# MINUTES OF CEOS SIT-TW - 14-15 September 2022


## Executive Summary

1. The main CNES **CEOS Chair Themes** were reviewed: ensuring the long-term sustainability of CEOS demonstrators; CEOS Support to the UNFCCC Global Stocktake; and, support to CEOS Cal-Val Initiatives.
2. A follow-up to the SIT-37 **New Space** session was held, with case studies from Agencies (USGS, ESA, GISTDA, NASA, CSA), and further examples presented (ARD support, WGCV). Formation of a **New Space Task Team to further develop the 'New Space'** topic was agreed.
3. An action on further coordination of **CEOS engagement with standards organisations** was agreed. A specific action around engagement with the **OGC ARD Standards Working Group** was also agreed.
4. An update on the **CEOS Strategy for the GST Update** was provided, along with preparations for SBSTA and COP. Detailed discussions were held on the **GHG Roadmap**, **AFOLU Roadmap**, and **IMEO**. An action was agreed to further progress on cooperation requests submitted by IMEO.
5. There was a special report on **Ocean Carbon**, and it was noted that a roadmap for observations might take a few years to complete.
6. There was a session on **biodiversity** which agreed actions to identify key milestones, and also to define Terms of Reference for an **Ecosystems Extent Task Team**.
7. An action was agreed to send comments on the draft paper on **Monitoring Surface PM2.5**. This paper will be presented to Plenary for endorsement.
8. An action was agreed to flesh out the concept of a **CEOS Interoperability Framework** for discussion at Plenary.
9. The development of a **GEOGLAM Capacity Development Guidance Document** was presented, and will be shared before consideration at CEOS Plenary.
10. Progress on **CEOS Deliverables for the Sustainable Development Goals** was processed, and plans for 2023 Deliverables were discussed.
11. The **Incoming CEOS Chair priorities** from GISTDA were presented: preparations for the Global Stocktake; and, New Space geometries.
12. An action was agreed to support the **GISTDA-Silvacarbon 2023 CEOS Workshop on National Forest Inventories and Mangrove Techniques**.
13. A discussion was held on **GEO Post-2025 and CEOS Engagement**, and points from the recent side meeting and upcoming workshop were discussed.
14. Recent discussions in the **CEOS Ocean Coordination Group** were reviewed, and it was agreed that the CEOS-COAST ad hoc Team should seek a one year extension at CEOS Plenary. Further the Coordination Group should make recommendations to the CEOS Plenary on coordination of CEOS activities related to oceans.

**Session Index**

# Wednesday September 14th

## Session 1: Welcome and Opening Session

### 1.1: Welcome and Opening Remarks

Presenters: Simonetta Cheli (ESA, SIT Chair) and Ivan Petiteville (ESA, SIT Chair Team) *[presentation]*

Simonetta Cheli (ESA, SIT Chair) welcomed participants to ESRIN, noting the progress that has been made over the past two years despite the virtual nature of our interactions. Simonetta reflected on the passing of Mike Frielich since the last time we met face to face.

Main points:

- As the Director of ESRIN, international collaboration remains a top priority for Simonetta, who has been long engaged in the CEOS community.
- Space agencies have a clear mandate around global significant issues such as climate, the Paris Agreement, and the SDGs.
- ESA is busy working on preparations for November's Ministerial meeting, including working on lining up members' contributions to significant programs.
- Ivan Petiteville (ESA, SIT Chair Team) reviewed the main topics and objectives for the Workshop, and the Sessions planned.


### 1.2: CEOS Plenary 2022 Objectives

Presenter: Olivier Marsal (CNES, CEOS Chair Team) *[presentation]*

Main points:

- The main CNES themes are:
  - Ensuring the long-term sustainability of CEOS strategies through sustained operation and application of CEOS demonstrators and exploration of establishing services from CEOS demonstrators.
  - CEOS Support to the UNFCCC Global Stocktake.

  - Support to CEOS Cal-Val Initiatives (initiating a CEOS protocol for cross-calibration of thermal infrared measurements and establishing joint multi-thematic cal-val sites to develop CEOS Agency synergies and support future applications).

- The CEOS Executive Officer (CEO) provides key support to all CEOS member agencies and entities. The position is currently staffed by Marie-Claire Greening, via a contract funded by NASA, which ends in December 2022. Over the past months, the CEOS Chair team has invited CEOS members to nominate candidates for the 2023/2024 period (official emails were sent in February and June 2022), with no candidates identified so far.
- Because we are close to the deadline (December 2022), NASA and NOAA recently agreed to jointly fund the existing CEO contract for one additional year (2023). This short-term solution gives CEOS more time to prepare for the future, but should in no way reduce efforts to rapidly identify future CEO candidates.
- CEOS Agencies are encouraged to reach out to the CEOS Chair with suggestions for CEO continuity.

**1.3: CEOS 2022-2024 Work Plan**

Presenter: Marie-Claire Greening (CEO) *[presentation]*

Main points:

- The CEO is responsible for the annual update of the CEOS 3-year Work Plan. The plan is updated by all CEOS entities every year and put forward for formal endorsement at SIT in March. Rigorous work planning, execution and monitoring are critical to CEOS's credibility.
- Of the 2022-24 deliverables: 13 are closed, 4 are new, and 95 are assessed to be on track. 49 deliverables are due for completion this year and 38 in 2023.
- All SIT-37 actions due before or at Plenary are complete and have already been reported on or will be addressed during the Workshop.
- Three of the four actions from CEOS Plenary 2021 are complete, with the fourth in progress.

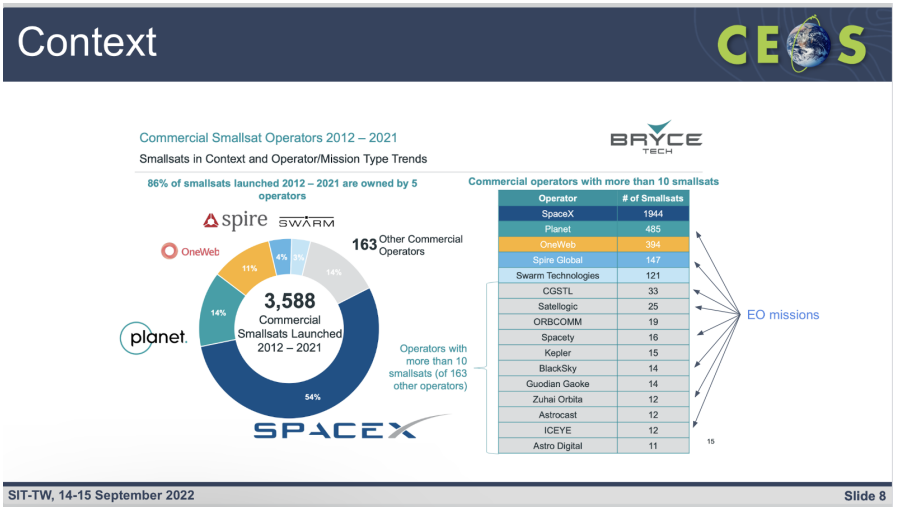
## Session 2: New Space & Future CEOS

### 2.1: Scene Setting: Review of Discussion to Date

Presenters: Ivan Petiteville (ESA, SIT Chair Team) *[combined session presentation] [background paper]*

Main points:

- This session builds on a brief initial discussion at SIT-37 which was limited by the virtual format. Several themes started to emerge during the SIT-37 discussion, including: new geometries in the EO sector; increasing proportion of commercial missions; commercial data buy and partnerships; and, hearing examples of agency experiences.
- It is important to treat key space market segments individually as the nature of each dictates different approaches. This includes upstream, midstream, and downstream.
- **Upstream** changing context, where in 2012, CEOS agencies launched 14 missions. By 2020 more than 50 private companies had announced their intention to develop missions or constellations (roughly 1,800 satellites).
- **Downstream** evolution of data processing, services, and marketplaces is ongoing. To date this has been driven by government and defence, but new companies are trying to drive change and growth of the marketplace. This growth has significant potential to impact how users interact with and extract value from EO data streams, including the scale brought by cloud computing and the insights generated from new approaches such as machine learning.




### 2.2: Further Case studies from CEOS Agencies

*USGS*

Presenters: Tim Stryker (USGS) *[presentation]*

Main points:

- There are a number of areas USGS is looking at in terms of New Space: commercial EO data access; ground stations as a service; cloud data hosting and distribution; applications development; and, downstream services.
- WGISS and WGCV have relevant discussions underway, as does LSI-VC. USGS's JACIE and ESA's VH-RODA are also of great relevance.
- The role of Venture Capital remains important but it is unclear what kinds of returns will be realised, and what impact these ventures will have on the future of the EO space, and how many will survive.

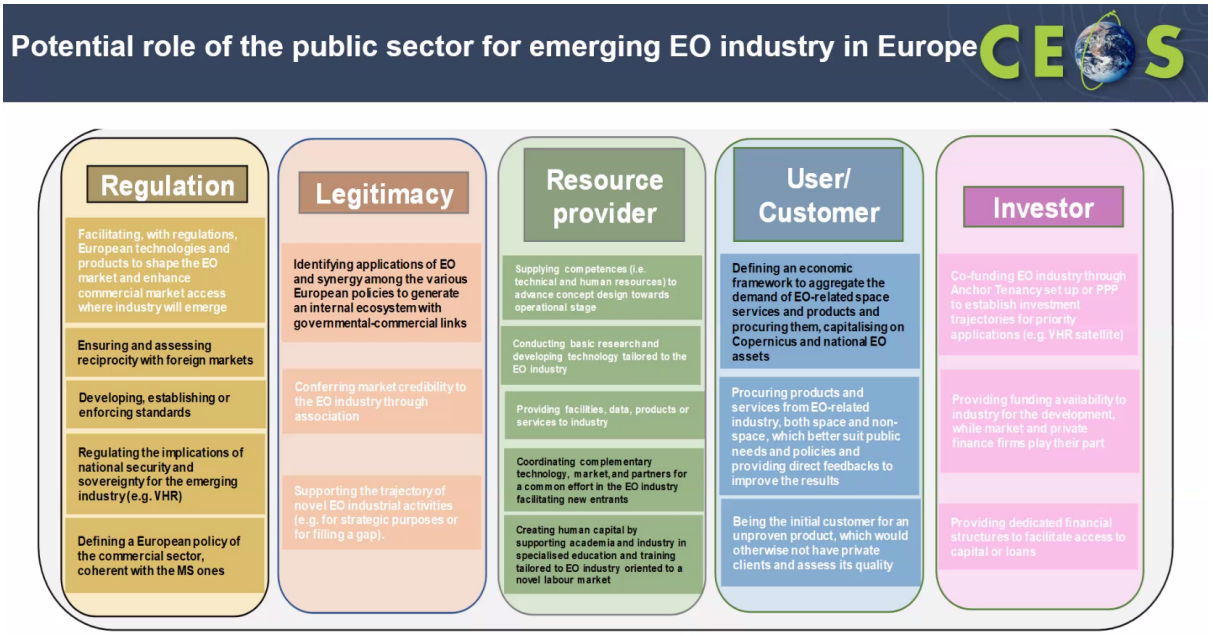
- Maxar, Planet and BlackSky have recently won multi-year contracts with the US NRO worth $Bns, with significant government money being spent on commercial data sources. Working closely with these government agencies to gain access to the same sources for civil benefit. Potential for extension of this to international partnerships, perhaps via CEOS.
- It remains unclear how well these companies will perform without government contracts underpinning them. Need to avoid reliance on single companies, as any failure can impact both data continuity and impact government programs.
- USGS is undertaking a multi-step user needs and gap analysis through the sustainable land imaging process. Engagement with users and identification of additional complementary data sources.
- The topics of data quality assurance, fitness for purpose, and authority (provenance) are key areas where CEOS agencies may be able to collaborate.
- USGS suggests that CEOS could establish a Task Team for Leveraging Commercial Space Products and Services. This would explore the principle of shared value between public and private commercial space services in delivering public benefit. USGS suggest an initial CEOS internal dialogue with subsequent involvement of commercial providers at a dedicated public, international meeting. The upcoming Pecora meeting may cover some of these issues.

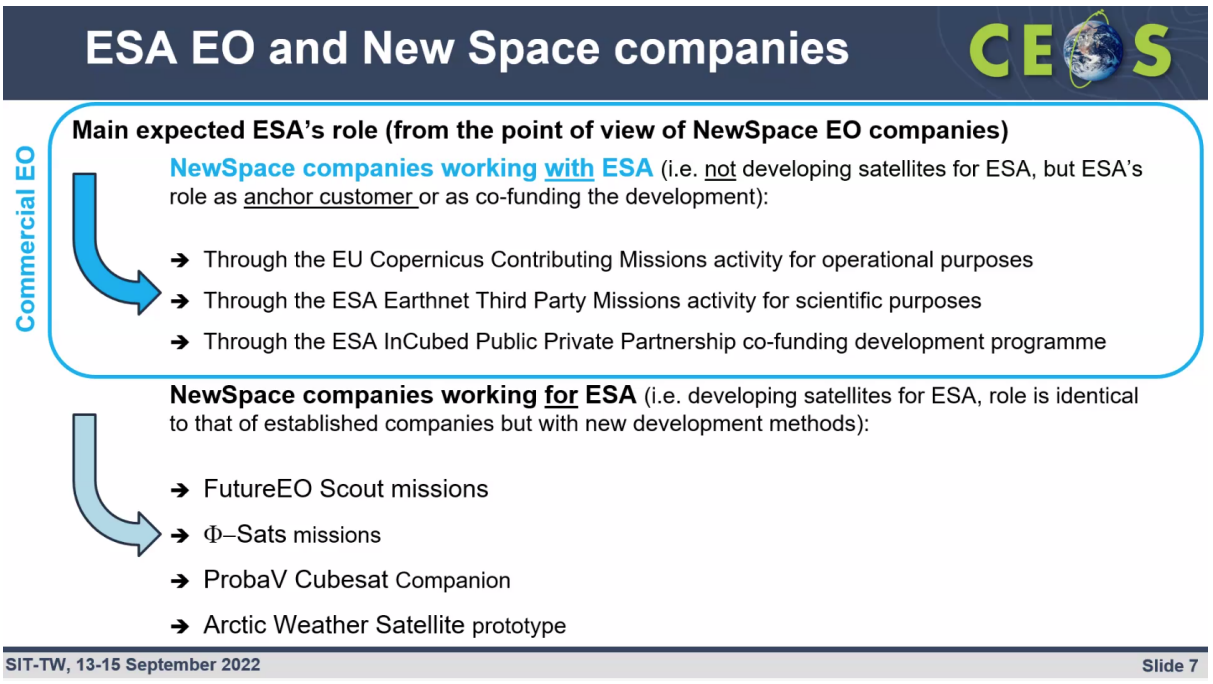
*ESA*

Presenters: Antonio Ciccolella (ESA) *[presentation]*

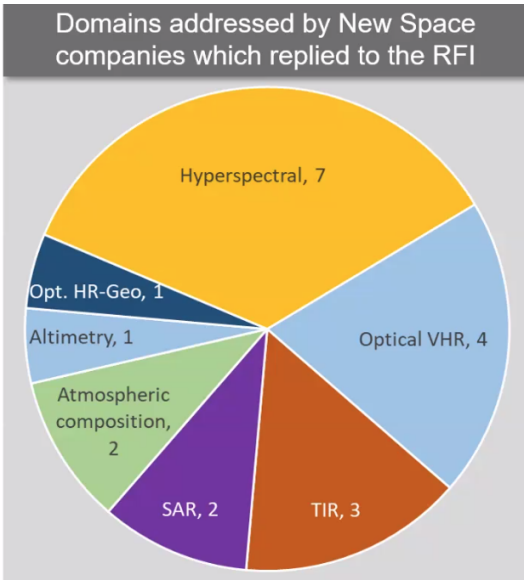
Main points:

- EO is only a small fraction of the commercial space market, with most purchases coming from the government in large transactions. Public-Private Partnerships are one of the most likely ways to underpin market sustainability.
- There is a need to be clear with definitions as the line between traditional private company and New Space can be difficult to discern.
- If the space economy is becoming more commoditised we can expect a significant share of commercial applications and internationalisation.
- We see a dynamic and successful commercial EO data market in the US, with NASA and other agencies having a clear mandate to work with the commercial sector.
- In Europe, the commercial sector is yet to reach the level of activity of the US. In the optical very high resolution domain, the monopoly of consolidated land surface imaging creates a high barrier of entry for New Space companies. Hyperspectral is still experimental and success will rely on how well the technical specifications meet user needs. In the SAR domain, ICEYE has provided a good example of how New Space capabilities can be integrated into Copernicus. European startups generally find funding more difficult than in the US.
- Copernicus serves as an enabler for New Space, providing a stable and long-lasting environment for European business and investors, underpinned by the Sentinels, which provide the basis for new services and business activity.




- The European Commission issued a Request for Information (RFI) regarding the state of the upstream New Space market. Three of 19 respondents are providing data. Several companies are aggregators. A common theme of the responses is short term horizon outlook and planning, with prioritisation on consolidation.




- Noted ESA InCubed program, which aims to develop prototypes, as well as the Phi-Sat missions, which aim to demonstrate new sensing techniques or apps of AI/ML, rapid development and cubesat approaches.
- Conclusion:
  - In the EO domain, New Space is still at an early stage and dependent on public sector funding, but it appears to be here to stay. How it grows is dependent on how well they perform and how well they meet the needs of users.
  - Copernicus is the big enabler of EO New Space in Europe.
  - Direct dialogue between the private and public sector, with users is needed to develop the way forward for partnerships.
  - A new culture of risk-sharing in Europe may really help New Space to flourish.

*GISTDA*

Presenters: Watanyoo Suksa-ngiamm (GISTDA) *[presentation]*

Main points:

- Key global trends include: cost reductions; increase in demand; and, an increase in entrepreneurial activity.
- GISTDA is promoting private enterprises throughout the supply chain; developing space infrastructure; developing a National Space Master Plan (2023 - 2037) as the blueprint of Thailand's new space economy; and, drafting Thailand's first space law as the implementation of international space laws.
- GISTDA would support a CEOS mechanism to address the New Space economy. The overall objective would be to provide a forum ('think tank') for the development of new concepts and ideas. There are a number of topics of common interest which the forum could address, including: law and regulation, space resources (e.g. spectrum, debris), investment opportunities, sustainable development, and the roles of public and private sectors.

*NASA*

Presenters: Alfreda Hall (NASA, CSDA Project Manager) *[presentation]*

Main points:

- NASA's Commercial Smallsat Data Acquisition (CSDA) pilot initiative started in 2017 intended to evaluate data from commercial small satellite operators, seeking to provide an on-ramp for new

vendors. The most recent RFI (December 2022) included data from Capella Space, ICEYE, GeoOptics, and GHGSat.

- Efforts have been made for the CSDA program license agreements to be expanded in order to broaden the applicability for scientific non-commercial use across the US government. Some practical progress has been made in this area, with three End User Licence Agreements developed which can be used (Public, US government plus (selected partners), and US government).
- ESA-NASA have a joint program on ground segments and data, and this is looking at coordination evaluation of commercial Third Party mission data. This group has drafted Joint ESA-NASA EO Mission Quality Framework Guidelines for Optical and SAR. The group was involved in cross-assessment of some missions (in particular PlanetScope and SkySat), and conducted other collaborations.
- Alfreda Hall (NASA) identified three areas for potential collaboration: data evaluation; data quality assessments; and, end user licenses.

*CSA*

Presenter: Marie-Josee Bourassa (CSA) *[presentation]*

Main points:

- Data infrastructure and regulations need change within Canada in order to better enable the uptake of New Space data.
- The benchmarking topics discussed in this session would be quite valuable from a Canadian perspective.
- There are significant cultural challenges in interacting with client agencies such as forest and agricultural services.
- The highest frequency feedback from industry presented at the Canadian 2022 National Forum on Earth Observation included: access to data and open data; collaboration between academia, research, industry, and the public sector.

Discussion of case studies from CEOS Agencies.

- There were a number of common issues raised during the agency presentations, including a number of different perspectives on the issue. Simonetta Cheli (ESA, SIT Chair) stressed that translating this into support from CEOS agencies to the commercial and non-CEOS entities is important. A task team could be useful in progressing these topics.
- Helene De Boissezon (CNES, WGDisasters) noted that Planet has been contributing to the Charter on Space and Major Disasters via USGS, as are companies such as ICEYE. This has been welcomed by the Charter.
- Mark Dowell (EC) noted the suggestion of a guidance framework for quality and thinks this is relevant to multiple interests in CEOS, including GHG.
- Paul Counet (EUMETSAT) reported that EUMETSAT has started a procurement of commercial data on a trial basis with good results - using operational criteria. There are questions around the business model and pricing, and challenges with rules around European procurement. The rules of meteorology around data policy were preserved, i.e. full free and open in near real time - this was a strong message from the EUMETSAT member agencies.
- Jeffrey Privette (NOAA) noted that as an operational agency, NOAA is thinking about long term sustainability and risks associated with procuring commercial data. WGClimate is concerned about changes with large economic impacts, as we consider a model where we move more to New Space approaches is algorithm and AI heavy. This presents a risk around the transparency and the large economic decisions based on data and products from the commercial space using

these methods. This includes around the transferability of algorithms, and ensuring consistency. There is a balance to be struck between fully open science and some use of new space.

- Steven Covington (USGS) noted that with the proliferation of commercial satellites, the topic of traffic management should be considered by CEOS. In particular, the impact of large constellations on CEOS agency architectures. For example, Landsat-10 is already working with this constraint.
- Ivan Petiteville (ESA, SIT Chair Team) noted the proposal from USGS for a task team, to be revisited in item 2.4.

**2.3: Other Examples in Relation to New Space**

**CEOS-ARD Oversight Group: CEOS-ARD Supporting New Space**

Presenter: Ferran Gascon (ESA, LSI-VC) *[combined session presentation]*

Main points:

- CEOS-ARD is a key step on the 'interoperability spectrum'. The CEOS-ARD Product Family Specifications (PFS) define parameters which facilitate interoperability – a subset of what is needed to achieve full interoperability (additionally need to consider: gridding, cloud-optimisation, discoverability (STAC), consistent terminology, consistent radiometric and geometric references, traceability, etc.).
- Moving CEOS Agency and other data providers' land surface imaging datasets along the interoperability spectrum will maximise the uptake and impact of all data sources for societal benefit, and reduce the data processing burden on users.
- Products assessed as CEOS-ARD are known by the community to meet the high standards set by CEOS space agencies, can be branded as such with the CEOS-ARD logo, and will be listed on ceos.org/ard. Assessments increase confidence and expand the reach and uptake of datasets.
- CEOS, with its long heritage, experience and expertise has a key role to play in defining ARD for the community and led the way with land surface imaging. The CEOS-ARD Oversight Group is now looking to expand the concept first developed by LSI-VC to other thematic domains.
- The overwhelming feedback from industry is that formal standards are needed for 'ARD' and that without a standard it is difficult to implement CEOS-ARD into operational workflows and to ensure product interoperability.
- The CEOS-ARD Oversight Group and LSI-VC have an increasing level of engagement with the private sector (incl. 'New Space') on CEOS-ARD, for example:
    - Sinergise: Produced the first Normalised Radar Backscatter CEOS-ARD – Sentinel-1 RTC for Digital Earth Africa
    - Satellogic: Presented to LSI-VC, will consider CEOS-ARD PFS, currently developing their Surface Reflectance product – potential for CEOS-ARD from outset
    - Capella: Free SAR imagery via the Registry of Open Data on AWS, CEOS-ARD Oversight Group engaged with them on the possibility of CEOS-ARD assessment of products.
- In the frame of the 'New Space & Future CEOS' theme, CEOS should consider the following actions to increase the impact of its own data as well as that from the commercial sector:
    - Promote CEOS-ARD from its own missions; fully resource effort to move to routine production of CEOS-ARD for all missions, from the outset;
    - Look at reprocessing campaigns for older missions;
    - Resource an updated CEOS-ARD Commercial Engagement Strategy (incl. New Space);
    - Take the lead in the standardisation of ARD for the EO community;
    - Work with the commercial sector to promote datasets in line with CEOS-ARD specifications;

- Provide support to the commercial and new space sector to meet the CEOS-ARD specifications;
- Seek to evolve CEOS datasets along the interoperability spectrum – working on the necessary additional components in a coordinated and holistic manner;
- Support the CEOS-ARD Oversight Group's work on CEOS-ARD for other thematic domains.

**ARD Standards**

Presenter: Steve Labahn (USGS, LSI-VC Co-Lead) *[presentation]*

Main points:

- Two topics were raised: CEOS involvement in the development of ARD Standards and CEOS interaction with standards bodies.
- The overall objectives of CEOS in engaging in the discussion around ARD standards are to provide a firm definition in an area which is often subjective, and to ensure CEOS remains engaged in the formulation and promulgation of these definitions. This is also key to enabling interoperability with the wide variety of commercial data sources emerging, planned, or considered.
- ISO/OGC have initiated a process to define ARD standards, and CEOS should ensure that a few people with CEOS-ARD heritage (from LSI-VC agencies) are involved in the OGC ARD Standards Working Group. This effort is using CEOS-ARD as a basis and will likely proceed regardless of CEOS involvement, introducing the possibility of divergence.
- Through this effort to define the next steps for ARD standards, the LSI-VC and CEOS-ARD Oversight Group identified that CEOS, through its member agencies, has representation in numerous standards body discussions, but this is seemingly in an *ad hoc* fashion. This creates potential for: lack of coordination, conflicting messages, inconsistent positions across CEOS, no clarity on status of CEOS Agency engagement, no possibility for a coordinated CEOS input, lack of CEOS-level representation in standards.
- After broad consultation across CEOS, and discussion at a SIT Technical Workshop side meeting, it was agreed that increased CEOS coordination on standards would be beneficial. Increased coordination will clarify CEOS resourcing, avoid duplication of effort, give CEOS Principals visibility over the breadth of CEOS representation to these bodies, ensure a CEOS position is formulated and heard in all relevant fields, and allow CEOS Principals to understand the interests and activities of the various agencies with regard to standardisation.
- It was suggested that SIT TW make a decision to prepare a report to CEOS Plenary and suggest an action to prepare a *Strategy for CEOS Engagement with Standards Organisations* (with a CEOS Plenary 2023 target for completion).

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| **SIT-TW-2022-01** | SIT Chair, in consultation with current and incoming CEOS Chair and the SEO to assemble a Task Team to further develop the 'New Space & Future CEOS' topics and initiatives (including Task Team proposed Terms of Reference to be confirmed at Plenary). | **2022 CEOS Plenary** |
| | *Rationale: Significant interest across CEOS agencies in this topic and a desire to explore ideas for concrete collaboration* | |

**WGCV: Supporting Smallsat Data Quality**

Presenter: Philippe Goryl (ESA, WGCV) *[presentation]*

Main points:

- Earth observation data without proper calibration has little value for most applications, because if the data cannot be trusted, no reliable information can be derived from it. SmallSat/NewSpace teams are interested in increasing the reliability of their data while ensuring a fast data delivery and return of investments. WGCV Cal/Val support helps to move forward and reach these goals. Providing such Cal/Val support will reduce their operating costs and add value to their end products. It will enhance their science/application/service capabilities, strengthen their competitiveness, and reduce time to market.
- WGCV elements fit together to provide a coherent and comprehensive system for Cal/Val: facilitating Sensor to sensor interoperability by establishing a CEOS post launch Cal/Val reference; increasing the reliability of data – including New Space.
- Philippe presented an example concept being researched called 'EO AIM'. EO AIM seeks to improve confidence and trust in more EO data sources and to thereby provide increased commercial opportunities for New Space companies and associated societal benefit for many applications. It would provide access to legacy public cal-val ground sites and an automated open source toolkit to participating data providers to allow them to undertake routine checks on fundamental data quality measures. Frequent characterisation and reporting of these measures is assumed to foster improved trust in the data and its fitness for new purposes. EO AIM seeks to mainstream application of regular cal-val to New Space missions and to provide free, open and transparent tools (as automated as possible) to incentivise uptake – Cal-Val as a service (CVAAS)

**2.4: Discussion on CEOS Strategy for New Space**

- Ed Armstrong (NASA, via chat): cautioned against ending up with CEOS ARD specifications locked behind a paywall via engagement with groups like ISO.
- Osamu Ochiai (JAXA): anticipating increasing involvement of the private sector in ARD and WGCV, should we be thinking about how CEOS structure may be affected. In particular, this may be in future a desire from the private sector to engage further in CEOS matters. Ivan suggested that while we won't likely solve this issue today, this could be addressed in the GISTDA proposal for workshops, and could be discussed by the Task Team being suggested by USGS.
- Jonathon Ross (GA): government programs as enablers of private activity resonates with GA's interests, and is at the heart of the recently-announced first Australian civil Earth observation mission (NSMEO). NSMEO is designed for support and encouragement of greater uptake of commercial data with government system data in mind. GA would like to avoid the perception that data is exclusively from one source or another, rather the interoperable use of data from different sources is key. NSMEO comprises an initial series of four cross-calibration satellites (Satellite Cross-Calibration Radiometers, SCR) with a very specific job: to transfer calibration from gold standard systems to some of the other commercial satellites that are less well calibrated. We need to address how to make it easier for users to combine these data for richer services and avoid users being dependent on one single system, especially for countries that are totally dependent on data from other countries.
- Jonathon also noted the AusCalVal program of upgraded cal-val infrastructure in Australia, and that all data from SCR and AusCalVal will be free and open. Australia has an altruistic motivation, enabling new data providers to engage new users in an easy manner, and making data users more open to using multiple and new data sources.
- Brian Killough (NASA, SEO) noted that we don't have a New Space strategy for CEOS with written goals and objectives addressing what CEOS would like to achieve. Topics may include: users and producers of data, ARD and standards, licensing, and others. This could also be a good priority for GISTDA as CEOS Chair next year.
- Steve Labahn (USGS) noted there was a commercial engagement strategy document, 2019, focused on CEOS-ARD, and noted the suggestion from LSI-VC and Ferran Gascon to update that.
- Ivan Petiteville (ESA, SIT Chair Team) noted the suggestion from USGS to create a task team, addressing and expanding on the topics of common interest mentioned by presenters in this

session. The Task Team would brainstorm, discuss, and come back with findings and recommendations on what CEOS could do. Timothy Stryker (USGS) agreed, suggesting we not be too prescriptive on topics to be addressed to ensure there is room for the perspectives of many CEOS agencies to be included. Seeking to learn from one another, and to define best practice would be helpful.

- Charles Wooldridge (NOAA) agreed the list of topics discussed in this session form a good basis for a Terms of Reference. He suggested the group should also look at work that has happened, and that is ongoing in other fora. For example in the GNSS-RO space around data licensing. He hopes the task team would be looking to build on experience of other groups.
- Timothy suggested expediting engagement with the commercial sector as these topics are being discussed actively at the moment in industry. Ivan agreed, and suggested this could be an early task of the Team.
- Pakorn Apaphant (GISTDA) supported the idea of a Task Team, noting the group will need contributions and support from all CEOS agencies, reflecting all country and regional perspectives. He agreed with the need to link with the commercial sector.
- Olivier Marshal (CNES) noted CNES welcomes this idea, and is willing to contribute to the Task Team as proposed. He agreed we should use SEC meetings to provide information on the preparation of the ToR of the Task Team.
- Steve Labahn said that LSI-VC would be prepared to lead the effort on defining the input for Plenary on a standards organisation strategy. Mark Dowell (EC) agreed with the suggestion that LSI-VC lead the initial input to Plenary on the standards engagement strategy.
- Jonathan Ross suggested that others work with LSI-VC to prepare the plenary topic on standards engagement strategy to ensure a broad approach. Ferran offered to contribute via the CEOS-ARD Oversight Group. WGCV will also contribute to the action and Kuze-san offered support.
- Steve Labahn suggested an action to bring CEOS into the ARD Standards Working Group that is being established by ISO-OGC, and this was agreed.

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| **SIT-TW-2022-02** | LSI-VC Co-Leads, supported by the CEOS-ARD Oversight Group Lead and WGCV Chair, to prepare an agenda item for the 2022 CEOS Plenary formulating an action for CEOS to prepare a way forward for increased coordination of CEOS engagement with standards organisations. | **2022 CEOS Plenary** |
| | *Rationale: Following broad consultation with the CEOS community, including at a 2022 SIT Technical Workshop side meeting, it was agreed that more coordination on the engagement of CEOS with standards organisations would be beneficial. While this action originated from the LSI-VC and CEOS-ARD Oversight Group, the scope is intended to cover all of CEOS' engagement on standards.* | |
| **SIT-TW-2022-03** | CEOS Agencies to consider designating one or more representatives with CEOS Analysis Ready Data (ARD) heritage to join the OGC ARD Standards Working Group. | **Before the October 2022 OGC Member Meeting** |
| | *Rationale: The OGC ARD Standards Working Group will be proceeding with their effort to define joint ISO and OGC standards for "ARD" based on CEOS-ARD. CEOS needs to be engaged and represented in this process.* | |

## Session 3: Climate and Carbon

### 3.1: Session Introduction

Presenter: Stephen Briggs (ESA, SIT Chair Team) *[presentation]*

Main points:

- Stephen Briggs (ESA, SIT Chair Team) provided an update on the GST actions along the lines of the recommendations from the CEOS Strategy for the GST Update. Individual reports have been developed to address these recommendations, as well as other activities ongoing.

### 3.2: WGClimate Update on SBSTA and COP, Recent Activities

Presenters: Albrecht von Bargen (DLR, WGClimate) *[presentation]*

Main points:

- Dr. Wenying Su (NASA/Langley) has been nominated as the WGClimate Vice-Chair - subject to approval of CEOS plenary.
- The ECV inventory has been consolidated to version 4.1. A gap analysis workshop was organised with focus on ECVs driving the Earth's climate Carbon cycle. A brief report with findings related to GCOS IP draft has been submitted to GCOS Secretariat in June 2022.
- WGClimate is collecting use cases for climate data records using theclimatemonitoring.info webpage. This is led by NASA (Wenying Su) and WMO (Zoya Andreeva).
- COP-27 side events agenda is now available: https://seors.unfccc.int
- Earth Information Day (EID) is grouped around the climate cycles and the Ocean decade - starting with an extra presentation of the new GCOS implementation plan (EID planned for 9 November 2022)
- CEOS-CGMS SBSTA-57 statement has been drafted and sent to CEOS-SEC and CGMS-SEC for comment.
- Currently preparations are underway for COP-27, with inputs being consolidated in September-October.

**CEOS Preparations for COP-27**

- Albrecht von Bargen (DLR, WGClimate) recalled the SBSTA statement due October to UNFCCC and reminded CEOS that we must clarify who will deliver the statement - either the delegation of the CEOS Chair country or another. The normal procedure is that the statement is presented by the CEOS Chair country's national delegate.

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| **SIT-TW-2022-04** | WGClimate Chair to confirm with CEOS Chair as to who will present this year's CEOS-CGMS Joint Statement to the UNFCCC SBSTA | **ASAP** |
| | *Rationale: The CEOS-CGMS Joint Statement to SBSTA must be delivered by a suitably-credentialed person, in accordance with UNFCCC processes.* | |

- Mark Dowell (COM) noted preparations for CEOS engagement in the IMEO event are ongoing, and will be provided to the CEOS delegation in due course.
- Marie-Josee Bourassa (CSA) reported briefly on a planned EO Event at Canada's COP-27 Pavilion, a panel: *Global Transparency to Move the Global Methane Pledge to Action.*

### 3.3: GHG Roadmap Update

Presenters: Mark Dowell (COM, GHG Task Team) *[presentation]*

Main points:

- CEOS has facilitated and proposed for endorsement contributions to the global stocktake for CO2 and CH4 emissions based on satellite observations of total column CO2 and CH4. These pilot top-down GHG products are intended to start a conversation with stakeholders and users to establish the utility and best practices for combining bottom-up and top-down products to enable a more complete Global Stocktake (Available at https://ceos.org/gst/ghg.html )
- WMO initiative on an international framework for coordination is very welcome and space agencies are engaging appropriately. This is consistent with the original constellation strategy White Paper.
- The critical actions in transition to operations are: space segment towards WIGOS vision; standards for operational products; operational QC and Cal/Val framework; identify continuity issues and make proposals for contingency planning; training and end user support,
- Next steps include:
    - Support efforts to integrate $CO_2$ and $CH_4$ based inventories using fluxes from total column data and fossil emissions from high-resolution plume mappers (e.g. GHGSAT and Carbon mapper, Methane-Sat)
    - Support nascent efforts to develop greenhouse gas information systems (e.g. COCO2, IMEO, NASA)
    - Intercomparison between CEOS AFOLU estimates and top-down forestry net carbon exchange using atmospheric GHG measurements
    - Host a workshop on evaluating and attributing uncertainties in top-down CO2 and CH4 emissions.
    - Work with Working Group on Climate to define GHG essential climate variables based on May 2022 gap workshop
    - Pilot products are also being developed to track emissions from localised sources including large urban areas, power plants and oil fields

In summary: The team is starting to address Roadmap Actions looking forward towards GST2 and beyond. They will update the roadmap and address additional actions that have emerged in recent years, such as low latency product demand, commercial sector data and products, standards, and new cal-val opportunities. They will engage in the new WMO international GHG monitoring framework. GHG TT leadership transition is foreseen in the coming months after discussion at the GHG Task Team meeting, and Plenary will be informed.

Discussion

- Stephen Briggs (ESA, SIT Chair Team): On intercomparison between AFOLU estimates and top-down measures, this is an important point to keep in mind for the future - connecting the top-down and bottom-up. There is a key connection to be made between the AFOLU and GHG activities.

### 3.4: AFOLU Roadmap Update

Presenters: Ben Poulter (NASA, AFOLU Roadmap Co-Lead) *[presentation]*

Main points:

- The heritage of the AFOLU Roadmap includes a discussion paper prepared by the LSI-VC Forests & Biomass Subgroup, as well as the CEOS GHG Roadmap (with CGMS).
- Work to date has included an assessment of available AFOLU products that could be ready for COP-26, engagement with existing activities and users, and significant input to a report on "The Role of Systematic Earth Observations in the Global Stocktake".
- Ben reviewed the objectives and expected contents of the AFOLU Roadmap. The overall goal is to provide a framework and guiding vision for long-term (15 year, 2035) coordination of CEOS agencies, and for communication to stakeholders.
- A CEOS-TOPC AFOLU Workshop was held recently (12 Sep, ESRIN) which brought together the team along with the Terrestrial Observation Panel for Climate (TOPC). The workshop was structured along the lines of the AFOLU thematic expert teams, along with aspects of global assessments and synthesis, national climate policy, and GHG inventories.
- The virtual environment has greatly slowed progress, and so there is a bit of a reboot ongoing.
- The workshop:
  - Affirmed AFOLU is a 'generational challenge' that CEOS should attempt to rise to;
  - Addressed a framework for long-term coordination to 2035 (GST1, GST2, GST3);
  - Began a discussion on the elements of the guiding vision.
- It was clear from the discussion that contributions from agencies or other resources are required to progress the activity, and realise its ambitions.
- AFOLU thematic teams are already doing important relevant work (e.g. GEOGLAM for Ag) that we must harness for efficiency.
- End 2023 (GST1) is assumed to be the latest sensible delivery for the Roadmap.
- The Roadmap is primarily an internal document but also communicates our intent for public EO to serve society and these policy processes.
- A step up in capacity is needed to realise the ambition now.

## CEOS AFOLU Data Strategy (TBC!)

| | COP-26 (Nov 2021) | GST1 (2021-23) | GST2 (2026-28) | By (2035?) |
|---|---|---|---|---|
| Forest - Above Ground Biomass | Individual existing datasets<br>Tool for visualisation of global AGB products developed, with country use case examples and capacity for product assessment | Synthesized, jurisdictional level biomass, emission factors (and prototype biomass change) | Synthesized spatially explicit, annual biomass, emission factors and biomass change | (ALL sectors)<br>Overall approach should aim for all observations to be integrated through reanalysis / use as priors in inversion models |
| Land Cover & Forest (Area) | - Copernicus annual global land cover<br>- C3S/CCI Land Cover<br>- WorldCover, HILDA+<br>- Global Forest Watch tree cover loss and forest fluxes | Synthesised map products and estimates of land cover and change at regional, and global levels<br>Global tree cover and forest emissions and removals | Statistically robust activity data estimates (6 IPCC classes) at national and global levels<br>Global annual forest emissions and removals at 30-100 m resolution. | +<br>Increased use of high-resolution PPP missions |
| Mangroves & Wetlands | - Global Mangrove Watch cover and change (1996-2020)<br>- Global Mangrove biomass (2000) | - Global mangrove cover and change at 25 m (1996-2022)<br>- Global mangrove biomass at 12 m (2015) | Global annual mangrove emissions and removals at 10-25 m resolution. | +<br>Fully integrated crop physiology models in inversions |
| Agriculture | Demonstration WorldCereal products for at least 5 countries (Argentina, Spain, France, Ukraine and Tanzania) | Initial WorldCereal map and analytical system.<br>On-going seasonal analysis products | Continual system improvement and production of seasonal state and change products | +<br>Increased use of data portals for Parties organized through UNFCCC partnership |

Indicates off the shelf datasets possible. Indicates additional resources needed.

- The next steps are:
  - Reworked report skeleton and writing assignments with annotated guidance, around a structure of:
  - A projection of policy needs through 2035
  - A projection of EO capabilities in this timeframe
  - An adequacy assessment and implications for evolution

- A framework for CEOS agency actions
- Ideally identify a lead author to streamline management and work through section assignments and their confirmation
- Report to Biarritz Plenary on any capacity gaps and request Principals to address them
- Agencies with active interest in land surface observations strongly encouraged to sponsor participation of suitable experts in support of the Roadmap development

Discussion

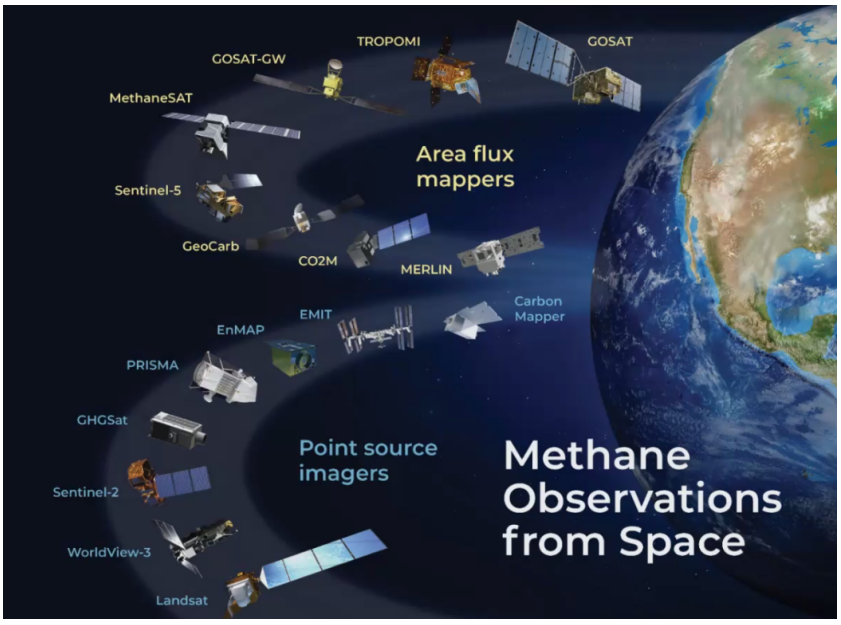
- Stephen Briggs (ESA, SIT Chair team) noted the importance of the long-term vision and integration of top-down and bottom-up approaches.
- Jeffrey Privette (NOAA) asked if the Roadmap will define a ground infrastructure for cal-val, and Ben confirmed there was some discussion on the need for suitable cal-val networks. It is expected to be a thread in the report.
- Mark Dowell (EC) suggested the inclusion (as done with GHG Roadmap) to have a section that discusses the resourcing of these activities. Without it, there is a risk that Principals will require resource info before committing. It is critical that CEOS and agencies step up to this very important opportunity.

**3.5: IMEO Update and Technical Needs**

Presenters: Luis Gaunter (IMEO, remotely) *[presentation]*

Main points:

- The Methane Alert and Response System (MARS) has been developed as a response to the global methane pledge. This pledge has now been signed by >120 countries.
- >50% of global methane emissions are anthropogenic, meaning this is an area where actions taken can make a difference.
- MARS is one output of IMEO, which aims to catalyse reductions of methane emissions using transparent, data driven approaches. It uses satellite remote sensing for detection and attribution of methane plumes from point sources and will include notification and mitigation-tracking workflows.




- The ecosystem of methane sensitive satellite missions is very heterogeneous in terms of detention limits, spatial and temporal sampling, and availability of ARD methane data products.

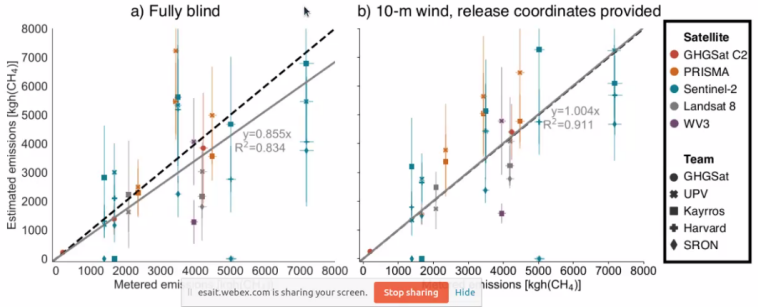
- Addressing the issue will require measurements from both area flux mappers (lower resolution, global coverage, area averages) as well as high resolution point source imagers, utilising both hyperspectral and multispectral missions.
- IMEO-MARS has two distinct tasks: ultra-emission detection system (rapid detection and attribution where possible; global coverage) and persistent point-source detection (identification and characterisation of point sources, focused on regions where strong and persistent emissions are detected).
- TROPOMI is key to the global coverage, detection of ultra-emission events (rapid response). Point source imagers will be utilised if attribution is not possible using the TROPOMI data. TROPOMI and other wide area coverage sources are also used to identify the regions of persistent emissions, for follow up with other sources that are high resolution and may require tasking.
- MARS is focused on detection and attribution of methane plumes and attribution to sources. The validation concept is still under discussion - potentially including plume detection algorithm intercomparisons

## Validation

- **MARS' main objective: detection of methane plumes and attribution to sources**; flux-rate estimates (quantification) to be included as ancillary information for each detection.
- The validation concept is under discussion - possibilities:
  - Plume detection algorithms: inter-comparison of the "operational" MARS algorithms used in Task 1 (Kayrros) and 2 (SRON) (focus on TROPOMI, but also hi-res, ...)
  - Performance of the different satellites for point-source detection: inter-comparison of concurrent acquisitions by different satellites
  - Plume quantification & (to some extent ) detection limits: controlled methane release experiments (e.g. U.Stanford)

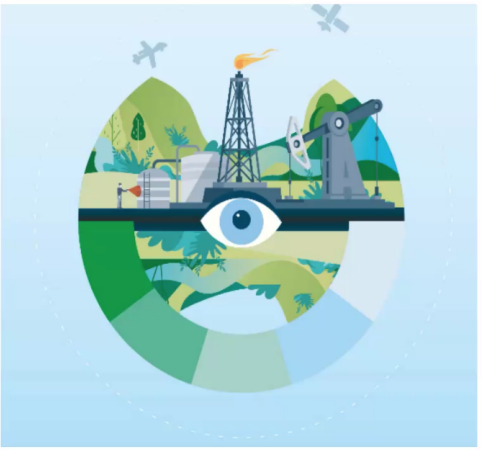
*Satellite results from the "Stanford" controlled release experiment*

*Sherwin et al. (preprint, 2022)*




## MARS – Concluding remarks

- A diverse ecosystem of methane-sensitive missions already operating; a number of powerful missions to operate soon
- MARS-Detection: a satellite-based system for the detection, quantification, and attribution of methane emissions from point sources (energy sector)
- The project team and an initial concept based on two tasks (rapid reponse and persistent sources) have been implemented - first results expected by COP27
- Potential contribution by CEOS:
  1. Facilitate access to satellite data, esp. targeted imagers such as PRISMA (ASI), EnMAP (DLR), EMIT (NASA), AHSI (MEE) and GHGSat (Canada)
  2. Help coordinate the development and consolidation of data processing methods (e.g. retrieval algorithms)
  3. Help coordinate validation efforts



Thank you for your attention!

Discussion

- Stephen Briggs (ESA, SIT Chair Team) noted the public-private integration aspects.
- Simonetta Cheli (ESA, SIT Chair) as SIT Chair wrote to the relevant agencies in July requesting support to IMEO.
- Ferran Gascon (ESA, ARD Oversight Group) asked about the reference to Analysis Ready Data and whether IMEO sees CEOS going in the direction of developing PFS for methane products. Luis Gaunter (IMEO) noted the use of some of the missions for Methane mapping is the result of some good developments in this area in the past years. Most of the mission spectrometer, spectral radiance retrievals are being done by IMEO. Consolidation of the different retrieval methods has not been done yet. As this field is evolving quickly it would be better to have some consolidation for the harmonisation of methods.
- Akihiko Kuze (WGCV) noted that WGCV would be interested in collaborating on this activity, and that there have been a couple of recent campaigns which may be of relevance. Stephen Briggs welcomed the statement from WGCV that they would like to support validation efforts of IMEO.
- Marie-Josee Bourassa (CSA): comes back to the role of CEOS with commercial data. GHGSat have been providing data to IMEO for some time. Luis Gaunter (IMEO) confirmed at the moment IMEO have access to the archive, and some selected near real time data, but regular new acquisitions remain to be discussed (no agreement in place). Stephen Briggs suggested asking CSA to become involved in any discussions between IMEO and GHGSat.
- Albrecht Von Bargen (DLR) asked how IMEO compares from year to year the data and what sort of accuracy measures are in place.
- Stephen Briggs: noted that access to global mapping data is not an issue, but access to high resolution datasets remains problematic. SIT Chair Team welcomes agencies responsible for high resolution datasets to respond.
- Luis noted that IMEO does not have any sort of future requirements for particular accuracy. IMEO tries to use the satellite data which is valuable, put this on the data portal and use the information to collaborate with the government to help in mitigation. The scenario is changing quickly in terms of methods. In terms of valuable satellite missions, MethaneSat is going to make a huge difference.
- Julie Robinson (NASA) noted EMIT is not yet operational, and is focused on dust mapping. There is no methane product planned, but it will be investigated. Once the mission is operational, all data and algorithms will be available.
- Klaus Schmidt (DLR) noted EnMap is in cal-val mode, and is expected to go public in November. IMEO can contact DLR via Klaus for further assistance. Luis noted they have been using PRISMA data for the past couple of years.
- John Worden (JPL): asked about what IMEO are trying to validate, i.e. detection vs. release rate. Luis replied that they are hoping to avoid false positives, and also to make sure the estimates are clear. Details are being coordinated.
- Stephen Briggs noted the further point in the letter from Simonetta around definition of future SWIR specifications - and requests that CEOS agencies keep in mind the needs expressed by IMEO.

| | | |
|---|---|---|
| **SIT-TW-2022-05** | SIT Chair will follow up with relevant agencies and CEOS teams on the cooperation requests submitted by IMEO to CEOS through the recent letter and TW presentation and bring an update to CEOS Plenary | **2022 CEOS Plenary** |
| | *Rationale: IMEO will headline an EO-based methane detection system at COP-27 and there is a significant opportunity for CEOS agency data and capabilities to feature* | |

**3.6: JRC Workshop Report**

Presenters: Mark Dowell (COM) *[presentation]*

Main points:

- This Workshop was held in November 2021 and took into account evolving policy needs - seeking to provide a comprehensive picture for decades to come. This includes the capability to provide integrated observations of GHG emission plumes (and their reduction) over the next 15-30 years. There will also be an important role for the monitoring of unavoidable emissions which should be compensated by global carbon sinks elsewhere.
- There has been a lot of focus on forests to date, and an increased focus on agriculture and other land uses is needed. The development of the Essential Agricultural Variables (EAVs) may provide an important starting point for the discussion.
- Mark Dowell (COM) reviewed selected outcomes around: data and standards, engaging the carbon cycle community, prioritisation of research needs, and how to progress towards a common system.
- A final report will be released by the end of year, with a first draft to be sent to attendees in October.

Discussion

- Stephen Briggs (ESA, SIT Chair Team) noted that a unified approach is emerging from multiple discussions. It provides us with a structured and strategic goal to share, but will need a staged effort.
- Jeff Privette (NOAA) asked if there would be summary actions included in the Roadmap. Mark Dowell (COM) noted they hadn't considered that, but it makes sense. He noted there will be periodic updates on research priorities, and agreed that the workshop report will provide good additional inputs to the Roadmap.

**3.7: GCOS Implementation Plan Update**

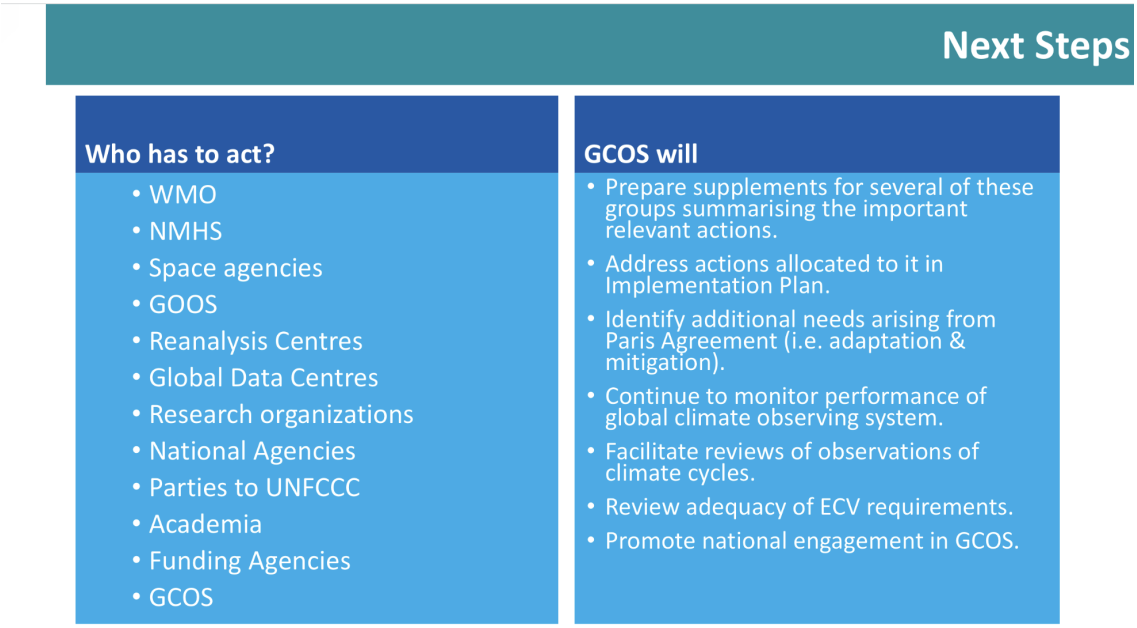
Presenters: Anthony Rea (WMO, remotely) *[presentation]*

Main points:

- The GCOS Implementation Plan (IP) has typically been updated every 5-6 years, with the latest update coming this year (2022). This year's IP has a different structure with fewer, more focused, and better integrated actions with a clearer means of assessment and stakeholders.
- In this IP, a wide range of views has been condensed into six themes for action.


**Themes for Action**

- The next steps were reviewed, including specific actions for space agencies.




Discussion

- Albrecht Von Bargen (DLR) noted that in the past CEOS-CGMS has produced a response to the IP, and this will be prepared over the next year or so.
- Stephen Briggs (ESA, SIT Chair Team): asked whether the satellite supplement has returned. Anthony confirmed that it has. GCOS is assigning names against each of the actions and has returned to past practice with a section that summarises the actions for the space agencies.
- Osamu Ochiai (JAXA): What will happen with the UNFCCC angle - can it be a source of feedback? Is there a sense of how applicable the GCOS IP actions are to the types of topics that UNFCCC and countries are interested in? And do the needs of the parties feed back to the GCOS IP actions. Is there a mechanism for that? Anthony replied that the GCOS IP can be a framing reference for a lot of activities around UNFCCC. It will be presented at the Earth Information Day. The IP informs parties on what they need to do to address gaps for a climate observation system and is officially recognised. It is expected that it will be referenced in the outcomes of SBSTA and

that engagement via Earth Information day will see some of the gaps addressed at the governmental level. It has a real role in the UNFCCC process and GCOS will be working to make sure parties are well aware, particularly in SBSTA RSO discussions.

### 3.8: Ocean Carbon Special Report

Presenters: Marie-Helene Rio (OCR-VC) *[presentation]*

Main points:

- 25% of $CO_2$ released into the atmosphere is absorbed by the ocean. Whilst there is a good estimate and measurements, the total global land sink is difficult to measure accurately and is often computed indirectly from the ocean carbon sink. Ocean carbon is therefore a key constraint on global carbon budgets, and improving the ocean carbon budget will improve the land budget. The ocean component of the budget now has a greater dependence on observations via the integration of observations into models.
- Space agencies, via OCR-VC, have proposed two activities: an aquatic carbon from space special journal issue and the aquatic carbon from space workshop.
- The Ocean Carbon from Space Workshop was held in February 2022 and strongly attended with around 450 participants. All presentations and posters are available on the workshop website, together with the synthesis, by every chair of the session discussion outcomes. A community white paper gathering the workshop's outcome and recommendations has been submitted for publication to the *Earth System Reviews Aquatic Carbon From Space Special Issue*. First manuscripts are to be published by the end of 2022 and the issue completed by the end of Q1 of 2023 (or Q2 at the latest).
- These activities have created a strong momentum around the Aquatic carbon from space topic, a key component of the Global Carbon Budget. Space Agencies will further advance toward an OCR-VC led CEOS Aquatic Carbon Roadmap, as the Aquatic leg of the CEOS GHG and AFOLU roadmaps. The goal is to summarise what is known right now about Aquatic Carbon and its role in the global carbon cycle, and to identify which variables can be provided in the context of global integrated carbon monitoring, and provide a roadmap towards filling the main knowledge gaps, focusing on a few major gaps to which all agencies can contribute.

Discussion

- Ivan Petiteville (ESA, SIT Chair Team) asked about the time frame for an ocean carbon roadmap. Marie-Helene Rio noted that much additional work would be required and would need a few years at least.
- Mark Dowell (COM): suggested that its important to recognise that blue carbon is (from a policy point of view) often grouped into AFOLU aspects. e.g. recent EU legislation. If CEOS decides to go ahead with a roadmap, which is linked to the second recommendation in GST Strategy - we would need to make a comprehensive assessment along lines of what has been done and look at requirements coming from the oceans community. Need consistency between the ocean carbon community and the superset of cross-domain perspectives. Develop a list of ocean variables that are needed in the more comprehensive system assessment and make sure there is consistency.
- Stephen Briggs (ESA, SIT Chair Team): Annex C of the GHG report covers observations for ocean carbon. He encourages the ocean carbon group to review Annex C and to provide input - in parallel with any ocean-specific wor. Comments would be helpful to ensure Annex C is on the right track.
- Marie-Helene Rio: noted that we have global products for satellite measurements for many of the different components in the ocean carbon cycle, but they have been developed in separate ways - and we need to increase consistency. In any global carbon budget assessment, we usually

use one specific path of the system - but they are interdependent - and need an integrated view of the whole system.

- Jeff Privette (NOAA): suggested that the roadmap identify what is possible now and what is targeted in future via a stepped approach.

### 3.9: GEO-TREES Update

Presenters: Klaus Scipal (ESA) *[presentation]*

Main points:

- Iris-Amata Dion took up duty as GEO-TREES executive as of 15th June - funded for two years by CNES and hosted by Jérôme Chave's Evolution et Diversité Biologique Lab at CNRS.
- GEO-TREES Governance and Implementation Plan draft is ready and due for revision and acceptance by the GEO-TREES steering board.
- GEO-TREES Trust Fund set up has been started with the GEO secretariat.
- Securing funding remains a challenge, though an initial funded has been secured (private company).

Discussion

- Stephen Briggs (ESA, SIT Chair Team): remarked that it is good to have initial funding from outside the space agencies and hoped that the required support will be forthcoming. Its good to have reach beyond our immediate community.

### 3.10: The Case for Coordinated Global Greenhouse Gas Monitoring

Presenters: Lars Peter Riishojgaard, WMO *[presentation]*

Main points:

- The case for coordinated monitoring is built around increasing the understanding and reducing the uncertainty of the $CO_2$, $CH_4$, and $NO_x$ budgets.
- In order to support mitigation action, Parties to the UNFCCC need:
  - current status of emissions, geographical and sectoral distribution of emissions
  - expected responses in atmospheric concentrations to mitigation actions
  - projected concentrations of GHGs and climate impacts, and
  - a global, internationally coordinated sustained GHG monitoring network.
- Current estimation methods are based on annual totals, subject to significant time lags, and not applicable to all counters. Top down measurements from satellites allow for a comprehensive global approach. Top down is not cheap, and doesn't give fine grain sectoral information - so there are strengths and weaknesses. Overall, it is felt that in the context of COP, EO observations are underutilised.
- A combination of bottom up and top down methods could be used for GST1. However, large parts of the systems (top down and bottom up) do not exist today. Missing components include:
  - no comprehensive timely international exchange of GHG observations;
  - lack of systematic comparisons of model systems and of protocols for data assimilation and product validation;
  - and, no international agreement on specification of products required to support decision making and data processing for service production.

- The WMO World Weather Watch (WWW) is a good model for how such an observing system should be constructed.
- Workshop on *"The case for a coordinated GHG Monitoring Infrastructure"* from May 2022 recommendations were:
  - Consensus on the need to reach fully integrated GHG Watch
  - Consensus on World Weather Watch as a paradigm
  - Agreed immediate actions
- WMO took the recommendations from the workshop to WMO Executive Council 75 which agreed to undertake two tasks, including the creation of a joint study group on GHG monitoring infrastructure, which has four task groups covering: landscape analysis, GHG monitoring system requirements, input data requirements, and outputs.
- Many of the elements of such a system already exist but need to be brought together. There are also missing components such as: internationally agreed standards on measurements, model products and data exchange; integrated observing system design; mechanisms to sustain observations; recommendations on the utilisation of global model products. The Joint Study Group is working to provide recommendations on ways to develop the missing elements.
- This system will support UNFCCC and Paris Agreement by providing time continuous delivery of consolidated, top-down, monthly, global estimates of net GHG fluxes in and out of the atmosphere at a 100x100km resolution.
- WMO international GHG monitoring symposium is planned at WMO HQ, Geneva, January 30 - February 1, 2023. WMO seeks engagement from scientific, policy, and other user communities. Deadline for abstracts is November 1.

**3.11: GEO Climate Change Working Group Subgroup on Adaptation Update**

Presenters: Sara Venturini, Ian Jarvis (GEO Secretariat) *[presentation]*

Main points:

- GEO Work Programme is strongly aligned with Paris Agreement workstreams – Adaptation is the most addressed but delivery needs improving. More numerous but less mature/less operational activities on Adaptation (50), Means of Implementation (43), Loss and Damage (41). Fewer Mitigation activities including REDD+ (37) but provide more concrete contribution
- GEO activities mostly involve: climate science and developing EO applications; promoting EO technology development and transfer and capacity building in developing countries; monitoring and assessing local climate risks, impacts and vulnerability; supporting early warning systems and emergency preparedness.
- Half of the Adaptation activities state suitability of work/contributions for supplementary technical guidance for developing countries to integrate EO into NAP processes.
- GEO supplemental technical guidance helps LDCs and other developing countries to integrate climate science Earth observation information, data, and tools into their NAPs. First guidance was by GEOGLAM, followed by other GEO initiatives – to be launched at GEO Week and COP-27.
- Contribution on Adaptation, Loss and Damage, and other cross-cutting themes was undertaken via a joint submission for the Global Stocktake, with participation in UNFCCC SB June 2022.
- GEO will participate in Earth Information Day 2022 with GEO initiatives (9 November - tbc) and there will be the GEOGLAM NAP guidance launch at a side event at COP-27 (tbc).
- GEOGLAM now has a track record of co-developed national crop monitor systems.

- GEOGLAM is working with UNFCCC to develop supplemental NAP guidance for agriculture to be launched at GEO Week 2022 and COP-27.
- Stephen Briggs (ESA, SIT Chair Team) thanked Sara Venturini and GEO for cooperation on the adaptation activities and Ian Jarvis (GEOGLAM) on AFOLU.

## Session 4: Biodiversity

### 4.1: Post-2020 Global Biodiversity Framework

Presenters: Gary Geller (NASA), Laurent Durieux (GEOBON/GEO Secretariat), Marie-Josée Bourassa (CSA) *[presentation]*

Main points:

- Marie-Josée Bourassa (CSA) noted that biodiversity is likely to be one of the themes for CSA's Chair term 2024, taking advantage of the co-location of CSA and the UN Convention on Biodiversity (CBD) Secretariat in Montreal.
- Following Plenary 2021 at SIT-37, two actions were agreed, and the response to these actions was limited.

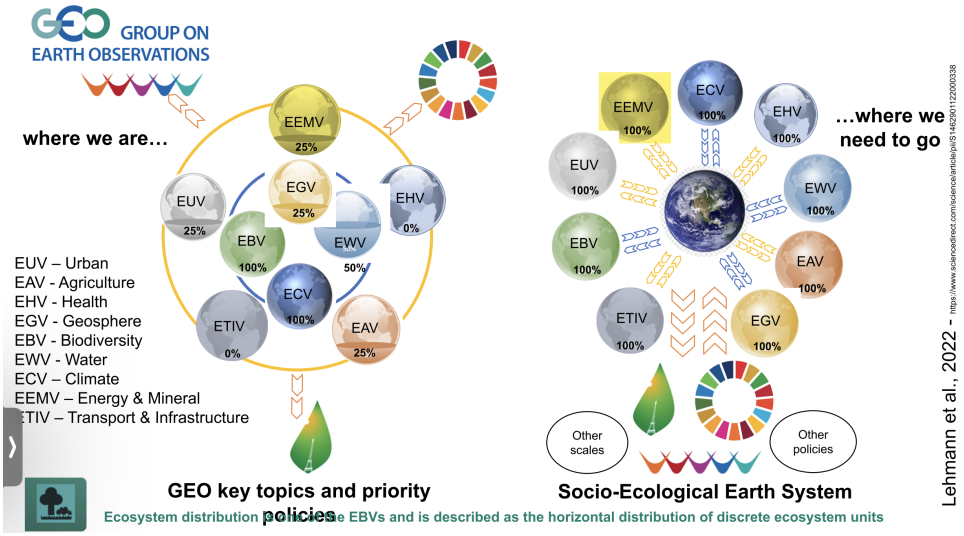
| | | |
|---|---|---|
| **SIT-37-06** | CEOS Principals are invited to name a representative to participate in the Biodiversity Discussion Group. | **May 2022** |
| | *Rationale: The engagement of CEOS agencies is needed to bring sufficient capacity to the group.* | |
| **SIT-37-07** | CEOS Principals are invited to offer a second co-lead for the CEOS Biodiversity Discussion Group. | **June 2022** |
| | *Rationale: Securing an additional co-lead would provide the level of leadership needed to further the activity, and is a priority.* | |

- CEOS Work Plan Deliverable BON-21-02 was closed, and BON-21-01 is nearing closure. Two further Deliverables have been added focusing on further development of GBiOS concept.
- The area where CEOS agencies can likely contribute most is ecosystem extent. This is widespread across many areas key to biodiversity, is essential to understand ecosystem services to society, and can't be done without EO. One example is the Global Mangrove Watch (supported by JAXA). Earth observation is explicitly linked to the needs of the CBD.
- It is important to note that ecosystem extent is not the same as land cover as it includes additional components related to the function of the ecosystem.
- Ecosystem extent is so important because it relates to many different policy components, including CBD, SDGs, etc.
- At SIT-37 a roadmap connecting user needs to observations was presented.

**Approach to Ecosystem Extent Key Variable**

Presenter: Laurent Durieux (GEOBON/GEO Secretariat)

- Laurent Durieux (GEOBON/GEO Secretariat) presented on joint CEOS-GEO Support for biodiversity in the context of the GEO post-2025. This proposed collaboration is around ecosystem extent.
- The approach proposes a level of alignment between climate and biodiversity ambitions, potentially via further extrapolation on the 'essential variables' concept.

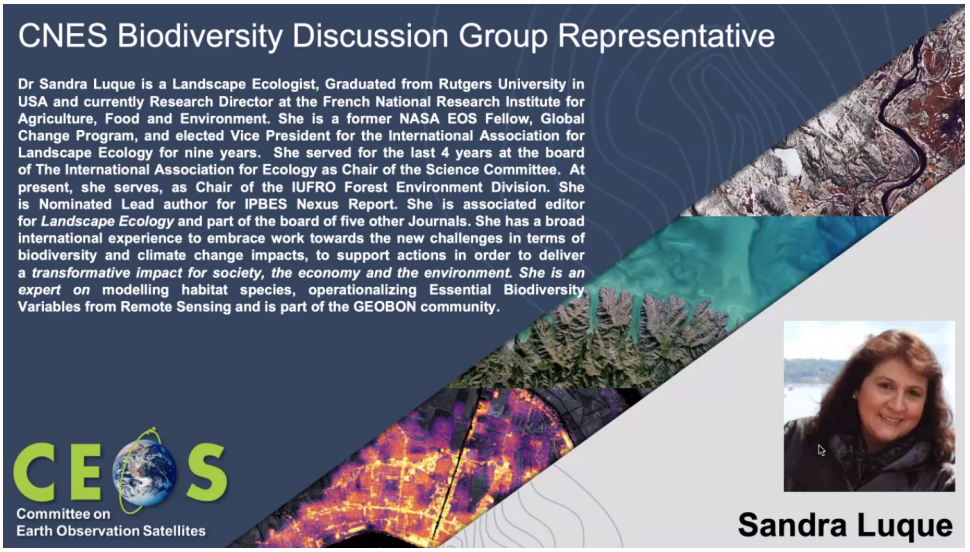



- There is a sense that progress made in other domains, as well as capacity from across GEO, can be used to address the needs of CBD ecosystem extent.
- It was noted that the IUCN Global Ecosystem Typology 2.0 is a good reference.

**4.2: Discussion Topics**

Main discussion points:

- Ivan Petiteville (ESA, SIT Chair Team): noted the broad scope of work to be done, and the need to define a clear and achievable role for CEOS. He suggested CEOS should consider whether we have all the material needed to assess what the contribution could be to ecosystem extent.
- Marc Paganini (ESA): noted the Ramsar Convention provides an ecological classification, and GEO wetlands has already addressed how it can be implemented. This needs to be connected to what will be adopted by CBD at the CBD COP later this year. Based on this, we can start to analyse what can be done with EO to address the classification system, make the mapping, and consider future capacity as well. This should consider both what can be done today, and what can be done in future.
- Julie Robinson (NASA): NASA is looking at the Earth system observatory, working on formulation, and looking at capabilities coming up by end of decade and their built in international cooperation. There are six agencies involved, and all will have biodiversity related products which combine datasets to get new info. This is an opportunity while developing instruments, to work with the community and identify how products could input to CBD. NASA would like to see interest from other agencies for an approximately a two year task team that could work on both the current capabilities, where there is effort required to close gaps, and what is needed in the further future. This is time sensitive as there are two years where international cooperation via CEOS could have a big impact. Would be a great time to work together with agencies involved with these instruments (CSA, CNES, ISRO, ASI, DLR all partners in these missions).
- Ivan: noted the need for another co-lead and members.
- Brian Killough (NASA): noted during the side meeting on SDGs it was useful to understanding the types of connections space agencies have with UN community and external groups. Need to better understand how these other communities are thinking and how we can connect. Noted Wetlands White Paper idea that came up in SDG side meeting.
- Charles Wooldridge (NOAA): IAC, EO committee in IAF proposes a special session, high level, proposed topic of *Addressing Biodiversity from Space*. Principals from various agencies will be speaking on biodiversity.
- Olivier Marsal (CNES): noted CNES welcomes the proposal from NASA. CNES will nominate an expert to participate in the proposed group (Sandra Luque).




- Takeshi Hirabayashi (JAXA): JAXA is working to understand how their products can contribute to biodiversity, and they would like to continue this work and provide datasets to this effort.
- Julie: thanked CNES and welcomed JAXA's support. She suggested that the expansion of existing local and regional projects is identified as a way to move forward.
- Marie-Josee Bourassa (CSA): noted the potential action to discuss how CEOS could support the CBD COP15 in Montreal in December (opportunity to be visible or play a role).
- Laurent Durieux (GEOBON): discussed a CEOS booth at RAMSAR COP 14 focused on wetland inventories, and potential similar support to the CBD COP 15.
- Osamu Ochiai (JAXA): noted Global Mangrove Watch is a global alliance across space agencies and academia. He asked about GEOBON and what the current interactions with CEOS are. Gary noted the next big thing for GEOBON is a global observation system, and CEOS contributions could be very helpful here. GEOBON could use CEOS agency help in extracting further value from EO data for biodiversity.
- Ivan suggested that to progress Marie-Josee's proposed action, the group should assemble a set of milestones. Marie-Josee tied this to a potential second action which would be to propose a task team, assembling the proposal between now and CEOS Plenary.
- Ivan noted that a follow-up session at the Plenary on biodiversity will be planned. It was agreed that CNES will add a biodiversity session on the CEOS Plenary agenda.

| | | |
|---|---|---|
| **SIT-TW-2022-06** | CEOS Biodiversity leads to compile a list of engagement opportunities with key stakeholders. | **CEOS SEC-298** |
| | *Rationale: Coordinate how CEOS could support biodiversity-related events, including CBD COP15 and RAMSAR COP14 focused on wetland inventories.* | |
| **SIT-TW-2022-07** | CSA and NASA to collaborate on a proposal with Terms of Reference for an Ecosystem Extent Task Team, to be presented to CEOS Plenary. | **2022 CEOS Plenary** |
| | *Rationale: Marie-Josee Bourassa and Gary Geller to coordinate the preparation of a presentation to CEOS Principals at CEOS Plenary 2022.* | |

# Thursday September 15th

## Session 5: CEOS Working Groups and Virtual Constellations

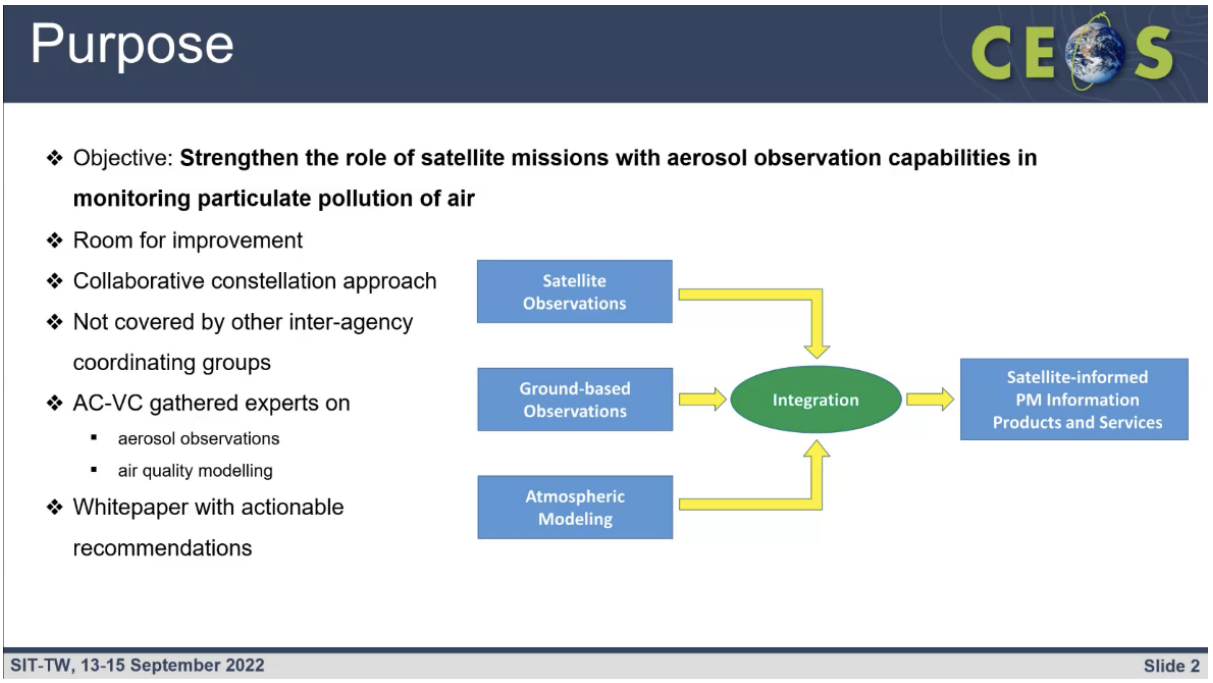
### 5.1: Working Group and Virtual Constellation Plenary Items

*Monitoring Surface PM2.5: An International Constellation Approach to Enhancing the Role of Satellite Observations*

Presenters: Ben Veihelmann (AC-VC) *[presentation]*

Main points:

- A draft of a paper called *Monitoring Surface PM2.5: An International Constellation Approach to Enhancing the Role of Satellite Observations* was reviewed.




- All participants are invited to review the draft on the website and send feedback by 15 October.
- The final version will be presented for endorsement at CEOS Plenary 2022.

Discussion

- Within CEOS, WGCV is the direct contact point for this topic, and Philippe offered to discuss this with Ben. WGCV should be listed as the first contact (ahead of GSICS).
- Ivan asked about the long term goal (i.e operational), and Ben noted that there is a need for information services but we aren't there yet. The long term goal would be an operational service. This activity represents pre-operational use cases and a demonstration.

| | | |
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| **SIT-TW-2022-08** | All CEOS Agencies are invited to provide comments on the draft of a paper Monitoring Surface PM2.5: An International Constellation Approach to Enhancing the Role of Satellite Observations. (Available on the SIT Technical Workshop website). | **Comments by 15 October 2022** |
| | *Rationale: This paper will be presented for endorsement at 2022 CEOS Plenary 2022.* | |

*AC-VC Progress and Status*

Presenters: Barry Lefer (AC-VC) *[presentation]*

Main points:

- Barry Lefer (AC-VC) noted the significant progress and activity ongoing within AC-VC over the past five years, including new capabilities from GEO as well as the information generated about the change in activity during the COVID pandemic and resulting shutdowns and changes in activity. The coming five years will also have significant milestones, with the completion of the GEO ring and the launch of a number of new capabilities. The GST1 will also represent a significant opportunity for AC-VC to contribute.
- Barry summarised the CEOS WP actions on AC-VC:


| ID | Title | Due | Description | Responsible | |
|---|---|---|---|---|---|
| VC-20-01 | Tropospheric ozone dataset validation and harmonization | 2022 Q4 | Production of peer-reviewed papers on intercomparisons and harmonization of tropospheric column ozone data sets | AC-VC | Diego Loyola |
| VC-20-02 | Air quality constellation validation coordination | 2024 Q4 | Coordinate implementation of recommendations expressed in CEOS document "Geostationary Satellite Constellation for Observing Global Air Quality: Geophysical Validation Needs". | AC-VC, WGCV | Ben Veihelmann |
| VC-20-03 | Air quality constellation validation coordination: validation plans | 2022 Q4 | Coordinate the writing of harmonized GEO-AQ mission validation plans. | AC-VC, WGCV | Ben Veihelmann |
| VC-20-04 | Air quality constellation validation coordination: announcements of opportunity | 2023 Q4 | Coordinate the formulation of harmonized GEO-AQ Announcements of Opportunity supporting mission validation activities. | AC-VC, WGCV | Ben Veihelmann |
| VC-20-05 | Aerosol air quality coordination | 2021 Q4 | Production of a white paper or peer-reviewed paper on satellite-informed products for air quality associated with aerosol | AC-VC | Shobha Kondragunta |

- On GHG, AC-VC is: contributing to implementation of the GHG Roadmap with GST1 Prototype Products and Guidance (CARB-21-01); tracking status of GHG sensors, products, retrieval algorithm, flux inversion capabilities, validation infrastructure; supporting pilot datasets in support of Global Stocktake (ceos.org/gst)
- On tropospheric ozone: AC-VC supports intercomparisons and harmonisation of tropospheric ozone data sets (VC-20-01);
- On the air quality constellation: the group supports Coordination of Calibration and Valiwas dation (VC-20-02) and Cal/Val Plans (VC-20-03). The Sentinel-4 and Sentinel-5 Cal/Val Plan jointly written by ESA and EUMETSAT in April 2021, and us taking up recommendations from White Paper "GEO AQ Constellation Geophysical Validation Needs". TEMPO Cal/Val Plan: consolidation ongoing, end 2022.
- On aerosol air quality: the group seeks to strengthen the role of satellite missions with aerosol observation capabilities in monitoring particulate pollution of air. The White paper (VC-20-05) "Monitoring Surface PM2.5: An International Constellation Approach to Enhancing the Role of Satellite Observations" has been delivered to CEOS and seeks endorsement at the Biarritz Plenary.

Discussion

- Julie Robinson (NASA) acknowledged the strong progress that this team has made in this area.

*Proposal for a CEOS Interoperability Framework*

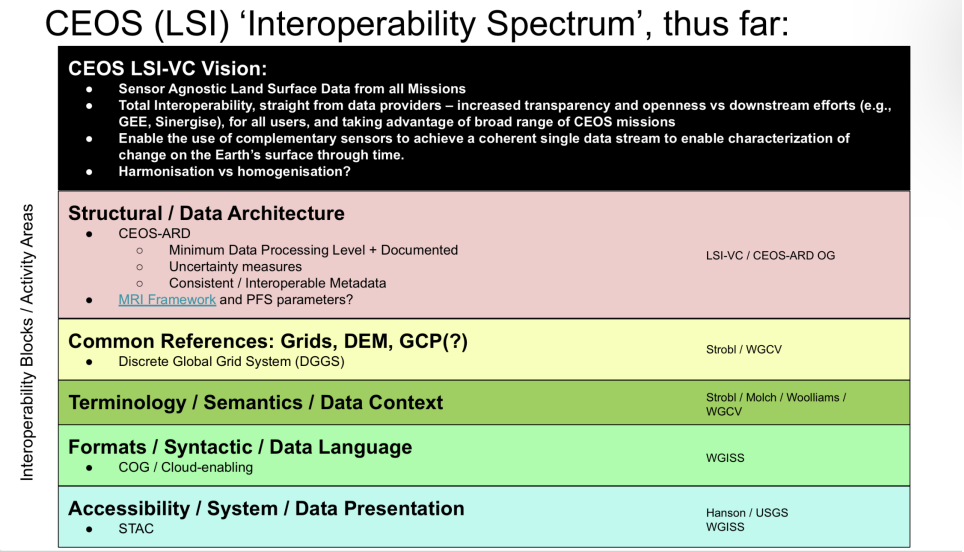
Presenter: Peter Strobl (remotely) (COM, LSI-VC Co-Lead) *[presentation]*

Main points:

- The CEOS Analysis-Ready Data (CEOS-ARD) Framework is a first step towards increasing the interoperability of Earth observation datasets. CEOS-ARD is a first step on the interoperability

spectrum, which was defined in the WGISS and LSI-VC developed CEOS Interoperability Terminology Report (2020).

- The CEOS-ARD Product Family Specifications (PFS) define parameters which facilitate interoperability, but they are only a subset of what needs to be considered when trying to achieve full interoperability of datasets.
- Addressing the full scope of interoperability requires a framework that captures all aspects of the problem. 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 of the necessary pieces.




- Peter reviewed a number of existing interoperability frameworks. It is proposed that CEOS effort should be built upon and derived from one of these existing, broad, well considered, and well defined frameworks.
- Once an appropriate framework has been agreed it should be applied to the specific problem of Earth observation dataset interoperability, and used to structure future work and define responsibilities across the CEOS organisation.
- It is suggested that the idea of a CEOS Interoperability Framework be presented to CEOS Plenary, seeking an action to flesh out the concept and come back with a concrete proposal for SIT-38 consideration.

Discussion

- Jonathon Ross (GA) thanked Peter for the presentation and the supporting contributors. He noted that this is important work that is addressing CEOS core business and building on significant past work such as QA4EO, the interoperability paper developed under the USGS CEOS Chair term; and demonstrations of ARD interoperability through the CEOS Data Cube activity. He is very happy to support a proposal going to Plenary to continue the work to develop the concept. Jonathon added:
  - A theoretical reference framework would be useful, but it is also important to understand how it will be put into action. It is important to get perspectives from those we hope would put the framework into action, such as the VCs.
  - CEOS Plenary would also benefit from a simple slide or diagram explaining the linkages and complementarity between four very related streams of work: interoperability framework, standards engagement, ARD, and enhanced engagement with the private sector. Principals will need to understand that all of these efforts are coordinated, working together and are not duplicative.

- Machine Learning (ML) is often touted as a way to address interoperability issues. However, it is clear in practice that if the data is not interoperable going into that process, ML techniques will not simply fix the issues.

- Jeffrey Privette (NOAA) noted that WGClimate has an inventory of thousands of Climate Data Records (CDRs). Interoperability is a key issue. They will be looking at the results of this activity, and would like to work with the interoperability team.

- Ivan Petiteville (ESA, SIT Chair Team) noted that it is important that this is not just a theoretical exercise; ensure that it is implementable.

| | | |
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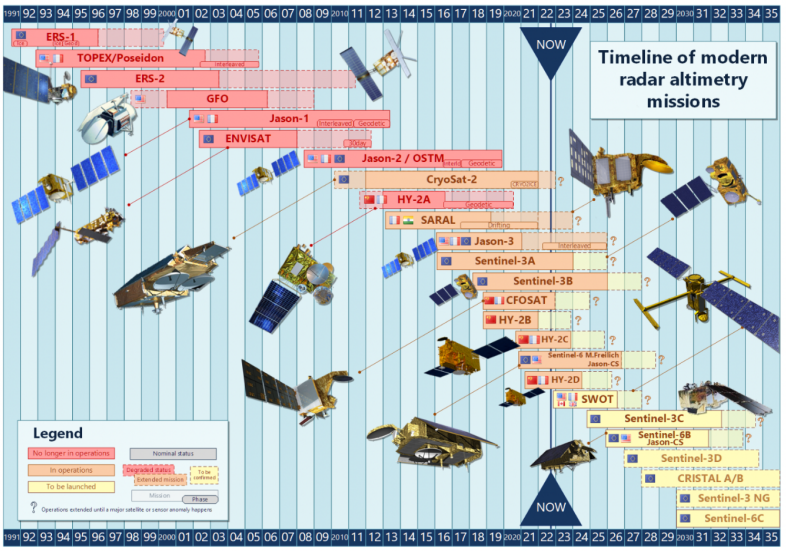
| **SIT-TW-2022-09** | LSI-VC Co-Leads to prepare an agenda item for the 2022 CEOS Plenary formulating an action for CEOS to further define and develop the concept of a CEOS Interoperability Framework with other interested parties (e.g., WGISS, WGCV) and to bring a concrete proposal for consideration at SIT-38. | **2022 CEOS Plenary** |
| | *Rationale: Given the scope of the EO data interoperability problem, with numerous components distributed across many CEOS groups (e.g., LSI-VC, WGISS, WGCV, etc.), a robust framework and coordination mechanisms are needed to address the problem in a systematic and comprehensive manner.* | |

*OST-VC*

Presenters: Estelle Obligis, Annick Sylvestre-Baron (OST-VC) *[presentation]*

Main points:

- The updated constellation timeline was shown:




- Sentinel-6 Michael Freilich: All products operational and disseminated to users (LR & HR, NRT/STC/NTC); first full reprocessing bringing all data in-line disseminated by EUMETSAT and PO.DAAC in July 2022; CEOS declared S-6 MF as the High Precision Ocean Altimetry reference mission in March 2022.

- Sentinel-6B storage started in July 2022 and launch is baselined for November 2025.

- SWOT mission is on track to be launched no earlier than December 5, 2022 and is highly anticipated by ocean, hydrology and coastal scientists and users.

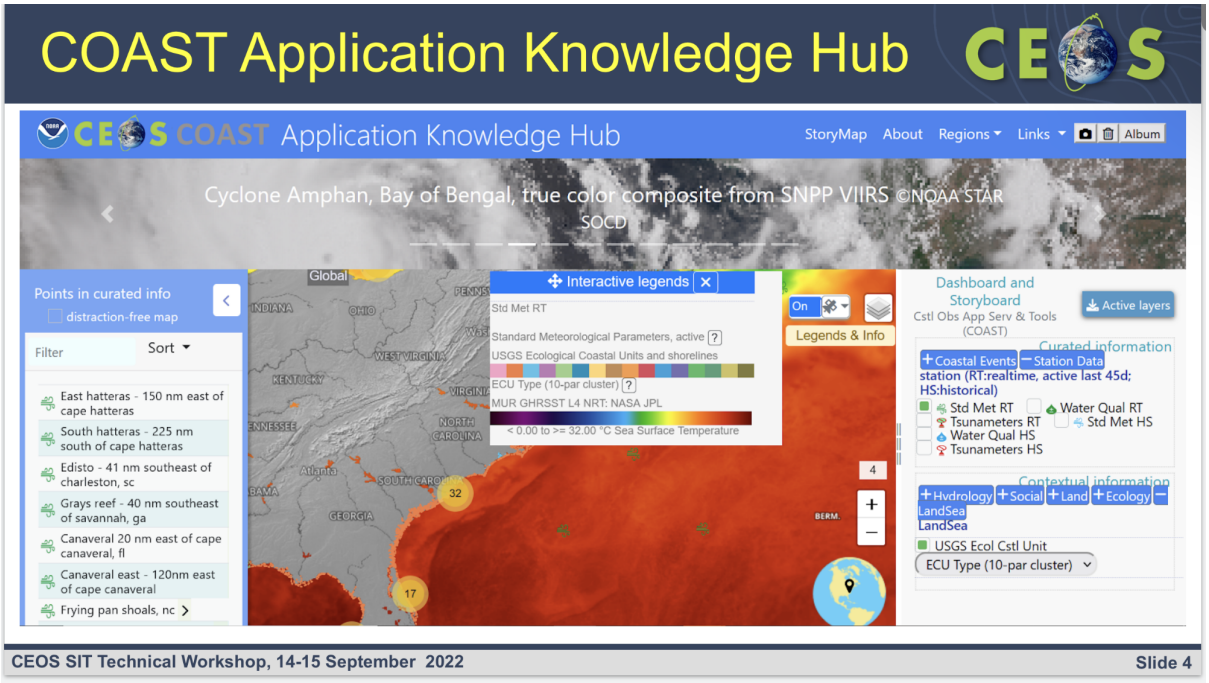
- Sentinel-3 Next Generation mission requirements have been developed at ESA (endorsed by Mission Advisory Group) based on EC user needs. Final decision to be taken if ESA Phase A/B1 study will continue with the implementation of two dedicated large-satellites carrying wide-swath altimeters or a constellation of 12 nadir altimeters, together with radiometer and POD instruments.
- Sentinel-6 Next Generation will come after Sentinel-6C (around 2035, to be confirmed).
- OST-VC white paper final delivery expected in Q4-2023.

*CEOS-COAST*

Presenters: Paul DiGiacomo (CEOS-COAST) *[presentation]*

Main points:

- Progress since SIT-36 includes successful outreach and stakeholder engagement events, Exceptional strides to train the internal CEOS teams and to work on product development in the CEOS Earth Analytics Interoperability Lab (EAIL), Continued work advancing thematic products (e.g. flooding, coastline mapping, coastal eutrophication), and emerging opportunities to pursue product development (e.g. coastal bathymetry).




- Upcoming activities include product development (e.g. Blue Carbon, Habitat Mapping/Monitoring, Biodiversity), and additional pilot regions (e.g. Polar Arctic focus, Asia).
- There are several needs of the group including support to Ingest and utilise data/products from additional CEOS missions, and more emphasis on using the CEOS EAIL. CEOS-COAST is looking for interested CEOS agencies to provide active leadership and support in these new and expanding areas.
- On the CEOS governance side, it appears the Ad Hoc Team will exceed its initial two-year term. Two options are being considered:
    - Request that Plenary grants CEOS-COAST a one year extension for a third year as an Ad Hoc Team (consistent w/process paper); and/or
    - In coordination with forthcoming CEOS Ocean Coordination Group recommendations, establish a new AHT for Ocean Decade to subsume COAST et al.
    - Request that:

- Request that plenary grants CEOS-COAST a one year extension for a third year as an ad hoc team, and/or
- In coordination with forthcoming ceos ocean coordination group recommendations, establish a new AHT for ocean decade that will include COAST and address the ocean component of the

Discussion

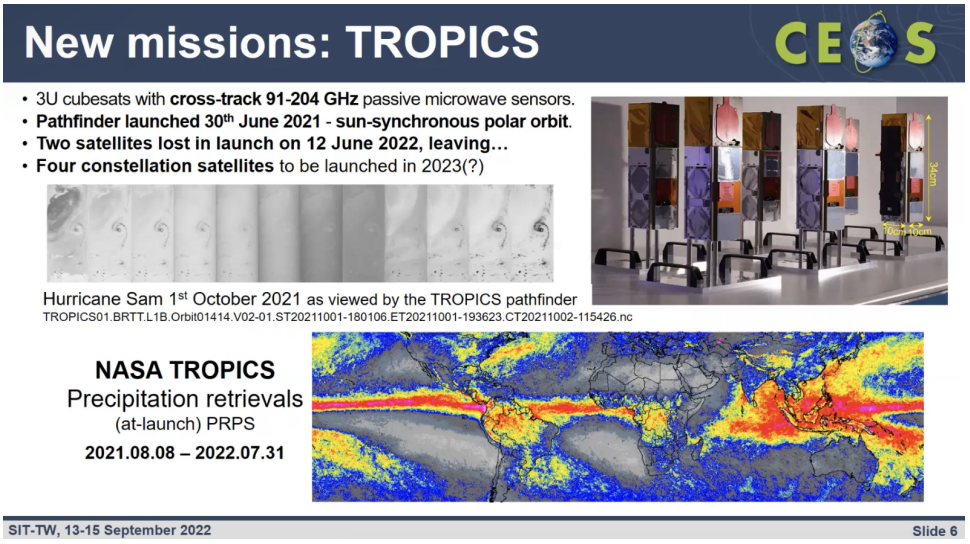
- Ivan Petiteville (ESA, SIT Chair Team) noted requests from the team. Supported the proposal for continuation in one form or another.
- Julie Robinson (NASA) noted that this work is very important, and has a linkage to biodiversity. In many disciplines, oceans and coasts / land and coast get separated, and that makes the work of this team to link the two domains unique. NASA thinks that the continued activities are important to maintain. How it fits in the broader context can be a bit challenging, but this is inherent in the nature of the coastal activities.
- Katy Matthews (NOAA): the UN Ocean Decade is showing what CEOS can achieve in terms of relations to diverse agendas. COAST is a useful way to demonstrate CEOS contributions.
- Ivan noted *ad hoc* Teams have a limited lifetime as written in the CEOS governance. Paul DiGiacomo (CEOS-COAST) has presented two options for continuity of the activities within COAST. Asked whether it is time to establish a broader AHT on the ocean decade. Will revisit under item 9.1.
- There was a discussion around continuity of the *ad hoc* Team. In principle NASA would support an extension of the *ad hoc* Team at Plenary. Meantime, if there is a proposal for a broader ocean coordination effort within CEOS, and that would also provide a continuity option, NASA would be happy to consider this as well.

*P-VC*

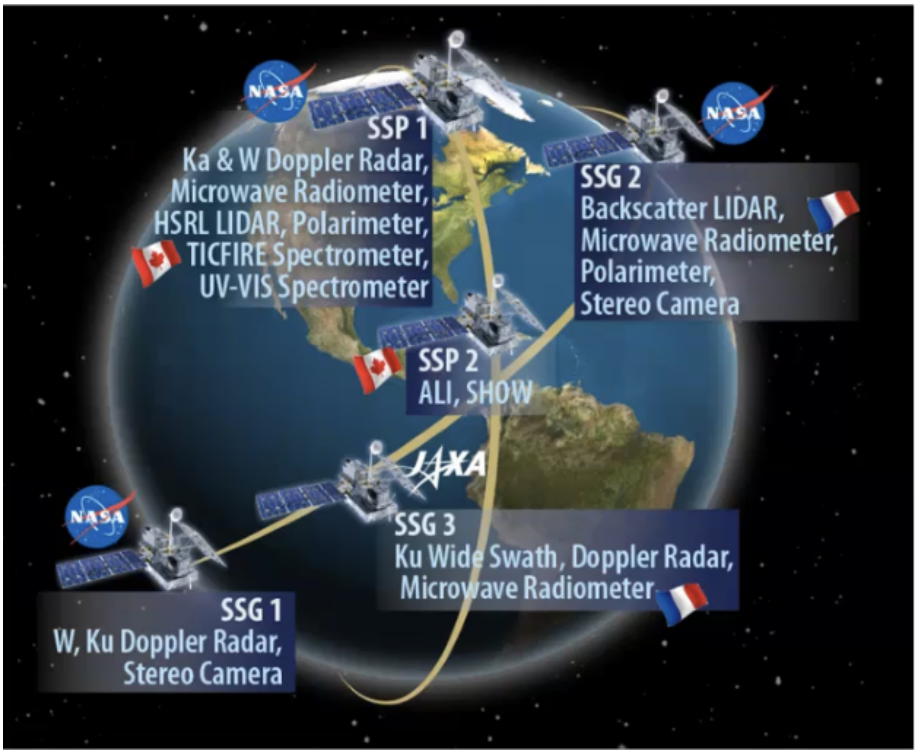
Presenters: Christopher Kidd (NASA) *[presentation]*

Main points:

- P-VC serves as an international framework for the maintenance and enhancement of precipitation observations and the virtual constellation, in particular around GPM (hoped to last until at least 2025).
- The current constellation consists of 10 sensors, and recently a white paper was published on the long-term continuity and strategy for the precipitation constellation.



- AMSR-3 will be flown as a follow-on to AMSR-2 on GOSAT-GW. Expected launch window is April 2023 - March 2024. It is expected to provide enhanced performance and continuity. AMSR2 is 10 years old, and continues to provide good data.
- A number of other mission updates (including important missions from NOAA and NASA) were reviewed.



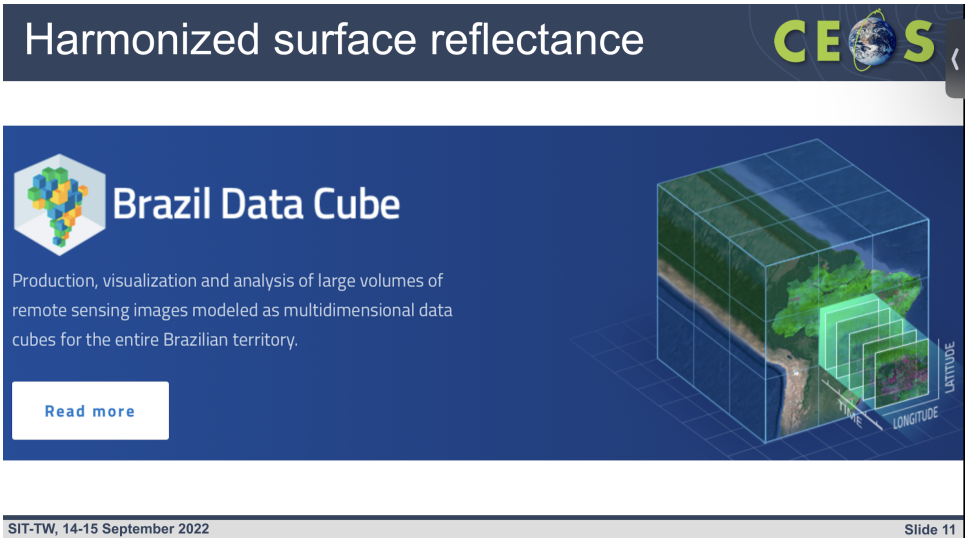

- The white paper calls for a non-sun synchronous cross-calibration satellite for the precipitation constellation.

*CBERS-4, CBERS-04A and Amazonia-1 Missions*

Presenters: Julio Dalge (INPE) *[presentation]*

Main points:

- Brief mission status update:
  - CBERS-4 mission: beyond design lifetime, fully operational;
  - CBERS-4A mission: 3 years of routine operations; and,
  - Amazonia-1 mission: 18 months of routine operations.
- These missions are providing data for forest monitoring and land use, land cover (LULC) applications, and generating Surface reflectance products for Brazil Data Cube.
- Julio noted the agreement with USGS which sees CBERS missions collect data over the US.




Discussion

- Ivan Petiteville (ESA, SIT Chair Team) noted the free and open data policy of INPE's missions.

*EOTEC DevNet*

Presenters: Jorge Del Rio Vera (UNOOSA) *[presentation]*

Main points:

- The Earth Observation Training, Education, and Capacity Development Network (EOTEC DevNet) plays a unique role in fostering collaboration and eliminating duplication among space-based asset providers and others engaged in EO-related capacity building.
- Key accomplishments have included:
  - Establishment of functional global and regional structures;
  - Preliminary needs identified by Communities of Practice (CoP);
  - Co-developed products: flood tools tracker; Flood extent use case;
  - Network analysis to assess coordination;
  - Joint work with EO College and EO4GEO Alliance, good engagement with Digital Earth Africa and SELPER;
  - Establishment communication platforms; and,
  - Development of a theory of change, M&E framework and sustainability plan.
- EOTEC DevNet will continue to function as an informal network of networks initiative.
- Additional outreach will be conducted to CoP members in each of the four regions to support the part-time positions of regional CoP coordinators.
- Support will also be sought to staff the Global Coordination team, with details available in the Sustainability Plan document.
- CEOS members are asked to:
  - Help grow the effort through participation;
  - Review the proposed Sustainability Plan document and consider outlined approaches to staffing, including in-kind support for the part-time positions of regional community of practice coordinators;
  - Continue CEOS SEO support key EOTEC DevNet products; and,

- Pending satisfactory Phase 2 report (will include monitoring and evaluation data, network analysis) endorse EOTEC DevNet initiative at CEOS SIT-38 to continue to Phase 3.

Discussion

- Julie Robinson (NASA) noted this type of capacity building is necessary for impact. NASA has made significant investments through Nancy Searby and Yasjka Meijer, and encourages agencies to consider the dividends that this investment pays.
- Brian Killough (NASA) confirmed the request for additional SEO support. Getting the database operational has been the biggest chunk so far, and will continue to implement updates and ensure strong connection to EOTEC DevNet community.
- Laurent Duriex (GEOBON) noted GEO capacity building coordinator. GEO fully supports this action.

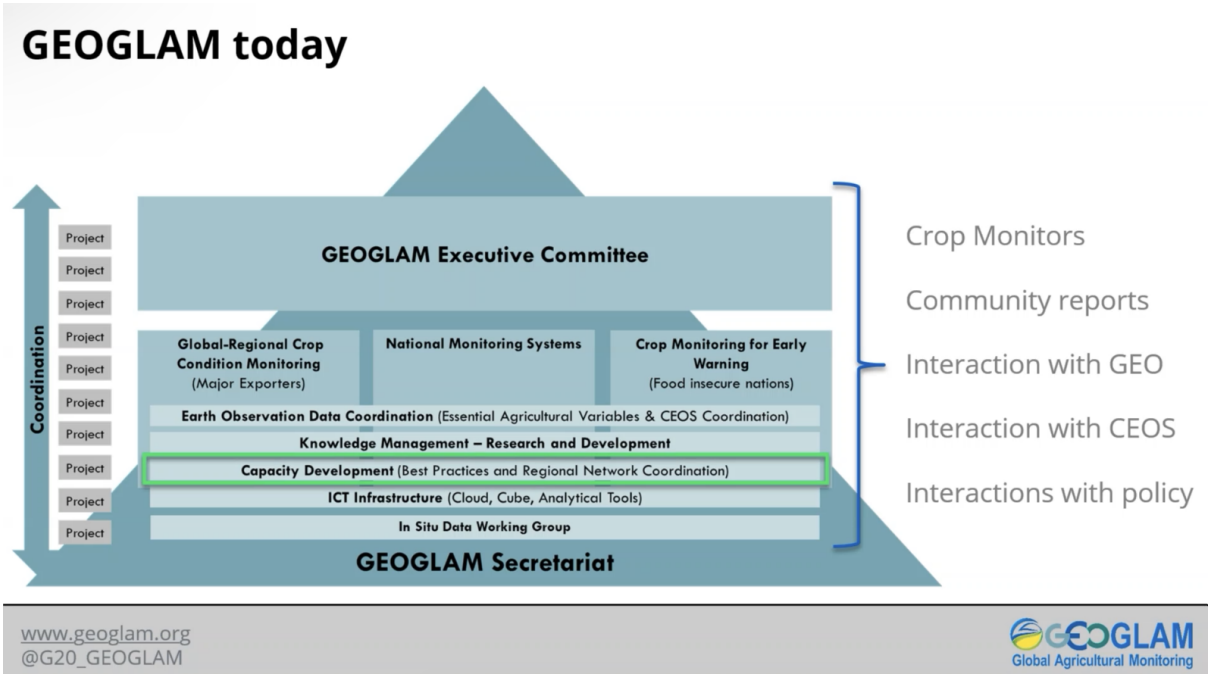
| | | |
|---|---|---|
| **SIT-TW-2022-10** | CEOS Agencies to review the proposed EOTEC DevNet Sustainability Plan (https://docs.google.com/document/d/19R5PC0Yg5Gu6RaPHP5nWMs4l6_iMHXkuC_CyaRWZIlM/edit) and consider outlined approaches to staffing, including in-kind support for the part-time positions of regional community of practice coordinators. | **2022 CEOS Plenary** |
| | *Rationale: CEOS Agencies to consider outlined approaches to staffing, including in-kind support for the part-time positions of regional community of practice coordinators.* | |

*GEOGLAM Capacity Development Guidance Document*

Presenters: Andy Nelson, Alyssa Whitcraft (GEOGLAM) *[presentation]*

Main points:

- A summary of the GEOGLAM structure was given.



- The GEOGLAM Capacity Development Working Group has developed the GEOGLAM Capacity Development Guidance Document. This Document 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.
- The next steps include a review by the GEOGLAM Executive Committee, seek feedback from networks, and then explore endorsement (if appropriate) from CEOS.

Discussion

- Ivan Petiteville (ESA, SIT Chair Team) noted that CEOS can only endorse things that CEOS has written and have used resources from CEOS agencies.
- Andy Nelson (GEOGLAM) asked for advice on how to further socialise this document. It will be ready at the end of this month. Ivan suggested the next step would be to present to the CEOS Plenary.
- Jorge Del Rio Vera (UNOOSA): noted there is lots of work in WGCapD. Directed Andy to resources on the CEOS website.

| | | |
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| **SIT-TW-2022-11** | Andy Nelson to share the GEOGLAM Capacity Development Guidance Document for consideration two weeks prior to the 2022 CEOS Plenary. | **Share Document by End of September** |
| | *Rationale: For information of CEOS members, and for consideration prior to discussion at 2022 CEOS Plenary.* | |

## Session 6: Sustainable Development Goals

### 6.1: 2022 Deliverables

Presenter: Brian Killough (NASA, SEO) *[presentation]*

Main points:

- CEOS endorsed the transition of the CEOS SDG *ad hoc* Team to a "CEOS SDG Coordination Group" at the 2021 CEOS Plenary. The CEOS SDG Coordination Group will communicate our current and planned resources (e.g., analysis ready satellite data, tools, guidance, capacity building) internally across the CEOS community, and externally, and will seek a better understanding of the evolving needs of U.N. Custodian Agencies and country-based users to address the UN Sustainable Development Goals (SDG), including through liaison with GEO.
- Since our endorsement at the CEOS Plenary in late 2021, the SDG Coordination Group has: been meeting monthly (last on August 16); made excellent progress on the planned deliverables (6 of 9 complete); reassessed our communications with GEO; and, plans to develop new and impactful deliverables for 2023 and beyond.
- The focus in the remaining months of 2022 is to address the 3 remaining deliverables and discuss and decide what CEOS will do in the future.
- Deliverable status was shown:

| Deliverables # | Name | Status | Comments |
|---|---|---|---|
| SDG-19-02 | Data Cube prototypes | *in progress* | expected by Plenary |
| SDG-20-03 | Water Support Sheet | *in progress* | expected by Plenary |
| SDG-20-04 | Urbanization Support Sheet | COMPLETE | Posted online |
| SDG-20-05 | Eutrophication Support Sheet | COMPLETE | Posted online |
| SDG-20-06 | Land Degradation Support Sheet | COMPLETE | Posted online |
| SDG-20-07 | EO Enabling Infrastructures | COMPLETE | Posted online |
| SDG-20-08 | EO Good Practice Guidance | COMPLETE | Superseded by EO Support Sheets |
| SDG-20-09 | EO Demonstration Cases | *in progress* | **Recommend Extension into 2023** |
| SDG-22-01 | SDG webpage (CEOS website) | COMPLETE | https://ceos.org/sdg/ |

**6 of 9 deliverables are complete**

**2 are due to be completed by CEOS Plenary (SDG-19-02 + SDG-20-03)**

**SDG-20-09 is proposed for an extension into 2023**

- EO support sheets are a valuable resource for the user community and Custodian Agencies and include current approaches and challenges, data requirements, access and tools, and important web and publication references.
- ceos.org/sdg has been developed to capture the CEOS contributions in support of the SDGs, including: links to previous *ad hoc* Team resources, requirements, stakeholders, primary missions, tools, services and derived data products. A series of six CEOS news articles focused on SDGs have been published. These articles have been released over several months (March-August) to maintain a steady flow of SDG material for CEOS visitors.
- The SEO is making progress on the development of several ODC Sandbox notebooks (algorithms) to support SDGs. There are two focus areas - water extent detection using Sentinel-1 radar and urban extent detection using Landsat.
- The CEOS Communications Team has released video on CEOS support to the SDGs.
- The SDG Coordination Group is working well. Potential future deliverables discussed this week in the side meeting are:
    - GEO LDN: Work with users (based on decision trees in the Good Practice Guidance document) to identify relevant datasets (e.g. small islands, mountainous and arid regions).
    - COAST project on satellite-derived bathymetry for the Pacific Islands (shallow, clear water) – would support SDG Climate 13. Plans to connect to the Pacific Community (SPC) and the Digital Earth Pacific initiative.
    - Task Group (EO4SDG, GEO Wetlands, CEOS Biodiversity) to create a CEOS "White Paper" on Wetlands Inventories (e.g. case of Ramsar) to help communicate current and future capabilities
    - Digital Earth Americas synergies - New Caribbean Pilot project funded by INEGI - Brian Killough (SEO), Alex Held (CSIRO) and Jonathan Hodge (CSIRO) will be meeting with INEGI in Mexico City on October 3-4 to develop future plans.
    - Consider an SDG EO Dashboard similar to the NASA-ESA-JAXA EO Dashboard. Focus on high-level statistical outputs to demonstrate EO support to sustainability
    - Pacific Island synergies – plans to include a special session at the CEOS Plenary with the Oceania Geospatial Symposium (OGS) event, held in Noumea at same time.

Discussion

- Ivan Petiteville (ESA, SIT Chair Team) noted the involvement of Argie in EO4SDG, and the connection that exists there. He supported the list of ideas presented for future deliverables.
- It is important to note that the SDGs are not just the Indicators. It is worth considering expanding the scope to sustainable development in general. There would be a need to consider resources to meet these broader ambitions.

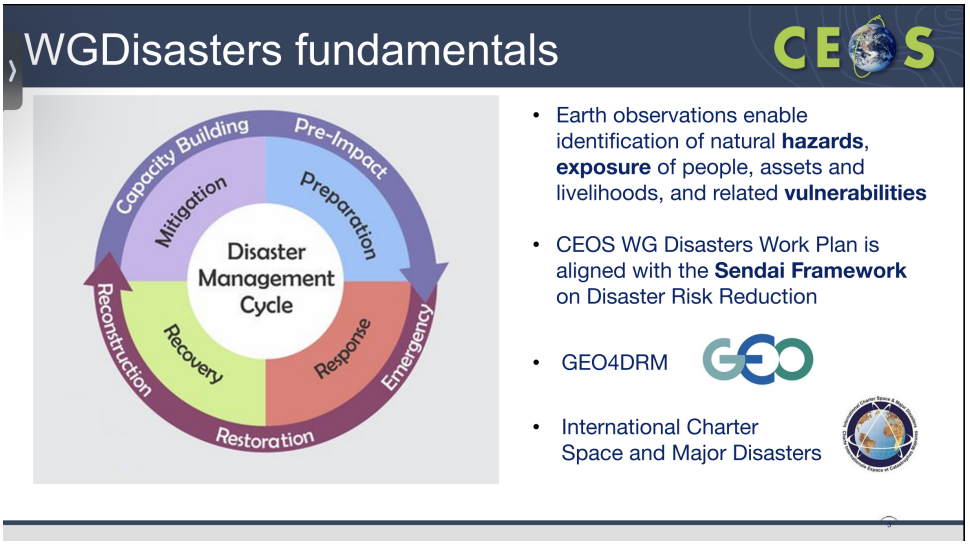
- Stephen Briggs (ESA, SIT Chair Team) noted the difference between Targets and their Indicators, and suggested we could consider a shift from the initial focus on Indicators. The Indicators are quantitative and therefore represent lower hanging fruit. But the formulation of Indicators and their relationship to the Targets is questionable. We should also consider whether we should evolve beyond what is explicitly covered in the SDG documents, e.g. we could consider sustainability more broadly.
- Stephen Briggs also noted that ESA should be able to contribute to the Ramsar proposal, given ESA has been involved for 25 years.
- Brian noted the SDG group shares the views from Stephen Briggs on the importance of the Goals and Targets. The group however is also unsure how to tackle this as an activity that is broader than the Indicators. On the resourcing question from Ivan, Brian noted it is less clear. The group is best efforts, and therefore need agency contributions to progress.
- Jonathan Ross (GA) congratulated the team. Long and difficult journey. Good persistence that is now paying off. GA supports Stephen Brigg's feedback. Good logic for targeting Indicators initially, but support looking at Target instead. Lots of things we can do to support those targets that don't get us bogged down in the details. CEOS should remember that the member states have signed up to meet those goals, and keep in mind the difference between working with them, and working for them. CEOS can offer support, without getting bogged down in the details.
- Marc Paganini (ESA) noted the reason to focus on Indicators, which is the priority of countries. It is clear the Indicators have not been defined with an EO mindset, which has made things difficult from the start. What CEOS has done with the support sheets highlights the relevance to the Indicator framework. Need to consider future missions as well and to ensure these capabilities are communicated to parties as well. Marc suggests sticking with the Targets and Indicators context.
- Marc: noted he has worked closely with Ramsar, e.g. toolkits provided with CEOS inputs. We can do much better by involving all space agencies, and by making future capabilities known to the Ramsar community.
- Brian noted the group will discuss these suggestions, and begin to formulate the plan for discussion at Plenary. Ultimately new Deliverables will need to be defined for the next CEOS Work Plan.

## Session 7: Disasters

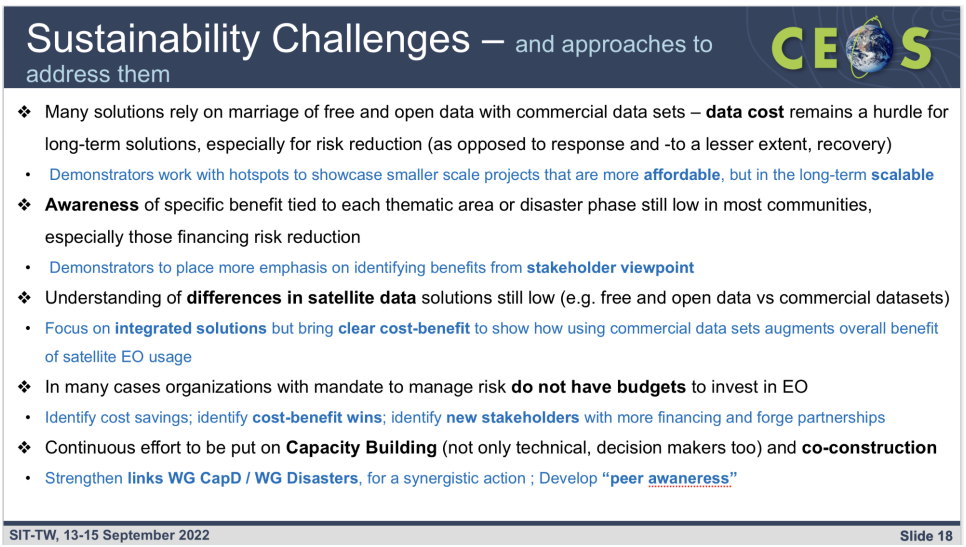
### 7.1: Disasters Session

Presenter: Helene De Boissezon, Laura Frulla (Working Group Disasters) *[presentation]*

- There was a brief review of the WGDisasters objectives, fundamentals, and priorities.




- The priorities are focused on the path to sustainability, and developing use cases or the operational uptake of satellite EO. This includes demonstrators, capacity building, strengthening ties to GEO WGs, linkages to climate related activities, and exploiting new technology opportunities.
- This has included demonstrators for volcanoes, landslides, seismic hazards, and the Recovery Observatory.
- The pilots and demonstrators have shown technical feasibility, and encouraged Working-level, proto-operational uptake of EO-based products. It has also allowed the exploration of new partnerships and bridging gaps between different types of partners, including the demonstration of best practice.
- The Group is considering challenges to sustainability, and approaches to try and address them.




- WGDisasters would welcome comments from SIT members on sustainability strategy, or specific recommendations for new partnerships relating to specific Demonstrators/Pilots.

Discussion

- Albrecht von Bargen (DLR) noted WGClimate connection, and they are open to discuss and increase communications as there are many topics that cross both climate and disasters. WGDisasters is welcome to participate in upcoming WGClimate meetings.
- David Borges (NASA): charter and New Space topic. CEOS should note the feedback from WGDisasters on this point.

## Session 8: CEOS leadership and coordination

### 8.1: SEO Report

Presenter: Brian Killough (NASA, SEO) *[presentation]*

Main points:

- The CEOS Systems Engineering Office (SEO) has been testing several cloud computing frameworks to better understand data access and technology capabilities.
- The Open Earth Alliance (OEA) is a new GEO Community Activity created in 2021 by the ODC Founding Partners to expand the impact of ODC, support the concept of regional data cubes, and explore new open source data solutions and technologies. The SEO and CSIRO have been the primary contributors to this initiative.
- Regional data cube updates:
  - Digital Earth Africa: The SEO led the deployment and testing of the African Regional Data Cube in 2018. The success of this prototype led to a fully funded DE-Africa. Leadership has now completely transitioned to Africa (SANSA). The SEO still represents CEOS on the Steering Group.
  - Digital Earth Pacific: The SEO has worked with the South Pacific Consortium (SPC) to guide the initial prototype and conduct user needs meetings. SPC is now working on securing funding. The SEO represents CEOS on the Steering Group.
  - Digital Earth Americas: The SEO is working with CSIRO (Chile) and INEGI (Mexico) to explore opportunities to build toward a future DE-Americas. To date, we have conducted several workshops in the region and explored user needs. These workshops have involved several regional stakeholders (e.g., AmeriGEO, ECLAC). A future Caribbean initiative funded by Mexico is likely the next opportunity to build awareness and explore needs.
- The Open Data Cube (ODC) Sandbox now has 19 notebook applications in GitHub. This open source tool is a great example of "open science" and has gained significant popularity as an educational and research tool. The SEO is planning to participate in several webinars to promote open science and use of CEOS satellite data. These include WGCapD "Jupyter Notebook Day" in September and the GEO Knowledge Hub (3-part webinar series in Sep-Nov). Each event will use the ODC Sandbox.
- CEOS website has new monthly articles (SDGs, MIM, ARD), a new video on CEOS and SDGs for SIT-TW, a new CEOS ARD Twitter page (@CEOSARD), and a new CEOS Newsletter website (from JAXA).
- The SEO met with the new GEO Communications lead (Sam Nuttall) on August 25 to discuss communications plans and ways to collaborate. We expect to have these meetings quarterly.
- CEOS will have an exhibition booth at the GEO Plenary (Ghana). Agencies invited to suggest ideas to share.

Discussion

- Jonathan Ross (GA) thanked Brian Killough (NASA) and his SEO team for all the support to CEOS on behalf of GA. Katy Matthews (NOAA) likewise, noted support for training sessions recently, CEOS-ARD twitter feed needs some tweets. Keen to explore communication.

### 8.2: 2022 CEOS Chair Priorities

Presenter: Olivier Marsal (CNES, CEOS Chair Team) *[presentation]*

Main points:

- **Priority #1: Ensuring Long-term Sustainability of CEOS Strategies:** Identify demonstrators / R&D stage activities across CEOS suitable to transition to operational services; Continue to develop

model partnerships through Demonstrators, specifically Recovery Observatory (RO); Develop synergies between CEOS projects and identify support mechanisms with key external stakeholders. Engagement with GEO is key in that manner. Progress:

- Focus has been the WGDisasters Recovery Observatory (RO). An RO sustainability sub-group was started at the WGDisasters-17 meeting in March. Links established with WGCAPD.
- To ensure long term sustainability, WGDisasters will keep on working on the development of strong and visible links with GEO and the GEO Disaster Risk Reduction Working Group. Continuous efforts have to be undertaken to develop strong policy linkages, e.g., to the Sendai Framework and International Charter "Space and Major Disasters".

- **Priority #2: CEOS Support to the UNFCCC Global Stocktake:** The main threads are:
  - Support Global Stocktake data requirements:
    - CNES with UKSA and DLR will ensure planned missions, such as MicroCARB & MERLIN, to provide practical support to Global Stocktake data requirements
    - AFOLU & GHG Roadmap development
  - Engage with countries for adaptation and mitigation support
    - Provide use cases through Space for Climate Observatory (SCO)
  - Support the implementation of the CEOS Biomass Protocol:
    - Supporting the secretariat of GEO-TREES.
    - The BIOMASS mission will be launched between Q3 2023 and Q1 2024. Biomass data will not be optimised until GEO-TREES can establish new reference sites to develop plot coverage with LIDAR and NISAR data. CNES will use its position as GEO-TREES Sec to work in particular on the governance (GEO, CEOS and external) of the project and ensuring links with CEOS.
    - Funding two biomass protocol implementation sites
- **Priority #3: Support to CEOS Cal-Val Initiatives.** Covers two major threads with the aim of maximising the benefit of future CEOS missions such as Trishna (CNES/ISRO), ESA/COM (LSTM), NASA/JPL (SBG), CSIRO (Aquawatch), etc.:
  - A CEOS protocol to support the cross-calibration of thermal infrared measurements from future CEOS Agency missions.
  - Definition of a common network of *in situ* calibration sites to harmonise calibration methods for thermal infrared instruments, taking advantage of the previous work done in the *"Land Surface Temperature Product Validation Best Practice Protocol*" written by the LPV WGCV subgroup.
- The 2022 CEOS Plenary will be held at The Bellevue Congress Centre in Biarritz, France. The dates are November 29th to December 1st, 2022. Attendees should register before the end of September and are asked to advise CNES of any side meeting needs as soon as possible.

Discussion

- CSIRO is interested in supporting Trishna cal-val activities but needs more info about what is expected and needed for the ground segment architecture. CSIRO is happy to continue the conversation.
- Philippe Goryl (ESA) noted that Trishna will be discussed at the upcoming WGCV-51 meeting. Cindy Ong of CSIRO will be attending that meeting.

**8.3: Incoming CEOS Chair Priorities**

Presenter: Pakorn Apaphant (GISTDA, Incoming CEOS Chair Team) *[presentation]*

Main points:

- Reviewed GISTDA's missions, infrastructure, applications, and history with CEOS. GISTDA previously chaired CEOS in 2009.
- GISTDA has two main priorities for its chair year:
  - Priority #1: CEOS preparations and inputs to the Global Stocktake of the UNFCCC Paris Agreement
    - Better connecting Southeast Asia nations with CEOS agencies and their datasets for carbon action
      - GISTDA-Silvacarbon 2023 CEOS Workshop on National Forest Inventories & Mangrove Techniques (Feb 2023): CEOS Agencies are asked to flag their interest in participating and contributing datasets, tools, and expertise to support the objectives of the workshop. JAXA supporting with Global Mangrove Watch (GMW) connections and expertise (e.g., GMW v3.0 dataset)
    - Broader exploration of opportunities to support CEOS datasets for the Global Stocktake
      - Further updates to the CEOS Global Stocktake Portal.
    - Stronger supporting implementation of the GHG and AFOLU Roadmaps on pilot uptake of CEOS datasets
    - Contributing to the GEO Community Activity: Forest Biomass Reference System from Tree-by-Tree Inventory Data (GEO-TREES).
  - Priority #2: The exploration of new geometries for space agencies and CEOS with new Space – in collaboration with the SIT Chair Team.
    - This thread will elevate and escalate the SIT Chair's priority on New Space and work with the proposed CEOS task team on New Space Economy, including:
      - Explore the status of the New Space sector and potential collaboration opportunities.
      - Workshops/Meetings as input to the border CEOS discussion on New Space opportunities.
      - Business matching, Exhibition, or Panel Discussion on New Space activities
      - A discussion on New Space at the 37th CEOS Plenary in 2023
      - Facilitate a discussion during the 2023 timeframe
      - Develop a New Space Economy document as a means for knowledge sharing with CEOS Agencies.
      - Seek for opportunities to develop linkages between CEOS and the private sector.
    - Collaborating with CEOS agencies to develop CEOS New Space Policy guidelines

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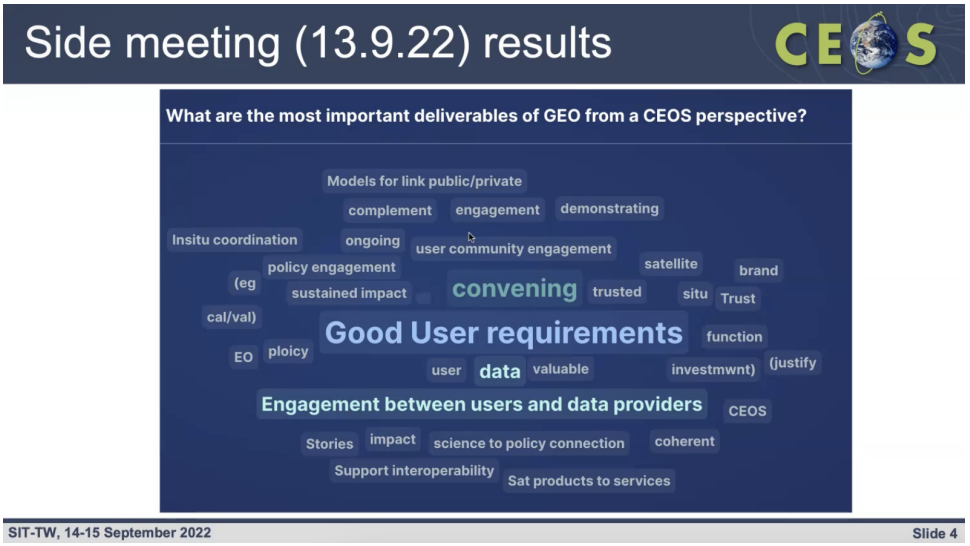
| **SIT-TW-2022-12** | CEOS Agencies are asked to indicate their interest in participating and contributing datasets, tools, and expertise to support the objectives of the GISTDA-Silvacarbon 2023 CEOS Workshop on National Forest Inventories & Mangrove Techniques (Feb 2023, Thailand). | **2022 CEOS Plenary** |
| | *Rationale: To provide CEOS Chair 2023 (GISTDA) with an indication of planned engagement at the workshop.* | |

### 8.4: Road to a GEO Post-2025 and CEOS Engagement

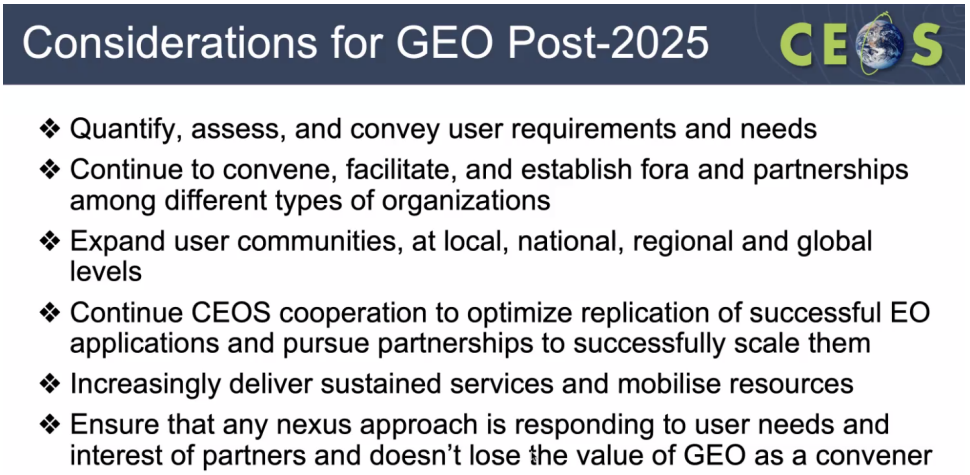
Presenter: Andreas Obrecht (GEO Secretariat), Marie-Josée Bourassa (CSA), Katy Matthews (NOAA) *[presentation]*

Main points:

- Marie-Josée Bourassa (CSA) noted she is one of several CEOS representatives in the GEO Post-2025 group, including Jonathan Ross (GA), Mark Dowell (COM), Katy Matthews (NOAA) Osamu Ochiai (JAXA).
- Katy Matthews (NOAA) presented a summary of the Working Group, including the composition and activities to date. The fourth meeting of the group will take place next week, and a high level paper will be prepared for GEO Week 2022. This paper can be shared with CEOS SEC once the draft is available.
- The intention is to have a set of next steps for GEO ready for GEO ExComm in March 2023. This will then be put through the 2023 Ministerial meeting prior to the 2023 GEO Plenary in South Africa.
- A summary of the side meeting held on Tuesday was presented.




- There was a discussion at the side meeting on the value of GEO collaboration to CEOS. Key points including:
  - Wide variety of stakeholders within GEO
  - Engaged in capacity development in particular at the country level
  - Strong coordination amongst work plan items (e.g. GEOGLAM, GFOI, SDG)
  - Wider distribution of use cases for satellite data (e.g. DRR, disaster response)




Discussion

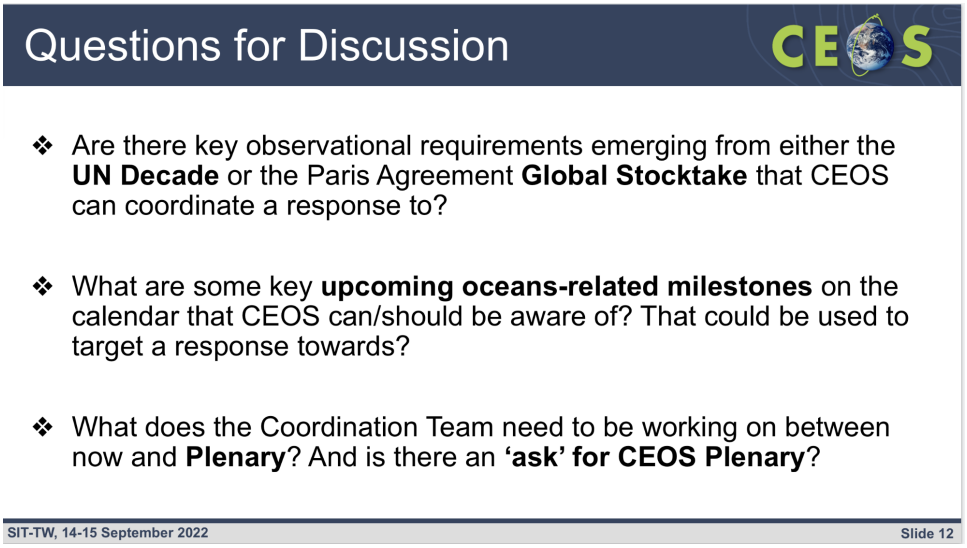
- Andreas Obrecht (GEO Secretariat) thanked CEOS for participating and contributing to this discussion, and engaging early in the process.
- Timothy Stryker (USGS) noted these findings resonate, in particular the focus on user requirements and needs. This is something GEO and CEOS have struggled with for years. The flagships have added some structure, and support to the user interface is a strength from the perspective of CEOS Agencies. This helps Agencies understand user needs, and deliver architectures built around those needs. Tim noted USGS has made a significant investment in the approach of gathering these requirements, and this is worthy of more discussion amongst CEOS. He noted that the NOAA and USGS approaches are quite sensor agnostic, and so approaches should apply to both satellite and *in situ* observations.
- Osamu Ochiai (JAXA): good to see concrete ideas forming, and he also would welcome additional ideas. He noted the CEOS role discussed in the side meeting, and how CEOS should consider how to better communicate and tap into the GEO processes. How to better interact with the government/ministerial level to help ensure alignment. Space technology should have more influence and connection to government and policy processes, and CEOS members should be encouraged to work with their own governments to try and bridge this gap.
- Paul Counet (EUMETSAT): shares the concern, and noted that from a CEOS perspective we should have clear a clear idea of what CEOS can bring for GEO. Changing priorities with changing GEO leadership makes engagement difficult. The Post-2025 plan should confirm a set of top priorities and give a long term perspective to enable engagement.
- Jonathan Ross (GA) noted one of the key findings from midterm evaluation of GEO was the need to define and communicate its unique value proposition amongst the many forums that are out there - to decide what makes it unique, e.g. flexibility, openness, agility, having stakeholders on an equal footing, reduced overhead and red tape. The process moving forward should clearly differentiate what is done by GEO Secretariat, what is done by the GEO activities, and what is done by the GEO community at large. It would be a sign of success if GEO Work Programme activities were transitioned to operations.
- Stephen Briggs: stressed that GEO priorities are set by GEO members, and he would hope that the priorities remain slowly evolving as a result. The role of GEO is to ensure the implementation of the members, and as such GEO should be about how things are done, not what is done. We shouldn't conflate the secretariat and the GEO members. There is broad scope for CEOS-GEO cooperation, for example on the GST.

## Session 9: Oceans and Coasts

### 9.1: CEOS Ocean Coordination Group

Presenter: Ivan Petiteville (SIT Chair Team) *[presentation]*

- This activity was initiated at the Technical Workshop in 2021, and then at CEOS Plenary 2021 the SIT Chair Team was actioned to convene a small team to progress the discussion. The team has initiated an information gathering process to understand the scope of ocean-related activities by CEOS entities including VCs, WGs, *ad hoc* Teams, and others.
- At the initial discussion, the IGOS holistic approach was considered a model, and the United Nations Decade of Ocean Science for Sustainable Development (2021-2030) ('the UN Decade') was suggested as a possible opportunity.
- After a start up period, the group has received good engagement from a number of CEOS groups: COVERAGE, CEOS-COAST Ad Hoc Team, VCs (OST-VC, OCR-VC, SST-VC, OSVW-VC), WGs (WGISS, WGCV, WGDisasters, WGClimate, WGCapD).
- A number of activities from those CEOS groups have been catalogued, and the key external engagement opportunities identified by the group were the UN Decade, and the Paris Agreement Global Stocktake (GST1).




- The next steps will include:
  - consolidate group's discussion and inputs from today's session;
  - understanding EO requirements from the UN Decade and GST1 (2023 Global Stocktake);
  - present findings to Plenary with some possible options for consideration;
  - and, formulate action to be presented, agreed, and to discuss resourcing at SIT-38.

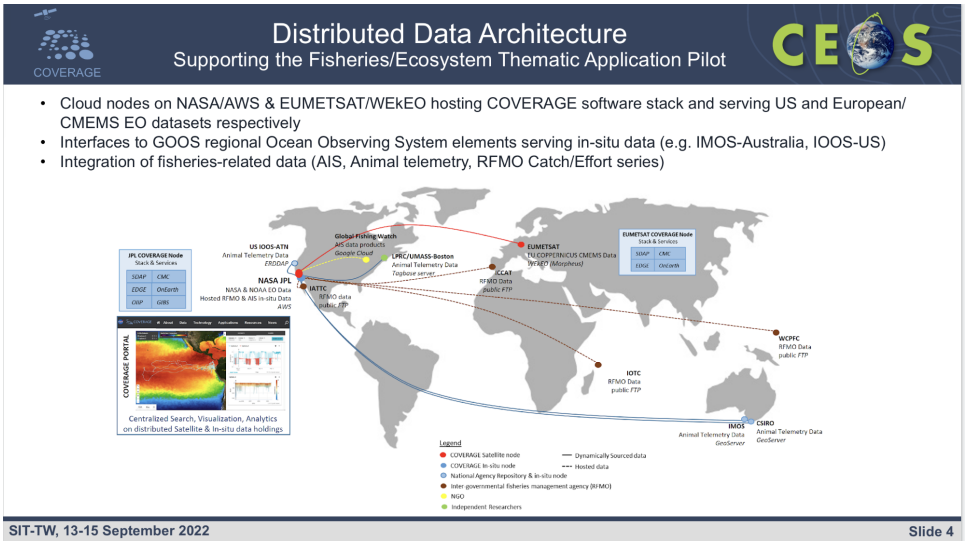
### 9.2: Ocean Observations and CEOS Contributions to the UN Oceans Decade

*COVERAGE*

Presenter: Vardis Tsontos (NASA) *[presentation]*

- COVERAGE has been involved in the formulation of an 'ocean shot' in response to a call from the US National Committee for the Ocean Decade looking at the, *"Next Generation Data Service Infrastructure for a Digitally Integrated Ocean Observing System"*. This activity also has linkages to UN SDG 14: "Life Below Water", emphasising the role of Earth Observations and data infrastructures in supporting ecosystem-based management efforts. This includes activities addressing biodiversity and fisheries.

- COVERAGE continues to advance its distributed data architecture, in this case in support of fisheries and ecosystems. This effort leverages a lot of constituent CEOS agency data, as well as a number of value added products. A number of core data services are delivered based on these products.




- EUMETSAT's provisioning of WEkEO cloud computing resources has been key to progressing the initiative. This has provided a reusable software platform with core capabilities, and integrates a range of interagency satellite and Ocean datasets, as well as value-added EO products with support for *in situ* data.
- COVERAGE is partnering with two Intergovernmental agencies (Species Survival Commission, SSC and Inter-American Tropical Tuna Commission, IATTC) to support emerging ecosystem-based management approaches that include remotely sensed environmental data in assessment frameworks.

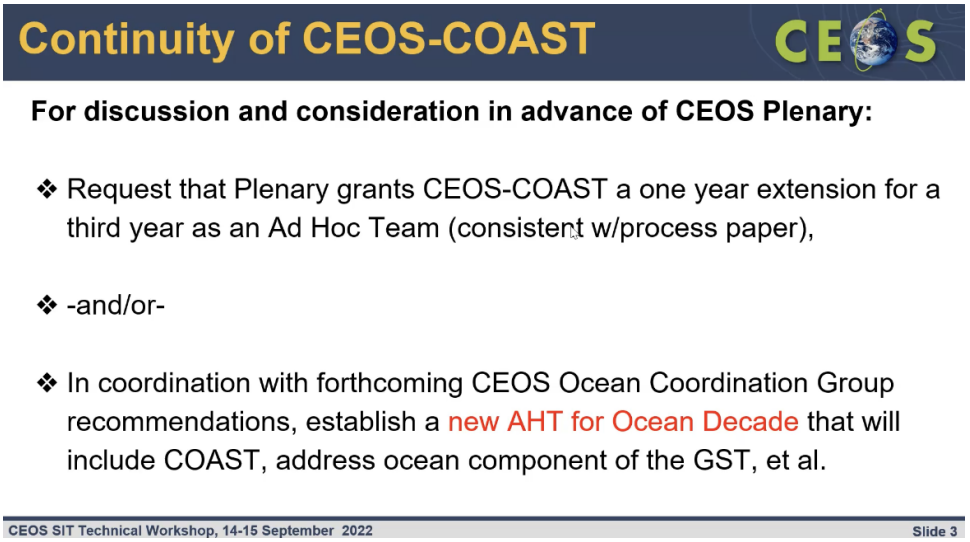
Discussion

- Marie-Helene Rio (ESA): asked what is the mechanism to add some other products to COVERAGE, and Vardis welcomed recommendations on datasets sent to him. Ideally these datasets would be in an interoperable form, and available through a standard data service. For example, anything through Copernicus Marine Service (CMEMS), and Marie-Helene confirmed the datasets she has in mind are available through CMEMS.

*CEOS-COAST*

Presenter: Paul DiGiacomo (NOAA) *[presentation]*

- The group needs help with leadership in several upcoming product development areas: Blue Carbon; Habitat Mapping/Monitoring; Biodiversity; Future Pilot Regions in Asia and Arctic; and, Leveraging data from more missions.
- The group would also like a CEOS-level commitment to host at least one CEOS collaborative outreach event related to the UN Decade in 2023. This might include support hosting an event webpage, arranging the agenda, generating a summary and action report afterward. The CEOS-COAST Team would also provide support staffing.




Discussion

- Ivan Petiteville (ESA, SIT Chair Team): noted the earlier discussion on CEOS-COAST continuity in the context of COAST as well as the Ocean Coordination Group strategy discussions.
- Julie Robinson (NASA): CEOS-COAST has rapidly achieved recognition, and she supports the extension and to avoid loss of momentum. She suggested letting the work continue to consider the ocean coordination group further and consider a merger later on. Ivan noted that the second option doesn't call for discontinuation of COAST, just a consolidation organisationally.
- Katy Matthews (NOAA): ensure these objectives don't get lost in the shuffle, and these should be highlighted in the paper. She agreed we want to ensure we don't lose momentum of CEOS-COAST and COVERAGE. NOAA supports the second option, with the note that the paper for plenary covers how we will avoid losing momentum.
- Ivan: suggested if we give another one year extension to COAST *ad hoc* Team (AHT), it is likely that one of the recommendations from the Ocean Coordination Group would be to create an AHT to carry on the work of the ocean coordination group.
- Jeffrey Privette (NOAA): *[noting that he was not expressing NOAA's official position]* Paul and team have made great progress, and that the coastline is a key interface for humanity. This is a unique focus which might be lost by including this work into a broader ocean group.
- Marie-Helene: agrees that both COAST and broader ocean coordination are needed. She suggests 'AND' not 'AND/OR' from the options presented. COAST should continue, but there is a need for an AHT on ocean coordination.
- Paul Counet (EUMETSAT): in the report for Plenary, we need to be very clear that the scope of the coordination effort is for activities within CEOS.
- Katy stressed the need to be cognisant of the resources required for an option where COAST and an ocean AHT coexist.
- Julie noted NASA hasn't set aside resources for the UN Decade specifically, but that resources are a challenge. She also noted that the AHT establishment and governance rules may present a barrier.
- Julie noted the 'OR' option is not feasible without subgroups in the AHT, and that it would be hard to maintain the profile of CEOS-COAST within an AHT without a subgroup.
- Stephen Briggs (ESA, SIT Chair Team): it is not clear what else would be in the AHT for the Ocean Decade apart from CEOS-COAST. He suggested it would be helpful to have a clear summary diagram of the CEOS groups and people involved in the UN Decade efforts, CEOS-COAST and how this would fit into a potential AHT. Paul DiGiacomo agreed that this diagram would be helpful, and suggested that the Ocean Coordination Group and CEOS-COAST collaborate on this.

- Katy: stressed she would like to see the activities of CEOS-COAST to continue in one way or another. We definitely need the one year extension of the CEOS-COAST AHT, and some additional consideration of the way forward. She also suggested we focus on what needs to be done before CEOS Plenary 2022.
- Paul DiGiacomo: suggested making a request for a one year extension of the CEOS-COAST AHT at Plenary, and deferring the decision on any UN Decade AHT until SIT-38. The discussion at SIT-38 should be foreshadowed at Plenary, and actions should be taken to flesh out the discussion lead by the Ocean Coordination Group.
- Marie-Claire Greening (CEO): noted that the Ocean Coordination Group exists, and for now an AHT is not needed. She suggested that this Group be the fora for development of the way forward, in parallel with a request for an additional year for the CEOS-COAST AHT at CEOS Plenary.
- Klaus Schmidt (DLR): agreed with the need for a clear explanation and diagram outlining the scope and relations between the groups in preparation for CEOS Plenary. In addition, there is a need to define the activities which would be undertaken as a part of the one year extension and how this relates to the Ocean Coordination Group. This should be provided clearly for review by CEOS Principals prior to CEOS Plenary.
- Vardis Tsontos (NASA JPL): noted that both CEOS-COAST and COVERAGE are involved with the UN Decade.
- Marie-Helele: supports requesting a one year extension of the COAST AHT, and noted that the three year limit on AHTs would also apply to any new UN Decade AHT. If such an AHT were to be established at CEOS Plenary 2023, this would take the group through CEOS Plenary 2026, falling short of the scope of the UN Decade (2021-2030). Governance will need to be considered.
- Ivan summarised what was agreed:
    - Request to CEOS Plenary for a one year extension of CEOS-COAST AHT;
    - Ocean Coordination Group to make recommendations to Plenary on the coordination of CEOS ocean-related activities including in support of the UN Decade and GST1, and also taking into account possible links to the future CEOS-COAST sustainability; and,
    - Pending outcomes of the Plenary discussion, the Ocean Coordination Group should plan a follow-up discussion on implementation planning and resource commitments for CEOS Principals and Agencies at SIT-38.

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| **SIT-TW-2022-13** | COAST AHT Leads to prepare an agenda item for the 2022 CEOS Plenary proposing a decision to extend the AHT for another year. | **2022 CEOS Plenary** |
| | *Rationale: The additional year will be used to help determine any interaction with outcomes being recommended by the CEOS Ocean Coordination Group (to be presented at SIT-38).* | |
| **SIT-TW-2022-14** | The Ocean Coordination Group is asked to make recommendations to the 2022 CEOS Plenary on the coordination of CEOS ocean-related activities, including activities in support of the UN Decade of Ocean Science for Sustainable development (2021-2030) and GST1 (2023 UNFCCC Global Stocktake). This talk also requires taking into account possible links to the future CEOS-COAST sustainability. | **2022 CEOS Plenary** |
| | *Rationale: Preliminary recommendations to be presented to the 2022 CEOS Plenary for consideration. Further follow-up on implementation planning and resource commitments for CEOS Principals and Agencies will occur at SIT-38.* | |

## Session 10: Towards Plenary

### 10.1: Any other business

- Week of 24 October, NASA and USGS are co-hosting the Pecora Symposium. There will be events that week to mark the 50th anniversary of Landsat. USGS appreciated CEOS' flexibility in accommodating these dates, and invited all to attend. There will be a workshop Monday of that week (before the technical sessions) on envisioning the future of international EO collaboration. More details at: pecora22.org.

### 10.2: Review of Outcomes from Each Session and 10.3: Review of Actions

Presenter: Stephen Ward (SIT Chair Team) *[presentation]*

- **Items 2.1 - 2.3:** no discussion beyond slides.
- **2.4:** not an *ad hoc* Team, but rather a task team should be mentioned (second bullet).
- **Items 3.1 - 3.3:** no discussion beyond slides.
- **3.4:** Suggestion to add formal action to stress the need for resources.

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| **SIT-TW-2022-15** | AFOLU Roadmap Leads to prepare input for 2022 CEOS Plenary noting, that additional resources are needed to advance the AFOLU Roadmap | **2022 CEOS Plenary** |
| | *Rationale: Communicate the need for resources to CEOS Principals.* | |

- **Items 3.5 - 3.11:** no discussion beyond slides.
- **4.1:** Mark Paganini (ESA) to provide draft text for the Terms of Reference for Ecosystem Extent Task Team (SIT-TW-2022-07) as a part of a proposal for presentation to CEOS Plenary 2022 for endorsement. This will also include a list of opportunities for stakeholder engagement.
- Mark Paganini also noted that the two actions from SIT-37 around the biodiversity discussion group can be closed (SIT-37-06 and SIT-37-07)..
- **5.1:** no discussion beyond slides.
- **Sessions 6 - 8:** no discussion beyond slides.
- **9.1 - 9.2:** no discussion beyond slides.
- Feedback is welcome on the usefulness of this session by session outcome review as a part of the SIT agendas.
- Olivier Marsal (CNES) noted that this is quite helpful for rapid turnaround updates to Agencies and participants.

### 10.4: Closing Remarks

- Simonetta Cheli (ESA, SIT Chair) thanked everyone for coming to ESRIN and those online, and noted that it is great to start the resumption of face to face meetings. This has clearly accelerated progress and started to rebuild momentum across the full suite of CEOS SIT activities. She looks forward to the follow-on discussions at CEOS Plenary 2022 to be hosted by CNES.

## APPENDIX A: Attendees

### SIT-TW Registered Participants List

***Bold** = confirmed attendee; * = virtual participation*

| Agency/Organisation | Name | Agency/Organisation | Name |
|---|---|---|---|
| AEM | Adan Salazar | ISRO | Abhisek Chakraborty* |
| AEM | **Adrian Guzman*** | ISRO | **Atul Varma*** |
| AGEOS | Aboubakar Mambimba Ndjoungui* | ISRO | **Nitant Dube*** |
| BOM (Australia) | Helen Beggs* | ISRO | **Pradeep Thapliyal*** |
| CEOS | **Marie-Claire Greening** | ISRO | Rajeev Jaiswal* |
| CMA/NSMC | Jinlong fan* | ISRO | **Rashmi Sharma*** |
| CNES | Annick Sylvestre-Baron* | ISRO | **Sandip Oza*** |
| CNES | **Aurélien Sacotte** | ISRO | **Shyam S Kundu*** |
| CNES | **Helene De Boissezon** | ITC, University of Twente, NL | **Andy Nelson*** |
| CNES | **Matt Steventon** | JAXA | **Ake Rosenqvist*** |
| CNES | **Olivier Marsal** | JAXA | **Akihiko Kuze** |
| CNES | Selma Cherchali* | JAXA | **Makoto Natsuisaka*** |
| CONAE | **Laura Frulla*** | JAXA | **Mariko Harada** |
| CSA | **Marie-Josée Bourassa** | JAXA | **Osamu Ochiai** |
| CSIRO | **Flora Kerblat** | JAXA | **Takeshi Hirabayashi** |
| DEFRA | **Melanie Hutchinson*** | JAXA/RESTEC | **Koji Akiyama** |
| DLR | **Albrecht von Bargen** | JAXA/RESTEC | **Yukio Haruyama*** |
| DLR | Katrin Molch* | NASA | **Alfreda Hall** |
| DLR | **Klaus Schmidt*** | NASA | **Argyro Kavvada** |
| COM | **Astrid Koch*** | NASA | **Barry Lefer** |
| COM | **Mark Dowell** | NASA | **Ben Poulter** |
| COM | **Peter Strobl*** | NASA | **Brian Killough** |
| EOTEC DevNet | Erin Martin* | NASA | **Christine Bognar** |
| ESA | **Ben Veihelmann*** | NASA | **Christopher Kidd** |
| ESA | **Ferran Gascon** | NASA | **David Borges** |
| ESA | **Frank Martin Seifert** | NASA | Emil Cherrington* |
| ESA | **Ivan Petiteville** | NASA | **Gary Geller*** |
| ESA | **Klaus Scipal** | NASA | **Jorge Vazquez*** |
| ESA | **Marc Paganini** | NASA | **Julie Robinson** |
| ESA | **Marie-Helene Rio** | NASA | **Mark Carroll*** |
| ESA | **Mirko Albani** | NASA | **Nancy D Searby*** |
| ESA | **Philippe Goryl** | NASA | **Wenying Su*** |
| ESA | **Simonetta Cheli** | NASA/JPL | **Edward Armstrong*** |
| ESA | Susanne Mecklenburg | NASA/JPL | **John R Worden** |
| ESA SIT Chair Team | **Tatiana Burukhina** | NASA/JPL | **Vardis Tsontos*** |
| ESA | **Yasjka Meijer*** | NOAA | **Albert DeGarmo** |
| ESA SIT Chair Team | **George Dyke** | NOAA | **Charles Wooldridge** |

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|---|---|---|---|
| ESA SIT Chair Team | **Stephen Briggs** | NOAA | Emily Smail* |
| ESA SIT Chair Team | **Stephen Ward** | NOAA | **Huan Meng*** |
| EUMETSAT | **Estelle Obligis*** | NOAA | **Jeffrey Privette** |
| EUMETSAT | **Paul Counet** | NOAA | **Katy Matthews** |
| EUMETSAT | **Robert Husband*** | NOAA | Kevin Gallo* |
| GEO | **Laurent Durieux** | NOAA | Ludovic Brucker* |
| GEO Secretariat | **Andreas Obrecht*** | NOAA | **Merrie Beth Neely*** |
| GEO Secretariat | **Sara Venturini*** | NOAA | **Paul DiGiacomo*** |
| | | NOAA | Shobha Kondragunta* |
| GEOGLAM | **Ian Jarvis** | Polish Space Agency | **Oskar Zdunek*** |
| GEOGLAM | **Sven Gillams** | Portugal Space | **Carolina Sá*** |
| Geoscience Australia | **Andreia Siqueira** | SANSA | Victoria Nkambule* |
| Geoscience Australia | **Jonathon Ross** | UKSA | **Beth Greenaway*** |
| Geoscience Australia | **Medhavy Thankappan*** | UKSA | **Shaneigh Turner*** |
| GFZ | Martin Herold | UKSA/NCEO | **John Remedios** |
| GISTDA | **Nuttavipa Thanthawewut** | UKSA/NCEO | **Paul Palmer*** |
| GISTDA | **Pakorn Apaphant** | UNOOSA | **Jorge Del Rio Vera*** |
| GISTDA | **Sitthisak Moukomla** | USGS | **Steve Labahn** |
| GISTDA | Suwat Sreesawet* | USGS | **Steven Covington** |
| GISTDA | **Tanita Suepa** | USGS | **Sylvia Wilson** |
| GISTDA | Tatiya Chuentragun* | USGS | **Timothy Stryker** |
| GISTDA | Warinthorn K. Evans* | USGS/KBR Inc. | **Christopher Barnes** |
| GISTDA | **Watanyoo Suksa-ngiam** | VNSC | Linh Phan* |
| INPE | **Julio Dalge*** | WMO | **Anthony Rea*** |
| ISPRS | Jie Jiang* | WMO | **Lars Peter Riishojgaard** |
| | **Itziar Irakulis Loitxate*** | UNEP/IMEO | **Cynthia Randles*** |
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## APPENDIX B: Actions Record

*Link to stand alone Actions document*

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| **SIT-TW-2022-01** | SIT Chair, in consultation with current and incoming CEOS Chair and the SEO to assemble a Task Team to further develop the 'New Space & Future CEOS' topics and initiatives (including Task Team proposed Terms of Reference to be confirmed at Plenary). | **2022 CEOS Plenary** |
| | *Rationale: Significant interest across CEOS agencies in this topic and a desire to explore ideas for concrete collaboration* | |
| **SIT-TW-2022-02** | LSI-VC Co-Leads, supported by the CEOS-ARD Oversight Group Lead and WGCV Chair, to prepare an agenda item for the 2022 CEOS Plenary formulating an action for CEOS to prepare a way forward for increased coordination of CEOS engagement with standards organisations. | **2022 CEOS Plenary** |
| | *Rationale: Following broad consultation with the CEOS community, including at a 2022 SIT Technical Workshop side meeting, it was agreed that more coordination on the engagement of CEOS with standards organisations would be beneficial. While this action originated from the LSI-VC and CEOS-ARD Oversight Group, the scope is intended to cover all of CEOS' engagement on standards.* | |
| **SIT-TW-2022-03** | CEOS Agencies to consider designating one or more representatives with CEOS Analysis Ready Data (ARD) heritage to join the OGC ARD Standards Working Group. | **Before the October 2022 OGC Member Meeting** |
| | *Rationale: The OGC ARD Standards Working Group will be proceeding with their effort to define joint ISO and OGC standards for "ARD" based on CEOS-ARD. CEOS needs to be engaged and represented in this process.* | |
| **SIT-TW-2022-04** | WGClimate Chair to confirm with CEOS Chair as to who will present this year's CEOS-CGMS Joint Statement to the UNFCCC SBSTA | **ASAP** |
| | *Rationale: The CEOS-CGMS Joint Statement to SBSTA must be delivered by a suitably-credentialed person, in accordance with UNFCCC processes.* | |
| **SIT-TW-2022-05** | SIT Chair will follow up with relevant agencies and CEOS teams on the cooperation requests submitted by IMEO to CEOS through the recent letter and TW presentation and bring an update to CEOS Plenary | **2022 CEOS Plenary** |

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| | *Rationale: IMEO will headline an EO-based methane detection system at COP-27 and there is a significant opportunity for CEOS agency data and capabilities to feature* | |
| **SIT-TW-2022-06** | CEOS Biodiversity leads to compile a list of engagement opportunities with key stakeholders. | **CEOS SEC-298** |
| | *Rationale: Coordinate how CEOS could support biodiversity-related events, including CBD COP15 and RAMSAR COP14 focused on wetland inventories.* | |
| **SIT-TW-2022-07** | CSA and NASA to collaborate on a proposal with Terms of Reference for an Ecosystem Extent Task Team, to be presented to CEOS Plenary. | **2022 CEOS Plenary** |
| | *Rationale: Marie-Josee Bourassa and Gary Geller to coordinate the preparation of a presentation to CEOS Principals at CEOS Plenary 2022.* | |
| **SIT-TW-2022-08** | All CEOS Agencies are invited to provide comments on the draft of a paper *Monitoring Surface PM2.5: An International Constellation Approach to Enhancing the Role of Satellite Observations*. (Available on the SIT Technical Workshop website). | **Comments by 15 October 2022** |
| | *Rationale: This paper will be presented for endorsement at 2022 CEOS Plenary 2022.* | |
| **SIT-TW-2022-09** | LSI-VC Co-Leads to prepare an agenda item for the 2022 CEOS Plenary formulating an action for CEOS to further define and develop the concept of a CEOS Interoperability Framework with other interested parties (e.g., WGISS, WGCV) and to bring a concrete proposal for consideration at SIT-38. | **2022 CEOS Plenary** |
| | *Rationale: Given the scope of the EO data interoperability problem, with numerous components distributed across many CEOS groups (e.g., LSI-VC, WGISS, WGCV, etc.), a robust framework and coordination mechanisms are needed to address the problem in a systematic and comprehensive manner.* | |
| **SIT-TW-2022-10** | CEOS Agencies to review the proposed EOTEC DevNet Sustainability Plan (https://docs.google.com/document/d/19R5PC0Yg5Gu6RaPHP5nWMs4l6_iMHXkuC_CyaRWZIlM/edit) and consider outlined approaches to staffing, including in-kind support for the part-time positions of regional community of practice coordinators. | **2022 CEOS Plenary** |
| | *Rationale: CEOS Agencies to consider outlined approaches to staffing, including in-kind support for the part-time positions of regional community of practice coordinators.* | |

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| **SIT-TW-2022-11** | Andy Nelson to share the GEOGLAM Capacity Development Guidance Document for consideration two weeks prior to the 2022 CEOS Plenary. | **Share Document by End of September** |
| | *Rationale: For information of CEOS members, and for consideration prior to discussion at 2022 CEOS Plenary.* | |
| **SIT-TW-2022-12** | CEOS Agencies are asked to indicate their interest in participating and contributing datasets, tools, and expertise to support the objectives of the GISTDA-Silvacarbon 2023 CEOS Workshop on National Forest Inventories & Mangrove Techniques (Feb 2023, Thailand). | **2022 CEOS Plenary** |
| | *Rationale: To provide CEOS Chair 2023 (GISTDA) with an indication of planned engagement at the workshop.* | |
| **SIT-TW-2022-13** | COAST AHT Leads to prepare an agenda item for the 2022 CEOS Plenary proposing a decision to extend the AHT for another year. | **2022 CEOS Plenary** |
| | *Rationale: The additional year will be used to help determine any interaction with outcomes being recommended by the CEOS Ocean Coordination Group (to be presented at SIT-38).* | |
| **SIT-TW-2022-14** | The Ocean Coordination Group is asked to make recommendations to the 2022 CEOS Plenary on the coordination of CEOS ocean-related activities, including activities in support of the UN Decade of Ocean Science for Sustainable development (2021-2030) and GST1 (2023 UNFCCC Global Stocktake). This talk also requires taking into account possible links to the future CEOS-COAST sustainability. | **2022 CEOS Plenary** |
| | *Rationale: Preliminary recommendations to be presented to the 2022 CEOS Plenary for consideration. Further follow-up on implementation planning and resource commitments for CEOS Principals and Agencies will occur at SIT-38.* | |
| **SIT-TW-2022-15** | AFOLU Roadmap Leads to prepare input for 2022 CEOS Plenary noting, that additional resources are needed to advance the AFOLU Roadmap | **2022 CEOS Plenary** |
| | *Rationale: Communicate the need for resources to CEOS Principals.* | |