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The vertical distribution of volcanic SO_2 plumes measured by IASI

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Sulphur dioxide (SO_2) is an important atmospheric constituent that plays a crucial role in many atmospheric processes. For example the current hiatus in global warming has been suggested to be caused by low level (< 15 km) volcanic activity (Ridley et al., 2014). Volcanic eruptions are a significant source of atmospheric SO_2 and its effects and lifetime depend on the SO_2 injection altitude. In the troposphere SO_2 injection leads to the acidification of rainfall while in the stratosphere it oxidises to form a stratospheric H_2SO_4 haze that can affect climate for several years. The Infrared Atmospheric Sounding Instrument (IASI) on the Metop satellite can be used to study volcanic emission of SO_2 using high-spectral resolution measurements from 1000 to 1200 cm^{-1} and from 1300 to 1410 cm^{-1} (the 7.3 and 8.7 μm SO_2 bands). The scheme described in Carboni et al. (2012) has been applied to measure volcanic SO_2 amount and altitude for 14 explosive eruptions from 2008 to 2012. The work includes a comparison with independent measurements: (i) the SO_2 column amounts from the 2010 Eyjafjallajökull plumes have been compared with Brewer ground measurements over Europe; (ii) the SO_2 plumes heights have been compared with CALIPSO backscatter profile. The results of the comparisons show that IASI SO_2 measurements are not affected by underling cloud and are consistent (within the retrieved errors) with the other measurements considered. The series of analysed eruptions (2008 to 2012) show that the biggest contributor of volcanic SO_2 was Nabro, followed by Kasatochi and Grímsvötn. Our observations also show a tendency of the volcanic SO_2 to be injected to the level of tropopause during many explosive eruptions. For the eruptions observed, this tendency was independent of the maximum amount of SO_2 erupted (e.g., 0.2 Tg for Dalafilla compared with 1.6 Tg for Nabro) and of the volcanic explosive index (between 3 and 5).