CGMS-54-JWGCLIM-WP-3p
6 May 2026
For plenary

Subject	**CEOS-CGMS WGClimate GHG task-team requirements for operational GHG products from space-based global mappers**
In response to CGMS action/recommendation	WGClimate GHG task team action A53.01 and Roadmap for a coordinated implementation of Carbon Dioxide and Methane monitoring from space.
HLPP reference	Item 5.4
Executive Summary	The GHG task-team of the WGClimate is asking the plenary for CGMS-54 to endorse its proposal for GHG product requirements for future operational MVS systems from global space-based GHG mappers. With this proposal, the GHG task-team is implementing its activity A53.01 under Annex I of the CEOS CGMS WGClimate roadmap to propose a set of requirements for space-based GHG products from operational missions supporting the efforts by WMO G3W and UNEP IMEP, as well as addressing the needs of future operational GHG MVS systems. With this proposal the GHG task-team is addressing item 5.4 of the CGMS High Level Priority Plan (HLPP) to “Engage with WMO and other initiatives to create an integrated global operational greenhouse gas observing system that combines space-based and surface-based assets to deliver fit-for purpose data products. Engage with WMO, CEOS, and other parties to define the requirements for the space-based operational observing system.”
Action/Recommendation proposed	CGMS is kindly requested to endorse the proposed product requirements for GHG satellite data

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1 INTRODUCTION

The Committee on Earth Observation Satellites (CEOS) and the Coordination Group on Meteorological Satellites (CGMS) recognize that high-quality, systematic observations of atmospheric carbon dioxide (CO2) and methane (CH4) from a virtual constellation of space-based sensors can make critical contributions to an integrated global greenhouse gas (GHG) observing system. They therefore directed the joint CEOS-CGMS Working Group on Climate (WGClimate) to formulate a roadmap to implement a constellation architecture for monitoring CO2 and CH4 from space, which led to issue 2 of the GHG Roadmap in 2024 (link). The primary objective of this GHG Roadmap is to coordinate efforts across CEOS and CGMS agencies to maximise the quality, utility, transparency and continuity of space-based GHG products for science and policy applications. Its ultimate goal is to facilitate the development of fit-for-purpose operational systems that integrate space-based GHG estimates with ground-based, airborne and shipborne observations of CO2 and CH4 to address the needs of a diverse range of stakeholders.

The key roadmap objectives relevant to this report on requirements for space-based operational GHG products are:

- Ongoing efforts to engage with new partners, including the World Meteorological Organization Global Greenhouse Gas Watch (WMO G3W) and United Nations Environment Programme International Methane Emissions Observatory (UNEP IMEO);

- An updated summary of the evolving requirements and capabilities for space-based measurements that can quantify CO2 and CH4 concentrations and support flux estimation; and

- Efforts needed to foster the transition from research to operations (R2O) to support the development of an operational GHG Monitoring and Verification Support (GHG MVS) system that serves stakeholders in the science, inventory, policy and regulatory communities.

The WGClimate is addressing these objectives and the associated tasks (see Appendix to the roadmap) in part through its dedicated GHG task-team. Following a meeting with WMO G3W and UNEP IMEO, the GHG task team is proposing a set of requirements for space-based GHG products from operational missions which will support the efforts by WMO G3W and UNEP IMEO, as well as address the needs of future operational GHG MVS systems.

CGMS is kindly requested to consider these requirements for their endorsement.

2 OPERATIONAL SPACE-BASED GHG PRODUCT RFEQUIREMENTS

Requirements for GHG product quality performance have been derived with respect to the precision and accuracies needed to accurately detect anomalies in the atmospheric column-averaged dry-air mole fractions of CO2 (XCO2) between 0.5 and 2 ppm. For XCH4, the accuracy of the derived atmospheric column for the detection of anomalies is expected to be better than 15 ppb.

For both products, spatial resolutions of better than 8 km are required for global mappers with short revisit times between 14 and 1 day(s).

These product performance requirements have been derived from many studies in the past (see also CEOS white paper on "A constellation architecture for monitoring carbon dioxide and methane from space") and are consistent with the most recent updates to the WMO OSCAR database for the application area "G3W analysis and forecasting" in the context of the currently ongoing WMO Rolling Review of Requirements (RRR) process.

For an operational observing system, the other key requirements relate to product latency (from sensing to user pick-up point), as well as product availability (number of measurements provided with respect to the theoretical maximum), and operator driven response times, which have so far not been defined for GHG products from global mappers. These latter requirements are fundamental in the context of the development of operational GHG MVS capacities with the objective to report on the GHG emission budgets on a monthly down to daily basis, and over regions of 100 km down to local scales.

In the following we recall the GHG product quality performance for operational GHG global mapping missions (Section 2.1) and add the relevant data provision requirements, which will make such products operational (Section 2.2). We use the categories of "threshold", "breakthrough" and "goal", as used in the WMO OSCAR database (application area "G3W analysis and forecasting").

Here we note that "breakthrough" is considered the current engineering target (supporting operational GHG MVS reporting of emissions on a monthly basis at 100km scales), whereas the goal requirements are linked to monitoring sources creating anomalies with respect to the background at or below the level of 0.5 ppm for XCO2 and significantly below 15 ppb for XCH4. These goal requirements are supporting MVS daily emission budget reporting. In contrast, threshold requirement values define the limit at which the product is considered to be at least of some use for GHG emission quantification.

2.1 Product performance

Table 1 provides the GHG product quality performance requirements.

Table 1. Product performance requirements for operational GHG products from global mappers at threshold (T), breakthrough (B) and goal (G) level

Product	Spatial resolution	Precision			Bias		
		T	B[1]	G	T	B[1]	G
XCO2	**8-2 km**	1 ppm	0.7 ppm	0.2 ppm	1 ppm	0.5 ppm	0.2 ppm
XCH4	**8-2 km**	20 ppb	10 ppb	5 ppb	15 ppb	5 ppb	2 ppb

[1] "breakthrough" is considered the engineering target

2.2 Product provision

Table 2 provides the requirements related to the product provision of operational GHG products.

Table 2. Product provision requirements for operational GHG products from global mappers at threshold (T), breakthrough (B) and goal (G) level

Product attribute	T	B[1]	G
Product revisit time	**<14 days**	**<4 days**	**<3 days**
Product Timeliness / Latency	**<1 week**	**<24 hrs**	**<5 hrs**
Availability	**>85%**	**>95%**	**>99%**
Operator driven anomaly response	**<1 week**	**<24 hrs**	**<12 hrs**

3 RECOMMENDATION FOR CONSIDERATION BY CGMS PLENARY SESSION

The GHG task-team of the WGClimate recommends to the plenary session of the CGMS-54 to endorse the product performance (Section 2.1) and product provision (Section 2.2) requirements for operational GHG products of XCO2 and XCH4 from space-spaced global GHG mappers[2].

4 CONCLUSIONS

The GHG task-team of the WGClimate is asking the plenary session of the CGMS-54 to endorse its proposal for GHG product requirements for future operational MVS systems from global space-based GHG mappers. With this proposal, the GHG task-team is responding to A53.01 and implementing its corresponding activity under Annex I of the CEOS CGMS WGClimate roadmap to propose a set of requirements for space-based GHG products from operational missions supporting the efforts by WMO G3W and UNEP IMEO, as well as addressing the needs of future operational GHG MVS systems.

The GHG task-team A53.01 is responding to the CGMS High Level Priority Plan (HLPP) item 5.4 to “Engage with WMO and other initiatives to create an integrated global operational greenhouse

[2] For a detailed definition of sensor categories and the physical basis of the outlined requirements we refer to the GHG road-map of the WGClimate, the CEOS white paper on “A constellation architecture for monitoring carbon dioxide and methane from space”, and the WMO OSCAR requirements (application area “G3W analysis and forecasting”), as well as to the requirement for an operational global greenhouse-gas Monitoring and Verification Support capacity as outlined by WMO G3W initiative and its requirements paper.

gas observing system that combines space-based and surface-based assets to deliver fit-for purpose data products. Engage with WMO, CEOS, and other parties to define the requirements for the space-based operational observing system."

CGMS is therefore kindly requested to endorse the proposed requirements.