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QUANTIFYING LOCALIZED CARBON DIOXIDE EMISSIONS FROM SPACE: THE CO2IMAGE DEMONSTRATOR

Abstract

Space-based measurements of carbon dioxide (CO_2) are the backbone of the global and national-scale carbon monitoring systems that are currently being developed to support and verify greenhouse gas emission reduction measures. Current and planned satellite missions such as JAXA's GOSAT and NASA's OCO series and the European Copernicus Anthropogenic Carbon Dioxide Monitoring (CO2M) mission aim to constrain national and regional-scale emissions down to scales of urban agglomerations and large point sources with emissions in excess of $\sim$10 $MtCO_2$/year.

We report on the demonstrator mission "CO2Image", now in Phase B, which is planned for launch in 2026. The mission will complement the suite of planned CO_2 sensors by zooming in on facility-scale emissions, detecting and quantifying emissions from point sources as small as 1 $MtCO_2$/year. A fleet of CO2Image sensors would be able to monitor roughly 80% of the CO_2 emissions from coal-fired power plants worldwide. The key feature of the mission is a target region approach, covering tiles of $\sim$50 $\times$ 50 km^2 extent with a resolution of 50 $\times$ 50 m^2. Thus, CO2Image will be able to resolve plumes from individual localized sources, essentially providing super-resolution nests for survey missions such as CO2M.

Here, we present the instrument concept which is based on a spaceborne push-broom imaging grating spectrometer measuring spectra of reflected solar radiation in the SWIR-2 spectral window. It relies on a comparatively simple spectral setup with one single spectral window and a moderate spectral resolution of approximately 1nm. The instrument is designed to fly in a sun-synchronous orbit at an altitude of 500 to 600 km. We further discuss the overall mission goals and evaluate the mission concept in terms of e.g. optimal local overpass time and sampling strategy.