

Multi-Angle Polarimeter observations supporting the Copernicus Anthropogenic CO₂ Monitoring (CO2M) Mission

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As part of the Copernicus Programme, the European Commission and the European Space Agency (ESA), are expanding the Copernicus Space Component to include measurements for anthropogenic CO₂ emission monitoring. The greatest contribution to the increase in atmospheric CO₂ comes from emissions from the combustion of fossil fuels and cement production. In support of well-informed policy decisions and for assessing the effectiveness of strategies for CO₂ emission reduction, uncertainties associated with current anthropogenic emission estimates at national and regional scales need to be improved. Satellite measurements of atmospheric CO₂, complemented by in-situ measurements and bottom-up inventories, will enable, by using advanced (inverse) modelling capabilities, the transparent and consistent quantitative assessment of CO₂ emissions and their trends at the scale of megacities, countries, and at global scale.

This presentation will provide an overview of the Copernicus CO₂ Monitoring (CO2M) mission and the role of aerosol. Operational monitoring of anthropogenic emissions requires high precision CO₂ observations (0.7 ppm) with, on average, weekly effective coverage at mid-latitudes. While the main measurements will be made by observing spectra in the NIR and SWIR for retrieving CO₂, the measurements will be complemented by (1) aerosol observations with a multi-angle polarimeter (MAP), to minimise biases due to incorrect light path corrections, and (2) NO₂ observations as tracer for high temperature combustion. Retrieval of CO₂ is further facilitated by a cloud imager, to identify measurements contaminated by low clouds and high-altitude cirrus. The presentation will first focus on the role of MAP for improving CO₂, which was supported by a study of Rusli et al [1] showing that observations significantly improve by adding MAP observations in the retrieval of CO₂ lowering its bias and enhancing the data yield. An overview of the MAP instrument will be given and how its observations are used in the product generation. Finally, the presentation is an opportunity to give the implementation status of the Copernicus CO2M space segment, as keystone of the future global stocktake.

References

- [1] Rusli, S. P., Hasekamp, O., aan de Brugh, J., Fu, G., Meijer, Y., and Landgraf, J.: Anthropogenic CO₂ monitoring satellite mission: the need for multi-angle polarimetric observations, *Atmos. Meas. Tech.*, 14, 1167–1190, <https://doi.org/10.5194/amt-14-1167-2021>, 2021.

Preferred mode of presentation: Invited