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MicroCarb – Data Policy

MAG / CNES / AERIS / EUMETSAT / UKSA Organization

	Nom et fonction	Date et visa
Préparé par :	Céline MENARD (DTN/CD/SA) Didier PRADINES (DOA/OT/MCA) Denis JOUGLET (DTN/TPI/SA)	Menard Celine — Signature numérique de Menard Celine Date : 2024.09.13 17:12:05 +02'00' Signature numérique de Pradines Didier Date : 2024.09.13 16:58:08 +02'00'
Vérifié par :	Carole DENIEL (DS/DAP/EOT) Isabelle CLERMONT (DOA/MDA/TAM) François-Marie BREON (LSCE)	Signature numérique de Clermont Isabelle Date : 2024.09.16 10:05:36 +02'00' Absent pour signature de cette version
Autorisé par :	Philippe LANDIECH (DOA/OT/MCA)	Signature numérique de Philippe Landiech Date : 2024.09.13 17:15:14 +02'00'

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MODIFICATIONS

Les modifications par rapport à la version précédente sont signalées par un trait vertical en marge gauche.

Ed.	Rev.	Date	Pages modifiées
1	0	03/05/2021	Création
2	0	22/10/2021	Modifications to fit as an annex to the CNES-UKSA Implementation Agreement
2	1	24/07/2024	- §1: update of launch date (for MicroCarb and CO2M). - §3: precision on L0 product content, and correction (L3 products are generated by DPU and not by scientists). - §3: L3 is now identified in this data policy perimeter. - §4.1: according to change request MYRIADE-FT-13362, MicroCarb products generated by CNES-TEC during Cal\Val-1 are no more distributed directly by CNES to MAG members, but trough the AERIS data portal especially configured to limit the diffusion of the data to the MAG members at this stage. - Update of the Distribution list.

SIGLES. ACRONYMES

Acronyme	Définition
4ARTIC	4A Radiative Transfer Inversion for CO2
AERIS	Données et Services pour l'Atmosphère
ACT	Across Track
AO-VAL	Announcement of Opportunity Validation (AO = Appel d'Offre)
AO-ROUT	Announcement of Opportunity Routine (AO = Appel d'Offre)
DPU	Data Processing Unit (algorithmic chain producing successively the different levels of products from L0 to L3).
EUMETSAT	European Organization for Exploitation of Meteorological Satellites
FOV	Field Of View
ISRF	Instrument Spectral Response Function
LSCE	Laboratoire CEA des Sciences du Climat et de l'Environnement
MAG	Mission Advisory Group
Psurf	Surface Pressure
SIF	Solar Induced Fluorescence
UoL	University Of Leicester

Table of Contents

REFERENCE DOCUMENT

CARB-MIS-NO-2114-CNES MICROCARB C/D/E1 Terms of references of the Mission Advisory Group (MAG)

1. INTRODUCTION

As MicroCarb is a scientific mission, the data, once validated, are intended to be free and open to the entire international community. CNES has set up a MAG (Mission Advisory Group) made up of FR and UK scientists and observers from EUMETSAT, NASA and ESA. The MAG is composed of representatives of the main users of the products. In addition, the ground segment of the mission is optimized to be consistent with an operational use of the data within the framework of the Copernicus services.

Before opening data access, it is necessary to ensure the quality of the data through regular CNES reviews and in a closed loop with the MAG. The MAG is the entity responsible for working with CNES to ensure the quality of the data during the first year after launch (expected by mid-2025). The MAG is also in charge of preparing the use of MicroCarb data by the scientific community and demonstrating potential use of the data in the regulatory and business domains, especially in light of the forthcoming CO2M Copernicus mission expected end of 2026 at the earliest.

CNES is considering the implementation of dedicated Calls for Opportunity to the international community for validation (AO-VAL) and then scientific use (AO-ROUT). These calls could be done jointly with partner organizations (still TBD).

This document presents the data policy according to data types (product levels) as well as the different phases of the MicroCarb project operations period. MAG meetings already periodically held along development phase shall be organized all along CalVal period. They will provide recommendations and quality expertise to the CNES project. Also, Joint Steering Committee with partners (UKSA) and information meetings with collaborative entities (EUMETSAT, ESA, EU) will be scheduled throughout each phase and may also provide recommendations. At the end, operational final decisions will be taken by CNES.

2. MISSION ADVISORY GROUP COMPOSITION

See Reference Document CARB-MIS-NO-2114-CNES 2.0

3. DEFINITION OF PRODUCTS

- The nominal products will be split by orbit and each distributed file will contain nadir, scan, glint modes of one orbit. The specific products in target, off-nadir target, city and regional mode will be distributed in separate files (TBC).
- Level 0: raw data containing electronic signals output from instrument detectors, satellite data allowing to calibrate spectra and images (like temperatures acquisitions for example), and orbit and attitude data coming from Command and Control Centre allowing to initiate spectra and images geolocation => not distributed
- Calibration products (dark, lamp, sun) => not distributed (except for sun measurements on specific request).
- Level 1: radiometrically (luminance), spectrally (dispersion law and ISRF) and geometrically (geolocation, angles) calibrated spectra
    - L1A: basic pixel spectra of the detectors => not distributed, products not stored
    - L1B: spectra summed by FOV (@nadir 3 FOV ACT 4.5 * 9 km2, @city 6 FOV ACT 2x2km2)
    - L1C: improved L1B spectra with exogenous data (polarization correction, geolocation, law of dispersion), and flags linked to clouds presence

- L1B&C products are accompanied by the ISRF of each spectral channel of each FOV and meteorological profiles (from ECMWF), CO2 & aerosols (from CAMS), albedo (from Sentinel 2), DEM (from Copernicus) associated with each FOV.

- Level 2 CO2: dry column mixing ratio of CO2 (+ SIF, Aerosols, Airglow, Water vapor, clouds, Psurf) from 4ARTIC code
- Level 2 SIF by specific algorithm from UoL (UK).
- Level 3: products generated by DPU by L2 interpolations on a regular grid.

All L0, L1, L2 nominal products are calculated on near real time and the expected availability of L2 products is 2 days after acquisition for 95% of the time.

Higher level products (L4: fluxes maps generated by scientists or higher users…) are out of scope of this data policy.

4. PROCESSING AND DISTRIBUTION ALONG STEPS

Due to the innovative aspect of the MicroCarb mission and its products, CNES has planned a one-year calibration-validation phase to ensure the quality of level 1 and 2 products. Opening the routine distribution of products to all users is dependent on achieving an acceptable level of performance (thanks to L1 and L2 validations) and having a minimum quantity of data meeting this quality level.

T0 = Date of MicroCarb launch.

4.1 CAL/VAL-1 PHASE (T0 TO T0+ 6 MONTHS)

- After 1 month of satellite + instrument flight acceptance (and instrument decontamination), Cal/Val-1 phase will cover 5 months devoted **to ensuring the quality of Levels 1B and 1C**. All satellite programming modes will be operated (target / nadir / glint / city / off nadir).
- Limited production of L1 and first tests on L2 data.
- Release of an international Call (AO-VAL) to organize the validation of L2 during the Cal/Val-2 phase.

Responsibilities

CNES: In charge of satellite and instrument commissioning; responsible for calibration of L1; testing of production and evaluation of L1 and L2 products at TEC-CNES; steering the production at EUMETSAT and distribution by EUM only to TEC-CNES. Production of L1 and possible L2 samples by TEC-CNES and partial distribution to the MAG members through the AERIS distribution portal.

EUMETSAT: initial testing of the processing capacity and carrying out of a first reprocessing run (on request by CNES) with first data using updated versions of 4ARTIC and SIF (UoL) codes. Distribution only to TEC-CNES (typically 2 reprocessing runs in 4 months).

AERIS Data Center: Archiving and distribution of L1 and possible L2 samples generated by TEC-CNES only to the MAG members. Tests of compatibility with EUM system distribution but no redistribution or online uses of data coming from EUM system carried out by AERIS at this stage. Preparation of services to help the teams selected at the end of AO-VAL to validate L2 products during CAL/VAL-2 phase.

UKSA: Support to UK members of MAG, especially for the preparation of SIF and L2 validation.

MAG: First tests/evaluation of L1 and L2 data generated by TEC-CNES.

4.2 CAL/VAL-2 PHASE (T0+6 TO T0+12 MONTHS)

- 6 months focused on **consolidation of Level 2 (XCO2)** data, with intense validation campaigns using external means and coordinated by the MAG. Possibility to include new experts in the MAG.
- **Distribution of L1 and L2 data (generated at EUMETSAT) will be carried out by the AERIS data center and limited to all MAG members. AERIS will provide** the possibility of a common work space to carry out validation activities.
- Release of an international Announcement of Opportunity for the Routine phase (AO-ROUT).

Responsibilities

CNES: Strong interactions with EUM in order to steer production, reprocessing and distribution to TEC-CNES and AERIS Data Center. At T0 + 7 months, organization of exchanges with teams who have proposed validation projects to the AO-VAL Announcement of Opportunity. Start of intensive L2 validation campaigns. Development of updated L1 and L2 processing codes and provision to EUMETSAT.

EUMETSAT: Near Real time production of L1 and L2 products and distribution to AERIS and CNES (for TEC and Archive). For the reprocessing, it will be done following CNES update of codes (typically at 6, 9 and 12 months) and distributed to AERIS for redistribution, after validation by TEC (+ 1month).

AERIS: Start distribution of NRT and reprocessed products to MAG members. Coordination and distribution of data for L2 validation with ground-based and/or airborne products. Opening of a dedicated « Work-space » to MAG members and teams selected by AO-VAL, in order to test online innovative processing codes and comparisons with other satellite data (OCO, 3MI, IASI). Tests on L4 (Fluxes) production.

MAG: Start of validation and scientific activities (level 4, test on city mode, etc.).

UKSA: Support to UK MAG members and contribution to mission decisions, participation to the CNES AO-VAL Announcement of opportunity.

4.3 ROUTINE PHASE (T0+1 YEAR TO T0+5 YEARS)

- Production (at EUM) and **open distribution (ETALAB license) of L1 – L2 from EUMETSAT and AERIS Data Center: see details in chapter 6**
- Regular upgrading of processing lines based on advances in product development.
- Nominal mission operations. Open Data for Science.

Responsibilities

CNES: Development of updated L1 and L2 processing codes and their provision to EUM. Long term archive of L0, L1b and L2 (last versions). Organization (with UKSA) of regular workshops to present science uses and particularly an Announcement of opportunity for Routine phase projects: AO-ROUT.

EUM: NRT production and reprocessing with updated L1, L2 and L3 codes. Archive and distribution of all products for operational users (Copernicus services at ECMWF and National Met offices), and toward AERIS.

AERIS: Distribution of NRT and reprocessed L1 and L2 products to the international scientific community (open distribution but data users identification through download process). Production of L4 and/or innovative L2 products.

UKSA: Organization (with CNES) of exchanges with users through the AO-ROUT Announcement of Opportunity. Support for UK contributors.

5. SPECIFICITY OF « CITY MODE » DATA

During the CalVal-1 & CalVal-2 periods, programming of city mode planned several times a month and L1c and L2 will be processed only at TEC and analyzed by MAG. In principle no processing is foreseen at EUM but a dedicated "WorkSpace" might be proposed by AERIS. UKSA / CNES to jointly decide acquisition plan, allowing for targeted city data acquisition in support of UK and French research programs.

During the routine phase, city mode programming will be organized by CNES following MAG recommendations and possibly open to the wider science community if the quality of the data produced is deemed acceptable by the MAG and CNES. UKSA / CNES to jointly decide acquisition plan, allowing for targeted city data acquisition in support of UK and French research programs.

The standard algorithm in place at EUMETSAT (with the nadir and Glint modes) could then include the City (and Target) modes during the routine phase, after validation of the L2 products by TEC and MAG (6 months later than the other products) and be distributed by AERIS like other products.

6. DATA OWNERSHIP AND DISTRIBUTION

All data products generated by the MicroCarb mission including levels L1, L2, L3 products are CNES property. MicroCarb products are released by CNES under the French government's Open License ETALAB v.2.0. This license provides data users with full rights of access to and use of MicroCarb data free of charge for any purpose worldwide. Under this license, data users are required to acknowledge the data source. The following accreditation is proposed:

These MicroCarb data are provided by CNES with the support of CGPI (French Commissariat Général Pour l'Investissement), UKSA and EC and were downloaded from [Insert website address here].

The English version of the ETALAB v.2.0 license is found here: https://www.etalab.gouv.fr/wp-content/uploads/2018/11/open-licence.pdf. This license is compatible with any free license that requires acknowledgement of authorship (for example Creative Commons CC-BY).

7. EXTERNAL COMMUNICATION AND SCIENTIFIC PUBLICATIONS

During the calibration-validation phase, all the scientific publications and communications are submitted to the approbations of the MICROCARB Principal Investigator and CNES, which shall be given within one month. Absence of comments within a month is considered to be an approval. UKSA is informed as soon as CNES is notified of these scientific publications and communications, and UKSA's contribution is acknowledged in all the scientific publications and communications.

We can expect that CNES in association with MAG members, shall publish the first paper describing the first calibration and validation results and describing the operational algorithm used.

During the routine phase, all publications have to be forwarded to PI and to CNES and they all have to acknowledge mission partners CNES, CGPI (French Commissariat Général Pour l'Investissement), UKSA and EC and identify CNES as having ownership of the MicroCarb L1, L2, L3 products.

Publications co-authored by several members of the MAG shall be encouraged.

8. COMMERCIAL USE

Commercial use of MicroCarb data distributed under the aforementioned ETALAB license is possible provided acknowledgement of authorship of the data is provided using the standard acknowledgement given above.

CNES internal distribution

Project Team and Supports	
AICARDI Corinne	
AIT ZAID Sonia	
ALFANO Simone	
ANSALAS Carole	
BEGOC Sébastien	
BELLOIR Jean-Marc	
BELLOIR Séverine	
BOCLET Brice	
BOSCHETTI Marco	
BOUVIER Mélanie	
BURSACHI Noé	
CACHOT Alban	
CADIERGUES Laurent	
CANSOT Elodie	X
CARAYON Guy	
CASTELNAU Matthieu	
CASTRO Serge	
CERANTOLA Benoît	
CHAN HIN Christopher	
CHARPIGNY Noé	
CLERMONT Isabelle	X
DARNES Henri	
DELAVAULT Stéphanie	
DELAVOIPIERE Guillaume	
DELBEGUE Diane	
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GASQUEZ Julien	
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HUENS Thomas	
ANADON Marie Laure	
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DEGUINE Béatrice	
CORCORAL Nathalie	
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SCAO	
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LAULHERET Roland	
LAMBERT Pierre-Baptiste	
MARTINEZ Pierre-Emmanuel	
CHARRONT Yann	
SM	
AUDOUY Claude	
LAPAWA Pierre	
ULTRE-GUERARD Pascal	
CHERCHALI Selma	X
GUAY Philippe	
VENET Christophe	
THIESER Anne	
LEUDIERE Vincent	

External Distribution			
LSCE	BREON Francois Marie	breon@lsce.ipsl.fr	X
AERIS	Patrice HENRY	Patrice.henry@cnes.fr	X
AERIS	Nicolas PASCAL	nicolas.pascal@univ-lille.fr	X
AERIS	Jerome RIEDI	jerome.riedi@univ-lille.fr	X
AERIS	Sebastien PAYAN	sebastien.payan@latmos.ipsl.fr	x