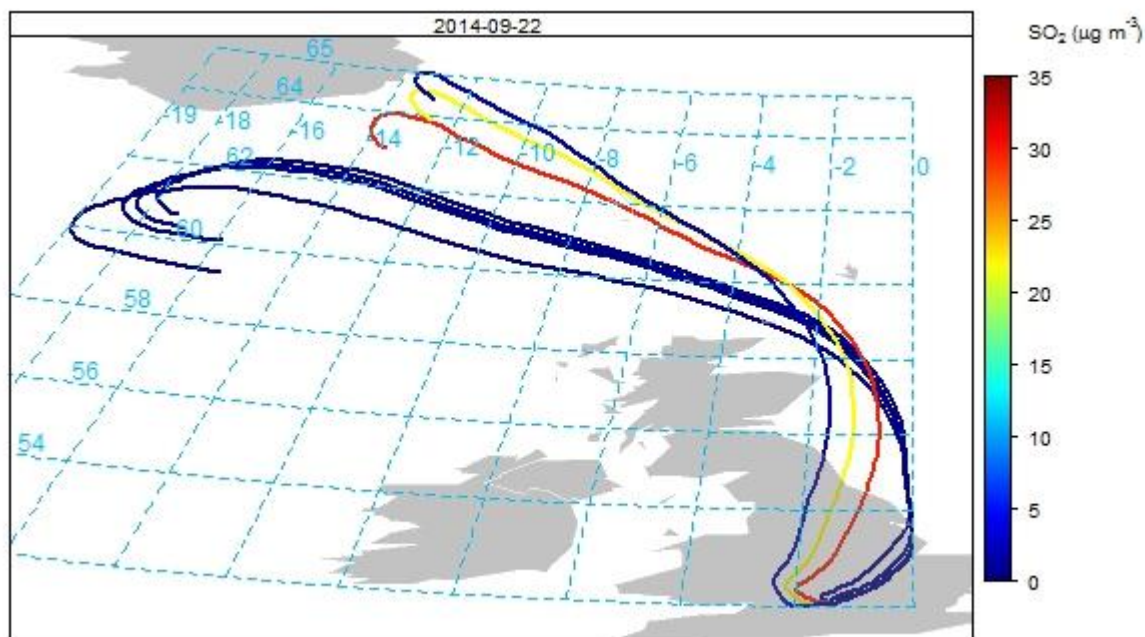


Figure S1 96 hour back trajectories using the HYSPLIT model merged with SO<sub>2</sub> measurements from the MARGA instrument for the 21/09/14 to further demonstrate that peak SO<sub>2</sub> concentrations at Auchencorth Moss originated from the Holuhraun effusive eruption. (Figure produced using Open air; Carslaw and Ropkins, 2012)

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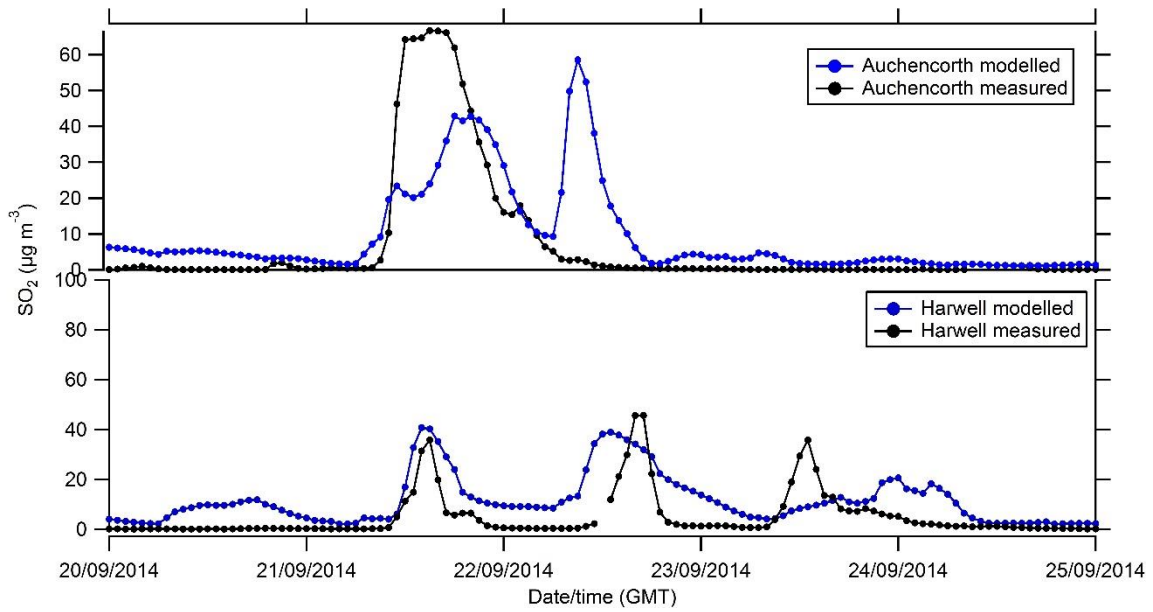
**Figure S2 96 hour back trajectories using the HYSPLIT model merged with SO<sub>2</sub> measurements from the MARGA instrument for the 22/09/14 to further demonstrate that peak SO<sub>2</sub> concentrations at Harwell originated from the Holuhraun effusive eruption (Figure produced using Open air; Carslaw and Ropkins, 2012).**

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The EMEP4UK model was also used to confirm the distribution of the plume, as presented in Figure 4 in the main text. To provide further evidence of the agreement of the spatial distribution of the plume by the model, data for the sites Auchencorth Moss and Harwell data were plotted in a time series against the observed concentrations. It is clear to see that the model is able to show that Auchencorth Moss the observed plume on the 21/09/14, however the site did not observe the plume predicated on the 22/09/14 or match the magnitude of the plume at the surface. At Harwell, the observed 3 pulses on consecutive days (21/09/14- 23/09/14) from the volcanic plume were identified in the temporal pattern. There are a number of explanations why the magnitude and even the spatial of the distribution of the plume was not comparable to surface concentration measurements, these include that the emission rate from source and the injection height were variable, the model has a resolution of 50 x 50 Km<sup>2</sup> and so variations at surface are not well replicated at this spatial resolution.

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**Figures S3 Times series of modelled plume by EMEP4UK and that observed by the MARGA instrument.**

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**References**

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