

**Minutes v1.0**  
**30<sup>th</sup> CEOS Plenary**  
**Brisbane, Australia**  
**1–2 November 2016**

**Tuesday, November 1<sup>st</sup>**

**Session 1: Core Business**

**CEOS Chair Introduction**

David Williams (CSIRO, CEOS Chair) welcomed everyone to the Plenary and respectfully acknowledged the Traditional Owners/Custodians of the land on which this event is taking place and Elders both past and present. David then introduced a video address from Greg Hunt MP, Australian Minister for Industry, Innovation and Science.

David summarised the objectives of the 30<sup>th</sup> CEOS Plenary.

**Korea Meteorological Administration (KMA) Application for CEOS Membership**

Geun-Hyeok Ryu (KMA) introduced the organisational structure of KMA. KMA operates the National Meteorological Satellite Center (NMSC), which receives data from a wide variety of missions, either directly or via internet transmission, for the production of composite meteorological products and services.

KMA have an existing collaboration with NASA and JAXA, specifically for the development of a Global Precipitation Measurement (GPM) passive microwave rainfall retrieval algorithm for the Korean Peninsula.

GEO-KOMPSAT-2A represents the next-generation of Korea's meteorological geostationary satellite programme. The mission's AMI instrument will capture full-disk images every 10 minutes, using 16 bands. GEO-KOMPSAT-2A data will be distributed free-of-charge, and by the end of 2016, 29 derived meteorological products will also be available. Geun-Hyeok noted the relevance of GEO-KOMPSAT-2A and its products to the 2016 CEOS Chair's Initiative on *Non-meteorological Applications for Next-generation Geostationary Satellites*.

Geun-Hyeok ended by presenting the development roadmap for the agency's LEO programme.

At the request of the CEOS Chair, the representative of KMA left the room and the floor was opened for comment. No objections were expressed, and the CEOS Chair welcomed KMA as the newest Member of CEOS, and invited Geun-Hyeok Ryu and KMA to join the remainder of the Plenary.

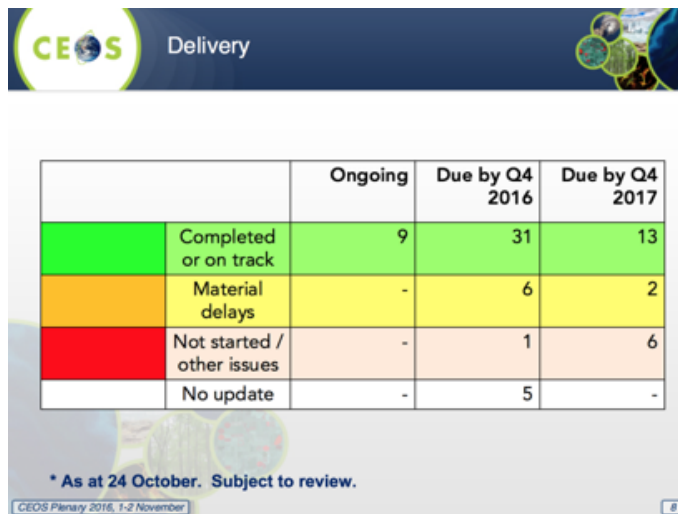
<b>D30-1</b>	The Korean Meteorological Administration (KMA) was admitted to CEOS as a Member.	
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**Status of Actions from the 29<sup>th</sup> CEOS Plenary**

Jonathon Ross (GA, CEO) reviewed the status of the actions from the 29<sup>th</sup> CEOS Plenary. All actions have been completed.

### CEOS 3-Year Work Plan Annual Update

Jonathon Ross (GA, CEO) reviewed the purpose and functions of the CEOS 3-Year Work Plan. Jonathon noted that a majority of Work Plan activities have a duration of one year. He suggested that contributors keep in mind that this is a 3-Year Work Plan, and this timeframe should be reflected in task due dates. Jonathon presented a summary of the status of Work Plan tasks:



		Ongoing	Due by Q4 2016	Due by Q4 2017
	Completed or on track	9	31	13
	Material delays	-	6	2
	Not started / other issues	-	1	6
	No update	-	5	-

\* As at 24 October. Subject to review.


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Jonathon recalled the process for updating the CEOS Work Plan. He added that the ceos-deliverables.org website should also be updated regularly. The CEO Team is available to upload updates on behalf of CEOS entities.

## Session 2: Thematic Acquisition Strategies

### Revisit of the CEOS Thematic Data Acquisition Strategy Status and Issues Presented at SIT-31

Stephen Briggs (ESA, SIT Chair) recalled the thematic data acquisition strategy discussion from SIT-31. The SIT Chair has placed an emphasis on ensuring well-founded, directed and sustained thematic acquisition strategies for CEOS. CEOS has committed to a number of thematic areas including forests, agriculture, disasters, carbon, water and climate – presenting significant coordination and resource challenges. Stephen noted the following key issues for consideration by the Plenary:



Issues for attention

1. LSI-VC review of agency tools to manage multiple requirements didn't yield much of value for CEOS use. But practical efficiency of bringing forests and agriculture under LSI-VC banner still a logical goal.
2. Viable way forward formulated at SIT-TW on Carbon, for Plenary discussion. Must encourage GEO to ensure success of GEOCARBON to demonstrate credibility
3. If GEO is the counterpart for CEOS on Water, opinion tends to the need for stronger requirements, with better policy linkages and large institutional buy-in. GEO must demonstrate credible geometry and strategy
4. Will GEO achieve anything via GD-08?

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### Related GEO Efforts

Osamu Ochiai (GEO Secretariat) presented a summary of the Societal Benefit Area (SBA) experts currently at the GEO Secretariat. Osamu noted the restructuring of the GEO Water tasks in the 2017-2019 GEO Work Programme (WP). A number of activities and initiatives are being combined in the newest iteration of the WP, simplifying the structure of the GEO Water tasks.

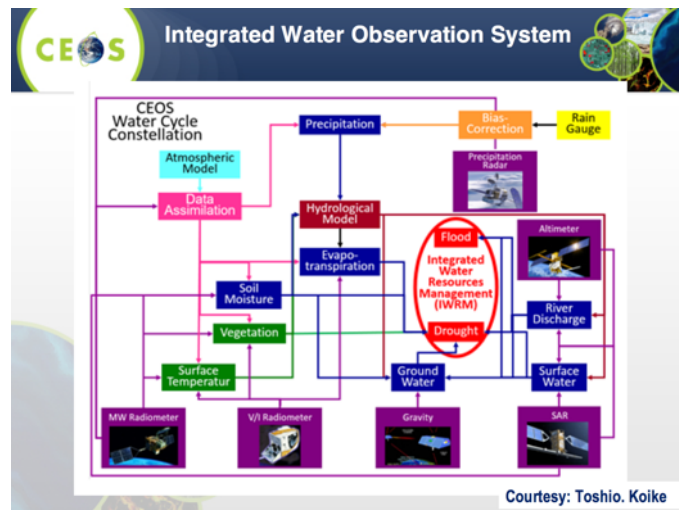
The key GEO Foundational Task GD-08 aims to undertake regular, systematic analyses of global observational requirements using the SBA framework. The implementation of GD-08 is planned to begin with pilot activities for two of the SBAs (Food Security and Sustainable Agriculture, Sustainable Urban Development). Osamu reported that progress on GD-08 has been slow, and he is uncertain whether preliminary results from the pilots will be ready in time for GEO Plenary.

Stephen Briggs (ESA, SIT Chair) acknowledged the significant changes to the structure of the GEO Water SBA, noting that this is a moving target for CEOS, and we have to see how it develops over time. Stephen also noted the importance of GD-08 for CEOS. It is expected that GD-08 will provide the overarching framework for a CEOS response, and he encouraged the GEO Secretariat to allocate increased resources to this important task. David Williams (CSIRO, CEOS Chair) supported Stephen's message, adding that the CEOS response is dependent on an effective GD-08 process.

### CEOS Strategy for Water Observations from Space

*Water Strategy Implementation Study Team (WSIST) Water Constellation Feasibility Study Report (C.1)*

Shizu Yabe (JAXA) presented on behalf of Chu Ishida (JAXA, WSIST Lead). She recalled the 2015 CEOS Plenary decision to proceed with the Water Constellation Feasibility Study and outlined some of the linkages to international frameworks including the Sendai Framework, the 2030 Agenda for Sustainable Development, and the Paris Agreement. Shizu reviewed the main elements of the Integrated Water Observation System.



The Feasibility Study reviews user requirements from several reports including US-09-01a: Critical Earth Observations, the GCOS Implementation Plan, and the WMO Statement of Guidance (WMO-SOG). The status of observations across precipitation, soil moisture, evapotranspiration, river discharge, surface water storage, and groundwater were reviewed, and a sampling analysis for microwave imagers, and the synergies between variables were identified. The components of a proposed water constellation were identified in the Feasibility Study.

• Instruments requirement for observing a water variables considering synergies of other variable observations are shown in the following.

Instrument	PR	MWI	MWS	TIR GEO/ LEO	OPS MODIS/ Landsat	Radar L/CX band	Alti meter	Gravity	Remarks
P	○	○	○	○					MWI is strongly preferred than MWS and TIR.
SM		○ 37GHz is critical		○		○ Lband preferred			MWI+TIR, MWI+Radar can improve accuracy, resolution.
ET		○		○	○				Pairs of cloud-free TIR images are needed.
RD		○			○	○	○		Improvement of altimeter revisit time is needed.
ST				○	○	○	○		ditto DEM is required to estimate water volume
GW								○	SM and ET are closely related with GW in data assimilation.

Shizu reviewed the requests presented to Plenary:

1. To endorse the WSIST Water Constellation Feasibility Study Report; and,
2. To consider the next steps for actions C.2 to C.9 from the CEOS Strategy for Water Observations from Space and the recommendations of the Feasibility Study by SIT-32 (April 2017).

*Hyperspectral Water Quality Report (C.10)*

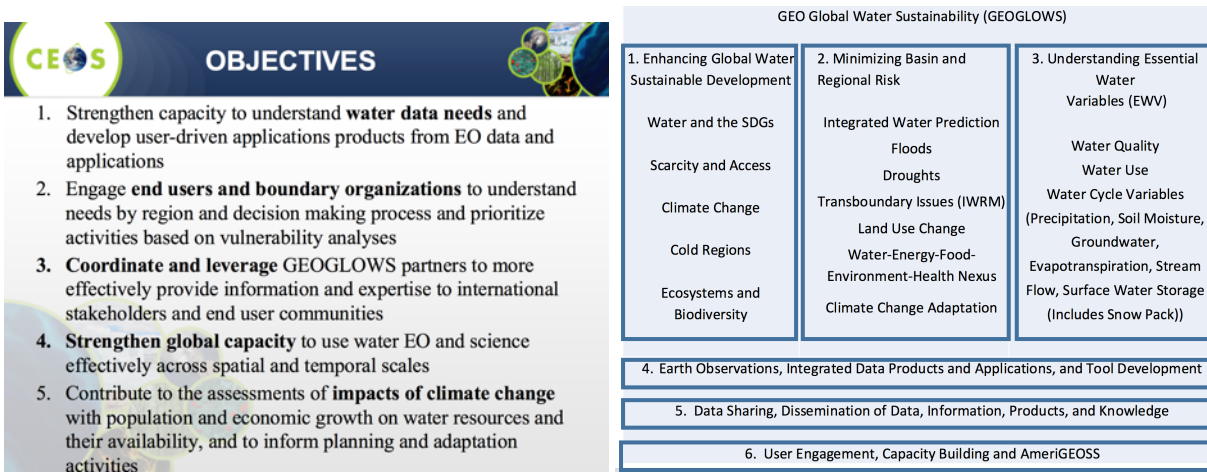
Arnold Dekker (CSIRO) has been leading a team that is preparing a report on the feasibility of a hyperspectral imaging spectrometer specifically designed to monitor water quality and other key environmental parameters for a variety of ecosystems. The diverse ecosystems and requirements being investigated together for the first time present a challenge, and numerous simulations are being performed to determine the necessary sensor

parameters. Spatial resolution is key, as it determines the percentage of inland water bodies that can be covered. Arnold noted that there are multiple United Nations Sustainable Development Goals (SDGs) related to the parameters under consideration.

Arnold closed by noting that a final draft of the report is expected in January, with final presentation planned for SIT-32.

*GEO Global Water Sustainability (GEOGLOWS)*

Brad Doorn (NASA) presented a brief update on GEOGLOWS, noting that it is strongly linked to ongoing and developing GEO water-related activities. The motivation is to build a framework that provides cohesion between the various GEO and water community activities. He reviewed the objectives of GEOGLOWS, as well as the framework components.



The diagram illustrates the objectives and framework components of GEOGLOWS. On the left, under the heading 'OBJECTIVES', five key goals are listed. On the right, under the heading 'GEO Global Water Sustainability (GEOGLOWS)', a table outlines three main pillars: 1. Enhancing Global Water Sustainable Development, 2. Minimizing Basin and Regional Risk, and 3. Understanding Essential Water Variables (EWV). Below these pillars are three horizontal bars representing cross-cutting components: 4. Earth Observations, Integrated Data Products and Applications, and Tool Development; 5. Data Sharing, Dissemination of Data, Information, Products, and Knowledge; and 6. User Engagement, Capacity Building and AmeriGEOSS.

GEO Global Water Sustainability (GEOGLOWS)		
<b>1. Enhancing Global Water Sustainable Development</b> Water and the SDGs Scarcity and Access Climate Change Cold Regions Ecosystems and Biodiversity	<b>2. Minimizing Basin and Regional Risk</b> Integrated Water Prediction Floods Droughts Transboundary Issues (IWRM) Land Use Change Water-Energy-Food-Environment-Health Nexus Climate Change Adaptation	<b>3. Understanding Essential Water Variables (EWV)</b> Water Quality Water Use Water Cycle Variables (Precipitation, Soil Moisture, Groundwater, Evapotranspiration, Stream Flow, Surface Water Storage (Includes Snow Pack))
4. Earth Observations, Integrated Data Products and Applications, and Tool Development		
5. Data Sharing, Dissemination of Data, Information, Products, and Knowledge		
6. User Engagement, Capacity Building and AmeriGEOSS		

Brad noted that there will be a GEOGLOWS side meeting at GEO Plenary next week, which will seek to establish the steps required to move the initiative forward.

Several discussion points were raised:

- Mark Dowell (EC/JRC) suggested that CEOS hold a follow-up session at SIT-32 which covers GEOGLOWS, AquaWatch and the Hyperspectral Water Quality Report together. Arnold agreed with the suggestion.
- Alex Held (CSIRO, CEOS Chair Representative) asked Arnold which ecosystems are in scope for the Hyperspectral Water Quality Report. Arnold noted that the boundary was set where there is significant water content, though increasing vegetation content broadens the scope and requirements.
- Adam Lewis (GA) noted that it is clear the unifying role of GEOGLOWS is a necessity. He added that there is a need to balance short-term practical achievements with the development of new technologies for the future.
- Stephen Briggs (ESA, SIT Chair) agreed that GEOGLOWS is an important task that will ensure GEO’s water-related activities are coherent, and the requirements are robust.
- Mauro Facchini (EC) stated that comprehensive water requirements will be useful in formulating future Sentinel missions.
- Mike Freilich (NASA) asked for clarification on the status of the WSIST following Plenary. Arnold noted that actions C.2 to C.9 are assigned to various CEOS entities, the CEOS response to action C.1 has concluded as of Plenary, and the response to action C.10 will continue until the resulting report is presented at SIT-32.

- Stephen Briggs noted that the GEO requirements related to water are changing (with the emergence of GEOGLOWS, AquaWatch), and the future CEOS response will be to those requirements. Stephen suggested that based on this, there isn't a basis for the WSIST to continue, and Mike Freilich agreed.
- Jonathon Ross (GA, CEO) recalled the actions from the CEOS Strategy for Water Observations from Space. In total there were 10 actions, with 8 allocated to existing CEOS entities. Action C.1 (Water Constellation Feasibility Study) has been completed under the leadership of Chu Ishida (JAXA). Action C.10 is the study being led by Arnold Dekker. Jonathon asked whether a CEOS structure is required to oversee the response to C.10 or whether oversight should be handled by the SIT Chair. The latter was recommended, and Stephen Briggs (ESA, SIT Chair) accepted the responsibility.
- David Williams confirmed that CEOS will consider the future strategy and framework for CEOS water efforts at SIT-32.

D30-2	CEOS Plenary acknowledged completion of the Water Strategy Implementation Study Team (WSIST) <i>Water Constellation Feasibility Study Report</i> (response to action C.1 from the <i>CEOS Strategy for Water Observations from Space</i> ).	
D30-3	CEOS Plenary did not extend the mandate of the WSIST, but noted that the CEOS feasibility study on the use of imaging spectrometers for water quality in response to action C.10 from the <i>CEOS Strategy for Water Observations from Space</i> is ongoing and will be completed by Arnold Dekker (CSIRO), reporting to the SIT Chair, for presentation at CEOS SIT-32.	Revisit at CEOS SIT-32.
D30-4	CEOS Plenary agreed to reconsider its approach to water observation requirements at CEOS SIT-32, in the context of developments within GEO (AquaWatch, GEOGLOWS, etc.).	Revisit at CEOS SIT-32.

### GEO Blue Planet Update

Andy Steven (CSIRO) presented a summary of GEO Blue Planet, and noted that it can contribute to United Nations Sustainable Development Goal 14. He recalled that CEOS is a founding partner of Blue Planet, is represented in its interim governance, and is committed to supporting the components of Blue Planet related to providing coordinated satellite-based Earth observations and derived products/services. Blue Planet represents a source of observation requirements/priorities for ocean-related services. Andy also reviewed a number of cross-GEO initiatives being conducted by Blue Planet.

CEOS BP Activities – 1:	CEOS BP Activities – 2:
<p><b>1. Supporting SDG's- 14 life below water</b></p> <ul style="list-style-type: none"> <li>Conserve and sustainably use the oceans, seas and marine resources for sustainable development</li> <li>UN Conference to support the implementation of SDG 14</li> </ul>  <p><b>2. 4M – Multi-purpose Marine Monitoring Mechanism</b></p> <p>UNDP / CARIBE-GOOS proposal for Grenada and Barbados to:</p> <ul style="list-style-type: none"> <li>access expertise in capacity building and technical requirements for providing real-time information</li> <li>to promote evidence-based marine and fisheries policy programming and further strengthen the justification and accuracy in resource mobilization effort</li> </ul> <p><small>CEOS Plenary 2016, 1-2 November</small></p>	<p><b>3. COVERAGE:</b></p> <p><b>CEOS Ocean Variables Enabling Research and Applications for GEO</b></p> <p>Use the Sargasso Sea as a regional pilot application</p>  <ul style="list-style-type: none"> <li>assemble and present satellite and <i>in situ</i> ocean data in a compelling web-based format to demonstrate the value added of multivariate ocean data integration is support of science, applications, and public engagement.</li> <li>International collaboration via CEOS and GEO-Blue Planet for global extension based on a priority-set of use-cases.</li> </ul>  <p><small>CEOS Plenary 2016, 1-2 November</small></p>

Jonathon Ross (GA, CEO) asked for clarification on the Blue Planet governance structure, to help CEOS understand its potential contributions. Andy noted that this is still formative, but there will be a Steering Group, Management Committee, Secretariat, and Working Groups. Andy requested that CEOS leadership (either the CEOS Chair or the SIT Chair/Vice Chair) serve on the Blue Planet Advisory Board.

<b>30-1</b>	The CEOS Executive Officer (CEO) and SIT Chair Team to work with Paul Di Giacomo (NOAA) and Andy Steven (CSIRO) to understand potential CEOS contributions to the governance structure of GEO Blue Planet.	Present the way forward and roles at CEOS SIT-32.
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David Williams (CSIRO, CEOS Chair) asked about the boundary between CEOS and Blue Planet. Andy noted that the value-add of Blue Planet is that it will clarify requirements for CEOS, its agencies, and their programmes, and also act as a vehicle to increase data uptake.

**CEOS Ad Hoc Working Group on GEOGLAM Report**

Brad Doorn (NASA, CEOS Ad Hoc Working Group on GEOGLAM Co-Lead) presented a summary of the Group on Earth Observations Global Agricultural Monitoring (GEOGLAM) initiative. He reviewed the new organisational structure of GEOGLAM, which was developed based on feedback from the GEOGLAM Steering Committee, with the goal of revising how the initiative is presented to stakeholders. He added that GEOGLAM recently had its importance reaffirmed by the G20 Agricultural Ministers and AMIS Steering Committee.



Brad noted that there is an initial interaction with LSI-VC on the application of GEOGLAM’s EO Data Requirements Development and Evaluation Framework for other land applications.

In 2017, the CEOS *Ad Hoc* Working Group on GEOGLAM will support GEOGLAM’s review of its EO data requirements and work to ensure that the GEOGLAM Rangelands and Pasture Productivity (RAPP) initiative requirements are well covered. There are also ongoing discussions around integrating JECAM and USDA LTAR sites, as well as support to national-scale monitoring efforts.

<b>30-2</b>	The CEOS <i>ad hoc</i> Working Group on GEOGLAM, in consultation with the CEOS Secretariat, to provide feedback on the GEOGLAM Secretariat paper on commercial engagement. The CEOS <i>ad hoc</i> Working Group on GEOGLAM and GEOGLAM Secretariat to discuss, and ensure the inclusion of a clear statement of the value proposition for each entity involved.	When the GEOGLAM paper is ready for comment.
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David Williams (CSIRO, CEOS Chair) asked if there were any objections to extending the mandate of the *Ad Hoc* Working Group for another year. None were raised and the continuation of the CEOS *Ad Hoc* Working Group on GEOGLAM was confirmed.

<b>D30-5</b>	CEOS Plenary extended the mandate of the CEOS <i>ad hoc</i> Working Group on GEOGLAM for another year.	
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### CEOS Response to the Sendai Framework

Stéphane Chalifoux (CSA, WGDisasters Chair) presented a summary of CEOS’s response to the Sendai Framework for Disaster Risk Reduction 2015–2030, which is primarily via WGDisasters. Earth observation is specifically referenced in the Framework, in relation to the production of up-to-date risk maps; monitoring risk reduction progress; and disaster risk outreach information for decision-makers, the general public, and communities.

The WGDisasters Pilots and Recovery Observatory meaningfully demonstrate how satellite EO contributes to all disaster-risk management phases, with strong user involvement. Additionally, CEOS and GEO developed a new GEO Initiative, *GEO-DARMA (Data Access for Risk Management)*, which was endorsed at the 2015 GEO-XII Plenary.



GEO-DARMA brings together international stakeholders, including UN Agencies and regional organisations, to address the priorities of the Sendai Framework using Earth observations.

### Thematic Acquisition Strategy Discussion

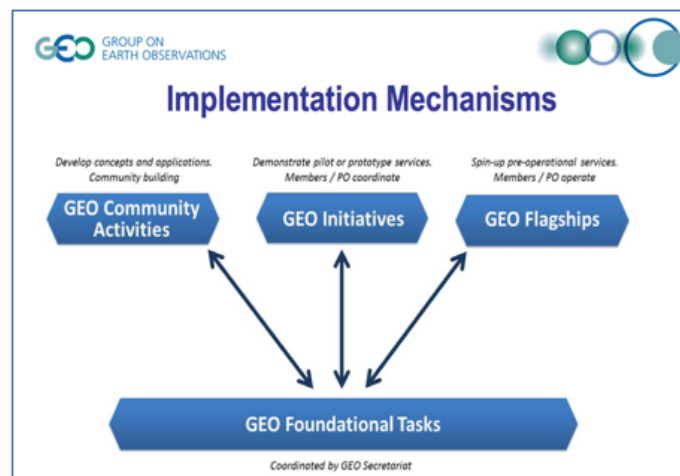
David Williams (CSIRO, CEOS Chair) recalled that the issue to be discussed is whether CEOS is sufficiently addressing user requirements, and whether those user requirements are clearly articulated by the relevant experts. Managing the numerous sets of acquisition requirements is key, and CEOS needs a coherent strategy for doing so.

Stephen Briggs (ESA, SIT Chair) noted that the Earth observation programmes of space agencies are being increasingly driven by societal/policy requirements, and this is a welcome trend.

## Session 3: Key Stakeholder Initiatives

### GEO Secretariat Report

Barbara Ryan (GEO Secretariat Director) noted some key GEO events for 2016, in particular the transition of GEO's structure and programmatic mechanisms – Community Activities, Initiatives and Foundational Tasks – structured as shown below. She added that GEO now comprises 103 Members, 103 Participating Organizations, and 12 Observers.



Barbara reviewed the GEO Initiatives, Community Activities, and Foundational Tasks, noting that these objectives will only be achieved by following the *GEO Data Sharing Principles* of full and open exchange of data, data and products at minimum time delay, and data free-of-charge or at cost of reproduction; and the *GEO Data Management Principles* of discoverability, accessibility, usability, preservation, and curation.

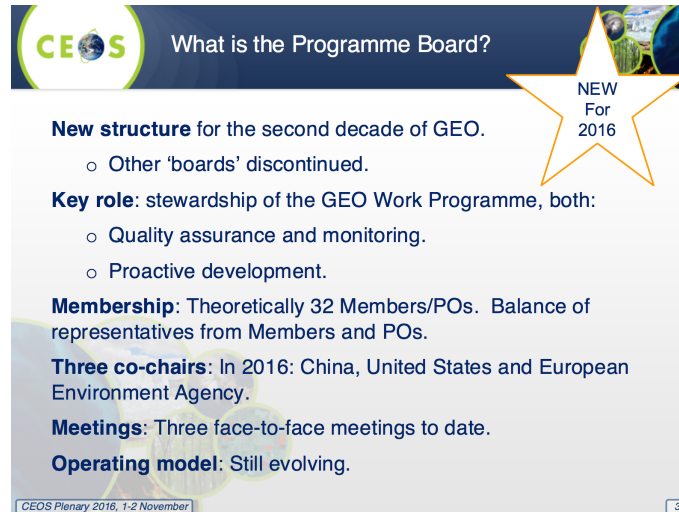
Barbara also noted some developments around GEONETCast, including the increased bandwidth in Europe and new station deployments (20 per month).

She closed the presentation with a summary of GEO's work around the United Nations Sustainable Development Goals (SDGs), including the mapping of existing GEO Work Programme tasks to SDG indicators. She noted that GEO will work in coordination with CEOS and other stakeholders to engage with statistical agencies to ensure methods are sound for use with indicators and targets; to ensure methods and solutions are available for all to use; and to support countries and stakeholders with the use of methods.

Frank Kelly (USGS, 2017 CEOS Chair) stated that he looks forward to leading the CEOS delegation to GEO-XIII Plenary next week.

## CEOS-GEO Matters and CEOS Representation at GEO-XIII Plenary

Jonathon Ross (GA, CEO) reviewed some of the details of how CEOS interacts with GEO, including through its role on the GEO Programme Board (PB).



**CEOS** What is the Programme Board? **NEW For 2016**

- New structure** for the second decade of GEO.
  - Other 'boards' discontinued.
- Key role:** stewardship of the GEO Work Programme, both:
  - Quality assurance and monitoring.
  - Proactive development.
- Membership:** Theoretically 32 Members/POs. Balance of representatives from Members and POs.
- Three co-chairs:** In 2016: China, United States and European Environment Agency.
- Meetings:** Three face-to-face meetings to date.
- Operating model:** Still evolving.

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He noted that engagement in the PB is strong, however there are fewer developing countries represented than desired. Jonathon presented some of his thoughts on the GEO PB:

- It has so far taken a relatively 'lenient' approach (e.g., proposals often state they will 'work out' governance).
- To date, the focus has been 'bottom-up' rather than 'challenge-centred'.
- The PB needs to monitor the extent to which 'cross-cutting' topics (e.g., climate, capacity building) are addressed.
- There is some confusion around the extent to which the PB should validate that GEO Flagships are 'politically acceptable' (versus policy-relevant).
- Its focus on individual review teams has not fostered the type of holistic view that will be required in the future.

Jonathon reviewed the GEO PB Terms of Reference, noting that these are less formal than those found in other forums (e.g., the UN), and that the GEO Executive Committee will provide support to resolve conflicting views if and as required.

CEOS has renominated for the 2017–2019 GEO PB as it is an important group through which to ensure CEOS contributions are efficient and impactful. It also provides a pathway to representation on the GEO Executive Committee.

A brief discussion followed:

- Adam Lewis (GA) asked why there isn't evidence of a stronger relationship between CEOS and GEO.
- Barbara Ryan (GEO Secretariat Director) noted that there are other GEO Participating Organizations (POs) that deal with space, and reaching out and bringing the whole community together would help. The GEO Secretariat has been trying to encourage these organisations to engage with CEOS.
- Kerry Sawyer (NOAA, SIT Vice-Chair Team) noted the importance of the annual CEOS-GEO bilateral meeting.
- Simonetta Cheli (ESA) supported CEOS's increased engagement in GEO governance.

Jonathon reviewed the preparations for GEO-XIII Plenary, noting that this is the first Plenary of the second decade of GEO. He summarised the key meeting topics/objectives:

- Reflect upon implementation of the GEO Strategic Plan 2016–2025 and the Mexico City Ministerial Declaration.

- Engagement with the commercial sector.
- The GEO Engagement Strategy (with the UN, development banks, etc.)
- Approval of the 2017–2019 GEO Work Programme.

Jonathon reported that POs will not give verbal statements during this year's GEO Plenary. Instead, CEOS has submitted a written statement and provided a 'think piece' for the panel session on the implementation of GEOSS. He called for any feedback for the CEOS delegation to GEO-XIII, and also on the 'think piece'. Adam Lewis (GA) suggested that the 'think piece' should focus more on what CEOS is going to do in support of GEO.

Jonathon reviewed the GEO Engagement Strategy. CEOS will be responsible for reaching out and activating internal users, and will also act as a GEO ambassador (including leading and contributing to engagement activities). Jonathon noted that there is additional material specifically on commercial sector engagement that should be reviewed by CEOS Agencies.

### United Nations Sustainable Development Goals (SDGs)

Marie-Josée Bourassa (CSA, DCEO) presented an overview of CEOS's progress on the SDGs and the proposed next steps. She noted that many CEOS agencies/people are responding to national needs to further the 2030 Agenda for Sustainable Development and providing expert advice and guidance to national statistical agencies/international organisations. Collectively, CEOS is working with GEO and UN-GGIM to support the coordination of observational efforts, and is also focusing on top-down dialogue with relevant UN Agencies.

It is recognised that a more formal, coherent, and consistent approach is now required for CEOS to have a greater impact. Marie-Josée proposed that CEOS take the steps necessary to establish a new *ad hoc* team on the SDGs.

The plan presented by Marie-Josée proposed that agencies indicate their interest in participating in the *ad hoc* team in the November timeframe, with the terms of reference for the *ad hoc* team being defined in coordination with the CEOS Secretariat over the period from January to March, after which the *ad hoc* team will be presented for endorsement at SIT-32 (along with the group's terms of reference, success measures, and draft work plan).

A discussion followed:

- Kerry Sawyer (NOAA, SIT Vice-Chair Team) suggested that CEOS Plenary endorse the creation of the SDG *ad hoc* team now, with the terms of reference and membership to be confirmed over the coming months.
- Mike Freilich (NASA) suggested that the *ad hoc* team be endorsed at this occasion, rather than waiting for a Plenary session at SIT-32.
- Marie-Josée noted that she was not suggesting the *ad hoc* team be endorsed at this occasion, rather she suggests that CEOS agree to take the steps necessary to present the *ad hoc* team for endorsement at SIT-32.
- Pascale Ultré-Guérard (CNES) asked whether an *ad hoc* team can be endorsed without terms of reference. Kerry confirmed that terms of reference are not a pre-requisite for the endorsement of an *ad hoc* team.
- Tapan Misra (ISRO) reported that ISRO is willing to take part in an SDG *ad hoc* team.
- Astrid-Christina Koch (EC) suggested that terms of reference be prepared before proceeding any further, as the objective is currently unclear.
- Simonetta Cheli (ESA) supported the idea of endorsing the *ad hoc* team at this CEOS Plenary, in the interest of saving time and accelerating CEOS progress on the SDGs.
- Stephen Briggs (ESA, SIT Chair) proposed that the *ad hoc* team be endorsed now, with the proviso that the membership and terms of reference be endorsed at SIT-32.
- Mike Freilich requested clarification on the reporting chain for the *ad hoc* team. It was agreed that the *ad hoc* team should report to the SIT Chair.

D30-6	<p>CEOS Plenary agreed to the establishment of an <i>ad hoc</i> team, reporting to the SIT Chair, to coordinate and drive CEOS engagement on UN Sustainable Development Goals (SDGs).</p> <p>The <i>ad hoc</i> team's specific short-term objectives will be confirmed with the CEOS Secretariat, following which the team will commence work, including confirming membership and developing terms of reference.</p>	<p>Existing contributions in this area will continue, under the coordination of the SIT Chair.</p>
30-3	<p>The CEOS Executive Officer (CEO), in coordination with the CEOS Chair Team, SIT Chair Team, and CSIRO, to prepare a statement of objectives for the new <i>ad hoc</i> team on the UN SDGs, and to seek approval of the statement by the CEOS Secretariat at CEOS SEC-219.</p> <p>Pending approval, the <i>ad hoc</i> team co-leads will seek members for the team (December 2016) and prepare terms of reference, to be confirmed to the CEOS Secretariat at CEOS SEC-220.</p>	<p>CEOS SEC-220</p>

### Revisit of Strategic Discussions on Future Partnerships and Priorities

Stephen Briggs (ESA, SIT Chair) recalled the action from SIT Technical Workshop to perform a stocktake of CEOS's relationships. He reviewed several trends in terms of how CEOS partnerships have evolved:



**CEOS Trends & observations**

- Evolving partnerships over three decades, **evolving configurations**
- **Reduced involvement of science programmes** in CEOS Plenaries
  - Not necessarily negative
- **Reduced participation of UN and other user agencies** in CEOS Plenaries (also in projects/activities?) - due to positive effect of creation of GEO?
- **Development banks** also active but EO often not central to financial support even when fundamental. Have very important potential role to play.
- **Non-expert users with policy-oriented problems**, not historical expert science users, becoming increasingly interested parties. Strong policy background (SDGs, UN Conventions etc.)
- **'Internet giants'** are also active and changing expectations of users
- Increasing emphasis on **'user-facing' data** uptake and application
  - Thematic WGs (climate, disasters), GEO Projects, Ad-hoc Teams
- **Data size/complexity remain significant obstacles** to uptake of CEOS agency data, some solutions emerging

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Stephen also reviewed several relevant outcomes from the 2016 SIT Technical Workshop:



## Session 4: Climate

### Implications of the Paris Agreement

Pascal Lecomte (ESA, WGClimate Chair) presented a summary of CEOS interactions related to COP22 and SBSTA45, including the preparation of the CEOS Statement to SBSTA45. Pascal summarised the background of the Statement and asked that CEOS Plenary endorse the document as circulated.

A brief discussion followed:

- Mark Dowell (EC/JRC) noted that the EC endorses the Statement, and he asked if some speaking points would be prepared for CEOS Agencies to circulate to their national delegations to COP/SBSTA. Pascal suggested that the Statement be the reference for any speaking points. An action was recorded for agencies to promote the Statement with their national delegations.
- Steve Labahn (USGS) confirmed that the U.S. national delegation will present the Statement on behalf of CEOS/USGS (as CEOS Chair at the time).
- No objections were raised and the CEOS Statement to SBSTA45 was agreed.

<b>D30-7</b>	CEOS Plenary endorsed the <i>‘Statement Reporting on Progress by the Committee on Earth Observation Satellites (CEOS) and Coordination Group for Meteorological Satellites (CGMS) on Coordinated Response to UNFCCC Needs for Global Observations’</i> for presentation at SBSTA45.	Delivery at SBSTA45.
<b>30-4</b>	CEOS Agencies to liaise with their national delegations to COP22 to encourage interventions in support of the CEOS Statement to SBSTA45.	COP22

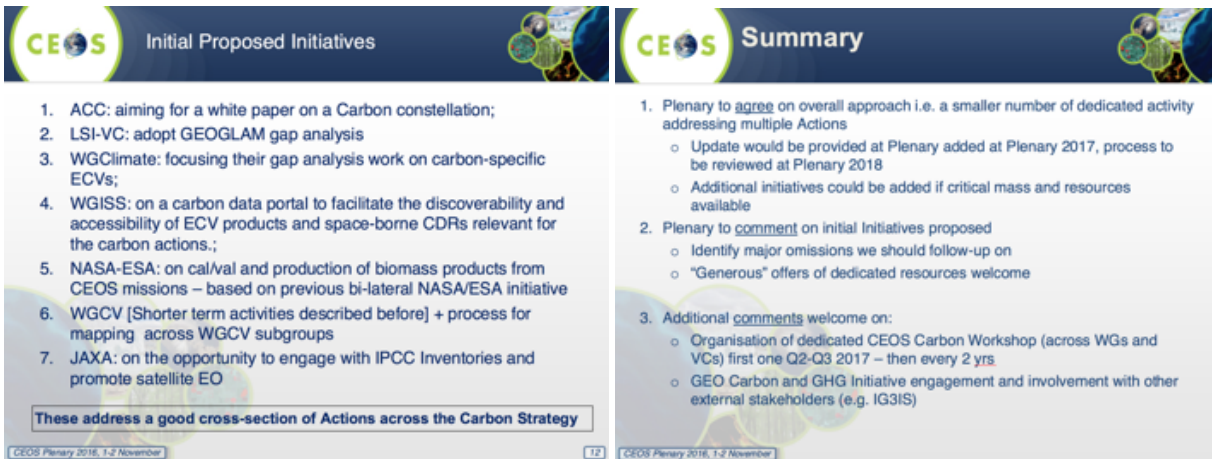
### CEOS Carbon Strategy Implementation

Mark Dowell (EC/JRC) recalled that the *CEOS Strategy for Carbon Observations from Space* is the CEOS response to the *GEO Carbon Strategy*, and it delivered 42 actions for CEOS implementation. Mark noted that the carbon

actions cross-cut many CEOS entities, further increasing the complexity of the follow-up activities. The carbon actions are now part of the CEOS Work Plan (CARB-08).

Mark presented the proposed way forward on the CEOS carbon actions. He suggested that CEOS focus on 5–7 WG and VC initiatives, which will act as prototypes. In parallel, CEOS will continue several shorter-term and supporting activities, such as engaging with the GEO Carbon and Greenhouse Gas Initiative, mapping agency-level projects to the CEOS carbon actions, and the organisation of biennial CEOS carbon workshops.

Mark presented the WG and VC initiatives that are proposed to be carried forward:



The image shows two presentation slides side-by-side. The left slide is titled 'Initial Proposed Initiatives' and lists seven items: 1. ACC: aiming for a white paper on a Carbon constellation; 2. LSI-VC: adopt GEOGLAM gap analysis; 3. WGClimat: focusing their gap analysis work on carbon-specific ECVs; 4. WGISS: on a carbon data portal to facilitate the discoverability and accessibility of ECV products and space-borne CDRs relevant for the carbon actions.; 5. NASA-ESA: on cal/val and production of biomass products from CEOS missions – based on previous bi-lateral NASA/ESA initiative; 6. WGCV [Shorter term activities described before] + process for mapping across WGCV subgroups; 7. JAXA: on the opportunity to engage with IPCC Inventories and promote satellite EO. A box at the bottom of the slide states: 'These address a good cross-section of Actions across the Carbon Strategy'. The right slide is titled 'Summary' and contains three main points: 1. Plenary to agree on overall approach i.e. a smaller number of dedicated activity addressing multiple Actions, with sub-points: 'Update would be provided at Plenary added at Plenary 2017, process to be reviewed at Plenary 2018' and 'Additional initiatives could be added if critical mass and resources available'; 2. Plenary to comment on initial Initiatives proposed, with sub-points: 'Identify major omissions we should follow-up on' and '"Generous" offers of dedicated resources welcome'; 3. Additional comments welcome on: 'Organisation of dedicated CEOS Carbon Workshop (across WGs and VCs) first one Q2-Q3 2017 – then every 2 yrs' and 'GEO Carbon and GHG Initiative engagement and involvement with other external stakeholders (e.g. IG3IS)'. Both slides have a CEOS logo in the top left and a small 'CEOS Plenary 2016, 1-2 November' footer.

A brief discussion followed the presentation:

- Yoshinori Yoshimura (JAXA) noted the planned 2019 update of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, to be led by the IPCC Task Force on National Greenhouse Gas Inventories. He suggested that this is a key opportunity for CEOS to engage with the UNFCCC and IPCC, in particular around the use of EO for verification. Stephen Briggs (ESA, SIT Chair) supported the idea, noting that it is precisely the right way to integrate satellite data directly into UNFCCC processes.
- Stephen recalled the SIT Technical Workshop discussion and agreement that CEOS-CGMS coordination of CO<sub>2</sub> observations should be handled within existing AC-VC activities. He presented the draft mandate for a Satellite Carbon Report, to be undertaken by AC-VC (below). An action was recorded for the CEOS Chair to follow up with the AC-VC Lead.



- The Plenary agreed on the overall approach to CEOS Carbon Strategy implementation (i.e., a small number of dedicated activities), as well as the initial selection of WG and VC initiatives.

<b>D30-8</b>	CEOS Plenary agreed on the proposed step-by-step approach to progressing the <i>CEOS Strategy for Carbon Observations from Space</i> – with an update to be provided at the 31 <sup>st</sup> CEOS Plenary. When the initiatives are agreed they will feature as CEOS Work Plan "CARB" deliverables/objectives, with timeframes and identified lead entities/agencies, in the CEOS 2017-2019 Work Plan.	Update to be provided at the 31 <sup>st</sup> CEOS Plenary.
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<b>30-5</b>	CEOS Agencies to provide any comments to Mark Dowell (EC/JRC) on the initial initiatives proposed as the next steps for implementation of the <i>CEOS Strategy for Carbon Observations from Space</i> – to identify major omissions and consider support capacity for the initiatives.	December 2016
<b>30-6</b>	CEOS Chair to write (with the mandate outline attached) to the CGMS Chair advising of the CEOS Atmospheric Composition Virtual Constellation (AC-VC) task to develop a Satellite Carbon Report. CGMS should be invited to nominate additional contributors, if desired, for development of the Report.	November 2016
<b>30-7</b>	CEOS Chair to provide the AC-VC Chairs with the outline mandate for the Satellite Carbon Report for comment.	November 2016

- Kerry Sawyer (NOAA, SIT Vice-Chair Team) thanked Mark and the EC for supporting the implementation of the CEOS Carbon Strategy.

### Marrakech Declaration at UNFCCC COP22

Pascale Ultré-Guéraud (CNES) reviewed the current status of the Marrakech Declaration to be proposed by CNES, CRTS, and CRERS at UNFCCC COP22. She noted that a new version will be sent to heads of space agencies a couple of weeks after COP-22. She added that some missions were previously missing from the Declaration. The final version is expected to be endorsed by heads of agencies in early 2017.

David Williams (CSIRO, CEOS Chair) asked for clarification on the due date for feedback. Pascale confirmed that comments are needed before the 11<sup>th</sup> of November, and these will be reflected along with other comments following COP22.

30-8	CEOS Agencies to provide Pascale Ultré-Guéraud (CNES) with feedback on the Marrakech Declaration: <i>'Heads of Space Agencies Support Actions at COP22 for Water Management'</i> (individual agency comments; CEOS has already provided its input).	11 November 2016
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### Global Climate Observing System (GCOS) Status and Plans

Mark Dowell (EC/JRC) spoke on behalf of Carolin Richter (GCOS Secretariat Director) about the 3<sup>rd</sup> GCOS Implementation Plan (IP). He noted the long heritage of the CEOS-GCOS relationship and the CEOS responses to the GCOS IP.

The writing team for the 3<sup>rd</sup> GCOS IP was first assembled in July 2015, with the final report submitted in October 2016. Throughout the drafting process, over 2000 comments were received in two review cycles.

The 3<sup>rd</sup> GCOS IP includes new Essential Climate Variables (ECVs) for lightning, ocean surface stress, ocean surface heat flux, marine habitat properties, land surface temperature, and greenhouse gas fluxes. There are also revisions to some of the ECV products that are one layer below the ECVs themselves.

Mark noted that the main aspects of the Satellite Supplement have now been integrated into the GCOS IP itself; comprehensively covering both *in situ* and remotely-sensed requirements. This was done to eliminate the time-lag between the IP and the Satellite Supplement, as well as for the following reasons:

#### ECV Product Requirements and the Satellite Supplement

1. Maximise GCOS - CEOS / CGMS synergy
2. Reduce time-lag between IP and Satellite Supplement release
3. Align requested reporting of both GCOS and the Space Agencies to SBSTA
4. Provide Satellite Supplement as an Appendix to this Implementation Plan
5. Extend ECV product requirements provided in satellite supplement to all observations (incl. those based primarily on in-situ observations)
6. Action to define review process in 2017 and provide periodic updates



## CEOS/CGMS Working Group on Climate (WGClimate) Report

### CEOS Response to the New GCOS Implementation Plan (IP)

Pascal Lecomte (ESA, WGClimate Chair) shared the plan for the CEOS response to the new GCOS IP, noting that the writing team will be structured around the IP, with one lead per domain. Work will start immediately after COP-22 and the formal release of the GCOS IP, and the final response will be presented at COP-23.

### Essential Climate Variable (ECV) Inventory Update

Pascal noted that the ECV Inventory describes the current and planned space-based climate monitoring capability on an ECV basis; establishes traceability with respect to GCOS principles, requirements, and guidelines; and directly supports gap analyses.

**Usage of the ECV Inventory by WG Climate**

- Description of current and future monitoring capability on an ECV basis allows easier response to e.g. GCOS IP (may suffer from mismatch after update but discussion on ECV list in GCOS not finished);
- Combined perspective of the logical and physical views of the architecture should enable the definition of an optimum "macroscale" space system configuration and its components;
- Used at the ECV/product level to identify gaps and shortfalls as well as to provide recommendations for action;
- Formulation of a coordinated action plan to address recommendations;
- Trigger for the medium-term activities that need to be undertaken to sustain the long-term implementation of the architecture.

**Potential Usages of the ECV Inventory beyond the WGClimate**

- Can inform data record users with a public repository of verified information on what is available and how to access the data;
- Can inform climate services on what to use;
- Can inform data providers on competitive situations;
- Can inform developers with whom to collaborate;
- Can inform reviewers of proposals for new CDRs if it is worth investing ...

The ECV Inventory currently holds 318 records (219 current, 99 future) distributed across domains as follows: atmosphere (171), land (37), ocean (33), and undefined (77). Pascal noted that there are 125 responders registered, with 43 of them being very active; there has been no response/input from ASI, JMA, ROSHYDROMET, and some ESA-CCI projects. A two-week extension has been granted for this round of record collection (to 21 November 2016), after which the following schedule will be followed:

Objective/Deliverable	Background Information	Target Date
Cycle #2 – Stage #1	Collection of New and Updated Information from Data Providers	Sep. 2016
Cycle #2 – Stage #2	Data Incorporation and Quality Control	Nov. 2016
Cycle #2 – Stage #3	Gap Analysis	Feb. 2017
Cycle #2 – Stage #4	Action Plan	Jun. 2017
Comp. Activity #1	Hosting of the ECV Inventory	Dec. 2016
Comp. Activity #2	Development of Further ECV Inventory Capabilities	Feb. 2019
Comp. Activity #3	Development / Promotion of Case Studies	Sep 2017
Comp. Activity #4	Development and Maintenance of a WGClimate Web Site	Sep 2017

Pascal closed by noting some general issues/challenges, reporting that there is great diversity in the quality of inputs, resulting in extended quality control processing times; mismatches between the records, the previous GCOS IP, and the 2016 GCOS IP; and that there is not yet a gap analysis coordinator, although tool development has begun and the gap analyses are expected to begin in January 2017.

### Update on the Space Data Coordination Group (SDCG) for GFOI

Masanobu Shimada (JAXA, CEOS Lead for GFOI) presented an overview of the status and outlook for GFOI:

The presentation consists of three slides, each with a CEOS logo and a globe graphic in the top right corner. The slides are numbered 1/3, 2/3, and 3/3.

**Slide 1/3: GFOI Status and Outlook 1/3**

- GFOI Office operating at FAO since early 2016
  - Funded by Australia and Norway
  - Led by Tom Harvey (Australia)
  - Improvement in coordination and outreach
- Methods and Guidance Documentation V2 a significant milestone for GFOI and country engagement
  - Accompanying REDDCompass web system to assist
  - University course in development
- Capacity Building component has active workshop programme, now emphasising the MGD
- R&D Coordination component
  - Funded by ESA until March 2017
  - Active external research programme supported by CEOS agencies

**Slide 2/3: GFOI Status and Outlook 2/3**

- GFOI Review undertaken in 2016:
  - Jim Baker (Clinton Foundation, ex-NOAA)
  - In support of renewed funding from Australia and Norway
  - To aid formulation of the next phase for GFOI
- GFOI Review headlines:
  - GFOI successful in meeting initial goals
  - Space data availability and awareness much increased
  - Outreach and capacity building needs attention – FAO role will help
  - Paris agreement intensifies need for GFOI
  - UN-REDD aligning all in country materials around REDDCompass
  - Report will be provided to CEOS

**Slide 3/3: GFOI Status and Outlook 3/3**

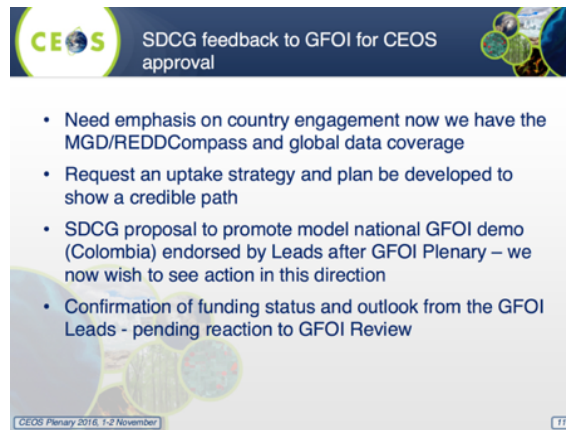
- New funding cycle for Australian support
  - Office renewal
  - MGD support
  - No more Space Data Component support as of Nov 2016
  - Chair of Leads for 2017 (Doug Muchoney gone to FAO)
- Strong interest from the 'GNU' alliance in GFOI as an 'assurance framework'
  - GNU committed \$5bn in forest development aid at COP21
  - Positive first meeting in London in Sept around SDCG-10
  - Active follow-up by Leads/Office
- Stephen Ward (SDCG Sec) serving as alternate when Masanobu Shimada not available for CEOS/GFOI mtgs

Stephen Ward (SDCG Secretariat) introduced Nikki Fitzgerald (Australian Department of the Environment), the Australian Government point of contact for the SDCG. Nikki acknowledged the major CEOS contributions to the Space Data and R&D Components of GFOI. Nikki also noted the recently finalised GFOI Review, which was overall positive and acknowledged the importance of CEOS' contributions to GFOI's success. GFOI is now restructuring its efforts to address recent developments related to countries' Nationally Determined Contributions (NDCs) under the United Nations Framework Convention on Climate Change (UNFCCC), The Paris Agreement, REDD+, and the UN SDGs, with a focus on implementation of the GFOI methods.

Stephen noted the SDCG's Global Data Flow Study and its relevance to CEOS's FDA work. The SDCG studied the challenges related to the current vast flow of data for today's practical forest product needs and found that reducing barriers and cost are critical, and that Analysis-Ready Data would be greatly beneficial according to the study respondents.

Stephen reported that the global baseline coverage has been achieved – with at least one annual global coverage provided by the core data streams. The SDCG is also investigating further historical datasets for the purpose of baseline forest map generation, and is engaging CNES, CONAE, INPE, and JAXA on this topic. Shimada-san noted the recent release of the JERS-1 25 metre global mosaic, and he encouraged everyone to take a look.

Stephen noted the proposed feedback to GFOI for CEOS approval (below). This was agreed and SDCG will follow up through the CEOS Lead.



Stephen noted that Australian funding for the SDCG Secretariat has now come to an end. He thanked Nikki and the Australian Department of the Environment/Government of Australia for their 8 years of support.

Stephen reported that CSIRO and NASA have recently confirmed support for SDCG Secretariat operations in 2017, and he expressed his gratitude for their contributions.

A brief discussion followed the presentation:

- Beth Greenaway (UKSA) reported that the GFOI meeting recently held in Reading was very well received, and the UK Government is now investigating further involvement in GFOI. She also noted that the NovaSAR mission could be a potential UK contribution to GFOI.
- Stephen noted the UK-hosted meeting between the GFOI Leads and representatives from the GNU-bloc (Germany, Norway, and the UK), who have the capacity to invest a collective 5 billion USD in REDD+ initiatives. If this connection can be made, there appears to be an opportunity for GFOI to serve as an assurance framework for these investments.
- Adam Lewis (GA) asked whether a quantitative analysis of GFOI-stimulated data use has been undertaken. Stephen reported that the only information available is qualitative and derived from interviews/anecdotes.
- Stephen noted the emerging plan to co-locate the SDCG, LSI-VC, and GEOGLAM meetings in late-2017.
- Adam initiated a round of applause in recognition of JAXA’s release of the JERS-1 25 metre global mosaic.

<b>D30-9</b>	CEOS Plenary extended the mandate of the CEOS Space Data Coordination Group (SDCG) for GFOI for another year.	
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## Wednesday, November 2<sup>nd</sup>

### Session 4: Climate (continued)

#### GEO Carbon Initiative

Osamu Ochiai (GEO Secretariat) presented on the GEO Carbon Initiative, which builds on existing initiatives and networks, supporting their continuity and coherence, facilitating their cooperation and interoperability, and filling gaps to obtain a comprehensive, globally coordinated GHG observation and analysis system. It will not be a self-standing entity or rewrite strategies/duplicate existing efforts, but rather focus on the interfaces between domains and systems.

The objectives are as follows:

1. Facilitate cooperation to develop a coordinated system of domain overarching observations;
2. Evaluate changes in the carbon and other cycles, and greenhouse gas emissions as they relate to human activities and climate change; and,
3. Provide decision-makers with timely and reliable policy-relevant information.

Osamu noted that CEOS is a key partner, and alignment with the *CEOS Strategy for Carbon Observations from Space* is very important. Synergies and mutual benefits are expected through coordination, and improving the consistency between *in situ* and satellite observations is a priority for the interaction with CEOS.

A brief discussion followed:

- Mark Dowell (EC/JRC) noted that the GEO Carbon Initiative will provide a comprehensive and consolidated interface to the *in situ* communities, and it is therefore very beneficial for CEOS to be involved.
- Stephen Briggs (ESA, SIT Chair) acknowledged the importance of this coordination task, which brings together the numerous ongoing activities in this area. The challenge for GEO is that they are playing a coordination role without control of the individual components.

### Session 5: Future Data Architectures and Analytics

#### Future Data Architectures Introduction

Alex Held (CSIRO, CEOS Chair Representative) presented the motivation behind the initiation of the 2016 CEOS Chair's Initiative on *Future Data Access and Analysis Architectures*. New-generation EO satellites will create such significant volumes of data, with such comprehensive global coverage, that for many important applications a 'lack of data' will no longer be the limiting factor. He stressed that the gap between data and application needs to be bridged. It will not be technically feasible or financially affordable to consider traditional processing and data distribution methods to address this 'scaling' challenge, due to data size, preparation, handling, storage, analysis, and basic processing obstacles.

Alex highlighted that these issues are being experienced now and first-hand by CEOS Agencies through their involvement in user-facing initiatives such as GFOI and GEOGLAM. Clear user-needs have been communicated directly by countries and donor bodies (e.g., The World Bank via the CEOS SEO and the SDCG-GFOI Global Data Flow Study).

Alex closed by noting that subsequent agenda items will cover key steps and components related to this 2016 CEOS Chair's Initiative, and we will end the session with a Plenary discussion on the overall CEOS FDA strategy.

### **Future Data Access and Analysis Architectures *Ad Hoc* Team (FDA-AHT) Report Overview**

Robert Woodcock (CSIRO, FDA-AHT Co-Lead) presented a scene-setting video and the findings from the FDA-AHT's study, which revealed current developments and priorities from a range of agency contributions, and confirmed that there are both challenges and opportunities in the operating environment. Of particular note for CEOS, as a community that recognises the need for coordination, are the following increasing trends:

- Strong investment driven directive to maximise the value of EO (for industrial and economic benefit);
- Contributions to global initiatives (interoperation and integration); and,
- Engagement with developing countries (access to data and analysis).

Robert also noted that a growing awareness of EO is resulting in continued investment and significant activity. Finally, the work of CEOS, GEO, and others around open data, interoperability, data discovery, new missions, and cooperation is having a valuable impact.

Robert presented the recommendations resulting from the first year of the FDA-AHT:

- The FDA-AHT recommends that CEOS adopt a two-stream approach to continue its engagement with this topic:
  1. A further year of work to continue exploration of key areas, and for facilitated strategic discussions;
  2. Parallel efforts to progress CEOS pilot projects to ensure strategic discussions are supported by real-world evidence.
- Specifically, the FDA-AHT recommends the following:
  1. Approval for the *ad hoc* team on Future Data Access and Analysis Architectures to continue for a further year to complete the mandate. And confirmation of the Co-Chairs.
  2. Agreement for a proposed pilot project(s) (TBD) to be progressed in parallel with the ongoing report work, with oversight by the FDA team and contributions from LSI-VC, SEO, and SDCG.
  3. Invitation for further proposals for practical demonstrations in the area of FDA for 'lessons learnt' evaluation by CEOS Principals at CEOS-31.
  4. Action for CEOS and SIT Chairs to confer with the FDA Team to ensure necessary CEOS Principal engagement on the strategic issues arising from the 2017 Report, in support of identifying common ground as the basis for a long-term CEOS strategy.

### **CEOS Systems Engineering Office (SEO) Data Cube Three-Year Work Plan and Pilot Activity Updates**

Brian Killough (NASA, SEO) recalled the Data Cube concept and some of the trends that CEOS and the SEO are seeing in the areas of 'big data' and open source software. He introduced the *CEOS Data Cube Three-Year Work Plan*, noting that the document is a tool to guide work related to the CEOS Data Cube, but is not presented for endorsement. Brian reported that the Work Plan will continue to evolve and updates are expected at SIT-32 and the 2017 CEOS Plenary.

The tasks in the Work Plan cover core technology, data preparation, prototypes, user engagement, and capacity building:



- The Work Plan includes a new task summary that summarizes the responsible groups and the status and schedule for each task.
- The tasks are grouped into 5 major categories ... (1) Core Technology, (2) Data Preparation and Formatting, (3) Prototypes, (4) User Requirements and Engagement, and (5) Capacity Building. Here are some highlights ...
  - **Core Technology** ... Amazon demo (**next charts**), GIS integration (ArcGIS, QGIS), Change Detection (CCDC, BFAST)
  - **Data Preparation** ... Working on Data Cube ingestors for Sentinels, SRTM/ASTER, SPOT-5, ALOS-PALSAR and climate data
  - **Prototypes** ... Colombia and Switzerland in progress. Others proposed or in planning: FDA pilot, Asia Cube, Balkans, Disasters Landslide Pilot
  - **User Engagement** ... FAO Forest Division and SEPAL tool integration
  - **Capacity Building** ... ALOS-PALSAR training manual completed, World Bank (Lake Chad, Tonga, Togo), SERVIR training in Jan 2017

Brian noted the pilots currently running on the Amazon Web Services (AWS) platform, in particular demonstrations for Lake Chad (for flood extent mapping; using GA’s Water Observations from Space algorithm, WOfS) and Lake Baringo in Kenya (on Total Suspended Matter, TSM), which have generated significant interest from The World Bank and other stakeholders.

The CEOS Data Cube activity is led by the SEO, GA, and CSIRO; and will continue as a Future Data Architecture task through 2017.

30-9	CEOS Data Cube team to prepare a governance plan for the management of a consolidated open source repository, by CEOS SIT-32.	CEOS SIT-32
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### LSI-VC Analysis-Ready Data Description

Adam Lewis (GA, LSI-VC Co-Lead) reported on the work undertaken by the LSI-VC to define intercomparable Analysis-Ready Data (ARD) products within the context of land surface imaging. This definition is important as users need information to support decision-making, and ARD removes the burden of pre-processing for the user, allowing them to focus on the problem of interest.

CEOS Analysis Ready Data for Land (CARD4L) are satellite data that have been processed to a minimum set of requirements and organised into a form that allows immediate analysis with a minimum of additional user effort, and, interoperability both through time and with other datasets.

The CARD4L description document is presented for CEOS Plenary endorsement. Following endorsement of the description, a technical specification framework is also needed. The purpose of the framework will be to ensure a level of consistency between the ARD being generated by different agencies, while allowing the necessary flexibility. The sample CARD4L specification table is indicative of the type of specifications targeted, and is built around the idea of minimum- and aspirational-level specifications. The framework, as well as a counterpart description for SAR, will be the subject of further work by the LSI-VC.

A brief discussion followed the presentation:

- Frank Kelly (USGS, 2017 CEOS Chair) commended the LSI-VC for its effort on the CARD4L description and he supported the plan to develop the specification framework.
- Beth Greenaway (UKSA) supported the CARD4L description, noting that the definition is very valuable and should help address some of the issues currently being experienced by European agencies.

- Tapan Misra (ISRO) supported the concept of CARD4L and noted that ISRO has developed its own interoperability framework for INSAT-3D and INSAT-3DR.
- Adam reported that consistent gridding systems are a target for future development.

**Plenary Discussion on the CEOS FDA Strategy**

A discussion was held around the broader CEOS strategy for future data architectures and analytics:

- Simonetta Cheli (ESA) thanked CSIRO for initiating the FDA-AHT. She noted that it was very timely, as ESA is currently evaluating its FDA strategy. ESA formally supported the continuation of the FDA-AHT for another year to carry out the tasks identified in the Report recommendations. ESA also nominated a Co-Chair for the extended FDA-AHT – Nick Hanowski.
- Éric Laliberté (CSA) voiced his support for the continuation of the FDA-AHT, and also reported that CSA is keen to contribute to the SAR ARD description.
- It was noted that the EC has initiated activities to improve the Copernicus ground segment, in collaboration with ESA and EUMETSAT. The EC acknowledges that the Data Cube is one potential FDA solution; they will present their strategy in the future.
- Yoshinori Yoshimura (JAXA) reported that JAXA supports the continuation of the FDA-AHT.
- Mike Freilich (NASA) commended the FDA presentations and declared that NASA will continue to support these efforts in the future.
- Mike asked Brian Killough (NASA, SEO) to describe the The World Bank’s interest in the CEOS Data Cube. Brian clarified that they are interested because the Data Cube offers time-series applications not otherwise available; they hope to integrate satellite data into many of their global projects. It remains to be seen how this might be achieved outside of the *ad hoc* efforts of the SEO, however there might be a pathway via GEO, as The World Bank has just entered the GEO framework, and Brian is following up with Barbara Ryan (GEO Secretariat Director). Mike suggested that it would be helpful to have statements and testimonies on the value of CEOS’s work from stakeholders such as The World Bank.
- Stephen Briggs (ESA, SIT Chair) urged caution when engaging with The World Bank. He noted that it is a large organisation with many groups, a complicated structure, and fragmented projects – making it difficult to establish a single, consolidated relationship.
- Arnold Dekker (CSIRO) encouraged CEOS to consider a definition of ARD over water bodies sooner rather than later.
- Steven Hosford (CNES) thanked the FDA-AHT for their report and noted that CNES is happy to see broad CEOS Agency engagement. CNES will nominate a person to join the FDA-AHT for its second year.
- Frank Kelly (USGS, 2017 CEOS Chair) noted that USGS will take the FDA work forward as one of their CEOS Chair Initiatives, with an emphasis on implementation through increased pilots covering different architectures/approaches, trial production and delivery of CARD4L, and further research on communities/end users. The CEOS strategic dimension will also be considered.

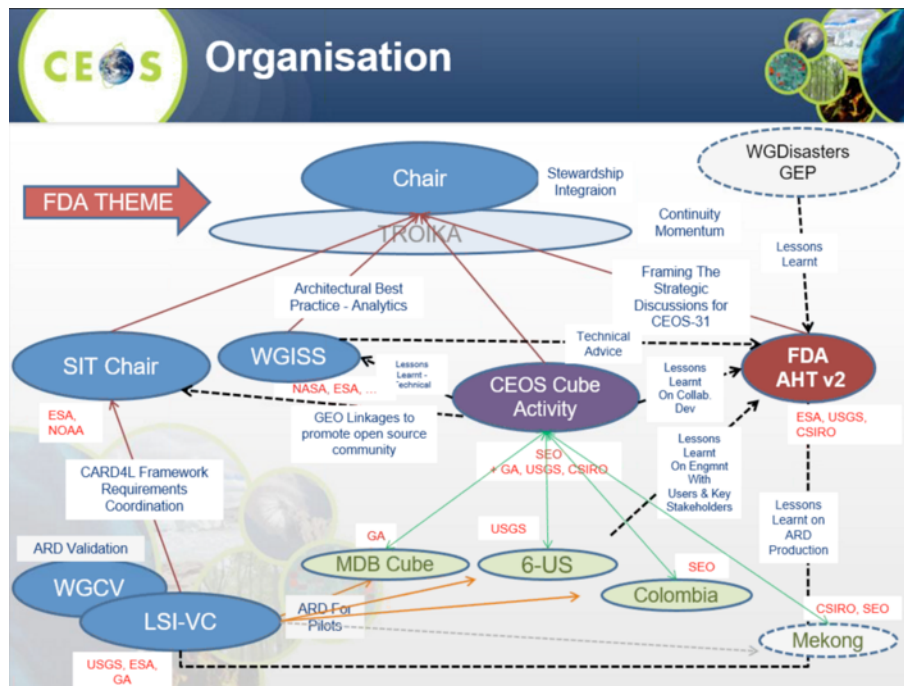
D30-10	CEOS Plenary endorsed the recommendations of the <i>Future Data Architectures Interim Report</i> .	
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<p><b>D30-11</b></p>	<p>USGS will take forward the Future Data Architectures (FDA) topic as a CEOS Chair priority theme for 2017, with an emphasis on framing strategic discussions on the way forward for CEOS at the 31<sup>st</sup> CEOS Plenary, reflecting progress by the various stakeholders such as:</p> <ul style="list-style-type: none"> <li>– The Land Surface Imaging Virtual Constellation (LSI-VC) (Analysis-Ready Data);</li> <li>– The CEOS Systems Engineering Office (SEO) (CEOS Data Cube as an FDA Pilot); and,</li> <li>– The Working Group on Information Systems &amp; Services (WGISS) (best practices, etc.).</li> </ul> <p>The 31<sup>st</sup> CEOS Plenary in 2017 will include discussions on how CEOS should take the various activities forward within the CEOS structure.</p>	<p>Update to be provided at the 31<sup>st</sup> CEOS Plenary.</p>
<p><b>D30-12</b></p>	<p>CEOS Plenary extended the mandate of the CEOS Future Data Access and Analysis Architectures (FDA) <i>ad hoc</i> Team for another year.</p>	
<p><b>D30-13</b></p>	<p>CEOS Plenary endorsed the LSI-VC <i>CEOS Analysis-Ready Data for Land (CARD4L) Description</i> and encouraged the proposed trial production of CARD4L, commencing in 2017, with a view to developing an understanding of the costs and benefits of ARD production for CEOS Agencies and users, specifically through the implementation of the Future Data Architectures (FDA) Pilots.</p>	

#### FDA Organisation for 2017

Jonathon Ross (GA, CEO) discussed the organisation of the 2017 FDA work within the overall CEOS structure. He noted the need to leverage and build upon existing structures and activities, while ensuring there is clear leadership and cross-linkages. Capacity commensurate with the scope is required, and opportunities for agencies to contribute at the desired level of commitment are needed. Jonathon presented the following organisational chart:





Jonathon also presented some proposed criteria for the assessment and acceptance of a new FDA pilot:

- User feedback and engagement is crucial.
- Lessons learned must inform CEOS’s strategic discussions.
- Multiple agency engagement is key.
- A clear statement of governance and resources is needed.

He then presented some proposed steps for the adoption of a new FDA pilot:

1. The relevant activity is endorsed in the CEOS Work Plan.
2. The activity leads write to the CEOS Chair and CEO with a description of:
  - The activity’s alignment with the criteria noted above; and,
  - The feedback process.
3. The FDA pilot will then be confirmed by the CEOS Chair.

A brief discussion followed Jonathon’s presentation:

- Stéphane Chalifoux (CSA, WGDIsasters Chair) noted the potential applicability of the WGDIsasters Landslide Pilot, and reported that WGDIsasters is interested in applying the ARD concept in this instance.
- Mark Dowell (EC/JRC) encouraged CEOS to periodically assess how these activities fit into the overall CEOS structure in the long-term and suggested that agencies consider the resources committed in support of these activities going forward.
- Andrew Mitchell (NASA, WGISS Chair) supported the points raised by Jonathon, noting that the governance model and data stewardship are issues that will need to be addressed in order to make the Data Cube and similar projects sustainable.

- Stephen Briggs (ESA, SIT Chair) noted the complexity of the organisational diagram and suggested that the CEOS Chair and CEO consider a simplified version that might explain the approach in a simpler manner.

## Session 6: Broader Applications for Next-Generation Geostationary Satellites

### Non-meteorological Applications for Next-Generation Geostationary Satellites *Ad Hoc* Team (NMA-AHT) Report

Thomas Schroeder (CSIRO, NMA-AHT Co-Lead) introduced the background of the initiative, noting that this one-year study aimed to assess the potential non-meteorological opportunities arising from next-generation geostationary satellites and GEO-LEO synergies.

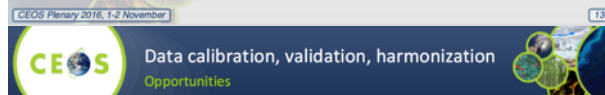
The AHT was led by CSIRO (Thomas Schroeder), the Australian BOM (Ian Grant), EUMETSAT (Kenneth Holmlund), and NOAA (Satya Kalluri). The Study was prepared by a small team, including the co-leads, Albrecht von Bargaen (DLR, WGCV Chair), Robert Husband (EUMETSAT), and Tom Cecere (USGS). The Study was shared with CEOS WGs and CGMS for review.

Thomas presented some sample applications across each of the domains considered—atmosphere, land, and ocean—as well as the opportunities identified in five key areas: user engagement; application development; data calibration, validation, harmonisation; data management; and outreach:



**CEOS** User engagement  
Opportunities

- The **determination of user requirements** and priorities would benefit from developing strong links with the relevant non-weather communities.
- Study in detail the suitability of GEO observations to contribute to **United Nations Sustainable Development Goals (UNSDG)**.

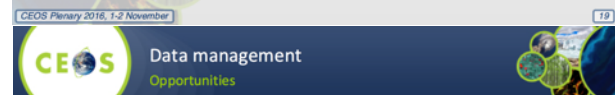



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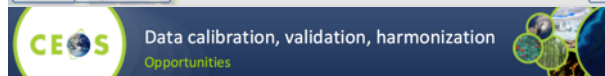


**CEOS** Application development  
Opportunities

- Support **collaborative efforts for algorithm development** and inter-comparison activities to achieve consistent GEO-ring products.
- A **broad engagement with the EO community and LEO science teams** to foster collaborative developments of advanced algorithms, and identify potential non-meteorological applications for coordinated GEO-ring implementation.
- Continue working towards the **operational delivery of NMA geophysical products** to achieve quasi-global consistent coverage, particularly **radiometric products** that underpin downstream products.
- Consider identifying a suitable **pilot project for a new GEO-ring product** within existing coordination activities.
- **Synergistic use** of data from GEO and LEO imagers is **encouraged**.
- Study in detail the suitability of GEOs to contribute to the **climate monitoring framework**.

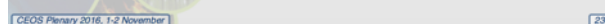


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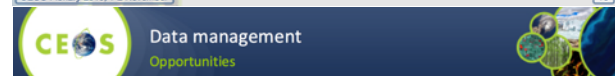


**CEOS** Data calibration, validation, harmonization  
Opportunities

- Promote **consistency of products and algorithms** between platforms.
- To achieve consistent products **continued strong inter-agency coordination and engagement** in various calibration and validation initiatives, like GSICS and CEOS WGCV, is **encouraged**.
- Algorithm development and validation benefits from **openly shared in-situ validation data** and simulated test data sets. **Coordination of validation data acquisition** such as from field campaigns, which are often resource intensive, would be highly beneficial.
- **Support to cal/val infrastructure** for validation of radiometric products such as the RadCalNet or AERONET(-OC) networks including system vicarious calibration sites, fosters interactions with the user community in support of validation and accuracy assessments.

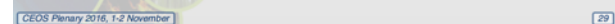


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**CEOS** Data management  
Opportunities

- Promote **uniform data and metadata formats** across missions.
- **Take advantage of modern data approaches** such as those identified by the CEOS Ad Hoc Team on Future Data Architectures.
- Emphasise the **generation of information** rather than product files.
- Consider how the **“Analysis-Ready Data” concept** would apply to GEO-ring products and GEO-LEO integration.
- Create data that is readable by **non-meteorological application software** such as GIS to broaden the user base.
- **Develop common tools** so that GEO data and applications can be integrated into commercial or open source software.



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### Plenary Discussion on NMA

Wei Caiying (NSMC-CMA) thanked the NMA-AHT for their work and supported their findings. In regard to follow up activities, Wei suggested that combination datasets (both GEO-LEO and GEO-GEO) should be pursued as a priority. Wei supported the continuation of CEOS activities around non-meteorological applications of next-generation geostationary satellites, to promote new and increased applications.

Kerry Sawyer (NOAA, SIT Vice-Chair Team) thanked the NMA-AHT for their work. She reported that the SIT Vice-Chair Team recommends agencies work bilaterally to address the opportunities identified in the report. NOAA acknowledges the significance of the report and the identified opportunities, and wish to see these taken forward by CEOS Agencies, however it is not certain at this stage whether NOAA will carry the initiative forward as a priority during their SIT Chair term.

Anthony Rea (BOM) supported the statement of NSMC-CMA, stating that services/applications are key. He noted that there are complementary and supplementary activities ongoing within WMO and CGMS that should be assessed.

Paul Counet (EUMETSAT) also thanked the NMA-AHT for their report. He announced that EUMETSAT will present the report and opportunities at the next CGMS Plenary, and will report back to CEOS at the 2017 CEOS Plenary.

Osamu Ochiai (GEO Secretariat) noted the great potential for the GEO SBAs, and he suggested that the report could be published on the GEO website. He added that the GEO SBA framework could be used to engage with potential users.

<p><b>D30-14</b></p>	<p>CEOS Plenary endorsed the <i>Non-meteorological Applications for Next Generation Geostationary Satellites Study</i>. CGMS will look at the opportunities described in the study report and inform CEOS about the ones that CGMS will pursue. Individual CEOS agencies are encouraged to explore the issues therein. The 31<sup>st</sup> CEOS Plenary will revisit developments in this area during 2017.</p>	<p>Update to be provided at the 31<sup>st</sup> CEOS Plenary.</p>
<p><b>30-10</b></p>	<p>CEOS Agencies to provide updates at the 31<sup>st</sup> CEOS Plenary on opportunities taken forward from the <i>Non-meteorological Applications for Next Generation Geostationary Satellites Study</i>.</p>	<p>Updates to be provided at the 31<sup>st</sup> CEOS Plenary.</p>

30-11	EUMETSAT to provide the final <i>Non-meteorological Applications for Next Generation Geostationary Satellites Study</i> to CGMS and provide any feedback from CGMS Agencies via the CEOS Secretariat and an update at the 31 <sup>st</sup> CEOS Plenary.	Update to be provided at the 31 <sup>st</sup> CEOS Plenary.
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## Session 7: VCs and WGs

### Working Group on Information Systems & Services (WGISS) Report

Andrew Mitchell (NASA, WGISS Chair) presented a summary of 2016 WGISS activities. A key event was the Cloud Computing Workshop, held in September at ESA ESRIN, which provided important input for the FDA Study. The central finding from the meeting was that due to the sharp increase in EO data volumes, there is a strong need to move users closer to data, avoiding large transfers. In response, WGISS will give further consideration to the following questions:

- Will cloud services save agencies money?
- What interoperability issues will the cloud solve/create?
- What is the best way to make ARD discoverable and accessible via cloud services?
- What are we doing/can we do with data in the cloud? (i.e., cloud-enabled applications)

WGISS is also working on consolidating the current CWIC/FedEO/IDN overall architecture to quickly address some of the identified open issues and have created an integrated system team to coordinate and oversee the WGISS integrated system and standards. The WG is aiming to facilitate the discoverability and accessibility of ECV products and space-derived Climate Data Records (CDRs) that are relevant for the actions identified in the *CEOS Strategy for Carbon Observations from Space*. WGISS is also developing a prototype Carbon Portal, similar to the Water Portal (<http://waterportal.ceos.org/>), to display carbon datasets and provide assistance to scientists and general users in the development of related services and tools.

To ensure full representation of CEOS Agency datasets in the IDN and to ensure that they are accessible via WGISS interoperability standards, WGISS has initiated discussions with ISRO and various Australian centres (GA, CSIRO, Bureau of Meteorology, Australian National University/National Computational Infrastructure) to make their data accessible via the IDN and CWIC. New entries were also added to the IDN from ESA, EUMETSAT, and JAXA. WGISS is also progressing CEOS Work Plan Task VC-1, consulting VCs and WGs on relevant datasets.

Andrew noted that USGS intends to dispose of its Landsat Multispectral Scanner (MSS) and Thematic Mapper (TM) satellite film, and an announcement in-line with the CEOS Data Purge Alert Procedure has been issued. The Purge Alert White Paper and associated materials are being finalised for publishing on the CEOS website, and an approach for engaging commercial data owners is being considered. Other documents in progress are the Associated Knowledge Preservation Best Practices and Maturity Matrix/Model.

Andrew closed his presentation by summarising the current state of WGISS-GEO interactions, noting that WGISS has been added as a contributor on GEO Foundational Task GD-7, sub-task two, 'GCI Development'; and GD-2, 'GCI Operations'. The CEOS Water Portal also features on the AmeriGEOSS Pilot and CWIC is being integrated into the GeoSUR Portal, GeoPlatform, and ArcticSDI.

**GEO Interactions**

- As a GEOSS Clearinghouse Infrastructure (GCI) provider of CEOS data, presented WGISS activities related to CWIC, FedEO and the IDN at the GCI Workshop on May 5<sup>th</sup> and 6<sup>th</sup> in Switzerland.
- Initiated a review of the draft **GCI User Requirements**.
- Representing CEOS by presenting methods of data discovery and access during the **Data Providers Side event in the GEO-XIII Plenary – Nov 7<sup>th</sup>**.
- GEO Secretariat request: **“CEOS WGISS to identify a PoC to discuss further for improving CEOS agencies assets discoverable and accessible through IDN, CWIC and FedEO”**
  - WGISS response: **WGISS identified the NEW System Level Team**

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Stephen Briggs (ESA, SIT Chair) commended Andrew’s presentation, noting that the content was on-target and well presented. Jonathon Ross (GA, CEO) noted a point previously raised by Tapan Misra (ISRO), that the concept of a single, consolidated agency data archive is not realistic. Jonathon asked whether WGISS will continue to explore new data distribution solutions, and Andrew confirmed that this is planned.

**Working Group on Calibration & Validation (WGCV) Report**

Albrecht von Bargaen (DLR, WGCV Chair) presented an overview of WGCV’s CEOS Work Plan Tasks:

**CEOS Work Plan Deliverables**

#	Short Title	Due date	Comment
CV-01	CEOS WGCV Cal/Val portal update	Q2 / 2017	Web Concept consolidation Q4 / 2016
CV-03	Workshop on pre-flight / on-ground calibration	Q4 / 2017	In cooperation with GSICS
CV-04	WGCV self-analysis to serve other VC and WG needs	Q4 / 2016	Report delivery end of 2016
CV-05	GSICS cooperation	closed	See below
CV-09	Establishment of RadCalNet	Q4 / 2016	Beta-phase opened, see below
CV-12	Evaluation of validation supersites	closed	<a href="https://svn.gfsc.nasa.gov/IV_CS_gen.html">https://svn.gfsc.nasa.gov/IV_CS_gen.html</a>
CV-13	Inter-comparison of atmospheric correction models	Q4 / 2018	Task team ACIX, see below
CV-14	Report on application of approaches for cloud masking	Q4 / 2018	In planning phase
ORG-7	Working Group Terms of References	[closed]	Today's endorsement item

- **CV-01** Overall web concept for WGCV which includes also the appearance on the CEOS web page, presented during WGCV 41 and now under consolidation (inclusion of comments); implementation is planned for 2017.
- **CV-03** Such a workshop exists for SAR; set-up for optical sensors is planned for implementation together with GSICS at projected and updated due date.

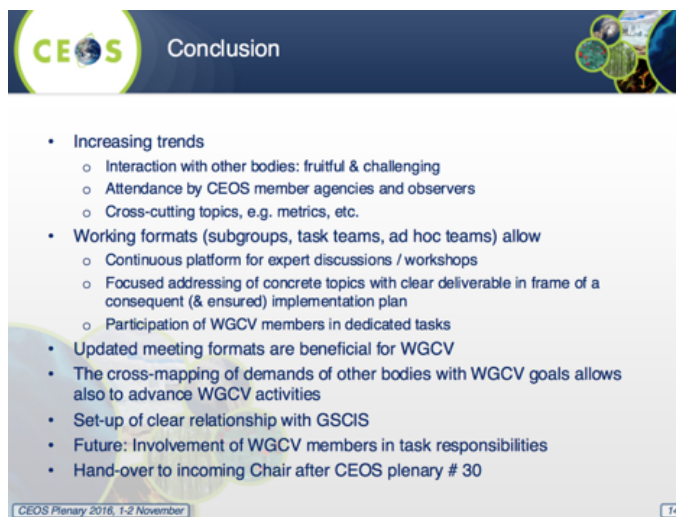
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Albrecht reported that WGCV is coordinating the Atmospheric Correction Inter-comparison EXercise (ACIX), which is performing an assessment of atmospheric correction processors for high spatial resolution optical imagers. The results are expected in Q1 2017. WGCV is also undertaking the RADCALNET initiative – a network of instrumented sites dedicated to the radiometric calibration of EO optical sensors (developed within the IVOS subgroup). The RADCALNET Portal is expected to be operational in mid-2017.

Albrecht presented the results of a mapping between the actions identified in the *CEOS Strategy for Carbon Observations from Space* and WGCV internal tasks. It is expected that all action items will be addressed before the end of 2017.

Albrecht noted the September WGCV SAR Workshop held at Tokyo Denki University (hosted by JAXA). Around 90 people from government agencies, research entities and instrument providers were in attendance. An abstract book with approximately 60 contributions is available here: [http://sarvc.ceos.org/site\\_media/static/symposium/data/ceos-2016.pdf](http://sarvc.ceos.org/site_media/static/symposium/data/ceos-2016.pdf)

Albrecht noted the close links between WGCV and other entities, highlighting WGCV's participation in LSI-VC teleconferences, the co-located WGISS and WGCV meetings, and interactions with the International Ocean-Colour Coordinating Group (IOCCG).



Albrecht closed by thanking CEOS for the opportunity to serve as WGCV Chair, and he thanked Kurt Thome (NASA) in particular for his support as WGCV Vice-Chair. Albrecht confirmed the WGCV Chair handover to Kurt and noted that Cindy Ong (CSIRO) has been nominated as the new WGCV Vice-Chair. The CEOS Plenary endorsed Cindy as the new WGCV Vice-Chair.

<b>D30-15</b>	CEOS Plenary endorsed Cindy Ong (CSIRO) as the new Vice-Chair of the CEOS Working Group on Calibration & Validation (WGCV).	
<b>D30-16</b>	CEOS Plenary endorsed the new WGCV Terms of Reference.	

**Working Group on Capacity Building & Data Democracy (WGCapD) Report**

Jane Olwoch (SANSA, WGCapD Chair) presented an update on the WG’s activities, noting in particular key meetings and workshops:

- The 5<sup>th</sup> annual WGCapD meeting was hosted by the CEOS Systems Engineering Office (SEO) in Hampton, Virginia, USA, from March 30 – April 1.
- The WG was represented at the ESA Living Planet Symposium by ESA and DLR. WGCapD members provided training activities in collaboration with the Czech Space Office and the UK National Space Academy. A ‘teachers course’ was also conducted and positive responses were received through the evaluation forms. Jane expressed her gratitude to DLR for sending staff and to ESA for financing the Symposium.

- Jane also noted the WGCapD SAR Training Workshops held in Colombia and Zambia, which were sponsored by CSA and supported by NOAA (provided translation services). The workshops introduced participants to the use of SAR for agricultural monitoring and applications in the areas of seismology and volcanology. Around 95% of the workshop participants were lecturers at universities, fostering further knowledge transfer. All available SAR tutorials, tools, and online courses are being collated for the reference of participants.
- A four-day regional training workshop on the Shuttle Radar Topography Mission (SRTM-2) took place from 19–22 September 2016 at the International Centre for Integrated Mountain Development (ICIMOD) Headquarters, Kathmandu, Nepal. The workshop focused on the use of the free and publicly available 30-metre elevation SRTM-2 datasets, which are extremely valuable for addressing critical issues impacted by the Earth’s topography, including water flow, heavy rainfall, river plain flooding, coastal storm surges, agricultural stresses, and public health challenges. The U.S. Government (NASA, USAID, NOAA, and USGS), CEOS (WGCapD), and the Secure World Foundation (SWF) partnered with ICIMOD to organise the workshop.

Jane reported that WGCapD is evaluating new strategic initiatives in support of the UN Sustainable Development Goals (SDGs), CEOS efforts around Data Cubes, GEOGLAM, and GEO (in particular AmeriGEOSS and AfriGEOSS). Jane closed the presentation noting that a new WGCapD Vice-Chair is yet to be identified.

### Working Group on Disasters (WGDisasters) Report

Stéphane Chalifoux (CSA, WGDisasters Chair) presented a summary of the work undertaken by WGDisasters this past year, covering the:

- Flood, seismic hazard, and volcano pilots;
- Recovery Observatory (RO);
- Creation of a new landslide pilot EO implementation plan, including strategic data acquisition plan; and,
- GEO Geohazard Supersites and Natural Laboratories (GSNL).

**CEOS Status of Disaster Risk Management (DRM) Pilots**

**Flood, Seismic Hazards, Volcano, and RO pilots are progressing very well with positive feedback from end users:**

- Series of on-going end-to-end projects (end in 2017) to demonstrate benefits of satellite EO to ALL DRM phases, with strong user involvement.
- CEOS Agencies have provided imagery and very good value-adding support from non-CEOS partners (practitioners, end users, major stakeholders).
- Excellent collaboration with the International Charter Space & Major Disasters.
- Initial discussion begun on pilot evaluation and on sustainability strategy.
- CEOS Web story:
  - Earthquake struck island of Cephalonia (Jan. 26, 2014), Greece.
  - Supporting flood emergency relief (May, 2016), Sri Lanka.

**CEOS New Landslide Pilot**

**Plenary endorsed creation of multi-hazard landslide pilot team at the 29<sup>th</sup> CEOS Plenary in 2016**

**Main Goals of the landslide pilot:**

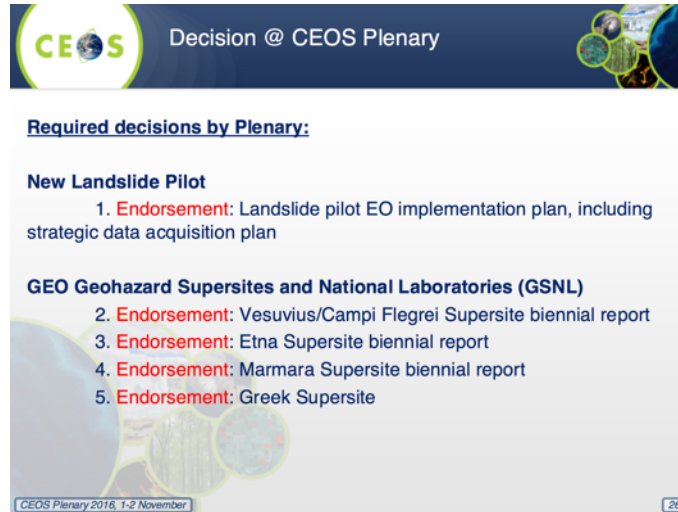
- To demonstrate the **effective exploitation** of Earth observations (EO) data and technologies to **detect, map and monitor landslides**, in different physiographic and climatic regions.
- To apply satellite EO across the **cycle of landslide disaster risk management**, including preparedness, situational awareness, response and recovery with a distinct multi-hazard focus on cascading impacts and risks.

**View from the ground (Photo credit USGS)**

**Damage Proxy Map (DPM) from ALOS-2 Data**

Stéphane reviewed progress on the new landslide pilot, which was endorsed at the 2015 CEOS Plenary. He noted that the main goals of the landslide pilot are to demonstrate the effective exploitation of Earth observations to detect, map and monitor landslides, and to apply satellite EO across the cycle of landslide disaster risk management. He noted that to date, support from CEOS agencies has been very positive, however, data are provided on R&D terms, and so if/when systems become operational, data funding issues will need to be addressed.

He reviewed the strategic data acquisition plan addressing the landslide pilot EO requirements, progress on the GEO Geohazard Supersites and Natural Laboratories (GSNL), and the Greek Supersite proposal. Stéphane also reviewed the decisions requested of the Plenary:



A brief discussion followed:

- Mauro Facchini (EC) noted that Copernicus provides a number of data streams in support of the full disaster management cycle, but was not referenced during the presentation. He suggested that it could be referenced in future. Ivan Petiteville (ESA, SIT Chair Team) noted that the role of WGDisasters is to be complementary to existing activities (e.g., The International Charter) and that it is not focused on response.
- Mike Freilich (NASA) asked how the ALOS data contributions to the Greek Supersite (currently marked as TBD) will be defined. Stéphane noted that he is working with a new POC at JAXA and he hopes to have these details soon.
- David Williams (CSIRO, CEOS Chair) asked the Plenary if there were any objections to the endorsements being requested. None were raised and the items were endorsed.

<b>D30-17</b>	<p>CEOS Plenary made the following endorsements proposed by the CEOS Working Group on Disasters (WGDisasters):</p> <ul style="list-style-type: none"> <li>– Landslide Pilot EO Implementation Plan, including the Strategic Data Acquisition Plan</li> <li>– Geohazard Supersites and Natural Laboratories (GSNL) Vesuvius/Campi Flegrei Supersite Biennial Report</li> <li>– GSNL Etna Supersite Biennial Report</li> <li>– GSNL Marmara Supersite Biennial Report</li> <li>– GSNL Greek Supersite</li> </ul>	
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### Virtual Constellation (VC) Report and Issues for Consideration

Jean-Louis Fellous (SIT Chair Team) presented a CEOS VC synthesis report. The following table presents only a few key points from each VC update. For the full presentation file, please see: <http://ceos.org/meetings/30th-ceos-plenary/>

<p><b>AC-VC</b></p>	<ul style="list-style-type: none"> <li>– AC-VC-12 was hosted by the Korea National Institute of Environmental Research (NIER) and Yonsei University. NIER plans to apply to become a CEOS Member next year.</li> <li>– The AC-VC Air Quality Constellation welcomed its first participation from China, and will work to include the LEO GaoFen-5.</li> <li>– A prototype greenhouse gas VC will come into existence by the end of the decade, and will consist of several LEO passive sensors and one active LEO sensor.</li> <li>– Deliverable VC-02 regarding total ozone dataset harmonization is on schedule, and work on tropospheric ozone and nadir profile trends has started.</li> </ul>
<p><b>LSI-VC</b></p>	<ul style="list-style-type: none"> <li>– Jean-Louis reported that the renewed LSI-VC, led by ESA (Bianca Hoersch), GA (Adam Lewis), and USGS (Jenn Lacey) has made great progress in just one year. He noted that it is one of the most active VCs.</li> <li>– LSI-VC served as the forum for developing the CEOS Analysis-Ready Data definition (now known as CARD4L – CEOS Analysis-Ready Data for Land). CARD4L underpins a large amount of the future data architectures work being progressed within CEOS. The VC is now establishing a team to define SAR ARD to integrate into CARD4L.</li> <li>– LSI-VC is currently investigating how to bring together requirements (from communities of practice, using a common framework) and the necessary observing capabilities – to establish a standard ‘CEOS Approach’ to LSI requirements and capabilities analysis. Preliminary studies will be carried out in support of the CEOS Carbon Strategy.</li> </ul>
<p><b>SST-VC</b></p>	<ul style="list-style-type: none"> <li>– The SST-VC spent the last year focusing on activities specifically identified in the CEOS Work Plan:             <ul style="list-style-type: none"> <li>○ <b>VC-1:</b> List of Relevant Datasets from VCs</li> <li>○ <b>VC-19:</b> Documented Plan for the SST Virtual Constellation</li> </ul> </li> <li>– In response to VC-1, 81 Group for High Resolution SST (GHRSSST) products are now in the archive.</li> <li>– In response to VC-19, progress has been made on the SST-VC white paper on the next generation of the SST constellation. The aim is to have the publication finished in early 2017.</li> </ul>

<p><b>OST-VC</b></p>	<ul style="list-style-type: none"> <li>– At the next OST-VC meeting (Thursday 3<sup>rd</sup> November), OST-VC will discuss the status of the action requested by CEOS SIT to produce a catalogue of existing calibration/validation facilities maintained and used for OST, as well as the potential benefits of a second generation OST-VC that would provide significant improvements in the overall space and time coverage of the VC.</li> <li>– Two recent successful launches (Jason-3 and Sentinel-3A) represent major milestones for the future of the OST-VC.             <ul style="list-style-type: none"> <li>○ Jason-3 is now operational and Jason-2’s orbit has been successfully shifted to an interleaved track with Jason-3 to optimize overall coverage.</li> <li>○ An in-orbit assessment of the Sentinel-3A altimetry mission has confirmed its quality.</li> </ul> </li> </ul>
<p><b>OSVW-VC</b></p>	<ul style="list-style-type: none"> <li>– The OSVW-VC Co-Chair position is open following the withdrawal of Julia Figa (EUMETSAT) in early 2016.</li> <li>– The next OSVW-VC meeting will be scheduled in conjunction with the next International Ocean Vector Winds Science Team (IOVWST) meeting (May 2–4, 2017 at Scripps, San Diego, California) to continue efforts to integrate IOVWST and OSVW-VC activities.</li> <li>– Jean-Louis noted that ISRO successfully launched Scatsat-1 on September 26, 2016. Scatsat-1 is a Ku-band scatterometer and a follow-up to ISRO’s OSCAT sensor with several improvements. The in-orbit assessment of Scatsat-1 is underway.</li> <li>– Mike Freilich (NASA) noted that RapidScat on the ISS is no longer operational, as of last week.</li> </ul>
<p><b>OCR-VC</b></p>	<ul style="list-style-type: none"> <li>– The OCR-VC has expanded with the addition of OLCI on Sentinel-3A. Level-1B data is now publicly available, with Level-2 data expected by early 2017.</li> <li>– Reprocessed life-of-mission VIIRS OCR data is now available from the JPSS Ocean Color EDR team using the NOAA MSL12 enterprise processing system (for more details see: <a href="http://coastwatch.noaa.gov/cwn/cw_products_ocLOM.html">http://coastwatch.noaa.gov/cwn/cw_products_ocLOM.html</a>)</li> <li>– NASA’s PACE (Plankton, Aerosol, Cloud, ocean Ecosystem) mission is scheduled to launch in 2022/23 and will expand upon the NASA Goddard legacy of measuring ocean colour from space.</li> <li>– OCR-VC contributed to the 2016 GCOS Implementation Plan, the Blue Planet Implementation Plan, and the development of AquaWatch – the GEO water monitoring and forecasting service.</li> </ul>

<b>P-VC</b>	<ul style="list-style-type: none"> <li>– P-VC members have made good progress and contributions in support of VC-16, VC-17, VC-18, and VC-22.</li> <li>– Concern remains regarding microwave radiometer (GCOM-W2/W3, DMSP FO) and precipitation radar continuity.             <ul style="list-style-type: none"> <li>○ NASA’s TROPICS cubesat constellation and JAXA’s post-GPM study suggest alternative technology paths.</li> <li>○ Efforts are being made to obtain MTZVA-GY/Meteor-M N2 data to replace DMSP-F19 observational capability, which was lost earlier this year.</li> </ul> </li> </ul>
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*Recommendations from the SST-VC Gap Analysis on Passive Microwave Radiometers*

The use of Passive Microwave Radiometers (PMW) for Sea Surface Temperature (SST) retrievals is an essential component of the global constellation of SST sensors. PMWs are important for a number of reasons. They are able to discern the temperature of the ocean under clouds, which is not possible using infrared sensors, albeit with poorer spatial resolution; and also in high-latitude regions. Currently there are risks and gaps identified in the PMW SST constellation; continuity and redundancy continues to be sought.

SST-VC recommends that, given the risk to the current and continued PMW constellation for SST and the need for a redundant capability of PMWs with 7 GHz channels, CEOS coordinate and encourage its agencies to ensure the continuity and redundancy of PMWs for SST measurements.

<b>30-12</b>	<p>Given the risk to the current and future passive microwave constellation for sea surface temperature and the need for a redundant 7 GHz capability, CEOS to encourage its Agencies to ensure the continuity of existing capabilities and to coordinate efforts to ensure continuity and redundancy of these measurements in the future. The CEOS Sea Surface Temperature Virtual Constellation (SST-VC) to report a status update via the SIT Chair at the 31<sup>st</sup> CEOS Plenary.</p>	31 <sup>st</sup> CEOS Plenary
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**Session 8: Other CEOS Business**

**CEOS Mission, Instruments and Measurements (MIM) Database and CEOS Information Systems**

Ivan Petiteville (ESA) reviewed some statistics related to the 2016 update of the CEOS MIM Database:

- Responses were received from 30 CEOS agencies;
- 32 new mission records were added, with 250 existing records updated;
- 14 new instrument records were added, and 144 existing records were updated; and,
- The database currently features, operating or planned for launch in the next 15 years:
  - 322 Earth observing satellite missions; and,
  - 916 instruments.

Ivan noted that there was no Earth Observation Handbook released in 2016, as there were two published in 2015 in support of major international agreements – the Third UN World Conference on Disaster Risk Reduction and the 21<sup>st</sup> Conference of the Parties to the United Nations Framework Convention on Climate Change. In 2017 the EO

Handbook Team will consider if the Handbook can provide additional promotion on the use of EO satellite data and the coordination role of CEOS Agencies in relation to a specific framework (perhaps the UN SDGs).

A CEOS Information Systems Survey has been conducted by the ESA CEOS Database/EO Handbook and SEO teams as part of ongoing efforts to improve the services offered by several core CEOS information services (i.e., EO Handbook, CEOS Database, COVE, CEOS Data Policy Portal). The goal is to form a better understanding of how these resources are used, and to study possible future enhancements.

**CEOS Results Summary**

- **29 responses received**
  - 45% from space agencies
  - 21% government other than space agency
  - 21% university
  - 10% NGO and International Organisation
  - None identified from industry
- **Preliminary results assessment underway**
- **Features and enhancements highlighted by respondents**
  - API; direct link between CEOS DB and COVE coverage
  - Links to instrument data stores / data access
  - Custom mission/instrument timelines

CEOS Plenary 2016, 1-2 November

A complete assessment of survey responses will be completed by the end of 2016, with results to be presented at SIT-32.

### CEOS Systems Engineering Office (SEO) Report

Brian Killough (NASA, SEO) reported the major activities of the SEO in 2016, namely CEOS Data Cube development (including the CEOS Data Cube 3-Year Work Plan; and coordination with GA, CSIRO, and USGS), support to the new LSI-VC (in particular the CARD4L description and gap analysis discussions), supporting SDCG for GFOI and GEOGLAM data acquisition planning, and maintaining existing CEOS tools and services (COVE, Data Policy Portal, CEOS website).

**CEOS Systems Engineering Tools**

**COVE Tool**

- 3700+ unique users in 2016. Free and Open
- Over 130 missions in the database. Upgraded user interface in October 2016.
- New archive link to Sentinel-1 through ASF mirror hub. Plans to add Sentinel-2 archive link through the USGS mirror hub by Dec-2016.

**Data Policy Portal**

- 141 current CEOS missions in orbit as of October 2016.
- 74% of instruments are OPEN data access.
- Entire database (past and current) includes 651 mission/instrument combinations from 28 countries.
- Updated annually, including links to client data portals. Linked to MIM Database and COVE.

[www.ceos-cove.org](http://www.ceos-cove.org)

[www.ceos-datapolicy.org](http://www.ceos-datapolicy.org)

**CEOS SEO Plans for 2017**

- **GeoCube (Data Cube):** Continue significant support to this effort in 2017. Work with multi-agency team to develop a governance plan and to advance the infrastructure. Continue to progress several prototypes and develop new prototypes. Enhance the use of CEOS satellite data through improved data interoperability, time series analyses, and solutions for developing countries.
- **GEOGLAM, GFOI and LSI-VC:** Continued support for data acquisition planning, systems analyses and ARD definition.
- **COVE Tool:** Add enhancements to the Coverage Analyzer sub-tool to improve support of GFOI and GEOGLAM. Add more missions and links to data archives (Sentinel-2 priority).
- Annual updates to the **Data Policy Portal** and the **MIM Database**.
- **Outreach** support for SilvaCarbon, IGARSS Conference, and GEO. Develop new outreach materials and continue to expand the impact of CEOS through social media.

Brian thanked Analytical Mechanics Associates, Symbios, Ake Rosenqvist, and Alyssa Whitcraft for their SEO support, and noted the CEOS outreach and meeting support efforts of Kim Holloway (NASA, SEO) in particular.

Kim reported some CEOS communications related updates and statistics. She noted that the CEOS website received 48,000 visits in the last year, with more than 30,500 of those being from new users. Kim encouraged everyone to review parts of the website that are relevant to them and to send any updates, as well as short summaries of newsworthy CEOS activities/accomplishments for promotion via the website and social media (@ceosdotorg on Twitter, socialceos on Facebook). She also reminded the Plenary that anyone with an account can edit the website, and suggested that they get in touch if they require a new username and/or password.

## Session 9: Agency Updates

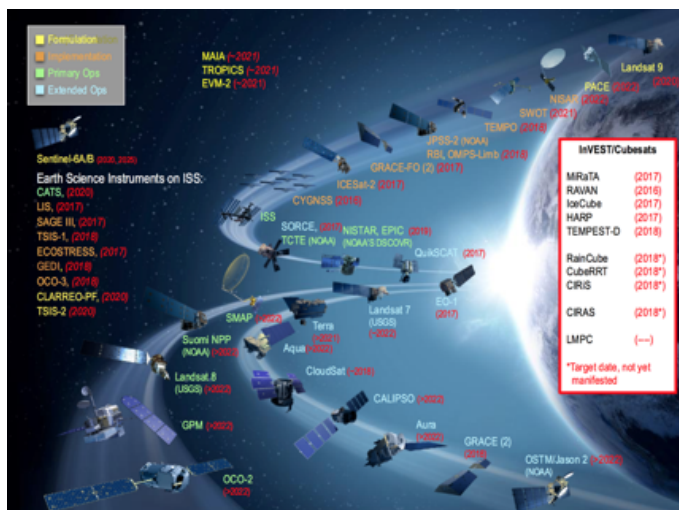
### Key Updates on Existing Space Assets or Upcoming Launches

The following table presents only a few key points from each agency update. For the full presentation files, please see: <http://ceos.org/meetings/30th-ceos-plenary/>

<b>Copernicus Programme</b>	<ul style="list-style-type: none"> <li>– Mauro Facchini (EC) presented a summary of the Copernicus programme, noting that it has a budget of 4.5 billion Euros from 2014–2020, supporting six services via full, free, and open Earth observation data.</li> </ul>
<b>ESA</b>	<ul style="list-style-type: none"> <li>– Simonetta Cheli (ESA) presented a summary of ESA’s EO missions, noting in particular the upcoming Sentinel-2B, -3B, and -5P.</li> <li>– ESA is experiencing a sharp increase in the number of users of EO data as a consequence of the Copernicus open data policy and the mission operations concept of systematic observation, acquisition, processing, and dissemination.</li> <li>– The open access data hub now has around 51,000 self-registered users and approximately 810,000 products (totalling 1.35 PB). 8.2 million products have been downloaded, representing more than 12 PB of data transfer.</li> <li>– Simonetta noted that Sentinel-2’s spare ‘northern winter’ capacity is being used for Antarctic campaigns.</li> </ul>
<b>NOAA</b>	<ul style="list-style-type: none"> <li>– Chuck Wooldridge (NOAA) provided an update on GOES-R, which is currently expected to launch on the 16<sup>th</sup> of November 2016.</li> <li>– GOES-R is NOAA’s next-generation geostationary satellite. Its Advanced Baseline Imager (ABI) will offer spatial resolutions of up to 500m and provide full-disk Earth scans 5 times faster than previous GOES satellites, with the ability to perform scans of severe weather events every 30 seconds.</li> </ul>

**NASA**

- Mike Freilich (NASA) noted some near-future NASA launches from the following illustration of the NASA Earth science mission portfolio, namely the RAVAN cubesat (November 6), the CYGNSS constellation (December 12), and the launch of SAGE-III and LIS (January 15).

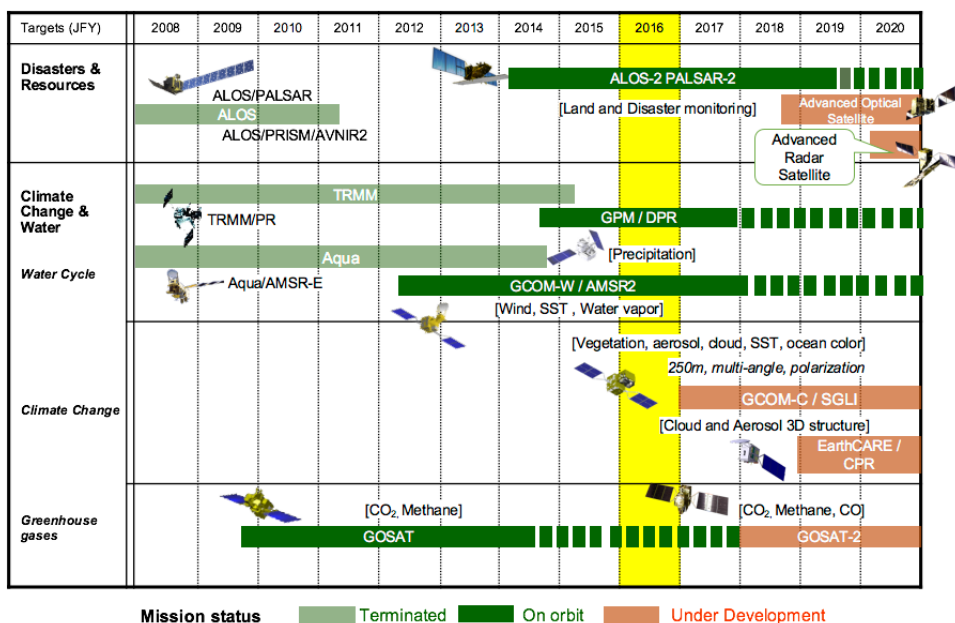


- Mike also noted that the Earth Venture Mission-2 selection announcement is imminent and the RapidScat-ISS mission recently ended.
- The *Decadal Survey for Earth Science and Applications from Space* is expected by December 2017.

<p><b>ISRO</b></p>	<ul style="list-style-type: none"> <li>- Tapan Misra (ISRO) noted the following Indian EO missions launched since the 29<sup>th</sup> CEOS Plenary:                     <ul style="list-style-type: none"> <li>o Cartosat-2 Series (June 22, 2016) – Advanced EO satellite with sub-meter resolution.</li> <li>o INSAT-3DR (September 8, 2016) – Repeat of the advanced weather satellite of India configured with an improved imaging system and atmospheric sounder.</li> <li>o Scatsat-1 (September 26, 2016) – Dedicated Ku-band scatterometer mission.</li> </ul> </li> </ul> <div data-bbox="565 548 1240 1050" style="text-align: center;"> <p><b>EO Missions - Near Future</b></p> <table border="1"> <tr> <td> <p><b>2016</b> <b>RESOURCESAT-2A</b> Continuity for Resourcesat-2</p> <ul style="list-style-type: none"> <li>LISS 4 (5.8 m, 70 km swath, 10 bit)</li> <li>LISS 3 (23 m, 141 km swath, 10 bit)</li> <li>AWIFS (56 m, 800 km swath, 12 bit)</li> </ul> <p>Orbit : 817 km Local time: 1030 hrs</p> </td> <td> <p><b>2017</b> <b>CARTOSAT- 2D &amp; 2E</b> VHR Panchromatic and Multispectral Imaging</p> <ul style="list-style-type: none"> <li>PAN (0.60 m, 10 km swath, 11 bit)</li> <li>Mx (2m , 10 km swath, 4 Xs, 11 bit)</li> </ul> <p>Orbit : 500 km Local time: 0930 hrs</p> </td> <td> <p><b>2016</b> <b>GISAT - 1</b> Geosynchronous Orbit</p> <ul style="list-style-type: none"> <li>HR Mx VNIR : 50m; SWIR: 1.5 Km</li> <li>HYSI VNIR: 320m; WIR : 192m</li> </ul> <p>Orbit : 36000 km Every 30 min</p> </td> </tr> <tr> <td> <p><b>2016</b> <b>CARTOSAT-3</b> VHR Panchromatic, Multispectral Imaging</p> <ul style="list-style-type: none"> <li>PAN (0.25 m, 16 km swath, 11 bit)</li> <li>Mx (1m , 16 km swath, 11 bit)</li> </ul> <p>Orbit : 450 km Local time: 1030 hrs</p> </td> <td> <p><b>2018 &amp; 2019</b> <b>Oceansat-3 &amp; 3A</b> Continuity for OS-2 with Improvements</p> <ul style="list-style-type: none"> <li>13 band OCM, IR-SST</li> <li>Ku-band Scatterometer ,</li> </ul> <p>Orbit : 720 km Local time: 1200 hrs</p> </td> <td> <p><b>2016</b> <b>RISAT-1A</b> Continuity for RISAT-1</p> <ul style="list-style-type: none"> <li>C-Band SAR</li> </ul> <p>Orbit : 536 km Local time: 0600 hrs</p> </td> </tr> <tr> <td> <p><b>2019 &amp; 2020</b> <b>RESOURCESAT- 3 &amp; 3A</b> Continuity for Resourcesat-2A</p> <ul style="list-style-type: none"> <li>ALISS-3:10m &amp; 12m, 925 km, 5 Bands, ATCOR: 240m, 0.4-1µm, , 10 bit)</li> </ul> <p>Orbit : 795 km Local time: 1030 hrs</p> </td> <td> <p><b>2019 &amp; 2020</b> <b>RS SAMPLER- 3S &amp; 3SA</b> High Res. 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<p><b>ASI</b></p>	<ul style="list-style-type: none"> <li>- Laura Candela (ASI) presented the current status of the COSMO-SkyMed constellation and noted its application for interferometry following the recent earthquake in central Italy.</li> <li>- She also noted the open call for COSMO-SkyMed data, which exists to promote R&amp;D on new technologies, algorithms, methods, and applications: <a href="http://www.asi.it/en/agency/calls-and-opportunities/calls/cosmo-skymed-constellation-data-utilization">http://www.asi.it/en/agency/calls-and-opportunities/calls/cosmo-skymed-constellation-data-utilization</a></li> <li>- She closed by noting the COSMO-SkyMed Second Generation development plan; the PRISMA hyperspectral mission; and the China Seismo-Electromagnetic Satellite (CSES), for which Italy provides the High Energy Particle Detector (HEPD).</li> </ul>									

**JAXA**

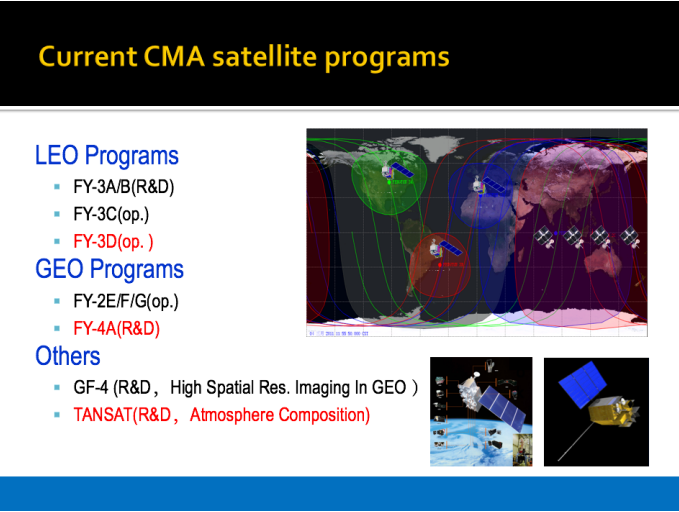
- Following the live launch of Himawari-9, Yoshinori Yoshimura (JAXA) presented the following timeline of JAXA’s EO missions, as well as JAXA’s Global Rainfall Watch, GSMaP (<http://sharaku.eorc.jaxa.jp/GSMaP/index.htm>) and its new Real-time Rainfall Watch component: [http://sharaku.eorc.jaxa.jp/GSMaP\\_NOW/index.htm](http://sharaku.eorc.jaxa.jp/GSMaP_NOW/index.htm)



**DLR**

- Klaus Schmidt (DLR) reported the completion of the new TanDEM-X global elevation model.
- EnMAP, planned for launch in 2019, is a hyperspectral mission, aimed at monitoring and characterizing the Earth’s environment on a global scale, measuring and modelling key dynamic processes of the Earth’s ecosystem.
- MERLIN, a CNES/DLR cooperative climate mission, will be the first space-borne methane Integrated Path Differential Absorption (IPDA) LIDAR when it launches in 2021, facilitating global measurements of XCH<sub>4</sub> on a country scale at all times of day.
- He also noted METImage (2021), the imaging radiometer contribution for the next EUMETSAT Polar System (EPS-SG) and the High Resolution Wide Swath (HRWS, 2022) SAR mission offering performance well beyond today’s limitations by incorporating digital beamforming techniques.



<p><b>EUMETSAT</b></p>	<ul style="list-style-type: none"> <li>– Paul Counet (EUMETSAT) reported that Meteosat-8 has now shifted to 41.5°E over the Indian Ocean as a contribution to an international effort with India, China and Japan.</li> <li>– Paul noted some of the mission milestones of Jason-3 and Sentinel-3A, which were launched earlier this year, as well as the upcoming launches of Metop-C (2018), MTG-I1 (2021), MTG-S1 (2022), Metop-SG-A1 (2021), Metop-SG-B1 (2022) and Jason-CS-A/Sentinel-6A (2020).</li> <li>– The EUMETSAT Council approved updated strategy, Challenge 2025, can be downloaded here: <a href="http://www.eumetsat.int/website/home/AboutUs/Publications/Brochures/index.html">http://www.eumetsat.int/website/home/AboutUs/Publications/Brochures/index.html</a></li> <li>– Paul closed by noting that this year, on the 30<sup>th</sup> anniversary of EUMETSAT, The University of Wisconsin retrieved 1 years’ worth of previously thought lost Meteosat data for the period 2 December 1978 to 24 November 1979.</li> </ul>
<p><b>NSMC-CMA</b></p>	<ul style="list-style-type: none"> <li>– Wei Caiying (NSMC-CMA) reviewed some of the current and upcoming satellite programmes of CMA, in particular a few new-generation GEO imagers offering very high-resolution acquisitions and interferometric infrared sounding.</li> <li>– Wei also presented the TANSAT global CO<sub>2</sub> observation and monitoring mission, which aims to acquire global atmosphere column-averaged CO<sub>2</sub> dry air mole fractions.</li> </ul> <div style="text-align: center; margin: 10px 0;">  <p>The slide titled "Current CMA satellite programs" lists the following:</p> <ul style="list-style-type: none"> <li><b>LEO Programs</b> <ul style="list-style-type: none"> <li>▪ FY-3A/B(R&amp;D)</li> <li>▪ FY-3C(op.)</li> <li>▪ FY-3D(op.)</li> </ul> </li> <li><b>GEO Programs</b> <ul style="list-style-type: none"> <li>▪ FY-2E/F/G(op.)</li> <li>▪ FY-4A(R&amp;D)</li> </ul> </li> <li><b>Others</b> <ul style="list-style-type: none"> <li>▪ GF-4 (R&amp;D, High Spatial Res. Imaging In GEO )</li> <li>▪ TANSAT(R&amp;D, Atmosphere Composition)</li> </ul> </li> </ul> <p>The slide also includes a world map showing satellite orbits and two images of satellites in space.</p> </div>

**European Space Policy**

Philippe Brunet (EC) presented a summary of recent developments in European space policy, noting that during the last four years, Copernicus has taken large steps into its operational phase. Four dedicated Copernicus satellites are now in orbit (Sentinel-1A, -1B, -2A, and -3A). The latest satellite, Sentinel-3A, launched on the 16<sup>th</sup> of February this year, and was declared operational in October. In 2017 we will also see the launch of Sentinel-2B, -3B, -5P (precursor).

The new space strategy adopted by the EC last Wednesday will underpin EU activities in space over the next 15 years, providing not only guidance but also operational certainty. Philippe noted that the Strategy is one of both continuity and change; committed to ensuring the sustainability of Europe’s investment in space and recognizing changing needs across the whole space industry value chain. Europe recognizes that business as usual will not be sufficient in this dynamic environment.

Philippe noted that the first priority of the new Strategy is to maximize the benefits that Copernicus brings to the economy by creating new opportunities for innovation, jobs, and growth. He added that today the potential remains largely untapped, and establishing a market for innovative space-based industry and connecting it to other sectors and industries to create real value is a priority.

Copernicus data distribution systems are also being reassessed, with Europe looking to online processing systems to increase usability by eliminating the need to download data.

In summary, Europe's 'Big Data' strategy is to:

1. Ensure sustainability on the data supply side;
2. Meet increasing user demand;
3. Provide users with adequate data access tools; and,
4. Fully integrate space technology into the economy for maximum benefit.

At the same time, Copernicus is also forward-looking and aware of evolutions in space technology. The future of Copernicus will take into account the availability of smaller satellites, their more frequent revisit times, and the role of their data in the digital economy. The EC is considering new small missions dedicated to CO<sub>2</sub> emission monitoring, a thermal infrared land observation mission for water management purposes and a polar mission to assess changes in the arctic regions.

Noting that space is increasingly commercial and attracting substantial private investment, new models are required for greater involvement of the commercial sector. The EC is looking to facilitate the emergence of space hubs across Europe and financing prototype activities to help new EO companies (which are mostly SMEs or start-ups) to explore new markets.

Europe recognizes that through its development efforts and open data policy, it will help expand the EO market globally, creating opportunities that will benefit both EU businesses and international partners. Philippe noted that international cooperation is more important than ever and he voiced his support for the work of CEOS, encouraging all agencies to consider these principles.

## **Session 10: Closing Business**

### **CEOS Chair Annual Report**

David Williams (CSIRO, 2016 CEOS Chair) reported that instead of a formal *Brisbane Statement*, CSIRO has opted for a *CEOS Chair's Annual Report* that states achievements, key decisions at Plenary, and future tasks. He added that the document has been posted on the 30<sup>th</sup> CEOS Plenary page on the CEOS website, and encouraged everyone to review the report. He noted that while the report does not require endorsement, feedback via email is welcome.

### **Review of 2016 CEOS Plenary Decisions and Actions**

Due to time constraints, David Williams (CSIRO, 2016 CEOS Chair) reported that the Plenary will not review the draft actions and decisions during the meeting. He requested that any edits and feedback be submitted in writing via email in response to the draft decisions and actions that will be distributed shortly.

### **Announcement of the 2018 CEOS Chair**

David Williams (CSIRO, 2016 CEOS Chair) passed the floor to Philippe Brunet (EC). Philippe acknowledged the excellent work of CSIRO as 2016 Chair and then announced that the European Commission would like to accept the 2018 CEOS Chair position. No objections were raised and the EC's nomination was accepted by the Plenary.

D30-18	CEOS Plenary approved the European Commission as CEOS Chair for 2018.	
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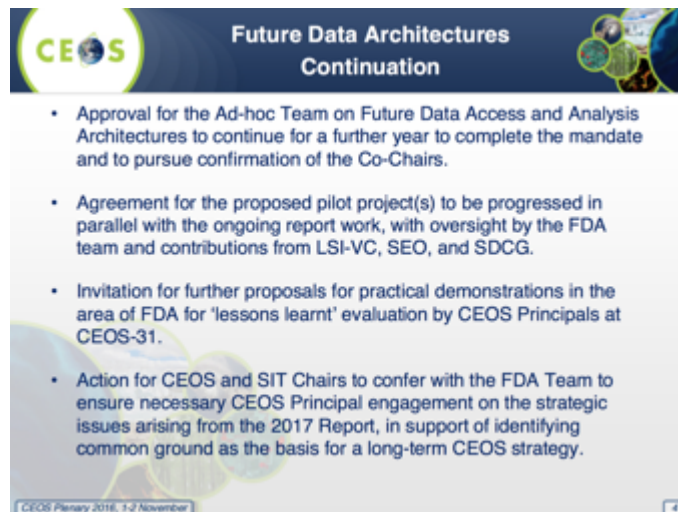
### CEOS Chair Handover

David Williams (CSIRO, 2016 CEOS Chair) expressed his gratitude to CEOS for the opportunity to serve as Chair for 2016, noting that it was a great pleasure to lead a year of such great productivity and progress. He added that he looks forward to seeing future outcomes from the work seeded by CSIRO. He thanked the rest of the CSIRO CEOS Chair Team for their assistance throughout the year. Alex Held (CSIRO, 2016 CEOS Chair Representative) supported the sentiment, in particular thanking Kim Holloway (NASA, SEO); Caroline Bruce and Flora Kerblat (CSIRO, CEOS Chair Team); Jonathon Ross (GA, CEO); Marie-Josée Bourassa (CSA, DCEO); and Stephen Ward, George Dyke, and Matthew Steventon (CEOS Chair Team).

### Introduction to CEOS Chair Priorities for 2017

Frank Kelly (USGS, 2017 CEOS Chair) thanked David Williams (CSIRO, 2016 CEOS Chair) as well as CEOS for the opportunity to serve as Chair in 2017. Frank reported that he is looking forward to the Chair year and all of the activities therein. He noted that the USGS CEOS Chair priorities for 2017 have been formulated to ensure continuity of current CEOS activities and the coherence of work around FDA and ARD. Namely, the USGS CEOS Chair Initiatives for 2017 are:

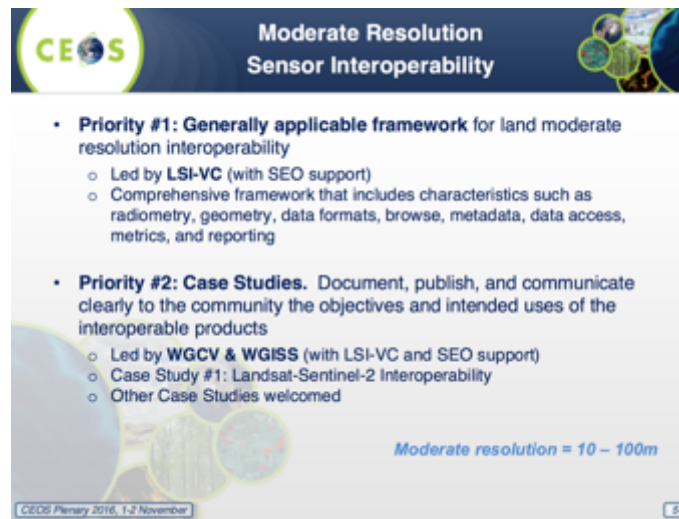
1. Future Data Architectures Continuation; and,
2. Moderate Resolution Sensor Interoperability.



**CEOS Future Data Architectures Continuation**

- Approval for the Ad-hoc Team on Future Data Access and Analysis Architectures to continue for a further year to complete the mandate and to pursue confirmation of the Co-Chairs.
- Agreement for the proposed pilot project(s) to be progressed in parallel with the ongoing report work, with oversight by the FDA team and contributions from LSI-VC, SEO, and SDCG.
- Invitation for further proposals for practical demonstrations in the area of FDA for 'lessons learnt' evaluation by CEOS Principals at CEOS-31.
- Action for CEOS and SIT Chairs to confer with the FDA Team to ensure necessary CEOS Principal engagement on the strategic issues arising from the 2017 Report, in support of identifying common ground as the basis for a long-term CEOS strategy.

CEOS Plenary 2016, 1-2 November

A presentation slide with a dark blue header containing the CEOS logo and the title 'Moderate Resolution Sensor Interoperability'. The slide lists two main priorities: a generally applicable framework for land moderate resolution interoperability, and case studies. It also includes a note on moderate resolution being 10-100m and a footer with the date 'CEOS Plenary 2016, 1-2 November' and a small '3' icon.

**Moderate Resolution Sensor Interoperability**

- **Priority #1: Generally applicable framework** for land moderate resolution interoperability
  - Led by **LSI-VC** (with SEO support)
  - Comprehensive framework that includes characteristics such as radiometry, geometry, data formats, browse, metadata, data access, metrics, and reporting
- **Priority #2: Case Studies.** Document, publish, and communicate clearly to the community the objectives and intended uses of the interoperable products
  - Led by **WGCV & WGISS** (with LSI-VC and SEO support)
  - Case Study #1: Landsat-Sentinel-2 Interoperability
  - Other Case Studies welcomed

*Moderate resolution = 10 – 100m*

CEOS Plenary 2016, 1-2 November 3

Frank closed with an announcement and video of the 31<sup>st</sup> CEOS Plenary, which will be held in Rapid City, South Dakota, from 18–20 October 2017.

### Closing Remarks

David Williams (CSIRO, 2016 CEOS Chair) thanked everyone once again for their attendance and contributions to the very successful and productive 30<sup>th</sup> CEOS Plenary. He wished everyone all the very best for the future and safe onward travels.

## Appendix A List of Participants

Agency/Organisation	Participant	Agency/Organisation	Participant
AEOCGG	<i>Stuart Phinn</i>	EC	<i>Philippe Brunet</i>
AGEOS	<i>Aboubakar Mambimba Ndjoungui</i>	EC	<i>Jonas Rupp</i>
ANU	<i>Naomi Mathers</i>	ESA	<i>Bianca Hoersch</i>
ASI	<i>Laura Candela</i>	ESA	<i>Ivan Petiteville</i>
Australian Bureau of Meteorology	<i>Agnes Lane</i>	ESA	<i>Jean-Louis Fellous</i>
Australian Bureau of Meteorology	<i>Anthony Rea</i>	ESA	<i>Mirko Albani</i>
Australian Bureau of Meteorology	<i>Jamie Treleaven</i>	ESA	<i>Pascal Lecomte</i>
Australian Department of Industry	<i>Mark Todd</i>	ESA	<i>Simonetta Cheli</i>
Australian Department of the Environment	<i>Nikki Fitzgerald</i>	ESA	<i>Stephen Briggs</i>
Australian Joint Remote Sensing Research Program	<i>Peter Scarth</i>	EUMETSAT	<i>Paul Counet</i>
CAST	<i>Li Shaohui</i>	EUMETSAT	<i>Robert Husband</i>
CNES	<i>Pascale Ulte-Guerard</i>	GA	<i>Adam Lewis</i>
CNES	<i>Steven Hosford</i>	GA	<i>Jonathon Ross</i>
CONAE	<i>Laura Frulla</i>	GA	<i>Medhavy Thankappan</i>
CSA	<i>Eric Laliberté</i>	GA	<i>Simon Oliver</i>
CSA	<i>Marie-Josée Bourassa</i>	GA	<i>Trevor Dhu</i>
CSA	<i>Stéphane Chalifoux</i>	GCOS	<i>Carolin Richter</i>
CSIRO	<i>Alex Held</i>	GEO Secretariat	<i>Barbara Ryan*</i>
CSIRO	<i>Andy Steven</i>	GEO Secretariat	<i>Osamu Ochiai</i>
CSIRO	<i>Arnold Dekker</i>	IMOS	<i>Tim Moltmann</i>
CSIRO	<i>Caroline Bruce</i>	ISRO	<i>Tapan Misra</i>
CSIRO	<i>Cindy Ong</i>	JAXA	<i>Koji Akiyama</i>
CSIRO	<i>David Williams</i>	JAXA	<i>Shizu Yabe Ogawa</i>
CSIRO	<i>Flora Kerblat</i>	JAXA	<i>Yoshinori Yoshimura</i>
CSIRO	<i>Matt Paget</i>	KMA	<i>Geun-Hyeok Ryu</i>
CSIRO	<i>Matthew Steventon</i>	NASA	<i>Andrew Mitchell</i>
CSIRO	<i>Mike Grundy</i>	NASA	<i>Bradley Doorn</i>
CSIRO	<i>Paul Bertsch</i>	NASA	<i>Brian Killough</i>
CSIRO	<i>Robert Woodcock</i>	NASA	<i>Christine Bognar</i>
CSIRO	<i>Stephen Ward</i>	NASA	<i>David Green</i>
CSIRO	<i>Thomas Schroeder</i>	NASA	<i>Kim Holloway</i>
CSIRO	<i>Tim Malthus</i>	NASA	<i>Kurtis Thome</i>
DLR	<i>Albrecht von Bargaen</i>	NASA	<i>Matthew Koeppe</i>
DLR	<i>Klaus Schmidt</i>	NASA	<i>Michael Freilich</i>
EC	<i>Astrid-Christina Koch</i>	NOAA	<i>Charles Wooldridge</i>
EC	<i>Dinka Dinkova</i>	NOAA	<i>Kerry Sawyer</i>
EC	<i>Mark Dowell</i>	NRSCC	<i>Chuanrong Li</i>
EC	<i>Mauro Facchini</i>	NRSCC	<i>Shi Qiu</i>

\* indicates remote participation.

Agency/Organisation	Participant	Agency/Organisation	Participant
NSC	<i>Einar-Arne Herland</i>	SEO Support	<i>George Dyke</i>
NSMC/CMA	<i>Caiying Wei</i>	US Department of State	<i>Fernando R. Echavarria</i>
NSMC/CMA	<i>Jiashen Zhang</i>	USGS	<i>Eric Wood</i>
NSMC/CMA	<i>Jinlong Fan</i>	USGS	<i>Frank Kelly</i>
NSMC/CMA	<i>Wang Keran</i>	USGS	<i>Jennifer Lacey</i>
NSMC/CMA	<i>Yeping Zhang</i>	USGS	<i>Steve Labahn</i>
Office of the Queensland Chief Scientist	<i>Geoff Garrett</i>	VAST	<i>Anh Tuan Pham</i>
SANSA	<i>Jane Olwoch</i>	VAST	<i>Khac Ban Ninh</i>

\* indicates remote participation.

## Appendix B Record of Actions and Decisions from the 30<sup>th</sup> CEOS Plenary

### Actions

No.	Action	Due Date
30-1	The CEOS Executive Officer (CEO) and SIT Chair Team to work with Paul Di Giacomo (NOAA) and Andy Steven (CSIRO) to understand potential CEOS contributions to the governance structure of GEO Blue Planet.	<b>Present the way forward and roles at CEOS SIT-32.</b>
30-2	The CEOS ad hoc Working Group on GEOGLAM, in consultation with the CEOS Secretariat, to provide feedback on the GEOGLAM Secretariat paper on commercial engagement. The CEOS ad hoc Working Group on GEOGLAM and GEOGLAM Secretariat to discuss, and ensure the inclusion of a clear statement of the value proposition for each entity involved.	<b>When the GEOGLAM paper is ready for comment.</b>
30-3	The CEOS Executive Officer (CEO), in coordination with the CEOS Chair Team, SIT Chair Team, and CSIRO, to prepare a statement of objectives for the new ad hoc team on the UN SDGs, and to seek approval of the statement by the CEOS Secretariat at CEOS SEC-219. Pending approval, the ad hoc team co-leads will seek members for the team (December 2016) and prepare terms of reference, to be confirmed to the CEOS Secretariat at CEOS SEC-220.	<b>CEOS SEC-220</b>
30-4	CEOS Agencies to liaise with their national delegations to COP22 to encourage interventions in support of the CEOS Statement to SBSTA45.	<b>COP22</b>
30-5	CEOS Agencies to provide any comments to Mark Dowell (EC/JRC) on the initial initiatives proposed as the next steps for implementation of the CEOS Strategy for Carbon Observations from Space – to identify major omissions and consider support capacity for the initiatives.	<b>December 2016</b>
30-6	CEOS Chair to write (with the mandate outline attached) to the CGMS Chair advising of the CEOS Atmospheric Composition Virtual Constellation (AC-VC) task to develop a Satellite Carbon Report. CGMS should be invited to nominate additional contributors, if desired, for development of the Report.	<b>November 2016</b>
30-7	CEOS Chair to provide the AC-VC Chairs with the outline mandate for the Satellite Carbon Report for comment.	<b>November 2016</b>
30-8	CEOS Agencies to provide Pascale Ultré-Guérard (CNES) with feedback on the Marrakech Declaration: 'Heads of Space Agencies Support Actions at COP22 for Water Management' (individual agency comments; CEOS has already provided its input).	<b>11 November 2016</b>
30-9	CEOS Data Cube team to prepare a governance plan for the management of a consolidated open source repository, by CEOS SIT-32.	<b>CEOS SIT-32</b>

<b>30-10</b>	CEOS Agencies to provide updates at the 31st CEOS Plenary on opportunities taken forward from the Non-meteorological Applications for Next Generation Geostationary Satellites Study.	<b>Updates to be provided at the 31st CEOS Plenary.</b>
<b>30-11</b>	EUMETSAT to provide the final Non-meteorological Applications for Next Generation Geostationary Satellites Study to CGMS and provide any feedback from CGMS Agencies via the CEOS Secretariat and an update at the 31st CEOS Plenary.	<b>Update to be provided at the 31st CEOS Plenary.</b>
<b>30-12</b>	Given the risk to the current and future passive microwave constellation for sea surface temperature and the need for a redundant 7 GHz capability, CEOS to encourage its Agencies to ensure the continuity of existing capabilities and to coordinate efforts to ensure continuity and redundancy of these measurements in the future. The CEOS Sea Surface Temperature Virtual Constellation (SST-VC) to report a status update via the SIT Chair at the 31 <sup>st</sup> CEOS Plenary.	<b>31<sup>st</sup> CEOS Plenary</b>

## Decisions

No.	Decision/Outcome	Status
<b>D30-1</b>	The Korean Meteorological Administration (KMA) was admitted to CEOS as a Member.	
<b>D30-2</b>	CEOS Plenary acknowledged completion of the Water Strategy Implementation Study Team (WSIST) Water Constellation Feasibility Study Report (response to action C.1 from the CEOS Strategy for Water Observations from Space).	
<b>D30-3</b>	CEOS Plenary did not extend the mandate of the WSIST, but noted that the CEOS feasibility study on the use of imaging spectrometers for water quality in response to action C.10 from the CEOS Strategy for Water Observations from Space is ongoing and will be completed by Arnold Dekker (CSIRO), reporting to the SIT Chair, for presentation at CEOS SIT-32.	<b>Revisit at CEOS SIT-32.</b>
<b>D30-4</b>	CEOS Plenary agreed to reconsider its approach to water observation requirements at CEOS SIT-32, in the context of developments within GEO (AquaWatch, GEOGLOWS, etc.).	<b>Revisit at CEOS SIT-32.</b>
<b>D30-5</b>	CEOS Plenary extended the mandate of the CEOS ad hoc Working Group on GEOGLAM for another year.	
<b>D30-6</b>	CEOS Plenary agreed to the establishment of an ad hoc team, reporting to the SIT Chair, to coordinate and drive CEOS engagement on UN Sustainable Development Goals (SDGs).  The ad hoc team's specific short-term objectives will be confirmed with the CEOS Secretariat, following which the team will commence work, including confirming membership and developing terms of reference.	<b>Existing contributions in this area will continue, under the coordination of the SIT Chair.</b>



<b>D30-7</b>	CEOS Plenary endorsed the ‘Statement Reporting on Progress by the Committee on Earth Observation Satellites (CEOS) and Coordination Group for Meteorological Satellites (CGMS) on Coordinated Response to UNFCCC Needs for Global Observations’ for presentation at SBSTA45.	<b>Delivery at SBSTA45.</b>
<b>D30-8</b>	CEOS Plenary agreed on the proposed step-by-step approach to progressing the CEOS Strategy for Carbon Observations from Space – with an update to be provided at the 31st CEOS Plenary.  When the initiatives are agreed they will feature as CEOS Work Plan "CARB" deliverables/objectives, with timeframes and identified lead entities/agencies, in the CEOS 2017-2019 Work Plan.	<b>Update to be provided at the 31st CEOS Plenary.</b>
<b>D30-9</b>	CEOS Plenary extended the mandate of the CEOS Space Data Coordination Group (SDCG) for GFOI for another year.	
<b>D30-10</b>	CEOS Plenary endorsed the recommendations of the Future Data Architectures Interim Report.	
<b>D30-11</b>	USGS will take forward the Future Data Architectures (FDA) topic as a CEOS Chair priority theme for 2017, with an emphasis on framing strategic discussions on the way forward for CEOS at the 31st CEOS Plenary, reflecting progress by the various stakeholders such as:  <ul style="list-style-type: none"> <li>– The Land Surface Imaging Virtual Constellation (LSI-VC) (Analysis-Ready Data);</li> <li>– The CEOS Systems Engineering Office (SEO) (CEOS Data Cube as an FDA Pilot); and,</li> <li>– The Working Group on Information Systems &amp; Services (WGISS) (best practices, etc.).</li> </ul> <p>The 31st CEOS Plenary in 2017 will include discussions on how CEOS should take the various activities forward within the CEOS structure.</p>	<b>Update to be provided at the 31st CEOS Plenary.</b>
<b>D30-12</b>	CEOS Plenary extended the mandate of the CEOS Future Data Access and Analysis Architectures (FDA) ad hoc Team for another year.	
<b>D30-13</b>	CEOS Plenary endorsed the LSI-VC CEOS Analysis-Ready Data for Land (CARD4L) Description and encouraged the proposed trial production of CARD4L, commencing in 2017, with a view to developing an understanding of the costs and benefits of ARD production for CEOS Agencies and users, specifically through the implementation of the Future Data Architectures (FDA) Pilots.	
<b>D30-14</b>	CEOS Plenary endorsed the Non-meteorological Applications for Next Generation Geostationary Satellites Study. CGMS will look at the opportunities described in the study report and inform CEOS about the ones that CGMS will pursue. Individual CEOS agencies are encouraged to explore the issues therein. The 31st CEOS Plenary will revisit developments in this area during 2017.	<b>Update to be provided at the 31st CEOS Plenary.</b>

<b>D30-15</b>	CEOS Plenary endorsed Cindy Ong (CSIRO) as the new Vice-Chair of the CEOS Working Group on Calibration & Validation (WGCV).	
<b>D30-16</b>	CEOS Plenary endorsed the new WGCV Terms of Reference.	
<b>D30-17</b>	<p>CEOS Plenary made the following endorsements proposed by the CEOS Working Group on Disasters (WGDisasters):</p> <ul style="list-style-type: none"> <li>– Landslide Pilot EO Implementation Plan, including the Strategic Data Acquisition Plan</li> <li>– Geohazard Supersites and Natural Laboratories (GSNL) Vesuvius/Campi Flegrei Supersite Biennial Report</li> <li>– GSNL Etna Supersite Biennial Report</li> <li>– GSNL Marmara Supersite Biennial Report</li> <li>– GSNL Greek Supersite</li> </ul>	
<b>D30-18</b>	CEOS Plenary approved the European Commission as CEOS Chair for 2018.	