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SO2 volcanic clouds detected from space: a new database

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Explosive volcanic eruptions can generate ash and SO_2 clouds rising to the stratosphere and dispersing on a global scale. Such volcanic features are at the origin of many hazards including aircraft engine damages, ash fallouts, acid rains, short-term climate changes and health threats. It is thus crucial to monitor volcanic clouds altitude and dispersion over time in order to prevent these hazards. In the past decades, satellite monitoring techniques have proven to be efficient at detecting volcanic aerosols in the atmosphere. In particular the detection of SO_2 (e.g. IASI, AIRS, GOME-2) spatial and temporal dispersion and altitude (e.g. CALIOP). However, satellite data are scattered amongst the different institutes and agencies acquiring and processing them, and their retrieval is time-consuming.

In this study, we are building a whole new database gathering SO_2 volcanic cloud altitude and dispersion data of 12 VEI 4 volcanic eruptions from 2008 to 2019. The spatial and temporal dispersion is retrieved from AIRS, IASI and GOME-2 sensors, as well as from collocated backscatter data of CALIOP sensor. Cloud altitude estimations are retrieved based on IASI, CALIOP and Global Navigation Satellite System (GNSS) radio occultation (RO) data when available. Besides, GNSS RO atmospheric profiles collocated with the other sensors at 12h temporal window and 0.2° spatial window, will be included. For the first time a dataset gathering several of the primary sensors used to monitor volcanic clouds and new ones will be freely available. Such new tool provides direct access to volcanic clouds data, and enables to perform original analysis and comparisons between different techniques. Applications for this dataset will impact many fields of volcanology and atmospheric physics, including but not restricted to volcanic clouds dispersal numerical modelling and volcanic aerosol impact on the atmosphere and climate. In fact, the collocation with GNSS RO will allow the study of the atmospheric structure with high vertical resolution.