Towards Disentangling Natural and Anthropogenic GHG Fluxes from Space - The CarbonSat Earth Explorer 8 Candidate Mission

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ABSTRACT:

Understanding and quantifying climate feedback and forcing mechanisms involving the two most important anthropogenic greenhouse gases, CO2 and CH4, requires the discrimination of natural and anthropogenic CO2 and CH4 fluxes globally, with regional to local spatial scale resolution. The objective of the CarbonSat mission is therefore to quantify natural and anthropogenic sources and sinks of CO2 and CH4. The unique feature of the CarbonSat mission concept is its "GHG imaging capability", which is achieved by combining high spatial resolution (6 km2) and good spatial coverage (breakthrough: 240 km swath, contiguous ground sampling). This capability enables global imaging of localized strong emission source areas such as cities, power plants, methane seeps, landfills and volcanoes and better separation of natural and anthropogenic GHG sources and sinks. The latter will be further supported by CarbonSat's ability to constrain the fluxes of CO2 exchanged to and from the land biosphere by simultaneously measuring CO2 and sun induced chlorophyll fluorescence (SIF), a process strongly associated with Gross Primary Production (GPP). Source/sink information will be derived from the retrieved atmospheric column-averaged mole fractions of CO2 and CH4 via inverse modelling. CarbonSat aims to deliver spatially-resolved time varying global estimates of dry column mixing ratios of CO2 and CH4 with high precision (~1 to 2 ppm and ~12 ppb, respectively) and rel. accuracy (~0.5 ppm and 5 ppb, respectively). Benefiting from its imaging capabilities along and across track, CarbonSat will provide at least an order of magnitude larger number of cloud-free CO2 soundings than GOSAT and OCO-2. CarbonSat was selected by ESA as one of two candidates for the Earth Explorer Opportunity mission (EE8).

Recent results from SCIAMACHY and GOSAT as well as from the CarbonSat scientific studies and supporting campaigns documenting the expected data quality and potential application areas will be presented.