UP 12: Methods - Remote Sensing

Time: Thursday 11:15–13:45 Location: H41

UP 12.1 Thu 11:15 H41

Accurate prototype remote sensing of correlated CO_2 and SO_2 emissions at Mt.Etna — •Anna Solvejg Dinger[1], André Butz[2], Nicole Bobrowski[1,3], and HeiKa Team[1,2] — [1]IUP, University of Heidelberg, Germany — [2]IMK-ASF, Karlsruhe Institute of Technology, Germany — [3]University of Mainz, Germany

Volcanic carbon dioxide (CO_2) and sulfur dioxide (SO_2) emissions have a direct as well as an indirect impact on climate and air quality. Moreover the ratio of these two gases is a tracer for dynamic processes inside volcanoes and hence volcanic activity. Remote sensing of volcanic emissions allows for monitoring a volcano's activity from a safe distance to the volcano. Further it enables sampling of cross sections of the entire plume, which suffer less from representativeness errors than common in-situ techniques. Remote sensing of SO_2 is well developed, whereas the measurement of volcanic CO_2 requires high accuracy in order to measure little concentration enhancements above the atmospheric background. We employed combined direct sunlight spectroscopy for SO_2 (UV-DOAS) and CO_2 (FTIR) during a three-week campaign at Mt.Etna, Sicily. The whole setup was installed on a mobile platform, which allowed for sampling plume cross sections in a stop-and-go pattern. We measured significant CO_2 column density enhancements, even though the enhancement was only slightly above the detection limit. Our measured volcanic CO_2 and SO_2 column densities show a strong correlation and their emission ratios are in the range of 5-15.

UP 12.2 Thu 11:30 H41

Detection of noctilucent clouds in SCIAMACHY/Envisat nadir UV-measurements — •Langowski Martin and Christian von Savigny — Ernst-Moritz-Arndt-Universität Greifswald, Greifswald, Deutschland

The polar summer mesopause is the coldest region in the Earth's atmosphere and yields favorable conditions for cloud formation during three summer months and >50 deg. latitude. These clouds are called noctilucent clouds (NLC), as through their high altitude of about 83 km they are still illuminated several hours after/before sunset/sunrise. As NLCs were first observed in 1885, it is discussed if they are an indicator for climate change. Some long term studies show a long term trend, while others do not. An issue in this analysis is that long term studies rely on satellites with drifting local time. Currently a new algorithm for the GOME, SCIAMACHY and GOME-2 instruments is being developed to extend the NLC data from nadir measurements. This algorithm is an adaption of the algorithm used in other long term studies to the specifications of the three instruments. The algorithm searches for strong positive deviations in the albedo of different nadir measurements, which are caused by a higher reflection of solar radiation by the NLCs. The instruments are very similar and have a similar local time (9:30, 10:00 and 10:30) at the descending node during their whole measurement period. We aim to retrieve NLC albedo, occurrence rate and ice water content for all three instruments which until now combine 20 years of nadir data. This data set will then by analyzed for long term trends.

UP 12.3 Thu 11:45 H41

Designing a muon detector for volcanoes — •Lukas Fieber[1], Nicole Bobrowski[1,2], Markward Britsch[3,4], Ulrich Platt[1], and Michael Schmelling[4] — [1]IUP, Heidelberg, Germany — [2]University of Mainz, Mainz, Germany — [3]Physikalisches Institut, Heidelberg, Germany — [4]Max Planck Institut für Kernphysik, Heidelberg, Germany

High energy muons can penetrate about one kilometer of rock. Measurements of the absorption of cosmic ray muons can be used to determine the density profile of the material traversed by these particles. Applying this method to a volcanic edifice can open a window to its inner structure and even the magma level. This method improves the resolution by one order of magnitude compared to traditional measurement methods like seismologic and electromagnetic ones.

Such investigations have been carried out by several research groups using scintillator detectors with an exposure time of the order of a month. The results obtained are very promising and could indicate that muon detection techniques will play a key role in volcano structure analysis and understanding volcano eruption dynamics.

Our aim is to build a muon detector, using a detector material such that the exposure time can be reduced by enlarging the detection area without unduly increasing the costs. The detector should be functional in the given environment of volcanoes, meaning low power consumption, relatively small and easy to transport. To achieve this goal, we look into alternatives to the standard detection devices. Theoretical considerations and practical tests will be presented.

UP 12.4 Thu 12:00 H41

Quantitative Imaging of Volcanic Plumes, Recent Developments and Future Trends — •Ulrich Platt, Peter Lübcke, Jonas Kuhn, and Nicole Bobrowski — Universität Heidelberg, Deutschland

There are a number of indicators for volcanic activity including seismic events, deformation, and gaseous emissions. While the former two indicators have been routinely monitored at many active volcanoes, long term monitoring of gas fluxes and gas emission is only now becoming a standard approach and thus help to better forecast volcanic events. Recently developed remote sensing techniques allow two-dimensional "imaging" of trace gas distributions in volcanic plumes in real time. In contrast to older, one-dimensional remote sensing techniques, which are only capable of measuring total column densities, the new imaging methods give insight into details of transport- and mixing processes as well as chemical transformation within plumes. We give an overview of gas imaging techniques already being applied at volcanoes (SO2 cameras, imaging DOAS, Fabry-Pérot imaging), present techniques where first field experiments were conducted (LED-LIDAR, tomographic mapping), and describe some techniques where only theoretical studies with application to volcanology exist (e.g. Gas Correlation Spectroscopy, bi-static LIDAR). Finally, we discuss current needs and future trends in gas imaging technology.

Mittagspause (90 min)