

CEOS/CGMS Working Group on Climate 10th Plenary

19-22 March 2019
Marrakesh, Morocco

Minutes

WGClimate
The Joint CEOS/CGMS
Working Group on Climate



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1 Introduction and Context

Jörg Schulz (EUMETSAT), WGClimate Chair

Welcome and Round Table Introduction

Jörg Schulz (EUMETSAT), WGClimate Chair

Jörg Schulz welcomed everybody to the 10th WGClimate Meeting (WGClimate #10), reminding the attendants that this is actually the 7th meeting since the WGClimate became a joint CEOS and CGMS working group. Jörg suggested that the meeting would start with a *tour de table* so that all participants would have the chance to introduce themselves and get to know the other participants. The WG noted with appreciation the first attendance by KMA and welcomed Eunha Sohn as a new member. In addition, several guests were only attending parts of the meeting, and in case of having the attendance of more than one participant from one agency, the WGClimate representative of the agency has been identified.

Acceptance of the Agenda

Jörg Schulz (EUMETSAT), WGClimate Chair

Jörg went briefly through the agenda, mainly to check whether any changes were needed to accommodate the presence/absence of attendants, and highlighted the intervention of some guest participants with crucial roles in discussion topics to be addressed.

Regarding Day 1, due to the overlap of the meetings' agendas, the WGClimate members were not able to participate in the GCOS Earth System Cycles breakout group discussions. As a mitigation measure, the attendants to the WGClimate meeting went back to the GCOS Plenary session for the conclusions of the breakout groups and the presentations on the way forward with the preparation of the next GCOS-IP, from 16:30 onwards. Jörg thanked Chris Merchant for his additional contribution to the proposal on (T)CDR and ICDR definitions, to be discussed under Item 3., in which Toshiyuki Kurino will also give a presentation highlighting the importance of ICDRs for extremes' monitoring.

Jörg also reminded the participants of the need for an earlier start on Day 2, to close the morning session (Item 4. of the agenda) in time for some presenters to leave to the airport.

For Day 3, the joint session with WDAC was highlighted (Item 6.), where the discussion on the ECV Inventory and Gap Analysis will start, being then followed by a WGClimate solo session for the planning of this year's Gap Analysis exercise (Item 7.).

Regarding Item 8. (Day 4), Jörg reminded the participants that there is the opportunity for the space agencies to give their presentations to the WGClimate for the first time since the WGClimate #6 (Paris, March 2016), and that two time slots are still available, from the planned seven slots.

There were no suggestions or additions to the agenda.

Overview of Agenda Items and Scene Setting

Jörg Schulz (EUMETSAT), WGClimate Chair

Jörg opened the presentation informing the attendants that the Vice-Chair of the WGClimate, John Dwyer (USGS), who had contributed to the material being shown, apologised for his absence, due to health reasons. This led to the most crucial issue on the table, concerning the leadership of the WGClimate. The USGS CEOS representative had informed the WGClimate Chair and other CEO delegations at the CEOS Technical Workshop in September 2018 that John will not be able to fulfil his upcoming chairmanship's mandate. Jörg presented the plan for mitigation (earlier discussed within the WGClimate and endorsed at the CEOS-32 Plenary, Decision 03), and the timeline for succession and associated mandates.

The achievements since WGClimate #9 (Geneva, March 2018) were highlighted and revisited, and an outlook for the years ahead was presented, mainly focussed on the actions, recommendations, and decisions resulting from the CEOS and CGMS Plenaries. The main topics concerned: the ECV Inventory and Gap Analysis activities (CGMS-A46.10, CGMS-A46.13), the space agencies' contribution to the Paris Agreement (CEOS-31-01, CEOS-32-02), the CNES Space Climate Observatory (SCO) (CEOS-32-03), the coordination of the GHG Monitoring (CGMS-A46.18, CGMS-R46.13, CEOS-32-05, CEOS Decision 04, and CEOS Decision 05). The progress on the implementation of the coordinated actions was also assessed, and the Objectives/Deliverables for the CEOS 2019-2021 Workplan revisited.

In light of the above (including Item 1.3.), Jörg summarised the goals for the meeting, and proposed that the next meeting, WGClimate #11, should be held before or after the 2019 CEOS SIT Technical Workshop (scheduled for the week 9-13 September in Fairbanks, Alaska (USA)), also in Alaska (either Fairbanks or Anchorage, depending on hosting opportunities). The rationale for the proposal is the need for a meeting before the CEOS-33 Plenary (14-17 October 2019) to finalise the 2019 gap analysis report and the update of the coordinated action plan and the fact that some members of the WGClimate will already be attending the CEOS SIT TWS. The duration of the WGClimate #11 still needs to be assessed, and that together with the exact dates for the CEOS SIT TWS and the hosting opportunities (to be investigated by Jörg) will further define the time and location of the meeting (Action **WGClimate10-1**).

Mark Dowell (EC) proposed that the original "badgeless approach" adopted by the WGClimate, relevant at the time of the definition of the architecture for climate monitoring from space, should be revisited, in particular for the web appearance. He suggested adding this as a discussion topic for WGClimate #11 (Action **WGClimate 10-2**).

2 Nomination of new Vice Chair

Jörg Schulz (EUMETSAT), WGClimate Chair

Candidate(s) introduction and decision on recommendation to CEOS and CGMS

Jörg Schulz (EUMETSAT), WGClimate Chair & All

In response to the letter of nomination for Vice-Chair sent in November 2018 to the CEOS and CGMS space agencies represented in the WGClimate, with a deadline for applications set to the 28th of February 2019. A single nomination was presented, by DLR, who put forward Albrecht von Barga (DLR) as a candidate for taking up the Vice-Chairmanship of the WGClimate.

Albrecht regretted the very sad circumstances leading to this nomination, and emphasised how much he would prefer John Dwyer to be able to continue as a Vice-Chair and eventually take on the chair role of the WGClimate. He also recognised the challenging amount of work for the coming years, needed to keep the momentum generated by the ongoing activities (e.g. ECV Inventory and Gap Analysis) and the emerging ones (GHG Monitoring Activities), and he hopes that the WGClimate will be up to the challenge – and that the members owe this to John.

Mark Dowell (EC) thanked DLR for its contribution, stressing the fact that Albrecht has already chaired a CEOS Working Group before. Albrecht briefly described his relevant experience and path in the context and scope of the WGClimate.

Selma Cherchali (CNES) and Simon Pinnock (ESA) also thanked DLR for its availability and appreciated Albrecht as the new Vice Chair.

WGClimate unanimously proposed Albrecht for nomination by CEOS and CGMS as the incoming Vice-Chair of the WGClimate, and the WGClimate Chair will propose him for endorsement to the CEOS and CGMS Plenaries. Given the present circumstances and the fact that the CEOS Plenary will only be held in October, Jörg will assess the possibility of a written approval by CEOS or endorsement at the CEOS-SIT-34 (2nd – 4th April) (Action **WGClimate10-3**). Jörg further informed the Working Group that John will remain member of the WGClimate for USGS, and that he will surely be happy with the solution found.

3 Data Record Definitions

Jörg Schulz (EUMETSAT), WGClimate Chair

Introduction to FCDR, CDR, ICDR

Chris Merchant (University of Reading representing UKSA)

Chris reminded the attendants that the proposals for definitions of FDR and FCDR (already presented to the group during a telecom in November) were the result of the Horizon 2020 project FIDUCEO Workshop held in Lisbon in May 2018. The main distinction between FDR (Fundamental Data Record) and FCDR (Fundamental Climate

data Record) definitions comes from the more stringent needs regarding length and stability for climate applications. A stabilised record is essential, but a unique record length cannot be given, as it depends on the rate of temporal change of a variable and the quality of the measurement.

The documents distributed in advance of the meeting contain a contextual preamble, a short definition, and a longer interpretation and guidance section. The proposals for definition of CDR (at the level of the geophysical variable) and ICDR (Interim CDR) follow the same approach. But they take into account how FCDRs link to CDRs, in particular, that FCDRs are the input for creating CDRs and through the propagation of uncertainty from the FCDR to the CDR. For the ICDR, the main points would be stating the level of inconsistency with the underlying CDR (in order to meet the required timeliness).

Importance to produce ICDR for climate extreme monitoring in operation

Toshiyuki Kurino (WMO)

Toshiyuki Kurino presented the main outcomes from the “WMO Initiative for Space-based Weather and Climate Extremes Monitoring, from Demonstration to Operation” in what concerns the importance to produce ICDRs, based on the lessons learned from its Demonstration Project.

Toshiyuki confirmed to Mark Dowell that the same processing chain had been used for the production of the whole data record. There were also comments regarding the latency of the data record vs. their characteristics and envisaged applications, and how that relates to the distinction between real-time data and ICDR.

Discussion and eventual endorsement of proposals

All

Joachim Saalmüller (EUMETSAT) asked for a justification for dropping “Thematic” from the (T)CDR acronym, but there is no apparent reason for it, except for the historical rationale within GCOS, pointed out by Mark Dowell. Jean-Noël Thépaut (ECMWF, Copernicus Climate Change Service) wondered whether a notion of ICDR would also be considered for the FCDRs. Jörg suggested that the discussion should start focussed on the definition of FCDR (and FDR), followed by the (T)CDR, and leaving the potentially more complex ICDR to the end.

The discussion on the definition of FCDR started with the analysis of the word “stabilised”: what that accounts for, if it has a meaning in the context of metrology, and how it relates to other terms in use like “homogenised”, “harmonised”, and “coherent”. Chris clarified that “stabilised” refers to the stability of the observing system and the quantification of the error, and that this should include both “harmonised” and “homogenised”; the relationship with “coherent” is not clear.

Jeff Privette (NOAA) highlighted the issues raised by the existence of different definitions across different communities, and the potential implications of adopting a too restrictive constraint for classifying a data record as an FCDR. Simon Pinnock suggested that the definition could be regarded more as a list of qualities serving as guidelines for aspiring data records to be considered FCDRs. Mark pointed out that the lack of a commonly

adopted definition, and the understanding of what is referred as an FCDR, may lead to issues for the future. He added that the guidelines are already part of the document written by Chris. Jörg stated that the definition of FCDR (National Research Council¹ adopted by GCOS) leaves a lot room for interpretation, and that while GCOS defined specific requirements for uncertainty and stability for the CDRs addressing ECV Products, it never did so for the input data (e.g. the FCDR).

Mark pointed out the difference in responsibility between the WGClimate and GCOS is that space agencies should focus on what needs to be done in order to comply with the guidelines and requirements defined by GCOS, and this is what the definitions should address.

Jeff expressed his doubts about what belongs to the data record definitions, as well as his concerns regarding writing a definition as representatives of space agencies, as different agencies produce CDRs for different reasons. Jörg showed understanding of Jeff's concerns, but added that the role of space agencies should be addressing the GCOS needs. The approach followed by the ECV Inventory and the Gap Analysis process [also considering climate applications other than the GCOS long-term climate monitoring] is not fully consistent with the GCOS framework. Jeff added that the GCOS requirements are overrated, and that many CDRs that do not comply with GCOS are suitable for the applications they are used for.

For the way forward, Mark suggested an external review process for the proposed definitions, with broad distribution, not only among space agencies but also including other communities. Jörg proposed to update the definitions for FCDRs and CDRs, with an introductory section focussed on context and history, and that Chris and Jeff could work together on incorporating the constructive additions of Jeff in the document(s) before any distribution for review (Action **WGClimate10-4**). It was agreed that this process will be followed up in the upcoming telecons, and the results hopefully brought up for discussion at WGClimate #11. Then the WG can also take a decision on the review process.

4 GHG Monitoring

Jörg Schulz (EUMETSAT), WGClimate Chair

CEOS/CGMS status on GHG monitoring

Mark Dowell (EC), Coordinator for the Implementation of the CEOS Carbon Strategy & David Crisp (NASA)

Mark Dowell presented the background to the GHG Monitoring Activities with emphasis on the historical perspective and latest developments on this topic, mainly with respect to the outcomes of the CEOS and CGMS Plenaries and the resulting actions / decisions concerning the WGClimate.

¹ National Research Council, 2004: Climate Data Records from Environmental Satellites: Interim Report. The National Academies Press, Washington, D.C., 136 pp.

Lessons learned from a-decade long GOSAT observations

Akihiko Kuze (JAXA), CEOS WGCV Vice-Chair

Akihiko Kuze gave a presentation on JAXA's long record of CO₂ and CH₄ observations from GOSAT. The 5% radiance difference between GOSAT and OCO-2 was highlighted, and attention was drawn to the upcoming CEOS AC-VC Meeting in Tokyo (10th-12th June 2019), with a full day devoted to GHG. Mark Dowell praised the cal/val efforts made for GOSAT, and the advantages of the lessons learnt.

Activities of the CEOS AC-VC

David Crisp (NASA) & Ben Veihelmann (ESA), CEOS AC-VC Co-Chair

David Crisp presented the CEOS AC-VC GHG White Paper "A constellation architecture for monitoring carbon dioxide and methane from space", to be formally published by WMO and Copernicus during this year. He focussed on its rationale, goals, and outcomes (actions proposed and foreseen progress timeline). The timeline for GHG-observations missions (CO₂ and /or CH₄ measuring capabilities) was also shown, with 16 missions to be launched until 2025. The inherent risks of some very short overlaps in time were pointed out and discussed, as well as the potential limitations of large observation footprints, and the science-oriented nature of most of the missions – with the need for operational monitoring capabilities still to be fulfilled.

The issue of coordination for the establishment / optimisation of an observation constellation was briefly discussed, with emphasis on effort required in considering orbital parameters across missions from different agencies (Jeff Privette (NOAA), Ken Holmlund (EUMETSAT)). David Crisp suggested that CEOS could provide some help. Joanna Post (UNFCCC) indicated there might be interest from UNFCCC in the evolving monitoring system and the potential complementary information that can be provided in support of the GHG inventory activities, and that this could be presented to the planned Earth info day at COP-25 (December 2019, Chile).

Ben Veihelmann highlighted the sixteen recommendations of the White Paper and their mapping into actions, and the proposed tentative output from the AC-VC by 2021, emphasising the possible interactions with the WGClimate and the CEOS WGCV-ACSG and CGMS GSICS.

Regarding the proposed contribution from the AC-VC to the consolidation and refinement of space-derived GHG product requirements, Mark Dowell pointed out that the work on product requirements should be an input to the GCOS requirements update instead of the definition of an independent new set of values. Selma Cherchali asked whether a single set of requirements would apply to all measuring instruments, and David suggested that the target should be on the capabilities offered by the future missions, further indicating that there are many ways to fulfil the requirements. Mark drew attention to the "technology agnostic" nature of GCOS requirements.

Ben proposed that the AC-VC should work together with WGCV and GSICS towards the definition of cal/val needs for both Level 1 and Level 2 products.

Activities of CEOS WGCV Atmospheric Composition Subgroup and CGMS GSICS

Bojan Bojkov (EUMETSAT), CGMS GSICS / CEOS WGCV-ACSG

Bojan Bojkov briefly described the mission and activities of the CEOS WGCV-AC Sub Group (ACSG) and the CGMS/GSICS, with emphasis on their relevance to GHG monitoring. Support to GHG instrument calibration in GSICS falls under the newly renamed Reflective Solar Spectrometers Subgroup (GSICS/UVSG). Participation/interest in ACSG has always been challenging, the focus by agencies in the last 10-15 years has been shifting from research missions to operational missions addressing air quality, greenhouse gases, and down-stream services. CGMS/GSICS-UVSG addresses many activities for the operational Atmospheric Chemistry missions with the benefit of the inter-calibration activities. GHG mission interoperability is critical especially in the next years, as the first operational missions will be launched. The challenge of bringing in the contribution from research was highlighted, with focus on calibration activities.

Towards an operational GHG monitoring system

Bojan Bojkov (EUMETSAT), CGMS GSICS / CEOS WGCV-ACSG Chair

The presentation was limited in scope to the satellite component and concerning the atmospheric domain. In the short-term (mid-2020) the goal would be to conduct a sober analysis of the foreseen status of the monitoring system by 2025, including cal/val possibilities (ground-based remote-sensing instruments for high precision FRM – Fiducial Reference Measurements). In the medium- to long-term, address the gaps for FRM, make inter-calibration operational, identify long-term validation needs, identify and follow the best practices and standard metrics.

Toshiyuki Kurino asked whether the inter-calibration was concerning L2 products, and Bojan clarified that stability should be monitored using all different techniques, and that an educated decision could be made after analysing the stability of L1 data. Geophysical variables could be validated using ground-based measurements. For example, TCCON (Total Carbon Column Observing Network) spectroscopic measurements are directly traceable to laboratory measurements of CO₂ and CH₄ absorption, while the XCO₂ and XCH₄ estimates are directly calibrated against in situ measurements collected by aircraft. Bojan suggested the topic could be addressed within CEOS AC-VC over the next years. Ben Veihelmann suggested that maybe GSICS could contribute to this topic.

Bojan commented on the extremely ambitious schedule of the AC-VC contribution, and David Crisp clarified that the goal is deliver a prototype product in 2021 and to achieve operational status by 2025. This still requires a steep learning curve until 2021. Bojan welcomed the approach, but emphasised that preparation is key, and that best practices should be defined upfront, 6-7 years before the launch of an operational system.

Towards a roadmap for GHG monitoring

Mark Dowell (EC), Coordinator for the Implementation of the CEOS Carbon Strategy

Mark Dowell listed the proposed CEOS actions, the White Paper status, plans, pointing to the interdependencies between partners (internal and external), and their implications to the organisation of the work, with the formation of an eventual Task Team within the

WGClimate. A roadmap of the EC activities (CHE and Verify projects, etc.) was shown to be very much in line with that of the space component, being the broader milestones 2021-2122 for a prototype, and 2025-2026 for a pre-operational environment. Mark also presented the reference set of documents that reflect the basis and progress of the process (to be shared with any newcomers), and welcomed inputs from the CEOS WGCV.

Organisation of GHG monitoring work in WGClimate

Jörg Schulz (EUMETSAT), WGClimate Chair

On the discussion on the way forward, Jörg reminded the WG of the CEOS-32 Plenary proposals and decisions, and presented the rationale for the organisation of the activities in WGClimate. He proposed a dedicated task team within the WGClimate, consisting of a leader and a deputy with nominal terms of 2 years. The WGClimate Chair selects the leader and the deputy will always be the Vice Chair of the WGClimate to assure the coordination with the WG Chair. The Vice Chair would never become the Task Team leader. Representation of CEOS and CGMS bodies is achieved by identifying Points of Contact (PoCs) for tasks planned to be executed in the contributing CEOS and CGMS bodies (AC-VC, WGCV/ACSG, GSICS/UVWG, etc.).

The WG accepted the proposal and decided that Mark Dowell will lead the task team, and that the deputy would be on a systematic basis the Vice Chair of WGClimate, so as to ensure the direct leadership link to GCOS and SBSTA, therefore in this initial phase this responsibility would fall to the newly nominated Vice Chair of WGClimate Albrecht von Bergen. The leader and deputy will work with a virtual group consisting of representatives of the CEOS AC VC (David Crisp, Ben Veihelmann or Yashka Meijer), CEOS WGCV-ACSG (led by Bojan Bojkov), CGMS GSICS (represented by Bojan (TBD)) plus a maximum of two other representatives from agencies not already represented.

The next activity will be the development of the roadmap towards an operational system based on recommendations from the GHG white paper. From the discussion, it became clear that the roadmap has three major milestones:

- support to the first UNFCCC stocktake in 2023 with a prototype system available in 2021/22;
- support to the second UNFCCC stocktake in 2028 with an advanced system available in 2026/27; and
- an operational system available after 2030.

It was decided that the work on the roadmap shall start immediately from the already collated individual work plans of the different groups. The dedicated task team shall break-down in a first instance the work plan into clearly defined work packages with milestones identifying the responsible lead. Review of the work plan including status of work package and schedule shall be always during WGClimate meetings offering agencies a transparent insight into the progress of the initiative with attending the WGClimate meeting. The work on the plan should advance into a draft for presentation at CGMS-47 in May (Action **WGClimate10-5**). A meeting on Sunday June, 9th in Tokyo is possible for those who participate in the IWGGMS-15 (15th International Workshop on Greenhouse

Gas Measurements from Space) and/or AC VC meetings in Japan. WGClimate #11 in September shall reach final agreement for the roadmap. The agreed roadmap with indications of needed additional resources shall be presented at the CEOS SIT Technical Workshop in September and then be forwarded to the 33rd CEOS Plenary for endorsement in October (Action **WGClimate10-6**).

Considering the preparations for the meeting in Japan, Mark Dowell pointed out that the existing spreadsheet [mapping the recommendation of the white paper into actions on different partners] is already outdated, and that a faster way forward should be found. Jörg agreed, and reminded that the initial approach was mainly meant to show the 32nd CEOS Plenary how the GHG White Paper had been translated into actions. Robert Husband suggested that a different tool, allowing for time scheduling, should be used. Albrecht and Jörg will look for an appropriate and easily accessible tool, and Jörg suggested as a starting point to combine the planning contained in the presentations with the previous contents of the spreadsheet and to consolidate this.

Mark Dowell commented that several space agencies had expressed their interest in actively participating in this GHG monitoring activities and WGClimate should benefit from this interest. Jörg clarified that even though the Task Team will be relatively small, these agencies can become involved through participation in WGClimate meetings, which is not restricted.

Ken Holmlund (EUMETSAT) pointed out that there might be benefits to a close joint monitoring of progress with other existing Working Groups in CGMS dealing with coordination of constellations. Mark Dowell suggested a closer involvement of the inventory communities, and mentioned the UNFCCC REDD++ as an example for forestry that could be followed for GHG. He added that the Task Team could be the interface with GCOS, the modelling community, and the in-situ community.

Jörg also emphasised that another topic to be discussed is the GCOS requirements and how the WGClimate should feedback into the GCOS Science Panels in time for the next GCOS-IP, noting that the long-term climate monitoring is not the only application to be considered in the frame of this activity. Ken Holmlund noted that the discussions held during the GCOS Carbon Cycle session [during the Joint GCOS Panels Meeting] resulted in the decision to write specific requirements for these applications, considering the emerging capabilities for measuring fluxes. The quantitative requirements derived from this activity should be useful for GCOS. Ken also referred to the possible involvement of WCRP DAC and that it will need to be taken into account where the space agencies will be represented in the upcoming structure.

Jörg added that upcoming WGClimate meetings will devote a day to this topic. Jeff Privette expressed concerns that the foreseen effort of the WGClimate focussed on only one ECV, and also on how the whole activity would be easily integrated in the mission and goals of the WGClimate and compatible with the 2-years leadership. Jörg expects that most of the effort allocated by the WGClimate to this activity will very likely happen during the first 2 years, after which it should become more routine. Mark added that even though the WGClimate should devote their efforts to all ECVs, some are more critical, and that is the case for GHG, which is getting much attention now. He suggested that another Task Team

or focus on another ECV may be needed in some years' time. Ken Holmlund also added that this activity will entail a change in focus for the WGClimate, as it will also include other communities, and not only the space community. Jörg emphasised that this kind of activity will only be successful with the kind of cooperative approach currently existing in the GHG space community, and that it might be more difficult to pursue such an initiative in other areas. Jeff suggested a close monitoring of the impact of such an activity in the WGClimate, and praised the close cooperation of all the groups involved.

5 WMO Congress, Initiatives and Case Studies

Jörg Schulz (EUMETSAT), WGClimate Chair

Resolution for 18th WMO Congress on Architecture for Climate Monitoring from Space

Werner Balogh (WMO)

The discussion on the draft of the WMO report on the Architecture for Climate Monitoring from Space, to be presented at the 18th WMO Congress, started with the acknowledgement of the comments already received from some WGClimate members. Werner Balogh stressed that the WMO Resolution would be a recognition of the work done. Further comments to the document will be beneficial, and a submission status can be achieved soon.

The agreed schedule for refinement of the document is:

- Jörg will send around the latest version of the document (Action **WGClimate10-7**);
- WGClimate members have until 27 March EOB CEST time for further comments/change request (comments to be sent to Jörg and Werner) (Action **WGClimate10-8**);
- WMO Space Programme agreed to finalise doc until 28 March EOB CEST (action on Werner), and the updated version will be redistributed to WGClimate. Any further comments can still be taken into account until 31 of March (silence is agreement) and WMO will submit the final version on 1 April (Action **WGClimate10-9**). Mark Dowell suggested that the WGClimate representatives should inform their respective agencies about the document and its submission to the WMO Congress.

WMO Congress climate architecture demonstration agenda, contributions, who is there

Jörg Schulz (EUMETSAT), Chair of the WGClimate, Werner Balogh (WMO)

Werner Balogh informed the Working Group that the number of WMO Congress (Cg-18) related events designated as "side or special events" will be strictly limited (see <https://public.wmo.int/en/eighteenth-world-meteorological-congress-cg-18/Hydrology%20Assembly>) and that the architecture demonstration, as agreed by EC-70 in its Decision-35, will not be labelled as such a "side or special event". However, a demonstration in some form or another is still anticipated to be held during the time of the Congress and different locations are under consideration, including the Palexpo in

Geneva. He further informed the Group that ideally the preferred dates for the demonstration are the 6th or 7th of June, given that the resolution on the implementation of the architecture for climate from space is expected to be considered by Congress on 7th June. Joachim Saalmüller suggested that the location of the demonstration should take into account the presence of the decision makers, and Werner agreed. Mark Dowell asked what is intended by a “demonstration of the architecture [for climate monitoring from space]”, and Jörg pointed out that these are the terms used by the WMO Executive Council, and that his understanding of it is a user-oriented event. Jörg added that it would be a good idea to coordinate the event with C3S (Copernicus Climate Change Service), e.g. by demonstration of a case study, for which some catchy, self-explanatory material could be used. However, there needs to be more information on the planned demonstration, and confirmation that it will materialise and exactly when. Werner will inform the WGClimate of developments with respect to the time and the location of the planned architecture demonstration, as soon as this information becomes available (Action **WGClimate10-10**).

Evolution of SCOPE-CM

Jeff Privette (NOAA), Chair of the SCOPE-CM Executive Panel

Jeff Privette (NOAA) presented a plan for reviving SCOPE-CM (Sustained and COordinated Processing of Environmental satellite data for Climate Monitoring) highlighting synergies with the WGClimate and emphasising the fact that the relationship between SCOPE-CM and the WGClimate, while obvious, it will also be a changing one. The plan presented was well received by WGClimate members. Joachim Saalmüller welcomed the focus on the maintenance of the GEO-ring L1 records (FCDRs) and suggested that the WMO could support this coordination effort by providing the SCOPE-CM Secretariat, stating that WMO should be the umbrella to help strengthening a multi-lateral cooperation. He also added that a way forward should be indeed pursued, as ending SCOPE-CM now would mean creating a new similar initiative in the near-future. Jeff clarified that the focus should not exclusively be on Geo-ring products and FCDRs, as that could be counter-productive, but that it should be indeed regarded as a priority. He also pointed out the struggles of SCOPE-CM projects working under best efforts, which affects delivery, if they are not mature enough. Joachim suggested that future decisions on which projects to support should be based on feasibility and available support.

Mark Dowell mentioned that SCOPE-CM on the CGMS side could be a catalyst for the involvement of the CEOS VCs in the generation of CDRs, and to encourage more participation of the CGMS-only agencies in the WGClimate - a more palpable initiative might help the engagement of some agencies.

A document on the proposed way forward for SCOPE-CM will be prepared for the CGMS-47 Plenary for endorsement, including the lessons learnt from the current projects. WGClimate asked SCOPE-CM to provide feedback on the outcome (Action **WGClimate10-11**).

Status of Space Climate Observatory

Selma Cherchali (CNES), SCO Program Director

Selma Cherchali (CNES) presented the aims and status of the CNES initiative SCO, highlighting the linkage to socio-economic data, and the perceived benefit in fostering the key role of EO data in assessing the impacts of climate change, the definition of indicators, and the international coordination and shared data portal. SCO has been submitted as GEO initiative by now. At this stage it is not possible yet to aim at an international agreement – need to do it in smaller steps – first step is a joint declaration of intent (after receipt of comments will be opened for signature between beginning April and early July 2019) to be signed on 22 August in Biarritz, alongside the G7.

Jörg informed the participants that a letter from CEOS SIT was sent on Monday, 19 March to CNES, and its content was provided to the discussion. Even though CEOS will maintain its observer status (represented by the Chair of the WGClimate) until the scope and outputs of the initiative are further clarified, Selma pointed out that CNES will respond to the comments and questions raised in the letter. The overall position of CEOS might not be consistent with feedback received from some of its member agencies, in particular, through the feedback received during and after the SCO international meeting held on 1st of February where partners pointed out that SCO bridges a real gap and it was recognized that there is a strong need to structure international collaboration on climate change impact monitoring. Selma will give feedback on those comments at the next CEOS SIT meeting in Miami.

The presentation given was seen as a step forward in the clarification of the initiative, being understood that it addresses adaptation in general. ESA was pleased to see that the definition of SCO is much clearer now, and reiterated that it is important to take advantage of the high-level political interest behind SCO. ESA also remarked that it is good to see non-space stakeholders included in SCO, as they will be needed to access the non-space expertise, in-situ and socioeconomic data necessary to develop credible and useful indicators. Questions were raised on the need to consider attribution, and which communalities on climate change impact exist at what spatial scales. In particular, the ability to extrapolate the findings of the case studies to be supported by SCO, i.e., if you have demonstrated a case somewhere, its application to other places in the world was challenged. David Crisp pointed out that the kind of activities envisaged by SCO are rather on the research side, which is not obvious from the way the project is presented. Selma pointed out that there is of course a strong need to support research activities in order to address the challenge of the adaptability of the methodology to others territories facing the same impacts. The objective to share those capabilities at international level will strengthen the expertise and respond globally adaptation needs of the Paris Agreement. It was also pointed out that the SCO activities relate to work in other CEOS WGs, e.g. Disasters and Capacity Building. It was suggested that SCO identifies common interests with such groups as well. Mark pointed the WG to the facts of EC's investments not only into the Copernicus Climate Change Service but also in the uptake of such results in developing countries using the European Development Fund mechanisms. This is funding aiming at sustainability for providing and using services in less-developed regions, and one could suggest to SCO to think about sustainability as well. He also pointed out that it

will be interesting if after two years of implementation as presented, SCO could make an analysis of additional requirements (or typologies of requirements) for the implementation of the Scenarios dealing with the impacts of Climate Change. This could then be considered complimentary to, or integrated in, the existing requirement, which the Space Agencies address through GCOS.

Discussion on way forward for case studies for the architecture

Jörg Schulz (EUMETSAT), WGClimate Chair

(This topic was moved to Day 3) The discussion was focussed on the provision of further case studies on the usage of climate data records in applications to further promote the architecture for climate monitoring from space. The analysis shall keep the same style as in the 2015 WMO report (Bojinski et al.). WMO was open to the possibility of leading this initiative once again, and Werner Balogh will confirm decision and availability of resources (Action **WGClimate10-12**). Selma Cherchali and Simon Pinnock, amongst others, signalled their interest in contributing case studies (Action **WGClimate10-13**). WGClimate #11 will carefully review the proposed case studies and decides which will be included in the report.

Note: After the meeting, the EC indicated that it is probably interested to contribute to this. Either through C3S/ECMWF or the work of Commission Services.

6 Joint Session with WCRP DAC

Jörg Schulz (EUMETSAT), WGClimate Chair

Discussion on WCRP strategic priorities

Michel Rixen (WCRP)

Michel Rixen gave a presentation on the WCRP strategic priorities, summarising the main features of the review/restructuring of WCRP introduced by WMO Chief Scientist in the opening session of the Joint GCOS Panels Meeting (Earth system approach). Michel clarified that there is no significant change in the main focus of the programme. It was discussed if the needs for observations should become part of what is communicated through GCOS to keep a “one voice” principle for needs and requirements towards space agencies, but it is not clear whether GCOS would take this up. It was suggested to develop a common position paper from WDAC and WGClimate on the needs of long-term sustained observations for the applications mentioned in Michel’s presentation, which should be covered in the next GCOS IP. In addition, it was suggested that the GCOS and WCRP Panels related to observations should work more closely together, up to the formation of joint GCOS/WCRP Panels.

The organisation of research in WCRP needs further attention as the proposed structure has the observations outside of the WCRP core (consistent with the idea of seamless consideration of weather and climate). WCRP is planning to have an implementation plan in about one year, and interactions with the WGClimate during the drafting phase is welcomed.

The joint meeting also discussed the status of the Obs4MIPs activity (Observations for Model Inter-comparisons Project). The interest to learn how the provided data are used is very high. Another Obs4MIPs workshop could be planned for 2020/21. The organisation of such a meeting and major topics will be followed-up in upcoming WGClimate telecons and/or joint telecons (Action **WGClimate10-14**). WGClimate also suggested developing a better pipeline for data records from the ECV Inventory to usage in Obs4Mips. In addition, the discussion on using satellite data simulators together with FCDRs for climate model evaluation was encouraged.

CEOS/CGMS WG Climate Update

Jörg Schulz (EUMETSAT), WGClimate Chair

Formal presentation skipped due to lack of time.

Status of ECV Inventory

Alexandra Nunes (Hamtec Consulting Ltd. c/o EUMETSAT)

Alexandra Nunes briefly presented the structure and status of the ECV Inventory, as well as the planned schedule of activities for 2019. The current contents of the inventory per domain (Atmosphere, Land, Ocean) and per ECV were also described, highlighting some existing gaps in the population, and the importance of the verification process. Discussion of this item was held together with the following one in the agenda.

Gap analysis past and future

Jörg Schulz (EUMETSAT), WGClimate Chair & Alexandra Nunes (Hamtec Consulting Ltd.), EUMETSAT WGClimate Support Team

Jörg Schulz gave a short presentation on the approach followed for the gap analysis exercise of 2017/18 and its main outcomes, linking those to the draft plan for the upcoming 2019 gap analysis exercise. WCRP showed its interest in the ECV Inventory, providing positive feedback and offering to help promoting the initiative. Jörg suggested that some WCRP groups could support to the gap analysis process. One possibility of connecting the ECV Inventory with scientific data set quality assessments as done by GEWEX (e.g. for water vapour CDRs) was also discussed, with a first step being the addition of links to the WCRP assessment reports from the ECV Inventory for those CDRs that participated in assessment activities (Action **WGClimate10-15**). Jean-Noël Thépaut pointed out that using exclusively the GCOS as a framework for the gap analysis (for what concerns requirements) could be limiting, and also that input from users could provide information on perceived gaps vs. missed opportunities. For instance, even though some available data might have not been used to produce an SST CDR, is there the need for more SST CDRs? Jörg emphasised that different applications could benefit from data that has not yet been used to produce CDRs, but that an analysis of usefulness is required before a new CDR is recommended. In particular for SST the WGClimate Coordinated Action Plan contains several of such assessment actions, e.g., for geostationary data.

Susann Tegtmeier asked whether Ozone is part of the upcoming gap analysis, considering it a priority ECV. Jörg clarified that the resources involved in the detailed gap analysis (workload and expertise) limit the scope of the activity, and that, together with an

analysis of the latest GCOS-IP listed actions, mostly determined the set of ECVs targeted in 2019. He added that Ozone is not currently being considered for the 2019 gap analysis.

7 ECV Inventory Gap Analysis Organisation

Jörg Schulz (EUMETSAT), WGClimate Chair

Registration of ECV Inventory CDRs in the CEOS International Directory Network (IDN)

Mirko Albani (ESA), CEOS WGISS Chair

Mirko Albani presented the CEOS IDN project and how its data collection could benefit from the ECV Inventory initiative, namely by the identification of CDRs that are missing from the IDN database (not exclusively devoted to CDRs), and by the use of some overlapping information already contained in the ECV Inventory.

The discussion that followed was focussed on the possibilities of integration of part of the IDN questionnaire into the one supporting the ECV Inventory, and concern over differences in scope and potential disadvantages for the ECV Inventory project in overloading its pool of contributors with extra workload – not needed for the purposes of the original goal. The discussion focussed on to find a way forward that satisfies the needs of both WGClimate and WGISS.

It was agreed that the IDN support team will analyse the published version 2.0 of the ECV Inventory and make a proposal to the WGClimate by mid-April identifying the possible contribution from the existing information and the “delta” needed to fulfil their needs (Action **WGClimate10-16**). Jörg Schulz clarified that for the current update phase of the ECV Inventory, it is not possible to make any additions to the questionnaire to fulfil IDN information needs, and Alexandra Nunes added that a question was nonetheless reformulated asking the Responders whether their CDRs are registered in IDN, noting that the feedback received on that question is not encouraging. Mark Dowell suggested that an analysis of the response would allow for a more informed decision on further steps. Mark added that the IDN database does not seem to be very familiar to most ECV Inventory Responders, and the results of such a question may lead to the simple identification of a gap, to be then reported to CEOS. It was decided that the discussion on this topic needs to continue, also in light of the input to be received from the CEOS IDN Team, regarding their needs and in light of a usage of external metadata bases for further automating the population of the ECV Inventory (Action **WGClimate10-17**). The overall opinion was that synergies between the ECV Inventory and other external databases should be further assessed, with the focus on reducing the workload asked from the ECV Inventory Responders. This could develop into a new joint activity of WGClimate and WGISS.

Gap Analysis 2019 Organisation

Alexandra Nunes (Hamtec Consulting Ltd. c/o EUMETSAT)

Alexandra Nunes presented a proposal for the organisation of the gap analysis for 2019: scope, approach, and tentative schedule. Alexandra briefly described the contents of the ECV Inventory, highlighting current gaps and newly addressed ECV products, and emphasising that all figures are still provisional, with changes expected to occur during the verification process. The agreed plan was to keep the basic approach from last year's gap analysis exercise (detection of absolute gaps and gaps in time, and assessment of contents of the ECV Inventory against GCOS criteria for CDRs addressing GCOS ECV Products).

A set of 13 ECVs distributed across the Atmosphere, Land and Ocean domains (Aerosols, Lightning, Surface winds, Upper-air winds, Water vapour (UT/LS), Fire, Land Cover, Soil moisture, FAPAR, Glaciers, Sea level, Sea state, and Ocean-surface heat-flux) was selected according to issues specifically mentioned in the GCOS IP 2016. This set will be the object of a detailed gap analysis, including the analysis of the current and future availability of measurements. Jörg Schulz, Wenying Su, Simon Pinnock, and Jeff Privette volunteered to cover (and / or involve other agency experts in) the activities concerning the selected set of ECVs, and it was agreed that small teams will be established for each ECV during the next 2 months (Action **WGClimate10-18**). In case of insufficient resources regarding expertise and availability, the analysis of some of the selected ECVs needs to be postponed.

Regarding the assessment of all individual CDRs against the GCOS criteria, Jörg suggested that the teams from the previous exercise should be kept as much as possible, to build on their experience, but that some members would need to be replaced due to changing availability or work circumstances. In light of the expected workload per domain and time frame for this activity, Alexandra and Jörg will analyse the perceived needs and seek confirmation from the members of the previous teams, in order to fill any identified gaps (Action **WGClimate10-19**).

Details on the best approach to revisit the set of ECVs analysed in the previous gap analysis exercise and its inclusion in the 2019 report will be further discussed with the gap analysis teams. The timeline of the process is mainly dictated by the needs for presentation and endorsement of results to the CEOS and CGMS Plenaries. The 2019 Gap Analysis Report will need to be ready for submission to the 33rd CEOS Plenary (14-16 October 2019) in mid-September, i.e. shortly after the WGClimate #11 (tentatively scheduled for early September). Preliminary results should be presented to this year's CGMS Plenary (CGMS-47, May 2019) – with the endorsement of the Gap Analysis Report taking place only in next year's Plenary or by written procedure.

8 Agency presentations

Jörg Schulz (EUMETSAT), WGClimate Chair

It was agreed to skip the agencies' presentations due to lack of time. The presentations prepared by the WGClimate members are available on the meeting web page.

9 climatemonitoring.info and Summary and Actions

Jörg Schulz (EUMETSAT), WGClimate Chair

Evolution of climatemonitoring.info

Jörg Schulz (EUMETSAT), WGClimate Chair & All

(This item was moved to Day 3) A discussion was held on the future of the climatemonitoring.info web page that provides public access to the ECV Inventory. Robert Husband suggested that the baseline content should be the one coming from the CEOS Climate brochure, and Jörg clarified that this content is actually on the webpage, but is not interactive as was intended to be.

It was agreed that the website does not look overly attractive, and the approach should be more focussed: e.g. for the ECV Inventory, an explanation on why it was done, etc. Robert also asked whether the badge-less approach referred by Mark Dowell earlier during the meeting was somehow related to the URL. Simon Pinnock informed that he had registered the domains wgclimate.org and wgclimate.info, in case they would be of use for the group. He also asked whether the reformulation of the website would be more focussed on appearance rather than contents. To which Jörg clarified that both aspects need to be worked on. Jeff Privette suggested that the ECV Inventory should be definitely highlighted, and Robert agreed that the Responders deserve that their effort is given visibility. Selma Cherchali and Jeff Privette agreed to propose a vision for the website, to be discussed during the next WGClimate meeting, with inputs from Simon and Robert (Action **WGClimate10-20**).

Review of Minutes and Actions, Concluding Remarks

Jörg Schulz, WGClimate Chair (EUMETSAT)

Jörg Schulz verbally summarised the main outcomes from every session of the agenda, with focus on pending issues and resulting actions. He further informed the Group that Alexandra Nunes will draft the minutes of the meeting, which will be distributed to the participants for feedback. All the presentations of the meeting, together with the agenda and the final version of the minutes, will be made publicly available on the WGClimate webpages on the CEOS website (<http://ceos.org/meetings/wgclimate-10/>), and the participants will be informed by e-mail (Action **WGClimate10-21**).

Jörg thanked everybody for the active participation and interesting discussions in a very fruitful meeting, and adjourned the meeting wishing all safe travels.

Actions

| Action | Description | Responsible | Due date |
|-----------------------|---|--|--------------------------------|
| WGClimate10-1 | Define the exact time and location of the WGClimate #11, to be held in Alaska in the days preceding the CEOS 2019 SIT Technical Workshop | Jörg Schulz | 15.05.2019 |
| WGClimate10-2 | Add discussion of “badgeless approach” for WGClimate to WGClimate #11 agenda | Jörg Schulz | 31.08.2019 |
| WGClimate10-3 | Propose Albrecht von Bargaen (DLR) as new Vice Chair for WGClimate to CEOS and CGMS. Assess the possibility of an early written approval by CEOS (or endorsement at the CEOS-SIT-34) of the nominated Vice-Chair of the WGClimate | Jörg Schulz | 01.06.2019 |
| WGClimate10-4 | Incorporate in the CDR and FCDR definitions documents the results from the discussion at WGClimate #11, and add and introductory section explaining the history and context | Chris Merchant, Jeff Privette | 31.07.2019 |
| WGClimate10-5 | Consolidate the already existing inputs to the GHG Monitoring Activities roadmap from the different groups into a draft document to be presented by WGClimate Chair to CGMS-47 | Mark Dowell, Albrecht von Bargaen, Jörg Schulz | 20.05.2019 |
| WGClimate10-6 | Finalise the roadmap for the GHG Monitoring Activities, with timeline and indication of needed additional resources, to be presented to the 33 rd CEOS Plenary | Mark Dowell, Albrecht von Bargaen | WGClimate #11 (September 2019) |
| WGClimate10-7 | Distribute to the meeting participants the latest version of the document concerning the progress made on the implementation of the architecture for climate monitoring from space | Jörg Schulz | 25.03.2019 |
| WGClimate10-8 | Send feedback to Jörg Schulz and Werner Balogh regarding the document to be submitted to the WMO Congress | All | 27.03.2019 |
| WGClimate10-9 | Incorporate the inputs from the WGClimate members into the document for the 18 th WMO Congress, distribute for information and last-minute feedback, and submit to the WMO Congress | Werner Balogh | 01.04.2019 |
| WGClimate10-10 | Inform the WGClimate of the exact time and location of the side event to be organised during the 18 th WMO Congress | Werner Balogh | ASAP |
| WGClimate10-11 | Inform the WGClimate (via the Chair) of the outcome of the proposal to the CGMS-47 Plenary concerning the future of SCOPE-CM | Jeff Privette | 15.06.2019 |

| Action | Description | Responsible | Due date |
|-----------------------|--|---|---------------|
| WGClimate10-12 | Confirmation of availability of resources within WMO to lead and publish a report on case studies illustrating the use of climate data records in climate applications | Werner Balogh | WGClimate #11 |
| WGClimate10-13 | Pre-selection of case studies to be part of the case studies report | Simon Pinnock, Selma Cherchali, All | WGClimate #11 |
| WGClimate10-14 | Report on potential set-up for an Obs4MIPs workshop in 2020/21 addressing the use of satellite CDRs in CMIP-6. | Jörg Schulz, Jean-Noël Thepaut | WGClimate #11 |
| WGClimate10-15 | Assess and, if feasible, implement links to GEWEX assessment reports for CDRs in ECV Inventory | Alexandra Nunes | WGClimate #11 |
| WGClimate10-16 | Provide the WGClimate with an assessment of the information for the CEOS IDN database that could be harvested from the existing contents of the ECV Inventory and the additional related input needed to fulfil the CEOS IDN needs | Mirko Albani | 30.04.2019 |
| WGClimate10-17 | Discuss and decide on the approach to be followed with respect to the use of external metadata bases for the ECV Inventory population and for the provision of information to the CEOS IDN database | WGClimate | WGClimate #11 |
| WGClimate10-18 | Finalisation of the 2019 Gap Analysis ECVs Teams (for the detailed analysis) | Jörg Schulz, Wenying Su, Simon Pinnock, Jeff Privette | 31.05.2019 |
| WGClimate10-19 | Consolidate the 2019 Gap Analysis Domains Teams (GCOS Criteria assessment) | Alexandra Nunes, Jörg Schulz | 10.05.2019 |
| WGClimate10-20 | Propose a consolidated vision for the evolution of the climatemonitoring.info website | Jeff Privette, Selma Cherchali, Robert Husband, Simon Pinnock | WGClimate #11 |

Annex A. Attendees²

Mirko Albani (ESA) – Chair of WGISS

Werner Balogh (WMO)

Bojan Bojkov (EUMETSAT) - CGMS GSICS & Chair of the CEOS WGCV-ACSG

Selma Cherchali (CNES) – Director the SCO Program

David Crisp (NASA) - Expert for CEOS AC-VC

Mark Dowell (EC) - CEOS Coordinator for the Implementation of the Strategy for Carbon Observations

Steven Hosford (ESA/CNES) - CEOS Executive Officer

Robert Husband (EUMETSAT)

Toshiyuki Kurino (WMO)

Akihiko Kuze (JAXA) – Vice-Chair of the CEOS WGCV

Pascal Lecomte (ESA)

Chris Merchant (UKSA)

Alexandra Nunes, ECV Inventory Support Team (Hamtec Consulting Ltd. c/o EUMETSAT)

Simon Pinnock (ESA)

Jeff Privette (NOAA) – Chair of SCOPE-CM Executive Panel

Joachim Saalmüller (EUMETSAT)

Jörg Schulz (EUMETSAT) – Chair of the WGClimate

Eunha Sohn (KMA)

Wenying Su (NASA)

Ben Veihelmann, Co-Chair of the CEOS AC-VC (ESA)

Albrecht von Barga (DLR)

Ken Holmlund, Co-Chair of the GCOS AOPC (EUMETSAT)

Joanna Post (UNFCCC)

Joint Session WGClimate & WCRP-DAC

Jean-Noël Thépaut (ECMWF, Chair WCRP-DAC)

Michel Rixen (WMO, WCRP)

Susann Tegtmeier (IFM-GEOMAR, Vice Chair WCRP-DAC)

Christian Kummerow (Colorado State University, WCRP-DAC)

Dorothea Bakker (University of East Anglia, WCRP-DAC)

Andrea Storto (CMRE, WCRP-DAC)

² People in bold font are the agency representatives in the WGClimate.

Annex B. Agenda

10th Meeting of Joint CEOS/CGMS Working Group on Climate

Es Saadi Hotel, Marrakech, Morocco

Preliminary Agenda of the Meeting

Day 1: Tuesday 19th March 2019

1. Introduction and Context

| | |
|---------------|---------------------------------------|
| 14:00 – 14:10 | Welcome (Jörg Schulz) |
| 14:10 – 14:20 | Round table introduction (All) |
| 14:20 – 14:30 | Acceptance of Agenda (Jörg Schulz) |
| 14:30 – 15:00 | Status of Working Group (Jörg Schulz) |

2. Nomination of new Vice Chair

| | |
|---------------|---|
| 15:00 – 15:15 | Candidate(s) introduction and decision on recommendation to CEOS and CGMS (Jörg Schulz) |
|---------------|---|

3. Data Record Definitions

| | |
|---------------|---|
| 15:15 – 15:30 | Introduction on FCDR, CDR, ICDR (Chris Merchant) |
| 15:30 – 15:45 | Importance to produce ICDR for climate extreme monitoring in operation (Toshiyuki Kurino) |
| 15:45 – 16:15 | Discussion and eventual endorsement of proposals |
| 16:15 | Coffee break and move to Plenary for GCOS Summary |

Day 2: Wednesday 20th March 2019

4. GHG Monitoring

| | |
|---------------|---|
| 08:30 – 10:00 | <ul style="list-style-type: none"> • CEOS/CGMS status on GHG monitoring (Mark Dowell, David Crisp) • Lessons learned from a-decade long GOSAT observations (Akihiko Kuze) • Activities of the CEOS AC-VC (Ben Veihelmann, David Crisp) • Activities of CEOS WG CV Atmospheric Composition Subgroup and CGMS GSICS (Bojan Bojkov) • Towards an operational GHG monitoring system (Bojan Bojkov) |
| 10:00 – 10:30 | Coffee Break |
| 10:30 – 12:00 | <ul style="list-style-type: none"> • Towards a roadmap for GHG monitoring (Mark Dowell) • Organisation of GHG monitoring work in WGClimate (Jörg Schulz) • Discussion and Decision for Plenary Action CEOS-32-05 for CEOS-SIT (Jörg Schulz) |
| 12:00 - 14:00 | Lunch |

5. WMO Congress, Initiatives and Case Studies

| | |
|---------------|--|
| 14:00 – 14:45 | <ul style="list-style-type: none"> • Resolution for 18th WMO Congress on Architecture for climate monitoring from Space (Werner Balogh) • WMO Congress side event agenda, contributions, who is there (Jörg Schulz and Werner Balogh) |
| 14:45 – 15:15 | Evolution of SCOPE-CM (Jeff Privette) |
| 15:15 – 15:45 | Coffee Break |
| 15:45 – 16:15 | Status of Space Climate Observatory (Selma Cherchali) |
| 16:15 – 17:00 | Discussion on way forward for case studies for the architecture (Jörg Schulz) |

No host Dinner (Place TBD)

Day 3: Thursday 21st March 2019

6. Joint session with WCRP DAC

| | |
|---------------|--|
| 09:00 – 10:30 | <ul style="list-style-type: none"> • Discussion on WCRP strategic priorities (Michel Rixen) • CEOS/CGMS WG Climate Update (Jörg Schulz) • Status of ECV Inventory (Alexandra Nunes) • Gap analysis past and future (Jörg Schulz and Alexandra Nunes) |
|---------------|--|

| | |
|---------------|--------------|
| 10:30 – 11:00 | Coffee Break |
|---------------|--------------|

7. ECV Inventory Gap Analysis Organisation

| | |
|---------------|---|
| 11:00 – 11:30 | Registration of ECV Inventory CDRs in the CEOS International Directory Network (IDN) (Mirko Albani) |
| 11:30 – 12:30 | Gap Analysis 2019 Organisation (Alexandra Nunes) <ul style="list-style-type: none"> • Main targets (comparison to ECV 2.0, new ECVs, GCOS actions, ...) • Process and timeline • Commitments |
| 12:30 – 14:00 | Lunch |

8. Agency presentations

| | |
|---------------|--------------|
| 14:00 – 15:30 | 4 talks |
| 15:30 – 16:00 | Coffee Break |
| 16:00 – 17:00 | 3 talks |

Day 4: Friday 22nd March 2019

9. **Climatemonitoring.info and Summary and Actions**

| | |
|---------------|---|
| 09:00 – 10:00 | Evolution of climatemonitoring.info (Jörg Schulz) |
| 10:00 – 11:00 | Review of Minutes and Actions, Concluding Remarks (Jörg Schulz) |

ADJOURN!