

MINUTES v1.0

CEOS SIT-40 Meeting

8-10 April 2025

Executive Summary

- 1. The CEOS 2025–2027 Work Plan will be shared for CEOS Principal review by 5 May 2025, and nominally endorsed virtually by 19 May 2025.
- 2. UKSA, as the 2025 CEOS Chair, is advancing the theme "Unlocking Earth Observation (EO) for Society", and a joint CEOS Chair and SIT Chair side event was hosted alongside SIT-40 to discuss CEOS Agency interactions with UNFCCC COP delegates. A side event is planned for SIT Technical Workshop 2025 to discuss CEOS Agency initiatives for increasing the use of EO for public service.
- 3. As part of the CEOS in Schools programme, UKSA hosted two international webinars with 125 students from six countries. Students will develop posters to be presented at the CEOS in Schools Youth Event, hosted alongside CEOS Plenary 2025.
- 4. The GHG Task Team continues to develop the *Best Practices for Remote Sensing-based Estimates of Facility-scale Methane Emissions*. The document will be shared for CEOS-CGMS review in June, followed by completion of the final version in July 2025.
- 5. The SIT Chair Team is working with the GHG Task Team on engagement with the International Methane Emissions Observatory (IMEO), in particular on the Use Case Working Group, establishment of a database of controlled release experiments, and ensuring access to CEOS Agency data.
- 6. The implementation of WMO's Global Greenhouse Gas Watch (G3W) is progressing well with alignment between CEOS and CGMS activities, which effectively represent the space component of G3W.
- 7. The Biodiversity Study Team (BST) is concluding their stakeholder assessment activity. This will be followed by a consultation across the CEOS community to assess the potential to address the identified needs. The team will then develop a recommendation for sustainable CEOS support for biodiversity, along with the associated documentation, to be brought to CEOS Plenary 2025.
- 8. WGISS presented the first draft of the *CEOS Interoperability Handbook 2.0.* The Handbook includes a number of recommendations for data providers to improve the interoperability of their data and services. The document is now open for community comment, and a final version will be brought to CEOS Plenary 2025 for endorsement.
- 9. WGClimate has initiated an activity to expand the utility of the CDR Inventory to address emerging priorities, and are calling for participants to assist with the introduction of application/stakeholder typologies.
- 10. The *Space Agency Response to the 2022 GCOS Implementation Plan* was endorsed by SIT-40. This document provided responses to 48 activities identified by GCOS.
- 11. The IPCC Task Force on Inventories (TFI) Database is a potential mechanism through which EO data can improve national inventories, through the validation and enhancement of the default emission factors.
- 12. SIT-40 endorsed the Lessons Learned and Recommendations from Space Agencies' Support for the First Global Stocktake produced by the CEOS/CGMS WGClimate.
- 13. The JAXA SIT Chair Team will lead the development of the CEOS GST Strategy Issue 2 and oversee its implementation. The CEOS community are invited to nominate representatives to assist with the development of the document, which will be presented for endorsement at CEOS Plenary 2025.
- 14. WGClimate is working to increase engagement with UNFCCC. A UNFCCC COP Tiger Team under WGClimate has been established to coordinate CEOS and CGMS inputs to the annual UNFCCC COP meetings. WGClimate and UNFCCC will also hold a joint, virtual workshop on 30 April, 2025, to inform and engage division focal points and define follow-up activities.
- 15. The Aquatic Carbon Roadmap development continues, with a first draft shared for discussion. A consolidated draft is expected by CEOS Plenary, with endorsement planned for early in 2026.
- 16. WGCV have developed the CEOS Product Validation Platform (PVP), which includes a database for image comparisons as well as a tool for radiometric and validation analytics. The CEOS community are asked to engage with the initiative and provide imagery from their own sensors, and encourage other satellite



operators, including commercial operators, to also do so.

- 17. WGDisasters has established a subgroup to support the UN's Early Warning for All (EW4All) initiative. A workshop with the CEOS community and UN representatives has been proposed, however the objectives of such a workshop remain to be refined. WMO leads the second pillar of EW4All, focused on hazard detection.
- 18. A national emissions estimates session was held at WGClimate-22, where several national inventory teams from around Europe presented their approaches and challenges using EO data. Feedback from national inventory teams highlighted the need for better guidance on how to find and use EO datasets, as well as clearer resources for seeking help with EO data.
- 19. The SIT Chair Team will continue the series of Climate Policy Impact calls throughout 2025, to continue exploring ways to improve the use of EO data for national inventory reporting.
- 20. The CEOS AFOLU Roadmap team have defined over 30 actions to follow on from the Roadmap's recommendations. The LSI-VC Forests and Biomass Subgroup will monitor and track the progress of these actions.
- 21. SST-VC presented a statement regarding extended observation coverage from new ultra-high-resolution thermal infrared instruments. Following feedback at SIT-40, this statement will be refined and then shared for virtual endorsement.
- 22. The CEOS Executive Officer participated in the 14th GOOS Steering Committee (SC14) in Paris, France, in February 2025, on behalf of COAST-VC. GOOS expressed interest in partnering with CEOS on critical ocean observation infrastructure.
- 23. The LSI-VC GEOGLAM Subgroup asked CEOS Agencies to review the Subgroup's Terms of Reference and provide a response to GEOGLAM Points of Contact for any revisions, as well as nominations to join the Subgroup. A workshop will be held on 13-15 May, 2025, to discuss the Essential Agriculture Variables (EAVs).
- 24. LSI-VC's management of thematic areas for CEOS is overdue for strengthening to ensure consistent and robust oversight, and better integration of thematic work. Points of contact for AFOLU, GFOI and Agriculture were confirmed.
- 25. The International Coordination Group for Spaceborne SAR (ICGS-SAR) held its third workshop in Saga Prefecture, Japan, in November, 2024, where a number of recommendations were produced. The group would like to explore options to become integrated with CEOS, and will discuss with CEOS leadership over the coming months.
- 26. The SDG Coordination Group is working to ensure that the availability and capabilities of Earth observations are clearly understood as the next Global Development Agenda is shaped. The group has provided technical contributions to the UN Global Geospatial Information Management (GGIM) Working Group on Geospatial Information (WGGI) paper, which highlights the value and role of geospatial and Earth observation data in global development.
- 27. A formal letter of cooperation was received from UNCCD in May 2024, which included seven specific requests. The results of Step-D of the CEOS External Request Process were presented, and a response to UNCCD will be drafted by the CEOS Executive Officer.
- 28. WMO began an effort in January 2025 to update the WIGOS Vision for 2050. Osamu Ochiai (JAXA, SIT Chair Team) represents CEOS on the core drafting team.
- 29. CNES is leading the establishment of the Space4Ocean Alliance. The UN Ocean Conference, held in Nice, France, in June 2025, will be a key opportunity to join the alliance and contribute.
- 30. SIT Technical Workshop 2025 will be hosted by EUMETSAT in Darmstadt, Germany, on 9-11 September, 2025.
- 31. CEOS Plenary 2025 will be hosted by UKSA in Bath, UK, on 4-6 November, 2025.



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DECISION 04

The use of ceos.org/pvp to redirect to the WGCV Product Validation Platform was approved.

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8-10 April 2025



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DECISION 04

The use of ceos.org/pvp to redirect to the WGCV Product Validation Platform was approved.



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Wednesday April 9th

Session 1: Welcome and Core Business

1.1: Welcome and Opening Remarks

Presenter: Hironori Maejima (JAXA, SIT Chair) [presentation]

Main points:

- Hironori Maejima (JAXA, SIT Chair) welcomed everyone to Fukuoka, Japan for the 40th CEOS Strategic Implementation Team (SIT) meeting. Fukuoka is one of Japan's most rapidly growing cities and is home to space startups and leading universities.
- Hironori Maejima presented the JAXA SIT Chair priorities for 2024-2025, which remain as presented at the 2024 CEOS Plenary. The main headlines are "Earth Observation Data Impact and "Coordination of Greenhouse Gas Observations". JAXA also emphasises the importance of the continuity of SIT and CEOS Work Plan activities.



 CEOS Principals were invited to introduce members of their delegation attending SIT-40.The full list of participants can be found in Appendix A.

1.2: EarthCARE Mission Update

Presenter: Takuji Kubota (JAXA, P-VC Co-Lead) [presentation]

- Takuji Kubota (JAXA) is the CEOS Precipitation Virtual Constellation (P-VC) Co-Lead as well as JAXA EarthCARE Mission Scientist..
- The Earth Cloud Aerosol and Radiation Explorer (EarthCARE) is an ESA Earth Explorer jointly developed and operated by ESA and JAXA to observe clouds, aerosols and radiation. It will contribute significantly to the improvement of climate models and support the training and development of cloud and snowfall detection algorithms, with applications in numerical weather prediction and parameterisation refinement.
- The satellite carries four primary instruments: the Multi-Spectral Imager (MSI), Broadband Radiometer (BBR), Atmospheric Lidar (ATLID), and Cloud Profiling Radar (CPR). Synergistic observations from the four instruments are key to its utility, providing unique various synergy products. The satellite was launched on 29 May, 2024 with first images later shared on 27 June, 2024.



- The CPR instrument represents the world's first spaceborne Doppler radar in the W-band (94 GHz), capable of measuring vertical cloud motion. It was jointly developed by JAXA and Japan's National Institute of Information and Communications Technology (NICT). The instrument provided the world's first measurements of vertical cloud motion from space.
- Validation activities are ongoing, and the EarthCARE validation community contributed to the *"Best practices for validation of Aerosol, Cloud, and Precipitation Profiles (ACPPV)."* The document was endorsed by the CEOS Working Group on Calibration and Validation (WGCV) and published in March 2025.
- Level 1, Level 2 Single Sensor, and Level 2B EarthCARE Sensor Synergy data products have been released to the public and are accessible via JAXA's <u>G-Portal</u> and ESA's <u>EO Gateway</u>.
- Joint ESA-JAXA EarthCARE In-Orbit Validation Workshops were held virtually in January and March 2025 at ESA ESRIN, Frascati, Italy. The EarthCARE Science and Validation Workshop is scheduled from 1-5 December, 2025 at the University of Tokyo.

Main discussion points:

 Barry Lefer (NASA) congratulated NASA and ESA on the significant achievement of launching several 'first ever' space-based instruments. NASA is actively involved in several EarthCARE calibration activities, including airborne campaigns in the US.

1.3: SIT-40 Objectives and Action Review

Presenters: Osamu Ochiai and Matt Steventon (JAXA, SIT Chair Team) [presentation]

Main points:

- Reviewed the meeting objectives and provided updates on actions due at SIT-40:
 - <u>SIT-39-09</u>: Points of contact for the LSI-VC POLINSAR team have been received from NASA (NISAR), JAXA (ALOS-4), ESA (BIOMASS), CSA (RCM, Radarsat-2), and CSIRO (NovaSAR). Nominations are forthcoming from CONAE (SAOCOM-1) and ASI (COSMO-SkyMed). Responses are still sought from DLR (TerraSAR-X dual-pol) and ISRO (EOS-04, NISAR-S).
 - <u>SIT-TW-2024-03</u>: Regarding the action for the CEOS Executive Officer to ensure broad CEOS input to the WGISS Interoperability Handbook v2.0, Tom Sohre (USGS, WGISS Chair) confirmed that this action can be closed since the team has the representation required.
 - Actions <u>SIT-TW-2024-07</u> and <u>SIT-TW-2024-08</u> regarding COAST-VC talking points on the UN Ocean Decade were closed.
 - <u>SIT-TW-2024-09</u>: The recommendation from COAST-VC and SST-VC regarding extended observation coverage from new ultra-high-resolution thermal infrared instruments will be presented under item 7.1 at SIT-40. The authors desire endorsement by CEOS. This will happen virtually after SIT-40 as this was not planned or received in time for SIT-40 endorsement. We will clarify the next steps and a timeline during SIT-40.
 - Action <u>CEOS-38-03</u> relates to the activity of the CEOS Biodiversity Study Team (BST). The CEOS Chair Team has invited the BST Co-Leads to present at SIT-40 and recent SEC meetings. This regular reporting will continue to ensure the BST's mandate is met for 2025 CEOS Plenary.
 - <u>CEOS-38-09</u>: Working Groups were requested to share linkages between their work and the SDGs during a recent CEOS Secretariat meeting. This information was then passed on to the SDG Coordination Group. No new activities resulted and the action was closed.

1.4: CEOS 2025-2027 Work Plan

Presenter: Steven Ramage (CEOS Executive Officer) [presentation]



- The CEOS Work Plan outlines the short term objectives and deliverables of CEOS for the next three years. Last year's edition of the CEOS Work Plan featured a number of new activities, including the CEOS-ARD Strategy 2024, the Biodiversity Study Team, Early Warnings for All, and the WGISS Interoperability Handbook.
- The four key governing documents that primarily guide the work of CEOS are the <u>CEOS Terms of</u> <u>Reference</u>, <u>CEOS Strategic Guidance document</u>, <u>CEOS Governance and Processes document</u> and the <u>CEOS Work Plan</u>.
- The CEOS Executive Officer is the custodian of the CEOS Governing Documents, including the annual update of the 3-year CEOS Work Plan and the monitoring of the deliverables it informs.
- Detailed work items are defined as deliverables. Deliverables are outlined in the Work Plan and are reconciled and tracked in the <u>CEOS Deliverable Tracking Tool</u>. Updates are provided by points of contact directly in the Deliverable Tracking Tool.
- An overview of the progress of deliverables from the 2024-2026 CEOS Work Plan was provided.
 See <u>slides</u> for details.

The CEOS 2025–2027 Work Plan will be shared for CEOS Principal review by 5 May 2025, and nominally endorsed virtually by 19 May 2025. Main discussion points:

 Hironori Maejima (JAXA, SIT Chair) expressed his gratitude for the CEOS Executive Officer team in its update of the CEOS Work Plan, the foundational document for defining the outcomes and deliverables of CEOS activities.

1.5: UKSA CEOS Chair Themes Update

Presenter: Beth Greenaway (UKSA, CEOS Chair Team) [presentation]

- UKSA's CEOS Chair theme for 2025 is 'Unlocking Earth Observation for Society'. This comprises four headline activities:
 - <u>Unlocking EO for Public Service</u>: This will be discussed further under item 4.8 in the EO Data Impact session. A side meeting is being planned for SIT Technical Workshop 2025 to discuss CEOS Agency initiatives for increasing the use of EO for public service applications such as urban planning, climate and environmental monitoring, and mineral management. Inputs from this discussion will be compiled into a short white paper to be presented to CEOS Plenary 2025 highlighting key barriers and opportunities.
 - <u>Unlocking EO for the UNFCCC Global Stocktakes</u>: A SIT-40 side meeting was held on 8 April, 2025 to explore how stronger connections could be made between CEOS Agencies and national UNFCCC COP delegates to support the increased use of EO in climate policy and decision-making. Findings included the need to develop positions and interventions with national delegations well in advance, the need for coordinated and consistent messaging across agencies, and a clear shared objective.
 - Unlocking EO for the Global Methane Pledge: UKSA is working with the Climate and Clean Air Coalition (CCAC) and Global Methane Pledge (GMP) teams to secure recognition of the CEOS Methane Best Practices at UNFCCC COP30 (10-21 November, 2025). This work was recently discussed at the CCAC Plenary in Brasília. The UK's Department for Energy Security and Net Zero has recently taken on the role of CCAC Vice Chair. CCAC has proposed a meeting in April between the Methane Best Practice leads and GMP champion countries to explore opportunities for further collaboration.
 - <u>CEOS In Schools and CEOS Youth Event</u>: UKSA are piloting a CEOS mechanism to inspire global youth collaboration in Earth observation. 125 students from six countries have been involved so far. The CEOS Chair Team hopes to establish a lightweight and repeatable program within CEOS. Two online international webinars held so far focused on 'EO for the Urban Environment' and 'EO for Biodiversity.' Posters developed by participating students will be



Main discussion points:

 Hironori Maejima (JAXA, SIT Chair) thanked UKSA for their efforts and noted that the discussions held at the WGClimate-22 meeting and the SIT-40 COP Delegation Side Meeting also supported and advanced the SIT Chair priorities. He added that Japanese high school students participated in the CEOS in Schools international webinars and valued the experience and collaboration. JAXA looks forward to attending the Youth Event at CEOS Plenary 2025 and seeing the results from students.

Session 2: Coordination on Greenhouse Gas Observations

Hiroshi Suto (JAXA) moderated this session and provided a brief introduction.

2.1: CEOS Greenhouse Gas Roadmap Actions and Progress

Presenter: Yasjka Meijer (ESA, CEOS Greenhouse Gas Task Team Lead) [presentation]

Main points:

- The CEOS Greenhouse Gas Task Team (GHG-TT), part of the joint CEOS-CGMS WGClimate, is responsible for maintaining and implementing the Greenhouse Gas (GHG) Roadmap and coordinating GHG-related activities across CEOS and CGMS working groups.
- The first issue of the GHG Roadmap was published in March 2020, following recommendations from the GHG White Paper. An update to the Roadmap was mandated at SIT-39.
- The second and final version of the <u>Roadmap</u> was developed in close collaboration with CGMS, the Global Greenhouse Gas Watch (G3W), and UNEP's International Methane Emissions Observatory (IMEO). It received parallel endorsements from the CEOS Plenary and CGMS Plenary and was made publicly available in October 2024. This version focuses on the co-development of fit-for-purpose products in collaboration with stakeholders. It includes key sections addressing stakeholder interactions and requirements (including WMO, G3W, and IMEO), as well as outlining thematic activities and fostering stakeholder engagement.
- Short-term actions are defined as 6-12 month activities in the GHG Roadmap's <u>Annex C</u>, which are coordinated by the GHG Task Team thematic leads. Progress to date includes the initiation of Best Practices for GHG monitoring with an initial focus on facility-scale methane emissions, renewed collaboration with IMEO, and continued engagement with WMO G3W.
- The GHG-TT is also working on broader coordination of the CEOS Carbon Roadmaps and increased national stakeholder engagement and capacity-building efforts, including at the joint WGClimate-22 / GHG-TT-5 meeting (Harwell, UK; 11-13 February, 2025). This meeting included national inventory compilers who shared their experiences with EO data, gaps, and requirements.

- Jörg Schulz (EUMETSAT) noted that in 2024, prior to the CGMS Plenary, a workshop was held between the CGMS Working Groups to explore pathways to the operationalisation of GHG data. CGMS would like to repeat the workshop in 2025. With CO2M on the horizon, the timing is very appropriate. Discussions with WMO G3W have reinforced the idea that there is a need to further develop this framework. There is already a solid foundation in place for operational activities.
- Selma Cherchali (CNES) noted that CNES is strongly supporting GHG cal/val activities and the development of science-grade products. While discussions are ongoing about integration at the UNFCCC level and moving toward operational production, Selma stressed that substantial work is still needed to achieve the required performance levels for these products. As the launch of MicroCarb approaches, there is still much to be done to meet the mission's objectives. The CEOS community needs to be careful in maintaining its rigour and not spread efforts and resources too



thinly; there should be a strong continued focus on CEOS' fundamental role in delivering high-quality, science-grade products. In preparation for the operational CO2M mission, Selma highlighted the need to continue developing the necessary science and capabilities. MicroCarb is currently planned for launch on 25 July, 2025.

- Mauro Facchini (European Commission) acknowledged that the work of the GHG Task Team is essential in laying the groundwork for CO2M. He noted that the community is still on a steep learning curve and stressed the importance of considering how the GHG Task Team's current work will carry forward. The European Commission remains very supportive of these efforts.
- Yasjka Meijer (ESA, GHG Task Team Lead) noted the GHG Roadmap has made it clear that research remains essential, especially in understanding biogenic processes and how the biosphere is responding to a changing climate. Yasjka also expressed anticipation for the upcoming launch of MicroCarb. The inclusion of more explicit science questions would be welcomed.
- David Crisp (SIT Chair Team) noted that the CEOS Global Stocktake (GST) Strategy will be revised this year. It aims to integrate multiple systems in a quasi-operational style. The team will be reaching out for inputs during the drafting process.
- Selma Cherchali (CNES) added that in preparation for MicroCarb's launch, there are over 200 Cal/Val activities underway. This includes linking existing processes in Level-2 products and the assessment of error budgets. There is a close connection between this work and the preparation for CO2M. Selma suggested that these elements should be explicitly reflected in the Roadmap.
- Hiroshi Suto (JAXA) noted that the GHG-TT is focused on developing common products such as match-up datasets like those in the cal/val portal. These efforts are also contributing valuable lessons that will help in the preparation of future operational systems like CO2M. WGCV members are coordinating aerial campaigns to support cal/val activities, with the next campaign scheduled for June 2025. Participation from the MicroCarb team is welcomed.

2.2: Best Practices for Remote Sensing-based Estimates of Facility-scale Methane Emissions

Presenter: Paul Green (NPL) [presentation]

- The development of the *Best Practices for Remote Sensing-based Estimates of Facility-scale Methane Emissions* is an activity under the GHG Task Team.
- The Global Methane Pledge has been signed by 155 countries and seeks to reduce methane emissions by 30 percent by 2030.
- Fugitive emissions and high emitters (emissions > 100 kg / hr) represent a substantial fraction of fossil and waste emissions.
- Public and New Space observations of CO₂ and CH₄ are increasingly being used to identify large emitters to improve efficiency, support regulation, and are likely needed for a functioning carbon market and reporting system.
- Currently, there are three operational commercial satellite missions dedicated to facility-scale emissions monitoring, with another ten expected over the next few years – in addition to the products generated from public data.
- Agreed best practices for reporting VVUQ (Verification, Validation, and Uncertainty Quantification) and quality assurance for facility-scale emissions are needed so that data producers know what is expected by the community and users know how the data should be generated and reported so that it can be trusted.
- At the end of 2023 there was the introduction of significant new legislation in the EU and U.S. to curb methane emissions from the fossil fuel industry. This opened the doors to the use of satellite data for quantifying and reporting emissions. Corporate emissions and the climate risk



reporting environment have tools in place to encourage corporate responsibility and market competitiveness.

- The document covers common practices for Level 0 to Level 4 products, an overview of the current state of the art for validation, and a quality assessment framework.
- Controlled release experiments are also covered, with a process for blind testing of super emitters. There has been substantial effort in the community over the last year to coordinate controlled releases.
- The Best Practices seek to adopt the maturity matrix approach used by the NASA CSDA/ESA EDAP Framework for Quality Assessments. The underlying cal/val maturity matrix is an output of the CEOS WGCV.
- Version 0.2 of the Best Practices was opened for review and consultation through Q1 2025.
 Version 0.3 is now being developed and a final version will be shared for CEOS and CGMS review in June. The final version will be completed by July 2025. A future version to include wide area mappers is being considered.

Main discussion points:

- Patrick Gibson (UKSA, CEOS Chair Team) thanked Paul and encouraged next steps on user uptake.
- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) appreciated the important work to increase transparency in this domainCEOS can have an important role in providing frameworks that ensure quality in this space, which has an increasing representation of the commercial/New Space sector, helping to uphold the overall credibility of Earth observation.
- Alex Held (CSIRO) noted the importance of the cal/val element and signaled CSIRO's expertise, equipment and interest in collaborating.
- Rob Sturgiss (IPCC TFI) asked whether the focus is on leak detection (qualification) rather than quantification, since national inventories were not listed among the stakeholders. Paul acknowledged the point, agreeing that national inventories as well as the IPCC should be included as stakeholders, as they play a key role in inventory construction. He explained that the Best Practices framework addresses three stages: Identification, with quick turnaround similar to IMEO/MARS; Quantification, with broader uncertainty margins; and Long-term measurement, aimed at greater accuracy. The Best Practices cover all three of these time scales.

2.3: CEOS Engagement with the International Methane Emissions Observatory (IMEO)

Presenters: Stephen Ward (SIT Chair Team) and Yasjka Meijer (ESA, GHG Task Team Lead) [presentation]

- CEOS has engaged with UNEP's International Methane Emissions Observatory (IMEO) through the SIT Chair Team since 2021 as a key end-user of CEOS data. A joint CEOS-IMEO workshop was held in June 2023 at Harvard University in Cambridge, Massachusetts, United States. The workshop led to the formation of five IMEO working groups. These groups, however, stalled after initial meetings.
- A renewed collaboration was initiated in late 2024, with a call in February 2025 identifying ongoing shared priorities. Current efforts include revitalising the IMEO working groups under CEOS leadership, starting with the Use Case Working Group, which held a kick-off meeting in March 2025. The Roadmap Working Group is expected to follow in August–September 2025.
- The interface is currently managed by the SIT Chair Team and the GHG Task Team. Future joint
 meetings will be assessed pending progress on the working group activities.
- IMEO would be an ideal partner to promote the Methane Best Practices. IMEO serves as a valuable link to oil and gas industry and also funds several research projects, which CEOS aims to highlight in the context of the best practices.



Further comments added:

- Stephen Ward (SIT Chair Team) noted additional collaboration opportunities around controlled release experiments and ensuring they are more widely communicated and coordinated to increase observations and intercomparisons. He mentioned a recent discussion with James France (EDF, IMEO) about identifying user needs, including the development of a central database and improving data access.
- Yasjka Meijer (ESA, GHG Task Team Lead) added that these controlled releases involve actual methane emissions, so the data should be centrally shared and fully utilised. He encouraged collaboration with IMEO and invited CEOS Agencies to actively engage and contribute to this effort.
- In the Methane Best Practices, a proposal was made to establish a centralised scheduling tool or calendar for controlled release experiments. CEOS will survey agencies to gather information on methane detection algorithms to coordinate efforts and avoid duplication.
- The SIT Chair Team is working to address data access challenges highlighted by IMEO with PRISMA (ASI), EnMAP (DLR), and Himawari (JAXA/JMA). Discussions are ongoing to expand quotas, simplify data access, and prioritise observation sites.
- A CEOS–IMEO community workshop is planned for late 2025 in Europe to discuss the Use Case Working Group output and initial IMEO Roadmap priority settings.
- CEOS Members are invited to participate in IMEO working groups, contribute to best practices, support the controlled release database, assist with data access, and notify the GHG-TT lead, Yasjka Meijer (ESA), of relevant algorithm development efforts.

- Jörg Schulz (EUMETSAT) noted increased requests for GEO observations and suggested making it an agenda item for a workshop ahead of the CGMS plenary. The observational capabilities are already in place, and this presents a good opportunity to create a GEO-ring product, similar to what has been done for meteorological data products. This could be a relevant topic for CGMS and a valuable point of discussion. Methane leak events can be transient and short-lived, and hence difficult for LEO sensors to capture. GEO observations could fill a gap. He asked about the long-term stewardship of this IMEO engagement effort, which is currently led by the SIT Chair Team with engagement through G3W and the GHG Task Team.
- Stephen Ward (SIT Chair Team) noted that the JAXA SIT Chair Team has picked up this priority for the third consecutive SIT Chair term, and intends to continue pragmatic support.
- Yasjka Meijer (ESA, GHG Task Team Lead) added that the initiative was stalled but is now reactivated thanks to the SIT Chair Team's support. He confirmed that the GHG Task Team is the appropriate long-term home.
- John Remedios (UKSA, CEOS Chair Team) suggested two different categories of use cases: leak detection versus quantification.
- Yasjka clarified that different stakeholders require different use cases. Oil and gas leak detection
 is distinct from the requirements of regulatory bodies, so the Use Case Working Group will tailor
 its outputs accordingly.

	Agencies with methane detection science programmes are invited to notify the GHG Task Team	h
SIT-40-01	lead (Yasjka Meijer, ESA) to support information exchange with IMEO.	June 2025



Rationale: IMEO is interested in collaborating with CEOS Agencies on methane detection science and algorithms to ensure effective application of CEOS EO data for the IMEO applications

2.4: CEOS Engagement with the WMO Global Greenhouse Gas Watch (G3W)

Presenter: Natalia Donoho [presentation]

Main points:

- A G3W Data Provider Workshop took place from 5-7 March, 2025, in Geneva, Switzerland, and discussed modelling systems, data exchange, and data architectures. A mapping of input data was undertaken, including a satellite data exchange framework under WGClimate and the GHG-TT, and WIS2.0 (WMO Information System 2.0). Atmospheric non-satellite data and *in situ* ocean topics and requirements were also raised.
- A presentation will be delivered at the upcoming Policy Advisory Committee in April 2025 and the WMO Executive Council in June 2025. There is some degree of concern regarding the long-term funding of a critical mass of people within the G3W Secretariat at WMO.
- Specific recommendations for CEOS:
 - Continue working on low latency products, as this is decisive input for the overall system latency.
 - Need to fill spatial gaps (particularly identified: stratospheric methane).
 - Prioritise sustainability for long-term operations.

- Yasjka Meijer (ESA, GHG Task Team Lead) noted that the letter from G3W effectively highlighted the CEOS perspective and the key aspects of G3W relevant to CEOS. The role of the oceans in G3W should be revisited at a later date. Regarding the request for low latency data, Yasjka asked for clarification on what "low latency" means, specifically, whether it refers to near-real-time data, and if so, what timeframes are implied.
- Natalia will forward Yasjka emails regarding latency. Natalia noted that the current acting director is the director for infrastructure, with Oksana Tarasova (WMO) taking a supporting role. WMO is discussing a permanent replacement for Gianpaolo Balsamo (WMO).
- Beth Greenaway (UKSA, CEOS Chair Team) thanked Natalia on behalf of the CEOS Chair. It's clear how important G3W is as a transformative initiative that unites both the scientific and operational communities. CEOS is the space component of G3W and is committed to continuing that collaboration. G3W has strong links with Earth Information Day which could be jointly leveraged.
- Natalia noted that the last EID had a minimal focus on space and suggested discussing ways to better leverage satellite data. There are several actions related to sustainability. For WMO, data exchange remains the top priority.
- Wenying Su (NASA, WGClimate Chair) appreciated the close collaboration between the WGClimate, GHG Task Team, and G3W. Regarding near real-time (NRT) requirements, there is an opportunity to work with GCOS. A new status report will be released in 2027. Their last status report and implementation plan had a NRT request for GHG datasets, although their definition is vague. This is a key area to collaborate on and define.
- David Crisp (SIT Chair Team) requested CEOS be kept informed regarding the WMO/G3W booth at COP. He added that current NRT data delivery varies by product. CO₂ and CH₄ concentrations can be available within a day or two, whereas flux data often takes a couple of years to compile. Additional resources are critical to reduce the turnaround time for GHG flux inversion. Dave



suggested that G3W consider a staged implementation to help CEOS Agencies develop faster flux inversion capabilities.

- Jörg Schulz (EUMETSAT) drew an analogy with the Global Weather Watch, outlining capabilities to get data out of the system into an assimilation, beginning mostly with Level 2 data. This depends on the system's ability to deliver sufficiently accurate fluxes and that, as we bring another item into the operational world, we need to accommodate it with appropriate technology. He suggested making the GCOS requirements more oriented and scale-dependent and discussing this at the next GCOS workshop to inform the next GCOS Implementation Plan.
- Hironori Maejima (JAXA, SIT Chair) added that G3W will be a key consideration in planning CEOS efforts around GST2.

Session 3: Working Group Topics

Yuko Nakamura (JAXA, SIT Chair Team) moderated this session and provided a brief overview.

3.1: Biodiversity Study Team Progress

Presenter: Gary Geller (NASA, Biodiversity Study Team Co-Lead) [presentation]

Main points:

- In 2024, the CEOS Chair (CSA) selected biodiversity as its focus theme, leading to the establishment of the Biodiversity Study Team (BST) based on the Chair's recommendation at the CEOS Plenary in October 2024. The BST is a follow-on to the previous Ecosystem Extent Task Team (EETT).
- The overall task of the BST is to assess options for sustainable support for biodiversity within CEOS and to make a recommendation at the 2025 CEOS Plenary.
- In Phase 1, the team is conducting a stakeholder assessment to identify the needs of end users.
 In Phase 2, the team will consult across CEOS entities and agencies to assess the potential to address these user needs. In Phase 3, the team will develop a recommendation for sustainable CEOS support for biodiversity.
- The team is in the process of finalising the consolidated user needs table.
- The consultation is expected to conclude around 15 May 2025, with consolidation of feedback continuing until 30 May 2025.
- By August 26, 2025, draft deliverable documents will be submitted for the SIT Technical Workshop meeting. A side meeting will be held at SIT TW. The BST is on track to deliver on its mandate by CEOS Plenary 2025.

- Darcee Killpack (USGS) noted that Roger Sayre (USGS), who has been instrumental in this area, has retired from USGS, but is hoping to return to this activity as a volunteer. Kelly Bruno (USGS) is also interested in contributing.
- Alex Held (CSIRO) recalled that Shaun Levick is the CSIRO co-lead, and Adriana Parraruiz from CSIRO is also supporting the effort. He emphasised the importance of involving biodiversity experts from other agencies and pointed to the next UNCBD COP in Armenia in 2026 as a key opportunity.
- The SST-VC and BST leads will discuss an extension to the SST-VC's contribution to Phase 2 such that inputs can be sought at the June GHRSST Science Team and SST-VC meetings. BST leadership might be able to participate in those meetings.
- Barry Lefer (NASA) commended the BST's efforts and progress and thanked Roger Sayre and USGS for their support to this point.



- Selma Cherchali (CNES) highlighted ongoing interaction with the French team on the Costa Rican tropical forests EETT demonstrator project and noted that the new generation of hyperspectral missions is of high importance to this team.
- John Remedios (UKSA, CEOS Chair Team) noted the many commonalities across the user needs table, meaning that numerous stakeholders could be satisfied efficiently.
- He added that at the national level, UKSA reviews carbon and GST datasets alongside global assessments, and asked for advice on engaging national biodiversity colleagues to distinguish between global and country-specific metrics.
- Steven Ramage (CEOS Executive Officer) suggested reviewing National Biodiversity Strategies and Action Plans (NBSAPs) as a key source.
- Osamu Ochiai (JAXA, SIT Chair Team) asked whether marine biodiversity and atmospheric biodiversity should be included. Noting that not all agencies have biodiversity expertise, he suggested learning from others' experiences and for more systematic mapping of Essential Biodiversity Variables (EBVs).
- Gary noted that while there are only about 22–23 EBVs, the CBD's indicator list contains many more specific metrics and space agencies currently produce relatively few higher-level products of relevance, which the EETT identified as a gap. He also noted that the marine biome is underrepresented. NOAA, which has the necessary expertise on marine biodiversity, participated in the BST but lacked resources to continue. Marc Paganini (ESA) is now leading the assessment of marine-specific needs. He acknowledged that some gaps will remain after the BST's work.
- Ake Rosenqvist is contributing to the BST user needs from the perspective of wetlands/Ramsar Convention on behalf of JAXA.

3.2: WGISS Interoperability Handbook Issue 2

Presenters: Tom Sohre (USGS, WGISS Chair) and Nitant Dube (ISRO, WGISS Vice Chair) [presentation]

- The CEOS Interoperability Handbook 2.0 provides guidance for developing interoperable data and services and assessing their maturity level.
- The first draft of the handbook is available on <u>GitHub</u> for review and feedback.
- The handbook is organised into seven chapters: Introduction, Interoperability Framework, Vocabulary (Semantics), Architecture, Interface (Accessibility), Quality, and Policy.
- The Vocabulary chapter emphasises the importance of standardised terminology, version control, and domain-wide adoption of terms through collaboration with ISO TC 211, OGC, WMO, and GEO. It also highlights the need to avoid circular dependencies and establish clear relationships among terms.
- The Architecture chapter focuses on data preservation, metadata standards, and data publishing. It includes frameworks such as CEOS-ARD, CEOS Open Data Cube, and ISO 19115 metadata standards. This chapter drives an interface with the Interoperability chapter, and hence features numerous recommendations.
- The Interface chapter addresses data discovery, data access, and user authentication. It incorporates tools and protocols such as STAC, OpenSearch, linked data keywords, and OpenAPI 3.0 to support both human and machine interfaces.
- The Quality chapter covers calibration and validation and the use of resources such as RadCalNet, SARCalNet, QA4EO, and the CEOS Cal/Val Portal.
- The Policy chapter covers topics including open data, licensing, open standards and software, procurement from third parties, data preservation, community engagement, support for open science, and transparency.



 A timeline was presented for review and endorsement of the handbook. The community review is scheduled to begin in April 2025, followed by a status update in June 2025. Final reviews and endorsement are planned for October/November 2025:

Sequence of Activities

- WGISS-59 (Thailand) Detailed discussion of each factors and recommendations (Completed, 1st Draft available)
- SIT-40 : Presentation to SIT on 1st Draft and Approval for Community Review
- April 2025: Circulation of 1st Draft for Community Review
- **June 2025:** Brief on status to SEC
- SIT-Technical Workshop (Sept 2025): Review of Community Recommendations and their Close-out
- ♦ WGISS-60 (Oct 2025) : Review of Final 1st Draft
- CEOS Plenary (Nov 2025) : Interoperability Handbook 2.0 for Endorsement

- Barry Lefer (NASA) thanked GISTDA for hosting the WGISS-59 meeting (Bangkok, Thailand; 24-28 March, 2025) and complimented the joint leadership and effort from USGS and ISRO required to complete Issue 2 of the Interoperability Handbook. NASA recognises the fundamental importance of increasing interoperability and appreciated WGISS for their efforts.
- Alex Held (CSIRO) thanked GISTDA for hosting WGISS-59.
- Darcee Killpack (USGS) thanked Nitant Dube for the summary and progress update. This topic is critical for CEOS success, and for making the most of multi-modal observations. She encouraged the further development of interoperability not only among CEOS Agencies but also with the commercial sector.
- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) welcomed this milestone. He noted that interoperability is crucial and will serve as a valuable reference for LSI-VC's development of the CEOS-ARD Framework and Product Family Specifications.
- Poramet Thuwakham (GISTDA) congratulated WGISS on this achievement and the success of the WGISS-59 meeting.
- Yuko Nakamura (JAXA, SIT Chair Team) invited CEOS to review the Interoperability Handbook Issue 2 draft and encouraged CEOS agencies to seek feedback from external partners/users.

SIT-40-02	CEOS Agencies to provide feedback on the draft Interoperability Handbook to the WGISS Chair and Vice Chair. Inputs are also welcomed from the broader community and CEOS Agencies are asked to share the link to the <u>GitHub</u> as appropriate with their experts.	SIT TW 2025
	Rationale: WGISS welcomes review and comments on t of the Interoperability Handbook ahead of the 20 Workshop, where community recommendations will be completion of the final draft at the WGISS-60 meetin	he latest iteration 25 SIT Technical reviewed prior to 1g (October 2025)



and presentation for potential endorsement at the CEOS Plenary in November 2025.

3.3: WGClimate Report

Presenter: Wenying Su (NASA, WGClimate Chair) [presentation]

Main points:

- The WGClimate-22 and Greenhouse Gas Task Team joint meeting was held in Harwell, UK, from 11-13 February, 2025, with 43 in person and 34 virtual participants, including representatives from CEOS, CGMS, and national GHG inventory compilers. Participants encouraged CEOS and CGMS to send a letter to WMO in support of the Global Greenhouse Gas Watch (G3W) initiative, which was sent on 30 March, 2025.
- Representatives from the World Climate Research Programme (WCRP) attended the meeting and expressed interest in collaborating more closely with WGClimate to support initiatives like Earth System Modelling and Observations (ESMO) and the Coupled Model Intercomparison Project (CMIP).
- WGClimate is looking to expand the utility of the Climate Data Record (CDR) Inventory to address emerging priorities and is considering various application and stakeholder typologies. This includes areas such as climate cycles, climate modelling (EMSO, CMIP), attribution, tipping points, the Global Carbon Project, EW4ALL, and Solar Radiation Management.
- Space agencies provided responses to 48 activities of the 2022 GCOS Implementation Plan. Feedback from GCOS panels was addressed, and the comments and clarifications received so far have been appreciated. Responses were submitted for CEOS review on 24 March, 2025, and WGClimate is seeking CEOS endorsement at SIT-40. The responses were also submitted for CGMS review and endorsement at the end of March 2025. WGClimate will meet with the GCOS Joint Panel and use the GCOS IP response as input.
- CEOS provided pilot top-down CO₂ and CH₄ inventories to support the first Global Stocktake (GST1) in 2023. These inventories received positive recognition in international settings, but few national inventory compilers have adopted these satellite-based data to support inventory development or for quality assurance and control. CEOS and CGMS are currently reevaluating their approach to inform future efforts. WGClimate has compiled a GST1 Lessons Learned document with recommendations across three key areas: GHG flux datasets, stakeholder engagement, and communication. For more details, refer to item 4.3 below.
- The CEOS UNFCCC Tiger Team aims to ensure consistent preparation across CEOS and CGMS agencies for key UNFCCC events throughout the year and develop a comprehensive multi-year engagement strategy aligned with the phases of the GST process, including proactive preparation for party submissions. The team will define key objectives for each COP and Earth Information Day (EID) to ensure that CEOS and CGMS efforts are strategic and aligned with broader climate goals.

- Marie-Claire Greening noted that ESA has been closely involved with the Space Agency Response to the 2022 GCOS IP, with over 15 staff members contributing. ESA is pleased to endorse the Space Agency Response to the 2022 Global Climate Observing System (GCOS) Implementation Plan.
- Jörg Schulz (EUMETSAT) praised WGClimate's effort to consolidate such a magnitude of inputs for the Space Agency Response to the 2022 GCOS IP. This activity strengthens CEOS' relationship with GCOS, which is currently reworking the entire ECV framework for its next Implementation Plan in 2028. Jörg emphasised the need to maintain and deepen this collaboration. Regarding the effort to increase usage of the CDR inventory and map typologies, additional contributors are



welcomed. The ultimate goal is to enable users to search for specific products and applications within the CDR Inventory.

- Natalia Donoho (WMO) noted that GCOS is sponsored by WMO, thanked WGClimate for their effort, and recognised this key collaboration.
- Niall Bradshaw (UKSA, CEOS Chair Team) thanked WGClimate for their effort on the response to the GCOS IP and supported the proposed evolution of the CDR Inventory.

DECISION 01	CEOS endorsed the <u>Space Agency Response to the 2022 Global Climate</u> <u>Observing System (GCOS) Implementation Plan</u> .	
	Agencies are invited to nominate participants to the WGClimate activity on expanding the utility of the CDR Inventory to address emerging priorities.	May 2025
511-40-05	Rationale: There is an activity underway to application/stakeholder typology to the CDR Invenence emerging priorities.	introduce an ntory to address

Session 4: EO Data Impact

4.1: Session Overview

Presenter: Osamu Ochiai (JAXA, SIT Chair Team) [presentation]

Main points:

- "EO Data Impact" has been a priority for the SIT Chair Team during its two-year term, aiming to address the obstacles and opportunities that allow CEOS Agency data to have the greatest impact on key climate policy processes, such as the Global Stocktake.
- CEOS and its Agencies invest more effort in climate-related activities than any other area, prompting a reflection on whether current stakeholder engagements are sufficient or require adjustment.
- The SIT Chair team seeks to evaluate whether the current strategies and partnerships are optimally aligned to maximise the impact of EO data on climate policy or whether alternative approaches are needed.
- A series of Climate Policy Impact online meetings were held throughout the SIT Chair term to expand discussion time on these critical topics. These discussions have been highly productive and are expected to continue in 2025.

4.2: CEOS Engagement with the Intergovernmental Panel on Climate Change (IPCC)

Presenters: Rob Sturgiss (IPCC TSU) [presentation], Joana Melo (JRC) [presentation]

Main points:

Rob Sturgiss (IPCC TSU) reported:

One lesser-known element of the IPCC is the Task Force on National Greenhouse Gas Inventories, which was created as an interface between science and climate policy. The Task Force is responsible for the IPCC Guidelines, which are recognised by the Paris Agreement and earlier climate treaties. They underpin climate policy by building confidence in government estimates, providing a basis for government mitigation commitments, ensuring stability and continuity, and offering a focus for the design of mitigation policies and actions.



- The IPCC Guidelines, refined in 2019, emphasise the use of Earth observation data in inventories, recognising satellite imagery as valuable activity data for detecting changes in land use. The Guidelines highlight the importance of quality assurance for inventories, which can be supported by 'top-down' models that use atmospheric measurements of greenhouse gas (GHG) concentrations.
- There are two pathways to improve inventories through IPCC referencing EO data. The first involves strengthening emission estimation techniques and building confidence in EO data, with a possible focus on methane emissions. The second pathway involves validating and enhancing default emission factors using EO data, with the EO community potentially contributing to the IPCC TFI Emission Factor Database (EFDB).

Two pathways to improve inventories through the IPCC

- 1) Strengthening/testing emission estimation techniques using EO data
 - Build mutual understanding of the current strengths/weaknesses of estimates based on EO data
 - Targeting an IPCC expert workshop
 - Building confidence in EO data among the inventory community
 - Maybe methane....
- 2) Strengthening/testing IPCC GLs
 - Validating / improving IPCC default factors with EO data
 - IPCC TFI would be open to EO community becoming data suppliers to support the IPCC TFI Database of emission factors and emission measurements
 - One possible avenue leading to future IPCC GLs refinements

<u>Discussion</u>

- David Crisp (SIT Chair Team) noted that the topics are starting to align and suggested holding further discussions with the IPCC TFI team to refine the guidelines and explore opportunities around the EFDB. He recalled a workshop held in 2022 and raised the possibility of CEOS supporting future workshops, asking when and how these should be organised.
- Rob noted that the IPCC Plenary must also consider workshop proposals and expressed willingness to work on drafting a proposal for a future workshop.
- Stephen Ward noted that the SIT Chair Team discussed systematic representation of CEOS data in the IPCC EFDB with Sandro Federici (IPCC), which has been echoed today by Rob Sturgiss.

Joana Melo (JRC) <u>reported</u> on the translation of EO datasets to national GHG inventory (IPCC Guideline) definitions to reduce the historical gap in forest-related CO_2 emissions related to the differing definitions of 'natural' and 'anthropogenic'.

- The IPCC has explicitly indicated in the outlines of its AR7 reports that estimates and scenarios for anthropogenic land-based CO₂ fluxes shall ensure consistency with national inventory definitions in order to track progress towards the objectives of the Paris Agreement. This is detailed in the document <u>here</u>.
- The EO community is aligning with this goal by enabling like-for-like comparisons with released datasets. An example of this is seen at the global level, where the historical gap in forest-related CO₂ emissions is reduced when independent estimates are translated to the National Greenhouse Gas Inventory (NGHGI) definitions of 'natural' and 'anthropogenic' sinks as outlined



in the IPCC Guidelines. This is more of a conceptual difference than a disagreement over datasets.



 The LULUCF data-hub is hosted by the European Commission Joint Research Centre in the EU Observatory. It aims to strengthen dialogue across communities and demonstrates ongoing efforts from the scientific community in presenting their data in a conceptually similar way to NGHGI / IPCC guidance to effectively help track progress.

- Yasjka Meijer (ESA, GHG Task Team Lead) noted that the strengths of EO are its global consistency and rapid availability compared to most inventories. EO is intended to augment, not replace, the current inventory process.
- Clement Albergel (ESA) echoed Yasjka's comment, noting that while national inventories are used to track progress officially, EO can offer independent measurements for transparency, and direct identification and verification of emission factor estimates. It is important to carefully separate managed and unmanaged land and reconcile what is found from top-down vs bottom-up estimates.
- Joana Melo (JRC) agreed with both comments, noting that sometimes there are different estimates which are not inherently wrong, but need to be presented differently.
- David Crisp (SIT Chair Team) asked how, as EO data becomes more useful for inventories, CEOS can effectively promote these capabilities and build community capacity.
- Rob suggested direct engagement with the people producing the inventories is most effective.
 IPCC hosts workshops for community dialogue and could facilitate engagement with inventory compilers.
- Joana Melo (JRC) highlighted the REDD+ programme's role in encouraging the use of satellite imagery. Developing countries' reporting histories are shorter with formal submissions only steadily encouraged since 2014, but capacity-building initiatives like REDD+ and SilvaCarbon have significantly improved reporting rates.
- Osamu Ochiai (JAXA, SIT Chair Team) concluded that these discussions need to be fully captured in the renewed CEOS GST Strategy.

	SIT Chair and WGClimate Chair to follow up on IPCC	
SIT-40-04	threads regarding an Expert Workshop and more	SIT TW 2025
	systematic and comprehensive representation of	



CEOS agency datasets in the IPCC Emission Factors Database.

Rationale: Dialogue between the SIT Chair Team and IPCC TSU has led to opportunities for closer engagement

4.3: Lessons Learned and Recommendations from Space Agencies' Support for the First Global Stocktake [Document]

Presenter: Wenying Su (NASA, WGClimate Chair) [presentation]

Main points:

- The Lessons Learned and Recommendations from Space Agencies' Support for the First Global Stocktake report was presented for endorsement at SIT-40. The document will also be submitted for CGMS endorsement shortly after.
- For the first Global Stocktake (GST1), in 2023, CEOS provided pilot top-down CO₂ and CH₄ inventories, which received positive recognition internationally. However, few national inventory compilers adopted these satellite-based data for inventory development or quality control.
- CEOS and CGMS are reevaluating their approach to inform future efforts. The lessons learned and corresponding recommendations are categorised into three key areas: 1) GHG flux datasets, 2) Stakeholder engagement, and 3) Communication.
- Details of the lessons learned and recommendations for each of these areas can be found in the slides.

Main discussion points:

- Jörg Schulz (EUMETSAT) noted that activities have already started in response to the recommendations. The lessons learned have served as a real catalyst. The lessons extend beyond the initial GST scope, which should be kept in mind when updating the GST Strategy.
- Beth Greenaway (UKSA, CEOS Chair Team) endorsed the work, praising its broader relevance beyond the GST. Each recommendation effectively represents a multi-year project and will require prioritisation. The CEOS UNFCCC Tiger Team is already well underway and there is a clear consensus on the path forward.
- ESA and JAXA both formally endorsed the Lessons Learned and Recommendations from Space Agencies' Support for the First Global Stocktake report, commending the important recommendations and the significant substance they provide to define the CEOS GST Strategy update and beyond.

	CEOS endorsed the "Lessons Learned and Recommendations from Space
DECISION 02	Agencies' Support for the First Global Stocktake" produced by the
	CEOS/CGMS WGClimate.

4.4: Updating the CEOS Global Stocktake Strategy (2021)

Presenter: Osamu Ochiai (JAXA, SIT Chair Team) [presentation]

Main points:

 The CEOS GST Strategy Issue 1, published in 2021 under the Australian SIT Chair Team, focused on the first GST in 2023 and included nine key recommendations. Contributions came from CEOS groups like WGClimate, LSI-VC, WGCV, as well as SilvaCarbon.



- JAXA has committed to providing an update to the strategy during its SIT Chair term, reflecting lessons learned from the GST1 efforts. WGClimate has shared their lessons learned in a report, and all CEOS groups have been invited to contribute additional perspectives, with responses received from LSI-VC and the WGCV LPV Biomass team.
- Issue 2 of the CEOS GST Strategy aims to address the outcomes of the Lessons Learned study, advance priority recommendations, understand the changing landscape with organisations like the UNFCCC, GEO, and WMO for optimal CEOS engagement, define next steps to improve the representation of systematic observations in the GST process and beyond, and engage relevant CEOS Agency experts and groups to enhance implementation capacity.
- The kick-off for the GST Strategy update will take place at SIT-40. A draft of GST Strategy Issue 2 will be presented for discussion at the SIT Technical Workshop in September 2025, with the final version to be presented for endorsement at the CEOS Plenary in November 2025.
- The SIT Chair Team seeks a more proactive, strategic, and long-term UNFCCC engagement, currently being pursued through the WGClimate UNFCCC Tiger Team, which will develop and implement a sustained engagement plan, a more coordinated RSO community preparation, more systematic CEOS-UNFCCC SEC engagement, etc.

- Darcee Killpack (USGS) noted that the SilvaCarbon programme has been terminated. While USGS can no longer contribute to the model, she encouraged other agencies to adopt and advance it.
- Yasjka Meijer (ESA, GHG Task Team Lead) welcomed the GST Strategy update and suggested the scope be expanded beyond the GST's role in supporting the Paris Agreement. He proposed annual, or even biannual, space-based transparency reporting to monitor and mitigate global temperature rise.
- Jörg Schulz (EUMETSAT) agreed it is timely to revisit the strategy and widen its focus to the entire Earth system. The previous strategy briefly mentioned activities beyond the GST and argued for a more prominent inclusion this time. He suggested incorporating geoengineering elements such as monitoring the Earth Radiation Budget and proposed developing the strategy jointly with CGMS, subject to CGMS Plenary approval.
- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) welcomed the ongoing SIT Chair coordination of the CEOS GST Strategy. The SIT Chair's convening role will ensure the necessary, broad representation of CEOS entities.
- JAXA will provide the capacity to coordinate the GST strategy update.
- David Crisp (SIT Chair Team) cautioned against expanding the scope, since we have a short time frame for the update, which must be completed by SIT Technical Workshop in September. He recommended retaining a focus on the GST and deferring broader climate science topics elsewhere.

	CEOS Agencies and WG, VC, and AHT leads are asked to name representatives to the SIT Chair to help with	20 April 2025
SIT-40-05	development of the 2025 update of the CEOS GST Strategy and to provide feedback and preliminary ideas.	30 April 2025



Rationale: Given the broad set of inputs required from across the CEOS organisation, the SIT Chair will lead the development of GST Strategy – Issue 2. A draft will be presented and discussed at the SIT Technical Workshop before presentation for potential endorsement at the 2025 CEOS Plenary.

4.5: UNFCCC / COP / EID Engagement

Presenters: Mark Dowell (European Commission) and Vincent-Henri Peuch (ECMWF) [presentation]

- Recommendation 2.1.5 of the GST Lessons Learned called on CEOS to establish a dedicated "Tiger Team" for coordination with UNFCCC. This team, led by WGClimate leadership and supported by members of the CEOS Chair and CEOS SIT Chair teams, is focused on aligning objectives across space agencies, national delegations, and other relevant stakeholders. Its mandate includes ensuring consistent preparation for EID, enhancing coordination at key events, and transforming EID into a compelling platform for showcasing the transformative potential of space-based data.
- The team is tasked with developing a comprehensive multi-year engagement strategy aligned with the phases of the GST process. This strategy serves as a roadmap for consistent, proactive engagement and ensures meaningful contributions to international climate discussions. The multi-year plan should clearly define key objectives for each COP and EID, ensuring that CEOS and CGMS efforts are strategic and aligned with broader climate goals. A central component of this strategy is the proactive preparation for party submissions.
- Through these actions, CEOS and CGMS can build stronger relationships with key stakeholders, enhance the visibility of space-based data, and secure its integration into global climate processes. This coordinated approach will amplify the contributions of satellite-derived Earth observations, establishing them as indispensable tools for supporting Paris Agreement objectives.





Providing a comprehensive, up-to date data source to inform:

Tracking of GHG emissions (consideration of temporal and spatial monitoring)

Present observed climate impacts (including loss and damage, land-use change) Determine the effectiveness of climate actionutilizing existing baselines

CE

- Building strategic relationships with key stakeholders is vital to foster stronger connections with high-level COP delegations and align with the specific policy priorities of these delegations. We should identify and nurture "COP champions," who can serve as influential advocates for integrating space-based data into global climate frameworks. Secondments to UNFCCC could also be considered. A unified and strategic representation at UNFCCC events would leverage WMO as a credible central channel and empower national delegations for advocacy at EID.
- Progress on the dialogue with UNFCCC includes a meeting held on 19 February between Vincent-Henri Peuch (ECMWF), Heather Maeseko (UNFCCC), and Annette Möhner (UNFCCC). Bi-monthly tag ups will be organised between the UNFCCC Secretariat and members from the Tiger Team and WGClimate. WGClimate are considering developing a briefing document to reflect the key messaging and strategic inputs.
- A half-day virtual workshop is planned for 30 April, 2025 to inform and engage division focal points, define follow-up activities, and encourage broader participation across CEOS and CGMS, making the most of the virtual format to maximise involvement.

Main discussion points:

- Hironori Maejima (JAXA SIT Chair) noted that JAXA has supported COPs for many years by organising joint side events with ESA and other partners, as well as leading various related activities.
- Vincent-Henri Peuch (ECMWF) noted that the 2025 SBSTA cycle includes June sessions in Bonn, Germany, which is too soon for input from the UNFCCC Tiger Team. However, Tiger Team members will attend to gauge relevant activities for 2026.
- Mark Dowell (EC-JRC) added that delegates typically need final topics for EID by the end of August. The plan is to agree on a common set of topics within the Tiger Team in June 2025, enabling CEOS Agencies to approach their national delegations in a coordinated manner. Having multiple country delegations advocate for consistent proposals will greatly increase the chances of those topics being accepted.

4.6: CEOS Aquatic Carbon Roadmap

Presenter: Marie-Helene Rio (ESA, OCR-VC Co-Lead) [presentation]

- The CEOS Aquatic Carbon Roadmap concept was actioned at the CEOS Plenary in November 2023 as the "Aquatic leg" of the CEOS Carbon Strategy, complementing the GHG and AFOLU Roadmaps. It is targeted for completion in the first quarter of 2026.
- The space agency coordinators of the roadmap are Marie-Helene Rio (ESA), Laura Lorenzoni (NASA), and Hiroshi Murakami (JAXA). The scientific leads include Jamie Shutler (University of

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Exeter), Bob Brewin (University of Exeter), Cecile Rousseaux (GSFC-NASA), and Kelsey Bisson (NASA).

 The outline, timeline, and contributors of the roadmap were shared. More details can be viewed in the <u>slides</u>:



- At the ESA Living Planet Symposium in Vienna, Austria on 22-27 June 2025 the team will present the roadmap in ocean carbon dedicated sessions on 'Marine and Ocean Coastal Carbon,' and in the insight session on the 'Aquatic Carbon Roadmap as a key integrated contribution for the GST.'
- The Ocean Carbon from Space Workshop will be held virtually on 24-27 November, 2025, hosted by EUMETSAT and ESA with support from the EU and Copernicus.

Main discussion points:

- Misako Kachi (JAXA, SST-VC Co-Lead) noted that SST-VC is keen to contribute to the Aquatic Carbon Roadmap and is considering ways to provide support and welcomes guidance and suggestions from OCR-VC.
- Maire-Helene Rio (ESA, OCR-VC Co-Lead) noted that Ocean Surface Topography (OST), Ocean Surface Vector Winds (OSVW) and Coastal Observations, Applications, Services, and Tools (COAST) have not been formally involved in developing the roadmap. Input from other VCs might be valuable, and the draft roadmap has been circulated for comment.

4.7: Coordination among the CEOS AFOLU, GHG, and Aquatic Carbon Roadmaps

Presenter: Osamu Ochiai (JAXA, SIT Chair Team) [presentation]

- At SIT-39, the SIT Chair committed to coordinate with the leads of the CEOS GHG, AFOLU, and Aquatic Carbon Roadmaps to open channels for necessary linkages. Multiple coordination teleconferences have been held, most recently on 27 February 2025, with participation from all three Roadmap lead teams. These efforts aim to connect the teams, share progress, and support the Aquatic Carbon Roadmap in shaping its structure and ensuring alignment with the GHG and AFOLU domains.
- Issues discussed include the need for better integration with the inverse modelling community.
 WMO's G3W initiative offers a policy gateway, but internal alignment between roadmap teams is crucial. The Global Ocean Observing System (GOOS) may support the Aquatic Carbon Roadmap, and the GHG Roadmap team is considering necessary linkages.
- There is a potential for collaboration with the Global Carbon Project. A key question is whether the three roadmaps could jointly explore future requirements from the inverse modelling community, possibly with WGClimate involved.



- The SIT Chair Team will continue to support coordination among the three Roadmap lead teams.
 WGClimate may explore how to better align their Climate Data Record (CDR) work with the needs of the inversion modelling community. It is also essential to ensure the Aquatic Carbon Roadmap reflects integration needs across domains.
- The insight session on "Toward an Aquatic Carbon Roadmap as a key integrated contribution to the Global Stocktake," at the upcoming Living Planet Symposium 2025, offers an opportunity to bring together contributors from all three CEOS Roadmaps to discuss synergies and interconnections.

4.8: Unlocking EO for Public Service – SIT Technical Workshop 2025 Side Event Overview

Presenter: Beth Greenaway (UKSA, CEOS Chair Team) [presentation]

Main points:

- The UKSA CEOS Chair theme for 2025 is 'Unlocking Earth Observation for Society' with a focus on improving public services and making them more efficient. From the UKSA perspective, this includes areas such as public health, social care, food production, and climate. The emphasis is on the services that the public sector requires, rather than solely on feeding EO data into policy processes.
- UKSA is proposing a side meeting at the SIT Technical Workshop in September 2025 to share perspectives and insights on barriers, what has worked well in the community, and how to secure the future of upstream EO and encourage uptake. Four to five speakers will present their insights, and volunteers are welcome.

- Mauro Facchini noted that the European Commission has established the Knowledge Centre on Earth Observation (KCEO) to help EU policymakers fully exploit the growing amount of EO data, products and applications. This is done by assessing needs of EU policies and translating these into technical requirements for EO products and services; analysing research needs and priorities for innovating EU EO programmes; and bringing together an active community of scientists, policymakers and specialists.
- Hironori Maejima (JAXA, SIT Chair) welcomed the SIT Technical Workshop side event proposal, remarking that this is a common consideration for all countries and sharing experiences and approaches would be valuable.

	CEOS Agencies to consider providing a talk for the <i>Unlocking EO for Public Service</i> side meeting being convened by the UKSA CEOS Chair at the 2025 SIT Technical Workshop (on the side meeting day, 9 September 2025).	19 May 2025
SIT-40-06	Rationale: The CEOS Chair Team would like to gath perspectives as input to the summary paper that will be 2025 CEOS Plenary. Agencies are invited to share perspectives and insights services and activities that work now? What benefits ha Could this be duplicated elsewhere? What new opport for EO in public services? What interventions do CE associated Governments implement to encourage use of countries/regions? What are the barriers? What collectively?	er broad, global e presented to the on: What are the twe been realised? tunities are there OS Agencies and of EO data in their could CEOS do



5.1: CEOS Product Validation Platform (WGCV Match-up Database)

Presenter: Nigel Fox (NPL, WGCV IVOS Subgroup Chair) [presentation]

Main points:

- Previously named the WGCV Spatial and Radiometric Matchup Database, the CEOS Product Validation Platform (PVP) is a database for image comparisons and a tool for radiometric and validation analytics. The platform will enable satellite operators to demonstrate their performance consistently using a range of independent references.
- CEOS Agencies are asked to regularly collect and provide free access to Level 1 satellite imagery and metadata over set calibration sites. This will then be integrated into a virtual reference. Commercial data providers are encouraged to follow similar practices.
- This virtual reference will then be used to provide quality assurance feedback to satellite operators and data users through an NPL-developed web application.
- The identified radiometric sites include instrumented sites in Railroad Valley (USA), Gobabeb (Namibia), and Lake Tahoe (USA), as well as natural pseudo-invariant calibration sites in Libya and Algeria.
- Spatial sites for high-resolution sensors include the King Fahd Causeway (Saudi Arabia-Bahrain) and the Lake Pontchartrain Causeway (USA). Sites for medium-resolution sensors include the Baotou Target (China) and the ISRO NRSC target (India).
- A database including radiometric and spatial data will be developed within NPL's cal/val infrastructure, with initial data from Sentinel-2, Landsat, and Planet. Radiometric sites have been defined as CEOS references, and while more may be added, the aim is to maintain a minimum core set of sites.
- A framework for collecting images has been written. Data is intended to be open access, although there may be licensing considerations for some data. Spectral response functions of sensors are required for comparisons, but do not need to be made publicly available. The radiometric comparison tool has been tested with Sentinel-2, Landsat-8, Planet SuperDove, and Pleiades data.
- Nigel requested that a redirect to the platform be accommodated on the CEOS web domain. For example, a redirect from <u>ceos.org/pvp</u> to the platform would be helpful.
- The PVP will be populated with commercial and space agency satellite imagery and serve as a fully functional service for agencies and commercial operators alike. In time, other types of products are envisioned beyond Level 1 optical data, such as SAR and surface reflectance products.
- WGCV requests member agencies to engage with the initiative and provide imagery and encourages sharing the PVP with other satellite operators in their sphere of influence.

- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) welcomed this initiative, noting that trust and integrity issues are becoming more important. Jonathon thanked Nigel and the UK for, noting the contribution by the UK Earth Observation Data Hub. He also commended the foundational work of the CEOS SEO to clarify the role of the commercial sector in CEOS, which enables activities like the PVP to proceed with confidence.
- Alex Held (CSIRO) suggested including an additional dark target in the southern hemisphere to test the signal-to-noise performance of new sensors.
- Nigel clarified that dark targets are primarily used as thermal references for infrared missions, although he agreed that ensuring a comprehensive set of sites is important.
- Dave Borges (SEO) offered to collaborate with WGCV IVOS on provisioning a new CEOS website address for the PVP.



- IVOS will leverage networks like JACIE and VH-RODA to promote the PVP to commercial operators, some of whom are already IVOS members. Nigel welcomed the SEO's support in raising visibility and tracking user engagement. The CEOS booth at the ESA Living Planet Symposium will be another good outreach opportunity.
- Darcee Killpack (USGS) affirmed USGS's support for the PVP and agreed that a CEOS URL would be helpful.
- Osamu Ochiai (JAXA, SIT Chair Team) commended the initiative and asked how the database could be expanded to include other instrument subgroups like those for GHGs, pointing to JAXA's existing GHG cal/val portal as an example.
- Nigel noted that although the underlying work originated within IVOS and therefore has an initial focus on infrared and visible optical sensors, it is a broad WGCV effort and the PVP framework could host additional product types and tools.

SIT-40-07	CEOS Agencies and entities (WGs, VCs, AHTs) are asked to engage with the WGCV Product Validation Platform (PVP) initiative and provide imagery from their own sensors and to encourage other (e.g., private sector) satellite operators in their sphere of influence to also do so. Contact should be made via <u>Samantha.Malone@npl.uk</u>	SIT TW 2025
	Rationale: The CEOS WGCV Product Validation Platform (PVP) would benefit from additional reference imagery from CEOS agencies and the private sector. CEOS Agencies are asked to regularly collect and provide free access to Level 1 satellite imagery and metadata against a common 'CEOS reference' (representing radiometric and spatial properties). Similar imagery is welcomed from commercial data providers.	
	WGCV is asked to incorporate other types of tools/databases in the WGCV Product Validation Platform (PVP).	May 2025
SIT-40-08	Rationale: The CEOS WGCV Product Validation Platford comprises the Comparison Image Database (CID) Validation AnaLytics tool (RADVAL). There is scope for other tools, e.g., the CEOS GHG cal/val database coordin	m (PVP) currently and Radiometric r the inclusion of pated by JAXA.

	The use of <u>ceos.org/pvp</u> to redirect to the WGCV Product Validation
DECISION 04	Platform was approved.



Thursday April 10th

Session 5: Working Group Topics (continued)

5.2: CEOS Support for the United Nations' Early Warnings for All (EW4All) Initiative

Presenter: Laura Frulla (CONAE, WGDisasters Chair) [presentation]

Main points:

- The Early Warnings for All (EW4All) initiative was launched in 2022 by the UN Secretary General to ensure that everyone on Earth is protected from hazardous weather, water, and climate events.
- The initiative is structured around four pillars:
 - Disaster risk knowledge; led by the United Nations Office for Disaster Risk Reduction;
 - Detection, observation, monitoring, analysis, and forecasting; led by WMO;
 - Warning dissemination and communication; led by the International Telecommunication Union; and,
 - Preparedness and response capabilities; led by the International Federation of Red Cross and Red Crescent Societies (IFRC).
- Following action SIT-39-11, WGDisasters established a dedicated subgroup to support the EW4All initiative. The Subgroup includes members from CEOS WGDisasters, the SIT Chair Team, CEO, and SEO, as well as representatives of the GEO Secretariat. CEOS is positioned to contribute to Pillars 1 and 2, with some potential to support Pillars 3 and 4 through collaboration
- Potential contributions from WGDisasters include: the Geohazard Supersites and Natural Laboratories of the Institute of Geophysics and Volcanology (INGV), the Tonga Preparedness Pilot (UNOOSA), the Wildfire Pilot (Natural Resources Canada), the Flood Pilot (CONAE), and additional efforts focused on drought, landslides, seismic activity, recovery observatories, and global volcano early warning systems.
- The SIT Technical Workshop 2024 established an action to gauge CEOS support for the EW4All initiative. At CEOS Plenary 2024, there was a request for the WGDisasters Chair to provide an overview of the EW4All Subgroup and its current tasks so that CEOS Principals can assess nominations and resourcing.
- The subgroup's most recent teleconference in March 2025 invited Natalia Donoho (WMO) and Agnes Lane (BOM), who are leading a WMO task team to develop EW4All user requirements and undertake a gap analysis for the Asia-Pacific region.
- Wider participation from across CEOS is encouraged, given the cross-cutting nature of the initiative.
- The CEOS Executive Officer proposed a workshop to bring together the four pillars of EW4All and the CEOS community. A draft proposal for the workshop is currently being developed.

- Mauro Facchini (European Commission) recalled a recent EU-level communication on crisis preparedness and noted the work of the Copernicus Emergency Management Service (EMS).
 EMS has operational modules for floods, fires, drought, and ground motion using radar interferometry. Mauro will explore whether someone from Copernicus EMS could join the WGDisasters EW4All Subgroup.
- Selma Cherchali (CNES) emphasised the importance of capitalising on existing initiatives and enlarging the scope to cover additional user needs from the EW4All perspective. A clear outline of needs is required before agencies can engage/commit.



- John Remedios (UKSA, CEOS Chair Team) acknowledged the importance of this activity, noting UKSA contributions to earthquake and volcano monitoring. John emphasised the need to work closely with WMO and meteorological agencies in areas such as floods, droughts and fires, where UKSA already has partial involvement. He also suggested adding heat waves to the focus areas.
- It is important to be clear on what 'early' means in the context of these activities, distinguishing between a definition in terms of imminent events versus one in terms of adaptation, and ensuring clarity on the distinction.
- Laura Candela (ASI) noted that these activities complement ongoing WGDisasters efforts and are not pilot projects. Understanding stakeholder requirements is key and will guide CEOS's role after the workshop. Early warning systems require monitoring predictive parameters, which fits well with CEOS capabilities.
- Jörg Schulz (EUMETSAT) highlighted that in early warning systems, weather forecasting plays a key role. Space agencies within CGMS work to improve forecast lead times for disaster prevention. Adaptation requires understanding past extremes, prediction capabilities, and associated risks. CEOS should broaden its approach by considering wider user needs and collaborating with CGMS and initiatives like the European Commission's Destination Earth. Identifying gaps and matching requirements is essential.
- Selma Cherchali (CNES) highlighted the ongoing efforts to improve forecast modelling for early warnings, mentioning internal proposals with Pacific stakeholders on GNSS early warning for tsunamis.
- Osamu Ochiai (JAXA, SIT Chair Team) called for CEOS Principals to indicate their interest in engagement with the four pillars and asked if CEOS Principals are interested in supporting the proposed workshop. Clear direction is necessary.
- Mauro Facchini (European Commission) noted the need to consider adaptation and preparedness activities..
- John Remedios (UKSA, CEOS Chair Team) offered to explore UKSA's support for the workshop and stressed defining clear objectives and requirements. We need a clear message from the EW4All stakeholders that there is a role for increased satellite EO involvement.
- Marie-Claire Greening (ESA) emphasised clarifying workshop objectives, engaging stakeholders to understand their needs, and avoiding overburdening the community without clear requirements.

SIT-40-09	-40-09	WGDisasters EW4All Subgroup to share the current concept note for a proposed CEOS-EW4All workshop with the SIT Chair Team.	June 2025
		Rationale: A draft proposal has been developed for EW4All workshop.	a joint CEOS and

5.3: WMO Activities and Perspectives on the United Nations' Early Warnings for All (EW4All) Initiative

Presenter: Natalia Donoho (WMO) [presentation]

Main points:

WMO leads Pillar 2 of EW4All – detection, observation, monitoring, analysis, and forecasting – which is aligned with WMO's mandate for weather and climate. WMO has identified 30 countries and minimum core capabilities, with a focus on developing countries. A rapid assessment of country capacity was conducted for 51 countries, particularly Least Developed Countries (LDCs), Landlocked Developing Countries (LLDCs), and Small Island Developing States (SIDS).



- The WMO information system (WIS2) is on track to deliver a reliable real-time data sharing framework to support EW4AII, and has been operational since January 2025. Global services are provided by 11 countries around the world, and 50+ WIS2 nodes are sharing real-time data. WIS2 training has been delivered to 90 countries in the past two years, and will be expanded to another 70 countries in 2025. Another 30 countries will receive operational WIS2 nodes.
- WMO has undertaken a survey for Latin America on products and hazards, and has developed a gap analysis. The next steps include developing training activities, with ongoing pilot projects.
- There is strong support and interest in early warning systems. WMO is working to expand its coverage across the Pacific with assistance from Agnes Lane (Australian Bureau of Meteorology).
- WMO is collaborating with GEO to appoint a representative for EW4All. Countries with access to satellite data should be encouraged to share it through a clear, accessible catalogue to support hazard monitoring and early warnings.

Session 6: EO Data Impact – Country Engagement

6.0: SIT Chair Team Session Introduction

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

Main points:

- The first Global Stocktake (GST) made clear that space agencies need to prioritise engagement of national agencies, including inventory agencies, to improve understanding and uptake of EO satellite data and its use in national reporting systems and processes.
- CEOS and its agencies have a strong foundation in this area through initiatives such as:
 - Longstanding engagement in the Global Forest Observations Initiative (GFOI) since 2009;
 - The SilvaCarbon capacity building workshop series, initiated in 2011;
 - $\circ~$ Earth observation based IPCC Tier 1 biomass estimation through biomass harmonisation efforts;
 - Agency-led programmes like NASA's SERVIR.
- The main objectives of this session are:
 - Consider and discuss ideas on how to improve country engagement and address the lessons learned from the first GST;
 - Reflect on the trial session on national inventory partnering held during the WGClimate-22 meeting in February 2025 in the UK;
 - Hear updates on JAXA's national pilot activity with SilvaCarbon in Cambodia;
 - Report on the initial version of the CEOS AFOLU Roadmap actions.

6.1: Report on the WGClimate-22 National Emission Estimates Trial Session

Presenter: Wenying Su (NASA, WGClimate Chair) [presentation]

- A session dedicated to national emissions estimates at the WGClimate-22 meeting (11-13 February, 2025; Harwell, UK) aimed to initiate a dialogue between national GHG inventory teams and space agencies, and understand the opportunities and barriers for the uptake of EO data in national inventories.
- The United Kingdom already has an emission verification system in place, using tall towers to contribute to national inventories and GHGSat data to validate facility-scale emissions. The United Kingdom is collaborating with the Greenhouse Gas Emissions Measurement and



Modelling Advancement (GEMMA) programme to explore how satellite and ground-based data can be integrated into the inventory process.

- In France, Earth observation data is used to quantify emissions from Land Use, Land-Use Change, and Forestry (LULUCF) and shipping sectors, with geophysically explicit monitoring on finer grids combining Earth observation and field data to track changes and outcomes at multiple scales. Key challenges include detecting real changes (that is, avoiding false positives), ensuring data consistency and interoperability, and assessing dataset maturity to guide effective integration.
- The Integrated Greenhouse Gas Monitoring System (ITMS) is being developed in Germany as an observation-based verification system, progressing from demonstration to first-generation and eventually operational use, leveraging data from ICOS and TROPOMI to detect methane sources, trace CO₂ from the steel industry, and understand cross-border emissions emphasising satellite data accuracy as critical for model evaluation.
- Norway currently does not have an independent verification of national GHG totals. However, it
 is supporting research on satellite-based methane monitoring and has developed a national
 roadmap for CO2M/CO2MVS, funded by the Norwegian Space Agency. Satellite-based
 approaches over Norway face limitations due to the high latitude, winter data gaps, and frequent
 cloud cover. LULUCF has been a big contributor to their emissions, making quality assurance
 critical for the sector.
- Denmark has strong national expertise in satellite data processing but lacks specific capabilities in GHG monitoring and inverse modelling. Ongoing dialogues with authorities aim to raise awareness of the potential of satellite-based CO₂ and CH₄ observations, with plans to secure funding for a national monitoring activity that will leverage CAMS GHG MVS products and adapt them to national needs to support decision making.
- Feedback from national inventory teams highlighted the need for better guidance on how to find and use Earth observation datasets, as well as clearer resources for seeking help with the data. Rather than new products, teams expressed a preference for a guidebook on finding and using the right datasets, noting that each country is approaching satellite data usage differently.
- WGClimate would like to have more of these sessions with participation from different regions and welcomes host offers and suggestions. There were two follow up actions recorded at WGClimate-22, due at WGClimate-23:
 - WGClimate, with UNFCCC and IPCC TFI, to consider establishing regional satellite data experts to advise national inventory compilers.
 - WGClimate to consider how best to provide capacity development resources around using satellite data for national inventories. This could be done as an expansion to the CEOS GST Portal.

- Stephen Ward (SIT Chair Team) noted that country expertise extends beyond WGClimate, and the SIT Chair can help ensure all relevant groups are linked to these activities. While the <u>CEOS</u> <u>GHG Portal</u> is a strong foundation, additional practical guidance material could be helpful.
- Wenying noted that WGClimate is interested in replicating the session at future WGClimate meetings.
- Mauro Facchini (European Commission) suggested contacting Vincent-Henri Peuch (ECMWF, WGClimate Vice Chair) noting that as part of the Copernicus Atmosphere Monitoring Service there is a programme to harmonise data at the European level.
- David Crisp (SIT Chair Team) noted that the five country examples represented at WGClimate are just a small snapshot of relatively advanced members of the inventory community, with well-established programmes and processes. He contrasted this with the roughly 100 Paris Agreement signatories that have only one or two staff handling inventories, which poses a



different engagement challenge. He proposed recruiting a few 'champions' from the developing world.New capacity building and outreach efforts will be needed given the recent end of some long-running capacity building programs.

- Clement Albergel (ESA) noted his experience working with national inventory agencies in ESA projects, particularly from developing countries where definitions of GHGs can vary widely. It is important to embed capacity building within existing networks.
- Stephen Ward (SIT Chair Team) concluded by noting that this national engagement thread will continue through the SIT Chair Climate Policy Impact calls, with ongoing coordination with IPCC and engagement with national contacts. Stephen anticipated that much of this work would flow into the next CEOS GST Strategy.

6.2: Candidate Initiatives to Improve Country Engagement and Uptake of Space-based EO Data

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

Main points:

- Participants were asked to consider and debate initial ideas emerging from the Climate Policy Impact calls and the GST Lessons Learned on optimal ways to improve country engagement outcomes. SIT guidance can help inform the development of the GST Strategy update in 2025 and broader country engagement activities.
- Ideas emerging from the Climate Policy Impact call series include:
 - Developing a directory of national inventory contacts for CEOS Agencies.
 - Establishing a partnering process involving space agencies and national inventory counterparts.
 - Providing step-by-step guidance to help inventory communities understand the roles of top-down and bottom-up approaches.
 - Improving coordination and institutional memory across country engagement efforts to accelerate progress (e.g., using a GFOI Methods and Guidance Documentation approach).
 - $\circ~$ Exploring whether the USGS SilvaCarbon model could be expanded to include GHG flux datasets.
 - Supporting the reconciliation of EO datasets with national definitions using IPCC guidance, as discussed by the IPCC TFI and reflected in AR7, to build trust and encourage uptake.

- John Remedios (UKSA, CEOS Chair Team) noted that while Methods and Guidance Documentation (MGD) approach of GFOI could be effective, its implications need careful consideration. For one, CEOS will need to explain variances in data sources and advise on the best to use. He agrees that an up-to-date directory of national inventory contacts would be useful.
- Stephen noted that the GFOI MGD process was fortunate to have involvement from IPCC that engagement is crucial.
- Rob Sturgiss (IPCC TFI) welcomed these candidate initiatives to engage the inventory community and align Earth observation products with their needs. He offered IPCC's support in organising a workshop/dialogue and encouraged CEOS Members to engage.

	CEOS agencies are invited to nominate representatives	
	to the Climate Policy Impact call series continuing	May 2025
SIT-40-10	through 2025.	



Rationale: The call series has provided a useful increase in bandwidth and discussion time on the issues related to the GST Strategy update and continues to inform that process

6.3: Cambodia National Case Study

Presenter: Takeo Tadono (JAXA, LSI-VC Co-Lead) [presentation]

Main points:

- JAXA is conducting a research project entitled "Establishment and Strategic Implementation of Forest Biomass Estimation Methodology for Realization of Carbon Neutrality" under the Strategic Program for Acceleration of Space Utilization (Stardust Program) supported by the Cabinet Office of Japan and MEXT.
- One of the tasks in the project is the development and validation of a national-scale forest Above Ground Biomass (AGB) map.
- Between FY 2023-2024, Version 1 and Version 2 AGB maps were created for the entirety of Japan.
- In FY 2024, a collaboration agreement was concluded with the General Directorate of Environmental Knowledge and Information (GDEKI) and Ministry of Environment (MOE) of Cambodia to develop a national AGB map for Cambodia. As part of this effort, JAXA conducted training for the Department of Geospatial Information Services (DGIS) technical team on EO dataset preparation and AGB estimation, from 12-13 March, 2025. DGIS contributed national forest inventory (NFI) data and local expertise.
- The main objectives of the DGIS-JAXA training were to strengthen the capacity of DGIS and GDEKI in developing satellite-based AGB maps, explore the use and access of satellite data (ALOS-2, GEDI), train on dataset preprocessing for AGB estimation, discuss LULC classification and tree species, and explore the integration of field surveys and NFI data for validation. Lectures were delivered on SAR remote sensing, CEOS-ARD, ALOS-2, and GEDI, plus hands-on training using Google Earth Engine and Colab, and discussions on related issues.



 JAXA's country engagement recognises that different countries have varying definitions of forest types. Discussions have been held with partner countries to identify suitable training data and ensure its accuracy and reliability.



- JAXA anticipates expanding these activities to other Asian countries.

Main discussion points:

- Hironori Maejima (JAXA, SIT Chair) noted that utilising space-based biomass maps in developing countries is not straightforward and requires detailed assistance. He explained that the training workshop in Cambodia focused on how to access and analyse the data, and stressed that ongoing support and training are essential.
- David Crisp (SIT Chair Team) asked how easily the lessons learned in Cambodia could be transferred to other Southeast Asian countries.
- JAXA has developed tools to ingest data and create maps tailored to specific inventory questions.
 In addition, CEOS-ARD compliance is critical.
- Takeo Tadono (JAXA, LSI-VC Co-Lead) noted that JAXA used ground-based analysis with Google Earth Engine and ALOS-2 ScanSAR data compliant with CEOS-ARD, and GEDI data to estimate biomass.

6.4: CEOS Agriculture, Forestry and Other Land Use (AFOLU) Roadmap Actions

Presenter: Ben Poulter (CEOS AFOLU Roadmap Co-Lead) [presentation]

- The CEOS AFOLU Roadmap was endorsed at the 2023 CEOS Plenary, and since then, its recommendations have been used to develop and progress over 30 actions.
- AFOLU plays a key role in the Global Stocktake (GST) by providing greenhouse gas emissions and removals data from the land use, land-use change, forestry (LULUCF), and agriculture sectors using activity data and emission factors. The focus is on direct anthropogenic emissions from managed ecosystems.
- Comparing emission estimates from national inventories and atmospheric inversions can differ significantly. Roadmap actions seek to identify steps needed to reconcile these differences.
- Within National Inventory Reports (NIR), AFOLU covers six land use categories: forest, cropland, grassland, settlement, wetland, and other land. Independent verification of net GHG emissions from AFOLU is a key research focus, with new methods requiring reconciliation of definitions. The IPCC Expert Meeting on Reconciling Anthropogenic Land Use Emissions held at EC JRC in Ispra, Italy on 9-11 July, 2024, sought to resolve these differences.
- The timing of the IPCC's 7th Assessment Report is uncertain following recent negotiations on chapter outlines, and it may not be published before the second GST. This presents an opportunity for CEOS to engage and contribute data to support the assessment.
- Recommendations from the CEOS AFOLU Roadmap include:
 - Ensure that every country has access to relevant satellite data from CEOS Agencies to report to UNFCCC under IPCC guidance.
 - Ensure continuity and long-term backward compatibility for CEOS missions providing activity data and emission factors.
 - Improve use of Earth observation data and derived products in UNFCCC reporting and IPCC Guidelines.
 - Enable dialogue between inventory practitioners and the CEOS community, recognising that different countries have various requirements to support their system for reporting.
 - Support efforts to reconcile bottom-up, top-down, and inventory estimates of GHG emissions and removals.
 - Systematically target activities to support IPCC Land Cover classes.



- Work with New Space data providers and commercial partners to provide the most comprehensive coverage possible in supporting national GHG inventories.
- Ensure consistency of the CEOS AFOLU and GHG Roadmaps to support integrated national GHG inventory systems.
- Ben has worked with the Biomass harmonisation team to support the uptake of Earth observation data for forest biomass estimation with policy reporting requirements. There has been coordination with GFOI on exploring the utility of biomass in MRV procedures, including a workshop held by GFOI in October 2024. Details on select AFOLU actions can be found in the slides.
- A second version of the CEOS AFOLU Roadmap is being considered, and would foresee activities being further aligned with GST2, IPCC AR7, and WMO G3W.

Main discussion points:

- Darcee Killpack (USGS) noted that while the SilvaCarbon programme has been discontinued, its expertise remains in the community.
- Maggie Arnold (Geoscience Australia) highlighted the importance of land-related fluxes in addressing climate change and the complementary roles of CEOS entities
- Hironori Maejima (JAXA, SIT Chair) announced that Takeo Tadono (JAXA, LSI-VC Co-Lead) will step up as a co-lead for AFOLU under LSI-VC, alongside Ben Poulter (NASA), Clement Albergel (ESA), and Inge Jonckheere (ESA).

Session 7: Virtual Constellation Topics

7.1: Priority Coastal Areas for Thermal Infrared Measurements

Presenter: Misako Kachi (JAXA, SST-VC Co-Lead) [presentation]

Main points:

- In response to action SIT-TW-2024-09, a meeting with the NASA-JPL Surface Biology and Geology (SBG) Thermal Infrared (TIR) mission team was held to discuss the possibility of extending coastal observation coverage.
- A joint presentation on the Sea Surface Temperature (SST) coverage recommendation was delivered at the TRISHNA Science meeting in November 2024, hosted by ISRO Space Applications Centre in Ahmedabad, India.
- To ensure the coastal coverage distance recommendation is science-based, a series of discussions and six teleconferences were held, with subject matter experts invited to provide guidance on the topic.
- Key outcomes of these meetings included the identification of six coastal features requiring ultra high-resolution SST data, development of a CEOS global coverage mask, recommendations on coastal coverage distances and seasonal sampling, and a summary of priority areas and features for targeted SST data collection. The six features are boundary currents, estuaries/river mouths (major), meltwaters, chronic harmful algal bloom areas, operational high-resolution coastal model areas, and highly productive habitats.
- SST-VC encourages CEOS member agencies planning ultra high-resolution TIR missions to consider the acquisition of coastal SST in GHRSST format with enough coverage up to minimum 100 km from the coast and additionally consider coastal coverage distances for features listed on page 4 and 7 of the statement, which are based on the justifications detailed in the appendices.
- Following these recommendations will increase data value for coastal science, support breakthrough research, improve decision-making, and deliver broad societal benefits.



- Mauro Facchini (European Commission) noted that the Copernicus Land Surface Temperature Monitoring (LSTM) mission will significantly contribute to these recommendations and is progressing well, with a planned launch before 2030.
- Marie-Claire Greening (ESA) added that the LSTM mission will provide 50 m resolution SST data in coastal zones. ESA is actively working on the mission, which fully aligns with and supports this CEOS recommendation.
- Selma Cherchali (CNES) noted the importance of a collective CEOS-level decision to work with WGCV on the assessment of surface temperature accuracy, particularly since TRISHNA and SBG serve as science mission precursors. Although TRISHNA's primary objective is land surface temperature monitoring for agricultural purposes, it also has a significant focus on coastal and inland waters. CNES is collaborating with NASA/JPL to optimise the orbits of TRISHNA and SBG to achieve higher temporal resolution for operational use.
- Jörg Schulz (EUMETSAT) noted the importance of temporal sampling in shallow coastal waters, where biological activity is driven by diurnal cycles. Jörg asked whether SST-VC is considering this in its planning.
- Misako Kachi (JAXA, SST-VC Co-Lead) noted that sampling is one of the considerations. 100 metre SST data is variable and sampling is longer compared to traditional 1 km coarse resolution TIR sensors. In the future, creating more frequent ultra-high resolution TIR observations would be an ideal aim.

DECISION 05	 CEOS Agencies acknowledged the requests and recom SST-VC and COAST-VC to: 1. Consider the acquisition of coastal SST in GHR enough coverage up to minimum 100 km from planning new ultra high resolution TIR missions. 2. Additionally consider coastal coverage distances for page 4 and 7 of the statement, which are based or detailed in the appendices. <i>Rationale: Following these recommendations will nemerging missions significantly more valuable and usab coastal ocean communities, and increase the likelihood science and improved information for decision makebenefits.</i> 	mendations from SST format with the coast when features listed on the justifications make data from the to the scientific of breakthrough sing and societal
SIT-40-11	SST-VC is asked to refine the statement presented at SIT-40 regarding extended observation coverage from new ultra-high-resolution thermal infrared instruments to reflect feedback from CEOS Agencies at SIT-40. It will also work with the SIT Chair Team to accomplish virtual endorsement by CEOS Principals.	May 2025
	Rationale: The statement was well received by CEOS A However, the SIT-40 discussion yielded feedback that she account before final endorsement.	gencies at SIT-40. ould be taken into

7.2: United Nations Decade of Ocean Science for Sustainable Development (2021-2030)

Presenter: Steven Ramage (CEOS Executive Officer) on behalf of the COAST-VC Co-Leads [presentation]



Main points:

- Initial discussions between Global Ocean Observing System (GOOS) leadership and COAST-VC began in December 2024, and in February 2025, the CEOS Executive Officer team participated in the 14th GOOS Steering Committee (SC14) meeting in Paris, supporting CEOS and COAST-VC collaboration.
- GOOS expressed interest in partnering with CEOS on critical ocean observation infrastructure, both *in situ* and satellite-based, requiring a future investment plan.
- CEOS was invited to engage with GOOS Steering Committee activities and to contribute to UN Ocean Decade (UNOD) efforts, including:
 - Reviewing Ocean Teaching Academy materials.
 - Enhancing GOOS communication efforts and visibility of satellite observations.
 - Promoting the complementarity of satellite and *in situ* data.
- Potential collaboration areas identified include marine heatwave early warning systems, satellite-ground truth exchange, and operational oceanographic data integration. GOOS discussed a two-way exchange between CEOS describing what requirements are needed for *in situ* measurements.
- Next steps for COAST-VC to communicate with GOOS include:
 - Engage someone from GOOS in COAST-VC.
 - Discuss CEOS Agency support for GOOS work on marine heatwaves.
 - Consider broader CEOS ocean activities, e.g. with SST-VC.
 - Identify a COAST-VC liaison contact with support from the SIT Chair.

Main discussion points:

- Yasjka Meijer (ESA, GHG Task Team Lead) highlighted the lack of GHG observations over oceans and expressed interest in collaborating with the EM27 network to improve ocean flux measurements.
- John Remedios (UKSA, CEOS Chair Team) noted that a key source of marine heatwave data is the Data Buoy Cooperation Panel.
- Selma Cherchali (CNES) reiterated the need for alignment within CEOS between roadmap activities and Virtual Constellations. Need to not only link GOOS and Earth observation data but also engage broader ocean-related organisations.

7.3: JAXA's Space Applications for Environment CH4Rice Project (Rice Paddy Field Methane Emissions)

Presenter: Shin-ichi Sobue (JAXA) [presentation]

- The Asia-Pacific Regional Space Agency Forum (APRSAF) is the largest space-related conference in the Asia-Pacific region, involving over 40 countries and regions and supporting the establishment of international projects to address common issues like disaster management and environmental protection, fostering cooperation among participating parties.
- The CH4Rice project was approved at APRSAF-28 in November 2022. It aims to contribute to climate change mitigation, particularly through carbon credit generation in methane Monitoring, Reporting, and Verification (MRV), using both satellite and *in situ* data. It also seeks to improve water management by promoting efficient irrigation practices that reduce methane emissions, such as Alternate Wetting and Drying (AWD).



ID	Activity	Sub-Activity	Organizations in Charge	2023	2024	2025	Stat us
•	Evente	APRSAF/SAWG, SAFE WS	All s	SAFE 🔺 🔺	APRSAF-29	▲ ▲	
U	Events	Related Events	,	EBM	EBM	30	
		1-1 Workplan Preparation	VNSC, Secretariat		EOS Plenary		
		1-2 Study Area Selection	All		→		
1	Methodology Development	1-3 Water Inundation Monitoring (in-situ & satellite monitoring)	All		 , , ,	•••	
		1-4 Methane Emission Estimation	All		──→ ••••		
		1-5 Tools Development	TBD				•
		2-1 Data Sharing (ALOS-2 Full-pol, etc.)	JAXA. TBD		 , , ,		
2	2 Data/Tool Sharing	2-2 Tools Sharing via Platform Manual preparation	TBD		→ ··	•••••	
		2-3 Capacity Building (e.g. webinar, ARTSA etc.)	TBD		Ted		
3	Promote Dialogs with Stakeholders for Applications	Stakeholder meeting	Secretariat				
	On-going Delay Stop (severe issue) Completed						

- CH4Rice utilises ALOS-2 PALSAR 2 (L-band, full-pol SAR) observations and *in situ* water-level/inundation and CH₄ measurements. The current project sites for the CH4Rice project include Subang (Indonesia–BRIN), Suphan Buri (Thailand–GISTDA), Nawagam (India–ISRO), Miyagi, Akita, Niigata, Ibaraki (Japan–JAXA), Bulacan (Philippines–PhilSA), Rajshahi (Bangladesh–PUST), Mekong Delta, An Giang, Bac Lieu province (Vietnam–VNSC), and Cambodia.
- Next steps for the CH4Rice project include refining the water/non-water detection methodology, conducting field surveys, comparing *in situ* data with ALOS-2 PALSAR-2 data, validating results, and publishing research papers. The project will also set up cost-effective gas sampling systems to measure CH₄ flux via AWD, share ALOS-2 data and tools with a platform manual, evaluate measurement devices, and focus on calibration and data quality improvement.

Main discussion points:

- Selma Cherchali (CNES) commended the project and JAXA's provision of ALOS-2 data. CNES is also supporting the project. Selma noted that such *in situ* network development is crucial to CEOS' broader GHG ambitions.
- David Crisp (SIT Chair Team) noted that agriculture is one of the top emission sources of methane, with rice cultivation second only to livestock production.

7.4: CEOS Response to the Essential Agriculture Variables (EAVs)

Presenter: Alyssa Whitcraft (LSI-VC GEOGLAM Subgroup) [presentation]

- The LSI-VC GEOGLAM Subgroup requests that CEOS Agencies review the subgroup's new Terms of Reference and provide nominations to join the subgroup.
- GEOGLAM was established in 2011 at the G20 Summit in France, and has renewed its mandate each year since 2016. The subgroup uses EO data to increase transparency in outlooks on food production as they impact agricultural markets and food security.
- The GEOGLAM community spans applied 'EO-for-ag' researchers to users of EO-based information, with major users including AMIS, Ministries of Agriculture, and those in regional/global early warning. GEOGLAM also supports national statistics, the UN Sustainable Development Goals, and the Sendai Framework.
- GEOGLAM EAVs were first launched in 2019, as a means to establish consistent definitions across borders and scales for agriculture assessments.



- CEOS Agencies are core supporters and data providers for GEOGLAM, which remains well situated to resolve issues for accessing, adopting, and using satellite data for agricultural applications.
- Priorities include:
 - Engaging agencies in the LSI-VC Subgroup on GEOGLAM ('reinvigorated' in 2024);
 - Taking stock of past, current, and future missions, instruments, measurements, etc. related to EAVs;
 - Identifying efficiencies across community "Essential Variables" (e.g., climate, biodiversity) via LSI-VC to maximise agency ROI.
- Next steps include:
 - Continue stocktake of EAV-related activities and missions;
 - Clarify and agree upon the CEOS-GEOGLAM scope of work;
 - Gather attendance from CEOS Agencies and GEOGLAM stewards;
 - Address precursor actions, including the identification of CEOS Agency PoCs and support to the GEOGLAM EAV workshop (13-15 May, 2025, at EC JRC in Ispra, Italy).

- Alex Held (CSIRO) asked whether discussions are ongoing regarding the definition of EAVs for pastures and grasslands. Alyssa noted that more rangeland experts need to be involved. A stocktake and gap analysis database is under development, which includes several pasture and rangeland variables, particularly vegetation characteristics and forage quality. Contributions from other experts in the area are needed.
- Clement Albergel (ESA) highlighted the EO AFRICA Rangeland Monitoring for Africa (RAMONA) initiative, which uses Earth observation products and has potential for expansion. The main ESA contacts for this are Patrick Griffith and Zoltan Szantoi.
- Wenying Su (NASA, WGClimate Chair) asked whether there is an effort to map overlaps in EAVs and ECVs. Alyssa confirmed this effort is ongoing and presented a spreadsheet showing such an assessment (as well as Essential Biodiversity Variables, and Essential Water Variables). This information will be used to construct a structured database.
- Jörg Schulz (EUMETSAT) reinforced the importance of recognising overlaps between essential variables across sectors to ensure consistency, efficiency, and clarity. Jörg emphasised the need to manage complexity in how variables are defined and used, and to develop guidance for reconciling terminology and data needs across diverse user communities around core geophysical properties.
- Selma Cherchali noted that CNES supports many companies to develop custom agriculture products for end users. Selma asked for clarification on the scope of products being considered here.
- Alyssa noted that the approach taken within GEOGLAM is to align on foundational definitions, particularly where land use classifications are complex or ambiguous. The group aims to guide typologies, classification hierarchies, and scalable frameworks. While the primary audience is the scientific community, rasterised variables are being developed for broader use. For more complex or customised applications, definitions and biogeophysical parameters will underpin agricultural domain specific needs.
- Osamu Ochiai (JAXA, SIT Chair Team) noted the issue of scale with all essential variables and the need for higher-level coordination.



 Alyssa noted that while some variables are defined by scientists, others are aimed at agricultural end products. GEOGLAM is working to standardise measurements so that different users receive consistent quality and definitions.

SIT 40 12	CEOS Agencies are asked to review the submitted <u>"LSI-VC Subgroup on GEOGLAM Terms of Reference"</u> and provide a response to GEOGLAM points of contact (akwhitcraft@geoglam.org; sgilliams@geosec.org; CC: <u>matthew@symbioscomms.com</u>), regarding suggested revisions or additions, and to RSVP about whether they are able to name an individual to contribute to the LSI-VC GEOGLAM Subgroup and EAV workshop (13-15 May, 2025).	9 May 2025	
	Rationale: This is a renewed call for representatives to the GEOGLAM (Agriculture) Subgroup of the LSI-VC. The draft terms of reference are provided to give more context and facilitate the selection of suitable points of contacts at CEOS Agencies. The EAV workshop will be held on 13-15 May, so responses are needed before 9 May, 2025. This action supersedes SIT-39-05 (call for POCs for LSI-VC Subgroup on GEOGLAM) and CEOS-38-08 (POCs to contribute to an 18-month Essential Agriculture Variables (EAV) stocktake and scoping effort).		

7.5: New Missions for Global Precipitation Measurement

Presenter: Takuji Kubota (JAXA, P-VC Co-Lead) [presentation]

- The main goals of the Precipitation Virtual Constellation (P-VC) are to maintain and enhance the precipitation constellation, integrate new satellites and sensors, develop and refine retrieval schemes, and validate precipitation products.
- P-VC also focuses on developing a long-term strategy for a viable and sustainable precipitation constellation, incorporating new and emerging technologies, as well as maintaining, expanding, and exploiting global ground validation efforts.
- More than one satellite sensor is needed to map global precipitation as it varies greatly in both time and space, often occurring over just a few miles or kilometres and changing rapidly within minutes. While a single sensor can provide high-quality measurements, it cannot cover global precipitation on its own.



- Future precipitation missions include JAXA's GOSAT-GW, which will carry AMSR-3 and is scheduled for launch in JFY2025. EUMETSAT is developing the Polar System Second Generation (EPS-SG), which will feature the Microwave Sounder (MWS), Microwave Imager (MWI), and Ice Cloud Imager (ICI), along with the EPS-Sterna mission currently in Phase C. NOAA is planning the QuickSounder mission for 2026, JPSS-4 for 2027, JPSS-3 for 2032, and the LEO Weather Satellites (LWS) and GeoXO missions, both anticipated post-2030. NASA's Atmosphere Observing System (AOS) will be an international collaborative mission involving JAXA's Precipitation Measurement Mission (PMM) radar and CNES's C2OMODO-R radiometer to study precipitation processes. ESA's Copernicus Imaging Microwave Radiometer (CIMR) is planned for launch from 2028 onwards.
- Detailed updates from CEOS agency precipitation missions can be found in the <u>slides</u>.
- New technology has driven a rise in CubeSats and SmallSats equipped for precipitation monitoring. These missions show promising results, with retrievals comparable to current sensors and improved coverage in the high-frequency range where lower-frequency sensors fall short.

7.6: Land Surface Imaging Virtual Constellation (LSI-VC) Report

Presenter: Takeo Tadono (JAXA, LSI-VC Co-Lead) [presentation]

- The LSI-VC-17 meeting will take place on 14-16 April 2025, in Tsukuba, Japan, hosted by JAXA at the Tsukuba Space Centre. The objectives and agenda are available <u>online</u>.
- LSI-VC oversees the implementation of the CEOS AFOLU Roadmap actions through its Forests and Biomass Subgroup. There is a need to establish an appropriate structure and designate key individuals or groups to provide regular updates to LSI-VC and CEOS leadership-level meetings.
- The LSI-VC's management of such thematic areas for CEOS is overdue for strengthening to ensure consistent and robust oversight and better integration of thematic work. The Co-Leads propose the following:
 - Formalising POCs for AFOLU, GFOI, and GEOGLAM;
 - Holding quarterly calls for progress updates;
 - Featuring a dedicated session for each area at physical LSI-VC meetings;
 - Having POCs report to SIT, SIT Technical Workshop and CEOS Plenary as needed.



- The LSI-VC GEOGLAM (agriculture) Subgroup is seeking to expand its membership to support the CEOS response to the Essential Agriculture Variables.
- The following individuals have been proposed as points of contact for the LSI-VC Subgroups.
 These proposals are presented for CEOS Principal confirmation at SIT-40.
 - <u>AFOLU:</u> Ben Poulter (NASA), Inge Jonckheere (ESA), Clement Albergel (ESA), Takeo Tadono (JAXA)
 - GFOI: Osamu Ochiai (JAXA), Stephen Ward (JAXA), Inge Jonckheere (ESA)
 - <u>Agriculture:</u> Sven Gilliams (GEOGLAM), Alyssa Whitcraft (GEOGLAM)
- CEOS Agency roles and ambitions in agriculture need clarification. A teleconference was held in Q1 2025 to brief CEOS Contacts so that they can identify contacts for the LSI-GEOGLAM Subgroup and hybrid GEOGLAM/EAV workshop at EC JRC in Ispra (13-15 May, 2025).
- CEOS-ARD updates include ongoing consolidation of the land optical PFS and a migration to GitHub to increase consistency and community engagement. The Aquatic Reflectance PFS v2.0 now covers oceans, and SAR PFS v1.2 incorporates InSAR specifications. Since CEOS Plenary 2024, five new products have achieved CEOS-ARD compliance. Future work for CEOS-ARD includes developing Level 3 SAR PFSs, updating the CEOS-ARD Framework to clarify product levels, and exploring data quality inclusion in CEOS-ARD specifications, with defined tolerances and ongoing monitoring.
- The LSI-VC Polarimetric SAR activity has been established to advance biophysical parameter retrieval by polarimetric and multi-frequency SAR. It originates from a ESA "POLINSAR" workshop series and recommendation.
- An LSI-VC theme on 'EO and Wetlands' was initiated in 2024, aligning with work to engage the Ramsar Convention on Wetlands. It supports Recommendation 5 of the AFOLU Roadmap, which targets activities to support IPCC Land Cover classes, including Other Land Use/Wetlands.
- The UN Convention to Combat Desertification (UNCCD) is requesting enhanced land Earth observation contributions to GEO LDN and SDG indicator 15.3.1, which tracks land degradation. CEOS-ARD is seen as a useful starting point for processing chains for the UNCCD indicator. Ongoing engagement between LSI-VC and UNCCD / GEO-LDN / OGC GRI SWG is a possibility and a number of LSI-related activities were identified in the UNCCD letter to CEOS.

- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) commended the four active and engaged co-leads and the continued support from CEOS Principals. He noted that the work of the New Space Task Team is informing LSI-VC's work, with engagement with the commercial sector being a priority for the VC.
- Darcee Killpack (USGS) reported that USGS remains committed to providing a co-lead for LSI-VC, noting the close alignment between the goals of LSI-VC and USGS.
- Alex Held (CSIRO) noted the strong engagement from the SAR community, referencing the very active multi-part Combined SAR PFS and the Polarimetric SAR activity. He is encouraged to see the potential links to UNCCD and land degradation, noting the related work under the SDG Coordination Group..
- Hironori Maejima (JAXA, SIT Chair) welcomed further discussion on CEOS-ARD within LSI-VC, especially in light of the recent commencement of ALOS-4 operations. He noted CEOS-ARD's role in helping to define mission products.
- Ake Rosenqvist (JAXA) provided an update on the Polarimetric SAR group, noting that an action from SIT-39 had requested agencies to designate points of contact. He thanked those who had done so and encouraged further participation from agencies operating SAR missions.



 Osamu Ochiai (JAXA, SIT Chair Team) mentioned that the SIT Chair Team reached out to Inge Jonckheere to see if ESA may want to take over as an LSI-VC point of contact for GFOI/AFOLU. Marie-Claire Greening (ESA) confirmed that ESA is willing to support Inge's involvement as proposed.

DECISION 06	In support of LSI-VC management of thematic areas, the following points of contact were confirmed: <u>AFOLU:</u> Ben Poulter (NASA), Inge Jonckheere (ESA), Clement Albergel (ESA), Takeo Tadono (JAXA) <u>GFOI:</u> Osamu Ochiai (JAXA), Stephen Ward (JAXA), Inge Jonckheere (ESA) <u>Agriculture:</u> Sven Gilliams (GEOGLAM), Alyssa Whitcraft (GEOGLAM)
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7.7: Virtual Constellation Synthesis Report

Presenter: Matt Steventon (SIT Chair Team) [presentation]

Main points:

Atmospheric Composition (AC-VC)

- The AC-VC-21 meeting is scheduled for June 2025, alongside IWGGMS-21 in Takamatsu, Japan.
- A new initiative is underway to write a white paper on expanding geostationary monitoring of atmospheric composition, with more details to be shared at SIT Technical Workshop 2025.
- Discussions have started on GHG flux CEOS-ARD products.
- The CEOS Work Plan deliverable for the validation and harmonisation of tropospheric ozone data (VC-20-01) is now complete, with the TOAR-II report and an AMT/ACP special issue to be published in 2025. Deliverables related to air quality constellation validation coordination are also complete.
- Efforts are ongoing to pursue the targets outlined in the AC-VC whitepaper on enhancing the role of satellites in PM2.5 monitoring.

Coastal Observations Applications Services and Tools (COAST-VC)

- COAST-VC aims to develop technology and transfer capabilities to regions in partnership with stakeholders. Recent and ongoing product developments include:
 - CNES is restarting the satellite-derived bathymetry working group.
 - Geoscience Australia is focusing on intertidal bathymetry.
 - NOAA is developing a Habitat Suitability Index and a coastal product suite (Chl-a, TSS, SST, light) along with marsh mapping and invasive species identification using MAXAR data.
 - ISRO is working on various products for the Bay of Bengal, including SAR-based bathymetry for delta regions, Oceansat-3 water quality parameters, intertidal mudflat topography (future), TRISHNA river plume dynamics, thermal pollution, coastal upwelling, and coastal ecosystem monitoring.
- COAST-VC is supporting the UN Ocean Decade through talks and training activities. The team has
 engaged with Coast Predict and is contributing to Building Block 1 in a draft 'Menu of Services'
 document, where CEOS and COAST will be key sources for satellite data and coastal data
 products.
- COAST-VC is connecting with GOOS/IOC-UNESCO through Joanna Post, head of GOOS, to raise the visibility of satellite observations within GOOS.
- COAST-VC has initiated collaboration with OCR-VC to support the Aquatic Carbon Roadmap.

Ocean Colour Radiometry (OCR-VC)



- OCR-VC is progressing the Aquatic Carbon Roadmap, with the current target for completion set for SIT-41 in early 2026.
- A dedicated session on the Aquatic Carbon Roadmap will be held at ESA's Living Planet Symposium in June 2025.
- The CEOS-ARD Aquatic Reflectance PFS update, which extends applicability to the oceans, is set for endorsement by OCR-VC, IOCCG, and LSI-VC on 14-15 April 2025.
- The OC-SVC White Paper for CEOS, has been published, with DOI: 10.1175/BAMS-D-24-0085.1.

Ocean Surface Topography (OST-VC)

- OST-VC is developing the OST 2050 strategy paper, with the final version expected by Q3 2025.
- Sentinel-6B is scheduled to launch on 17 November 2025, and Sentinel-3C is expected to launch by mid-2026.
- The SWOT mission has been a great success, delivering impressive results. Swath altimetry will also be implemented for the Sentinel-3 Next Generation Topography mission.
- OST-VC welcomes the participation of Chinese representatives from agencies running operational altimetry missions to contribute to the existing altimetry constellation.

Ocean Surface Vector Wind (OSVW-VC)

- The potential of ISRO's Oceansat-3A to cover different orbital configurations and fill measurement gaps was acknowledged.
- The NOAA SFMR dataset is being used as a standard for retrieving higher winds from scatterometers and SAR, though calibration and validation remain challenging.
- While moderate range winds are well covered, extreme high winds are difficult to measure due to their spatial scales. Low winds are also generally hard to measure. Currently, the only commercial OSVW measurements are from GNSS-R, and cal/val will be crucial.
- OSVW-VC encourages agencies to consider the design of a next-generation OSVW constellation to improve characterisation of the ocean surface.

Precipitation (P-VC)

- EarthCARE data is expected to be released in 2025.
- The EUMETSAT EPS mission is set to launch in 2025, with significant new microwave capabilities planned for 2026 on the microwave imaging satellite. EUMETSAT has not previously had direct precipitation observation capabilities but will now include two sounders, one imager, and one ice cloud imager that can contribute to precipitation monitoring.
- JAXA's GOSAT-GW, carrying the AMSR3 instrument, is scheduled to launch between April and September 2025.
- NASA/JAXA GPM version 8 data will be released in 2026.
- CEOS-ARD for precipitation remains an open task.
- P-VC agencies generate routine precipitation products that can be used for drought monitoring and prediction, which could be valuable for the UNCCD.

Sea Surface Temperature (SST-VC)

- SST-VC is collaborating with COAST-VC on the statement of requirements for ultra-high-resolution TIR instruments (under 100m spatial resolution) and defining coastal areas.
- There's a general need for additional missions to provide higher-resolution coverage of coastal areas.
- SST-VC is seeking a new co-lead to replace Christo Whittle (CSIR).



- SST-VC is also keen to engage in the Aquatic Carbon Roadmap.
- In 2020, SST-VC published a paper on the current and planned SST constellation. There is currently a gap in SST from microwave instruments.

Session 8: Other Business

8.1: Report on the Third Workshop for Coordination of International Spaceborne SAR Missions

Presenter: Shin-ichi Sobue (JAXA) [presentation]

Main points:

- Since 2018, the International Coordination Group for Spaceborne SAR (ICGS-SAR) has held community-wide discussions on ways to improve the coordination of SAR missions to maximise scientific and societal returns. ICGS-SAR consists of three working groups and three thematic teams (see here for details).
- The third workshop of the ICGS-SAR was held in Japan in November 2024, where a series of recommendations were developed to be considered by space agencies for future SAR missions and related activities. The details are available <u>here</u>.
- ICGS-SAR is actively discussing options for closer integration with CEOS, potentially as a Virtual Constellation for better coordination with other CEOS activities, formalisation of activities within the CEOS Work Plan, and to ensure continuity of the activities beyond the engagement of individuals.
- ICGS-SAR will engage with CEOS leadership over the coming months and will submit a draft concept for potential integration and harmonisation, potentially at the 2025 SIT Technical Workshop.

Main discussion points:

- SAR frequency spectrum protection for EO was noted as a topic where international coordination is critical. John Remedios (UKSA, CEOS Chair Team) noted the case of ESA's P-band Biomass mission and its incompatibility with military P-band radars. Shin-ichi added that besides P-band, there are challenges around X-band frequencies and terrestrial communication networks that also underscore the need for improved coordination.
- Mauro Facchini (European Commission) noted that SAR often lacks visibility in CEOS discussions compared to optical missions. Mauro suggested the need for a stronger CEOS presence in spectrum negotiations, particularly at the World Radiocommunication Conferences (WRC), and suggested a coordinated position.
- Marie-Claire Greening (ESA) acknowledged the collective power of CEOS in engaging on frequency matters, recalling a past letter regarding X-band protection.
- Marie-Claire welcomed ongoing coordination between CEOS and ICGS-SAR in some manner.
- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) echoed the need for continued discussion on spectrum issues. He noted that while CEOS has no direct influence at WRC, member states with WRC representation, particularly those without SAR missions (i.e., those with no conflict of interest), can be powerful advocates for EO if equipped with the right messaging by CEOS.
- Steven Ramage (CEOS Executive Officer) mentioned WMO's invitation for CEOS to join radio frequency discussions and noted that GEO might also be contributing. Steven also noted that SAR was a key topic at the WGDisasters meeting in Catania, particularly in the context of the International Charter on Space and major disasters.

8.2: Sustainable Development Goals (SDG) Coordination Group Report

Presenter: Steven Ramage (CEOS Executive Officer) [presentation]



- The Sustainable Development Goals (SDG) Coordination Group operates under the strategic leadership of the JAXA SIT Chair, and is composed of members from CSIRO, ESA, CEO, SANSA, and the GEO Secretariat.
- All deliverables for 2024 have been addressed, and monthly meetings have been held regularly, with plans for these to continue. A refresh of the SDG website is currently underway, and a StoryMap has been developed to support outreach and communication efforts.
- The task outlined in SIT-39-15 has been completed, which involved engaging the CEOS Secretariat on the matter of invigorating CEOS support for the Sustainable Development Goals (SDGs).

2025 Deliverables CESS					
Number	Deliverable Title	Due	Responsible User	Responsible Agency	PROGRESS
SDG-24-01	EO Support Sheet for Indicator 6.6.1 (Water related Ecosystems) Review	2025 Q3	Marc Paganini	ESA	ONGOING
SDG-25-01	EO Support Sheet for Indicator 11.3.1 (Urbanization) Review	2025 Q4	Martyn Clark, Nale Mudau	GEOSEC, SANSA	ONGOING
SDG-25-02	EO Support Sheet for Indicator 14.1.1 (Marine Pollution) Review	2025 Q4	Paul DiGiacomo	NOAA	ONGOING
SDG-25-03	EO Support Sheet for Indicator 15.3.1 (Land Degradation) Review	2025 Q4	Neil Sims	CSIRO	ONGOING
SDG-23-04 EO	Support Sheet for Indicator 15.3.1 (Land Deg	radation) Re	eview (Neil Sims, CSIRO	COMPLETE (Online)	
SDG-25-04	UNSC IAEG-SDGs WGGI Development Agenda Engagement	2025 Q4	CEO, Flora Kerblat	SDG CG/CEO	ONGOING
SDG-25-05	Create CEOS strategic communique for national delegations to UN-GGIM 15th Session.	2025 Q3	Flora Kerblat, Osamu Ochiai, CEO	SDG CG/CEO	ONGOING

- Change in the Extent of Water-related Ecosystems (Indicator 6.6.1) is monitored by UNEP and the Ramsar Secretariat. ESA is leading the engagement with the custodian agencies, ensuring that the 2025 update is aligned with UNEP's guidance. ESA is also coordinating and participating with the CEOS Biodiversity Study Team (BST).
- The Ratio of Land Consumption Rate to Population Growth (Indicator 11.3.1) is overseen by UN Habitat. The GEO Secretariat and SANSA are working closely with UN Habitat to provide holistic annual updates to the Earth observation Support Sheet.
- The Index of Coastal Eutrophication and Floating Plastic Debris Density (Indicator 14.1.1a) is overseen by UNEP. Members of the SDG Coordination Group (SDG CG) are working with UNEP and GEO Blue Planet to provide relevant annual updates.
- The proportion of land that is degraded over the Total Land Area (Indicator 15.3.1) is overseen by UNCCD. CSIRO is leading the engagement with UNCCD, and GEO-LDN is ensuring direct feedback and guiding the annual updates. CSIRO is also coordinating closely with the BST to ensure effective collaboration.
- The SDG Coordination Group is working to ensure that the availability and capabilities of Earth observations are clearly understood as the next Global Development Agenda is shaped. The group has provided technical contributions to the UN Global Geospatial Information Management (GGIM) Working Group on Geospatial Information (WGGI) paper, which highlights the value and role of geospatial and Earth observation data in global development.

Main discussion points:

Alex Held (CSIRO) acknowledged that Neil Sims and Flora Kerblat (CSIRO) have been instrumental in the development of guidance documents and EO support sheets. The incoming CEOS Chair Team from CSIRO is keen to support this activity and to explore future plans.



- Osamu Ochiai (JAXA, SIT Chair Team) thanked the CEOS SEO for its support. Osamu emphasised the need for CEOS to consider developments on the GEO side to strengthen future connections between EO and the SDGs.
- Marie-Claire Greening (ESA) noted that the re-envisioned GEO4SDGs collective requires CEOS to communicate its expectations and stay informed of UN developments to ensure meaningful contribution.

8.3: Concluding Step-C of the External Request Process Paper for the United Nations Convention to Combat Desertification (UNCCD) Approach to CEOS

Presenter: Satoshi Uenuma (JAXA, SIT Chair Team) [presentation]

Main points:

- CEOS has supported UNCCD on SDG indicator 15.3.1: Land Degradation for several years via the SDG Coordination Group and contributions to GEO-LDN.
- In May 2024, CEOS received a formal letter of cooperation from UNCCD, including seven specific requests, which required the initiation of the CEOS External Request Process.
- The external request process passed Step B in April 2024. The CEOS SIT Chair and SEO then conducted Step C and D assessments with the SDG-CG, LSI-VC, BST, ESA, and EC. The results, shown in the <u>slides</u>, determine whether the requests are covered by existing CEOS entities and should be added to the CEOS Work Plan, or if an entirely new entity is needed to address them.
- The results of Step D are as follows:

#	Request	Step-D Option	CEOS Entity in Charge	Note
1	Preparing for the next SDG 15.3.1 reporting process	B (add to WP)	SDG-CG	SDG-CG will support UNCCD through EO Support Sheet 15.3.1, in the cooperation with EC and ESA
2	Assessing the availability and suitability of land surface datasets	A (without WP)	SDG-CG	Technically, it is possible to support by SDG-CG however specific resources have not been identified through the CG. The ESA SEN4LDN Project and EC's CLMS could contribute to this subject for SIDS and should coordinate further through SDG-CG.
3	Providing assessment and improved guidance	A (without WP)	SDG-CG	Technically, it is possible to support by SDG-CG however specific resources have not been identified through the CG. The ESA SEN4LDN Project could contribute to this subject and should coordinate further through SDG-CG.
4	OGC standards for geospatial LDN reporting indicators	A (without WP)	LSI-VC	LSI-VC/ARD OG will address this request in the cooperation with EC.
5	To synergize national target setting between the UN CBD and the UNCCD LDN	N/A	A new entity after BST	A new entity, expected to considered after the BST, may be able to engage this request.
6	Strategic Guidance support. Contributions to GEO-LDN capacity development activities and collaboration on joint communications and outreach.	A (without WP)	SDG-CG WGCapD CEOS Comm Team	Just like #2&3, The ESA could contribute to this subject and should coodinate further through SDG-CG. WGCapD could support the capacity development of GEO LDN. Comm Team could support the collaboration on joint communication.

- Marie-Claire Greening (ESA) commended JAXA's thorough effort on this response. She noted Action 1 should fall under Option A, as it is already a standing item in the CEOS Work Plan (the SDG Coordination Group's EO support sheets). ESA confirmed its willingness to support the activities and has nominated representatives accordingly.
- Peter Strobl (European Commission) highlighted the Copernicus programme's strong contributions to Land Degradation Neutrality (LDN). These efforts are ongoing, operational, and expected to continue.

	CEOS Executive Officer is asked to coordinate a	
	response to UNCCD that will communicate the results	May 2025
SIT-40-13	of the CEOS External Request Process.	



Rationale: On 22 May 2024, CEOS received a 'Letter on enhanced cooperation between the UNCCD and CEOS'. The CEOS SIT Chair undertook a formal CEOS External Request Process to determine how CEOS can respond to each of the requests. This assessment has now concluded and a response to UNCCD is needed to communicate the results.

8.4: CEOS Systems Engineering Office (SEO) Report

Presenter: Dave Borges (NASA, SEO) [presentation]

Main points:

- The CEOS Analytics Lab is a cloud native analysis platform available to all CEOS activities that may
 not otherwise have group access to similar resources. Recent updates to the user interface and
 back-end have enhanced platform capabilities and improved the overall user experience.
 Account requests and platform usage continue to grow, with active engagement from initiatives
 such as COAST-VC, BST, WGDisasters, WGCV SARCalNet, and WGISS.
- SEO has implemented the next phase for the COVE Portal, and an open-source modular tooling update is underway. Individual COVE tools will become publicly available on the CEOS GitHub later in 2025, implementable in custom, end-user driven workflows.
- The CEOS organisational GitHub offers a consolidated, structured, versioned, and open-source repository of CEOS technical resources. A significant volume of previously dispersed content has already been collated, with ongoing development efforts including CEOS-ARD and the WGISS Interoperability Handbook. All CEOS members are encouraged to request GitHub accounts and establish new group-level repositories. Organisation-wide contributor guidelines are under development, as well as training materials.
- Licensing considerations are becoming increasingly important due to CEOS priorities such as CEOS-ARD uptake and legal interoperability. A trial implementation of licensing at the CEOS organisational GitHub repository level has begun, ensuring appropriate open-source licensing while preserving copyright ownership by contributing agencies. Software is released under the Apache 2.0 licence, and content under Creative Commons BY 4.0.
- The CEOS SEO introduced a new communications strategy in 2023. The CEOS Communications team have since released a multitude of materials supporting many CEOS entities and priorities. CEOS 40th anniversary content was developed with input from CEOS Principals in 2024.
- The SEO is developing 'Impact Cards' that capture the impact of CEOS activities and CEOS members are invited to share quotes from users to be featured.

- Jonathon Ross (Geoscience Australia, LSI-VC Co-Lead) commended the work of SEO. We are increasingly being required to collaborate across the boundaries of Working Groups, Virtual Constellations, Task Teams and other groups to tackle complex challenges. The SEO plays a central role in facilitating and supporting technical and scientific collaboration across CEOS, and provides critical technical, communications and engineering infrastructure that underpins the work of everyone in CEOS.
- Niall Bradshaw (UKSA, CEOS Chair Team) echoed these sentiments and recognised the SEO's achievements, particularly in the context of commercial collaboration.
- Marie-Claire Greening (ESA) thanked NASA for its continued support of the SEO, noting the impact of its tools and efforts, particularly in relation to commercial sector engagement.
- Selma Cherchali (CNES) thanked NASA and noted that, while commercial engagement offers opportunities, it also raises strategic questions for CEOS. SIT recalled the <u>guidance material</u>



developed by the SEO and 2024 CEOS Chair, which clarifies how CEOS commercial engagement should take place.

- Marie-Claire Greening (ESA) noted that CEOS WGs and VCs are open to the commercial sector engagement and have been for a while, but this engagement has not been consistently tracked at the CEOS leadership level.
- Alex Held (CSIRO) thanked the SEO and NASA, noting that the SEO is the glue for a lot of CEOS work. Alex noted the ongoing support to the CEOS Analytics Lab from CSIRO.
- Barry Lefer (NASA) welcomed the current approach to commercial engagement, highlighting that it is working well in the AC-VC, with excellent participation from several commercial data providers.

	CEOS Agencies are asked to provide feedback to the SEO on experiences and requirements related to licensing and the initial choice made for the CEOS GitHub repository (Software: Apache 2.0 Content: CC-BY-4.0).	SIT TW 2025
SIT-40-14	Rationale: Licensing has received little attention in because CEOS is not a legal entity. However, it is impo- discuss it further in light of increasing engagement wit sector and other topics. Trial licensing at CEOS GitHub has been implemented to provide necessary open-source necessary and maintain copyright ownership by indivi- (agencies).	CEOS historically ortant for CEOS to th the commercial orepository levels ce licensing where idual contributors

8.5: WMO Integrated Global Observing System (WIGOS) 2050 Vision Update and CEOS Participation

Presenter: Osamu Ochiai (JAXA, CEOS Representative to the WIGOS 2050 Expert Group) [presentation]

- An effort to update the WIGOS Vision for 2050 began in January 2025. An international team comprising experts from NASA, JAXA, ECMWF and others has been assembled to finalise the vision by 2026, covering both space and surface-based components to support weather, climate, and water monitoring.
- The update is driven by evolving user needs, rapid technological advancements, AI integration, and the growth of commercial and non-traditional observation systems. The vision is intended to guide the future design of global observing systems, encourage international collaboration, and inspire innovative solutions.
- Community engagement is essential, and input is being collected through workshops, conferences, and technical reviews.
- The WIGOS vision of the past has helped connect users of observations with observing system owners, influenced the plans of space agencies and surface observing system owners, helped applications area owners prepare for future global observing systems, and served as a focal point for international coordination and gap analyses.
- The 2050 vision intends to inspire, influence design, and evolve global observing systems harmoniously. It will facilitate discussions between operators and owners of applications, as well as provide visibility to new technologies and high level recommendations to the international community.

CE



- In the satellite component, the 2040 vision already describes trends and issues and a description
 of the space-based observing system component, each with a corresponding table. For the 2050
 vision, no large structural changes are expected from the 2040 vision.
- The CEOS MIM Database, Working Groups, and Virtual Constellations will be key references for the WIGOS 2050 Expert Group.

Main discussion points:

- Natalia Donoho (WMO) commended the undertaking, noting that the WIGOS vision document is comprehensive and technology driven. Some space agencies are using the vision as the primary document to justify future missions and requirements. Natailia offered WMO Secretariat support and welcomed input from everyone, particularly in terms of research missions and the commercial sector.
- Jörg Schulz (EUMETSAT) noted that CGMS takes this seriously as the vision drives a baseline of what agencies could commit to.
- Wenying Su (NASA, WGClimate Chair) added that WGClimate has started inputs.
- Mark Dowell (EC-JRC) reflected on the preparation of the previous 2040 vision, where there was
 an opportunity to strengthen aspects related to atmospheric composition. Mark noted that a gap
 still remains in the inclusion of the terrestrial biosphere and land surface imaging. While such
 data may not be a routine component for WMO's primary constituency, there are operational
 missions and long-term data series within CEOS that should be better reflected.

8.6: Space4Ocean Alliance

Presenter: Selma Cherchali (CNES) [presentation]

- The oceans are experiencing significant global impacts, and there is a fundamental gap in understanding how humanity is affecting them. A rapid, decisive, and unified effort is required to understand this.
- The Space4Ocean Alliance supports SDG 14 and the UN Ocean Conference by connecting the space sector with ocean stakeholders to enhance coordination and communication. The Alliance promotes data use, capacity building, new applications, and operational services. It also supports innovative space missions and the development of ocean health indicators.
- Over 100 participants from 15 countries joined the March 2025 Space4Ocean Alliance event in Monaco. The Alliance is open to UN Member States, public and private organisations, and international institutions. Steering Committee members oversee the implementation plan and annual events.



- UNOC-3, held in Nice in June 2025, is a key opportunity to join and contribute. The event aims to provide UN member states with an action plan to provide a solution for critical conditions that coastal areas are facing, acknowledge the Mercator Ocean International as an intergovernmental organisation, define and produce the scalable ocean health indicator Neptune Ocean Exploration initiative, and launch the Space4Ocean Alliance. The Alliance will identify user needs, gaps, and define a roadmap to improve ocean and coastal knowledge and management.
- The rationale for the Alliance includes:
 - Our oceans are at high risk and require decisive, rapid and unified efforts to remedy their critical condition.
 - Monitoring the ocean is challenging: Oceanography and Earth observation from space are invaluable assets in addressing ocean and coastal challenges.
 - There is a significant lack of coordination and communication between the space sector, marine and maritime stakeholders.
- CEOS Agencies are asked to consider submitting a declaration of interest to join the Space4Ocean Alliance.

Main discussion points:

 Selma noted that there are already some CEOS Agencies on board. The intention is for CEOS as a collective entity to join the alliance to address the global roadmap for EO data. It could be very powerful, and agencies have received invitations.

SIT-40-15	CEOS Agencies are asked to consider submitting a declaration of interest to join the Space4Ocean Alliance. Specifically, agencies are asked to send the following to <u>Selma.Cherchali@cnes.fr</u> : Confirmation of Interest and intention to sign the Declaration; intention to participate in the June events (UNOC3), with a list of expected participants.	30 April 2025
	Rationale: There is a lack of coordination and communication between the space sector and marine stakeholders. The Space4Ocean Alliance's objective is to coordinate and create more synergies, avoiding overlaps and leveraging operational solutions.	

Session 9: Closing Session

9.0: CEOS Missions, Instruments, and Measurements (MIM) Database

Presenter: Marie-Claire Greening (ESA) [presentation]

- Highlighted the importance of the <u>CEOS MIM (Missions, Instruments, and Measurements)</u> <u>database</u>, which is recognised globally by the Earth observation community. The CEOS MIM Database is operated and updated annually by ESA with survey inputs from CEOS Agencies.
- The front end of the database website has been refreshed over the past year. Feedback from the CEOS community is welcome.
- The MIM team will be reaching out to agencies around June to initiate the annual update of information on missions, instruments, and measurements of CEOS Agencies.



9.1: Review of SIT-40 Draft Actions and Decisions

Presenter: Matt Steventon (SIT Chair Team)

- Reviewed the full list of actions and decisions, which can be found in Annex B.

9.2: Update on the 2025 SIT Technical Workshop

Presenter: Jörg Schulz (EUMETSAT) [presentation]

Main points:

- The 2025 SIT Technical Workshop will be held at EUMETSAT Headquarters, Eumetsat-Allee 1, 64295 Darmstadt, Germany, on 9-11 September 2025.
- If a visa support letter is required, please contact the local organising team at <u>events@eumetsat.int</u>
- Week at a Glance:
 - 9 September 2025: Side meetings and icebreaker event
 - 10 September 2025: SIT Technical Workshop Day 1 and dinner hosted by EUMETSAT
 - 11 September 2025: SIT Technical Workshop Day 2

9.3: Update on the 2025 CEOS Plenary

Presenter: Niall Bradshaw (UKSA, CEOS Chair Team) [presentation]

Main points:

CEOS Plenary 2025 will be held from 4-6 November 2025 in Bath, United Kingdom. The venue will be the Apex City of Bath Hotel. The CEOS Chair Team has acquired a 10% discount code, 'CEOSUK25' for the Apex Hotel. There will be an evening dinner reception in Central Bath at the Roman Spa on 5 November 2025. Participants are advised to begin booking flights. Anyone who would like a personalised invitation letter should contact the UKSA CEOS Chair Team.

9.4: Closing Remarks

Presenter: Hironori Maejima (JAXA, SIT Chair)

- Extended sincere appreciation to all participants for their active engagement over the past two days and appreciated the cooperation that contributed to a smooth and productive meeting.
- Acknowledged the value of input provided on CEOS SIT and Chair priorities, as well as updates from CEOS Working Groups and Virtual Constellations. JAXA will continue progressing the JAXA SIT Chair priorities in preparation for the 2025 SIT Technical Workshop and CEOS Plenary.
- Barry Lefer (NASA) thanked the JAXA team for their leadership and hospitality. JAXA's goals and active involvement are a high bar for NASA to follow as the next SIT Chair.



APPENDIX A: Attendees

* = virtual participation

Agency/Organisation	Name	Agency/Organisation	Name
ASI	Laura Candela	JAXA	Misako Kachi
ВоМ	Agnes Lane	JAXA	Takuji Kubota
CEOS Executive Office	Steven Ramage	JAXA	Shin-ichi Sobue
CNES	Selma Cherchali	JAXA	Stephen Ward
CNES	Isabelle Fratter	JAXA	Matt Steventon
CNES	Aurélien Sacotte*	JAXA	Shoki Shimada*
CNES	Sophie Le Gac*	JAXA	Kazuhisa Tanada*
CNES	Aurelien Carbonniere*	JAXA	Hiroshi Murakami*
CONAE	Laura Frulla*	JAXA	Kei Oyoshi*
CSIRO	Alex Held	JAXA	Libby Rose*
CSIRO	Zandria Farrel	JAXA	Kazuhisa Tanada*
CSIRO	Flora Kerblat*	JAXA	Hiroshi Murakami*
CSIRO	Shaun Levick*	JAXA	Keishiro Nakamoto*
DLR	Albrecht Von Bargen*	JAXA	Ake Rosenqvist*
DLR	Klaus Schmidt*	MEXT	Aya Takatsuki
EC-JRC	Peter Strobl	MYSA	Kamaruzzaman Wahid
EC-JRC	Joana Melo*	NASA	Dave Borges
ECMWF	Vincent-Henri Peuch*	NASA	Christine Bognar
ESA	Marie-Claire Greening	NASA	Barry Lefer
ESA	Yasjka Meijer	NASA	Wenying Su
ESA	Clement Albergel	NASA	Sid Boukabara*
ESA	Marie-Helene Rio*	NASA	Chris Kidd*
ESA	Ben Veihelmann*	NASA	Gary Geller*
EUMETSAT	Jörg Schulz	NASA	Ben Poulter*
European Commission	Mark Dowell*	NASA	Jorge Vazquez*
European Commission	Mauro Facchini	NOAA	James Donnellon*
FAO	Matieu Henry*	NOAA	Shobha Kondragunta*
GEOGLAM	Alyssa Whitcraft*	NOAA	Jeff Privette*
Geoscience Australia	Jonathon Ross	NOAA	Katy Matthews*
Geoscience Australia	Maggie Arnold	NPL	Paul Green
GISTDA	Poramet Thuwakham	NPL	Nigel Fox*
IPCC TFI	Rob Sturgiss*	UKSA CEOS Chair Team	Beth Greenaway
JAXA	Hironori Maejima	UKSA CEOS Chair Team	Niall Bradshaw
JAXA	Osamu Ochiai	UKSA CEOS Chair Team	Patrick Gibson

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JAXA	Mariko Harada	UKSA CEOS Chair Team	John Remedios
JAXA	Yuko Namakura	UKSA CEOS Chair Team	Harvey Jones
JAXA	Satoshi Uenuma	UNOOSA	Jorge Del Rio Vera*
JAXA	Toshi Kamei	USGS	Darcee Killpack
JAXA	Sato Tappei	USGS	Tim Stryker
JAXA	Hiroshi Suto	USGS	Tom Sohre*
JAXA	Takeo Tadono	USRA	Tomohiro Oda
		WMO	Natalia Donoho



APPENDIX B: Actions & Decisions Record

ACTIONS

SIT-40-01	Agencies with methane detection science programmes are invited to notify the GHG Task Team lead (Yasjka Meijer, ESA) to support information exchange with IMEO.	June 2025
	Rationale: IMEO is interested in collaborating with C methane detection science and algorithms to ensure eff of CEOS EO data for the IMEO applications	EOS Agencies on ective application
	CEOS Agencies to provide feedback on the draft Interoperability Handbook to the WGISS Chair and Vice Chair. Inputs are also welcomed from the broader community and CEOS Agencies are asked to share the link to the <u>GitHub</u> as appropriate with their experts.	SIT TW 2025
SIT-40-02	Rationale: WGISS welcomes review and comments on the of the Interoperability Handbook ahead of the 20 Workshop, where community recommendations will be completion of the final draft at the WGISS-60 meetin and presentation for potential endorsement at the November 2025.	he latest iteration 25 SIT Technical reviewed prior to g (October 2025) CEOS Plenary in
SIT-40-03	Agencies are invited to nominate participants to the WGClimate activity on expanding the utility of the CDR Inventory to address emerging priorities.	May 2025
	Rationale: There is an activity underway to introduce an application/stakeholder typology to the CDR Inventory to address emerging priorities.	
SIT-40-04	SIT Chair and WGClimate Chair to follow up on IPCC threads regarding an Expert Workshop and more systematic and comprehensive representation of CEOS agency datasets in the IPCC Emission Factors Database.	SIT TW 2025
	Rationale: Dialogue between the SIT Chair Team and IP opportunities for closer engagement	CC TSU has led to
SIT-40-05	CEOS Agencies and WG, VC, and AHT leads are asked to name representatives to the SIT Chair to help with development of the 2025 update of the CEOS GST Strategy and to provide feedback and preliminary ideas.	30 April 2025



	Rationale: Given the broad set of inputs required from across the CEOS organisation, the SIT Chair will lead the development of GST Strategy – Issue 2. A draft will be presented and discussed at the SIT Technical Workshop before presentation for potential endorsement at the 2025 CEOS Plenary.	
SIT-40-06	CEOS Agencies to consider providing a talk for the <i>Unlocking EO for Public Service</i> side meeting being convened by the UKSA CEOS Chair at the 2025 SIT Technical Workshop (on the side meeting day, 9 September 2025).	19 May 2025
	Rationale: The CEOS Chair Team would like to gather broad, global perspectives as input to the summary paper that will be presented to the 2025 CEOS Plenary. Agencies are invited to share perspectives and insights on: What are the services and activities that work now? What benefits have been realised? Could this be duplicated elsewhere? What new opportunities are there for EO in public services? What interventions do CEOS Agencies and associated Governments implement to encourage use of EO data in their countries/regions? What are the barriers? What could CEOS do collectively?	
SIT-40-07	CEOS Agencies and entities (WGs, VCs, AHTs) are asked to engage with the WGCV Product Validation Platform (PVP) initiative and provide imagery from their own sensors and to encourage other (e.g., private sector) satellite operators in their sphere of influence to also do so. Contact should be made via <u>Samantha.Malone@npl.uk</u>	SIT TW 2025
	Rationale: The CEOS WGCV Product Validation Platform (PVP) would benefit from additional reference imagery from CEOS agencies and the private sector. CEOS Agencies are asked to regularly collect and provide free access to Level 1 satellite imagery and metadata against a common 'CEOS reference' (representing radiometric and spatial properties). Similar imagery is welcomed from commercial data providers.	
SIT-40-08	WGCV is asked to incorporate other types of tools/databases in the WGCV Product Validation Platform (PVP).	May 2025
	Rationale: The CEOS WGCV Product Validation Platform (PVP) currently comprises the Comparison Image Database (CID) and Radiometric Validation AnaLytics tool (RADVAL). There is scope for the inclusion of other tools, e.g., the CEOS GHG cal/val database coordinated by JAXA.	



SIT-40-09	WGDisasters EW4All Subgroup to share the current concept note for a proposed CEOS-EW4All workshop with the SIT Chair Team.	June 2025
	Rationale: A draft proposal has been developed for a joint CEOS and EW4All workshop.	
SIT-40-10	CEOS agencies are invited to nominate representatives to the Climate Policy Impact call series continuing through 2025.	May 2025
	Rationale: The call series has provided a useful increase in bandwidth and discussion time on the issues related to the GST Strategy update and continues to inform that process	
SIT-40-11	SST-VC is asked to refine the statement presented at SIT-40 regarding extended observation coverage from new ultra-high-resolution thermal infrared instruments to reflect feedback from CEOS Agencies at SIT-40. It will also work with the SIT Chair Team to accomplish virtual endorsement by CEOS Principals.	May 2025
	Rationale: The statement was well received by CEOS Agencies at SIT-40. However, the SIT-40 discussion yielded feedback that should be taken into account before final endorsement.	
SIT-40-12	CEOS Agencies are asked to review the submitted <u>"LSI-VC Subgroup on GEOGLAM Terms of Reference"</u> and provide a response to GEOGLAM points of contact (akwhitcraft@geoglam.org; sgilliams@geosec.org; CC: matthew@symbioscomms.com), regarding suggested revisions or additions, and to RSVP about whether they are able to name an individual to contribute to the LSI-VC GEOGLAM Subgroup and EAV workshop (13-15 May, 2025).	9 May 2025
	Rationale: This is a renewed call for representatives to the GEOGLAM (Agriculture) Subgroup of the LSI-VC. The draft terms of reference are provided to give more context and facilitate the selection of suitable points of contacts at CEOS Agencies. The EAV workshop will be held on 13-15 May, so responses are needed before 9 May, 2025. This action supersedes SIT-39-05 (call for POCs for LSI-VC Subgroup on GEOGLAM) and CEOS-38-08 (POCs to contribute to an 18-month Essential Agriculture Variables (EAV) stocktake and scoping effort).	
SIT-40-13	CEOS Executive Officer is asked to coordinate a response to UNCCD that will communicate the results of the CEOS External Request Process.	May 2025



	Rationale: On 22 May 2024, CEOS received a 'Letter on enhanced cooperation between the UNCCD and CEOS'. The CEOS SIT Chair undertook a formal CEOS External Request Process to determine how CEOS can respond to each of the requests. This assessment has now concluded and a response to UNCCD is needed to communicate the results.	
	CEOS Agencies are asked to provide feedback to the SEO on experiences and requirements related to licensing and the initial choice made for the CEOS GitHub repository (Software: Apache 2.0 Content: CC-BY-4.0).	SIT TW 2025
SIT-40-14	Rationale: Licensing has received little attention in CEOS historically because CEOS is not a legal entity. However, it is important for CEOS to discuss it further in light of increasing engagement with the commercial sector and other topics. Trial licensing at CEOS GitHub repository levels has been implemented to provide necessary open-source licensing where necessary and maintain copyright ownership by individual contributors (agencies).	
SIT-40-15	CEOS Agencies are asked to consider submitting a declaration of interest to join the Space4Ocean Alliance. Specifically, agencies are asked to send the following to <u>Selma.Cherchali@cnes.fr</u> : Confirmation of Interest and intention to sign the Declaration; intention to participate in the June events (UNOC3), with a list of expected participants.	30 April 2025
	Rationale: There is a lack of coordination and communication between the space sector and marine stakeholders. The Space4Ocean Alliance's objective is to coordinate and create more synergies, avoiding overlaps and leveraging operational solutions.	



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DECISIONS

DECISION 01	CEOS endorsed the <u>Space Agency Response to the 2022 Global Climate</u> Observing System (GCOS) Implementation Plan.	
DECISION 02	CEOS endorsed the <i>"Lessons Learned and Recommendations from Space Agencies' Support for the First Global Stocktake"</i> produced by the CEOS/CGMS WGClimate.	
DECISION 03	The JAXA SIT Chair Team will lead the development of the CEOS GST Strategy Issue 2 and oversee its implementation.	
DECISION 04	The use of <u>ceos.org/pvp</u> to redirect to the WGCV Product Validation Platform was approved.	
DECISION 05	 CEOS Agencies acknowledged the requests and recommendations from SST-VC and COAST-VC to: 1. Consider the acquisition of coastal SST in GHRSST format with enough coverage up to minimum 100 km from the coast when planning new ultra high resolution TIR missions. 2. Additionally consider coastal coverage distances for features listed on page 4 and 7 of the statement, which are based on the justifications detailed in the appendices. <i>Rationale: Following these recommendations will make data from emerging missions significantly more valuable and usable to the scientific coastal ocean communities, and increase the likelihood of breakthrough science and improved information for decision making and societal benefits.</i> 	
DECISION 06	In support of LSI-VC management of thematic areas, the following points of contact were confirmed: <u>AFOLU:</u> Ben Poulter (NASA), Inge Jonckheere (ESA), Clement Albergel (ESA), Takeo Tadono (JAXA) <u>GFOI:</u> Osamu Ochiai (JAXA), Stephen Ward (JAXA), Inge Jonckheere (ESA) <u>Agriculture:</u> Sven Gilliams (GEOGLAM), Alyssa Whitcraft (GEOGLAM)	