CarbonSat: a Candidate Greenhouse Gas Earth Explorer

Yasjka Meijer¹, P. Ingmann², A. Löscher², B. Sierk², H. Bovensmann³, M. Buchwitz³ and the CarbonSat Mission Advisory Group and Science Study Teams

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Introduction

Within ESA’s Earth Observation Envelope Programme, two candidate missions, called FLEX and CarbonSat, had been evaluated. In September 2015, the Earth Science Advisory Committee has recommended FLEX as ESA’s eighth Earth Explorer, which was endorsed by the Programme Board for Earth Observation in December 2015.

This poster provides an overview of activities related to CarbonSat and an outlook on future activities in the frame of Copernicus.

Mission Objectives

The CarbonSat mission objectives are at

• Regional scale:
  - to provide a breakthrough in the quantification and attribution of regional-scale surface-to-atmosphere fluxes of CO₂ and CH₄

• Country scale:
  - to increase the flux-resolving power of greenhouse-gas observing satellites to the scale of medium-sized countries

• Local scale:
  - to pioneer the spaceborne detection, characterisation and quantification of strong local sources of CO₂ and CH₄

Knowledge Gaps in Global Carbon Budget

From the identified knowledge gaps emerges the need to increase both spatial and temporal coverage allowing for better sampling of under-sampled regions, to investigate the response to climate variability and to separate anthropogenic emissions from natural fluxes.

Mission Concept

• Imaging spectrometer with NIR (O₂) and SWIR (CO₂ and CH₄) bands
• Demanding spatial, radiometric and characterisation requirements

Expected Performance & Science

Simulated random error of the products based on realistic data for albedo, aerosol, cloud and other parameters

Data processing chain from CarbonSat observations to calibrated spectra, to level-2 and science products

Future Activities

While CarbonSat has not been selected as Earth Explorer-8 and hence the foreseen mission objectives will not be achieved, the results of the scientific and the Phase A/B1 system studies can be partly exploited for defining a dedicated CO₂ emission monitoring instrument. Following a CO₂ report initiated by the European Commission (EC), the EC is now jointly with ESA investigating the possibilities to establish a pre-operational system for monitoring of CO₂ emissions in the frame of Copernicus. This will be supported by ESA through architectural, instrument design and pre-development activities.

References

• Mission Advisory Group: Hans Bovensmann, Paul Krapf, Eric Schützinger, Bernd Stein
• ESA Science: Yasjka Meijer, Paul Krapf, Eric Schützinger
• ESA System: Ans van der Hoeven, Piotr Koppelen, Bernd Stein
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Source: D. Brunner, EMPA COSMO model

http://esamultimedia.esa.int/docs/EarthObservation/SP1330/1 (Mission Objectives)

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