

# CEOS Newsletter

The CEOS Newsletter is published by JAXA on behalf of CEOS. It provides regular updates on the activities of CEOS, its agencies, Working Groups, Virtual Constellations, and Ad Hoc Teams.

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# Accelerating Societal Benefit One Data Portal at a Time

Last year, CEOS amplified the substantive body of work and Earth observation datasets and tools that its agencies share openly to address global concerns. This international coordination among remote sensing experts from across the globe continues to yield well curated resources and tools that are accessible to data users worldwide through the CEOS website (<https://ceos.org>).

Visitors to the website will find resources that demonstrate the solidarity in CEOS for the principle that satellite Earth observation data and products of high quality that are openly accessible and reproducible can serve as accelerators for open science. These resources also serve to inform decision and policy making associated with climate monitoring and research, disaster risk reduction and management, agricultural monitoring, land use and land cover change, water resource management, and ecosystem sustainability, among other drivers for sustainable development and societal benefit.

This newsletter article is an invitation for entities, institutions, and data users already utilizing CEOS data and tools to help us to broaden international awareness of the value and scope of satellite data and resources at your disposal from CEOS agencies at this website. CEOS invites data users to freely study, use, train, and encourage others to use the resources that are openly accessible with this website. Below are some examples of portals and capacity building resources.

– CEOS Global Stocktake (GST) Data Portal: This portal contains links to a wide range of CEOS agency supported datasets of direct interest to national inventory and other data users engaging in the UNFCCC Global Stocktake process and seeking to improve their reporting processes consistent with the climate action cycle of the Paris Climate Agreement (<https://ceos.org/gst>).

– CEOS Earth Observation Training, Education, and Capacity Development Network (EOTEC DevNet) for global users: This capacity building resource is a network of networks to enhance coordination and communication in the use of space-based Earth observations through regional meetings and online trainings (<https://ceos.org/ourwork/other-ceos-activities/eotec-devnet/>).

– CEOS Earth Observation Handbook and the Missions, Instruments, and Measurements (MIM) Database: Updated annually with CEOS member agencies, this database provides information on Earth observation missions and the measurements they provide (<http://database.eohandbook.com/>).

– CEOS Analysis Ready Data (ARD) Portal: This portal provides links to Earth observation satellite data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional data user effort and interoperability, both through time and with other datasets (<https://ceos.org/ard/>).

– Essential Climate Variable (ECV) Inventory v4.0: This inventory is published and maintained by the Joint CEOS-CGMS Working Group on Climate and provides links to existing Climate Data Records (CDRs) produced mostly by CEOS and CGMS member agencies. It is a structured repository that also includes placeholders for future CDR provision to help mitigate gaps in continuous climate recording (<https://climatemonitoring.info/ecvinventory/>).

– Vicarious Calibration (VCAL) Portal for Spaceborne Greenhouse Gas Sensors: Maintained by the CEOS Working Group on Calibration and Validation, this portal provides information and links to data acquired annually since 2009 to support the calibration and validation of spaceborne Greenhouse Gas (GHS) sensors ([https://www.eorc.jaxa.jp/GOSAT/GHGs\\_Vical/index.html](https://www.eorc.jaxa.jp/GOSAT/GHGs_Vical/index.html)).

We thank the entire CEOS community for its commitment to sustained international cooperation to mitigate global challenges with high quality satellite Earth observation data, products, and tools.



Karen M. St. Germain, Ph.D.  
NASA, 2021 CEOS Chair

# CNES CEOS Chair 2022: “Paths to Sustainability: from strategy to practical measures”

At the conclusion of the 2021 CEOS Plenary in November, the Centre National d'Études Spatiales (CNES) of France assumed the role of Chair of the Committee on Earth Observation Satellites (CEOS) for 2022. As is customary for a CEOS Chair, CNES has developed a set of priorities for the term as CEOS Chair.

CNES last chaired CEOS back in 1997. CEOS, and the world, has changed significantly over the 25 years since. CEOS has accomplished a great deal of work on the coordination of national EO satellite observation programmes, promoting free and open data principles, and helping society make the most of the unique data provided by EO satellites. Various CEOS strategies have been implemented to respond to the most pressing global issues, most recently in response to the Paris Climate Agreement, the Sendai Framework for Disaster Risk Reduction, and the 2030 Agenda for Sustainable Development.

Under the banner of “Paths to Sustainability: from strategy to practical measures” CNES aims to further increase CEOS impact by:

1. Increasing emphasis on the evolution of various CEOS R&D and demonstration activities into operational applications and services for society, with a particular focus on disaster risk reduction and management and climate activities.
2. Improving community understanding and appreciation of how EO data may help their information challenges.
3. Supporting key CEOS and community initiatives related to the UNFCCC Global Stocktake, including on agriculture, forestry and other land uses, noting the critical importance of satellite Earth observations for the global response to the climate crisis.
4. Initiating new and complementary activities, including further cooperation on satellite Earth observation calibration and validation, including development of multi-thematic calibration and validation sites.
5. Establishing a new cooperation for a CEOS protocol to support the cross-calibration of thermal infrared measurements from future CEOS Agency missions, in particular those missions identified as key for Surface Biology and Geology (SBG).

These priorities have been formulated in consideration of the NASA 2021 CEOS Chair priority: “Space-based Earth Observation Data for Open Science and Decision Support”, and seek to support the SIT Chair priorities of carbon and biomass; creating new opportunities for EO space agencies; and fostering the development and use of innovative digital services.

The CNES CEOS Chair Team thanks the CEOS community for the opportunity to serve as Chair in 2022 and hopes that these themes and priorities provide the scope for all CEOS Agencies to contribute and benefit from the platform that the CEOS Chair priorities provide. It is hoped that this year will bring together and elevate numerous activities already ongoing in CEOS and create an even greater positive impact for society.

Note: CNES opens SPOT World Heritage data to the world (<https://regards.cnes.fr/user/swh/modules/60>)



CNES is proud to announce that over 19M€ images acquired by the SPOT family of satellites during their 30-year mission starting in 1986 are now available for download from the Toulouse Space Centre. We are currently working with our CEOS colleagues to define how it will be possible to provide “CEOS Analysis Ready Data for Land” (CARD4L) products also.



Dr. Selma Cherchali  
CNES, 2022 CEOS Chair

## SIT-37 Highlights

Almost 150 individuals from 30 agencies attended the 37th Meeting of the CEOS Strategic Implementation Team, Chaired by the European Space Agency on 29-31 March 2022.

The meeting was held remotely under the continuing constraints of the Covid epidemic but this did not prevent a comprehensive and lively discussion on a number of important topics. Great credit is due to the speakers and session chairs for ensuring that the very compact meeting format with session of only 2.5 hours duration each day, due to the need to respect time zones across the world, could be maintained. In addition to the speakers from CEOS Agencies, three persons external to CEOS were invited to give very informative presentations on the needs of their respective communities: Joanna Post (UNFCCC Secretariat); Steve Hamburg (International Methane Emissions Observatory – IMEO) and Andy Gonzalez (GEO BON).

The agenda was mainly structured around the three central themes set out in the roadmaps on the CEOS Website, namely Carbon and Climate, Sustainable Development Goals and Disaster Risk Reduction. There were also specific sessions on Biodiversity, Oceans and Coasts and on the working mechanisms of CEOS, plus a very innovative session on the role of CEOS in the emerging more complex delivery of EO services under new mixed geometries. Additional topics covered included aquatic carbon, the oversight of ARD activities in CEOS, a new paper on PM2.5 observations and a very interesting discussion with IMEO on cooperation for improved observations of GHGs, notably methane. During the meeting, a short pause to allow Principals to meet in Plenary allowed CSA to announce its candidacy as CEOS Chair 2024. A further highlight during the meeting was the announcement of a substantial (1.2 Bn USD) investment by the Australian Government for the establishment of the first Australian national space mission for Earth Observation, composed of a constellation of four EO satellites.

The Carbon and Climate session covered a wide range of activities including the CEOS work on GHGs, AFOLU, climate use cases, partnership with GCOS and with the UNFCCC on the Paris Agreement and the Global Stocktake. Under the session

on SDGs, where work advances in particularly close cooperation with GEO, progress in the new mechanisms put forward to coordinate activities within CEOS was described and under Disaster Risk Reduction, it was announced that the CEOS Disaster Recovery Observatory demonstrator has been recognised by the UN as part of its Space 2030 agenda, paving the way to a potential future engagement of new funding agencies in particular from the UN System, with the objective of transitioning from an R&D to a sustained initiative.

A new topic introduced at the meeting concerned the role of CEOS under the increasingly flexible geometry usually called “New Space”. This session recognised the very rapid progress being made by non-state actors in the delivery of services based on EO satellite data. Players in the private sector but also in other sectors such as NGOs and non-profit organisations are taking an increasingly important role in the delivery of services through provision of novel space assets, in data management and access and in service delivery, all with the aim of increasing the offer of space-based services to the user community. The discussion was led by examples of their experience from three CEOS agencies NOAA, EC and CNES and lively debate followed. This will remain a topic of importance for CEOS which will need to consider how best to manage its operations so as to allow the best possible combination of satellite based services from all sources to be delivered to users.



Simonetta Cheli  
ESA, SIT Chair

# CEOS Earth Observation Handbook

The [CEOS Earth Observation Handbook](#) presents the main capabilities of satellite Earth observations, their applications and a systematic overview of present and planned CEOS Agency Earth observation satellite missions and their instruments.

The website is composed of two distinct parts, the CEOS EO Handbook, and the CEOS Missions, Instruments & Measurements (MIM) Database.

The CEOS EO Handbook is a publication by ESA, updated once every few years. Each edition focuses on a specific theme, such as the Sustainable Development Goals (2018 Edition) or Climate Change (unusually also a 2018 Edition for the Paris Conference), and are targeted as an educational tool for the general public not necessarily familiar with the satellite world. Through a series of articles, the EO Handbooks aim to increase the awareness of the user community on the potential benefits of EO on a particular subject. Past editions are available at [eohandbook.com/past-editions.html](http://eohandbook.com/past-editions.html), with future print editions anticipated in the same vein.

The CEOS MIM Database provides more detailed information on CEOS Agency satellites, with information obtained through an annual survey of CEOS Agencies. It represents the only official consolidated statement of agency programmes and plans, while also providing a community focal point for the coordination of future planning, research and gap analyses. The CEOS database is accessible at [database.eohandbook.com](http://database.eohandbook.com).

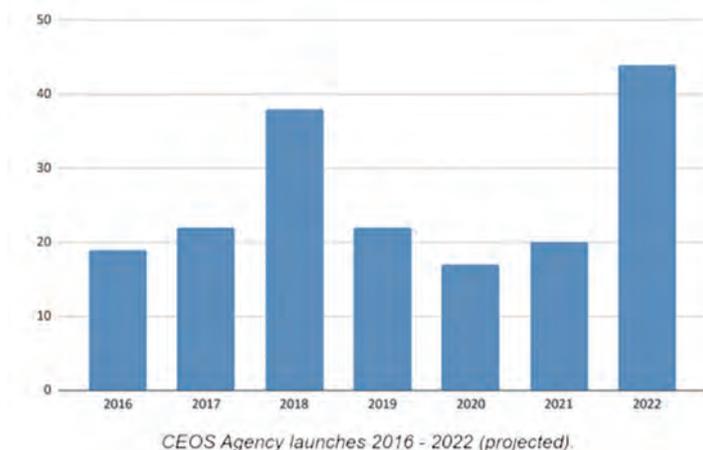
As of 2021, the team has begun publishing quarterly reports, a one page summary of recent and upcoming CEOS Agency mission launches, to keep the database more accurate and up to date. The reports are distributed to the CEOS mailing list, alongside promotion through the CEOS communication channels and publication on <https://ceos.org/ceos-database-quarterly-reports/>.

In addition to the annual update CEOS Agency missions, the CEOS Database is constantly evolving to include new functionalities to improve the service to the user community. For example, each instrument now lists which of the [Essential Climate Variables \(ECVs\)](#) the measurements contribute to. The team is considering a similar link for the [Sustainable Development Goals \(SDGs\)](#).



For more about the functions of the CEOS Database, see the [series of videos](#) published last year in support of the 2021 NASA CEOS Chair theme: “Space-based Earth observation for open science and decision support”. Follow [@EOHandbook](#) on Twitter for updates on CEOS Agency missions.

The CEOS Earth Observation Handbook operations and continuous enhancement activities are funded by ESA as a contribution to CEOS.



Simonetta Cheli  
ESA, SIT Chair

## CEOS COAST Ad Hoc Team has been working energetically

CEOS Coastal Observations, Applications, Services, and Tools (COAST) Ad Hoc Team has been quite busy during the past year executing our Phase 2 Implementation Plan through coastal product development and stakeholder engagement. A kickoff product showcase outreach event was held in October 2021, co-hosted by the Group on Earth Observations (GEO). This event introduced the two pilot domains (Land Impacts to Sea and Sea Impacts to Land) and the initial product themes of flooding, bathymetry, and coastline mapping (Sea Impacts to Land) and Coastal Eutrophication/Sediment (Land Impacts to Sea), as well as the five initial geographic pilot regions. Throughout 2021 and into early 2022, COAST product teams targeted the Chesapeake Bay and Bay of Bengal pilot regions as well as the West coast of Africa to independently advance potential CEOS COAST products. The most noteworthy result was the successful technology transfer in the Earth Analytics Interoperability Laboratory (EAIL) of the coastline mapping product developed by Geoscience Australia for Australia and the West coast of Africa to the Chesapeake Bay region.

On April 29, 2022, the half-day Chesapeake Bay Stakeholder Workshop was held virtually – engaging over 40 regional agency, NGO, academic, and industry representatives to see what the team had to offer to help their science and management of Chesapeake Bay. This was the first half-day workshop by CEOS COAST, and more are planned in the other CEOS-COAST geographic pilot areas. The workshop was designed and advertised using tools/templates which were developed by the CEOS WG CapD. Subsequent stakeholder co-design meetings have been held in group and 1:1 settings with the developers to ensure the products meet user needs and have a low technical barrier to access.

To learn more about co-design, CEOS COAST's program manager Dr. Merrie Beth Neely actively participated in the [Global Ocean Observing System \(GOOS\) Co-Design Virtual Workshop](#) held June 7-9, sponsored by the UN Decade of Ocean Observations for Sustainable Development – for which COAST is an IOC-endorsed contribution (recognized June 8,

2021). It is hoped the techniques and lessons Dr. Neely learned, especially during the storm surge exemplar collaboration with CoastPredict (an IOC-endorsed UN Ocean Decade Programme), will improve stakeholder co-design approach of COAST products.

COAST was prominently featured in the Coastal Hazards session of the [May 2022 ESA Living Planet Symposium](#), convened by Dr. Jerome Benveniste, and co-chaired by Dr. Neely. A community conversation and poster session also amplified products and lessons learned by COAST. Improvements to the CEOS COAST page on the CEOS website and an interactive brochure were completed in late 2021, and additional outreach opportunities at the [2022 GEO Virtual Symposium](#) (Monday May 2, 2nd session on Coastal Zone Management and Marine Spatial Planning), the [June Chesapeake Bay Program Wetlands Working Group](#), and the [NOAA 2021 Science Report](#) (page 59), as well as future general audience publication(s).



Merrie Beth Neely (NOAA), Rashmi Sharma (ISRO), and Paul DiGiacomo (NOAA)

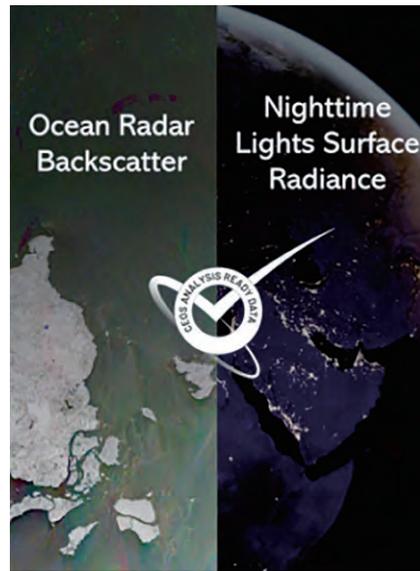
# LSI-VC-12 Report

LSI-VC-12 was hosted by ESA at ESRIN from September 8-9, the week before the CEOS SIT Technical Workshop. This is the first in-person meeting of the group since the COVID-19 pandemic, and it was great to have everyone back together! The LSI-VC took the opportunity to reflect on the progress that has taken place since the last face-to-face meeting, noting that in September 2019:

- There were no CEOS-ARD datasets – we now have seven approved datasets, with four more under peer review.
- The first version of the CEOS-ARD Strategy was in development, now we are implementing activities from [CEOS ARD Strategy 2021](#).
- There were only three PFS – we have since added four more: Polarimetric Radar, Aquatic Reflectance, Ocean Radar Backscatter, and Nighttime Lights Surface Radiance.
- There were no subgroups of LSI-VC – we have now incorporated the Forests & Biomass and GEOGLAM subgroups.
- There was no broader CEOS-ARD Governance Framework nor any thought of CEOS-ARD ‘beyond land’ – now we have a CEOS-ARD Oversight Group and Ocean Radar Backscatter and Aquatic Reflectance PFSs.

There has been a lot of great progress despite the challenging conditions of the past few years! With conditions normalising, and our experience at LSI-VC-12 confirming the value of in-person meetings and their ability to accelerate work, we are sure to see more great progress from here.

CEOS-ARD was of course a key discussion point at LSI-VC-12. A highlight from the meeting was the presentation for endorsement of two new CEOS-ARD Product Family Specifications (PFS): Nighttime Lights Surface Radiance and Ocean Radar Backscatter. Both PFS have now been endorsed and published on the CEOS-ARD website. Self-assessments of datasets against these specifications are expected to be forthcoming (e.g., NASA Black Marble). More details can be found in [this](#) CEOS website news story.



There are now seven CEOS-ARD datasets, with four more under peer review, and many more under development / assessment. These are detailed on the [CEOS-ARD website](#). Recent updates include the submission of the PROBA-V Collection 2 and ALOS-2 PALSAR-2 Global Mosaics (RTC) and ScanSAR NRB datasets to be peer reviewed, as well as the addition of the Sentinel-3 SYN SDR product to the under development list.

Another priority of LSI-VC-12 was to agree a position on the idea of a CEOS Interoperability Framework ([concept note](#)) ahead of the SIT Technical Workshop. It was agreed by the LSI-VC that given the scope of EO data interoperability issues, which are distributed across many CEOS groups (e.g., LSI-VC, WGISS, WGCV, etc.), a robust framework and coordination mechanism is needed to help build upon CEOS-ARD and move along the [interoperability spectrum](#). The LSI-VC agreed to take this idea to the SIT Technical Workshop and CEOS Plenary and will seek to establish an Interoperability Task Team within LSI-VC to take this topic forward for CEOS.

LSI-VC-12 also featured sessions led by the LSI-VC subgroups on Forests & Biomass and GEOGLAM.

The top priority for the Forests & Biomass subgroup is the development of the CEOS AFOLU Roadmap document, which aims to provide:

1. A framework for long-term (15+ years) coordination of CEOS agency observing programmes in support of the needs of society for AFOLU-related information, with a focus on the needs and ambition cycle of the Global Stocktake of the Paris Climate Agreement.
2. A guiding vision for long term space agency coordination around AFOLU, characterising the needs, the services and applications required, and the products and observing systems that can support these goals.
3. An effective means for communicating space agency intentions to society, the UNFCCC, national inventory communities, etc.
4. An understanding of basic observation continuity and the necessary agency coordination to achieve it.

The GEOGLAM Subgroup briefed LSI-VC-12 on the GEOGLAM Capacity Development Guidance Document, which seeks to share evidence-based good practices around capacity development to serve as a resource for organisations (including CEOS Agencies) seeking to support GEOGLAM. The key messages are that any capacity development activities should start at project conceptualization and have an emphasis on co-development, co-design, and co-production. LSI-VC was also briefed on the Essential Agriculture Variables for GEOGLAM. A priority in defining these variables has been

to link them to policy and use, and to have the EAVs serve as integrators – meaning that information produced by/for the GEOGLAM community can help support a multitude of policy targets. LSI-VC expects an updated statement of GEOGLAM Requirements in 2023, to which a CEOS Strategic Response is foreseen (the last iteration was in 2019).

Full minutes from the LSI-VC-12 meeting will be released soon on the [meeting website](#).

LSI-VC Co-Leads: Andreia Siqueira (GA), Steve Labahn (USGS), Peter Strobl (EC/JRC)

### Staying Connected

The [CEOS-ARD Twitter account](#) has continued to grow – and we encourage everyone to follow us there and to retweet and like when you can to help us increase the reach of CEOS-ARD!

The CEOS-ARD Oversight Group also publishes a regular CEOS-ARD Newsletter. A sign up form is accessible [here](#).

The LSI-VC Leads would also like to extend an open invitation for CEOS Agencies to join the LSI-VC. Should you require information on any of our work, please feel free to get in touch with the LSI-VC Leads or the LSI-VC Secretariat.

<http://ceos.org/ourwork/virtual-constellations/lvi/>

<http://ceos.org/ard>



LSI-VC-12 Meeting, ESA ESRI, September 8-9, 2022



## 2022 CEOS SIT Technical Workshop

The CEOS SIT Chair Dr Simonetta Cheli and her team had the pleasure to welcome 60 representatives from various CEOS agencies that travelled to ESA ESRI (Frascati, Italy) to participate in the 2022 CEOS SIT Technical Workshop (13-15 September 2022) while about 50 other CEOS colleagues joined the workshop remotely. This technical & scientific meeting helps preparing the more strategic CEOS Plenary. This event was the first major CEOS meeting held in person since the beginning of the Covid pandemic in 2020. Many participants highlighted the huge difference between virtual meetings and those held in person: more efficient debates, more productive outcomes, illustrated by the few examples given in this article.

Many decisions have been taken during the workshop and several actions have been raised. Following a warm welcome of the participants by the SIT Chair, the workshop started with the review of the main themes of the CEOS Chair (CNES): Ensuring the long-term sustainability of CEOS; CEOS Support to the UNFCCC Global Stocktake; and Support to CEOS Cal-Val initiatives.

During the Climate & Carbon session – a key element of the CEOS strategy – an update on the “CEOS Strategy for the Global Stocktake” was provided, along with preparations for SBSTA and COP-27 (6-8 November 2022). Detailed discussions were held in relation to the GHG Roadmap (Greenhouse Gases), AFOLU Roadmap (Agriculture, Forestry and Other Land Use), and International Methane Emissions Observatory (IMEO). The SIT Chair team invited Luis Guanter (Environmental Defense Fund) to present the Methane Alert and Response System (MARS) – a key element of IMEO, on behalf of the IMEO-MARS team at UNEP and EDF. It is worth noting that IMEO will headline an EO-based methane detection system at COP-27 and that there is a significant opportunity for CEOS agency data and capabilities to feature.

As a follow-up to the CEOS SIT-37 New Space session, another session on the same topic raised a lot of interest among the participants. A few CEOS Agencies (USGS, ESA, GISTDA, NASA, CSA) presented their case studies with the objective of sharing experience. In addition, two CEOS groups (e.g. ARD Oversight Group, and WGCV) introduced ideas related to Analysis Ready Data and to smallsat data quality that should enable the development of a series of innovative tools and services that rely on the combination of data from multiple data sources such as public satellites and commercial smallsats.

Given the growing interest of space agencies and CEOS for the EO New Space sector, the formation of a Task Team to further develop the ‘New Space’ topic was agreed.

Besides, an action on further coordination of CEOS engagement with standards organisations was agreed. The goal is for CEOS agencies to collaborate closely with commercial companies on the interoperability standards in order to ease and foster the partnership between public agencies and the New Space sector. A specific action around the engagement with the OGC ARD Standards Working Group was also agreed as well as another action to flesh out the concept of a CEOS Interoperability Framework for discussion at Plenary.

Following the special report on Ocean Carbon by the OCR-VC team (Ocean Colour Radiometry), it appeared that a roadmap for observations might take a few years to complete.

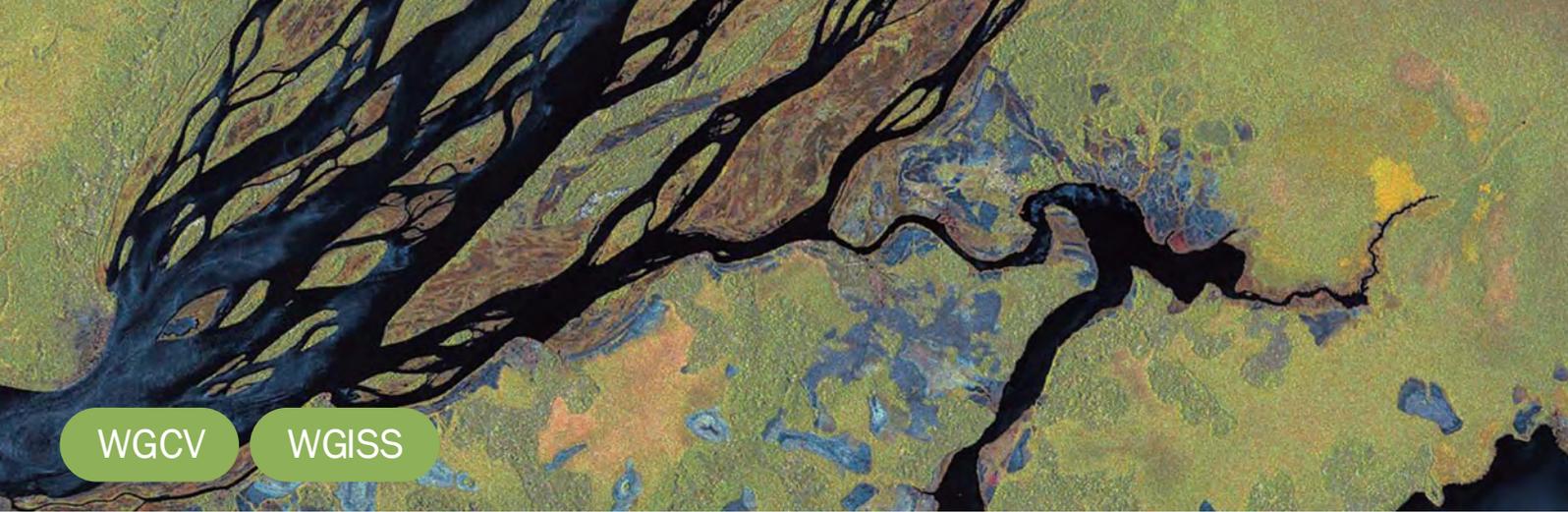
Recognising the potential added value of remote sensing to biodiversity, the speakers of the session dedicated to biodiversity recommended the identification of key milestones for the coming years and agreed to define the Terms of Reference for an Ecosystems Extent Task Team, for presentation and endorsement at the 2022 CEOS Plenary.

Another highlight of the workshop was the presentation by the AC-VC of the draft white paper on the Monitoring of the Surface Fine particulate matter (PM<sub>2.5</sub>), an air pollutant that is a major threat to human health worldwide. This paper will be presented to Plenary for endorsement.

Significant progress on CEOS Deliverables for the Sustainable Development Goals have been reported for 2022, and the CEOS SDG team presented their plans for 2023 Deliverables for discussion.

Workshop participants recommended that the CEOS-COAST Ad Hoc Team should seek a one-year extension at CEOS Plenary, and that the CEOS Ocean Coordination Group should make recommendations to the CEOS Plenary on coordination of CEOS activities related to oceans.

Finally, the Incoming CEOS Chair (GISTDA, Thailand) presented his main priorities for 2023: the support to the Global Stocktake, and the partnership between space agencies and the New Space sector.



WGCV

WGISS

# The 6th Joint Symposium with WGCV and WGISS



The 6th Joint Symposium with WGCV and WGISS

Makoto NATSUISAKA (WGISS Chair 2022-2023) Akihiko KUZE (WGCV Chair 2021-2022)

The 6th Joint Symposium with WGCV(the Working Group on Calibration & Validation) and WGISS(the Working Group on Information Systems & Services) was successfully held as an in-person meeting on 5th October 2022 in Tokyo JAPAN. Seventy-seven members from 21 organizations joined the meeting. The agenda, presentations and minutes can be found in the [WGISS-54 web site](#).

The joint symposium has been held on a biannual basis since 2008 to exchange information, identify common interests and foster joint collaborations. The main topics in this meeting were as follows.

- (1) CEOS CAL/VAL Portal, ESA EO Portal, CEOS MIM Database: Status, Synergies, and Improvements
- The status of CEOS CAL/VAL Portal, ESA EO Portal, CEOS Missions, Instruments, and Measurements (MIM) Database, which are being modernized was reported to get improvement ideas and consider

connectivity with other CEOS systems. A link between the MIM and the ECV inventory, and automation for the data providers to enter their information were suggested.

## (2) Status of ARD Activities

LSI-VC (Land Surface Imaging Virtual Constellation) introduced CEOS Analysis Ready Data (ARD) activities to foster engagement of WGCV and WGISS. The CEOS motivation to engage in ARD activities is to facilitate data usage by reducing data processing burden on users, looking toward a future of sensor-agnostic Earth data where the uptake and impact of all data sources for societal benefit are maximized. CEOS-ARD is a key step within the 'interoperability spectrum.'

Overwhelming feedback from industry is that formal standards are needed for ARD which will facilitate the implementation of CEOS-ARD into operational workflows and to ensure products interoperability.

## (3) Data Quality Assessment and Indicators, and Data Management and Stewardship Maturity Matrix

### (3-1) Data Quality Indicators

WGCV gave a presentation on data quality indicators, which can be expressed in different layers of information (per pixel, per measurement, as cal/val results summary, as summary quality in the metadata, and in tools and procedures).

Format is an important aspect of EO data products that ensures they are most easily accessible to the widest variety of users. Product metadata and flags offer users important extra layers of useful descriptive information in addition to the measurements themselves that can be crucial to their analysis. A cal/val maturity matrix provides a reader with the high-level summary of the output of a quality assessment. The matrix contains a column for each section of analysis and cells for each sub-section of analysis. Sub-section grades are indicated by the color of the respective grid cell, which are defined in the key.

### (3-2) Data Management and Stewardship Maturity Matrix: Introduction, Background and Definitions

WGISS gave a presentation on the Data Management and Stewardship Maturity Matrix (DMSMM). The DMSMM defines all activities needed to preserve and improve the information content, quality, accessibility, and usability of data and metadata. It provides a way to measure the status of the agency data stewardship processes in place, and to plan goals for future data stewardship processes and projects.

### (3-3) AVHRR DMSMM Use Case

The AVHRR DMSMM Use Case was reported. The evaluation is being performed on the AVHRR L1B Dataset using the Cal/Val Maturity Matrix (a subset of the DMSMM) and is currently in progress.

### (4) CEOS Interoperability Framework Initiative

A presentation on the CEOS Interoperability Framework Initiative was given by LSI-VC. This framework should help coordinate and streamline CEOS efforts, and support LSI-VC and SIT decisions. Addressing the full scope of interoperability requires a framework that captures all aspects of the problem. The following (non-exhaustive list) are equally important factors to consider, and each have several component pieces:

- Structural / Data Architecture
- Accessibility / System / Data Presentation
- Formats / Syntactic / Data Language
- Terminology / Semantics / Data Context

Factors and components are distributed across many CEOS groups (e.g., LSI-VC, WGISS, WGCV, etc.), and therefore a robust framework and coordination mechanisms are needed to address all the necessary pieces.

### (5) CEOS Common Online Dictionary: Progress with Joint Activity between WGISS and WGCV

The CEOS Common Online Dictionary team reported its progress as a result of a joint collaboration between WGCV and WGISS. The team has completed the merge of WGCV and WGISS glossaries and NOAA NESDIS Lexicon on a technical level into a [temporary Wiki solution](#).



# CEOS and the UNFCCC Global Stocktake

This page provides an entry point for access to the datasets and guidance being developed by CEOS space agencies and partners in support of the goals of the Global Stocktake process of the Paris Climate Agreement.

The Global Stocktake is a fundamental component of the Paris Agreement, being used to monitor its implementation and (GST) thus links implementation of it, and has the ultimate aim of raising

AGRICULTURE

FOREST

LAND USE

LSI-VC

## Update on the CEOS AFOLU Roadmap

CEOS is committing significant resources in support of the Paris Agreement, and its Global Stocktake process. We already have in place a Greenhouse Gas (GHG) Roadmap developed under the joint CEOS-CGMS Working Group on Climate. The 2020 CEOS Plenary recognised the need for coordination efforts in relation to the land sector emissions which are crucial to the Global Stocktake process and agreed to the development of a CEOS AFOLU (Agriculture, Forestry and Other Land Uses) Roadmap, led by the Forest and Biomass team within our Land Surface Imaging Virtual Constellation. The Co-Leads are: Osamu Ochiai (JAXA), Ben Poulter (NASA), and Frank Martin Seifert (ESA), where Ben takes on the Lead Author role for the Roadmap.

In 2021, the effort focused on support for the development of [the CEOS GST Portal](#) to provide a public interface to our efforts and support countries keen to explore EO datasets for their national reporting. The AFOLU Roadmap team was also involved in the Synthesis Report on “[The Role of Systematic Earth Observations in the Global Stocktake](#)”, submitted for the first Technical Assessment in the Global Stocktake process.

After two years of entirely virtual operation, the AFOLU Roadmap team was delighted to meet in person thanks to an invitation from the ESA SIT 37 Chair team, in cooperation with the GCOS Terrestrial Observations Panel for Climate (TOPC), to host an AFOLU workshop at ESA ESRIN in early September 2022. The day reaffirmed the vital importance of a CEOS strategy to ensure that public EO programmes are fit for purpose in meeting society’s needs for information to implement successfully the Paris Agreement. The objectives of the Roadmap were confirmed as:

- 1.To provide a framework for long-term (~ 15+ years) coordination of CEOS agency observing programmes in support of the needs of society for AFOLU-related information, with a particular focus on the needs and ambition cycle of the Global Stocktake of the UNFCCC Paris Agreement.
- 2.To serve as a guiding vision for long-term space agency coordination around AFOLU. The Roadmap will characterise the needs, the services and applications required;

the products and observing systems that can support; and explain the need to plan for ground segment, space segment and services.

- 3.Provide an effective means for communicating our intentions to society, UNFCCC, national inventory community etc.
- 4.Address basic observation continuity and the necessary agency coordination to achieve it.

The team agreed to work to a 2035+ horizon including to forecast the information needs EO satellites will have to support across the three dimensions of: global assessments and syntheses; national climate policy and actions; and GHG inventories. The discussion imagined a 2035+ fully coupled observation and modelling system for all sectors as a guiding ambition for the overall CEOS roadmap. This vision would be coordinated with in-situ greenhouse-gas observing systems like those proposed by the World Meteorological Organisation and the Integrated Global Greenhouse Gas Information System (IG3IS). The CEOS-GCOS workshop heard eloquent appeals for space agencies to step up to this significant challenge, and the importance of working with modelling groups to understand exactly the need for future observations, in all aspects of the emissions evaluation process. And for all agencies with active investments and plans in the supporting observations to be active participants as we plan together the future technologies and systems that will be necessary to respond to the needs of the countries of the world to achieve better management of mitigation and adaptation activities for climate change and raise their ambition.



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