

IAF EARTH OBSERVATION SYMPOSIUM (B1)  
Future Earth Observation Systems (2)

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SCARBO: A CONSTELLATION OF SMALL SATELLITES FOR THE MONITORING OF  
ANTHROPOGENIC GREENHOUSE GASES**Abstract**

The Space CARBOn Observatory project (SCARBO), is a project funded by the European Union's H2020 research and innovation programme, supporting one of the key challenges of anthropogenic greenhouse gases (GHG) monitoring from space: a significant increase of the temporal revisit over the various sites of interest while meeting the accuracy and spatial resolution requirements. This is achieved by implementing a novel miniaturised static spectrometer on a constellation of small satellites. The project is coordinated by Airbus Defence and Space, and features a consortium of eight European organisations, including scientific institutes and SMEs. The challenges identified at the start of the project such as the uncertainties due to aerosols, the provision of both high accuracy measurements and high temporal frequency of GHG measurements have been investigated during the four year project. The SCARBO project has also addressed the technical feasibility of the miniaturised CO<sub>2</sub> and CH<sub>4</sub> instrument – NanoCarb – and performed simulations of the science data retrieval chain. The overall measurement concept was validated during an airborne campaign held in October 2020. The project has been successfully completed in December 2021, and has comforted the ambition to overcome the current technological and economical obstacles of other existing and planned GHG missions. It is demonstrated that an intraday revisit can be offered by a 24 small satellite constellation, therefore valuably complementing the reference Copernicus CO<sub>2</sub>M mission. High accuracy measurements are achieved by collocating an ultra-compact aerosol sensor, SPEXone, on NanoCarb satellites and by cross-calibrating measurements with CO<sub>2</sub> reference instruments such as CO<sub>2</sub>M. The spectrometer technology has been raised from TRL2 to close to TRL5 with the development of a prototype for the airborne campaign. A market analysis assessed the commercial perspectives of the SCARBO mission services at global, regional and local scales, demonstrating SCARBO mission's added-value through the analysis of real-life use cases representative of CO<sub>2</sub> and CH<sub>4</sub> related issues. The paper presents the project outcomes in more details, together with the roadmap for future endeavours. With an unprecedented measurement frequency over the entire globe, the SCARBO constellation, costing no more than two mid-sized satellites, is a key step in European CO<sub>2</sub> and CH<sub>4</sub> emission tracing. Other complementary developments, such as HOLDON and LEMON projects, were also funded by the European Union's Horizon 2020 research and innovation program. Abstracts on these projects are submitted to the IAC B1.2 Earth Observation Symposium and B1.3 Earth Observation Sensors and Technology sessions.