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The importance of co-located aerosol observations for accurate retrievals of CO_2 and CH_4 for emission monitoring

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To limit global warming to well below 2°C compared to pre-industrial levels, many countries have pledged at the Conference of Parties in 2015 in Paris (Paris Agreement) to reduce their greenhouse gas emissions with the goal of reaching net–zero carbon emissions in the second half of the century. To track progress towards these emission reduction targets, and for verifying the effectiveness of mitigation policies, the European Operational Anthropogenic CO_2 Emissions Monitoring & Verification Support Capacity. The Copernicus CO2M mission will form the space component of this system providing global atmospheric CO_2 and CH_4 datasets to constrain anthropogenic greenhouse gas emissions.
CO_2 and CH_4 retrievals from space are now available for more than 20 years thanks to the pioneering missions SCIAMACHY, OCO-2 and GOSAT but these missions have not been designed with anthropogenic emission monitoring in mind. These missions have limited capabilities to correct aerosol-induced light path variations in the CO_2 and CH_4 retrievals and thus are limited to modest aerosol loadings of typically less than AOD of 0.3.
The CO2M mission promises great progress in CO_2 and CH_4 remote sensing. It includes a wide swath of 250 km to capture plumes from hot spots such as a cities or power stations with relatively small ground pixels of 4 km^2, it features a NO_2 channel as a tracer for fossil fuel combustion and it hosts a multi-axis polarimeter (MAP) for co-located aerosols retrievals. This will allow CO2M to carry out sufficiently accurate observations of CO_2 and CH_4 even in regions with enhanced aerosol loadings that are home to many large emission sources for CO_2 and CH_4 (e.g. Mega-cities). Exploiting this new capability of CO2M requires new retrieval approaches that combine trace gas and aerosol retrievals, and it is planned that three different retrieval schemes are run simultaneously for the CO2M mission.
In this presentation, we will first introduce remote sensing methods for CO_2 and CH_4 and the approaches used to deal with aerosols, describe the CO2M mission before discussing a new retrieval scheme that we developed for CO2M based on the GRASP aerosol scheme and the UOL-FP full physis retrieval for CO_2 and CH_4 and show an analysis of its performance

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