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Optimisation of GRASP for the Multi-Angle Polarimeter (MAP) in the context of atmospheric correction for CO2 retrievals

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The Copernicus carbon dioxide monitoring (CO2M) mission is the space component of the European integrated monitoring and verification support capacity dedicated to monitoring anthropogenic CO2 emissions. Due to the high accuracy requirements of this measurement, it is critical to measure and characterise aerosol in support of the CO2 retrieval. The Multi-Angle Polarimeter (CO2M-MAP) is therefore included as a payload on the CO2M mission and the measured aerosol properties are used to correct for aerosol scattering and transmission in the downstream greenhouse gas (GHG) retrieval.
The instrument itself is a multi-angle (45 views) multi spectral (6 polarised bands, 400-900nm) polarimeter, similar in terms of information content to the heritage instruments POLDER, or the forthcoming 3MI.
The MAP products are input to three independent downstream GHG retrieval algorithms:

- Fusional-P [1], which uses MAP L2 as a-priori aerosol information and can either simultaneously retrieve CO2 and aerosol, or CO2 only.
- Fast atmospheric trace gas retrieval (FOCAL) [2][3], which uses MAP L2 for the bias correction in the post-processing stage.
- RemoTAP [4] which ingests MAP L1C and can simultaneously retrieve aerosol and CO2.

The GRASP (Generalized Retrieval of Aerosol and Surface Properties)[5] will be used for the simultaneous retrieval of both aerosol and surface properties. GRASP is a state-of-the-art algorithm developed to achieve complete and accurate characterisation of aerosol and surface properties using full radiative transfer calculations and a highly elaborated statistically optimised fitting.
In the case of MAP, the aerosol retrieval performed in the VNIR, is used for an atmospheric correction in the SWIR for the CO2 retrieval. To improve the representation of the aerosol for this spectral region, in particular the characterisation of larger dust particles which scatter predominantly at these wavelengths, a "synergistic retrieval" is used which incorporates (single-view) SWIR channels at 1.6µm and 2µm from the CO2 spectrometer. As a result, GRASP will be used in a new configuration using radiances from two independent instruments and some enhancements will be needed. In particular, the models used to represent aerosol, particularly in the SWIR, require consolidation to ensure consistency throughout the entire processing chain encompassing both aerosol and downstream GHG retrievals.

Keywords: retrieval algorithm, aerosol, polarimetry, carbon dioxide, EUMETSAT, CO2M

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Preferred mode of presentation
☒ Oral
☐ Poster
☐ Either

Topic (check all that apply)
☒ Inversion algorithms - achievements and new ideas to derive aerosol, clouds and surface properties
☒ Characterization of aerosol, clouds and surface
☐ Modeling and inverse modeling of aerosol and clouds climatic effects
☒ Measurement synergy approaches
☐ *In situ* observations and field campaigns
☒ Upcoming and current satellite missions
☐ Other: if checked, enter description here