

CO2M Multi-Angle Polarimeter (MAP) aerosol product processing

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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 GHG retrievals (total column dry-air mole fractions of XCO₂ and XCH₄). The Multi-Angle Polarimeter (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. However, it uses a novel design with micropolarisers and filters directly glued to the focal plane detector. A dedicated resampling approach is therefore needed to co-register all views to the CO2M spectrometer grid in a dedicated MAP L1C product to support the downstream GHG retrieval. For CO2M, three independent GHG retrieval algorithms will be used downstream for the XCO₂ and XCH₄.

- Fusional-P [1], relies on MAP L2 as a-priori aerosol information in order to retrieve XCO₂/XCH₄.
- 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.

Additionally, the Copernicus Atmospheric Monitoring services (CAMS) has tasked EUMETSAT to develop Aerosol (and NO₂) products from CO2M with a better latency (better than 5 hours) than required for processing the GHG products (better than 24 hours).

The MAP L1B product provides multi-angle polarised radiances, acquired natively at 0.8×0.8 km² which are subsequently co-registered and re-gridded to the main CO₂ spectrometer instrument grid at MAP L1C stage. The L1C product contains multi-angle observations co-registered at surface altitude with respect to the WGS84 ellipsoid using a digital elevation model.

In this contribution we will describe the status of the developments of the CO2M-MAP aerosol processor using the the EUMETSAT implementation of the GRASP algorithm for the needs of CO2M GHG and aerosol retrievals from simulated MAP L1C products.

Here we will present the latest results of expected performance testing of aerosol processing at EUMETSAT and how it serves to achieve the stringent requirements for CO2M GHG product performance. We also show the benefit of an advance processing of auxiliary information in the CO2M ground-segment, which will also serve the product performance of the aerosol products and will ultimately also benefit the quality of the products provided to CAMS supporting their near-real time atmospheric composition forecast modelling.

References

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