INSTITUT FÜR UMWELTPHYSIK

UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

Master's Thesis

Quantifying volcanic water emissions in the atmosphere

Water is the most abundant volatile species in magmatic melts and, consequently, a key driver of volcanic activity. Remote sensing of water in volcanic plumes could provide critical insights into subsurface volcanic processes and create new opportunities for volcanic monitoring. However, the highly variable atmospheric background of water, as well as its occurence in several phase states has, thus far, hindered the use of atmospheric water measurements as a diagnostic tool in volcanology.

This master's thesis aims to facilitate remote sensing measurements of volcanic water emissions in the atmosphere by designing and implementing a spectroscopic instrument that optimizes atmospheric water vapor detection. In particular, the instrument will combine high spectral resolution with high optical throughput to provide rapid and precise measurements using scattered sunlight as light source. The instrument will enable new approaches for quantifying volcanic water emissions, thereby supporting the development of petrological and geochemical models and activity forecasting efforts.

As a member of the dynamic and collaborative research group **Atmosphere and Remote sensing** at the **Institute of Environmental Physics** and in collaboration with researchers from the US Geological Survey (USGS), you will contribute to the development of a novel spectroscopic instrument for the precise and accurate quantification of water vapor column densities in the atmosphere. Depending on your skills, interests, and start date, the thesis may include: (1) prototype design, assembly, and characterization; (2) development of a numerical instrument model for data evaluation; (3) design and execution of laboratory and field experiments in Heidelberg.

A strong motivation to engage in pioneering, interdisciplinary, and methodologically diverse research, together with a full-time commitment to the project is essential. Prior coursework or practical experience in optical spectroscopy, environmental and atmospheric physics, volcanology, remote sensing, and radiative transfer are preferred.

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