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As part of the Copernicus Programme of the European Commission, the European Space Agency (ESA) and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) are expanding the Copernicus Space Component to include additional measurements of atmospheric composition. To support the evaluation of greenhouse gas emission reductions decided during the COP21 meeting in Paris in 2015, new measurements are required with improved accuracy. Measurements from space-borne instruments are a key component of this effort – requiring improvements in both spatial and spectral resolution.
The Copernicus missions are Europe's primary contribution to this effort. The CO2M mission, initially with 2 platforms, is due to launch at the end of 2026. Data from the three instruments on board each platform – CO2I/NO2I, MAP, and CLIM – will be combined to act as a single "hyper-instrument". NO2 is often co-emitted with CO2, so the spectrometer (NO2I) will be used to detect near-surface NO2 plumes; aerosol pollution (in the form of Aerosol Optical Depth, AOD) will be measured by the Multi-Angle Polarimeter (MAP); and cloud contamination will be observed and removed via data from the Cloud Imager (CLIM). These data will be used within the CO2 and CH4 retrievals from the CO2I spectrometer to improve the retrievals and allow for a precision of 0.7 ppm and an error of 0.5 ppm for XCO2, and an uncertainty of ~10 ppb for CH4.
Sentinel-5 will fly on the EUMETSAT Polar System – Second Generation (EPS-SG) platform, due for launch in 2025. S-5 will be a push-broom hyperspectral UVNS spectrometer, with a 7.5 km2 spatial resolution and global daily coverage via a 2670 km wide swath. It will monitor various trace gases, including CH4, NO2, and CO.
Comprehensive calibration and validation analysis during the satellite's commissioning will be undertaken to ensure they meet the specified requirements, and ongoing monitoring will ensure the instruments continue to comply with the challenging requirements. External data from ground-, airborne-, and satellite-based instruments will be required, covering the whole globe and multiple parts of the EM spectrum. Calibration and Validation techniques are being developed across CO2M and S-5, as well as Sentinel-4 which is also due for launch in 2025. This inter-mission collaboration is underway to reduce duplication of effort and ensure lessons are learned from the commissioning of each mission.
Here we give an update on the current state of planning for the missions' Calibration and Validation operations.
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