Use of polarization measurements for aerosol characterization in the UoL CO_2 retrieval scheme

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The University of Leicester full physics (UoL-FP) scheme for the retrieval of the CO_2 dry-air mole fraction (XCO_2) involves fitting of high spectral resolution radiance measurements in three spectral bands. Two bands (one centered around 1.61 µm and one centered around 2.06 µm) are used to characterize absorption from CO_2, whereas the oxygen A absorption band centered around 0.76 µm provides information on scattering from aerosols and clouds, which is needed for a correct estimation of the CO_2 absorption optical depth [1,2].

While O_2-A band measurements provide valuable information on the aerosol vertical distribution, a limitation in their use to characterize aerosol scattering is that the optical properties of aerosols in this band may differ significantly from those in the bands that are actually used for the CO_2 retrieval. The UoL-FP XCO_2 retrieval scheme currently tries to circumvent this limitation by using information from Copernicus Atmospheric Monitoring Service (CAMS) forecasts in order to establish an aerosol prior for the CO_2 retrieval. However, the use of model data as priors does not come without limitations of its own, as several assumptions are needed in order to map such data into the aerosol optical properties that are relevant for the retrieval. An opportunity to overcome such limitations will be provided by the simultaneous availability of highly accurate multi-angle polarimetric (MAP) measurements and high spectral resolution SWIR measurements, as foreseen for the future ESA CO_2 Monitoring mission CO2M. MAP measurements have the potential of providing high quality information about the microphysical properties of atmospheric aerosols [3], thereby allowing for a more accurate aerosol characterization in CO_2 retrieval schemes.

In this poster we will discuss a number of options for combining MAP measurements and model reanalysis data in the UoL-FP CO_2 retrieval scheme.

References

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