MINUTES OF THE 32nd CEOS PLENARY

17-18 October 2018
Brussels, Belgium

Executive Summary

1. The National Institute of Environmental Research, Republic of Korea (NIER) and United Arab Emirates Space Agency (UAESA) were accepted as the newest Member Agencies of CEOS.
2. Plenary endorsed the *'Statement reporting on progress by the Committee on Earth Observation Satellites (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) on Coordinated Response to UNFCCC Needs for Global Observations'* for submission to SBSTA 49/COP 24.
3. Plenary endorsed the way forward proposed by the CEOS-CGMS WGClimate for the succession planning of its Chairmanship: to advertise the opening for a new Vice Chair, who will hold the position for one year instead of two, before transitioning into the Chair position. Jörg Schulz (EUMETSAT, WGClimate Chair) will hold the Chair position for an additional year. This approach has been agreed to provide leadership stability.
4. CEOS Plenary endorsed the report *'A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space.'*
5. Plenary confirmed CEOS interest in continuing collaboration with CGMS through a specific task in WGClimate on GHG monitoring, with dedicated resources and activities based on the mapping table of the actions identified in the Way Forward chapter of the report *'A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space.'* Plenary also endorsed the revision of the Terms of Reference of the WGClimate to accommodate these changes.
6. Oversight of the five themes of the FDA-AHT was assigned to permanent CEOS entities, with support to be provided by the CEOS Chair and SIT Chair. The FDA-AHT proposed that critical FDA work efforts continue through a high-level CEOS Work Plan element that LSI-VC, WGISS, and the SEO can each align their activities with – ensuring the future continuity of the FDA theme within CEOS, beyond the currently identified tasks. With this, Plenary decided to conclude the activity of the FDA-AHT.
7. The SIT Vice Chair will prepare a discussion paper to help formulate a broad CEOS Analysis Ready Data (ARD) strategy.
8. CEOS prepared a short Analysis Ready Data (ARD) statement before the end of the Plenary with the following components: a succinct definition of ARD; a top-level summary of CEOS ARD accomplishments to date; a high-level sketch of plans for the next two years; and, subject matter expert points of contact in CEOS.
9. Plenary confirmed Akihiko Kuze of JAXA as the new WGCV Vice Chair and expressed great appreciation for the efforts of Kurt Thome of NASA as the outgoing WGCV Chair. Cindy Ong (CSIRO) assumed the role of WGCV Chair.
10. Plenary endorsed the Training Calendar Implementation Plan proposed by the WGCapD.
11. Plenary renewed the AHT mandate for the SDCG for GFOI and for the CEOS *Ad Hoc* Working Group on GEOGLAM for 1 year – noting the intention for a SIT-34 discussion on organisational structure with the LSI-VC.
12. LSI-VC will draft a plan forward for the proposed merger of SDCG for GFOI and the CEOS *Ad Hoc* Working Group on GEOGLAM into LSI-VC. This plan would address the discussions and concerns raised at the CEOS Plenary meeting.
13. Plenary renewed the SDG-AHT for one year – with an action on the SDG-AHT Co-Leads to bring a proposal to SIT-34 on the organisational aspects (regarding the possible creation of a permanent CEOS Working Group on SDGs).
14. The SIT Chair proposed CEOS develop a predictable and documented approach to Virtual Constellation leadership – with leadership rotation at varying timescales and fixed terms, not term limits, of the choice of the Co-Leads. Organisations or individuals would not be prohibited from serving for multiple terms. Instead, CEOS could consider a process that introduces a routine review of leadership and level of engagement, as well as recommitment from Agencies. Each VC will be asked to consider and present a proposed approach for their Constellation at SIT-34.
15. The SIT Chair will develop agenda items for discussion at SIT-34, proposal at SIT TW, and recommendation(s) for decision at CEOS Plenary 33 on various CEOS governance, processes, and organisational issues (see page 27-28).
16. It was reaffirmed that ISRO will assume the role of CEOS Chair in 2020.
17. The Vietnam Academy of Science and Technology (VAST) Vietnam National Space Center (VNSC) assumed the role of CEOS Chair for 2019.

Wednesday October 17th

Session 1: Core Business

CEOS Chair Introduction

Philippe Brunet (COM, 2018 CEOS Chair) welcomed everyone to the 32nd CEOS Plenary and Brussels. He noted the focus of the 2018 CEOS chairmanship on Big Data and greenhouse gas monitoring, and said the European Commission's team looked forward to sharing the progress made throughout their term as CEOS Chair. Philippe then initiated a *tour de table*.

CEOS Membership Issues

Steven Hosford (ESA/CNES, CEO) presented a brief overview related to CEOS membership. He reviewed the current status, rights, and obligations associated with CEOS membership. In particular, he noted that CEOS Agencies must inform CEOS leadership of any changes to their status in regard to eligibility, in accordance with the CEOS Terms of Reference.

CEOS-32-01	CEOS Executive Officer to contact all CEOS Members and Associates regarding their membership status and participation in CEOS (active/inactive).	**December 2018**

Two entities that had submitted applications for CEOS membership, the National Institute of Environmental Research of the Republic of Korea, and the United Arab Emirates Space Agency (UAESA), were each invited to make a presentation on their space programs.

National Institute of Environmental Research, Republic of Korea

Jaehoon Jeong (NIER) presented background on NIER and its potential contributions to CEOS. NIER will launch the GEMS mission in the 2019 to 2020 timeframe and have a 10-year projected lifespan. A greenhouse gas satellite is planned for launch in the 2025 timeframe, and GEMS-II for launch in the 2029 timeframe. NIER hopes to work with CEOS Agencies on calibration and validation and on data access standards, among other topics. They would like to explore formation-flying options through engagement with AC-VC.

United Arab Emirates Space Agency (UAESA)

Fatima AlAydaroos (UAESA) presented an overview of the UAESA, which was established in 2014. UAESA places an emphasis on international collaboration; it is already a member of GEO and other multilateral groups: and it has undertaken bilateral efforts with many CEOS Agencies already. They have seven satellites in orbit, with four more on the way. Open data access is a priority for UAESA, as are future data architectures and platforms for space data analysis.

Discussion and Decisions

Steve Volz (NOAA, SIT Chair) supported the NIER application, noting the good fit, especially in the context of their new satellite and activities within AC-VC. Josef Aschbacher (ESA) also supported the nomination. Mike Freilich (NASA) supported the application, noting GEMS in particular, as well as their strong field campaigns.

Steve Volz (NOAA, SIT Chair), Josef Aschbacher (ESA), Raj Kumar (ISRO) and Juliette Lambin (CNES) supported the UAESA nomination.

Decision 01	The National Institute of Environmental Research, Republic of Korea (NIER) and United Arab Emirates Space Agency (UAESA) were accepted as the newest Member Agencies of CEOS.

Action Status

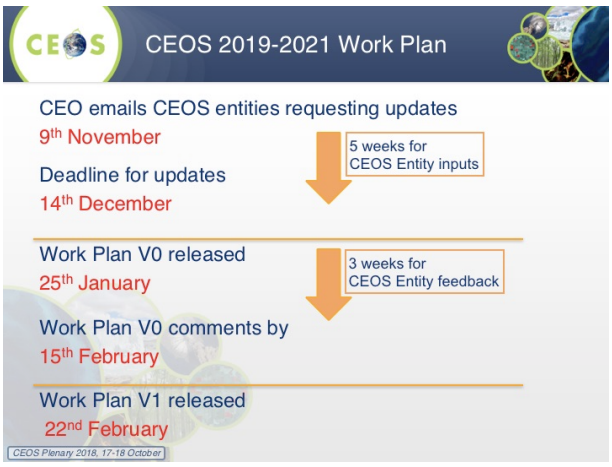
Steven Hosford (ESA/CNES, CEO) reviewed the status of actions from the 2017 CEOS Plenary, from SIT-33, and from the 2018 SIT Technical Workshop (currently in draft status).

Gilberto Câmara (GEO SEC Director) acknowledged the action (SITTW-2018-04) regarding the nomination of a member of WGISS to the GEO Expert Advisory Group (EAG). The EAG is advising GEO on the future of GEOSS. The GEO Secretariat welcomes the inclusion of a WGISS member in this group. Steve Volz (NOAA, SIT Chair) noted that this was raised at the SIT Technical Workshop, however more time is needed to ensure the necessary consultation before the nomination can be made. This action will be closed as soon as possible.

CEOS Three-Year Work Plan Annual Update Schedule & CEOS Work Plan Progress Report

Steven Hosford (ESA/CNES, CEO) presented an overview of progress on the annual review of the ongoing implementation of the CEOS 2018-2020 Work Plan. Updated information from task leads has been provided for 93% of tasks; 69% are complete/on-track, and 23% have been delayed. 62% of the tasks are due to be completed in 2018. Steven highlighted the need for improved due date and resource estimates, as delaying task due dates is a common occurrence.

The next revision of the Work Plan will place an emphasis on improving work traceability by better defining the *who, what, and when* of tasks. Links from the CEOS Work Plan to the GEO Work Programme will be explicitly included. The new Work Plan will also welcome agency-driven top-down task requests where these have been "adopted" by CEOS entities. The www.ceos-deliverables.org website will be overhauled to support these improvements. Steven presented the timeline for development of the 2019-2021 CEOS Work Plan:



Mike Freilich (NASA) suggested reducing the first deadline for CEOS Entity inputs to something like 10 days. A five-week period causes people to file and forget requests. Ivan Petiteville (ESA) highlighted the statistic that showed around 40% of the tasks due in 2018 were delayed, and noted that this is an unexpectedly high figure. He suggested a further analysis into why this is occurring. The discussion recommended examining and better tracking of which CEOS entities and activities are behind schedule; is it that the reporting is late, but the activities are on schedule; do some activities lack sufficient agency

involvement; is CEOS taking on new activities that are affecting its capacity to deliver on some existing commitments, etc.

Steve Volz (NOAA, SIT Chair) urged CEOS Principals to be aware of these delays, and assign appropriate resources to the teams responsible for the tasks to ensure that they will progress as planned.

Josef Aschbacher (ESA) suggested that CEOS needs a more flexible, dynamic, and proactive mechanism for dealing with tasks that fall behind schedule. Steve Volz commended Steven Hosford's CEOS Work Plan Progress Report, which goes some way towards achieving this.

Action **SITTW-2018-06** is closed.

Session 2: Climate

CEOS-CGMS WGClimate

Jörg Schulz (EUMETSAT, WGClimate Chair) presented the Space Agency Statement to COP 24/SBSTA 49 (for endorsement), the Statement of Space Agency Contributions in Support of Each Article of the Paris Agreement (for information), and a proposed solution to leadership continuity for the CEOS-CGMS WGClimate. Plenary was asked to endorse the statement to SBSTA 49 and asked to close CEOS Plenary action **31-01** calling for the statement of contributions to the Paris Agreement – which will be published on the CEOS and www.climatemonitoring.info websites. Jörg also reviewed the progress of the ECV Inventory, gap analysis, and the Coordinated Action Plan.

Regarding the WGClimate Vice Chair: USGS is unable to continue in the role. The proposed way forward is to announce the vacancy for a new Vice Chair, who will serve in the role for the remainder of the current Vice Chair term which is one year, and then transition into the role of WGClimate Chair in November 2020. In the interest of leadership continuity, Jörg proposed to serve as WGClimate Chair for an additional year.

Mark Dowell (COM, CEOS Chair Team) thanked Jörg for his effort on the response to **CEOS-31-01**, noting that it is a useful and unique document.

Josef Aschbacher (ESA) commended the CEOS-CGMS WGClimate on their work. ESA endorsed the proposed leadership succession strategy. Josef also recommended a public-facing/decision-maker version of the Statement of Space Agency Contributions in Support of Each Article of the Paris Agreement and further promotion and re-use of the CEOS EO Handbook developed for COP 21. Josef offered the support of the ESA Graphic Bureau to prepare the public-facing/decision-maker version.

CEOS-32-02	WGClimate to develop a 'decision-maker' version of the *Statement of Space Agency Contributions in Support of Each Article of the Paris Agreement*.	**February 2019**

Jenn Lacey, the USGS Principal for CEOS, thanked Jörg and the CEOS-CGMS WGClimate for their flexibility regarding the leadership of the Working Group.

Decision 02	Plenary endorses the *'Statement reporting on progress by the Committee on Earth Observation Satellites (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) on Coordinated Response to UNFCCC Needs for Global Observations'* for submission to SBSTA 49/COP 24.
Decision 03	Plenary endorses the way forward proposed by the CEOS-CGMS WGClimate for the succession planning of its Chairmanship.

Space Climate Observatory Update and Discussion

Juliette Lambin (CNES) presented an update on the Space Climate Observatory (SCO). The SCO seeks to provide States and the scientific community with space data necessary for monitoring the health of our planet. She noted that CNES has already invited European space agencies to participate. This initiative is currently supported by China, India, Russia, Mexico, Morocco, and the United Arab Emirates.

Mark Dowell (COM, CEOS Chair Team) presented the proposed follow up from the SCO side discussion at CEOS Plenary. The conclusions of the discussion were:

1. Recommend that the SCO team review the available documents addressing how Earth observations address the Paris Agreement Articles, from: CEOS, GCOS, and GEO; governance should then be consistent with the potential role of space agencies.
2. CEOS will send a letter to CNES suggesting the approach required for CEOS to consider information on the SCO, its scope, and relevance to existing activities.

Items suggested for inclusion in the CEOS letter to CNES/SCO:

- Description should be consistent with internationally agreed terminology, context, and structure (e.g., IPCC WG 1, 2, 3 & GCOS, SBSTA relations);
- Space agency contributions (added-value) should be clearly identified – especially if emphasis is placed on the local adaptation scale issues, where socio-economic and other data are critical;
- SCO should take advantage of existing tried-and-tested approaches for space agency engagement (i.e., statement of requirements (e.g., for adaptation));
- A stable set of objectives should be identified for the mid-term (5 years);
- A near-term (2 year) timeline should be identified for implementation.

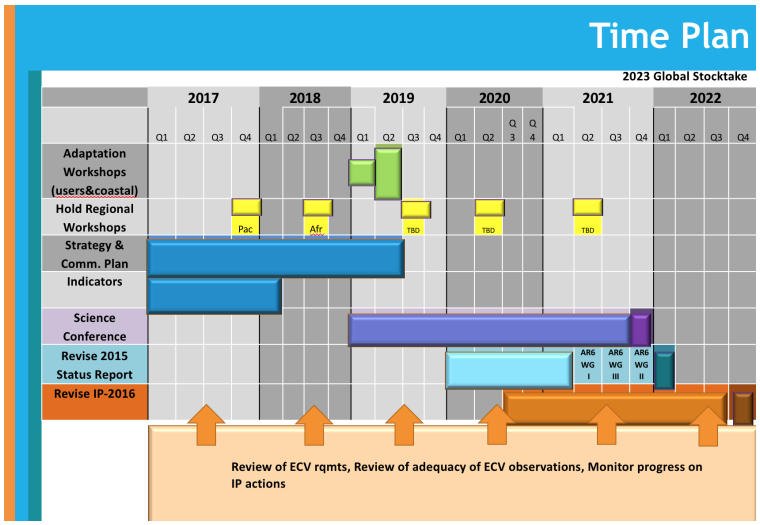
Mark also noted that Jörg Schulz (EUMETSAT, WGClimate Chair) has been nominated as the CEOS representative to the SCO (Action **SIT 33-07**).

CEOS-32-03	SIT Chair to lead the drafting of a CEOS letter to CNES suggesting the approach required for CEOS to consider information on the SCO, its scope, and relevance to existing activities.	**December 2018**

Jonathon Ross (GA, SIT Vice Chair Team) thanked France for raising the profile of the need for more effort on information for adaptation at regional and local levels. Australia will be continuing discussions with France on efforts in the South Pacific. Australia also welcomes the proposal communicated in Brisbane last week that the SCO would be put forward into the GEO structure. This is key in showing how France's efforts are complementary to the global structures we are all committed to.

Global Climate Observing System (GCOS) Report

Carolin Richter (WMO/GCOS) reported an update on the Global Climate Observing System (GCOS). The schedule of GCOS activities through to the 2023 Global Stocktake was shared:



GCOS will submit to COP 24/SBSTA 49 a paper: *Systematic Observations and the Paris Agreement*. A workshop is planned for 6-7 February 2019 at WMO on *Use of Space-based ECVs for Climate Adaptation*. The new GCOS Strategy is being considered by the partners before its final adoption.

Session 4: Agency and Partner Updates

These items were brought forward in the agenda to accommodate speaker availability.

GEO Update

Gilberto Câmara (GEO SEC Director) provided an update on GEO activities. Gilberto spoke about the paradigm shift toward cloud-based data and analysis solutions, noting Google Earth Engine, Open Data Cube, and the changing expectations of users. He noted GEO's recent 1.5M USD grant from Amazon Web Services for ten 'global-south' projects. He recognised GEO's necessary role in sharing reusable science and data. GEOSS is being reconfigured with the goal of being a trusted, reproducible, and robust source of guidance on the best use of Earth observation data for decision-making. A global *in situ* database is also increasingly important, and Gilberto noted the example of machine learning's dependency on this data.

CEOS-GEO Reporting and GEO-XV Plenary Preparations

GEO Programme Board Report

Kerry Sawyer (NOAA, SIT Chair Team) presented some key outcomes from the GEO Programme Board meeting (in which CEOS participates as a GEO Participating Organisation) such as:

- The request to respective governments to ensure updates of Earth observations in reporting of commitments to the Paris Agreement, the UN Sendai Framework for Disaster Risk Reduction, and the UN 2030 Agenda for Sustainable Development;
- A new *Sustainable Earth Observations* subgroup to focus on both satellite and *in situ* EO resources, and to evaluate strengths and weaknesses of robust observing systems for GEO;
- The Paris Climate Agreement workshop held in June 2018.

GEO Executive Committee (ExCom) Report

Alex Held (CSIRO, SIT Vice Chair) presented a GEO Executive Committee (ExCom) report, on which CEOS serves as an Observer.

CEOS Representation to the GEO-XV Plenary

Steven Hosford (ESA/CNES, CEO) reported on CEOS representation at the upcoming GEO-XV Plenary. The CEOS delegation to the meeting will be: Pham Anh Tuan (VAST-VNSC, 2019 CEOS Chair and Head of Delegation), Kerry Sawyer (NOAA, Alternate Head of Delegation), Steven Hosford, and Brian Killough. The CEOS Statement to GEO-XV Plenary has been distributed, and will be finalised at the end of CEOS Plenary. Final comments were welcomed before the end of the meeting.

Session 3: Carbon

CEOS Carbon Strategy Action Status

Mark Dowell (COM, CEOS Chair Team) has been leading the response to the CEOS Carbon Strategy actions. He presented on the heritage of the response, and the recent engagement of CEOS in the revitalized GEO-C and GHG initiative. He recalled the five actions that CEOS took forward as the first phase of the response to the Strategy, and reviewed in detail the WGISS Carbon Data Portal prototype and the WGCV cal/val and production of biomass products. Updates on the other three actions will be covered in subsequent agenda items.

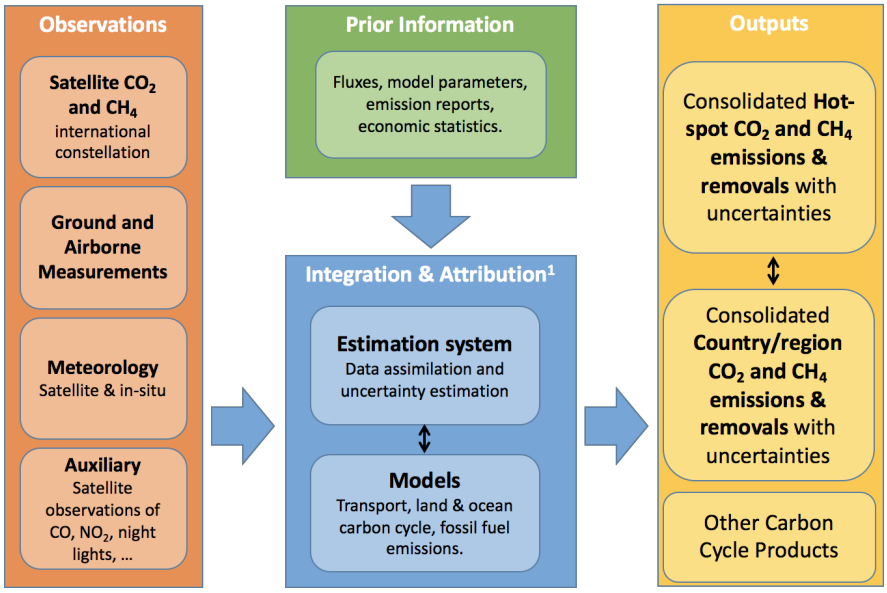
JRC Carbon Workshop & CEOS Chair CO_2 Initiative Report

Mark Dowell (COM, CEOS Chair Team) reported on the European Commission Joint Research Centre Carbon Workshop, which was held in response to the CEOS Chair CO_2 Initiative. The aim of the initiative was to "lay the foundation for an international CO_2 and GHG monitoring system" through three specific activities:

1. Facilitate the completion and follow-on activities of the AC-VC white paper on defining an optimum constellation for CO_2 and GHG monitoring, including the joint competences of CEOS and CGMS, and in the general framework of the continued implementation of the CEOS Carbon Strategy.
2. Advance the relationship with CGMS for an operationally implemented and sustained observation capability. Consider establishing a formal working relationship between CEOS and CGMS as with the successful ongoing relationship on Systematic Observations of ECVs in support of UNFCCC.
3. Place the space segment in the broader context of a fully sustained system for CO_2 monitoring. Individual CEOS Agencies have counterparts in their individual countries/regions who have responsibility for Inventories, the required modelling, *in situ* infrastructure and the ground segment elements.

The workshop was held in response to item 3, and sought to extract and document best practices on interactions between CEOS Members/Associates, and counterparts working on the modelling, *in situ*, and inventory aspects. The full minutes from the workshop are available here (closes Action **SITTW-2018-02**). It was agreed that a system approach is required to address the needs/requirements, which are:

- Helping countries improve their estimates of CO_2 and CH_4 emissions and removals in support of their Nationally Determined Contributions (NDCs) under the Paris Agreement; and,
- Providing an additional mechanism for validating the consistency between reported emissions and output from the system.



CEOS AC-VC White Paper – Architecture for Monitoring Carbon Dioxide and Methane from Space

David Crisp (NASA) reported remotely on the AC-VC White Paper. The CEOS Chair commissioned the Atmospheric Composition Virtual Constellation (AC-VC) to define the key characteristics of a global architecture for monitoring atmospheric CO_2 and CH_4 concentrations and their natural and anthropogenic fluxes from instruments on space-based platforms to: reduce uncertainty of national emission inventory reporting; identify additional emission reduction opportunities and provide nations with timely and quantified guidance on progress towards their emission reduction strategies and pledges (Nationally Determined Contributions, NDCs); and, to track changes in the natural carbon cycle caused by human activities (deforestation, degradation of ecosystems, fire) and climate change (drought, temperature stress, melting permafrost and changes in ocean thermal structure and dynamics).

The following proposed CEOS Actions were brought to the CEOS Plenary for disposition:

1. Link the atmospheric GHG measurement and modelling communities and stakeholders in the national inventory and policy communities (through UNFCCC/SBSTA) to refine requirements;
2. Exploit the capabilities of the CEOS and CGMS member agencies and the WMO Integrated Global Greenhouse Gas Information System (IG^3IS) to integrate surface and airborne measurements of CO_2 and CH_4 with those from available and planned space-based sensors to develop a prototype, global atmospheric CO_2 and CH_4 flux product in time to support inventory builders in their development of GHG emission inventories for the 2023 Global Stocktake; and,
3. Use the lessons learned from this prototype product to facilitate the implementation of a complete, operational, space-based constellation architecture with the capabilities needed to quantify atmospheric CO_2 and CH_4 concentrations that can serve as a complementary system for estimating NDCs in time to support the 2028 Global Stocktake.

The AC-VC GHG White Paper has been completed and closes CEOS Work Plan task CARB-12.

AC-VC will continue to support GHG constellation development and synergistic GHG and atmospheric composition observations and modelling efforts – led by David Crisp.

The CEOS SIT Chair has encouraged the publication of the white paper to facilitate citations and efforts to build on its content. Options are currently being explored.

Decision 04	CEOS Plenary endorsed the report *'A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space.'* It is emphasised that the three-step plan to implement the architecture contained in the paper, as well as the identified activities in the way forward, should be interpreted as recommendations to CEOS Agencies, for their consideration.

2019 IPCC Guidelines for National Greenhouse Gas Inventories

Osamu Ochiai (JAXA) presented the background and progress of the effort to include increased references to EO in the 2019 revision of the IPCC Guidelines for National Greenhouse Gas Inventories. References to satellite EO have been included in Volume 1, Chapter 6, with small chapters and subheadings related to satellite observation added, and satellite retrievals are recognised for their ability to cover large areas of the atmospheric column.

The Final Government Distribution (FGD) review period is 14 January – 10 March 2019. While only governments may submit comments, JAXA will coordinate suggested CEOS Agency inputs, so that agencies might submit coordinated feedback via their governments.

Update on CEOS Contributions to Forest Carbon Monitoring (GFOI/SDCG)

Osamu Ochiai (JAXA, CEOS Lead for GFOI) presented an update on the activities of GFOI. The Global Forest Observations Initiative (GFOI) has been a GEO Flagship since 2014, and it is currently working to define its Phase 2, which was approved earlier this year. Likewise, the Space Data Coordination Group for the Global Forest Observations Initiative (SDCG/GFOI) is defining its own contribution to GFOI Phase 2.

Stephen Ward (CEOS Alternate Lead for GFOI) reported that the following priorities have been identified by SDCG for GFOI Phase 2 and the CEOS role:

- Biomass
  - Accelerating the policy relevance of new data streams.
  - L-band SAR constellation.
  - Mission and application team engagement.
  - WGCV/LPV coordination.
- World Bank cooperation.
- New Early Warning module.
- Tools and services emphasis.
- Analysis Ready Data engagement with LSI-VC.
- New R&D programme based on user needs and donor funding.
- Closer integration of CEOS's GFOI work with the relevant mission and application teams in CEOS Agencies – providing a more effective framework for cooperation.

The way forward for CEOS engagement with GFOI depends on whether a critical mass of agencies exists to continue a stand-alone group (such as SDCG or some evolution of it). With the renewed engagement of USGS (as a Co-Lead), an improved secretariat funding outlook, and refreshing agency engagement and

coordination around the biomass theme, SDCG asks for a final year of operation from CEOS Plenary, and supports the recommendation from the September joint meeting with LSI-VC and GEOGLAM to further continue the merger with LSI-VC and establish SDCG as a Forestry subgroup (to be covered under item 6.8 and 6.9).

Alex Held (CSIRO, SIT Vice Chair) indicated that CSIRO, as a partner in NovaSAR, is willing to provide data on an R&D basis in support of the SDCG/GFOI biomass effort. He also suggested that CEOS could contribute data for the VAST-VNSC CEOS Chair initiative for 2019, perhaps for demonstration of the utility of the GFOI MGD in the context of the forest pilot that they are proposing.

Steve Volz (NOAA, SIT Chair) questioned whether CEOS should get involved in the GEO-GFOI dialogue on the matter of where the initiative is administered. Josef Aschbacher (ESA) and Jonathon Ross (GA) both agreed it is best for CEOS to remain neutral and not get involved in the debate.

Mark Dowell (COM, CEOS Chair Team) suggested that it would be good to identify external interfaces for the biomass effort, including preparing materials for a future SBSTA as to the CEOS and GFOI efforts on remotely-sensed biomass estimates.

CEOS-32-04	SDCG to explore a supplementary information paper for the SBSTA 51 CEOS submission – on forest biomass measurements from space.	**August 2019**

Ivan Petiteville (ESA) noted that it has been suggested to Gilberto Câmara (GEO SEC Director) that a meeting between the GEO, GFOI Leads, and MGD Advisory Group may be helpful.

Stephen Briggs (GCOS) stressed the importance of GFOI to GCOS. He added that the direction of GFOI is a matter for its donors/investors and not for the Secretariat of GEO – which has a facilitator role but not ownership of GEO initiatives.

Proposed Way Forward for CEOS on GHG Observations

Mark Dowell (COM, CEOS Chair Team) presented. Regarding advancing the relationship with CGMS for an operationally implemented and sustained observation capability for CO_2 and GHG monitoring, following initial discussions at CGMS Plenary and the 2018 SIT Technical Workshop, the following are proposed:

- Create a well-identified task within WGClimate addressing GHG monitoring (action WGClimate to decide how this would be implemented, by SIT-34).
- WGClimate to detail a roadmap based on activities from the AC-VC white paper and the outputs from the JRC GHG workshop (draft by SIT-34).
- WGClimate to establish appropriate links and cross-representation with AC-VC and the WGCV Atmospheric Composition subgroup.
- Relevant CEOS Agencies to dedicate appropriate resources.
- The task would also include the existing coordination layer for the CEOS Carbon Strategy.
- Update the WGClimate terms of reference (to also be confirmed by CGMS).

Mark clarified that the timeline is from now until SIT-34 (April 2019) and confirmed that Action **SIT 33-12** is closed.

Alain Ratier (EUMETSAT) confirmed the process is consistent with that discussed by CGMS.

Jörg Schulz (EUMETSAT, WGClimate Chair) reported that more time is needed to prepare the roadmap, hence the target of SIT-34.

AC-VC will work with CEOS and CGMS to implement a (new) CO_2/CH_4 focus within WGClimate, using their existing interfaces with GCOS, WMO, IPCC, and UNFCCC. Mark Dowell has agreed to lead this activity.

Decision 05	Plenary confirmed CEOS interest in continuing collaboration with CGMS through a specific task in WGClimate on GHG monitoring, with dedicated resources and activities based on the mapping table of the actions identified in the Way Forward chapter of the report *'A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space.'* Plenary also endorsed the revision of the Terms of Reference of the WGClimate to accommodate these changes.	
CEOS-32-05	WGClimate to report on internal implementation for the way forward on CEOS-CGMS coordination on GHG monitoring, including a roadmap based on the mapping of the GHG report recommendations and the JRC workshop conclusions.	**SIT-34**

Session 4: Agency and Partner Updates (Continued)

Agency and Partner Updates

UNOOSA	Luc St-Pierre reported on UNOOSA's work, activities, contribution to Sustainable Development Goal 17, and UNISPACE+50 and the four Space 2030 pillars.
GGOS	Richard Gross reported on geodesy and the Terrestrial Reference Frame, and its implications for other applications. The challenge for GGOS is to continue to provide the Terrestrial Reference Frame of improved accuracy and stability in a sustainable manner. CEOS can support GGOS: with open data policies, by advocating for satellite Earth observations, and by extension, the TRF needed to analyse the observations, and by promoting the importance of geodetic data and products for the Sustainable Development Goals.
WIGOS Vision 2040	Fernando Belda reported on the WMO Integrated Global Observing System (WIGOS), which aims to provide a solid and well-documented observational basis for all services in the areas of weather, climate, and water; acquired in a manner that is as cost-efficient as possible. The WIGOS Vision 2040 will serve as a reference for WMO Members and other observing system operators, providing context and expected boundary conditions relevant for observing system developments, and informs the long-term planning of satellite agencies about the expected evolution of WMO user requirements.
FAO	Doug Muchoney reported on FAO and its Geospatial Unit (CBDS), which covers climate change, land resources, agriculture monitoring and agro-ecology, ecosystem and biodiversity monitoring, and disaster risk management. He covered the Global Agro-Ecological Zones (GAEZ) Data Portal; the Land Cover Classification System; Land Resources Information Management System (LRIMS); national mapping efforts; and FAO support to REDD+, including through GFOI.
USGS	Jenn Lacey presented the operational status for both Landsat 7 and Landsat 8. Landsat 9 mission development with NASA is proceeding well. The Landsat Advisory Group (LAG) report on cost

	sharing models for Landsat data is expected in December 2019; no changes are expected to the data policy. The Sustainable Land Imaging (SLI) Architecture Study Team (AST) recommendation report is expected to be delivered in August 2019. Jenn also reviewed the latest with respect to the Landsat Collections.
NOAA	Steve Volz presented. NOAA priorities are set by U.S. National Essential Functions. The NESDIS Strategic Plan covers: continuity, observations, and information; architecture and gap analyses; and collaborations. CEOS benefits for NOAA: 1. CEOS constellation planning and focus on common data formats and standards across multiple measurement types makes sharing possible. 2. CEOS shared databases provide accurate current understanding of the global observing system. 3. CEOS constellation projections and gap analyses point to what is planned, what is needed, and what is possible. 4. CEOS Agency leadership sharing of plans allows for long range shared observations.
CSA	Éric Laliberté presented on the Radarsat Constellation Mission (RCM). Éric highlighted the possibility of sharing spare capacity in support of CEOS collaborations. Éric presented an overview of the RCM data policy, and noted that the expected coverage of RCM will be communicated soon.
NASA	Mike Freilich presented. NASA has 18 on-orbit research missions (excluding cubesats). All data is free and open. 20+ further missions are funded and planned for launch by 2023. GEDI will launch in November 2018 and OCO-3 in February 2019. NASA, USGS, ESA/EC are studying a Sustainable Land Imaging concept. NASA is exploring novel observing system architectures.
UKSA	Catherine Mealing-Jones reported. Catherine noted UKSA is considering the CEOS Chair role in the 2023 timeframe. Beth Greenaway spoke about UK contributions to CEOS, including contributions to the Working Groups, Virtual Constellations; Data Cube and ARD projects; and the Space Data Coordination Group for GFOI. Beth also noted NovaSAR, and UK contributions to SWOT, IASI-NG, and MicroCarb. Beth suggested that perhaps the greatest challenge CEOS could help meet is how to embed the same rigour and standards to missions funded and managed in the new commercial space era in a way that does not hinder new and evolving business models. This will ensure the data is just as trusted and useful for science and public policy evidence and business applications as it is today.
NRSCC / NSMC-CMA / CRESDA	Songmei Zhang presented an overview of the Chinese agencies participating in CEOS (NRSCC, CRESDA, NSMC, CAST) and their respective roles; an update on the Chinese EO satellite portfolio, covering some recently launched missions in detail; and some information on ground infrastructure and data. Chinese agencies are represented in most of the CEOS Working Groups and also GEO activities (GEOSS, GEOGLAM). Songmei closed by noting that China is willing to expand participation in CEOS to promote the application of remote sensing technology, and hopes that the CEOS Working Groups will attract more Chinese institutions and experts and carry out workshops and training courses on data standardization and quality control in China.
ISRO	Raj Kumar reported on ISRO's current and upcoming missions, in particular: Resourcesat Sampler, Resourcesat-3/3A, RISAT-1A, NISAR, OCEANSAT-3/3A, GISAT-1, Cartosat-3, and HRSAT-1. Raj also reviewed ISRO's ground segment, including their cal/val initiatives and data dissemination and analytics web portals.
JAXA	Naoto Matsuura presented JAXA's past, current and future satellite/sensor activities. National security, disaster risk management, and climate change are the priorities of Japan's Earth

	observation programme. Naoto showed some examples of EO data use for disaster response. A summary of output products for climate change was shown. GOSAT-2 is expected to launch on October 29, and the AMSR-2 follow-on mission is expected to be on GOSAT-3.
KMA	Geun Hyeok Ryu presented an update on GEO-KOMPSAT-2A (scheduled to be launched on the 5th of December 2018). GK-2A will provide full disk images over the Asia-Pacific every 10 minutes, with a couple of smaller areas covered at higher intervals (one of which can be selected dynamically based on user requests). GK-2A/AMI will produce a large number of geophysical products with non-meteorological applications. Geun covered some of these non-meteorological applications in more detail and also covered the specifics regarding data distribution.
Australian EO and Space Initiatives	Alex Held reported on the new Australian Space Agency and its strategic priorities (which includes EO). CSIRO is a partner in the recently launched NovaSAR-1, and will have control over tasking (10% of capacity) and direct data acquisition. Alex also reviewed the Digital Earth Australia Data Cube platform, contributions to ground validation activities, and the SDG-focused Pacific Island EO Platform.
EUMETSAT	Alain Ratier presented on the current EUMETSAT portfolio, including the upcoming launch of Metop-C and the commissioning of Sentinel-3B (flight operations handover to EUMETSAT expected by November 24). EUMETSAT are also collaborating with partners on data access platform pathfinders, including the Copernicus DIAS (through WEkEO).
ESA	Josef Aschbacher reported on the recent/upcoming launches of Sentinel-3B, Aeolus, and Metop-C; ESA's science, Copernicus, and meteorology EO portfolio (26 under development, 14 in operation); the latest Sentinel data access statistics; the Copernicus 2.0 priorities currently being studied; and ESA's ϕ-lab for disruptive EO technology.
DLR	Klaus Schmidt presented the *German EO Strategy Roadmap to Sustainable Services* and the latest on German EO missions, including the future X-Band SAR mission which will provide continuity of TerraSAR-X and TanDEM-X observations. Klaus also noted some key upcoming EO events in Germany. DLR's contributions to WGClimate, WGCapD, WGDisasters, and GFOI were also presented.
CNES	Juliette Lambin presented the CNES EO missions, and focused on Venμs and CFOSAT (China-France Oceanography Satellite, October 29 launch planned) in particular. The Earth System Research Infrastructure was also covered, along with CNES priorities for 2018-2019.
COM	Mauro Facchini reported on behalf of Philippe Brunet on the EU Space Strategy and the status of the Copernicus space component. He also presented the Commission's views on the benefits of engaging with CEOS, which include: networking and establishing international partnerships; establishing roadmaps for implementing coordinated observing systems; gathering and consolidating observational requirements from global initiatives (GEO, UN bodies, etc.); showcasing Copernicus assets through thematic WGs and AHTs; CEOS standards and methods for data pre-processing, dissemination, interoperability, and harmonisation; and quality control work (cal/val). Mauro noted the Copernicus Data and Information Access Services (DIAS) and closed with a summary of Copernicus space component evolution.
NSO	Joost Carpay reported on Netherlands activities in EO. He covered the NSO EO strategy and noted some of their priorities, which include: exploitation of OMI and TROPOMI; contributing to institutional/scientific climate and air quality research; broadening the use of space in Earth sciences; exploring the possibilities for small instruments (for air quality, water quality/water

	management, agriculture); spectrometers, hyperspectral imagers, and spectropolarimeters. CEOS aids NSO in linking space capabilities/results with policy, validating priorities and requirements, fostering cooperation with larger agencies, and the definition of ground segments.
SANSA	Andiswa Mlisa presented SANSA's strategic framework and EO priorities, and also their responses to user requirements and the Africa Developmental Agenda. CEOS supports SANSA's scientific exchange (e.g., through participation in SST-VC, WGCapD, WGISS) and strengthens partnerships. CEOS activities around Analysis Ready Data, Future Data Architectures and Open Data Cube influence their data infrastructure development.
ROSCOSMOS	Aleksandr Chunosov reported on the Russian Earth observation satellite constellation and information relay and services, in particular the Digital Earth concept – a cloud-based unified information space of EO data and products. He also spoke about the Federal EO data fund, which will help ROSCOSMOS better provide archived Russian EO data. ROSCOSMOS jointly with Brazil, India, China, and South Africa plan to establish the United BRICS EO Constellation. The task of this constellation is the application of EO data for peaceful purposes and strengthening of international cooperation in the space sphere in order to respond to global climate change, to protect the environment, to forecast and prevent disasters as well as manage mitigation, and to solve other global tasks with modern space technologies. Aleksandr also summarised ROSCOSMOS engagement in the CEOS Working Groups, International Charter on Space and Major Disasters, International Society for Digital Earth (ISDE), and the International Society for Photogrammetry and Remote Sensing (ISPRS).

Thursday October 18th

Session 5: EO Data Access, Delivery, and Interoperability

CEOS Future Data Architectures (FDA) Strategy and Activity Continuity

Nicolaus Hanowski (ESA, FDA-AHT Co-Lead) reviewed progress on the five FDA themes since the 2017 CEOS Plenary, and presented the following recommendations for each:

Analysis Ready Data (ARD): Oversight of ARD activities should be delegated to the CEOS LSI-VC, in close coordination with WGISS. LSI-VC to assure continued visibility in the CEOS context, and integration of New Space actors.

Data Cubes: Continued oversight of these activities by the CEOS Data Cube (CDC) coordination team, and assure continued visibility in the CEOS context.

EO Platforms: Assist standardisation and assure continued visibility in the CEOS context.

User Metrics Resource Inventory: Oversight of all User Metrics and EO Resource Inventory tasks should be delegated to WGISS. Assure continued visibility in the CEOS context.

Data Analytics: Task WGISS to identify perimeter and mechanisms to be applied to the Data Analytics tasks. Assure continued visibility in the CEOS context.

The FDA *Ad Hoc* Team proposes to terminate their mandate at the 32nd CEOS Plenary. The team proposes to maintain the focus on FDA through WG/VC activities as described above, with support by the CEOS Chair and SIT Chair. The FDA-AHT proposes that critical FDA work efforts continue through a high-level CEOS Work Plan element that LSI-VC, WGISS, and the SEO can each align their activities with – ensuring the future continuity of the FDA theme within CEOS, beyond the currently identified tasks.

Josef Aschbacher (ESA) noted the importance of the five different work areas, in particular because of their impact on increasing the use of data. Josef is keen to see further progress in these areas, in particular around ARD and interoperability, citing its potential impact for end users.

Steve Volz (NOAA, SIT Chair) congratulated the FDA-AHT for reaching a clear conclusion, with the delegation of tasks to the permanent CEOS structures.

WGISS – Activity Status Report

Mirko Albani (ESA, WGISS Chair) presented an update on the activities of the Working Group:

- Data Preservation and Stewardship: The Data Stewardship Best Practices Document Tree is recommended for application.
- Data Discovery and Access: IDN/CWIC/FedEO components provide a single entry point for external clients to discover and access CEOS Agencies' data (including for GEO, ESA EOPortal, CEOS COVE Tool, CEOS Carbon Portal, ECV Inventory, etc.). Agencies are asked to work with WGISS to register their data sets.
- Interoperability and Use: WGISS is supporting the FDA-AHT priorities, running FDA workshops, has developed the WGISS Carbon Community Portal, and wrote the EO Data Usage Best Practices and Federated Identity Management (SSO) white papers.
- Technology Exploration: WGISS has been running webinars and promoting the awareness of FDAs.

Mirko noted that a CEOS Agency nomination for the role of WGISS Vice Chair is still needed. The commitment would be for four years; the nominee would be WGISS Vice Chair for the term from October

2019 to October 2021, and then serve as WGISS Chair for the two-year term from October 2021 – October 2023.

WGISS-46 will be hosted by DLR in Oberpfaffenhofen, Germany (22-25 October 2018), and a CEOS/GEO FDA and Interoperability workshop will be held at the meeting.

CEOS Analysis Ready Data for Land (CARD4L) Status Report

Steve Labahn (USGS, LSI-VC Co-Lead) presented an update on CARD4L on behalf of the LSI-VC and his Co-Leads: Susanne Mecklenburg (ESA) and Adam Lewis (GA). He noted the following headline updates (see slides for full details):

CARD4L Specifications / Assessment

- Agreed near-term and annual process for updating the CARD4L Product Family Specifications (PFS).
- Reviewed plan for further Synthetic Aperture Radar PFS (backscatter, polarimetric, and interferometric)
- Agreed a WGCV peer review process for CARD4L product assessments.

Strategy / Promotion

- Agreed that a broader CEOS ARD strategy is needed. The SIT Vice Chair is adopting this topic (see agenda item 5.4).
- Refining the CARD4L information notes, and will prepare a CARD4L communication package.
- Progressing the CARD4L stocktake and will publish this information on the CEOS ARD website.

Organisation

- Identified that key overlaps exist between SDCG for GFOI, GEOGLAM, and LSI-VC on CARD4L pilots and user community links.

Steve also presented some overall thoughts on ARD that were gathered by the CEOS SEO, through their experience with data users:

- ARD is no longer just a desire of global users. It is now becoming a requirement and an expectation.
- Most global users (not scientists or commercial groups) do not desire, nor feel comfortable, making their own ARD. They want it to be provided.
- Growing interest exists in radar data, but few users understand its benefits or know how to use this data.
- CEOS can do more to make it easier for global users to have access to and use ARD.

Broader CEOS ARD Strategy

Alex Held (CSIRO, SIT Vice Chair) noted that the ARD concept started a few years ago, and CSIRO, USGS, and now COM have asked CEOS to continue it. Alex thanked LSI-VC for making great progress on the CARD4L Specifications. Alex asked for CEOS Plenary reflections on the ARD progress to date. He was interested to hear thoughts around the production of ARD compliant products, and where we should go in the future. He noted his plan to pursue the expansion of the ARD concept to other thematic areas during his term as SIT Chair. A discussion followed:

- Mike Freilich (NASA) summarised the two questions for CEOS Plenary: Does CEOS want to expand the ARD standards/refine them in any way to accommodate other types of data? Also, do people want to propose their products as candidates for CARD4L assessment?
- Stephen Ward (CEOS Chair Team) noted that he wrote a paper on a broader ARD strategy to stimulate discussion. Agencies need to take stock of what data they've got, and also demonstrate the value of and demand for ARD. He noted that USGS is seeing a 3:1 demand for ARD versus standard products, which is great evidence of the need to make changes to the way agencies present data to users.
- Andiswa Mlisa (SANSA) noted that substantial progress and adoption of ARD has been made in the commercial sector/GIS companies.
- Steve Labahn (USGS, LSI-VC Co-Lead) noted the forthcoming Landsat Collection 2 data, which will be CARD4L-compliant ARD. The priority of Collection 2 is to provide users with easier to use data and also facilitate interoperability with Sentinel-2. CARD4L is a stepping stone to fully interoperable data. USGS is hoping to generate Collection 2 on a global basis by late 2019, and they would like to work with other agencies that are keen to be involved in this interoperability effort.
- Ivan Petiteville (ESA) reported that ESA is convinced that ARD is a good strategy for enabling more users. He noted that 6-7 people from ESA are engaged in the CEOS ARD and interoperability work. The systematic Sentinel-2 Level-2A surface reflectance products present a great opportunity for interoperability.
- Brian Killough (NASA, SEO) cautioned against diluting the effort on ARD by expanding outside of the CARD4L scope too quickly. He noted the enormous demand for radar ARD products from non-expert users, and he suggested that these initial SAR ARD products be perfected first.
- Steve Volz (NOAA, SIT Chair) thinks that given the high value of other ARD products, delaying the expansion from CARD4L would be a bad move. Like Mike Freilich, Steve would like to see CEOS undertake an assessment of the applicability of the ARD concept to other domains. This is a top-level, top-down task that would be very helpful. Overall, Steve supported the idea of a broader ARD strategy for CEOS.
- Mark Dowell (COM, CEOS Chair Team) noted the Copernicus Global Land Service Level-2A data. The first global mosaic of Sentinel-2 surface reflectance will be available by next year.
- Nicolaus Hanowski (ESA, FDA-AHT Co-Lead) noted the importance of interoperable products. These products maintain the greatest level of fidelity (compared to merged harmonised products), making their utility much higher.
- Jenn Lacey (USGS) reported that LSI-VC shared a package of information with other VCs to get their assessment on the applicability of the CARD4L concept to their domain. She noted that not much feedback was received, and maybe following this up could serve as a good point to restart this dialogue.
- Alex Held noted that the SIT Vice Chair will prepare an updated paper on a broader CEOS ARD strategy, and will circulate it to everyone well in advance of SIT-34, in accordance with Action **SITTW-2018-05**, which has now been superseded by the following Plenary Action.

CEOS-32-06	SIT Vice Chair to prepare a discussion paper to: 1) help formulate a broad CEOS Analysis Ready Data (ARD) Strategy; and 2) confer with CEOS Virtual Constellations ahead of the April 2019 SIT-34 meeting to enable them to report on their perspectives for pursuing CEOS ARD in their domains.	**SIT-34**

CEOS Data Cube and FDA Pilot Status Report

Brian Killough (NASA, SEO) reported on the Open Data Cube (ODC) and explained the various CEOS Data Cube implementations, which aim to maximise the impact of CEOS satellite data with a focus on developing countries. There are over 49 implementations worldwide, with 9 of these considered operational. The Africa Regional Data Cube (ARDC) was launched in May 2018 for 5 countries (Kenya, Tanzania, Sierra Leone, Senegal, Ghana). It is initially based on Landsat ARD, with Sentinel-1, Sentinel-2, and ALOS support coming soon. The ARDC is supported by Amazon (donated cloud services) and the Global Partnership for Sustainable Development Data (training).

Digital Earth Africa is a newly proposed GEO initiative to develop a full-continent EO program based on the Open Data Cube. The effort is led by Stuart Minchin (GA) and Steven Ramage (GEO). A new Steering Committee has been formed to serve as an advisory body to provide inputs and recommendations on institutional arrangements, stakeholder engagement, and implementation plans. The Steering Committee includes representatives from GA (lead), GEO, World Economic Forum (WEF), SANSA, and CEOS. Brian Killough is the CEOS representative on the Steering Committee. He has relevant experience with the Africa Regional Data Cube (ARDC), which is seen as a prototype to Digital Earth Africa. This role is active through the end of 2019 and is supported by NASA management.

Brian presented some further thoughts on ARD, from a Data Cube perspective:

- The Data Cube pilots are an ideal way to prove the benefits of ARD.
- Data Cube pilots are a great place to demonstrate open source radar algorithms on ARD.

Brian closed by presenting the way forward for 2019, which includes supporting the new CEOS Chair (VAST-VNSC) initiative promoting the use of CEOS ARD in the Mekong Delta region using the Open Data Cube.

Ivan Petiteville (ESA) congratulated Brian and the SEO team on their progress. Ivan noted the Digital Earth Africa representation, and suggested using the opportunity of having Brian in this role to promote other CEOS capabilities, including ARD, WGCapD/capacity building activities, etc.

Doug Muchoney (FAO) asked whether the Data Cube is being leveraged in regard to Land Degradation Neutrality (LDN). Doug Cripe (GEO SEC) noted that the Data Cube solutions to LDN assessment needs at the national and regional levels would be an essential component of the data analytics working group that formed part of the LDN Initiative implementation. Data Cubes also featured as a key point of discussion during last week's EO for Pacific Island Nations workshop, held in Brisbane, Australia, that covered a range of environmental and policy issues facing island nations, including monitoring and reporting on SDGs. Marc Paganini (ESA) stressed the need to be as inclusive as possible regarding data analysis solutions for LDN.

Simona Zoffoli (ASI, WGDisasters Chair) encouraged Brian to consider possible disaster pilot activities that could be pursued in collaboration with WGDisasters.

Mike Freilich (NASA) noted the strong portfolio of activities around Analysis Ready Data, Future Data Architectures, etc. He further noted that the term "analysis ready data" lends itself to different interpretations in the absence of a definition that CEOS could agree to use for consistency of communication within the organisation, with stakeholders, and others. Given that it is a very productive and positive area of work for CEOS, he challenged CEOS to prepare a short statement before the end of the Plenary with the following components:

1. Succinct definition of Analysis Ready Data (ARD);
2. Top-level summary of CEOS ARD accomplishments to date;
3. High-level sketch of plans for the next two years; and,
4. Subject matter expert points of contact in CEOS.

The SIT Chair and SIT Vice Chair agreed to take on the action. The resulting slides were presented by Steve Volz (NOAA, SIT Chair) during Session 8.

CEOS-32-07	SIT Chair and SIT Vice Chair to collaborate on an interim paper, as a communication tool for use by CEOS Agency and stakeholder representatives, that clearly articulates: 1) a succinct definition of ARD; 2) a brief summary of our ARD accomplishments to date; 3) a brief overview of existing plans for the next two years; and 4) the designated points of contact within CEOS.	**November 2018**

Mark Dowell (COM, CEOS Chair Team) noted that Brian's Digital Earth Africa role presents an opportunity to look for potential new CEOS Agency contributions, as suggested earlier by Ivan. He suggested establishing an informal brainstorming group to pursue this.

CEOS-32-08	NASA SEO to confer with the CEOS Chair to establish a small brainstorming group to explore possible CEOS Agency contributions to the Digital Earth Africa initiative.	**November 2018**

Proposed Way Forward on the GEO-LEO Initiative

Chuck Wooldridge (NOAA, SIT Chair Team) presented the background of the GEO-LEO Initiative, noting its origin in the CSIRO CEOS Chair Non-meteorological Applications for Next Generation Geostationary Satellites Study in 2016. The SIT Chair has a priority of enhancing the utility of new observations from the next generation of geostationary satellites and exploring the development of GEO-LEO combination products and data processing capabilities. At SIT-33 two actions were taken to progress the activity: develop a proposal with appropriate CEOS entities for a GEO-LEO application case study using CARD4L and multiple datasets, and for the SIT Chair to identify CEOS Agency participants for the GEO-LEO flood mapping inter-comparison studies with CGMS.

Kevin Gallo (NOAA/NESDIS) has prepared a land application case study: *Multi Sensor Monitoring of Vegetation Condition*. This is a prototype using data over eastern Montana from Landsat OLI, Terra and Aqua MODIS, Sentinel-2 MSI, Suomi-NPP VIIRS, and GOES-16 ABI, with *in situ* networks. The next steps are:

1. Consider extending the prototype to 20 days to allow for comparisons of greenness change.
2. The VCs and WGs are requested to consider their respective contributions (e.g., additional data/products) for the next step (a formal proposal as requested in response to SIT-33 action 14).
3. Coordinate with CSIRO and other CEOS Members to consider other case studies in regions of interest.
4. Suggest a CARD4L data format.

VCs will be surveyed on other possible GEO-LEO blended products of interest.

CEOS-32-09	NOAA and CSIRO, in consultation with LSI-VC, to explore additional case studies related to the GEO-LEO initiative.	**SIT-34**

Flood Monitoring Pilot Study

Flood monitoring products are being developed experimentally from VIIRS and ABI by NOAA and provided to NWS, FEMA, and other partners. A pilot study has been initiated by NESDIS and CMA under CGMS. Participating agencies process flood maps with their own algorithms and use their own data for intercomparison. Seven flood cases are under consideration. CEOS is asked to consider possible contributions and additional data sources (e.g., SAR).

CEOS-32-10	NOAA to coordinate with WGDisasters and WGCapD to further develop ideas around the GEO-LEO flood-monitoring initiative with CGMS.	**SIT-34**

Alex Held (CSIRO, SIT Vice Chair) indicated his desire to continue the GEO-LEO work under his SIT Chair term. He suggested leveraging past work with KMA, and also looking at using the Mekong Delta for a GEO-LEO application case study, perhaps in collaboration with WGDisasters.

Steve Volz (NOAA, SIT Chair) noted the need to find a home for this activity in the future within the permanent structures of CEOS.

Session 6: Working Groups, Virtual Constellations, and *Ad Hoc* Teams

WGCV Report

Kurt Thome (NASA, WGCV Chair) presented the WGCV report. He highlighted key activities from the 2018-2020 CEOS Work Plan; updates related to ACIX, RADCALNET, Carbon, and WGCV subgroups; and interactions with other entities:

- The Radiometric Calibration Network (RADCALNET) is complete. The RadCalNet Portal was opened on July 24, 2018.
- The ACIX II intercomparison of atmospheric correction models is complete, and a summary report is on the CEOS cal/val portal. The CMIX (cloud masking, based on the ACIX example) deadline has been adjusted to Q2 2020.

- WGCV continues its close collaboration with GSICS, and is also working with IOCCG on ocean colour cal/val, participating in LSI-VC teleconferences (regarding CARD4L assessment in particular) and continues to hold combined meetings with WGISS.
- Biomass validation protocols are underway within the Land Product Validation subgroup. An initial set of protocols is planned by the end of 2018, and more formal documentation in 2019. Connection of this work to SDCG-GFOI and the policy community is being discussed.

Decision 06	Plenary confirmed Akihiko Kuze of JAXA as the new WGCV Vice Chair and expressed great appreciation for the efforts of Kurt Thome of NASA as the outgoing WGCV Chair.

Naoto Matsuura (JAXA) noted Akihiko Kuze's work on GOSAT, and conducting cal/val for the mission with NASA. He supported Kuze-san's nomination.

Mark Dowell (COM, CEOS Chair Team) thanked Kurt for his efforts and commended the increased links between WGCV and internal and external groups, which make this a truly cross-cutting WG.

WGCapD Report

Prakash Chauhan (ISRO, WGCapD Chair) presented updates on the Working Group's CEOS Work Plan tasks, including training in conjunction with the 2018 AfriGEOSS Symposium and AmeriGEOSS Week. He presented the Proposed Implementation of the Training Calendar also used by VLab and WMO Global Campus for CEOS Plenary endorsement. A common training calendar is beneficial as it presents activities on a standardised calendar with consistent information, and allows training participants to be able to more easily find, participate, and learn from training activities to use Earth observations for their needs.

Decision 07	Plenary endorsed the Training Calendar Implementation Plan proposed by the WGCapD.

A candidate for the WGCapD Vice Chair role for the October 2019 – 2021 period, and subsequently the Chair position (2021 – 2023) is yet to be identified. CEOS Agencies are requested to consider nominations for this role.

The 8th WGCapD meeting will be held in Dehradun, India, at the invitation of the WGCapD Chair, at ISRO's Indian Institute of Remote Sensing (March 4-8, 2019).

WGDisasters Report

Simona Zoffoli (ASI, WGDisasters Chair) presented updates on the Working Group's CEOS Work Plan tasks, covering: GEO Initiatives (GSNL, GEODARMA), CEOS DRM activities (Volcano Demonstrator, Seismic Hazard Demonstrator, Recovery Observatory, Landslide Pilot) and cross-cutting activities (GeoHazards Lab):

- Geohazard Supersites and Natural Laboratory, GSNL (GEO): in 2018 CEOS Space Agencies continued to provide data to the GSNL initiative and focused on the review of the reports from the Iceland, Marmara, Etna, Phlegrean Fields, and Vesuvius supersites. On the basis of a positive evaluation, it was decided to continue supporting these sites. The last meeting of the WG allowed face-to-face discussions with three supersite principal investigators, from Democratic Republic of the Congo, Iceland, and Italy. The Virunga supersite in Democratic Republic of the Congo, established at the last CEOS Plenary, is proceeding well under the lead of the Goma Observatory and with a major contribution from Copernicus EMS. In Hawaii, space data provided through GSNL formed a crucial component of the Kilauea eruption response.

- GEODARMA (GEO): the first GEO pilot project (for flooding in Myanmar) has been approved and arrangements are being finalised for data access. Regional assessment work is proceeding in Latin America and the Caribbean and should be completed in early 2019. The second series of pilots for Asia are also advancing and may be ready to move forward in early 2019.
- Volcano Demonstrator (CEOS DRM): work is progressing on defining the implementation strategy to extend the Volcano Pilot approach to other regions, and data is being collected over priority areas.
- Seismic Hazard Demonstrator and Geohazards Labs: the data plan was approved, and the first users are requesting data. Labs activity has been moving forward quickly and a permanent office has been established at BRGM.
- Recovery Observatory (RO): the Haiti RO has reached its halfway point and is viewed by locals as a strong success. Products have been produced for built area recovery, for agriculture, and for forested areas, especially Haiti's largest protected area (Makaya Park) and mangroves along the coast. Efforts are being put in place to reinforce capacity building and ensure a legacy for the RO. The RO team has held a first round of discussions with key international stakeholders (EU, World Bank, UNDP, UNEP) to extend RO experience on a generic basis after major events. A face-to-face meeting will take place in December to take stock of how satellite data is currently used to support recovery, and how this can be improved.
- Landslide Pilot: work is moving forward in Nepal, Africa, and China, with a distinct multi-hazard focus on cascading impacts and risks.

A candidate for the WGDisasters Vice Chair role for the October 2019 – 2021 period, and subsequently the Chair position (2021 – 2023) is yet to be identified. CEOS Agencies are invited and encouraged to consider making nominations for this role. The 11th WGDisasters meeting will be held in Athens at the invitation of Geohazards partner Harokopeion University of Athens (March 5-8, 2019) and WGDisasters-12 will be held in Reykjavik, hosted by the GSNL Iceland Supersite (late September/October 2019).

CEOS *Ad Hoc* Working Group on GEOGLAM (AHWG) Status Update

Brad Doorn (NASA, CEOS *Ad Hoc* Working Group on GEOGLAM Co-Lead) presented on the activities of the AHWG. He covered the history of the GEOGLAM requirements statement and the planned data requirements refresh. The new requirements, which will be presented to CEOS, have been defined based on research and global GEOGLAM activities, the GEOGLAM Requirements Survey (2017-2018), and the Ispra-JRC Requirements Meeting.

In response to growing requirements, an active EO Data Coordination and Management Thematic Coordination Team (TCT) has been established within GEOGLAM. This team is charting next steps on Application Ready Data (ARD+) and Essential Agricultural Variables (EAVs), and undertaking an access and needs assessment for GEOGLAM users.

In 2019, the AHWG will be preparing the CEOS strategic response to GEOGLAM's new requirements. The AHWG has already highlighted the need for latency requirements and traceability/value of requirements; GEOGLAM review and feedback on the "ARD+" plans; and, the need for a full description of the GEOGLAM Essential Agriculture Variable (EAV) concept.

CEOS Plenary will be asked to endorse a one-year extension for the CEOS AHWG on GEOGLAM, in order to prepare the CEOS strategic response to the updated GEOGLAM requirements, and to decide on the way forward for CEOS support of GEOGLAM after the 2019 CEOS Plenary.

Sustainable Development Goals (SDG) *Ad Hoc* Team Report

Marc Paganini (ESA) and Alex Held (CSIRO), Co-Leads of the SDG-AHT, reported on the history of the SDG AHT, its organisation, and meeting history. They noted the AHTs tasks in the CEOS Work Plan and presented some examples of 2018 tangible outputs, which include the CEOS Earth Observation Handbook on SDGs, GEO/CEOS participation at the UN High Level Political Forum 2018, and GEO/CEOS special issues in scientific journals. Marc also highlighted the references to EO data in SDG guidance documents and processes. Alex noted the development of SDG-related products using the Open Data Cube (ODC), highlighting the good overlap of priorities for CEOS.

The alignment and synergies between the AHT's tasks and GEO and the CEOS WGs were presented. The AHT will initiate a CEOS-level assessment/mapping of which VCs/WGs/AHTs are/could address each of the relevant SDG targets/indicators and which VCs/WGs/AHTs are/could address SDG cross-cutting activities and assess the sustainability of their efforts. This is a similar approach to that of the GEO EO4SDG and the GEO thematic initiatives (e.g., GEOGLAM, Aquawatch, Blue Planet, GEO Wetlands, Human Planet Initiative). The AHT will then develop a proposal (with new terms of reference, structure, and execution plan) for post-2019 CEOS engagement on SDGs.

The SDG-AHT Co-Leads invited CEOS Principals to:

- Acknowledge the achievements of the SDG-AHT in 2018 and the recognition of CEOS and its Agencies as key partners on SDGs by the UN system.
- Welcome the GEO/CEOS alignment of activities with respective roles and responsibilities and the efforts of the AHT to involve CEOS structures when appropriate.
- Embrace the decision taken by the AHT to prioritise its activities along the unique role that CEOS should play as a coordination body of the space community efforts.
- Ensure a favourable framework by encouraging CEOS Agencies to actively contribute to the work of the AHT, improving its workforce and achieving the necessary critical mass.
- Encourage the implementation of a *Roadmap from Plenary to Plenary*, to develop the necessary structure, membership, and implementation plan to justify a permanent structure within CEOS.
- Renew the SDG-AHT for one year with the objective of generating consensus around the creation of a permanent CEOS Working Group on SDGs (to be decided at the 33rd CEOS Plenary, October 2019).

Ivan Petiteville (ESA) noted the need for more links with National Statistical Offices (NSOs) and the custodian agencies of the SDG Indicators that could benefit from remote sensing observations. More clarity around exactly what is going to be contributed to each SDG and how feedback from the UN will work is also needed. Alex reported that the SDG-AHT plans to tackle these kinds of issues over the next year. Ivan suggested a need for specific actions, similar to the Carbon Strategy, to guide the work. Ivan noted the mentioned applicability of the Data Cube, and also urged making linkages to the WGs and VCs around this too.

Steve Volz (NOAA, SIT Chair) also noted the need to identify the activities that are going to be done over the next year. The SDG-AHT needs to make connections between CEOS entities and the planned tasks, and prepare a statement of needs and plans, as well as an understanding of how the feedback loop with agencies will work. Steve commended the CEOS-GEOGLAM AHWG approach, and suggested similar for the SDG-AHT.

CEOS-32-11	SDG-AHT Co-Leads are tasked to bring a proposal on the way forward organisationally for the SDG activity within the CEOS structure.	**SIT-34**

Virtual Constellation Issues, Discussion Points, and Decision Processes

Steve Volz (NOAA, SIT Chair) reported on the history of the VCs, and encouraged CEOS to consider whether we are ensuring tangible outcomes from them, as well as sustainable commitment to them. The SIT Chair Team has engaged with VCs and WGs through surveys and teleconferences in 2018. Key themes arising from the VCs were:

- The VCs can bring visibility of thematic areas within organisations;
- The importance of rigorous gap analysis in agency planning processes;
- There is a desire for increased participation from Chinese CEOS Members.

Key themes from the Working Groups were:

- Motivated to integrate their agency assets so that better decisions can be made more efficiently with EO, in particular by promoting collaboration in the development of systems;
- Difficulty in getting a broader connection between the membership and what is happening at the SIT and Plenary levels;
- Proposal for CEOS leadership to participate in a WG meeting in order to provide an "external" point of view;
- WG members tend to be active within specific satellite projects in their agencies. Collaborations with other projects tends to distract from their primary efforts.

Issues arising from the July teleconferences included:

- Whether rotation of VC Co-Leads might increase buy-in from the community and encourage engagement? Or perhaps create the same recurring difficulties in identifying WG leadership?
- Consistency of climate variables and consistency across measurements is a key coordination opportunity for CEOS as a data integrator.

Some key insights from the 2018 VC/WG Day were:

- CEOS should be aware of developments in, and stay engaged with, the commercial sector.
- Consider developing a CEOS Coastal Strategy to enhance coordination across ocean elements and the land/ocean boundary.
- There is the potential to target specific projects (intersection of needs) in coastal and delta zones.
- The issue of prioritisation of the implementation of actions to address GCOS needs vs. ECV Inventory Gap Analysis results.

Steve also presented a summary of the activities of each Virtual Constellation.

Over the past year, the SIT Chair has had lots of engagement from the Virtual Constellations and the Working Groups. Steve thanked all the VC Co-Leads and WG Chairs and Vice Chairs for their thoughtful answers to the questionnaires and to the time spent preparing for and participating in the two sets of tag-

up teleconferences and for the discussion and engagement at SIT-33 and the 2018 SIT Technical Workshop and VC/WG Day.

Ad Hoc Team Life Cycles and the Proposed Way Forward for the Existing _Ad Hoc_ Teams and Operating Principles and Practices of VCs and WGs

Steve Volz (NOAA, SIT Chair) reviewed the history and reason for the existence of the AHTs. The SIT Chair has, as one of its priorities, to reflect and report on the AHT trajectories and lifecycles and to gain a clear understanding of the outlook and evolution of the initiatives, including, if appropriate, long-term, sustained operations and the expectation for CEOS and CEOS Member Agency participation. The current teams and their characteristics were shown:

Team	External Interface	Formed	Report	Internal Links
SDCG for GFOI	GFOI (GEO Flagship)	2011 (before CEOS Governance & Processes doc)	CEOS Chair	LSI-VC & GEOGLAM AHWG (inc joint meetings)
Ad-hoc WG for GEOGLAM	GEOGLAM (GEO Flagship)	2012 (before CEOS Governance & Processes doc)	CEOS Chair	LSI-VC & GEOGLAM AHWG (inc joint meetings)
FDA	-	2015	CEOS Chair	WGISS & LSI-VC
SDGs	GEO, EO4SDGs (GEO Priority)	2016	SIT Chair	EVERYTHING?!

Key findings from the SIT Chair Team's assessment included:

- The AHT mechanism has provided an effective and efficient mechanism to scope and advance new topics for CEOS.
- SDG-AHT has great ambitions, but needs participation and resource commitment.
- The AHWG on GEOGLAM proposed a one-year extension to further coordinate within CEOS and formulate a way forward in the context of potentially becoming part of the LSI-VC.
- SDCG is shaping its role within GFOI Phase 2 and taking stock of Agency participation and support.
- The current annual processes should be adequate for review, provided AHTs deliver resourced plans for renewal.
- CEOS should require transition plans for each AHT when created at CEOS Plenary.

The SIT Chair is proposing CEOS develop a predictable and documented approach to Virtual Constellation leadership – with leadership rotation at varying timescales and fixed terms, not term limits, of the choice of the Co-Leads. Organisations or individuals would not be prohibited from serving for multiple terms. Instead, CEOS could consider a process that introduces a routine review of leadership and level of engagement, as well as recommitment from Agencies. Each VC will be asked to consider and present a proposed approach for their Constellation at SIT-34.

Jenn Lacey (USGS) asked whether the nominations for VC leadership are on a personal or Agency basis. Mike Freilich (NASA), past SIT Chair, remarked that the VCs bring together individuals who are subject matter experts on that basis, rather than Agencies as is the case with the Working Groups for which CEOS Agencies make a four-year commitment in the leadership roles [2 years as Vice Chair followed by 2 years as Chair].

CEOS-32-12	Virtual Constellation Co-Leads to propose at SIT-34: a documented approach to VC leadership that includes a leadership rotation cycle. Each VC has the liberty to propose different time cycles.	**SIT-34**

Recommendation Resulting from the 2018 Annual Joint Meeting – Proposed Way Forward for LSI-VC, SDCG for GFOI, and CEOS-GEOGLAM

Steve Labahn (USGS, LSI-VC Co-Lead) reviewed the history of the SDCG for GFOI, CEOS *Ad Hoc* Working Group on GEOGLAM, and the LSI-VC. Due to the long-term nature of the two AHTs, the need for continual annual approvals, and the potential for efficiency gains with regard to secretariat support, the three teams have discussed options for a long-term and permanent solution for the AHTs.

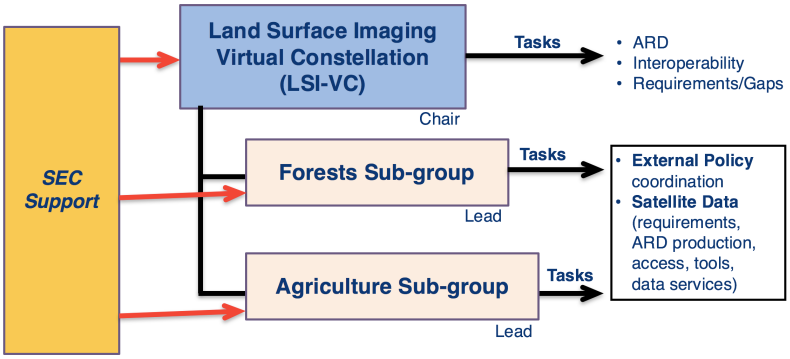
The proposed solution is:

LSI-VC: Maintain existing work (ARD, Interoperability).

SDCG for GFOI: Transition to a new LSI-VC Forests subgroup.

CEOS-GEOGLAM: Transition to a new LSI-VC Agriculture subgroup.

Secretariat support can be leveraged across all groups for operational efficiency.



The following is the proposed timeline for this merging:

SIT TW (September 2018)

- Present proposal for review and comment.

CEOS Plenary (October 2018)

- Request annual renewals for SDCG for GFOI and CEOS-GEOGLAM.
- Review proposal and prepare for a decision to merge groups into LSI-VC with an updated LSI-VC terms of reference to follow.

SIT-34 (April 2019)

- Present a new LSI-VC terms of reference for review.

CEOS Plenary (October 2019)

- Final decision.

Mike Freilich (NASA) expressed concern about burdening the LSI-VC with the inclusion of these two new subgroups. Mark Dowell (COM, CEOS Chair Team) noted that the proposed solution looks more like a WG than a VC. Josef Aschbacher (ESA) was concerned about the organisational overhead of creating new subgroups, rather than just absorbing these activities into the LSI-VC.

Jenn Lacey (USGS) urged CEOS to reach a conclusion on this issue as soon as possible, since a significant amount of time and energy has been spent on these purely organisational matters for these already very successful groups. A conclusion is needed so that these teams can continue their core work uninterrupted.

***Ad Hoc* Team Continuity Decisions**

Steven Hosford (ESA/CNES, CEO) recapped the proposed way forward for each of the AHTs, and the following decisions were made by CEOS Plenary:

Decision 08	Plenary renewed the AHT mandate for the SDCG for GFOI and for the CEOS *Ad Hoc* Working Group on GEOGLAM for 1 year – noting the intention for a SIT-34 discussion on organisational structure with the LSI-VC.	
Decision 09	Plenary renewed the SDG-AHT for one year – with an action on the SDG-AHT Co-Leads to bring a proposal to SIT-34 on the organisational aspects (regarding the possible creation of a permanent CEOS Working Group on SDGs).	
Decision 10	With all constituent tasks now assigned to permanent CEOS entities, Plenary decided to conclude the activity of the FDA-AHT.	
CEOS-32-13	LSI-VC to draft a plan forward for the proposed merger of SDCG for GFOI and the CEOS *Ad Hoc* Working Group on GEOGLAM into LSI-VC. This plan would address the discussions and concerns raised at the CEOS Plenary meeting.	**SIT-34**
CEOS-32-14	Outgoing FDA-AHT Leads to work with the CEOS Executive Officer to ensure that all FDA-AHT tasks are represented in the 2019-2021 CEOS Work Plan, and to provide a brief report to CEOS summarising the disposition of each of the tasks.	**December 2018**

Actions **SITTW-2018-10** and **SITTW-2018-11** are closed.

CEOS Organisational Matters

Steve Volz (NOAA, SIT Chair) presented an overview of CEOS governance and processes. The governing documents, CEOS organisational roles and responsibilities, and decision-making processes were endorsed approximately five years prior, and CEOS should consider if updates are needed to the CEOS structure, operations, and processes in order to address the evolving goals of the organisation. The following potential adjustments to procedures were presented for consideration:

- Define clearer guidelines for the Work Plan development, including:
  - Ensure traceability within the Work Plan (source of request, lead CEOS entity, supporting CEOS and partner entities, expected resources and sponsors, anticipated results/deliveries, etc.).
  - Include opportunity for the integration of Agency-driven top-down requests into relevant CEOS groups and the CEOS Work Plan.
- Improve Work Plan tracking and annual reporting (Agenda Item 1.4).
- Add terms to leadership for all standing CEOS bodies – VCs as well as WGs (Agenda Item 6.7).

- Define the duration/sustainability lifecycle for AHTs (Agenda Item 6.7).
- Improve clarity of CEOS activities (e.g., initiatives which are not showing up in the structure, such as Open Data Cube or CEOS Data Cube).
- Highlight where CEOS Agencies contribute significant resources to day-to-day operations of CEOS (e.g., SEO, MIM Database, CEOS Newsletter, Steering Committee representation).

The following suggestions for greater efficiency in how CEOS functions were also presented:

- Changes the SIT Chair thinks appropriate for discussion at SIT-34, with proposals at the September 2019 SIT Technical Workshop and decisions at the 33rd CEOS Plenary:
  - Governance and Processes:
    - Expand section on requirements for *Ad Hoc* Teams (defined tenure and expectation of desired end-state).
  - Virtual Constellation Process Paper
    - Reflect changes to VC Co-Lead rotation (pending proposal to SIT-34).
  - Terms of Reference
    - SEO and reference to Data Cube CEOS PoC.
- Organisational miscellaneous items (same timeline as above):
  - CEOS Experts
    - Do we need to formalise these positions?
  - CEOS representatives to external steering committees:
    - Committing person from an Agency and not CEOS.
  - Letters to CEOS from external partners asking for commitments:
    - Responses from CEOS Chair, follow-up dictated by the new Initiatives Process Paper.
  - Essential variables

Action **SIT-33-01** is closed.

CEOS-32-15	SIT Chair to develop agenda items for discussion at SIT-34, proposal at SIT TW, and recommendation(s) for decision at CEOS Plenary 33 on: various CEOS governance, processes, and organisational issues.	**CEOS-33**

Session 7: Other CEOS Business

CEOS Missions, Instruments, and Measurements (MIM) Database Report

Ivan Petiteville (ESA) presented an update on the Missions, Instruments, and Measurements (MIM) Database and Earth Observation Handbook. The total number of unique users for these resources is 230 – 500 per week (16,000 – 20,000 per year), which is around 12-17% higher from the previous year.

The 2018 MIM survey has just concluded. 33 Agencies engaged in the update of the database, which now consists of 322 EO satellite missions, covering 919 instruments. In addition to the usual feedback cycle, the MIM Database team also triaged 57 issues flagged by the WGClimate ECV Inventory Team on both CEOS MIM and WMO OSCAR.

The MIM team is also working on a series of improvements for the Database:

- Historical missions: 24 missions with instruments to be included in the database in this release.
- WMO OSCAR: Added 130 mappings (around a 37% increase) between the CEOS Database and OSCAR.
- "Report an Issue" link added to the website to enable self-reporting of data consistency questions.
- Waveband response curves: Database tables added to capture waveband responses for enhanced analysis capability.
- An API is currently being tested with the SEO (for future mission gap analysis), with a broader test user release planned before the end of 2018. This will enable machine-to-machine access to the CEOS Database, allowing the content to be leveraged by external developers for tasks such as gap analyses.

CEOS Systems Engineering Office (SEO) Report

Brian Killough (NASA, SEO) presented an overview of the SEO activities in 2018 and plans for 2019. Accomplishments in 2018 included:

- General technical: Supported the LSI-VC (ARD definition, gap analysis process), supported SDCG for GFOI and GEOGLAM (data acquisition planning, coverage reports), maintained and enhanced general CEOS tools (COVE, Data Policy Portal, website, ceos-deliverables.org website).
- Data Cubes: The SEO is a member of the Open Data Cube (ODC) "Partners Forum". The SEO has made a number of significant code contributions (e.g., user interface, applications) to the ODC open source repository, coordinated and led training for the Africa Regional Data Cube (ARDC) and led many other country pilots (see Agenda Item 5.5).
- Outreach: Coordinated two IGARSS paper sessions (13 papers) and a Data Cube training workshop. Kim Holloway (now part time) managed website and news content, developed and facilitated social media content, provided meeting logistics support, developed new outreach materials, and maintained the mailing lists.

Brian reported that the CEOS website continues to be a popular destination with over 20,000 visitors (84% new) in 2018. He requested CEOS Agencies provide new content, news items, edits, and ideas to Kim to keep content fresh and relevant. He reminded everyone that the CEOS website has capabilities for meeting registration and document management.

Brian closed with a summary of SEO plans for 2019 (slide 4).

Osamu Ochiai (JAXA) noted the continued commitment of JAXA to the CEOS Newsletter, and thanked everyone for their contributions to the latest issue.

Session 8: Closing Business

Overview of CEOS Leadership

Mauro Facchini (COM, CEOS Chair Team) reviewed the table of CEOS Leadership succession:

Position	2018	2019	2020	2021
CEOS Chair	COM (P. Brunet)	VAST (P. A. Tuan)	ISRO	TBD
SIT Chair **SIT Vice-Chair**	NOAA (S. Volz) CSIRO (A. Held)	NOAA (S. Volz) CSIRO (A. Held)	CSIRO (A. Held) TBD	CSIRO (A. Held) TBD
CEO **DCEO**	ESA/CNES (S. Hosford) –	ESA/CNES (S. Hosford) TBD	TBD TBD	TBD TBD
WGCapD Chair **WGCapD Vice-Chair**	ISRO (P. Chauhan) NASA (N. Searby)	ISRO (P. Chauhan) NASA (N. Searby)	NASA (N. Searby) TBD	NASA (N. Searby) TBD
WGCV Chair **WGCV Vice-Chair**	NASA (K. Thome) CSIRO (C. Ong)	CSIRO (C. Ong) TBD	CSIRO (C. Ong) TBD	TBD TBD
WGClimate Chair **WGClimate Vice-Chair**	EUMETSAT (J. Schulz) USGS (J. Dwyer)	EUMETSAT (J. Schulz) TBD	EUMETSAT (J. Schulz) TBD	TBD TBD
WGDisasters Chair **WGDisasters Vice-Chair**	ASI (S. Zoffoli) NASA (D. Green)	ASI (S. Zoffoli) NASA (D. Green)	NASA (D. Green) TBD	NASA (D. Green) TBD
WGISS Chair **WGISS Vice-Chair**	ESA (M. Albani) CSIRO (R. Woodcock)	ESA (M. Albani) CSIRO (R. Woodcock)	CSIRO (R. Woodcock) TBD	CSIRO (R. Woodcock) TBD

- **Raj Kumar (ISRO) reaffirmed that ISRO will assume the role of CEOS Chair in 2020.**

- Regarding WGClimate leadership: USGS is unable to take on the post-2019 term. The plan now is to advertise the opening for a new Vice Chair, who will hold the position for one year instead of two, before transitioning into the Chair position. Jörg Schulz (EUMETSAT, WGClimate Chair) will hold the Chair position for an additional year. This approach has been agreed to provide leadership stability.

- It was noted that WGCV, WGDisasters, and WGCapD are seeking Vice Chair nominations.

- The CEOS Executive Officer role succession needs to be addressed urgently, as Steven Hosford's term ends at the 2019 Plenary.

- Mike Freilich (NASA) acknowledged the past CEOs and the very important role they play. He urged all Agencies to seriously consider the open position.

CEOS Chair Handover

Philippe Brunet (COM, 2018 CEOS Chair) and Pham Anh Tuan (VAST-VNSC, 2019 CEOS Chair) exchanged the CEOS flag and gavel, signifying the transfer of the CEOS Chair role from the European Commission to VAST-VNSC.

Pham Anh Tuan thanked CEOS for the opportunity to hold this leadership role and stated that he looks forward to chairing CEOS for the next year.

Presentation by the 2019 CEOS Chair, VAST-VNSC

Pham Anh Tuan (VAST-VNSC, 2019 CEOS Chair) presented on the 2019 CEOS Chair Initiative and showed a video regarding the 33rd CEOS Plenary.

Review of the 2018 CEOS Plenary Decisions and Actions

Philippe Brunet (COM, 2018 CEOS Chair) summarised the main outcomes of the Plenary.

Stephen Ward (CEOS Chair Team) reviewed the decisions and actions of the 32nd CEOS Plenary (see Appendix B for the summary).

Closing Remarks

Philippe Brunet (COM, 2018 CEOS Chair) thanked everyone for coming to Brussels. He thanked the COM CEOS Chair Team and SIT Chair Team in particular for their support throughout 2018. Philippe wished VAST-VNSC good luck with their CEOS Chair year.

APPENDIX A

Attendees

Organisation	Name	Organisation	Name
ASI	Laura Candela	*ISRO*	Prakash Chauhan
ASI	Simona Zoffoli	*ISRO*	Raj Kumar
CAS-RADI	Yan Liu	*JAXA*	Hitoshi Tsuruma
CNES	Juliette Lambin	*JAXA*	Masatoshi Kamei
CNES	Richard Moreno	*JAXA*	Naoto Matsuura
CRESDA	Wei Wan	*JAXA*	Osamu Ochiai
CSA	Éric Laliberté	*KMA*	Geun-Hyeok Ryu
CSA	Marie-Josée Bourassa	*KMA*	Jae-Dong Jang
CSIRO	Alex Held	*NASA*	Andrew Mitchell
CSIRO	Cindy Ong	*NASA*	Bradley Doorn
CSIRO	Jennifer Zhu	*NASA*	Brian Killough
DLR	Klaus Schmidt	*NASA*	Christine Bognar
ESA	Ivan Petiteville	*NASA*	David Crisp (remotely)
ESA	Josef Aschbacher	*NASA*	David Green
ESA	Marc Paganini	*NASA*	David Jarrett
ESA	Martin Ditter	*NASA*	Dennis McSweeney
ESA	Mirko Albani	*NASA*	Kurt Thome
ESA	Nicolaus Hanowski	*NASA*	Michael Freilich
ESA	Simonetta Cheli	*NASA*	Nancy Searby
ESA/CNES	Steven Hosford	*NIER*	Ara Cho
EUMETSAT	Alain Ratier	*NIER*	Jaehoon Jeong
EUMETSAT	Jörg Schulz	*NOAA*	Charles Wooldridge
EUMETSAT	Paul Counet	*NOAA*	Kerry Sawyer
EUMETSAT	Robert Husband	*NOAA*	Stephen Volz
European Commission	Andreas Veispak	*NRSCC*	Songmei Zhang
European Commission	Apostolia Karamali	*NSC*	Per Erik Skrovseth
European Commission	Astrid Koch	*NSMC-CMA*	Jinlong Fan
European Commission	Bernard Pinty	*NSO*	Joost Carpay
European Commission	Elisabeth Hamdouch	*ROSCOSMOS*	Aleksandr Chunosov
European Commission	Hugo Zunker	*SANSA*	Andiswa Mlisa
European Commission	Lieven Bydekerke	*SANSA*	Imraan Saloojee
European Commission	Mark Dowell	*SNSA*	Göran Boberg
European Commission	Matt Steventon	*UAE Space Agency*	Fatima AlAydaroos
European Commission	Mauro Facchini	*UKSA*	Bertie Archer
European Commission	Michael Berger	*UKSA*	Beth Greenaway
European Commission	Michel Massart	*UKSA*	Catherine Mealing-jones
European Commission	Philippe Brunet	*UNOOSA*	Luc St-Pierre
European Commission	Stephen Ward	*US DoS*	Fernando R. Echavarria
FAO	Douglas Muchoney	*USGS*	Jenn Lacey
GA	Andreia Siqueira	*USGS*	Steve Labahn
GA	Jonathon Ross	*USGS*	Timothy Stryker
GCOS	Carolin Richter	*VAST-VNSC*	Pham Anh Tuan
GCOS	Stephen Briggs	*VAST-VNSC*	Ngoc Phuong Linh Phan
GEO	Gilberto Câmara	*VAST-VNSC*	Sean Lam
GEO	Ian Jarvis	*WMO*	Fernando Belda
GGOS	Richard Gross		

APPENDIX B

Actions and Decisions Record

No.	Action	Due Date
CEOS-32-01	CEOS Executive Officer to contact all CEOS Members and Associates regarding their membership status and participation in CEOS (active/inactive).	**December 2018**
CEOS-32-02	WGClimate to develop a 'decision-maker' version of the *Statement of Space Agency Contributions in Support of Each Article of the Paris Agreement*.	**February 2019**
CEOS-32-03	SIT Chair to lead the drafting of a CEOS letter to CNES suggesting the approach required for CEOS to consider information on the SCO, its scope, and relevance to existing activities.	**December 2018**
CEOS-32-04	SDCG to explore a supplementary information paper for the SBSTA 51 CEOS submission – on forest biomass measurements from space.	**August 2019**
CEOS-32-05	WGClimate to report on internal implementation for the way forward on CEOS-CGMS coordination on GHG monitoring, including a roadmap based on the mapping of the GHG report recommendations and the JRC workshop conclusions.	**SIT-34**
CEOS-32-06	SIT Vice Chair to prepare a discussion paper to: 1) help formulate a broad CEOS Analysis Ready Data (ARD) Strategy; and 2) confer with CEOS Virtual Constellations ahead of the April 2019 SIT-34 meeting to enable them to report on their perspectives for pursuing CEOS ARD in their domains.	**SIT-34**
CEOS-32-07	SIT Chair and SIT Vice Chair to collaborate on an interim paper, as a communication tool for use by CEOS Agency and stakeholder representatives, that clearly articulates: 1) a succinct definition of ARD; 2) a brief summary of our ARD accomplishments to date; 3) a brief overview of existing plans for the next two years; and 4) the designated points of contact within CEOS.	**November 2018**
CEOS-32-08	NASA SEO to confer with the CEOS Chair to establish a small brainstorming group to explore possible CEOS Agency contributions to the Digital Earth Africa initiative.	**November 2018**

CEOS-32-09	NOAA and CSIRO, in consultation with LSI-VC, to explore additional case studies related to the GEO-LEO initiative.	**SIT-34**
CEOS-32-10	NOAA to coordinate with WGDisasters and WGCapD to further develop ideas around the GEO-LEO flood-monitoring initiative with CGMS.	**SIT-34**
CEOS-32-11	SDG-AHT Co-Leads are tasked to bring a proposal on the way forward organisationally for the SDG activity within the CEOS structure.	**SIT-34**
CEOS-32-12	Virtual Constellation Co-Leads to propose at SIT-34: a documented approach to VC leadership that includes a leadership rotation cycle. Each VC has the liberty to propose different time cycles.	**SIT-34**
CEOS-32-13	LSI-VC to draft a plan forward for the proposed merger of SDCG for GFOI and the CEOS *Ad Hoc* Working Group on GEOGLAM into LSI-VC. This plan would address the discussions and concerns raised at the CEOS Plenary meeting.	**SIT-34**
CEOS-32-14	Outgoing FDA-AHT Leads to work with the CEOS Executive Officer to ensure that all FDA-AHT tasks are represented in the 2019-2021 CEOS Work Plan, and to provide a brief report to CEOS summarising the disposition of each of the tasks.	**December 2018**
CEOS-32-15	SIT Chair to develop agenda items for discussion at SIT-34, proposal at SIT TW, and recommendation(s) for decision at CEOS Plenary 33 on: various CEOS governance, processes, and organisational issues.	**CEOS-33**

Decision 01	The National Institute of Environmental Research, Republic of Korea (NIER) and United Arab Emirates Space Agency (UAESA) were accepted as the newest Member Agencies of CEOS.
Decision 02	Plenary endorses the *'Statement reporting on progress by the Committee on Earth Observation Satellites (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) on Coordinated Response to UNFCCC Needs for Global Observations'* for submission to SBSTA 49/COP 24.
Decision 03	Plenary endorses the way forward proposed by the CEOS-CGMS WGClimate for the succession planning of its Chairmanship.

Decision 04	CEOS Plenary endorsed the report *'A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space.'* It is emphasised that the three-step plan to implement the architecture contained in the paper, as well as the identified activities in the way forward, should be interpreted as recommendations to CEOS Agencies, for their consideration.
Decision 05	Plenary confirmed CEOS interest in continuing collaboration with CGMS through a specific task in WGClimate on GHG monitoring, with dedicated resources and activities based on the mapping table of the actions identified in the Way Forward chapter of the report *'A Constellation Architecture for Monitoring Carbon Dioxide and Methane from Space.'* Plenary also endorsed the revision of the Terms of Reference of the WGClimate to accommodate these changes.
Decision 06	Plenary confirmed Akihiko Kuze of JAXA as the new WGCV Vice Chair and expressed great appreciation for the efforts of Kurt Thome of NASA as the outgoing WGCV Chair.
Decision 07	Plenary endorsed the Training Calendar Implementation Plan proposed by the WGCapD.
Decision 08	Plenary renewed the AHT mandate for the SDCG for GFOI and for the CEOS *Ad Hoc* Working Group on GEOGLAM for 1 year – noting the intention for a SIT-34 discussion on organisational structure with the LSI-VC.
Decision 09	Plenary renewed the SDG-AHT for one year – with an action on the SDG-AHT Co-Leads to bring a proposal to SIT-34 on the organisational aspects (regarding the possible creation of a permanent CEOS Working Group on SDGs).
Decision 10	With all constituent tasks now assigned to permanent CEOS entities, Plenary decided to conclude the activity of the FDA-AHT.