The CO2I imaging spectrometer of the CO2M mission: Calibration and correction of instrument effects

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The Copernicus CO2M mission is currently under development by the European Space Agency (responsible for the space segment) and EUMETSAT (ground segment) on behalf of the European Commission. CO2M's goal is to contribute to the quantification and monitoring of anthropogenic emissions of carbon dioxide (CO2) and methane (CH4), as well as biogenic sources and sinks. The stringent requirements in terms of dry-air column averaged mole fraction of greenhouse gases (XCO2 and XCH4) are addressed by a combined use of a dedicated suite of instruments. It features a push-broom imaging spectrometer (CO2I) for measurement of CO2, CH4 and NO2, a multi-angle polarimeter (MAP) for measurement aerosol optical depth, and a high-resolution cloud imager (CLIM). The payload components are fully complementary and will be operated such as to allow for a combined retrieval approach, with the aim to optimise the accuracy of the Level-2 products. In this presentation we give an overview of the operational processing facility developed at EUMETSAT, with an emphasis on calibration aspects and Level-1 processing. We focus on the correction of instrument effects that are specific for the greenhouse gas imaging spectrometer. The CO2I instrument features a novel entrance slit homogenizer design, which presents opportunities for optimised data processing, including continuous straylight monitoring and spectral image reconstruction. Another specific aspect is a non-linear memory (or signal lag) effect identified in the short-wave infrared (SWIR) channels, which, if not corrected for, has a significant impact on the Level-2 products. The effect has been found to originate from the SWIR detector, and an empirical model has been devised by the instrument prime Thales Alenia Space. We simulate the correction performance based on this model using albedo measurements around the Jänschwalde power plant in Germany and evaluate the impact on XCO2 bias.

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