Geophysical Research Abstracts
Vol. 15, EGU2013-3504, 2013
EGU General Assembly 2013

Detection of volcanic sulfate aerosol with Envisat MIPAS shown for the Kasatochi, Sarychev, and Nabro eruptions

Sabine Griessbach (1), Lars Hoffmann (1), Reinhold Spang (2), Marc von Hobe (2), Rolf Müller (2), and Martin Riese (2)

(1) Forschungszentrum Jülich, JSC, Jülich, Germany (s.griessbach@fz-juelich.de), (2) Forschungszentrum Jülich, IEK-7, Jülich, Germany

Stratospheric sulfate aerosol is known to have a strong impact on climate. Transport pathways of sulfur dioxide and sulfate aerosol to the stratosphere are still discussed. It is known that volcanic eruptions can inject significant amounts of sulfur directly into the stratosphere. Most sulfur, however, is injected into the troposphere and only a fraction of it can make its way into the stratosphere. Global and altitude resolved time series of observations are a valuable source of information for sulfur dioxide and sulfate aerosol detection. Here we present a new aerosol detection method for the infrared limb sounder Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) and the results for the Kasatochi, Sarychev, and Nabro eruptions.

The new detection method utilizes three infrared window regions that are located around 830, 960, and 1224 cm^{-1}. The combination of these three windows allows for a better detection of enhanced aerosol events in the troposphere as well as the discrimination from ice clouds. With this new method the 10 year record of MIPAS measurements was analyzed. The most remarkable sulfate aerosol events follow the Kasatochi, Sarychev, and Nabro eruptions. After these eruptions enhanced aerosol is detected in the upper troposphere and lower stratosphere (UTLS) region. Within one to two months it spreads over most of the northern hemisphere. In the tropics the aerosol reaches altitudes up to around 20 km and in the Arctic up to 15 km. The enhanced aerosol signal can be observed for about 5, 7, and up to 10 month for the Kasatochi, Sarychev, and Nabro eruptions, respectively. During this period the enhanced aerosol detections decrease in number, strength, and observation altitude.

After the Nabro eruption on 13 June 2011 volcanic aerosol is detected in the UTLS region two days after the initial eruption. The following days the aerosol moves around the northern edge of the Asian monsoon region, is then transported southwards and later westwards around the Asian monsoon region. This observation contradicts a recent publication (Bourassa, 2012) that states that no direct injection occurred and that the aerosol was transported to the UTLS by convective uplift in the Asian monsoon only. Later in July MIPAS aerosol observations in combination with ensemble trajectory studies indicate that additional volcanic sulfate aerosol is transported into the UTLS via the Asian monsoon region.

Bourassa, A. E., et al.: Large Volcanic Aerosol Load in the Stratosphere Linked to Asian Monsoon Transport, Science, 337, 78-81, 2012.