UNIVERSITÄT HEIDELBERG
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Master thesis (M.Sc. Physics)

Quantitative comparison of volcanic SO_2 emissions retrieved from ground and satellite

Background:

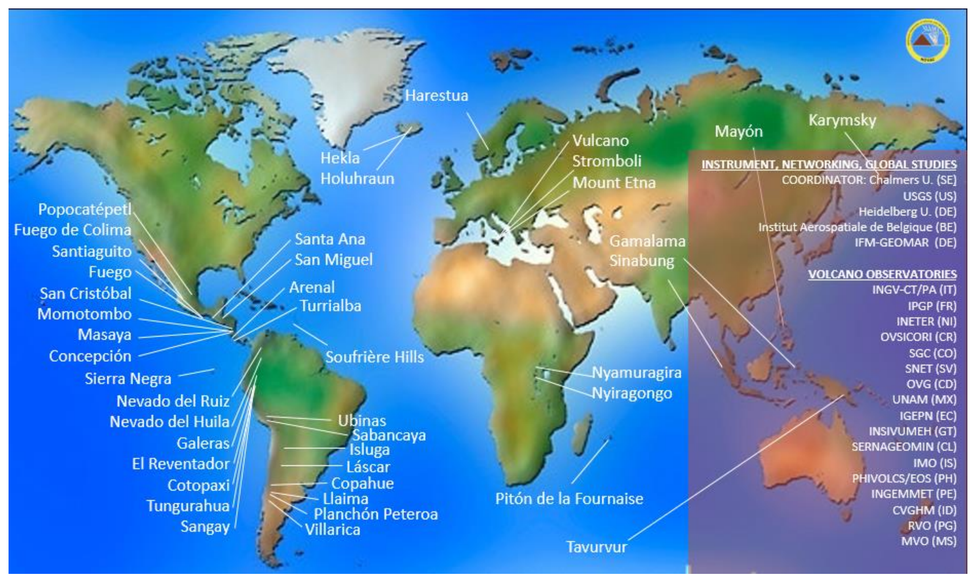
Monitoring volcanic SO_2 emissions is an important tool in volcanic hazard assessment. The SO_2 emissions can be retrieved via Differential Optical Absorption Spectroscopy (DOAS; Platt & Stutz, 2008) from spectra of back-scattered solar radiation recorded by UV-spectrometers. Nowadays many volcanoes are monitored by fixed ground-based UV-spectrometers, e.g. the Network for Observation of Volcanic and Atmospheric Change (NOVAC) encompasses more than 100 spectrometers installed at 42 volcanoes since 2005. Those instruments scan from horizon to horizon and allow to retrieve the SO_2 column densities in the volcanic gas plume with a temporal resolution of 10-15min. Satellite-based spectrometers pose another well-established tool for monitoring volcanic SO_2 emissions. Those instruments typically record once a day a global distribution of the vertical SO_2 column densities, i.e. the vertically integrated atmospheric SO_2 concentration averaged over the particular satellite ground pixel. In the past, satellite-based instruments were only sensitive to volcanic eruptions or strongly emitting volcanoes like Mt. Etna. Since November 2017 also much lower SO_2 emissions are detectable because the ground pixel of the new TROPOMI instrument has a spatial resolution of only up to 7km x 3.5km. While having a lower temporal and spatial resolution compared to ground-based instruments, the important advantage of satellite data is their global coverage, i.e. satellites observe the large number of volcanoes which are not monitored by ground-based networks.

Overall goal:

Establish a quantitative link between volcanic SO_2 emissions retrieved from ground-based and satellite-based measurements, respectively.

Work plan:

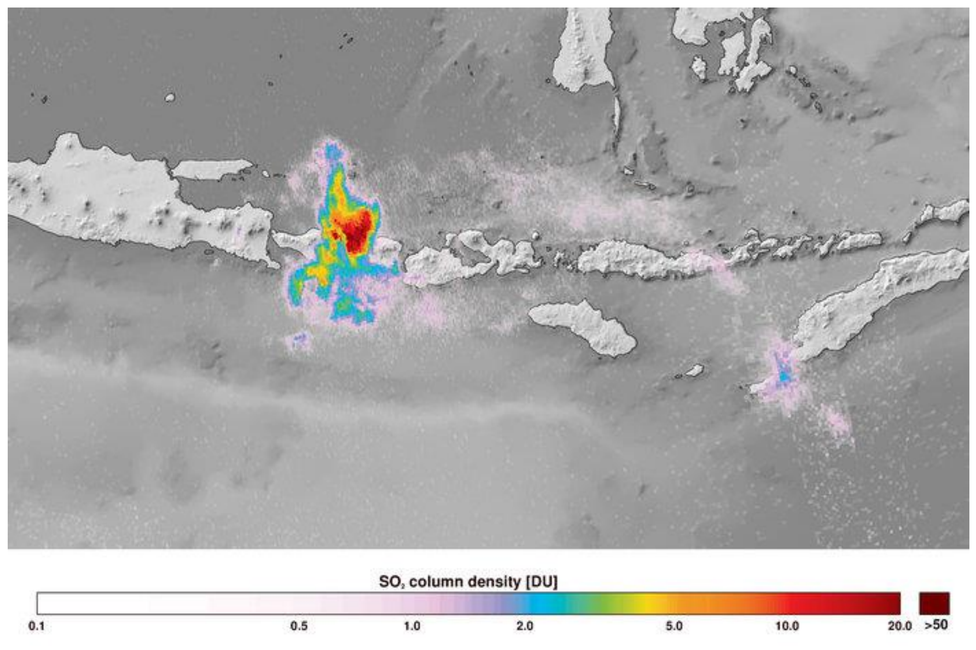
- Familiarise yourself with DOAS and atmospheric radiation
- Compare SO_2 time series retrieved from NOVAC and TROPOMI for several volcanoes, therefore identify which SO_2 proxies are most suitable for comparison.
- Propose a quantitative link between NOVAC and TROPOMI.



Volcanoes and institutions of the NOVAC network

Requirements:

- Interest in optics and spectroscopy
- Approach to programming and statistics
- The thesis will be carried out in collaboration with the Satellite remote sensing group at MPI for Chemistry in Mainz
- Start date: anytime



TROPOMI: SO_2 signal from Mt. Aung (Source: ESA)

Time stamp: 21.03.2018

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