Minutes of CEOS Strategic Implementation Team

Technical Workshop (SIT TW 2021)

14-16 September 2021 - Virtual Meeting

Tuesday 14th September

1.1: Technical Workshop Opening Session

1.1.1: Welcome and Introductions

Presenters: Alex Held (SIT Co-Chair, CSIRO), Adam Lewis (SIT Co-Chair, GA) [slides]

Main points:

- Adam welcomed everyone on behalf of SIT Chair Team and Co-Chair Alex Held.
- Adam noted the sad passing of Dr. Gail Skofronick-Jackson and passed on thoughts to our NASA colleagues.
- A *tour de table* was undertaken, with a full list of attendees provided in Appendix A.
- Adam reviewed the objectives of the Workshop including:
  - Support CEOS Chair priority for 2021: "Space-based Earth Observation Data for Open Science and Decision Support".
  - Support those activities related to CEOS relationships, e.g., GEO, GCOS, UNFCCC.
  - Progress SIT Chair Term Priorities: Analysis Ready Data (ARD); Sustainable Development Goals (SDGs); and, Carbon and Biomass.
  - Support preparations for CEOS Plenary 2021.

1.1.2: Review of Actions

Presenter: Marie-Claire Greening (CEOS Executive Officer, CEO) [slides]

Main points:

- Marie-Claire recalled the CEOS mission statement, primary objectives, and governing documents.
- The four main governing documents that guide the work of CEOS are the Terms of Reference, the Strategic Guidance document, the Governance and Processes document, and the CEOS Work Plan.
- An annual review of the CEOS Work Plan helps ensure it remains current and helps inform, define, and track progress.
- The SIT TW provides the opportunity to conduct a mid-year review to make sure that the deliverables are still on track and to identify any issues.
- CEOS deliverables tracking tool is available on the CEOS website to track the progress of CEOS Work Plan actions.
- Regular reporting into the tracking tool is highly encouraged as it helps CEOS leadership to track progress and to identify items that require attention.
- Quick update on 2021-23 Work Plan and deliverables: 28 of the previous year's deliverables were closed; 107 were carried over; 16 were newly created for 2021-23.
- From the WP endorsed in March 2021, 15 deliverables have been completed; a further 50 are due for completion by end of 2021; 46 deliverables will continue into 2022; and, a further 12 will remain active beyond 2022.

Select Action Updates:

- SIT-36-03: Will be addressed under SIT TW item 2.3.12.
- SIT-36-07 & SIT 34-16: Will be addressed under item 1.5.1.
- SIT-36-08: Will be addressed under item 1.4.2.
- CEOS-32-02: WGClimate will be addressed under item 2.2.4.
- CEOS-33-03: Mark Dowell (COM) confirmed that GHG-AFOLU Workshop is being developed for the second half of November i.e., Q4 2021.
- CEOS-34-05: No specific update currently and should be discussed during TW sessions.
- CEOS-34-06: Needs to be addressed at a dedicated meeting in September/October.

1.2: CEOS Chair Open Science Theme and Update on Implementation

Presenter: Karen St. Germain (CEOS Chair, NASA) [slides]

Main points:

- Karen noted the CEOS community embraced the open science theme that provided valuable inputs to the Implementation Plan for the 2021 CEOS Chair Theme.
- The Earth Analytics Interoperability Laboratory (EAIL) has been released and is now supporting several flood pilot projects.
- Endorsement of EOTEC DevNet: WGCapD is working with SEO to develop a capacity development matrix and an application interface that will promote open data sharing in support of decision-making associated with flood impacts.
- WGClimate identified 18 specific use-cases where climate data is used for decision making; CMA, JAXA, NASA, NOAA, SANSA, and UKSA have contributed to the use cases so far.
- Examples: SANSA used satellite observations to study the impact of wildfires on air quality and human health in sub-Saharan Africa; JAXA used satellite observations to monitor extreme rainfall and drought in East Asia and Western Pacific Areas, and NASA used satellite observations to produce crop yield information forecasts in Kenya.
- If any agencies would like to submit use cases, then they should contact the Chair of the Joint CEOS CGMS WGClimate Albrecht von Bargen or Vice Chair Jeff Privette (NOAA/WGClimate).
- WGCapD hosted Jupyter Notebook webinar training in July.
- SEO completed the first release of Open Data Cube Sandbox (ODC Sandbox) through Open Earth Alliance. Further work is ongoing to develop documentation and inputs for the GEO Knowledge Hub and the SDG Development toolkit. Microsoft Azure cloud platform is now offering global data for Landsat and Sentinel via the Planetary Computer.
- SEO plans to obtain credits to explore cloud services and data offerings. Copernicus Land Cover and Copernicus Digital Elevation Model global data are available for CEOS testing through the EAIL.
- Examples of cross-cutting cooperation with stakeholders: The Biomass validation protocol developed by the land, product validation subgroup of the working group on validation and calibration formally endorsed at the SIT-36 meeting, will advance global validation efforts, open sharing of data and biomass product harmonisation.
- CEOS contributed data and tools to UN-Habitat Urban Toolkit (11.3.1) and is developing new tools for water/flooding (SDG 6.6.1) and land change (SDG 15.3.1).
- CEOS communications have drafted a series of articles, branding guidelines on the CEOS website; the team is upgrading the website to enhance the user interface.
- Online demonstration videos are being prepared with a goal to increase online interactions and database users worldwide.

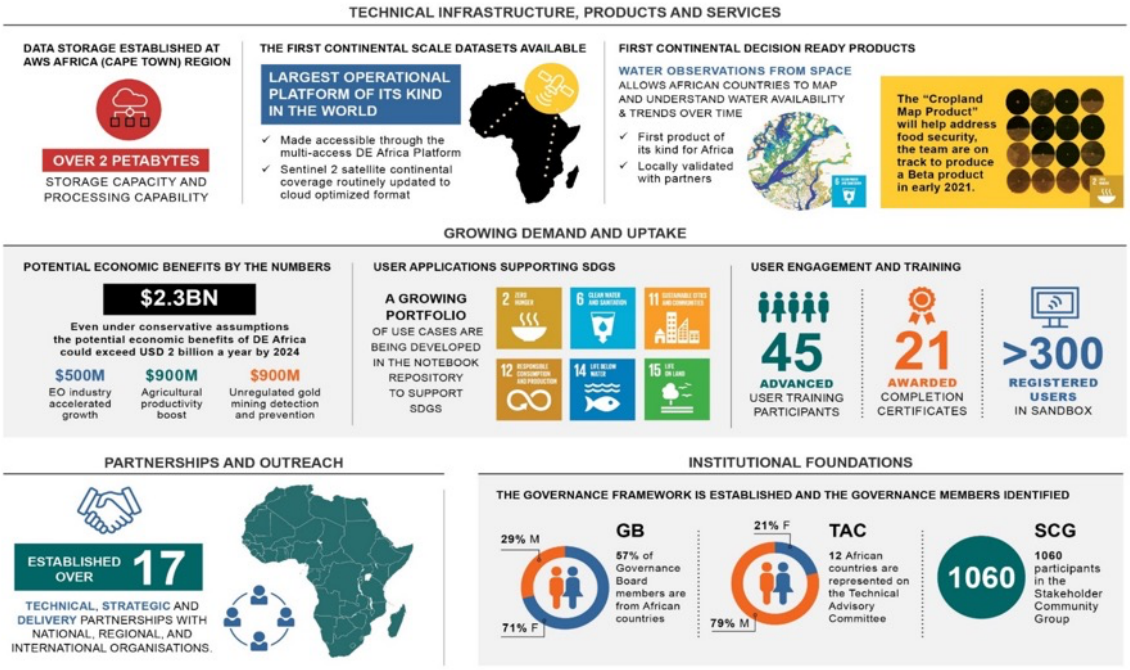
1.3: CEOS Impact on Open Science: Digital Earth Africa as a Case Study

Presenter: Adam Lewis (SIT Co-Chair, GA) [slides]

Main points:

- Open science and open data are exponentially increasing the reach of CEOS data thereby increasing positive impacts to society.
- Africa needs information, including to pursue its Agenda 2063, SDGs, and climate agenda.
- Digital Earth Africa (DE-Africa) is an example of CEOS's work delivering impact on global agendas through space-based Earth observations supporting open science for decision making.
- Creating analysis ready data (ARD) pipelines has been key in establishing the flow of data from data providers to end users. These pipelines have made use of frameworks such as CARD4L, STAC (stacspec.org), and COG (cogeo.org).
- For Landsat Collection-II, and 540 terabytes of data are processed to be COGS/STAC AWS specifications that land in Africa to generate the images.

- The Sentinel-1 Normalised Backscatter product is provided through a Sinergise CARD4L tool and is an interim solution. Ideally, this data would flow from the data provider.
- The Sentinel-2 is also provided through the Sinergise ARD tool that is reformatted by Element 84.
- JAXA is providing a global PALSAR mosaic, which is then reformatted for use by DE-Africa.



Main discussion points:

- David Green (WGDisasters, NASA), asked about the availability of a user list for DE-Africa. Adam noted that there are many DE-Africa contact lists, some of which could be discussed and shared on request.
- Nancy Searby (WGCapD, NASA) asked about the role of SANSA in operating DE-Africa. Adam noted that they have several regional implementing partners across the continent, including SANSA in South Africa, who will play a critical role as a Program Management Office for DE-Africa soon.
- Osamu Ochiai (JAXA) had queried on the matter of statistics on data usage. Adam noted that DE Africa has only just recently started collecting statistics on data usage.
- Richard Lucas (Aberystwyth Uni.) wanted to know if there is an opportunity to bring in external layers such as the Global Mangrove Watch, generated from radar/optical data to increase consistency in using data products. Adam confirmed that this can be implemented and noted that any open data with a friendly cloud format (STAC) could be indexed directly into the active framework and then used in the sandboxes with other data. These can be hosted in the Microsoft platform or AWS in Africa, but the issue would be who would take the responsibility to maintain and take care of those data sets.
- Ivan Petiteville (SIT Vice Chair Team, ESA) asked whether practitioners or value-adding companies are involved in the generation of information products for decision-makers. Adam confirmed that they are, and that the program is working with various groups like Big Data Ghana including the private sector to develop commercial capabilities. Adam also added that they are looking to their regional partners and groups who can be trained and are willing to go back to connect to their own government work.
- Paul Counet (EUMETSAT) recommended that it would be interesting to have a list of users and their repartition/country and noted the limitations of internet connectivity in African countries. Adam noted that he can provide the list of users by country but that would strongly depend on the availability of internet in those areas.
- Mark Dowell (COM/JRC) queried the plans for sustainability of DE Africa. Adam confirmed the activity is reaching the end of the Establishment Phase that would run until mid-2022 and then they are looking for another round of investment to go to the next level.

- Steve Labahn (USGS) asked whether there are additional CEOS datasets that would further advance the DE Africa work. Adam noted that any data which are in the cloud format (STAC) can be indexed into DE Africa. Other datasets from other platforms e.g., Microsoft. The program is working with the SEO on AFOLU datasets at the moment, looking at how to support countries with national reporting - mitigation or adaptation. CEOS data in a ready format would be helpful for such an activity. Adam can supply a list of users by country if helpful.
- Brian Killough (SEO, NASA) confirmed that as Adam noted, the SEO is investigating the addition of some AFOLU datasets to DE Africa. It might also include NASA's Black Marble (nightlight) data which will soon be ARD compliant.
- Adam shared that accessibility is difficult due to the network challenge and highlighted that they are working with various entities to get the network and connectivity problem resolved as soon as possible.

1.4: Analysis Ready Data (ARD)

1.4.1: ARD Beyond Land: CEOS ARD Governance Framework

Presenter: Adam Lewis (SIT Chair Team, GA), Ed Armstrong (SST-VC Co-Lead, NASA) [slides]

Main points:

- Adam provided a quick refresher on the CEOS approach to Analysis Ready Data (ARD). The documentation of the governance framework has greatly improved over the last couple of years.
- More information on CEOS ARD can be viewed on the ceos.org/ard website.
- Recently, the process of broadening the ARD Framework to address domains beyond land has begun.
- Governance framework for CEOS ARD accompanied by 'barebones' Product Family Specifications (PFS), is seeking to formalise the process LSI-VC has used for CARD4L and exploring the specifics of the broadened ARD concept.
- CEOS ARD coordination meetings will be held annually in the margins of the SIT meetings and SIT Technical Workshop. These meetings will include the CEO, SIT Chair, nominated representatives from the CEOS VC and Working Groups, and others as engaged.
- CEOS VC will serve as the forum where new PFS are proposed and developed when product benefits are realised by its stakeholders.
- Ed reviewed the PFS template and highlighted that PFS 'bare bones' template is composed of ~20 assessment factors thereby making it more compact compared to the size of the existing full PFS. It is designed to be highly adaptable to other disciplines without any limitations on additional assessment factors and is compatible with existing PFS.

Main discussion points:

- Merrie Beth Neely (CEOS-COAST) asked to elaborate the strategy to reach out to the community and wanted to know if there are groups such as GEO that they wish to engage. Adam noted that they have been communicating to all the CEOS working teams seeking engagements on a range of activities such as the framework, internal governance, and barebones template. Outside of CEOS, webinars and outreach programs are being organised to engage with the external community. Ed added that this activity was also promulgated to all the attendees in the side meeting that was held last week.
- Ivan Petiteville (ESA) asked when will the updated version of the PFS template be circulated. Ed advised that the PFS template is an active document and suggested viewing the Google Document.
- Both Adam and Ed noted the governance framework formalises the roles and responsibilities, which implies, any new PFS would be led by the VCs/expert team responsible for that thematic area.
- Merrie Beth added that she can recommend that GEO Initiatives would be a good place to start for input. It might also foster the type of relationship forged with GEO Aqua Watch on Aquatic Reflectance. Adam agreed that this is a good observation and noted that it needs to have a user-based input to balance the expertise-based input.

- Adam clarified that the purpose of developing the PFS is to prepare a well-designed living guidance document to help people develop the PFS with minimum cost. It is not part of the governance document.
- Sandra Cauffman (CEOS Chair Team, NASA) added that NASA is in favour of advancing the final ARD Governance Framework document to the 2021 CEOS Plenary for potential endorsement.

SIT-TW-2021-01	Feedback from CEOS Agencies was invited on the Draft Governance Framework for CEOS Analysis Ready Data (ARD) and the accompanying template PFS via email before both documents are finalised and presented for potential endorsement by the 2021 CEOS Plenary.	**8 October 2021**
	Rationale: These documents will be presented to the 2021 CEOS Plenary for endorsement, and CEOS Agencies were encouraged to review and send feedback before both documents are finalised.	
SIT-TW-2021-02	In view of the transition in leadership of some members of the current CEOS Analysis Ready Data (ARD) Oversight Group, nominations were requested to ensure robust support and continuity.	**31 October 2021**
	Rationale: The CEOS ARD Oversight Group has been identified as a core component of the future CEOS ARD Governance Framework. It will act as a forum for all matters related to CEOS ARD. Representatives from the CEOS Virtual Constellations are integral to the effort going forward, as these are the CEOS entities with the technical expertise to recommend, develop and maintain Product Family Specifications. The SIT Chair Team and CEOS Executive Officer have also been identified as key participants.	

1.4.2: CEOS ARD Strategy v2.0

Presenter: Adam Lewis (SIT Chair Team, GA) [slides]

Main points:

- Adam provided a brief context of CEOS ARD Strategy and presented the draft CEOS ARD Strategy 2021, which seeks to provide the direction for the next stage of CEOS activity on ARD.
- The strategy focuses to ensure that CEOS data is highly impactful and sustainable, including via an increased scope of the CEOS ARD concept beyond the land domain.
- Leadership, Governance and Accessibility, and Utilisation of CEOS ARD have emerged as pillars of the strategy.
- New objectives to be supported by 2021 strategy:
  - Continued maintenance of CEOS ARD that ensures CEOS ARD work continues to be coordinated and guided by an appropriate governance framework.
  - Ensure the sustainability of CEOS ARD for the machine-to-machine processes employed for the application of remote sensing data.
  - Continued evolution of the concept of CEOS ARD, to consider products that are further along the product chain ('ARD+').
  - Continue investigating further opportunities for the CEOS ARD concept to streamline user uptake of satellite Earth observation data, including new thematic domains and applications.

Main discussion points:

- Sandra added that NASA is in favour of advancing the ARD Strategy document that captures some revisions to the CEOS ARD Strategy that CEOS endorsed in 2019 to the 2021 CEOS Plenary.
- Mark Dowell (COM/JRC) about a discussion in the early days of the development of ARD about reaching out to external entities responsible for standards for geospatial information and to advocate them that these developments in CEOS could have a broader place in that area of standards. Adam noted that the previous strategy had mentioned this, this was carried out by speaking with ISO, IEE, OGC through calls. Based on those discussions, it was felt the cost of engaging surrendered too much control over to formal standards organisations. The team did engage with OGC and have taken forward a technical paper on ARD which is closely structured around CEOS ARD. They are influencing that community, without going all the way at this time. The question should however be revisited in the future. The strategic decision, for now, was to build CEOS ARD as a community driven best practice rather than a formal standard.
- Ivan Petiteville (SIT Vice Chair Team, ESA) added that it is important that we also become aligned with the industry. Open Geospatial Consortium (OGC) is not just a philanthropy organisation but also an industry that might invest more money into the ARD business. Financial investments should be taken care of and all ARD decisions, formats, implementations, algorithms that provide the generator should follow the global trend and specifications used by the industry to avoid useless developments out of specifications and that require workarounds in the future.
- Adam noted that they have been actively trying to reach out to the industry, engaging them in the webinars and inviting them to the discussion forums, one on one telecoms with industry leaders, contributing to ARD20/21 workshops. The industry is looking towards them to understand the specifications. They are heading in the same direction now and there is a strong convergence on CEOS providing a structure around the concept of ARD. These would be a part of the leadership strategy in CEOS continuing to engage with the broader community.
- Adam reflected on the industry discussion that they had previously worked with PCI Geomatics who had prepared ARD for SANSA and have uploaded their work in CEOS. They have received positive feedback as they are helping the industry to move forward.
- Sandra thanked GA for shepherding ARD and asked how the new ARD would be tackled with the transition from new SIT leadership to ESA moving forward. Adam clarified that CEOS ARD Oversight Group, ARD Framework, ARD Strategy, leadership from the VCs, SIT Chair, WGs, etc. structures are independent of the rotation of SIT Chairs, etc. The governance framework document covers this aspect which states that VCs should take ownership in their areas of expertise, convened by the SIT Chair, and supported by the CEO, should make a way for discussion about the ARD framework to carry the framework forward and for it to be stable.
- Ivan commented that CEOS has achieved remarkable progress and many great achievements have been made possible under GA/CSIRO leadership. The incoming SIT Chair Team of ESA would be very happy if GA could continue leading the ARD effort. Adam noted this request and advised he will take feedback up with the new GA CEOS Principal. Adam also acknowledged the efforts of the whole community on CEOS ARD as many people are contributing across CEOS. It is important that these efforts do not hinge on one agency, hence the framework and strategy.
- Sandra agreed with Ivan, added that this is an important activity that GA has been leading and it needs to receive the continued support that it deserves.
- Dave Borges (WGDisasters) stated that WGDisasters has also been engaged in the OGC Disasters Pilots, working to ensure the OGC disasters community is aware of CEOS ARD progress.
- Steve Labahn (USGS) added engagement with industry also includes VH-RODA and JACIE.
- Mark Dowell (COM/JRC) noted the key to the future governance implementation will be to have identified contacts for VCs by Plenary, and Adam strongly agreed.

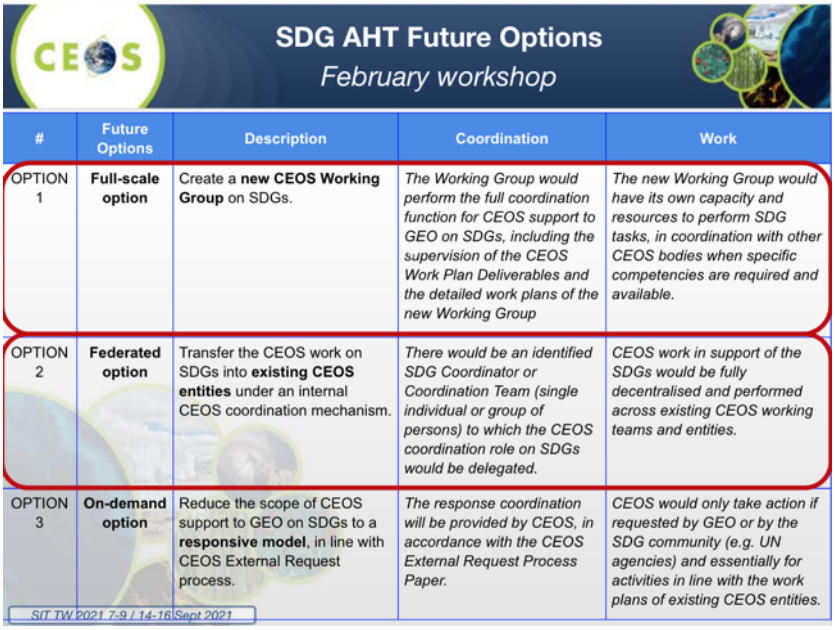
SIT-TW-2021-03	Further feedback from CEOS Agencies was invited on the Draft CEOS ARD Strategy 2021 document by Friday, October 8, 2021. Feedback can be provided via email or by adding comments/suggested edits directly into the online document, which will be finalized and presented for potential endorsement at the 2021 CEOS Plenary.	**8 October 2021**
	Rationale: Feedback from CEOS Agencies is invited prior to finalising the document to be presented for potential endorsement at 2021 CEOS Plenary. Points for consideration by reviewers who want to offer feedback: ● *Is the high-level structure sound?* ● *Is all of the content necessary and relevant?* ● *Are the actions listed relevant and needed?* ● *Are other actions needed?*	

1.5: Sustainable Development Goals Ad Hoc Team

Presenter: Alex Held (SDG AHT Co-Lead, CSIRO), Mark Paganini (SDG AHT Co-Lead, ESA), Flora Kerblat (SIT Chair Team, CSIRO) [slides]

Main points:

- Alex provided a brief overview of SDG AHT governance progress and provided a reminder of the two options presented at SIT-36: "Option 1 Full Scale" (i.e., Working Group); and, "Option 2 Federated". One of the main objectives of this session is to discuss the preferred option (Federated) and agree on actions to Plenary.
- The main objective of SDG AHT Work Plan 2020-21 is to ensure that the satellite Earth observation data is accessible and available in its different forms for reporting against their SDGs and the indicators that are specifically associated with each of the SDGs. Alex stressed this is an ongoing activity that CEOS needs to continue to support.
- Flora and Marc provided a brief summary of **AHT Sub-Team Progress**.
- CEOS Work Plan deliverables related to SDGs have made substantial progress in analysing the end-user requirements.
  - 6.6.1: http://deliverables.ceos.org/task_manager/deliverables/655/
  - 11.3.1: http://deliverables.ceos.org/task_manager/deliverables/656/
  - 14.1.1: http://deliverables.ceos.org/task_manager/deliverables/657/
  - 15.3.1: http://deliverables.ceos.org/task_manager/deliverables/658/
- It is notable that in a number of cases, Indicators require multi-sensor approaches that require expertise in satellite data exploitation.
- Marc reviewed the SDG AHT Transition Roadmap as a part of **Future Governance**, which culminates in the AHT being transitioned to a permanent arrangement following discussion and endorsement of CEOS Plenary 2021. He also reviewed the future options considered by a February workshop on the future of the AHT. The two proposed options were accepted for further development by SIT-36.



SDG AHT Future Options
February workshop

#	Future Options	Description	Coordination	Work
OPTION 1	**Full-scale option**	Create a **new CEOS Working Group** on SDGs.	*The Working Group would perform the full coordination function for CEOS support to GEO on SDGs, including the supervision of the CEOS Work Plan Deliverables and the detailed work plans of the new Working Group*	*The new Working Group would have its own capacity and resources to perform SDG tasks, in coordination with other CEOS bodies when specific competencies are required and available.*
OPTION 2	**Federated option**	Transfer the CEOS work on SDGs into **existing CEOS entities** under an internal CEOS coordination mechanism.	*There would be an identified SDG Coordinator or Coordination Team (single individual or group of persons) to which the CEOS coordination role on SDGs would be delegated.*	*CEOS work in support of the SDGs would be fully decentralised and performed across existing CEOS working teams and entities.*
OPTION 3	**On-demand option**	Reduce the scope of CEOS support to GEO on SDGs to a **responsive model**, in line with CEOS External Request process.	*The response coordination will be provided by CEOS, in accordance with the CEOS External Request Process Paper.*	*CEOS would only take action if requested by GEO or by the SDG community (e.g. UN agencies) and essentially for activities in line with the work plans of existing CEOS entities.*

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- **The SEO has proposed to lead the coordination capability in support of the" federated option"**. The current SDG AHT would be dissolved, and the SEO would host and lead the "SDG Coordination" activities, with support from the SIT Team, the GEO EO4SDG representative, and others. Governance and strategic direction will be more explicitly developed by the SIT, in particular around its relationship to GEO. The SEO will be the responsible CEOS entity for current and future SDG deliverables in the CEOS Work Plan.
- Discussions have been held with both LSI-VC and COAST concerning the proposed SDG federated option. Both groups support the proposal, but further discussion is needed to define detailed roles and responsibilities. More discussions with WGISS, WGCapD, and coordination with SEO on specific activities are also required.
- SDG AHT Co-Chairs recommend the Federated approach, through a new SDG Coordination team led by SEO, at the Plenary.
- The initial structure would have the SIT Chair handle oversight and strategy, implementation, and keeping activities moving would be handled by the SEO-lead coordination effort, with representatives from the SIT Chair, GEO, and identified from the deliverables experts.
- The group is primarily designed to support internal activities of CEOS in terms of communication reporting, as well as externally with other relevant groups, GEO activities, and Flagships. The group will also continuously track deliverables against the work plan, evaluate, support, and request additional external support when required.

Main discussion points:

- Adam Lewis (SIT Co-Chair, GA) noted terms of reference are needed to provide clarity of practical governance arrangements. Marc added two levels of coordination are foreseen: strategic and implementation. Brian Killough (SEO, NASA) added the idea of having a small group at the top level will be efficient for better progress.
- Marc added they were previously considering the integration of the existing AHT sub-teams as part of the work of the existing CEOS entities who are already working on related subjects. For example, LSI-VC for land-based Indicators. However, at present, it does not appear there, so it is a good fit in the case of LSI-VC.
- Neil Sims (CSIRO) noted that GEO LDN is hoping to be elevated to a GEO Flagship next year but this is yet to be officially confirmed.
- Mark Dowell (COM/JRC) asked if the RAMSAR Convention work is a fit for Indicator 6.6.1. Brian noted that the RAMSAR idea is interesting and worth considering, but with 2400 sites there is a scale to be managed. Mark noted an ongoing prioritisation exercise for countries to define which RAMSAR sites would be included in SDG assessment which could help.

- Paul DiGiacomo (CEOS-COAST, NOAA) added COAST also provides direct liaison with GEO Aqua Watch as they are likewise part of the COAST Team and 6.6.1 is part of their intended support.
- Adam asked why the connection on 15.3.1 would be to the GFOI sub-group of LSI, and Marc noted the thematic and content links between LDN and GFOI.
- Osamu Ochiai (JAXA) noted that Indicator 15.3.1 is focused on UNCCD and Land Degradation, while 15.1.1 is focused on forests. For UNCCD Land Degradation, CEOS has not started developing such applications yet, so new or existing harmonised resources may be required.
- Alex added for LDN, CEOS has not yet started this outside the SDG-AHT sub-team, but that Neil Sims is very closely linked to GEO and SDG AHT 15.3.1 sub-team.
- Frank-Martin Seifert (LSI-VC Forest and Biomass Subgroup, ESA) noted the SDG on Sustainable Forest Management is 15.2.1. This is also thematically related to GFOI.
- Marc noted Indicator 2.4.1 and 2.4.2 activities with FAO and GEOGLAM, and that FAO had strongly indicated that they want to leverage satellite Earth observation technology. There is a request from FAO to support the development of new Indicators that can be derived from satellite Earth observations to monitor the sustainable management of forests.
- Kerry Sawyer (NOAA) asked whether the SEO would be the one reporting at CEOS meetings on the status of SDG activities, and Brian noted this would need to be discussed before being proposed to Plenary.
- Kerry praised Marc, Alex, and Flora for their outstanding work over the past five years on moving CEOS contributions on SDGs forward.
- Steve Labahn (USGS) added that LSI-VC wants to be involved to the maximum extent possible based on their existing activities and connections.
- Jörg Schulz (EUMETSAT) asked if this way forward will be reflected in the next CEOS Work Plan as this would help with the implementation of the proposed approach, and Alex confirmed the plan would be to include some specific activities that will be undertaken by the 'federated team' after Plenary endorses the way forward.
- Marc added the time between the technical workshop and the Plenary is extremely short, considering the need to provide documentation before the Plenary. The first priority will be to describe the new governance structure and also to start to define actions for the Work Plan.
- Ivan Petiteville (SIT Vice Chair Team, ESA) noted that the SIT Chair could play a role in SDG oversight, strategy, external coordination (e.g., with GEO), and reporting (e.g., to SIT meetings), and Brian agreed this was a good suggestion.
- Christine Bognar (CEOS Chair Team, NASA) also agreed with Ivan's suggestion on SIT Chair oversight noting that this would be an important link the activities to the Work Plan as it is important to ensure they are linked to existing commitments and CEOS Agency support.
- Adam added that delegation from the SIT Chair to the SEO would be a clean approach as it would keep the lines of responsibility clear.
- Osamu noted that they have discussed with the JAXA Principal, and feel a federated approach is feasible and needs to be discussed within JAXA before Plenary. However, he suggested considering ways to engage with National Statistical Offices (NSO) for each country that are generally responsible for the implementation of SDGs Indicator monitoring. JAXA is building strong connections with the Japanese NSO, and encouraging the use of EO data, and exchanging best practices.
- Marc Paganini (ESA) added the SDG AHT sub-teams include members linked to the GEO initiatives. GEO has a strong link with the NSOs and National Agencies. They perform all the capacity building activities with the GEO team in coordination with the NSO. A toolkit in support of these ambitions is the ultimate solution that CEOS can develop with GEO.
- Flora added that it was decided that this direct engagement with NSO is now mainly done through GEO, and on case by case (upon requests) CEOS Agencies can support countries.
- Brian agreed with Flora, noting that CEOS engaging directly with NSOs is beyond our scope. Countries should rely on GEO and the UN groups to provide needs and best practices that guide how they provide data and tools.
- Tim Stryker (USGS) thanked the SDG AHT members for all their good work and noted the federated approach looks promising to USGS.

- Kerry added a number of actions on existing CEOS entities are levied to identify particular experts to support SDGs, ARD, etc. She suggested it would be good to map those exact requests in a summary document so that the VCs and WGs can easily see what is being asked of them. Brian and Ivan agreed this needs to be laid out. Brian added that architecture should be developed for all the entities. Raj Kumar (ISRO) and Marc agreed a summary document would be useful.
- Ake Rosenqvist (JAXA) added JAXA also has a direct relationship with UNEP - the other custodian for 6.6.1 and the Global Mangrove Watch dataset is now used by UNEP as the default dataset for SDG 6.6.1 reporting for countries without own national mangrove monitoring systems.

Decision 01	The SIT Technical Workshop agreed to the proposal of the SDG AHT Co-Chairs to recommend a Federated approach to SDGs for consideration and decision at the 2021 CEOS Plenary. The SIT Chair will have strategic responsibility for a new SDG coordination mechanism and will delegate coordination to the SEO.

SIT-TW-2021-04	Sustainable Development Goals *Ad Hoc* Team (SDG AHT) co-leads, SEO, the incoming SIT Chair Team, and the CEO to further discuss and agree on the documentation and information that will be provided to the 2021 CEOS Plenary, which is where the decision to potentially approve the proposed mechanism will be taken.	**25 Sept 2021**
	Rationale: The SIT Technical Workshop recommended this interim step in preparation for the 2021 CEOS Plenary.	

SIT-TW-2021-05	SDG *Ad Hoc* Team to develop and make available the document(s) so that CEOS Principals and the CEOS community can make an informed decision at the 2021 CEOS Plenary.	**16 Oct 2021**
	Rationale: The SIT Technical Workshop tasked the SDG ad hoc Team with finalizing its proposed continuity plan in advance of the 2021 CEOS Plenary.	

Wednesday 15th September

2.1: GEO Update

Presenters: Yana Gevorgyan (GEO Secretariat Director)

Main points:

- Yana summarised her views as the new GEO Secretariat Director, noting the priority is to accelerate actions from GEO, wrapping up the current ten-year plan. She reviewed areas she sees the Secretariat focusing on, including:
  - **Engaging with various user communities**, distinguishing, and differentiating between different user groups, starting with policy makers.
  - **Starting to develop 'policy briefs'** around the GEO activities to address the decisions policy makers must make (e.g., GEOGLAM, GEOGLOWS, Climate Change Working Group, Disaster Risk Reduction, others). These are to be complemented by **practical guidance** to provide technical details on how to achieve the briefs. GEO is working with UNFCCC to produce these.
  - **Tools, service, and products** - the deliverables from GEO. Working to be open source, open knowledge, and accelerate the knowledge in the GEO Knowledge Hub.
- GEO must engage with members to achieve these goals, which have the potential to form a powerful network. They are working to accelerate this engagement, putting emphasis on outreach and strategic communications with member states. This will help make the work suitable for the needs of the members.
- Need to bring the open data discourse back to GEO as there is still work to be done here. This includes legal license and interoperability, and how to ensure key data providers are putting the plans into action.
- GEO is also stepping up efforts to deliver analysis ready data (ARD). Yana would like to amplify the CEOS internal work in promoting ARD across the board and extend the discussion into CGMS and WMO.
- GEO will continue to work with technology providers, following success with work with cloud infrastructure providers (e.g., credit grants, other support). They will be looking to bring this into the GEO Work Programme to try and make it sustainable.
- Working with the five GEO Flagships and initiatives to make their projects knowledge-hub ready.
- Working to step up engagement with participating organisations of GEO, which now stands at over 160 organisations. Planning to categorise organisations into clusters, and tailor the engagement towards the clusters, with the aim to leverage the expertise of these organisations.
- Mobilising resources to allow for projects to be taken to the next level. Will work on marketing pitch to reach the right funding groups that are interested in the GEO work.
- More on all these topics will feature in GEO Week 2021, with detail being rolled out in the coming weeks.

Main discussion points:

- Adam Lewis (SIT Co-Chair, GA) asked what are the 1-2 things CEOS could do to best support GEO in this new era. Yana noted that CEOS should continue to support elements that drive open knowledge, exploring interoperability of data and technologies. This includes the use of Open Data Cube, and getting agencies to implement CEOS Analysis Ready Data. Ensuring these enabling conditions are in place is a vital role. GEO is looking to new specific activities that have high policy relevance but have been dormant and looking at the nexus between the various efforts.
- Ivan Petiteville (ESA) noted in chat: "*Currently, only the big companies can participate in GEO activities with their own funding. How could we attract in GEO the many downstream SMEs from various continents that are still staying out because of lack of funding from the GEO community?) ?"* Doug Cripe (GEO Secretariat) responded: "*Interesting question Ivan. I wonder to what extent GEO should be looking to fund SMES. I would think the greater impact GEO can have is in opening access to data and letting SMEs build added-value products as a result*."

2.2: Carbon and Biomass (Part 1)

2.2.1: Session Introduction, Context, Welcome

Presenter: Adam Lewis (SIT Co-Chair, GA) [slides]

Main points:

SIT Chair Team has been prioritising Carbon and Biomass issues during their 2-year term, including:

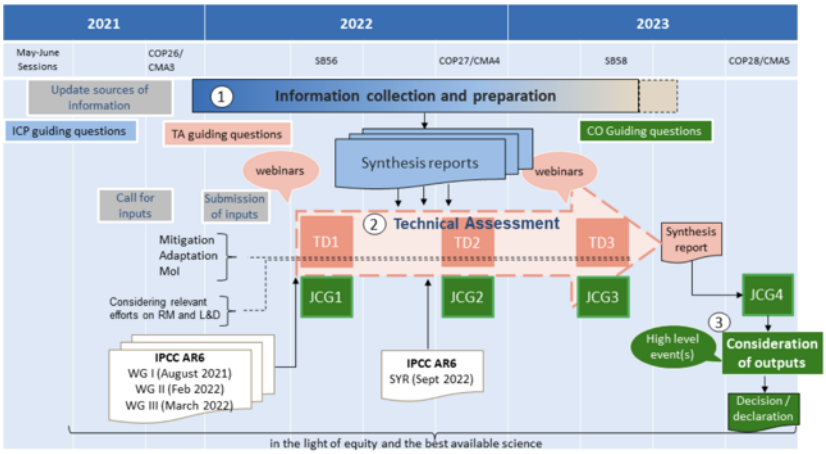
- Supporting the GHG Roadmap process: escalating, elevating, and accelerating progress towards major milestones, including for the 2023 Global Stocktake (GST), with 2021 prototype flux products.
- Encouraging stronger and more systematic CEOS engagement with convention frameworks: and national inventory communities as our future users.
- Reflecting large investment (2018-2024) in Above-Ground Biomass missions and seeking to accelerate the policy relevance of these new data.
- Promoting uptake of biomass datasets beyond the science community.
- A considered and coordinated approach to the opportunity and challenge of the GST.

2.2.2: GST & SO Synthesis Process Update

Presenter: Joanna Post (UNFCCC SEC) [slides]

Main points:

- Joanna focused on the GST, showing the timeline and progress.



- The systematic observation community *must* provide inputs to the GST on mitigation, adaptation, and MOI action in five-year cycles, with a pledge and review approach. This requires an understanding of the GST, with planning, aggregation of this information, preparation of a coordinated input, and participation in the GST. This should happen through coordinated input from the EO community and via collaboration on a synthesis report at a global level (GST 2023) with a deadline for inputs by February 2022.
- There is an opportunity for CEOS to provide inputs to the GST in an aggregated way that is a cut above other information sources that they are seeing.
- The observation community can play a role in developing and measuring adaptation indicators.
- The COP-26 agenda includes:
  - Research and systematic observation agenda including the Earth information day and negotiations.
  - The GST, with the non-paper update coming out today (15th Sept) and a portal for inputs also coming out today. There are co-facilitator technical dialogues onboard, and negotiations are occurring for additional sources of input to complement what is already provided.

Main discussion points:

- Neil Sims (CSIRO) commented in chat: *"I co-Chair the GEO LDN initiative and the CEOS AHT on SDGs. The GEO LDN Initiative works very effectively, and with support from the UNCCD and GIZ, we have developed tools and data analytics systems that are used widely. Currently, I translate my work in GEO into the CEOS format for CEOS reporting purposes, but it would be good to have CEOS go deeper into the data gaps and needs across geographies. Is it necessary to formalise CEOS engagement on GEO activities (this may have some advantages) or should I just keep calling my mates in CEOS and asking them to give me a hand? Cheers."*
- Joanna Post (UNFCCC SEC) commented in chat: *"We hope that the Earth information day will be 2 Nov - and definitely CEOS will be invited to speak, and provide posters - we will hold a virtual poster session. Please ensure that you are part of the delegation (even if not going to Glasgow) - as you will need to be officially registered to access the virtual platform"*

2.2.3: GCOS Process Update

Presenters: Anthony Rea (Director of Infrastructure/WMO, GCOS) [slides]

Main points:

- The Global Climate Observing System (GCOS) has been very successful in allowing the IPCC to identify and project climate change and attribute this to human activities.
- The report identifies four key areas where improvements are needed: sustainability, gaps in geological coverage, data stewardship, archiving and access, and supporting the Paris Agreement.
- These issues will be addressed in the next GCOS implementation plan to be published in mid-2022.
- GCOS is currently collecting contributions, with a public review planned for early 2022.
- GCOS is looking to CEOS and CGMS for inputs into the next GCOS Implementation Plan.
- The GCOS Status Report 2021 has been released (here).
- There is an interim report of the GCOS Study Group available on the WMO website.

Main discussion points:

- Jörg Schulz (EUMETSAT) commented in chat: *"Just for your info: The potential gaps in the satellite observing systems just shown are based on the analysis of the CEOS-CGMS ECV Inventory gap analysis."*
- Ivan Petiteville (ESA) responded: "*@Jörg: as you know, several potential programmes such as Aeolus Follow-on listed on Anthony's gap slides, are being studied in various space agencies"*
- Jörg responded: *"@Ivan: Yes, that's right and very good!, but there is a time lag between gap analysis report and the GCOS status report. That's why we try hard to update the gap analysis once per year that has been difficult during the pandemic"*

2.2.4: Draft CEOS Strategy for Support to the GST

Presenter: Steve Briggs (SIT Vice Chair Team) [slides]

Main points:

- The 2020 SIT TW and Plenary meetings included substantial items on GST related tasks and raised the need for a coherent and optimised approach. SIT Chair agreed to establish a GST Study team to develop a CEOS Strategy or Support to the GST setting out the various elements of CEOS support to the GST.
- V3.0 of the Strategy was circulated on 5 May 2021, including all comments received after the final meeting of the Study Team on 27 April. No further comments received on V3.0 thereafter.
- Following a suggestion at the SIT TW preparatory meeting last week, the Actions set out in V3.0 will be registered in an update to the CEOS Work Plan, giving a longer lifetime to the Strategy paper itself and ensuring consistency with other WP actions. The recommendations remain as before. A new Version V3.1 has the Action table removed and transferred to the draft CEOS WP 2022-24.

Decision 02	SIT Vice Chair Team will take forward the Draft CEOS Strategy for Support to the UNFCCC Global Stocktake (GST) for endorsement at the 2021 CEOS Plenary. The Actions will be migrated to the CEOS WP in collaboration with the CEO

2.2.5: Discussion on Optimising the Space Agency Contribution to the GST

Moderator: Steve Briggs (SIT Vice Chair Team) [slides]

Main discussion points:

- Kerry Sawyer (NOAA) (via chat): *"You reference that some recommendation actions are complementary to some already carried out by CEOS bodies. Have those connections been identified? It would be very helpful to have a mapping of resources against expectations against actions already undertaken so Principals are aware of impacts to the Agencies and how much they need to prioritize these CEOS actions, noting CEOS is best efforts."*
- Stephen Briggs (via chat): *"We had identified actions to reflect the recs and it was agreed that for consistency we should put those in the WP rather than try to maintain a separate list. This was a good idea. The actions themselves are not much more committing as such than the recommendations but they answer the question if we accept the recs then so what? There is not much additional effort involved, it is more incremental and organisational. But don't underestimate the importance of the augmentation of the GHG task - this was missing completely the terrestrial and ocean inputs which are absolutely vital to the establishment of an operational service. Does not need much effort, but is critical for success."*
- Joanna Post (UNFCCC) (via chat): *"It is worth noting that the info on loss and damage will now come under a category of guiding questions called "cross-cutting"."* She also noted the website on GST is at: https://unfccc.int/topics/global-stocktake.
- Albrecht von Bargen (DLR) (via chat): *"in reference to the mapping of recommendation actions to activities in other groups: at the side meeting* Jörg *added that we will have a WGClimate workshop regarding gap analysis of ECV and the next version, dedicated to carbon cycle which will address the GCOS ECVs (most of the variables needed) and the additional model-specific variables. He would like to have a back-to-back session to comment on action items under #1 and #2."*
- Jörg Schulz (EUMETSAT) noted that EUMETSAT welcomes the updates to the draft Strategy. He supports the decision table in the appendix of actions being moved to the CEOS Work Plan. In addressing comments from people, he noted better understanding of the efforts and inputs are needed from CEOS Agencies. Integrating into the CEOS Work Plan is a helpful step. Cooperation within CEOS with a series of workshops is also helpful and noted Mark Dowell's proposed workshop is a good starting point to identify experts and models that can be used in follow-up workshops on gap analysis that can inform an approach to the actions.
- Stephen Briggs noted that the intention of putting actions into the CEOS Work Plan would be first to engage and ensure they are consistent with the other actions that are going on; the CEOS Work Plan is used as it summarises CEOS activities across all areas, is time-invariant and ensures consistency with other ongoing work in CEOS.
- WGDisasters and WGCapD are key participants. Stephen Briggs noted equity points and WGCapD potential to push this forward. He noted also the SDGs, of which 13 of 17 directly link to climate and climate change - CEOS efforts on SDGs also strongly impact this, in particular adaptation. There are lots of ongoing activities across CEOS, so integrating these into the work plan makes sense. Stephen has been working with Marie-Claire to work the actions into the 2022 to 2024 work plan. About 4-5 of the 9 recommendations are already being acted on before the next three-year Work Plan would be formally approved at SIT next year.
- Frank Martin Seifert (ESA) noted they have created a writing team for the synthesis report for GST, and have assigned writers to specific chapters of the report. Mitigation is led by CEOS (Dave and himself), and adaptation is led by WMO. The team will try to have a draft of the report ready before COP-26, with the first version ready for the February deadline for technical assessment.

- Beth Greenaway (UKSA) raised the issue of timing, with the CEOS Plenary taking place at the same time as COP. She noted there is an opportunity to highlight some of the CEOS actions in this statement. Stephen Briggs noted the draft statement does reflect all of these different aspects.
- David Crisp (NASA) would welcome having a look at the final draft of the statement, and also agree it could be used to help accelerate some of the actions identified.
- Albrecht von Bargen (DLR) noted the statement is currently with NASA and the US State Department. CGMS and CEOS principals will get the final draft for approval, which should be next week.
- David Green (NASA) noted that WGDisasters would like to consider if they can help fill the knowledge or skill gap for the "Loss & Damage", and Steven Briggs agrees WGDisasters involvement will be key.
- Jörg noted that from experience, we shouldn't over emphasise the statement too much. Another option is to think about bringing the message to Earth Information Day. Should also discuss what we should do together for the virtual poster meeting, and work on how the contributions are made.
- Stephen Briggs noted the aim is to work with countries who will be trained in a way such that they can use satellite data and then have them advocate the use of satellite data to their peers. It's much more effective if we can partner with countries themselves and have them demonstrate how they're using the data.
- A number of agencies expressed interest in seeing the latest CEOS/CGMS statement to COP and the SIT Chair team will ask WGClimate to circulate.

SIT-TW-2021-06	CEOS Agencies asked to keep the WGClimate Chair and the CEO updated on developments and plans pertaining to the potential participation of their representatives in COP-26 and the EID.	**31 Oct 2021**
	Rationale: Multiple activities are being planned, and the SIT Technical Workshop noted that collective CEOS awareness and a coordinated effort is needed for COP-26. The WGClimate Chair and the CEO were identified as the relevant points of contact.	

SIT-TW-2021-07	CEOS Chair and SIT Chair to confer on reserving time on the 2021 CEOS Plenary agenda for CEOS to review and discuss the *UNFCCC Global Stocktake Systematic Observation Synthesis Report* and the CEOS contribution.	**31 Oct 2021**
	Rationale: The UNFCCC Secretariat emphasised the importance of CEOS fully engaging on the UNFCCC Global Stocktake Systematic Observation Synthesis Report.	

2.3: Carbon and Biomass (Part 2)

2.3.1: Introduction to the International Methane Emissions Observatory (IMEO)

Presenters: (Steven Hamburg, Environmental Defense Fund, EDF) [slides]

Main points:

- The IMEO represents an opportunity to catalyse and accelerate emissions reductions.
- IMEO's role is to determine what is being emitted, where it is being emitted and how much is being emitted.
- Better data is needed to enable targeted methane mitigation strategies and policies: satellites are complementary for collecting this data
- Targeted measures are needed to realise the full potential of methane mitigation in the fossil fuel sector. The tools that exist today could help reduce methane emissions from the oil and gas sector by 75% while saving money.
- The Oil & Gas Methane Partnership (OGMP) 2.0 was launched in November 2020 and will improve methane reporting around the world.
- IMEO will answer the methane emissions data problem by collecting data, applying Big Data, data science, and machine learning, reconciling inconsistencies, and identifying gaps.

2.3.2: Discussion of IMEO-CEOS Cooperation

Moderator: David Crisp (NASA JPL) [slides]

Main discussion points:

- David noted the need for more communication between IMEO and CEOS, and the many critical areas of possible collaboration. He asked how we can make the interface between IMEO and space agencies more coordinated and efficient, and what common set of requirements is in support of IMEO objectives.
- Steven Hamburg suggested that having a working group, broader than just space agencies, private sector, and hybrid, to create a mechanism for a rapid and constant update would be great.
- David Crisp suggested that IG3IS and WMO could take on the space segment within CEOS and try to manage the data flows within. They could rely on other organisations to manage the effort of putting together ground based, industry inputs, etc. Steven Hamburg agreed that we should explore it, however, there is a challenge around so many private sector products and how to integrate all of them. David noted the world geospatial industry council effort - can work with those organisations, with IMEO in this context.
- What specific types of collaboration between CEOS and IMEO would be most beneficial? Regular exchanges of information at CEOS and IMEO meetings? Coordination with campaigns or deliverables produced by CEOS WGs or VCs? Science campaigns - CEOS could contribute, including for national synthesis of all available resources.
- Steven Hamburg noted that IMEO is putting a science team together now, which Manfredi Caltagirone is leading. The effort was established in March, currently hiring a science manager in UNEP. This would be working with the scientific oversight committee to coordinate different scientific activities of IMEO. The UN recruitment process is ongoing. The science oversight committee officially formed last week and at the first meeting Steven was elected to chair. In general, IMEO needs to find ways to collaborate with the CEOS community. Manfredi agrees with the pragmatic approach suggested by Steven, in which we can try to see how the integration of different sources can be performed in a way that is practical and actionable.
- Jörg Schulz (EUMETSAT) noted that this is a very interesting activity, suggested the table on space data could include the Copernicus CO2 mission. Jörg also noted that the GHG Task Team can support technical engagement between CEOS and IMEO as Methane falls within its mandate.

- Adam Lewis (SIT Co-Chair, GA) noted SIT Chair and Vice Chair teams will follow up with all CEOS stakeholders and technical teams.
- Adam Lewis questioned whether these results are publicly available / released. Manfredi Caltagirone responded (via chat): *"Yes, other than assets data from companies (that are confidential), all IMEO data will be publicly available"*.
- Ake Rosenqvist (JAXA) (via chat): "*@Steven Hamburg: Thanks for an interesting presentation. To what extent are CH4 emissions from natural sources (e.g., Amazon/Congo wetlands) of interest? As they contribute to the total budget, knowing their contribution would help improve estimates of the anthropogenic emissions. Still, natural emissions are rarely discussed"*
- Steven Hamburg (IMEO) (via chat): *"IMEO focus is on quantifying and mapping anthropogenic methane emissions, initially fossil fuels. IMEO will need to look at biogenic sources related to source attribution, but it will not be a major focus of our work beyond the degree that is required to deal with attribution. Understanding biogenic emissions is very important but we are trying to stay focused to ensure we can provide the data need for rapid mitigation."*

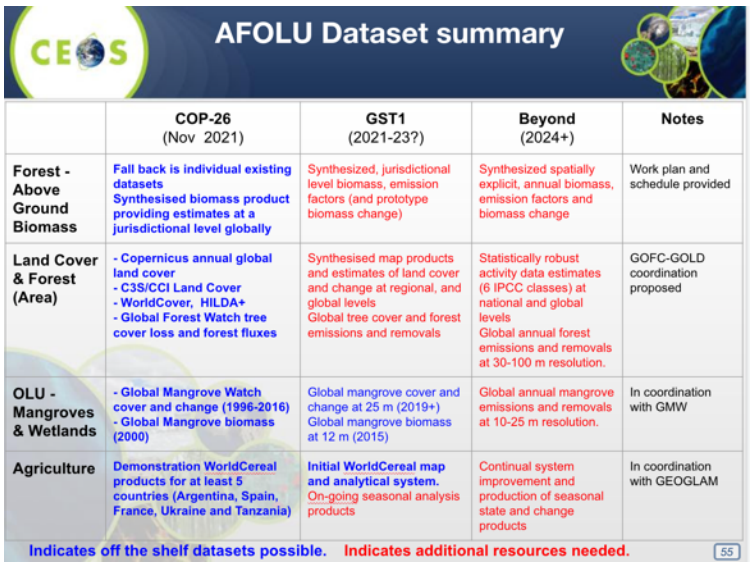
SIT-TW-2021-08	CEOS SIT Chair to follow up with the International Methane Emissions Observatory (IMEO) to explore possible avenues for cooperation on Carbon and Biomass between CEOS and IMEO.	**30 Sep 2021**
	Rationale: Some CEOS Agencies see opportunities to support IMEO objectives with data from a wide range of Earth observing missions.	

2.3.3: AFOLU Product Status & Roadmap Next Steps in 2022

Presenters: Osamu Ochiai (JAXA) and Frank Martin Seifert (ESA) (LSI-VC Forest & Biomass Team Leads) [slides]

Main points:

- The AFOLU Dataset is compiled from 4 dedicated product teams organized towards harmonizing different products: agriculture, above ground biomass (forest), land cover & forest, and other land use (mangroves and wetlands).
- The status of the dataset is summarised below:



- New biomass products are being released (e.g., GEDI, August 2021). Intercomparison, validation and harmonization of these products is being undertaken to increase product improvement and uptake. Open science activity using new 2020 products and available reference data is in progress.

- National Inventory Test User Group update: country engagement underway to improve understanding and uptake of EO data. Ten countries have been identified for a national test, and the case studies are in progress.
- Beyond COP-26, a comprehensive roadmap guiding a sustained coordination framework for AFOLU efforts by space agencies is needed for on-going efforts towards harmonized products for GST-1 in 2023, as well as efforts towards global land emission and removals modelling and countries reporting to the UNFCCC. AFOLU efforts will also support sustainable architecture supporting long term GST process and integration of GHG and AFOLU as top-down and bottom-up emissions and removals.
- Long term support and comprehensive satellite contribution to meet the needs of IPCC Guidelines will require more space agency support. Osamu and Frank will contact Principals to confirm support.
- Potential engagement with GEO linking related Initiatives e.g., GFOI, GEO-GLAM, GEO-Wetland, GEO-LDN, etc.

SIT-TW-2021-09	The CEOS AFOLU Roadmap team to reach out to CEOS Principals ahead of the 2021 CEOS Plenary to request support for escalation of a full Roadmap effort starting in 2022.	**31 Oct 2021**
	Rationale: At the SIT Technical Workshop, the AFOLU Roadmap team estimated that a significant increase in CEOS Agency support and resources will be needed to advance a full Roadmap effort in support of the UNFCCC Global Stocktake process.	

2.3.4: GHG Product Status

Presenter: David Crisp (WGClimate GHG Team Lead, NASA) [slides]

Main points:

- To support the 2023 Global Stocktake (GST), Parties to the Paris Agreement are compiling inventories of Greenhouse Gas (GHG) emissions to assess progress toward their Nationally Determined Contributions (NDCs) to emission reductions. These inventories are based on bottom-up methods that estimate annual emissions and removals of GHGs from the sectors specified in the 2006 IPCC Guidelines for National GHG Inventories.
- GHG emissions and removals can also be estimated from spatially- and temporally-resolved measurements of their concentrations using atmospheric inverse methods. The Top-down atmospheric inventories derived from these fluxes are not as process-specific as bottom-up inventories, complement those methods by providing an integrated constraint on fluxes from all processes on spatial scales spanning individual large power plants or urban areas to nations or the entire globe.
- The primary objective of these pilot top-down GHG products is to start a conversation with stakeholders and users to establish the utility and best practices for combining bottom-up and top-down products to enable a more complete GST.
- Pilot products are also being developed to track emissions from localized sources including large urban areas, power plants and oil fields.
- Preliminary regional to national scale GHG products and documentation are being delivered for review by CEOS GST Stakeholders. Examples of space-based estimates of local sources (power plants, large urban areas, fossil fuel extractions sites) under development. Updates to pilot inventories, documentation and capacity building activities continuing through October in preparation for COP-26.

- COP-26 Plans: Pilot top-down GHG products featured in CEOS Report to SBSTA; Prepare posters to support the 2021 Earth Information Day (Nov 2); and, Side Events have been proposed.

2.3.5: GHG-AFOLU cooperation

Presenters: David Crisp (WGClimate GHG Team Lead, NASA) [slides]

Main points:

- Agriculture, Forestry, and Other Land Use (AFOLU) contributes the second largest source of emissions (after fossil fuel use) globally and is the primary source of emissions in many developing nations.
- In the context of the GST, AFOLU emissions are estimated from the product of an activity index (i.e., number of acres of forest converted to agriculture) and an emission factor (i.e., number of tons of CO2 released per acre), and are only applied to 'Managed Land'.
- Top-down atmospheric measurements provide an integrated estimate of net emissions and removals by all processes and can cover all areas.
- The terrestrial Net Carbon Exchange (NCE) is the net flux of carbon between the surface and atmosphere, and can be defined as the sum of the fossil fuel and cement emissions, and the net biosphere exchange.
- The top-down GHG budgets for CO2 and CH4 are available at COP-26, while the bottom-up AFOLU inventory products are still evolving.
- The next steps are to add inputs to the GST website, and add chapters on AFOLU Input and GHG/AFOLU coordination to the UNFCCC Systematic Observations Synthesis Document.
- The GHG-AFOLU Workshop is now planned for Q4 2021.
- To advance the GHG-AFOLU integration, we must ensure that CEOS Principals have a clear understanding of the GHG/AFOLU coordination needs in the context of the GST.
- CEOS GHG and AFOLU teams must create a clear work plan to be implemented: A systematic approach to integrate and assimilate multiple products into models is needed and key partners must be identified inside and outside CEOS, and identify who is doing what by when (i.e., leads, contributors, milestone, work packages).
- Do we need to consider a revised target for coordinated GHG/AFOLU deliveries to the UNFCCC: Is there still time to affect GST-1 or should we retarget efforts for GST-2?

Main discussion points:

- Adam Lewis (SIT Co-Chair, GA) asked what sort of message will be presented for the principals at Plenary? For example, some sort of maturity index. David agreed we need something like the technology readiness levels (TRL). The primary message is that we accomplished a great deal to date, finalising the products to date. So far many of the activities have been science experiments, and we need more of an operational activity.
- John Remedios (UK NCEO) agreed a 'TRL' would be helpful.
- David noted that they rely on the Global Carbon Project to indicate best global estimates from a bottom-up context as there is too much going on in the global carbon cycle. The national inventory communities have a lot more inertia and tend to move forward in a more systematic way, whereas the scientific projects are much more responsive to the fact that the planet is changing incredibly fast. We need to combine the greatest assets from the operational and scientific activities.
- Albrecht von Bargen (DLR) noted that we will have an update of the GHG Roadmap, and will be looking forward to the GST strategy recommendations which will have good starting points to bring together the work plan. David noted that in the original work plan, there was a strong focus on GHG and the next step would be to better integrate the activities with those from the AFOLU team.
- Joanna Post (UNFCCC) (via chat): *"important to inform on and reconcile the emissions measured compared to emissions reported in national reports (e.g., as discussed for CH4 and biomass)"*
- Dave responded to Joanna's comment by noting that the team must consider two customers here: first the national inventory community trying to build their inventories, and the other is to start to build a measurement and verification system to help us understand to what extent UNFCCC/IPCC inventories are tracking GHGs. The primary reason for suggesting pilot activities was

to first identify the best products for doing this, and how to integrate those. This also included what are the best ways of integrating the bottom-up and top-down methods of the national inventory and space -based methods, and how do we put these together to make a synthesis report that will give us the best stocktake possible. David noted he needs some top-down help to get the conversation going and keep it moving.

SIT-TW-2021-10	SIT Chair will facilitate further discussion of the GHG-AFOLU cooperation ahead of the 2021 CEOS Plenary to support a clear understanding by Principals of the GHG/AFOLU coordination needs in the context of the UNFCCC Global Stocktake process. In addition, the GHG and AFOLU teams will work towards the late Nov. 2021 workshop at the JRC as an opportunity to plan 2022 activities and to start a cooperation work plan.	**31 Oct 2021**
	Rationale: The SIT Technical Workshop recognized the importance of GHG/AFOLU coordination and a plan for next steps is needed.	

2.3.6: Biomass Dataset & GEO-TREES

Presenter: Laura Duncanson (NASA/UMD) [slides]

Main points:

- The CEOS Biomass Protocol was endorsed at SIT-36. The summary of recommendations for improved global forest biomass mapping includes:
  - The large number of new biomass datasets could reduce product uptake by the user community unless validation activities are user-friendly, transparent, and well-coordinated.
  - Collection of reference data following shared protocols enables data to be used by the global community, not only one mission or agency.
  - Where possible, large forest plots, TLS, and airborne lidar should be collected following technical guidance in the protocol document.
  - We proposed a biomass reference system and encouraged CEOS agencies to support and fund data collection, particularly in the tropics.
  - Reference data should be free and open to allow for transparent, reproducible product validation.
- Encouraged CEOS agency cooperation and funding support of data collection for biomass validation following recommendations from the biomass protocol (open field and airborne data). There is an opportunity for lasting contributions to forest carbon monitoring.
- The GEO-TREES programme was an activity accepted in March 2021 for the 2021-2022 GEO work programme.
- Biomass harmonization products are being assessed following the WGCV biomass protocol using available reference data in pilot USGS SilvaCarbon countries.
- In collaboration with Development Seed and the MAAP (Multi-Mission Algorithm and Analysis) team, the biomass harmonization activity is working on a web-based dashboard to allow exploration of the new biomass products, and associated storytelling by product teams and data users (e.g., Paraguay, Peru, Wales, Japan). The dashboard is planned for release in advance of COP-26.

SIT-TW-2021-11	CEOS Agencies have been asked to consider contributing to the GEO-TREES activity, to build upon the initial support delivered by CNES, NASA and ESA.	**31 Oct 2021**
	Rationale: GEO-TREES is recognised as an important step to ensure the ground truth requirements for the CEOS Biomass Protocol.	

2.3.7: COP-26 and GST Dataset Communications

Presenters: Albrecht von Bargen (WGClimate) and Stephen Ward (SIT Chair Team) [slides]

Main points:

- The usual CEOS Statement at SBSTA is under preparation, and the draft will be circulated to CEOS and CGMS Principals.
- In addition, a UNFCCC side event request has been submitted jointly by RESTEC/JAXA, ESA and GOFC-GOLD on "Satellites in support of national GHG reporting and Global Stocktake".
- Earth Information Day during COP-26 is planned for 2 November 2021 (TBC).
- SIT Chair Team had an action from SIT-36 to prepare a dedicated area on ceos.org for our contributions to the GST, and has been developing a consolidated presentation of the various GHG and AFOLU datasets and associated guidance. This is planned to be a thin layer of introductory information to help users find all relevant CEOS contributions (and in English, French, Spanish).
- The site is currently being developed at ceos.org/observations/gst.
- Inputs are needed from the GHG and Biomass Teams and from GFW (via USGS).

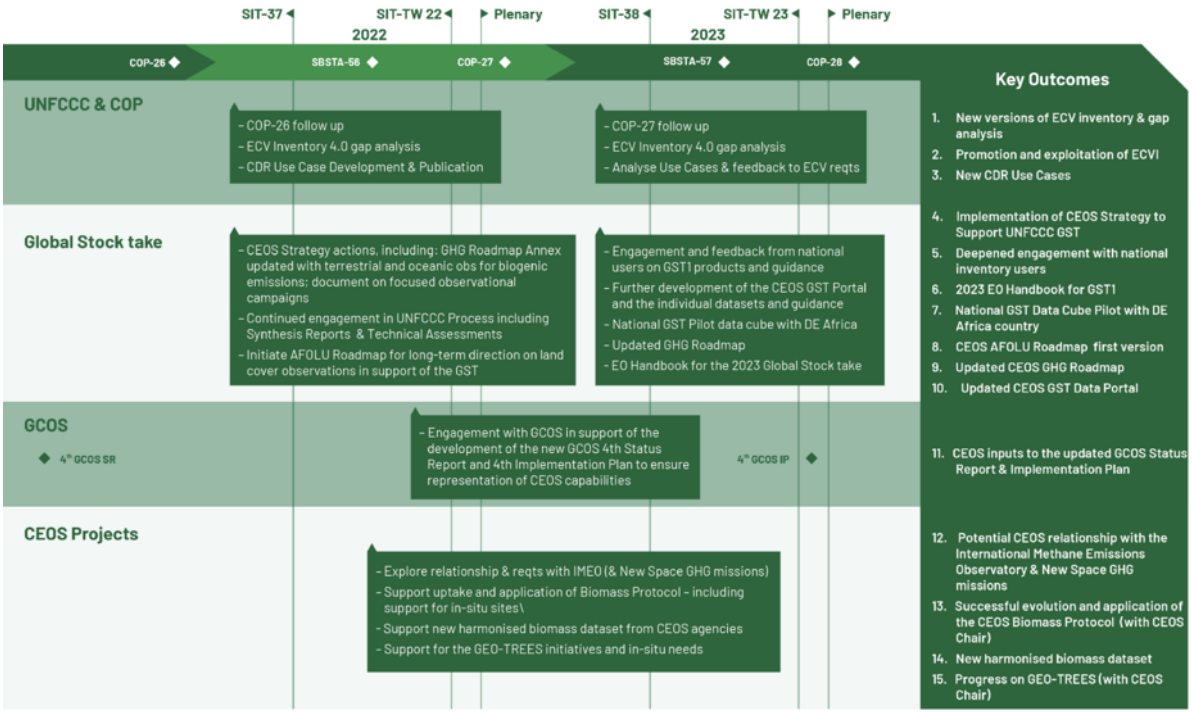
SIT-TW-2021-12	Biomass and GHG Teams to finalise inputs on their dataset representation on the CEOS GST Data Portal.	**30 September**
	Rationale: In preparation for COP26 (Nov. 1-12), the SIT Chair and CEOS Chair Teams plan to have the content translated into French & Spanish during the month of October.	

2.4: Introduction of the Incoming SIT Chair Prospectus

Presenters: Ivan Petiteville (Incoming SIT Chair Team, ESA) [slides]

Main points:

- As SIT Chair, ESA will focus on global challenges with strong UN mandates, GEO support, and high relevance for satellite Earth Observation. The term will explore how CEOS can employ new geometries with industry, new missions, and new data and analysis techniques for maximum impact and continued relevance in a changing sector.
- Thematic priorities are: Climate & Carbon (UNFCCC, Paris Agreement and the GST); Sustainable Development Goals (2030 Agenda); Disaster Risk Reduction (Sendai Framework); and potentially Resilient Cities & Human Settlements (New Urban Agenda 2016, SDG #11) that will be endorsed as 4th GEO Priority at the coming GEO Plenary; as well as support for ongoing CEOS thematic observing strategies, such as COVERAGE, COAST and our VCs (e.g., GEO Blue Planet & SDG 14.1 eutrophication).
- Success in these thematic priorities might translate into opportunities for engaging new users not familiar with EO from space, on these and other themes.
- The ESA team is developing outcome-focused plans in consultation with CEOS stakeholders (Climate and Carbon example below).



Main discussion points:

- Steve Briggs (SIT Vice Chair Team) noted that the presence of IMEO/EDF here with Steven Hamburg is one of the most important events for CEOS ever. In the future CEOS will need to be much more flexible in how it deals with agencies such as EDF and groups like IMEO as more and more data will come from non-traditional non-government sources. CEOS need to figure out how to be more inclusive to these, and this will be a focus for ESA in the coming two years, as you will see in the coming presentation. CEOS has struggled in the past in trying to deal with private sector data suppliers, in particular, and this needs to be addressed. Good examples have already been seen in, for example, the forest work with GEE and GFW.
- Face to face meetings highlighted is yet to be seen, depending on how the pandemic situation evolves. It will be planned to be face-to-face, however, the team will have to follow the rules of the Italian government.
- Kerry Sawyer (NOAA) (via chat): *"I note quite a bit of reference to new...new space companies, new mission needs, new users, new data techniques. And noting that our Strategic Guidance Document, which has 7-10 years lifespan, was endorsed in Nov 2013, is it time for a new CEOS? Is there any thought to updating CEOS Strategic Guidance and the way CEOS is structured to address these many new opportunities?"*
- Mark Dowell (COM/JRC) (via chat): *"On the user needs aspect, we should strive to increasingly think of this through the full value chain not just space segment to user need. I think about experiences over the last 5-10 years in CEOS (and in Europe through Copernicus). This includes engaging many stakeholders inside and outside of CEOS, e.g., the service provision aspects."*

Thursday 16th September

3.1: Working Teams and Other Plenary Items

3.1.1: Working Group Continuity

Presenter: Christine Bognar (CEOS Chair Team, NASA) [slides] [WG process paper]

Main points:

- Christine started the workshop by sharing an introduction of the CEOS Working Group (WG) process paper that highlights the cross-cutting work of the CEOS WGs, their complementarity with the Virtual Constellations (VCs) and with each other. The paper also guides on WG leadership succession.
- Three of the five WGs will transition to new leadership this year. The nominations have been approved by consensus within the relevant WG in preparation for the SIT Technical Workshop. Each nomination will be presented for endorsement during the CEOS Plenary on Nov. 1-4, if approved in this meeting. The term shall begin upon adjournment of the 2021 CEOS Plenary.
- **Working Group on Capacity Building and Data Democracy (WGCapD):** Simonetta Di Pippo (CEOS Principal, UNOOSA) nominated Mr. Jorge del Rio Vera as WG Chair to serve for two years.
- **Working Group on Disasters (WGDisasters):** Raul Kulichevsky (CEOS Principal, CONAE) nominated Dr. Laura Frulla (CONAE)to serve two years as WG Vice Chair, followed by two years as WG Chair.
- **Working Group on Information Systems and Services (WGISS):** Tim Stryker (CEOS Principal, USGS) nominated Mr. Tom Sohre, to serve two years as WG Vice Chair, followed by two years as WG Chair.
- Contribution of WG Chairs, completing their agency's four year commitment was acknowledged:
  - WGCapD - Dr. Nancy Searby, NASA;
  - WGDisasters -Dr. David Green, NASA; and,
  - WGISS - Dr. Rob Woodcock, CSIRO.

SIT-TW-2021-13	The SIT Technical Workshop asked CEOS Agencies to consider nominating a candidate to serve two years as WGCapD Vice Chair, followed by two years as WGCapD Chair.	**ASAP before CEOS Plenary**
	Rationale: Continuity of CEOS Working Group leadership is essential. To date in 2021, the CEOS WGCapD has sought nominations for both the Chair and Vice-Chair roles due to a change in the normal cadence of leadership rotation (the vacancies were accelerated by two years due to an incomplete four-year agency commitment). A nomination for WGCapD Chair has been received (Jorge del Rio Vera, UNOOSA), but a nomination for WGCapD Vice Chair is needed as soon as possible. Consistent with CEOS governance, nominations for both roles need to be presented for endorsement at the CEOS Plenary.	

Decision 03	The SIT Technical Workshop agreed to bring the following agency level nominations for Working Group Chair and Vice Chair to the 2021 CEOS Plenary for endorsement: ● WGCapD Chair: Mr. Jorge del Rio Vera (UNOOSA) ● WGDisasters Vice Chair: Dr. Laura Frulla (CONAE) ● WGISS Vice Chair: Mr. Tom Sohre (USGS)

3.1.2: WGCV Topics

Presenter: Akihiko Kuze (WGCV Chair, JAXA) [slides]

Main points:

- WGCV-49 discussed ways to improve its CARD4L efficiency and response times.
- WGCV members joined a recent ISO 19124 (August) where Maturity Matrix and Data Product Level Definitions were discussed. Draft technical standard deadline is the end of December 2021.
- The WGCV-50 has proposed a meeting with WGISS between May 21-24, 2022 in Tokyo.
- **Total and Spectral Solar Irradiance Sensor-1 (TSIS-1):** the objective of TSIS is accurate measurement of total and spectral solar irradiance to improve understanding of solar variability and the Earth's climate response to solar variability. It has a high accuracy of (0.3-1.3%), high resolution (0.01 nm or better). It is also called the TSIS HSRS database. TSIS-HSRS uncertainty in SWIR has been reduced to 1% from (8-10%). The plan is to recommend TSIS-1 HSRS as the new CEOS solar irradiance reference spectrum after one year of assessment.
- **Vicarious calibration and intercomparison (VCAL) portal site for Greenhouse Gas (GHG) sensors:** supports the radiometric calibration for GHG missions to estimate the light path modification by aerosol and clouds as they have the largest errors in retrievals. Absolute radiometric calibration is needed to distinguish between the scattering. Consistency between GHG sensors (i.e., OCO, TROPOMI, GOSAT) is currently being assessed for CH4 and CO2.
- The MODIS Bidirectional Reflection Distribution Function (BRDF) database for bright surface and Solar Reference Data are important references.

Main discussion points:

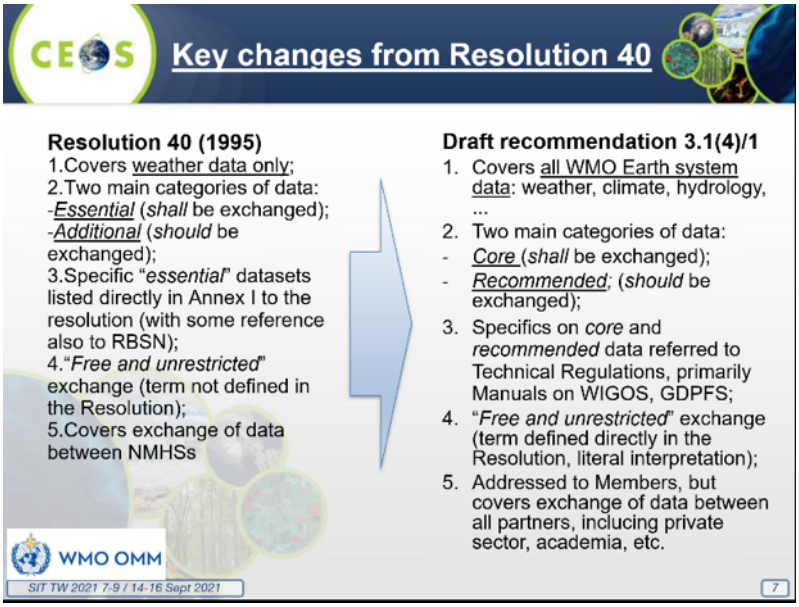
- Alex Held (SIT Co-Chair, CSIRO) asked where the data is currently based, and Akihiko noted it is test site based.
- Ivan Petiteville (SIT Vice Chair Team, ESA) asked about commercial operators of satellites carrying GHG sensors and their challenges around radiometric and geometric validation, and whether this calibration infrastructure is limited to space agencies or could it in future be used by commercial operators. Akihiko noted that it is an open database and they are happy to share with the commercials.
- Albrecht von Bargen (WGClimate) asked whether the solar reference data is also in collaboration with GSICS, and Akihiko confirmed this is the case. GSICS has already recommended TSIS as the recommended solar reference data. WGCV needs to access and evaluate the accuracy first which is why they need one more year for the testing.
- Adam Lewis (SIT Co-Chair, GA) thanked WGCV for their effort on the CEOS ARD assessment process as they are providing a vital service.
- Mark Dowell (COM/JRC) noted the need to build towards an operational GHG monitoring system, and that this kind of activity and service is a good example.
- David Crisp (NASA) added that currently, they have one vicarious calibration site (in Nevada) which is under serious threat from mining activities. CEOS need to coordinate with GSICS to find another sustainable site and validate it for future progress. Alex suggested Australia may have some candidate sites.

3.1.3: Update on WMO Data Policy

Presenter: Anthony Rea (Director of Infrastructure, WMO) [slides]

Main points:

- Anthony noted the World Meteorological Organization(WMO) Unified Policy For the International Exchange of Earth System Data will be presented at the Extraordinary Session of the World Meteorological Congress 11 to 22 October 2021 (virtual session). He also noted there is a website explaining some of the details: https://public.wmo.int/en/our-mandate/what-we-do/observations/Unified-WMO-Data-Policy-Resolution.
- International exchange of data is the major purpose of WMO. When the new data policy goes to WMO Congress later in 2021, congress hopes to agree to have a unified data policy for all WMO domains and disciplines.
- The key objective is the unrestricted exchange of the core data and also derived modelling products.
- Resolution 40 (1995) currently covers the weather data only, whereas the unified draft recommendation 3.1(4)/1 covers all WMO Earth system data: e.g., weather, climate, hydrology.
- Key expected benefits include improving the quality of downstream products such as precipitation forecast, understanding of the climate system and how it is reacting with the GHGs, the opportunity to strengthen national roles in coordination around acquisition and use of Earth system data, and a mutually beneficial relationship between public and private sectors.
- CGMS Agencies are committed to WIGOS vision 2040, i.e., to cover all key aspects of a comprehensive Earth System modelling. The commitment of CEOS agencies is also essential to realise the vision.
- The concept of core satellite data is framed primarily in terms of importance to global NWP, consistent with guidance from CM-14 and CGMS-47.
- WMO intends to approach the space agencies, assuming that the core satellite data gets approved by Congress in October.



SIT-TW-2021-14	SIT Chair will confer with CEOS Chair first, and with WMO if needed, to determine whether it would be feasible in terms of timing to have a formal update on the WMO Data Policy at CEOS Plenary, or at SIT-37 in the March/April 2022 timeframe.	**31 Oct 2021**
	Rationale: CEOS agencies may be impacted by some of the changes in the proposed WMO Data Policy. WMO Congress decision on the policy will occur before Plenary.	

3.1.4: CEOS Governance and Processes Document

Presenter: Marie-Claire Greening (CEO)

Main points:

- Marie-Claire had reviewed the CEOS Governance and Processes document and had advised that the document needed some updates. As per the document itself, specific amendments or modifications must be reviewed at a CEOS SIT meeting and approved at a subsequent CEOS Plenary. The revised document was therefore submitted to this SIT Technical Workshop for approval.
- Updated version of the document that has been thoroughly reviewed by the CEOS Secretariat and past CEOs can be found on the website (click here).
- There is a new organisation chart and a fully updated list of CEOS members and associates. Seeking feedback from all CEOS Agencies so that it can be presented for endorsement during the CEOS Plenary.
- No comments were raised, and both Sandra Cauffman (NASA/CEOS Chair) and Kerry Sawyer (NOAA) added their support.

Decision 04	The SIT Technical Workshop agreed to present for endorsement at the 2021 CEOS Plenary, the Governance and Processes v1.2 document updated with the approval of the CEOS Secretariat and further discussed at the SIT Technical Workshop.

3.2: Marine Science Session

3.2.1: Updates

Presenter: Adam Lewis (SIT Co-Chair, GA) [session intro slides]

Adam introduced the session, noting the focus is on the latest update on the UN Decade of Ocean Science for Sustainable Development. A discussion of the need for a more defined CEOS Oceans (marine and estuarine strategy), and the identification of issues and actions to be taken between now and CEOS Plenary will be covered.

OCR-VC contribution for UN Decade

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

Main points:

- Marie-Helene shared the role of OCR in the UN Decade of Ocean Science Themes: Clean Ocean, Safe Ocean, and Healthy and Resilient Ocean.
  - Clean Ocean: IOCCG has issued two reports. Earth Observations in Support of Global Water Quality Monitoring (2018) and Remote Sensing of Plastic Marine Litter and Debris (2021).

- Safe Ocean: IOCCG Report on Observation of Harmful Algal Blooms with Ocean Colour Radiometry (2021).
- Healthy and Resilient Ocean: Aquatic Carbon from Space: Community Workshop and White Paper, Q1 (Feb 2022), under the leadership of ESA and NASA; Special journal issue (Earth Science Reviews) on Aquatic Carbon Stocks and Fluxes: The Big Picture from Remote Sensing, Q4 2022.

- Three main reports have been developed:
  - The synergy between Ocean Colour and Biogeochemical/Ecosystem Models (2020). Integration of OCR and mathematical models help understand processes and trends in the ocean's ecosystem, biogeochemistry, and climate.
  - Protocol Series. Community-vetted field protocols for calibration & validation of satellite OCR data products, promoting the collection and assembly of climate quality, ocean optical datasets by the global ocean colour community (7 volumes to date).
  - Report on Uncertainties in Ocean Colour Remote Sensing (2019). Advancing quantification and dissemination of OCR product uncertainty estimates, ensuring traceability of OCR products, and provision of uncertainties to management systems and models.
- A Transparent Ocean-Open Access to Data, Information, Technologies role:
  - National space agencies operating OCR satellites provide free and open access to OCR data.
  - IOCCG conducts regular Summer Lecture Series to educate the next generation OCR scientists and users and addresses advanced topics in OCR remote sensing. Next course in Villefranche, France (July 2022).
- OCR-VC agencies aim to facilitate easy online access to complete OCR data time series and processing information.

Main discussion points:

- Stephen Briggs (SIT Vice Chair Team) noted that the requirement for ocean observations on Aquatic Carbon Stocks and Fluxes is relevant to the second recommendation of the GST Strategy discussion held on the previous day. It will be a great opportunity to work with the task force on these points. Marie-Helene noted that they are interested in collaborating on this matter.

SST-VC Update

Regionally relevant shelf-scale and coastal EO for marine stakeholders in southern Benguela Current Large Marine Ecosystem (BCLME).

Presenter: Christo Whittle (CSIR, SANSA) [slides]

Main points:

- Christo provided brief information on the technical road map for the development of Regional EO Data portals which seek to provide an accurate representation of the self-scale marine phenomenon. A recent comparison of 15 L4 SST products highlighted there is a high variance between them that corresponds to coastal upwelling zones.
- Since 4 products were representing SST from several sources, the results and outputs are affected by erroneous flagging of suspected cloud pixels on IR observations. Standard cloud flagging options for MODIS SST product that moves to ocean pixels retain the pixels representing cloud edges.
- CSIR developed its own cloud flagging procedure that reduces the impact of cloud edge pixels on single overpasses and further reduces cloud influence by generating daily averages of the cloud at single overpass scenes from both MODIS sensors using daytime and nighttime data. These CSIR MODIS SST products are being validated against GHRSST MUR and *in situ* data improving on the L4 SST datasets.
- Christo concluded by highlighting the further developments: extend EO products to the present to compliment near-real time data delivery; ingestion of EO products into a marine data cube; develop scripts to produce time-series analytics in Jupyter notebooks; validate SST from 3 hydrodynamic models (BRAN, GLORYS, and NGHYCOM); deploy ISAR in Cape Columbine upwelling

cell during BENFLEX cruise in December 2021; and, collaborate with COVERAGE to include regional Benguela EO products as a test case.

Main discussion points:

- Ed Armstrong (NASA) asked about the methodology used to produce the customised regional MODIS SST and ocean colour products. Christo noted that they used NASA SeaDAS for SST Development, as well as Python and Matlab. A write-up explaining the algorithm development is being prepared. For the ocean colour algorithm, a write up has been completed already. For MODIS, they aim to submit SST and model validation towards the end of this year.
- Adam asked about the Marine data cube project, and Christo noted the data cube development is a pilot project currently. This will gradually be expanded in the next financial year.

COVERAGE

Presenter: Vardis Tsontos (NASA, COVERAGE) [slides]

Main points:

- COVERAGE is cross cutting agency collaboration of the four ocean VCs, MBON and Blue Planet having cumulative CEOS contribution to the UN decade of the Ocean for Sustainable development.
- COVERAGE Phase C, launched in June 2021, is integral to the UN Decade of the Ocean and focuses on next generation data service infrastructure for a Digitally Integrated Ocean Observing System in Support of Marine Science and Ecosystem Based Management. There are links to SGD 14 (Life Below Water).
- An article on COVERAGE has been published in a special edition of Marine Technology Society Journal (June 2021, https://doi.org/10.4031/MTSJ.55.3.45).
- COVERAGE has been coordinating with relevant Decade U.S. and IOC efforts: “Open Ocean Cloud”, “Digital Twins of the Oceans (DITTO), Marine Life 2030, CEOS-COAST.
- Anticipated next steps include:
  - the consolidation and prioritization of concept proposals by mid-October; alignment with UN Decade program proposals approved by IOC; and,
  - continued work on advancing distributed, hybrid-cloud architectures (NASA/AWS & EUMETSAT/WEkEO) for improved integration of interagency EO and in-situ data.
- With regards to the two activities delineated:
  - Sargasso Sea Commission (SSC) - organisation promotes Sargasso Sea conservation; formed by 10 nation signatories; SSC has recently received multiyear global environmental facility support to develop the ecosystem and ecosystem assessment and action plan for Sargasso Sea which is an area beyond national jurisdiction. They are interested in enabling the routine production of ecosystem indicators.
  - Inter-American Tropical Tuna Commission (IATTC) - 21 nation intergovernmental agencies are responsible for monitoring, scientific assessment, and management of tuna and large pelagic fisheries in the E. Tropical Pacific. They are interested in leveraging COVERAGE to enable routine usage of EO data for emerging ecosystem based fisheries assessment approaches.

Update on the CEOS-COAST *Ad Hoc* Team

Presenters: Paul M. DiGiacomo (CEOS COAST AHT Lead, NOAA) [slides]

Main points:

- Paul noted that CEOS-COAST was endorsed as a ‘UN Ocean Decade’ Contribution in June 2021.
- There has been significant progress in product development and stakeholder engagement for the first 2 COAST Pilot Regions (the Bay of Bengal and the Chesapeake Bay) with 5 thematic product areas now in the development phase with 5 pilot regions for 2022. It will be expanding particularly in Argentina, South America, small island developing states like the Caribbean, the Pacific, and the west coast of Africa early next year.
- For 2022, COAST is preparing half day regional user engagement workshops to co-design and co-develop products.

- A high-level graphic and schedule of the CEOS-COAST Engaging Users Showcase event were shared. GEO/CEOS Engaging Users Event on COAST Product Showcase (5 Oct 2021). CEOS agencies should attend and promote the webinar: https://earthobservations.org/geo_blog_obs.php?id=521
- Paul presented the discussion for the development of a proposal for an overarching CEOS Ocean Strategy for 2022.

Main discussion points:

- Mark Dowell (COM/JRC) added that the idea of the CEOS ocean and coastal strategy should be given serious consideration, it is perfect timing and there are new opportunities.
- Paul noted they will be happy to facilitate analysis in terms of the different ocean decade programs and look for the complementarity between what CEOS can offer. There are opportunities to take some of the needs and requirements that are manifest as part of the decade, identify the gaps and opportunities, increase temporal, spectral coverage of the oceans.
- Merrie Beth Neely (CEOS-COAST) noted several coordination opportunities identified in the session today that could benefit the UN Ocean Decade: OCR-VC providing requirements; SST-VC encouraging the use of the EAIL/Data Cube; COVERAGE providing key tools; and COAST providing products/leveraging the EAIL and showcasing tools.

3.3: SIT Technical Workshop 2021 Final Review

Discussion leads: Adam Lewis (SIT Co-Chair, GA) and Alex Held (SIT Co-Chair, CSIRO) [slides]

Refer to the session slides for the points made under each topic. Below are major discussion items raised in addition.

Opening Technical Workshop (Adam, Alex) [slides]

- No additional comments were added.

CEOS Chair Theme Session (Karen St. Germain, NASA) [slides]

- Sandra Cauffman (CEOS Chair Team, NASA) agreed to the CEOS Plenary desired outcome about the CEOS Chair implementation plan.

CEOS's Impact on Open Science through DE-Africa (Adam Lewis, GA) [slides]

- Adam noted DE-Africa pulls together a broad suite of CEOS activities.

Analysis Ready Data (Lewis Armstrong, SIT Chair Team, LSI-VC, SST-VC) [slides]

- Christine Bognar (CEOS Chair Team, NASA) commented CEOS will be supportive of the actions and decisions recorded to ensure that the progress is made as noted.

Sustainable Development Goals AD Hoc Team (Alex and Marc Paganini, ESA, SDG AHT Co-lead) [slides]

- Sandra Cauffman (CEOS Chair Team, NASA), Brian Killough (SEO, NASA), Ivan Petiteville (SIT Vice Chair Team, ESA), Alex agreed with the summary as presented.

GEO Session (Yana Gevorgyan, GEO Secretariat Director) [slides]

- No additional comments were added.

Carbon and Biomass COP-26 Readiness & GST Portal (Adam) [slides]

- Beth Greenaway (UKSA) commented that the Plenary timing overlaps with COP-26. Christine noted the Plenary will be over four days and the plan is to have a late start in the U.S coast for the first two days allowing flexibility for UKSA and others who would be engaged in COP-26.
- Albrecht von Bargen (WGClimate, DLR) noted statements must be consolidated two weeks in advance of the meeting. The statement will be circulated to CEOS Principals for approval, following that to the US State Department, and then shared in advance of Plenary. At COP-26, the statement will be read by the US delegation.
- Christine confirmed the CEOS Chair will return its comments on the SBSTA statement early next week following review.
- The process of incorporating feedback from the Principals will be handled by WGClimate in coordination with CEOS Chair (Christine).
- Beth added they could make a short (e.g., 'Tweetable') statement in the media to help raise the profile. Kerry Sawyer (NOAA) welcomed the offer from UKSA to get some visibility for CEOS and CGMS. Christine suggested they discuss this offer offline.

SIT-TW-2021-15	CEOS Chair, SIT Chair, WGClimate Chair and UKSA to confer on opportunities for UKSA, CEOS and CGMS to focus world attention on CEOS remote sensing contributions, using social media and other platforms while the United Kingdom is hosting COP-26.	**COP-26**
	Rationale: U.K. Presidency of COP-26 provides extraordinary opportunities to focus international attention on CEOS as a key remote sensing forum for international coordination on Earth observation missions, data, and products for societal benefit.	

CEOS GST Strategy (Joanna Post, UNFCCC SEC) [slides]

- Stephen Briggs (SIT Vice Chair Team) noted that the decision was to put actions in the CEOS Work Plan related to the *CEOS Strategy for Support to the GST* that will be put forward for endorsement at CEOS Plenary.

IMEO-CEOS Engagement (Steven Hamburg, EDF) [slides]

- Stephen Briggs noted that this is an important area, Principals should take note of and consider how such opportunities in the future can be dealt with and built upon. Partnerships (e.g., with GEE, GFW, NICFI, Planet) might be worthwhile, and discussing around increasing collaboration between CEOS and 'non-traditional' contributors (i.e., companies, NGOs) could be useful for future CEOS meetings. This is compatible with the ESA SIT Vice Chair priority along these lines on 'New Space' and 'New Geometries'.
- Albrecht noted IMEO is under the umbrella of UNEP.
- Ivan added the ESA SIT Vice Chair Team will discuss the IMEO presentation and confirmed cooperation between the public and private sectors was one of the points ESA would like to explore as SIT Chair. Working with IMEO could be a good example of this kind of engagement. The IMEO interaction should fall under the responsibility of the SIT Chair during the exploration of potential collaboration.

AFOLU Roadmap (Osamu Ochiai, JAXA and Frank Martin Seifert, ESA, LSI-VC Forest & Biomass Team Leads) [slides]

- David Crisp (NASA) noted there is active cooperation in place between the GHG and AFOLU roadmap teams. Osamu noted that the GHG collaboration is ongoing. The summary slide was updated to reflect this.

GHG Roadmap (David Crisp, WGClimate GHG Team Lead, NASA) [slides]

- David added the only issue here is that the Plenary is starting after a couple of days after COP-26, and so, they can report out the reception of CEOS efforts and the statement at that time.
- David suggested the addition of engagement with other aspects of CEOS into these activities. Specifically, WGCapD around the development of capacity building support to promote AFOLU and Greenhouse Gas products to the relevant communities, the stakeholder community, UNFCCC, and the user community.
- Global stocktake discussion: There is a need to engage the ocean community in this discussion, including via the CEOS VCs, e.g., the work being looked at by OCR-VC.
- David noted that if the AFOLU and Greenhouse gas products are taken up by UNFCCC, the activity becomes a more operational activity, and the implications of this are something that CEOS would need to put thought into.
- Mark Dowell (COM/JRC) noted the issue of short-term demonstration products, promotion, and pilots vs. longer term operational ambitions that he is hoping is clear to Principals, given as it is addressed in the Strategy, the roadmap document, and often underlined. Mark stressed that due to the timing of events, it won't be clear how the CEOS inputs to SBSTA have been received at COP-26 until after the close of the CEOS Plenary.
- Frank Martin Seifert (ESA) stressed that Principals should be aware that while we are now demonstrating related to Global Stocktake 1 (GST1), the real effort and the main objective will be ramping up to GST-2 in 2028.

Introduction of the incoming SIT Chair Prospectus (Ivan Petiteville, Incoming SIT Chair Team, ESA) [slides]

- Ivan added there is strong continuity in their ambitions with actions from current and previous CEOS leadership, i.e., CEOS Chair, SIT Chair, etc.

Working Teams and Other Plenary (Christine Bognar, CEOS Chair Team, NASA) [slides]

- Marie-Claire added that it had been agreed to take the CEOS Governance and Processes v1.2 document to CEOS Plenary for endorsement.

Marine Science Session (Adam Lewis, SIT Co-Chair, GA) [slides]

- Mark added the proposal to investigate the need for "an overarching CEOS Ocean Strategy for 2022" is a good idea and it is the right time to do it. There have been contacts made to CEOS individual agencies, but they have not received much response yet. Now is a good time to come up with a visible strategy to support the creation of cross-cutting activities for CEOS.
- Kerry Sawyer (NOAA) asked whether this is an 'ocean' or a 'marine' strategy, and Ivan noted as the incoming SIT Chair they are willing to work with Paul DiGiacomo on the details. Paul supported this suggestion, and he also suggested the appropriate term would be 'ocean'.
- Sandra Cauffman (CEOS Chair Team, NASA) suggested the focus be on the UN Decade of Ocean Science for Sustainable Development.

SIT-TW-2021-16	SIT Chair with SIT Vice Chair to present for consideration by the 2021 CEOS Plenary, the idea for CEOS to develop an Ocean Strategy. The objective at Plenary will be to give approval to explore the idea between now and SIT-37, and to identify CEOS experts for the effort.	**CEOS Plenary**
	Rationale: Follow-up is needed to better understand the origins of the idea for CEOS to develop an Ocean Strategy, e.g., are the four CEOS ocean VCs recommending it, etc.	

3.3.3: Any Other Business (AOB)

- Adam noted that he will be retiring from GA but will continue as SIT Co-Chair until the close of Plenary. He will be continuing to work with DE-Africa and his email address will change. He has also stepped down as LSI-VC co-Lead. GA has made continuity plans which will be communicated to Principals via email shortly.

3.3.4: Review of Actions to the 2021 Plenary

- Draft action table to be circulated for comment.

3.3.5: Closing Remarks

- Alex acknowledged the outstanding work being carried out by all the teams across CEOS, in particular over what has been a challenging couple of years. The first SIT meeting planned in Hobart in March 2020 had to be cancelled on very short notice due to the pandemic, and since then the CEOS Chair and SIT Chair Teams have been trying to keep the activities going virtually. This has been a challenge, but broad cooperation across CEOS has made it possible. He also noted a key takeaway from virtual meetings is that it allows more people to participate actively relative to face-to-face only meetings, and hopes we can carry that gain forward. Alex is looking forward to the next face-to-face opportunity, hopefully in Frascati.
- Jonathan Ross (SIT Chair Team, GA) noted that GA will continue its support for CEOS via LSI-VC as well as our other contributions in COAST and WGCV. This will be outlined in a letter from the GA Principal to be circulated tomorrow.
- Stephen Briggs and Sandra Cauffman thanked both GA and CSIRO for their excellent and effective chairmanship of SIT, and the CEOS leadership over the past two years.

APPENDIX A: Attendees (All Virtual)

Note: Not all participants participated in all sessions over the three-day period.

Agency/Organisation	Name	Agency/Organisation	Name
Aberystwyth Uni.	Heather Kay	JAXA	Hiroshi Murakami
Aberystwyth Uni.	Richard Lucas	JAXA	Osamu Ochiai
AEM	Adrian Guzman	JAXA	Takeshi Hirabayashi
AEM	Adan Salazar	JAXA	Makoto Natsuisaka
BoM (Australia)	Alessandra Moneriis	JAXA	Riko Oki
CCRS	Francois Charbonneau	JAXA	Ake Rosenqvist
CEO	Marie-Claire Greening	JAXA	Kei Shiomi
CNES	Aurélien Sacotte	JAXA	Takeo Tadono
CNES	Paulin Mireille	JAXA/RESTEC	Koji Akiyama
CNES	Pierric Ferrier	JAXA/RESTEC	Yukio Haruyama
COAST	Paul DiGiacomo	JAXA/RESTEC	Toshi Kamei
COM	Astrid-Christina Koch	NASA	Jorge Vazquez
COM	Mauro Facchini	NASA	Christine Bognar
COM/JRC	Mark Dowell	NASA	David Borges
CONAE	Laura Frulla	NASA	Sandra Cauffman
CONAE	Marisa Kalemkarian	NASA	Lauren Childs-Gleason
CONAE	Ana Medico	NASA	Diane Davies
CSA	Paul Briand	NASA	Michael Falkowski
CSIRO	Alex Held	NASA	Lawrence Friedl
CSIRO	Flora Kerblat	NASA	David Green
CSIRO	Neil Sims	NASA	Kim Holloway
CSIRO	Robert Woodcock	NASA	Brian Killough
CSIRO	Amy Parker	NASA	Barry Lefer
CSIRO	Stephen Ward	NASA	John Worden
CSIRO	George Dyke	NASA	Andrew Mitchell
DLR	Klaus Schmidt	NASA	Nancy Searby
DLR	Albrecht Von Bargen	NASA	Karen St. Germain
EDF	Steven Hamburg	NASA	Wenying Su
ESA	Mirko Albani	NASA	Vardis Tsontos
ESA	Simonetta Cheli	NASA	Argyro Kavvada
ESA	Philippe Goryl	NASA	Hank Margolis
ESA	Marie-Helene Rio	NASA	Jack Kay
ESA	Frank Martin Seifert	NASA	Benjamin Poulter
ESA	Ivan Petiteville	NASA	David Crisp
ESA	Stephen Briggs	NASA	Edward Armstrong

Agency/Organisation	Name	Agency/Organisation	Name
ESA	Marc Paganini	NASA	Chris Kidd
ESA	Klaus Scipal	NASA	Matthew Steventon
ESSO	Hasibur Rahman	NIES	Tatsuya Yokota
EUMETSAT	Paul Counet	NOAA	Albert DeGarmo
EUMETSAT	Robert Husband	NOAA	Kerry Sawyer
EUMETSAT	Estelle Obligis	NOAA	Charles Wooldridge
EUMETSAT	Jörg Schulz	NOAA	Dana Ostrenga
GA	Adam Lewis	NOAA	Paul DiGiacomo
GA	Jonathon Ross	NOAA	Merrie Beth Neely
GEO Secretariat	Douglas Cripe	NOAA	Jeff Privette
GEO Secretariat	Craig Larlee	SANSA	Christo Peter Whittle
GEO Secretariat	Yana Gevorgyan	UAESA	Fatima Alaydaroos
GISTDA	Chuentragun Tatiya	UKSA	John Remedios
GISTDA	Disapat Sawadisukhitkul	UKSA	Svetlana Zolotikova
GISTDA	Suwat Sreesawet	UKSA	Beth Greenway
GISTDA	Watanyoo Suksa-ngaim	Uni. MD	Laura Duncanson
ISRO	C. Patnaik	UNEP/IMEO	Manfredi Caltagirone
ISRO	Raj Kumar	UNFCCC	Joanna Post
ISRO	Pradeep Thapliyal	UNOOSA	Jorge Del Rio Vera
ISRO	Arundhati Misra	USGS	Steve Labahn
JAXA	Ko Hamamoto	USGS	Timothy Stryker
JAXA	Misako Kachi	WMO	Kenneth Holmlund
JAXA	Akihiko Kuze	WMO	Anthony Rea

APPENDIX B: Decisions and Actions Record

DECISIONS

Decision 01	The SIT Technical Workshop agreed to the proposal of the SDG AHT Co-Chairs to recommend a Federated approach to SDGs for consideration and decision at the 2021 CEOS Plenary. The SIT Chair will have strategic responsibility for a new SDG coordination mechanism and will delegate coordination to the SEO.
Decision 02	SIT Vice Chair Team will take forward the Draft CEOS Strategy for Support to the UNFCCC Global Stocktake (GST) for endorsement at the 2021 CEOS Plenary. The Actions will be migrated to the CEOS WP in collaboration with the CEO
Decision 03	The SIT Technical Workshop agreed to bring the following agency level nominations for Working Group Chair and Vice Chair to the 2021 CEOS Plenary for endorsement: ● WGCapD Chair: Mr. Jorge del Rio Vera (UNOOSA) ● WGDisasters Vice Chair: Dr. Laura Frulla (CONAE) ● WGISS Vice Chair: Mr. Tom Sohre (USGS)
Decision 04	The SIT Technical Workshop agreed to present for endorsement at the 2021 CEOS Plenary, the Governance and Processes v1.2 document updated with the approval of the CEOS Secretariat and further discussed at the SIT Technical Workshop.

ACTIONS

SIT-TW-2021-01	Feedback from CEOS Agencies was invited on the Draft Governance Framework for CEOS Analysis Ready Data (ARD) and the accompanying template PFS via email before both documents are finalised and presented for potential endorsement by the 2021 CEOS Plenary.	**8 October 2021**
	Rationale: These documents will be presented to the 2021 CEOS Plenary for endorsement, and CEOS Agencies were encouraged to review and send feedback before both documents are finalised.	
SIT-TW-2021-02	In view of the transition in leadership of some members of the current CEOS Analysis Ready Data (ARD) Oversight Group, nominations were requested to ensure robust support and continuity.	**31 October 2021**

	Rationale: The CEOS ARD Oversight Group has been identified as a core component of the future CEOS ARD Governance Framework. It will act as a forum for all matters related to CEOS ARD. Representatives from the CEOS Virtual Constellations are integral to the effort going forward, as these are the CEOS entities with the technical expertise to recommend, develop and maintain Product Family Specifications. The SIT Chair Team and CEOS Executive Officer have also been identified as key participants.	
SIT-TW-2021-03	Further feedback from CEOS Agencies was invited on the Draft CEOS ARD Strategy 2021 document by Friday, October 8, 2021. Feedback can be provided via email or by adding comments/suggested edits directly into the online document, which will be finalized and presented for potential endorsement at the 2021 CEOS Plenary.	**8 October 2021**
	Rationale: Feedback from CEOS Agencies is invited prior to finalising the document to be presented for potential endorsement at 2021 CEOS Plenary. Points for consideration by reviewers who want to offer feedback: ● *Is the high-level structure sound?* ● *Is all of the content necessary and relevant?* ● *Are the actions listed relevant and needed?* ● *Are other actions needed?*	
SIT-TW-2021-04	Sustainable Development Goals *Ad Hoc* Team (SDG AHT) co-leads, SEO, the incoming SIT Chair Team, and the CEO to further discuss and agree on the documentation and information that will be provided to the 2021 CEOS Plenary, which is where the decision to potentially approve the proposed mechanism will be taken.	**25 Sept 2021**
	Rationale: The SIT Technical Workshop recommended this interim step in preparation for the 2021 CEOS Plenary.	
SIT-TW-2021-05	SDG *Ad Hoc* Team to develop and make available the document(s) so that CEOS Principals and the CEOS community can make an informed decision at the 2021 CEOS Plenary.	**16 Oct 2021**
	Rationale: The SIT Technical Workshop tasked the SDG ad hoc Team with finalizing its proposed continuity plan in advance of the 2021 CEOS Plenary.	
SIT-TW-2021-06	CEOS Agencies asked to keep the WGClimate Chair and the CEO updated on developments and plans	**31 Oct 2021**

	pertaining to the potential participation of their representatives in COP-26 and the EID.	
	Rationale: Multiple activities are being planned, and the SIT Technical Workshop noted that collective CEOS awareness and a coordinated effort is needed for COP-26. The WGClimate Chair and the CEO were identified as the relevant points of contact.	
SIT-TW-2021-07	CEOS Chair and SIT Chair to confer on reserving time on the 2021 CEOS Plenary agenda for CEOS to review and discuss the *UNFCCC Global Stocktake Systematic Observation Synthesis Report* and the CEOS contribution.	**31 Oct 2021**
	Rationale: The UNFCCC Secretariat emphasised the importance of CEOS fully engaging on the UNFCCC Global Stocktake Systematic Observation Synthesis Report.	
SIT-TW-2021-08	CEOS SIT Chair to follow up with the International Methane Emissions Observatory (IMEO) to explore possible avenues for cooperation on Carbon and Biomass between CEOS and IMEO.	**30 Sep 2021**
	Rationale: Some CEOS Agencies see opportunities to support IMEO objectives with data from a wide range of Earth observing missions.	
SIT-TW-2021-09	The CEOS AFOLU Roadmap team to reach out to CEOS Principals ahead of the 2021 CEOS Plenary to request support for escalation of a full Roadmap effort starting in 2022.	**31 Oct 2021**
	Rationale: At the SIT Technical Workshop, the AFOLU Roadmap team estimated that a significant increase in CEOS Agency support and resources will be needed to advance a full Roadmap effort in support of the UNFCCC Global Stocktake process.	
SIT-TW-2021-10	SIT Chair will facilitate further discussion of the GHG-AFOLU cooperation ahead of the 2021 CEOS Plenary to support a clear understanding by Principals of the GHG/AFOLU coordination needs in the context of the UNFCCC Global Stocktake process. In addition, the GHG and AFOLU teams will work towards the late Nov. 2021 workshop at the JRC as an opportunity to plan 2022 activities and to start a cooperation work plan.	**31 Oct 2021**
	Rationale: The SIT Technical Workshop recognized the importance of GHG/AFOLU coordination and a plan for next steps is needed.	

SIT-TW-2021-11	CEOS Agencies have been asked to consider contributing to the GEO-TREES activity, to build upon the initial support delivered by CNES, NASA and ESA.	**31 Oct 2021**
	Rationale: GEO-TREES is recognised as an important step to ensure the ground truth requirements for the CEOS Biomass Protocol.	
SIT-TW-2021-12	Biomass and GHG Teams to finalise inputs on their dataset representation on the CEOS GST Data Portal.	**30 September**
	Rationale: In preparation for COP26 (Nov. 1-12), the SIT Chair and CEOS Chair Teams plan to have the content translated into French & Spanish during the month of October.	
SIT-TW-2021-13	The SIT Technical Workshop asked CEOS Agencies to consider nominating a candidate to serve two years as WGCapD Vice Chair, followed by two years as WGCapD Chair.	**ASAP before CEOS Plenary**
	Rationale: Continuity of CEOS Working Group leadership is essential. To date in 2021, the CEOS WGCapD has sought nominations for both the Chair and Vice-Chair roles due to a change in the normal cadence of leadership rotation (the vacancies were accelerated by two years due to an incomplete four-year agency commitment). A nomination for WGCapD Chair has been received (Jorge del Rio Vera, UNOOSA), but a nomination for WGCapD Vice Chair is needed as soon as possible. Consistent with CEOS governance, nominations for both roles need to be presented for endorsement at the CEOS Plenary.	
SIT-TW-2021-14	SIT Chair will confer with CEOS Chair first, and with WMO if needed, to determine whether it would be feasible in terms of timing to have a formal update on the WMO Data Policy at CEOS Plenary, or at SIT-37 in the March/April 2022 timeframe.	**31 Oct 2021**
	Rationale: CEOS agencies may be impacted by some of the changes in the proposed WMO Data Policy. WMO Congress decision on the policy will occur before Plenary.	
SIT-TW-2021-15	CEOS Chair, SIT Chair, WGClimate Chair and UKSA to confer on opportunities for UKSA, CEOS and CGMS to focus world attention on CEOS remote sensing contributions, using social media and other platforms while the United Kingdom is hosting COP-26.	**COP-26**
	Rationale: U.K. Presidency of COP-26 provides extraordinary opportunities to focus international attention on CEOS as a key remote sensing forum for international coordination on Earth observation missions, data, and products for societal benefit.	

SIT-TW-2021-16	SIT Chair with SIT Vice Chair to present for consideration by the 2021 CEOS Plenary, the idea for CEOS to develop an Ocean Strategy. The objective at Plenary will be to give approval to explore the idea between now and SIT-37, and to identify CEOS experts for the effort.	**CEOS Plenary**
	Rationale: Follow-up is needed to better understand the origins of the idea for CEOS to develop an Ocean Strategy, e.g., are the four CEOS ocean VCs recommending it, etc.	