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A novel UV/vis/near IR optical spectrometer for limb and nadir measurements of atmospheric radiation and trace gases

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A new UV/vis/near-IR optical spectrometer (briefly called HALO mini-DOAS) has been assembled for deployments on the novel research aircraft HALO (High Altitude LOng range) at DLR (German Aerospace Center). The spectrometer will support simultaneous limb and nadir measurements of some important trace gases (O3, NO2, HONO, BrO, OClO, CH2O, C2H2O2, IO, OIO, O4, and all 3 phases of water) as well as the spectral radiances in 6 optical channels covering the wavelength bands at 320 - 410 nm (FWHM = 0.7 nm), 410 - 650 nm (FWHM = 1.2 nm) and 1100 - 1680 nm (FWHM = 6.8 nm). Interpretation of the measured data will need to address (a) the spectral retrieval of the targeted gases using the well known DOAS (Differential Optical Absorption Spectroscopy) techniques, (b) forward modeling of the relevant radiative transfer and (c) mathematical inversion of the inferred slant column densities by optimal estimation. In return, deployment of the instrument will provide measurements of the vertical profiles of the targeted gases from the ground to the aircraft flight altitude, with a height resolution ranging from several kilometers to several hundred meters, respectively, and of the spectral radiance of the atmosphere in dedicated directions as well as optical information on aerosol load and clouds.
Scientific objectives to be addressed with this instrument will include e.g., the photochemistry of the troposphere and lowermost stratosphere, assessment of the sources and budget of some relevant radicals and their precursor gases, the abundance and spectral signature of aerosols and the formation and development of mixed phases clouds, and characteristics of the transport and budget of solar radiation in the Earth's atmosphere.
The present poster will report on the design and major features of the HALO mini-DOAS instrument.