Geophysical Research Abstracts
Vol. 12, EGU2010-4733, 2010
EGU General Assembly 2010

Retrieval of volcanic products emissions: from detection to quantification.

Mathieu Gouhier, Yannick Guehenneux, and Philippe Labazuy

Clermont Université, Université Blaise Pascal, Laboratoire Magmas et Volcans, BP 10448, F-63000 Clermont-Ferrand 2CNRS, UMR 6524, LMV, F-63038 Clermont-Ferrand 3IRD, R 163, LMV, F-63038 Clermont-Ferrand

Every year, volcanoes emit billions of tons of ash and gas in the Earth's atmosphere, and this activity has a real impact on our environment, although it is difficult to assess. These issues are especially important today in a context of climate change. Therefore, the thorough study of volcanic emissions is very important, and remote sensing methods are especially valuable for the understanding of such processes occurring on a large spatial scale. The study presented here deals with detection and estimation of ash and SO2 inside volcanic plumes rising in the atmosphere using MODIS (Aqua/Terra) and SEVIRI (Meteosat) sensors. Both sensors are capable of monitoring ash and gas emissions using detection methods based on thermal infrared bands. Aqua-MODIS, which is part of the Afternoon-Train, permits a global spatial coverage of the Earth, although the low time resolution often impedes early detection of eruptive activity. On the contrary, Meteosat is a geostationary satellite, which permits to bring stringent constraints on the dynamics of short-term volcanic eruptions, thanks to its high temporal resolution (1 image every 15 minutes). As a consequence, SEVIRI sensor on board Meteosat can also be used for operational issues. We emphasize from several examples that Meteosat permits simultaneous retrieval of SO2 and ash at a high time-resolution. SO2/Ash ratios are very important and bring constraints on the deep plumbing system. In this work, we attempted to show that the detection step is essential for obtaining reliable quantitative estimations, and even more critical regarding operational purposes, such as for real-time detection and warnings of hazardous volcanic activities. Indeed, the commonly used 2-bands (11-12μm) Brightness Temperature Difference (BTD) model turns out to be insufficient in some cases. The analysis of the November 25, 2005 eruption at Karthala volcano, among others, reveals a range of artefacts concerning the discrimination of ash that may lead to an overestimation of ash loading. For instance, we observed large thermal relaxation effects on the seacoast. In addition, the presence of mixed ash/ice, ash/H2SO4 coated particles, as well as acid water droplets make the discrimination of pure ash particles even more difficult. The detailed analysis of the extinction coefficients of these different particles shows a significant dependence of the transmittance with diameter, making the interpretation of the 2-bands BTD model complicated. We show particularly that some of these artefacts can be filtered by using a 3-bands model based on the 8.7, 10.8 and 12μm wavelengths.