Activities status update of CEOS WGCV Atmospheric Composition Subgroup and the CGMS GSICS

and Towards an operational GHG monitoring system

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WGClimate 13

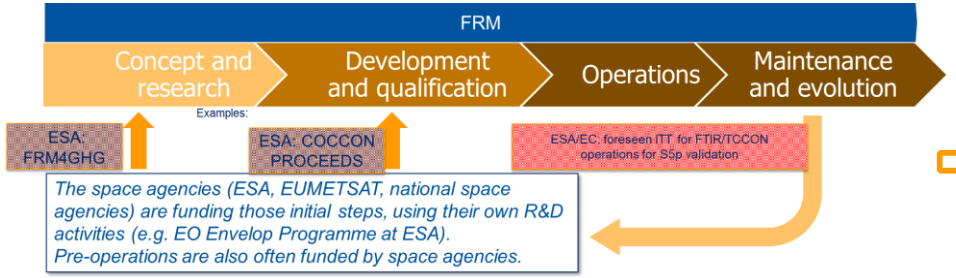
14 October 2020

Ground-based network / FRM capacity analysis for GHG Cal/Val

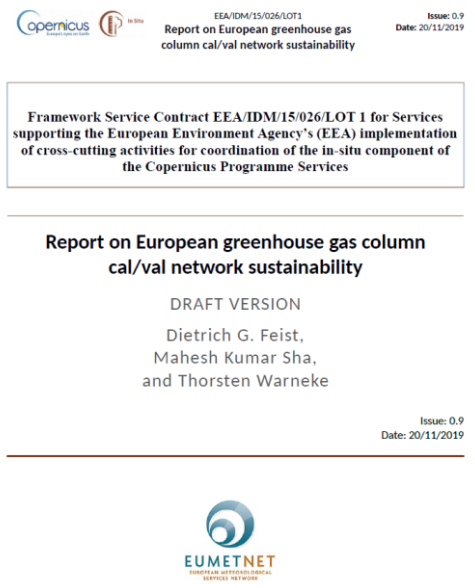
On Activity 2, 4b and 5:

European coordination meeting on GHG FRMs took place in April 2019 at EUMETSAT, focussing on the current status and long-term sustainability of the European Monitoring and Verification Support (MVS) capacity, for identifying the current shortcomings/gaps/sustainability in GHG Cal/Val.

E.g. through a report on European greenhouse gas column Cal/Val network sustainability by EEA, and we are currently putting together a position paper, which is planned for summer (short term objective).



European coordination meeting on GHG FRMs at EUMETSAT April 2019


EEA/IDM/15/026/LOT1
Report on European greenhouse gas column cal/val network sustainability
Issue: 0.9
Date: 20/11/2019

Framework Service Contract EEA/IDM/15/026/LOT 1 for Services supporting the European Environment Agency's (EEA) implementation of cross-cutting activities for coordination of the in-situ component of the Copernicus Programme Services

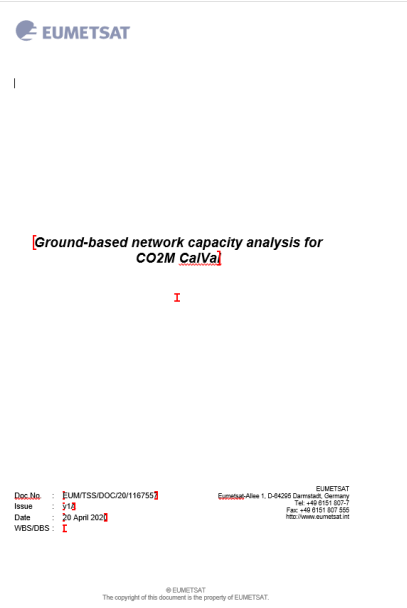
Report on European greenhouse gas column cal/val network sustainability

DRAFT VERSION

Dietrich G. Feist,
Mahesh Kumar Sha,
and Thorsten Warneke

Issue: 0.9
Date: 20/11/2019

EUMETNET


EUMETSAT

[Ground-based network capacity analysis for CO2M CalVal]

Doc.No. : [EUM/TSS/DOC/20/116755]
Issue : [v1.0]
Date : [20 April 2020]
WBS/DBS : [ ]

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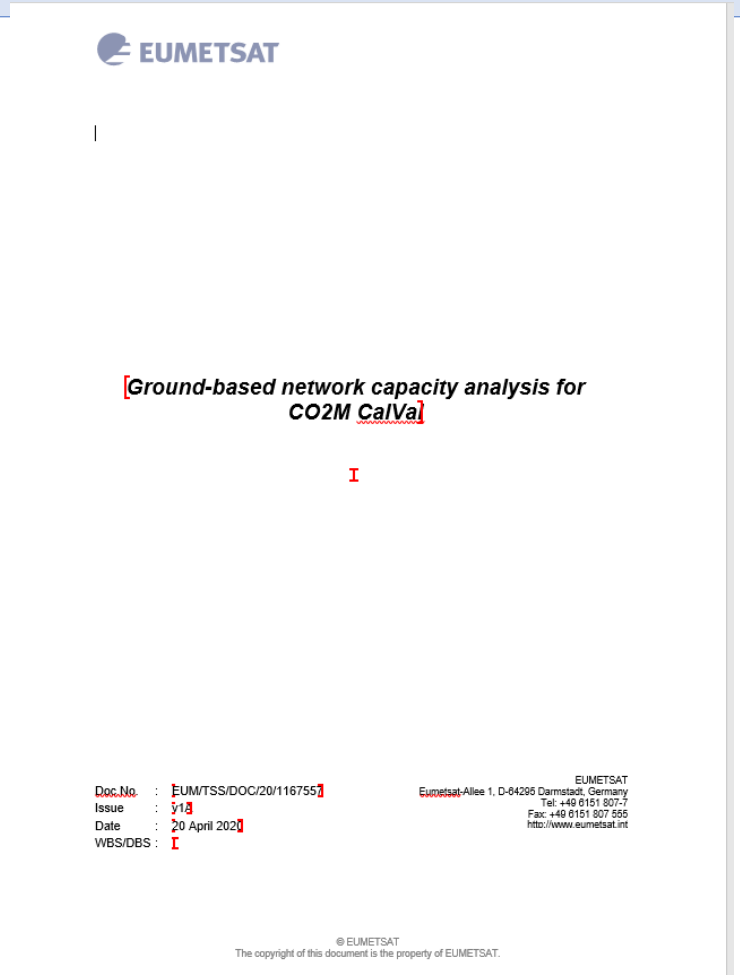
Ground-based network / FRM capacity analysis for GHG Cal/Val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[Ground-based network capacity analysis for CO2M CalVal]

Doc No. : EUM/TSS/DOC/20/1167557
Issue : v1.
Date : 20 April 2020
WBS/DBS :

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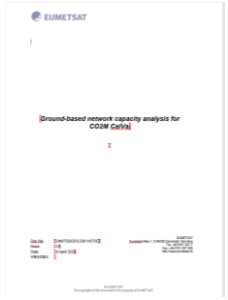
- 2 month study with D. Feist, LMU (TCCON Europe)
- Capacity analysis with focus on identifying gaps for operational support
- EUMETSAT provides identification for operational needs
- LMU, provides status and ideas for evolutions
- Input (starting point for 2 year EUM science support on Cal/Val - Q4 2020).

EUM 2-month TCCON OPS capacity study

Ground-based network / FRM capacity analysis for GHG Cal/Val



Ground-based network operations capacity study, D. Feist, LMU.

TCCON

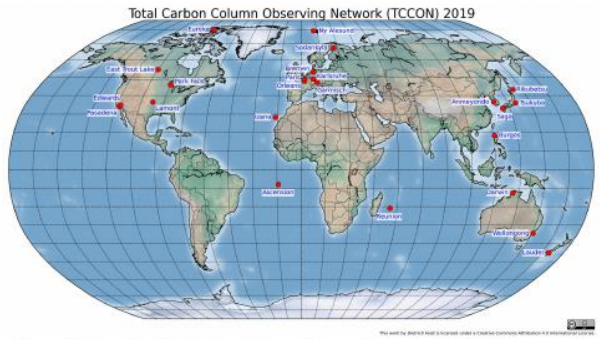


Figure 1: Map of the Total Carbon Column Observing Network (TCCON). There were 27 active TCCON stations in 2019.

COCCON

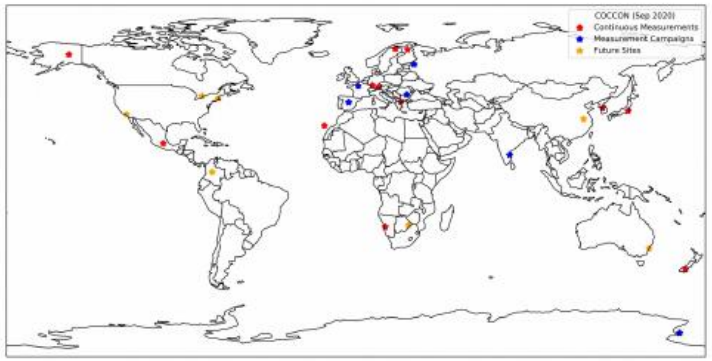


Figure 2: Map of the COllaborative Carbon Column Observing Network (COCCON). There were 12 active COCCON stations in 2020. Seven more are planned for 2020/21. Five stations are located close to TCCON stations. Seven multi-instrument campaigns have been conducted so far. Map provided by D. Dubravica, KIT.

Determine potential gaps between the capabilities of TCCON and COCCON and CO2M Cal/Val needs:

1. Inventory of existing capabilities of TCCON and COCCON with respect to CO2M cal/val. ***Objective:*** which parameters are needed to describe these capabilities and how they can be determined.

2. Define cal/val requirements of CO2M in a form that can be tested against the capabilities of the existing or future improved/extended networks. E.g. through network/CO2M OSSEs for CO2M.

Study results presentation planned 5th November (virtual meeting)

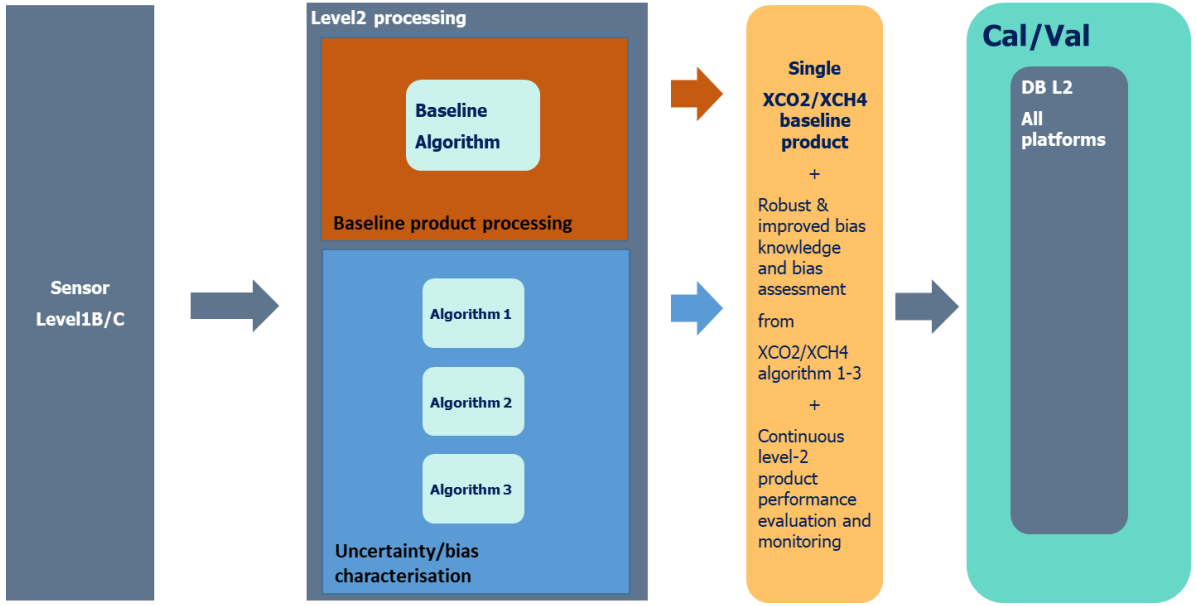
Parameter	Priority	Determination effort	Comment
			spectra by the PIs. Needs a clear definition of how noise and signal should be determined for all stations within each network.
Typical noise for XCO2	Important	Additional work: can be derived from existing time series.	Need clear instrument-independent definition of noise comparable to expected CO2M performance
Typical inter-station bias for XCO2	Critical	Dedicated study	Some literature available for GGG2014. However, station bias expected to be reduced with GGG2020.
Availability of aircraft or aircore calibrations	Useful	Additional work: available from TCCON aircraft profile database.	Similar database may exist for COCCON.
Station availability level	Important	Dedicated study	Input from PIs needed to determine reasons for missing observations (e.g. weather vs. downtimes).
Type and quality of on-site pressure measurement	Critical	Station survey	More stringent procedures for pressure measurements and QC are also currently discussed for TCCON.
Surface albedo around station	Critical	Dedicated study	Only coarse data available so far. Need to define wavelength, distance around site and horizontal resolution.
Projected CO2M overpass frequency	Critical	Dedicated study	Needs at least a CO2M orbit prediction tool. Optimal results could be derived from CO2M OSSE if that is available.
Cloud cover frequency at CO2M resolution	Critical	Dedicated study	Can be derived from NWP model data or CO2M OSSE if available. Unclear if horizontal resolution would be sufficient.
Cloud cover frequency from station data	Useful	Dedicated study	Unclear how many stations have direct solar radiation measurements on site.
Aerosol measurement availability	Important	Station survey	Unclear how many stations have some kind of AOD measurement nearby.
Aerosol	Critical	Dedicated study	Could be from local AOD

Station-parameter / capacity inventory
Ground-based network operations capacity study, D. Feist, LMU.

GHG level-2 validation infrastructures and inter-comparisons

On Activity 1, 3 and 6:

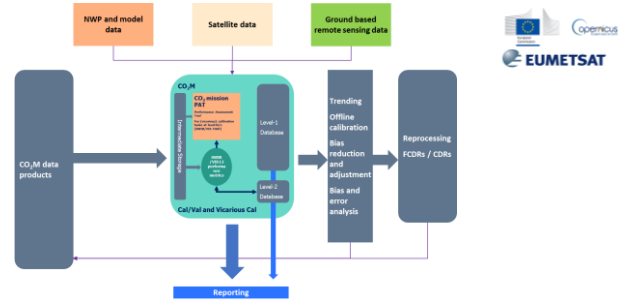
Progressing in proposing integrated operational systems and infra-structures for continuous and robust level-2 algorithm inter-comparisons and Cal/Val, in an operational context (and in the context of CO2M – the space component of the European MVS). Short-term objective is to report on initial system engineering results 2020/21 TBC).



GHG level-2 study objectives:

- Improvement of retrieval quality per individual algorithm (including the additional usage of MAP and CLIM) – end 2021+
- **Proposal of an optimal retrieval scheme and improved error assessment** – end 2020
- Decreasing processing cost per existing algorithms (optimising performances) – end 2020/21+

CO2M Cal/Val:



NIR/SWIR sensor inter-calibration

On Activity 4a:

GSICS - UVNS spectrometer sub-group inter-calibration related activities, with an activity in the sub-group on S5p / GOSAT inter-calibration currently delayed (as the GSICS meeting was also impacted by Covid-19) and to be restarted again soon (medium term objective).

<u>Outlook for UVNS Spectrometer Sub-Group</u>

Addressing the following aspects for UV – SWIR spectrometers

- On-ground characterization (workshop planned for October 2020)
- Solar calibration
- Lunar calibration
- Inter-calibration
- Polarization
- Development of common methods for use of invariant targets & vicarious calibration sites with homogeneous surface over sufficiently large area.