



Interim
Climate Working Group Meeting
23 February 2022
-with notes from meeting added-

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Interim Climate WG meeting February 2022

Purpose of the meeting

- Update on open actions and recommendations from ITSC-23 and earlier meetings: Feedback needed by ITWG co-chairs for their report at the next CGMS meeting
- New topics? No requests for topics received from group members before meeting.

Status of actions since last meeting (ITSC-22)

Global Observing System design

Action Climate-1 on Heikki Pohjola: Provide information on the status of information about FCDRs in OSCAR to the Climate WG. This information will also be added to the Climate WG webpage.

Status at ITSC-23: ongoing

Development work related to OSCAR/Space is ongoing: WMO is currently implementing a restful API to deliver WIGOS and JSON OSCAR/Space records; idea is to make OSCAR/Space WIGOS metadata record compatible allowing users to export information from the OSCAR/Space database based on the XML template, for example regarding the relationship between instruments and variables. The Joint Working Group Climate has been involved.

A first version of OSCAR/Space with this functionality will be released in August/September 2021. Once the new functionality is available, the respective information will be added to the Climate WG webpage.

Status of actions since last meeting (ITSC-22)

Hyperspectral IR sounder uncertainties

Action Climate-5 on Climate WG members: To determine the requirements for uncertainty information from all operational hyperspectral IR instruments and document.

Status: closed – New recommendations have been added to the ITSC-23 WG on this topic (Recommendations Climate-8, Climate-9, and Climate-10)

Mitigation of the impact of identified degradation or loss of capabilities

End of life of sensors and impact in climate time series:

- EUMETSAT Metop-A ~~will be~~ **has been** de-orbited in November 2021
- NOAA legacy satellites in orbit for long time (N15 > 20yrs, N18>15yrs), N16 and N17 decommissioned on 6/2014 and 4/2013, respectively
- potential impact of the loss of capabilities on climate applications is the termination of CDRs developed from these satellites

Recommendation Climate-1 to satellite agencies: The separation of instrument variability from the often subtle, long-term variations in climate related processes requires careful calibration and validation of the sensor and its derived data products. The Climate WG encourages satellite agencies to intercalibrate time series from overlapping satellites in order to allow a continuation of climate time series (including trend analysis) when transitioning from older to newer satellites.

Recommendation Climate-2 to satellite agencies: Satellite agencies should ensure a frequency continuity for all instruments in future sensor designs for developing credible climate data records.

-> see e.g. **2nd Climate Observation Conference:** „a conference to assess how the current global climate observing system can be improved to better support current and near-term user needs for climate information”

(https://www.eventsforce.net/eumetsat/frontend/reg/thome.csp?pageID=14409&ef_sel_menu=226&eventID=34)

Mitigation of the impact of identified degradation or loss of capabilities

Small satellites:

- Small satellites are becoming more important in the context of Earth observation and have potential for climate applications
- allow for an affordable future constellation that can offer measurements with a temporal-spatial resolution that is not accessible to traditional remote-sensing satellites, helping to fill the gaps in climate monitoring
- typically have a shorter lifetime than the traditional larger satellites -> complement to the larger satellites, but not as a replacement for them

Recommendation Climate-3 to space agencies: Consider climate requirements in terms of stability and length of life cycle when designing small satellite sensors

Mitigation of the impact of identified degradation or loss of capabilities

Impact on reanalysis

- Observations from many different satellites are assimilated in reanalysis
- Observation system changes over period of reanalysis
- Studies needed to understand the impact of losing different sensors and assess on the possible loss of performance
- ECMWF is currently planning to perform such studies in preparation of the next generation of their reanalysis (ERA-6)

Action Climate-1 on Bill Bell: Bill Bell to report at the next meeting (Climate WG meeting at ITSC-24) about the plans at ECMWF and progress to-date concerning impact studies on losing different satellite sensors for assimilation in a reanalysis

Status: **ongoing**

Idea during meeting was to schedule a separate science meeting on ERA-6 later this year, which Bill is happy to do. More information on status of ERA-6 from Bill: see next slide

Mitigation of the impact of identified degradation or loss of capabilities

Summary of information from Bill Bell (received via email after the meeting):

- Bill is very happy to talk about ECMWF's plans for ERA6 later in the year (meeting most likely in November 2022).
The aim is to start production of ERA-6 in early 2024 and ECMWF is now in the process of formulating the detailed R&D plans
- Bill suggests to have only the ITSC WG-CLIMATE for this talk and leave a larger audience to some other meetings (AGU, EGU, EUMETSAT Conf,)
- Regarding Action Climate-1: This is on schedule and Bill is happy to talk about it at the next ITSC WG

Long-term continuity of OSCAR/Space

- long-term continuity of OSCAR/Space as a primary tool to support the CGMS Risk assessment and the WMO Rolling Review of Requirements including gap analysis against observing system requirements for satellite data
- making OSCAR/Space the primary repository for WIGOS satellite metadata records generated by CGMS operators
- Updated OSCAR/Space planned to be released in Aug/Sep 2021 (making OSCAR/Space and WIGOS metadata compatible)

Recommendation Climate-4 to WMO: WMO to collect information on available FCDRs from data providers and include it in OSCAR.

-> related to Action Climate-1 from ITSC-22; Roger Saunders (retired from UK Met Office) started to work with WMO in fall 2021 to maintain and update their OSCAR-SPACE database

Coordination of data access and end-user support

- Clear references to data records are important for transparency and citation
- Adequate metadata are important to allow using full potential of data; internationally accepted standards and best practices should be applied to improve interoperability and compatibility

Recommendation Climate-5 to data record providers: CDRs should be citable by e.g. having Digital Object Identifier (DOI) reference and being accessible to users. All data records should be accompanied by metadata that follows WIGOS standards

Recommendation Climate-6 to data developers: CDR development and stewardship shall follow guidance similar to [NCEI Data stewardship maturity matrix](#) or the [Copernicus Climate Change \(C3S\) convention](#) (including recommendations for metadata)

Action Climate-2 to Climate WG co-chairs: Add information on NCEI Data stewardship maturity matrix and C3S convention to Climate WG webpage

Status: **ongoing**, update of webpage under preparation

Input will be sent to Leanne shortly after the meeting, update will also include correction of e.g. outdated links.

Calibration

Bias Monitoring

The NOAA Product Validation System (NPROVS) currently store collocated radiosonde (high-density) and hyper-infrared/advanced microwave instrument measurements for every GRUAN radiosonde that falls within 2 hrs of a MetOp or NOAA (SNPP, N20) overpass. These include radiosondes from the JPSS dedicated radiosonde program targeting NOAA satellites. The Climate WG supports these activities

Recommendation Climate-7 to EUMETSAT: The Climate WG recommends that EUMETSAT consider funding its own dedicated radiosonde program targeting MetOp satellites

Information forwarded to Viju John. Viju contacted Thomas August at EUMETSAT after the meeting and Thomas's feedback is on the next slide

Calibration

Information from Thomas August (via email):

EUMETSAT operates a dedicated facility to monitor the performance of the Polar sounding products against radiosondes. The tool is called MONA LiSA and will be extended for IASI-NG and MTG-IRS. We have been working closely together with NOAA on NPROVS results indeed. EUMETSAT has plans to ensure synchronised launches, as done for EPS in the past. There has been initial discussions with GRUAN and we have representatives in the newly created GRUAN Satellite task team in that perspective

Calibration

Hyperspectral instruments

- extensive calibration and validation programs before and after satellite launches to determine uncertainty information of operational hyperspectral IR instruments (AIRS, IASI, CrIS, etc.): information available via satellite agencies and [GSICS](#)
- WG emphasized importance of improving the accuracy and information content of spaceborne observations for detecting climate trends and quantifying feedback mechanisms using on-orbit SI standards for the absolute calibration of spectrally resolved radiances and adequate global sampling
- Significant progress is expected for the solar part of the spectrum via the US CLARREO Reflected Solar Pathfinder (2023), ESA TRUTHS mission (2026-28), and Chinese LIBRA mission (2025-2032); and future plans for new Earth emission observations by the ESA FORUM mission (2026) and the Chinese LIBRA mission

Recommendation Climate-8 to satellite agencies: Satellite agencies shall establish programs to conduct absolute calibration or inter-calibration for hyperspectral IR sounders during their life cycles and document and publish the results.

Recommendation Climate-9 to CGMS: WG recommends that CGMS emphasize the need to establish an improved global climate benchmark with multiple standards as soon as possible for verifying international progress toward dealing with the threat of climate change.

Recommendation Climate-10 to US satellite agencies: WG recommends that the US satellite agencies proceed with the Infrared Pathfinder defined by the CLARREO program.

- **In light of anticipated, enhanced involvement of NOAA in climate, a special effort should be made to make NOAA, as well as NASA, aware of the important Recommendation Climate-10**

Error characteristics of satellite data and products

- Common vocabulary and methodology with appropriate error propagation to include the errors associated with validation data is important in order to better understand and trace uncertainties when interpreting long time series of e.g. ECVs.

Recommendation Climate-11 to satellite data product developers: Report statistical uncertainties of the CDR trends together with the calibration uncertainties.

CrIS: new capability for determining a rigorous estimate of the CrIS measurement Radiometric Uncertainty (RU) for any individual spectrum available, details on next slide

Error characteristics of satellite data and products

Update from Hank on Section 3.6 of the Report of the Climate WG at ITSC-23 (Error characteristics of satellite data and products):

A new capability for determining a rigorous estimate of the CrIS measurement Radiometric Uncertainty (RU) for any individual spectrum from NASA L1b, Version 3, calibrated radiance files has been created. RU is an upper bound of the bias with respect to the true radiance (coverage factor $k=3$ or 3-sigma, not including noise), and is scene and instrument environment dependent.

RU for any selected spectra can be calculated using the L1b radiance data and a small amount of ancillary information provided in a static file. The procedure for doing this and example code will be provided in the NASA Cross-track Infrared Sounder (CrIS) Level 1B Radiometric Uncertainty Description Document available on the NASA GES DISC web pages starting in March. The following DOIs take you to the GES DISC landing pages for CrIS Version 3 data:

NOAA-20 FSR: [10.5067/LVEKYTNSRNKP](https://doi.org/10.5067/LVEKYTNSRNKP)

SNPP NSR: [10.5067/OZZPDWENP2NC](https://doi.org/10.5067/OZZPDWENP2NC)

SNPP FSR: [10.5067/ZCRSHBM5HB23](https://doi.org/10.5067/ZCRSHBM5HB23)

Advancing architecture for space-based monitoring of climate

- CEOS/CGMS [ECV Inventory Questionnaire Guide](#) identified about 30 ECVs, consisting of nearly 100 individual physical variables
- Current CEOS/CGMS [ECV inventory](#) includes nearly 800 CDRs
- [Gap analysis](#) of the existing ECV Inventory: some key ECVs, particularly GHG, are still under represented in the current ECV inventory

Recommendation Climate-12 to space agencies: Support the further development of ECVs and GHG CDRs to enrich the ECV inventory for climate change monitoring.

ECV inventory v4.0 is now available based on data collected during 2020-2021,

Updates are now possible at any time and a new version is released after the CEOS/CGMS Climate WG meetings. From the webpage: “The inventory is continuously updated by data producers and curators, and new incremental versions of the database will be tentatively published more than once per year, to provide the users with more up-to-date information, and to support Gap Analysis exercises. For any question or to provide your contribution, please contact ecv_inventory@eumetsat.int.”