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# Near-infrared extension of a visible spectrum airborne Sun photometer

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The continuously-measuring, multispectral airborne Sun and aureole photometers FUBISS-ASA and FUBISS-ASA2 were developed at the Institute for Space Sciences of the Freie Universität Berlin in 2002 and 2006 respectively, for the retrieval of aerosol optical and microphysical parameters at wavelengths ranging from 400 to 900 nm. A multispectral near-infrared direct Sun radiometer measuring in a spectral range of 1000 to 1700 nm has now been added to the system. The main objective of this NIR extension is to enhance the characterization of larger aerosol particles, as Mie scattering theory offers a more accurate approximation for their interaction with electromagnetic radiation, if both the VIS and NIR parts of the spectrum are considered, than it does for the VIS part only. Atmospheric gas absorption minima were selected and used as measurement channels for the derivation of aerosol optical parameters. Measurements were first carried out aboard the research vessel FS Polarstern on its transatlantic voyage ANT-XXVI/1, during which a dust cloud originating from the Saharan desert was recorded. Additional measurements were performed from the FU Berlin's measurement tower during an eruption of Eyjafjallajökull, which caused a volcanic ash plume to sweep over large swaths of Europe, as well as at the Sphinx High Altitude Research Station on the Jungfraujoch and in the Kleine Scheidegg locality at the foot of the Jungfrau mountain during the CLACE2010 measurement campaign. While at the research station, the system was calibrated using the Langley technique. Radiosonde, satellite and modeled trace gas data products were assimilated into an atmospheric model, whose spectral transmissivity was subsequently computed using the HITRAN2008 database. The result was used to subtract the remaining spectral trace gas absorption signal in the measurement channels and thus obtain more accurate aerosol optical parameters. The spectral slopes of the aerosol optical thicknesses derived from VIS and NIR measurements were compared to those of simulated aerosol mixtures in order to estimate the composition of the measured aerosol. In the future, the NIR direct Sun radiometer will enable the derivation of trace gas concentrations in the NIR absorption bands.