Geophysical Research Abstracts
Vol. 19, EGU2017-16719, 2017
EGU General Assembly 2017

IASI estimate of sulfur dioxide (SO_2) emissions from the 2014-2015 Bárðarbunga eruption (Iceland).

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Sulphur dioxide (SO_2) is an important atmospheric constituent that plays a crucial role in many atmospheric processes. The Bárðarbunga eruption, from August 2014 to February 2015, was the largest eruption in Iceland in more than 200 years and its emissions exceeded daily SO_2 emissions from all anthropogenic sources in Europe by a factor of three on average.
The high emission latitude and time of year (boreal winter) means the solar irradiation of the volcanic plume is low (or null) making it hard to observe with short-wave instruments. Here we use thermal infrared measurements from the IASI instrument onboard the METOP satellite.
We simultaneously retrieve both the SO_2 amount and altitude of the plume by exploiting all the IASI spectral range from 1000 to 1200 cm^{-1} and from 1300 to 1410 cm^{-1} (the 7.3 and 8.7 μm SO_2 absorption bands). The SO_2 band around 8.7 μm (1000 to 1200 cm^{-1}) is within an atmospheric window range, where the radiation from the surface transmitted through the atmosphere can reach the satellite sensor. This allows us to retrieve SO_2 amount down to the surface and lower troposphere.A comprehensive error budget for every pixel is included in the retrieval.
During the Bárðarbunga eruption the altidute, location and time of the plume are different from early studies (Carboni et al 2016). To check the validity of our retrieval we compare the IASI dataset against Brewer ground measurements locate at Sodankyla¨ (Findland) this shows that all the SO_2 episodes, are consistent between satellite and ground measurements.
For the 6 months period from September 2014 to February 2015, we show that the volcanic SO_2 was transported in the lower troposphere over much of the north hemisphere (30 to 90 deg North).
Time series of the total mass and emission flux of SO_2 are presented throughout the period. Integrating the fluxes we obtain a ‘minimum’ total mass of emitted SO_2 in the north hemisphere of 3.7+-0.8 Tg and average SO_2 lifetime of 2.4 +- 0.6 days.