EGU24-19527, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-19527
EGU General Assembly 2024

Development of a drone-based measurement system for real-time monitoring of volcanic gas composition

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Studying volcanic gas emissions is an important method to obtain information about volcanic systems and providing insight into magmatic processes. MultiGAS instruments allow to measure SO_2 and CO_2, alongside meteorological data which are important parameters in volcanic monitoring. In the past decade, these MultiGAS instruments have been adapted to be carried on drones, which enables the researchers to measure the gas composition from a safe distance as the drone operator can operate from farther away, probably even from a parking lot, therefore eliminating the need to reach the sampling site by foot. Additional, drone based measurements improve the possibility to undertake source specific measurements with a negligible influence of soil - as well as fumarole degassing.

Frequent calibrations, preferably with the same environmental parameters (T, RH, p) that prevail during the measurement, are important to measure correct concentrations. However, as calibration equipment can be quite heavy and takes a long time to set up, it is not practical to carry calibration equipment to a regular used measurement site.

We therefore propose to build a stationary measurement station with the aim of quickly taking correct measurements with minimal preparation and operating effort. The station will contain the aforementioned calibration equipment, a solar power supply for charging, a base station for all radio communications with the drone and sensors, and a data server with internet access to view the measurement data remotely. In addition to a typical MultiGAS instrument, a drone-based DOAS system will further expand the station's capabilities. The two instruments will be easily exchangeable by attaching the sensors with rails to the main body of the drone.