

FRM4GHG 2.0

Fiducial Reference Measurements for Greenhouse Gases



Report on comparison exercise on the data retrieval

Deliverable:	D3.1.3
Date:	05/12/2024
Lead authors:	Mahesh Kumar Sha, B. Langerock, B. Herkommer, Hase, F.
Subject:	ESA-Contract No. 4000136108/21/I-DT-lr
Category:	ESA Express Procurement (EXPRO)
Our ref.:	Proposal, FRM4GHG 2.0 – Expro, ESA RFP/3-17031/21/I-DT-lr, revision from 27 August 2021 and 7 September 2021

Table of contents

1 Document change record 3
2 Access list.....3
3 Purpose 3
4 Document structure.....3
5 Results.....3
6 Applicable documents 5
7 Reference documents 5

1 DOCUMENT CHANGE RECORD

Issue	Date	Item	Comment
V0.0	2024-12-05	-	Initial version

2 ACCESS LIST

This document is a deliverable “D3.1.3: Report on comparison exercise on the data retrieval – created for the project FRM4GHG 2.0 and will be submitted to ESA. The document can be downloaded from the project webpage <http://frm4ghg.aeronomie.be>.

3 PURPOSE

The document describes the comparison between the data retrieved with updated TCCON a priori and CAMS data as a priori profiles.

4 DOCUMENT STRUCTURE

See Table of Contents

5 RESULTS

The Copernicus Atmospheric Monitoring Service (CAMS) delivers the operational services for daily production of near-real-time analysis and forecasts of global atmospheric composition, reanalysis providing consistent multi-annual global datasets of atmospheric composition with a frozen model/assimilation system, amongst other products. The creation of the reanalysis data uses the ingestion of improved versions of the observations, which thereby benefits the quality of the product. The EGG4 dataset is a global reanalysis data set of atmospheric composition (AC) consisting of three-dimensional time-consistent AC fields, including aerosols, chemical species and greenhouse gases (GG). The current reanalysis dataset covers the period January 2003 to June 2022. The reanalysis data is provided to the user community from the Copernicus Atmospheric Datastore (ADS) <https://atmosphere.copernicus.eu/data> . The meteorological model is based on integrated forecast system (IFS) version CY42R1; the model resolution is T255L60 (a reduced Gaussian grid with 60 monthly means of daily means). A second candidate dataset is the high resolution model of the operational greenhouse gases dataset. The analysis run is daily updated with a latency of about five days and is available on an octahedral grid with 137 vertical layers (O400L137). The

operational analysis data is more recent but it contains the results of different experiments and is not one consistent data set for the complete time series of available data.

The overpass data for the TCCON and NDACC-IRWG sites are downloaded for both CAMS analysis experiments at our institute. A grid box around the ground-based measurement sites are defined and the data are stored in a netCDF file. Currently, we are downloading the data on a weekly basis but the frequency can be increased upon request. The profile information of the pressure, temperature, water vapour, carbon dioxide, methane, density and gravity are stored in a special format (.map files) similar to what the TCCON community is using. This format is also the same which is being used by the PROFFAST processing chain within the COCCON community.

The deliverable D3.1.2 describes in details the changes necessary for working with the extracted .map files as input for the PRFFAST run. Using this data as input the processing was done by KIT for the COCCON data with the CAMS profiles as a priori and the standard COCCON prior files. The maximum deviation for XCO₂ and XCH₄ are found to be about 0.08 % and 0.14 % for a single day of comparison. Figure 1 shows the a priori profiles for the TCCON case and CAMS case used for the analysis.

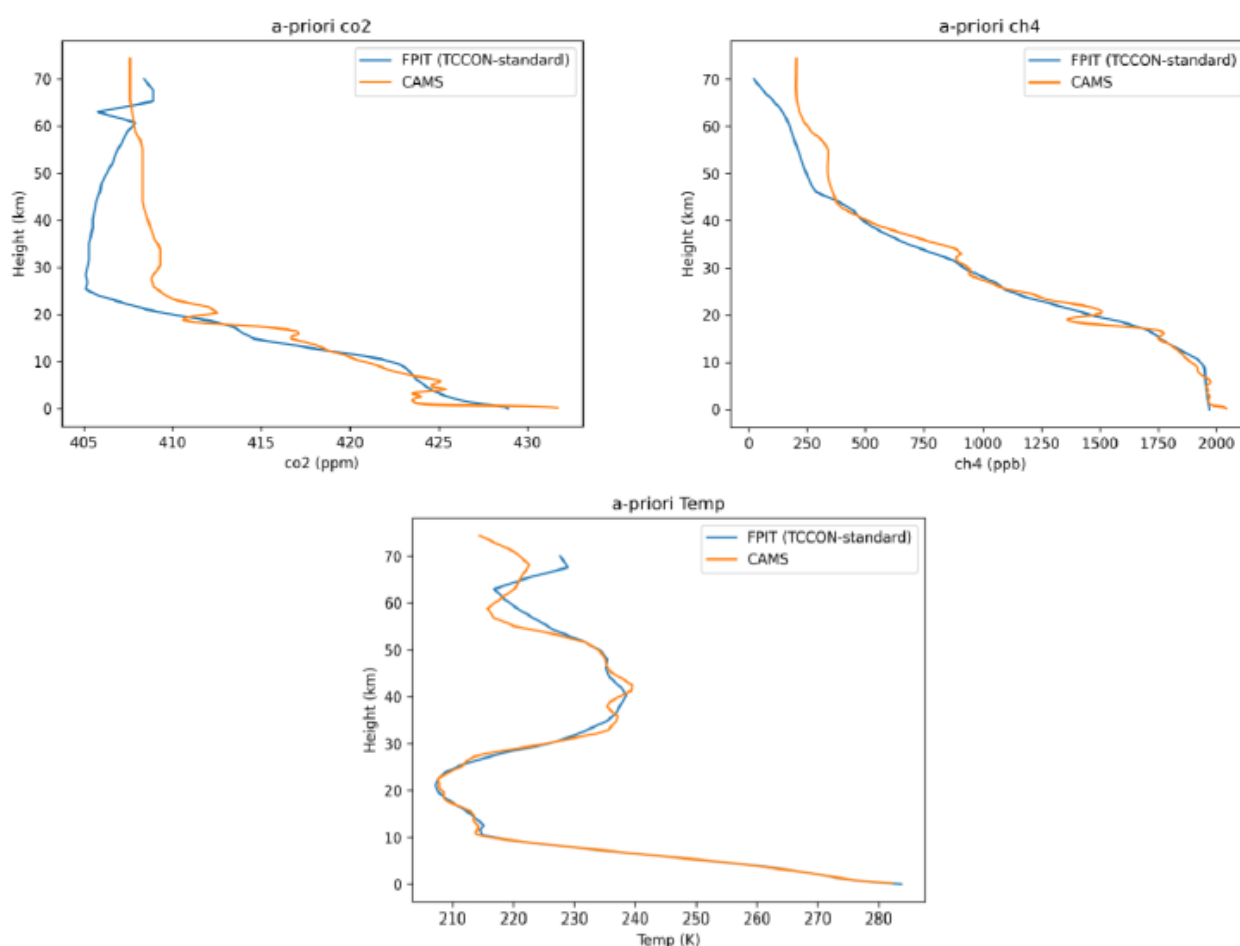


Figure 1: Profiles of CO₂, CH₄ and temperature from FPIT - TCCON a priori file (blue) and CAMS a priori file (red).

6 APPLICABLE DOCUMENTS

Statement of Work: Fiducial Reference Measurements for Ground-Based IR Greenhouse Gas Observations (FRM4GHG 2.0)
Prepared by: EOP-GMQ, Reference: ESA-EOPG-EOPGMQ-SOW-21

7 REFERENCE DOCUMENTS

CAMS global greenhouse gas reanalysis (EGG4):
<https://ads.atmosphere.copernicus.eu/cdsapp#!/dataset/cams-global-ghg-reanalysis-egg4?tab=overview>

Copernicus Climate Change Service, Climate Data Store, (2023): ERA5 monthly averaged data on pressure levels from 1940 to present. Copernicus Climate Change Service (C3S) Climate Data Store (CDS), DOI: 10.24381/cds.6860a573

Sha, M. K., Langerock, B.: Deliverable D3.1.1 Technical Note on ECMWF data stream for PROFFAST

Herkommer, B., Hase, F.: Deliverable D3.1.2 Create handling for CAMS a priori for PROFFAST