



## New measurements every day – Bardarbunga sulphur dioxide cloud

12 September 2014

The Bardarbunga volcano on Iceland began erupting on 31 August 2014 – an effusive eruption with no ejection of volcanic ash. However, measurements made by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) have since indicated that there is ongoing emission of sulphur dioxide (SO<sub>2</sub>). High sulphur dioxide concentrations in the atmosphere are a clear indication of volcanic activity, as there are no other natural emission sources, only anthropogenic ones.

Each day, DLR is publishing the **current distribution of sulphur dioxide here**.

The DLR Earth Observation Center (EOC) is measuring the emitted trace gases and their distribution in the atmosphere in near real time. The Earth observation satellites MetOp-A and MetOp-B are providing the experts with daily measurements of the distribution and density of the sulphur dioxide cloud. The analyses show that there were initially clouds over Greenland, central Russia and Ireland – and that the sulphur dioxide is currently spreading across northern Norway.

In volcanic eruptions, trace gas emissions are closely associated with ash emissions. The effects of volcanic ash on air traffic and the local population are well known – most recently following the eruption of the glacier volcano Eyjafjallajökull in April 2010. Sulphur dioxide can cause respiratory diseases both among the local population and among air passengers. Furthermore, in the form of acid rain it causes increased oxidation of aircraft components. Currently, the high concentrations of sulphur dioxide from Bardarbunga are affecting the air quality in parts of Iceland.

The activity of the volcano is currently continuing unabated. An explosive eruption of Bardarbunga is also possible, during which large quantities of ash could be produced, with potentially far-reaching consequences for European air traffic.

The values determined by the DLR EOC shows the sulphur dioxide content in the entire atmospheric column – corresponding to the satellite's nadir view from space through the atmosphere down to the surface of Earth. The two satellites MetOp-A and MetOp-B are equipped with ultraviolet spectrometers for this task. The GOME-2 measurement instrument sweeps the surface of the Earth at a resolution of 40 by 40 kilometres (MetOp-B) or a resolution of 80 by 40 kilometres (MetOp-A). The measurement does not provide any information on the height of the trace gas cloud.

Under the guidance of the DLR Remote Sensing Technology Institute (Institut für Methodik der Fernerkundung; IMF), the DLR EOC is providing operational trace gas measurements in near-real time – within two hours of the measurement – as part of the EUMETSAT Satellite Application Facility on Ozone and Atmospheric Chemistry Monitoring (O3M-SAF). The processed sulphur dioxide data is used by bodies such as the Volcanic Ash Advisory Centres (VAACs), which provide volcanic ash advisories to air traffic.

### Additional research

DLR is combining its research work on the effects of volcanic ash on air traffic in the VOLcanic Ash impact on the air Transport System VolcATS project. This project includes a satellite-supported process that quickly determines and predicts the distribution of ash in the air and contributes to flexible air traffic management so that ash-free and hence safe regions for commercial aviation can be approved. In addition, the still inadequately understood effects of

volcanic ash on aircraft engines are being investigated, and an ash warning system for commercial airliners is being designed. Participants include the DLR Institutes of Atmospheric Physics, Flight Guidance, Materials Research, Propulsion Technology, Flight Systems and Air Transportation Systems, together with DLR Flight Experiments.

During the Eyjafjallajökull eruption in 2010, the airspace over Germany was able to be re-opened on the basis of measurement flights performed by the DLR Falcon. The Falcon is the only research aircraft in Europe that is legally able to fly at high altitudes and over long distances in volcanic ash clouds.

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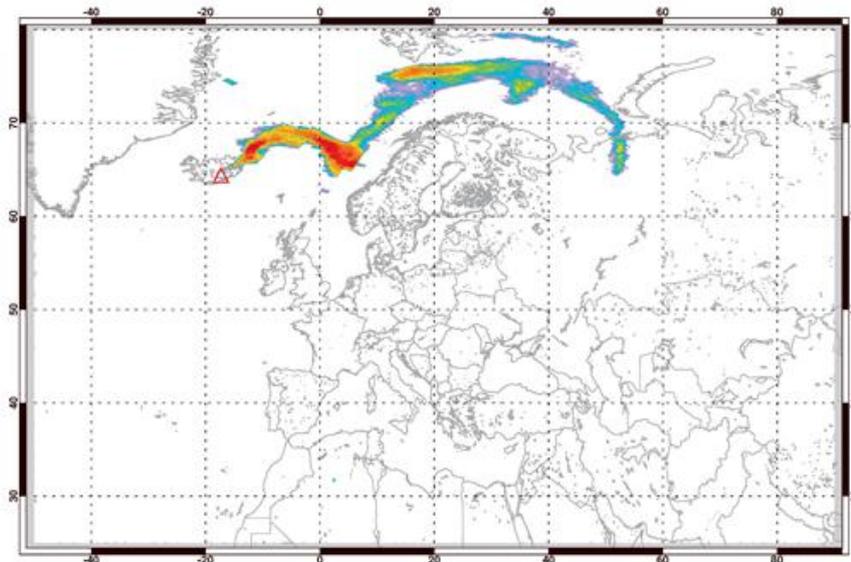
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## Sulphur dioxide cloud from the Bardarbunga volcano



The image shows the distribution of the sulphur dioxide cloud from the Bardarbunga volcano. The volume of sulphur dioxide in the atmosphere is colour-coded; the highest concentration (dark red) is shown over Iceland and the North Atlantic, off the coast of Norway. The image data was acquired on 9 September 2014 by the GOME-2 ultraviolet spectrometers on board the Earth observation satellites MetOp-A and MetOp-B.

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