

**MINUTES**  
**31<sup>st</sup> CEOS STRATEGIC IMPLEMENTATION TEAM MEETING (SIT-31)**  
**v1.1**

**19–20 April 2016**  
**ESA/ESRIN, Frascati, Italy**

**Main outcomes from the 31<sup>st</sup> CEOS SIT meeting:**

1. During a dedicated Plenary session, NOAA was confirmed as the **2016-2017 SIT Vice Chair**. NOAA will then serve as 2018-2019 SIT Chair (commencing at the 2017 CEOS Plenary).
2. The **CEOS-GEO relationship was discussed**, and it was agreed that it offers value to both parties and continues to be a priority. GEO's accommodation of CEOS's requests for Participating Organizations to make a greater contribution to GEO governance and leadership was acknowledged.
3. It was agreed that the preferred model would be GEO leveraging its 'convening power' to improve **high level interaction with UN agencies and development banks**, rather than CEOS establishing such relationships on a project-by-project basis, and that this is an important topic for CEOS.
4. **CEOS's ongoing support to key GEO initiatives** was affirmed (e.g. GFOI, GEOGLAM).
5. CEOS support to **GEO Blue Planet initiative** and the **G7 Oceans Initiative** was affirmed.
6. CEOS will **approach the UN-SDGs in conjunction with GEO and UN-GGIM**, including a top-down dialogue with other relevant UN agencies and individual CEOS Agencies connecting via their governments.
7. An overview of the **GCOS 2016 update plans**, and the CEOS response was discussed and the **impact and opportunities arising from COP21 and the Paris Agreement** for space agencies was affirmed.
8. CEOS noted the **Delhi Declaration** addressing the role of satellites in climate monitoring.
9. CEOS acknowledged the alignment of its activities with the potential value that **new actors adopting satellite data (e.g. 'Internet giants')** can offer, and CEOS Agencies affirmed their ongoing commitment to be active long-term stewards of the data.
10. CEOS Agencies agreed on the critical need to provide stable, quality controlled, accessible products that are processed to the furthest extent possible to facilitate user uptake and analysis of satellite EO in key global and regional agenda such as the SDGs and Sendai Framework, and to promote uptake by a broader range of users (i.e. small, medium), including through provision of properly defined **Analysis Ready Data (ARD)**.
11. LSI-VC and the SEO will **develop a definition of CEOS ARD** and present it for adoption at the 2016 CEOS Plenary.
12. Progress on the **CEOS Strategy for Carbon Observations from Space** actions was acknowledged as slow. It was agreed to hold a dedicated meeting on the topic in conjunction with the 2016 SIT Technical Workshop.
13. Guidance was given to the **Water Constellation Feasibility Study** team to look at existing studies (e.g. GPM follow-on), consider precipitation sampling requirements, and ensure a connection with the GEO Water Resources Management SBA and other water-related activities (e.g. GEOGLOWS).
14. The unique role CEOS has in **identifying thematic areas where there are synergies between user community requirements**, and the importance of engaging in **GEO Work Plan task GD-08 on SBA data requirements** in this capacity was agreed.
15. The **positive response to, and uptake of Copernicus Sentinel data** to date was recognised, with an opportunity for user feedback identifying areas for improvement. Plans to increase data distribution capacity were welcomed (e.g. via international mirror sites, Collaborative Ground Segments).

## 1. Welcome and Opening Remarks

Volker Liebig (ESA, Director of EO Programmes) welcomed participants to the 31<sup>st</sup> meeting of the CEOS Strategic Implementation Team (SIT) and to the European Space Agency's ESRIN establishment. He noted that Europe has several exciting milestones approaching, with both the acceptance review of Sentinel-5P and the launch of Sentinel-1B. The volume of downloads of Sentinel-1A and Sentinel-2A data globally to date have been encouraging. Volker noted that ESA remains a strong supporter of CEOS and SIT since ESA's strategies for EO are often in line with the ambitions of CEOS, including a strong interest in supporting society's needs for climate information, disasters, water, and food security. Volker noted that water, in particular, will be an increasingly critical societal and international issue and that space agencies should ensure space technology plays its part in finding solutions.

Participants introduced themselves in a *tour de table*.

### *SIT Chair Term Themes and SIT-31 Objectives*

Stephen Briggs (SIT Chair) welcomed all participants attending SIT-31 in person and via web-conferencing. He reviewed the SIT Chair Priorities for 2016-2017, noting that SIT-31 is the first of a series of SIT meetings over the next two years, and that the SIT Chair is seeking continuity across the meeting sequence in order to enable Agencies to engage with important strategic topics. The topics covered in the agenda represent the themes and priorities for the next two years of ESA's SIT Chair term:

1. Ensure successful advancement of ongoing CEOS commitments and deliverables, finding solutions for issues and obstacles facing existing priority initiatives.
2. Ensure full access to, and exploitation of Copernicus Sentinel data.
3. Further develop the relationships with IPCC and UNFCCC to support observation of climate indicators in the context of the new global Paris Agreement on climate change.
4. Maintain and strengthen strategic partnerships with key actors, in particular UN agencies, development banks, international programmes and agencies.
5. Support GEO as it moves into its next decade, using the substantial contributions of CEOS within GEO to support improvements in GEO's effectiveness and governance.
6. Support initiatives proposed by the CEOS Chairs in 2016 and 2017.

Stephen reviewed several issues that require attention to ensure CEOS is well positioned for future opportunities and challenges:

- **Future Strategic Partnerships** to foster uptake and application of government-sponsored EO programmes in support of key challenges (e.g. forestry, food security, water resource management, climate, disaster risk reduction);
- **Thematic Observing Strategies** how to manage the existing, and emerging, thematic observational strategies in relation to these sectors, considering the CEOS Agencies' resources;
- **Future Data Architectures** and big data stakeholders in relation to strategic partnerships and thematic observations;
- **New Opportunities** for EO satellite data in support of major new initiatives such as the Sendai Framework for Disaster Risk Reduction, delivery of the 2030 Agenda for Sustainable Development, and the Paris Agreement; and,
- **Management** how to adjust CEOS priorities and resources to respond to challenges and opportunities arising.

## 2. CEOS Plenary Session

### *CEOS SIT Vice Chair Nominations and Call for Endorsement*

Alex Held (CSIRO) introduced a brief CEOS Plenary session, noting that the objective is to nominate and endorse a CEOS SIT Vice Chair for 2016-2017. The SIT Vice Chair would then be expected to assume the SIT Chair role for 2018-2019 (effective from CEOS Plenary 2017).

Alex noted that NOAA has nominated for SIT Vice Chair 2016-2017, and opened the floor for any objections and endorsements. ESA, EUMETSAT, NASA, USGS, DLR, JAXA, CMA, and CNES all expressed strong endorsement for NOAA.

Steve Volz (NOAA) thanked CEOS for their support and noted NOAA's resolve to support and progress the many important CEOS initiatives including the Carbon and Water strategies, Blue Planet, the CEOS Chair initiatives, as well as CEOS interactions with international organizations such as GEO, GCOS, and UN Agencies and to continue to enhance the value of CEOS as a global provider of trusted, accurate, and actionable environmental information.

Stephen Briggs (SIT Chair) thanked NOAA for their nomination and looked forward to working closely with NOAA over the coming years.

<b>Decision 1</b>	<i>During a dedicated CEOS Plenary session, NOAA was endorsed as the SIT Vice Chair for 2016-2017 and subsequently SIT Chair for 2018-2019. Steve Volz will serve as SIT Vice Chair and subsequently SIT Chair for NOAA.</i>
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## 3. Strategic Directions and Partnerships

### *Introduction*

Stephen Briggs (SIT Chair) noted that the purpose of the session is to take stock of trends and future directions for CEOS and EO in general, identifying opportunities and challenges that need strategic attention, and considering, if necessary, adjustment of priorities and resources to reflect these and other set priorities for the two years of ESA's SIT Chairmanship. The history of the CEOS organisation and its membership and key partnerships was explained as the context for some of the main trends to be discussed.

Stephen noted that CEOS Associate engagement has decreased (around six of the 28 are regularly involved in CEOS Plenaries) - perhaps reflective of the emergence of GEO, which has replaced direct CEOS engagement with these communities.



The slide is divided into two main sections. The left section, titled 'Evolution of CEOS Partnerships for EO data uptake and benefits', lists key milestones from 1990s to late 2000s. The right section, titled 'Trends & observations', lists several key trends and challenges in CEOS partnerships and data uptake.

Time Period	Key Observations/Trends
1990s	Major science programmes as Associates: WCRP, IGBP etc. Major users gradually introduced as Associates – WMO, GCOS, FAO...
mid 90s	Broadened with thematic studies/alliances under IGOS-P umbrella – effective in establishing requirements and observing strategies in major areas
mid 00s	Alliances merged into GEO (2003+). Decreasing prominence of Communities of Practice. New relations with thematic science communities via VC mechanisms
mid 10s	Mature partnership with GCOS in support of UNFCCC/Parties. IGOS tradition continued via new CEOS Water, Carbon Strategies. Extended reach to individual govts and key intermediaries through thematic GEO programmes like GFOI and GEOGLAM – bringing CEOS and agencies closer to linking space data with societal benefits. Common role for UN agencies but complex in some cases
late 10s/17	GEO role evolving, and hence CEOS partnerships. Much broader, less sophisticated user base for especially land surface imagery; users more policy and issue driven. Financing institutions becoming important partners (WB, ADB, ...)

Trend/Observation
Evolving partnerships over three decades, <b>evolving configurations</b>
<b>Reduced involvement of science programmes</b> in CEOS Plenaries <ul style="list-style-type: none"> <li>Not necessarily negative</li> </ul>
<b>Reduced participation of UN and other user agencies</b> in CEOS Plenaries (also in projects/activities?) - due to positive effect of creation of GEO?
<b>Development banks</b> 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. <b>Strong policy background</b> (SDGs, UN Conventions etc.)
' <b>Internet giants</b> ' are also active and changing expectations of users
Increasing emphasis on ' <b>user-facing</b> ' data uptake and application <ul style="list-style-type: none"> <li>Thematic WGs (climate, disasters), GEO Projects, Ad-hoc Teams</li> </ul>
<b>Data size/complexity remain significant obstacles</b> to uptake of CEOS agency data, some solutions emerging

Stephen proposed two discussion topics to cover during the course of SIT-31.

1. *Should, and if so how might, CEOS establish a more systematic interaction and integration of UN agency and CEOS agency activities in areas of common interest? Is this*

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*the role for GEO in establishing a more strategic geometry for EOS programmes and the UN system? Is this the best route for CEOS?*

2. *How could CEOS work through GEO to achieve greater strategic integration of political & financial support for our data uptake initiatives, including with international donor bodies such as World Bank, regional development banks? How can we ensure both the success in relation to UN Agencies of GEO, and CEOS's role in it?*

User-facing activities	Development bank partnerships
<p>1. <b>Should, and if so how might, CEOS establish a more systematic interaction and integration of UN agency and CEOS agency activities in areas of common interest? Is this the role for GEO in establishing a more strategic geometry for EOS programmes and the UN system? Is this the best route for CEOS?</b></p> <ul style="list-style-type: none"> <li>• Noting: <ul style="list-style-type: none"> <li>• COP21 follow up</li> <li>• Successful GEO models of GFOI/GEOGLAM</li> <li>• SDG exploration</li> <li>• Successful model of CEOS-GCOS relationship (paper)</li> <li>• Data giants beginning to have direct agreements with UN agencies (often supplying CEOS agency data in some format)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Space agency EOS programmes often not properly reflected in own government development aid activities</li> <li>• Substantial funding is being applied to areas where CEOS seeks to contribute: forests, food security, disasters...including by international development banks</li> <li>• Individual agencies do have bilateral activities in this direction (ESA-WB, JAXA-ADB, NASA/SERVIR-WB etc)</li> </ul> <p>2. <b>How could CEOS work through GEO to achieve greater strategic integration of political &amp; financial support for our data uptake initiatives, including with international donor bodies such as World Bank, regional development banks? How can we ensure both the success in relation to UN Agencies of GEO, and CEOS' role in it?</b></p>

Stephen noted that these discussion points will be revisited during SIT-31, but also over ESA's full SIT Chair term. He highlighted examples of key CEOS partnerships including GEO-DARMA, GFOI, and GCOS, noting these examples show there are a number of approaches and models to working with other institutions (e.g. independently as space agencies, via GEO).

## 4. GEO and GEO Initiatives

### *GEO Framework Update and Outlook*

Barbara Ryan (GEO Secretariat Director) reviewed GEO's vision and objectives, which focus on ensuring that society's decisions and actions are informed by coordinated, comprehensive and sustained Earth observations and information. GEO aims to achieve this vision by:

- improving and coordinating observation systems;
- advancing broad open data policies/practices;
- fostering increased use of EO data and information; and
- building capacity.

Barbara noted that this is a unique period in GEO's history, with the next decade of activities (2016-2025) being defined. In November 2015 a new Strategic Plan with new programmatic mechanisms was endorsed including community activities, foundational tasks, initiatives, and flagships. The convening power of GEO, the importance of increasing linkages to development banks, foundations, and the emerging private sector have been highlighted as key areas for GEO in future. CEOS is now a member of the GEO Programme Board (PB), which is responsible for defining and driving the work programme through which GEO achieves its strategic objectives. CEOS was selected to be an observer to the GEO Executive Committee.

Barbara reviewed the GEO SBAs noting the addition of a new SBA on *Infrastructure and Transport Management*. She also noted the absence of a *Climate SBA*, which was deemed by GEO Plenary to be a cross-cutting area that will be touched upon by activities under all of the other SBAs. GEO's role in cross-cutting activities related to climate change has been recognised by SBSTA.



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### Societal Benefit Areas



### Four Types of GEO Activities



Barbara noted individual national statistical agencies will track progress against the UN Sustainable Development Goals (SDGs) through a series of indicators currently under discussion between governments, and making the connection between space agencies and the in-country statistical agencies is key to progressing the SDGs. A recent GEO-UN roundtable (7 March 2016) included 16 UN and international organisations and was an effective step in progressing the relationship among GEO and UN agencies.

Barbara reported that GEO will seek a renewed mandate from the G20 for GEOGLAM in November, and that the importance of GEO was highlighted in an October 2015 G7 communiqué. This policy recognition underscores the original vision for GEO, and has resulted from leverage of ongoing efforts by its membership.

### UNFCCC COP21 Subsidiary Body for Scientific and Technological Advice (SBSTA)



30. The SBSTA recognises the importance of: GEO, including its implementation plan for GEOSS; collaboration between GEO and GCOS; and of capacity building on systematic observation, inter alia, to enable developing countries to apply climate observations for impact assessment and preparation for adaptation. The new GEO Strategic Plan 2016-2025 establishes three Strategic Objectives – Advocate, Engage, Deliver – and emphasizes climate change and its impacts as a cross-cutting area, and strengthens the societal benefit areas making them more focused on the needs of society to support processes under the UNFCCC, the UN Sendai Framework for Disaster Risk Reduction, the SDGs and other UN agencies.

### G20 Meeting of Agricultural Ministers Action Plan on Food Price Volatility and Agriculture Paris, France, June 2011

32. In order to improve crop production projections and weather forecasting, with the use of modern tools, in particular remote sensing tools, we decide to launch, via the Group on Earth Observation, an international voluntary network of agricultural production monitoring based on geoinformation. This “Global Agricultural Geo-Monitoring Initiative” will be a useful input for AMIS concerning the provision of more accurate crop forecasts data.

Barbara reviewed a few key trends that will likely be important in future, including encouraging broad national participation to try and break down silos, the evolution of the Copernicus data policy, and growth of GCI usage (in 2014 there were 500K visits, in 2015 that grew to 2.5M, and in the three months of 2016 there have already been 3M).

She noted the GEO Work Programme Symposium will take place 2-4 May 2016 in Geneva, and that the GEO-XIII Plenary will be held 9-10 November in St. Petersburg, Russia.

A discussion followed:

- Stephen Briggs (SIT Chair) noted that there is now a GEO task aimed at defining the observational requirements for the SBAs (referred to as ‘GD-08’), and that one key goal of the GEO Work Programme Symposium is to define a process for collecting requirements from user communities. He noted the past example of how IGOS-P collected requirements.
- Steve Volz (NOAA) asked why we have an SBA for infrastructure and transportation if there are no tasks contributing to benefits in that area. Barbara noted that SBA areas were decided based on impact to society and then linked to existing tasks. She noted the role of the Programme Board in fostering new activities to address gaps.



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- Stephen Briggs noted that CEOS is firmly engaged in the governance of GEO, with observer status to the GEO Executive Committee, and representation on the Programme Board. It should be recognised that GEO has made a lot of effort to address the requests of CEOS, and CEOS now has an obligation to make the most of the opportunity.
- Brian Killough (NASA) asked about GEO's relationship with the development banks, and Barbara noted that they have been working to engage with banks in Latin America, Asia (Asian Development Bank), and The World Bank. The World Bank has indicated their willingness to act as a coordinating body.
- Barbara sees support to the delivery of the UN-SDGs as a point that the development banks could focus on, and Brian noted they could be key capacity building partners where specific projects have been identified.
- Brian asked about CEOS capacity to engage with The World Bank, and technology partners ('Internet giants'), and suggested that WGCapD and WGISS could have roles to play.
- Steve Volz asked about GEO's capacity to support sustained interaction with end users and other stakeholders, and Barbara replied that GEO has a small (20 person) Secretariat who are well positioned to establish and maintain communication channels, with implementation covered by GEO Members and Participating Organizations working with external funding and implementing partners.
- Andy Mitchell (NASA) noted use of the CEOS IDN as the connection to the GCI, and the work that has been done to automate that connection.
- Mark Dowell (EC/JRC) suggested CEOS needs to be involved in GEO's definition of SBA requirements (i.e. GD-08) to ensure that they are formulated in a format that allows CEOS and space agencies to effectively respond. Barbara noted that Giovanni Rum is coordinating GD-08, and has reached out to a number of agencies to discuss requirements during the Work Programme Symposium. She noted that a number of senior CEOS representatives will join this meeting.
- Mark noted the apparent lack of a mechanism to deal with the cross-cutting nature of climate requirements, and Barbara noted that GEO relies on GCOS to provide a coordination forum, and that more could be done around the definition of climate activities.
- Stephen Briggs noted it would be useful if GEO could establish partnerships and set the high level interaction with UN agencies and development banks, rather than having ad-hoc and individual arrangements each time CEOS and GEO needs to establish partnerships with these agencies.

Stephen Briggs concluded the discussion, noting that GEO has responded to CEOS's request for governance representation, and he hopes to see the benefit of these decisions bear fruit in the coming years.

### *GFOI Status and Issues*

Stephen Briggs noted the various recent leadership changes within GFOI. Masanobu Shimada of JAXA is now the CEOS lead for GFOI, Thomas Harvey is heading the GFOI Office, and Anssi Pekkarinen is the new GFOI Lead from the FAO. He gave a brief status report.

**Brief Status Report**

- Reinforcement in 2016 thanks to:
  - Enthusiastic GFOI Plenary in February in Frascati
  - New FAO lead and interest in GFOI
  - Formal establishment of GFOI Office within FAO
  - Increasing donor interest (including GNU countries)
  - MGD version 2.0 another tangible with great promise
  - R&D component reactivated by ESA through GOF-C-GOLD
  - Coordination of capacity building with SilvaCarbon, UN-REDD, and World Bank FCPF
  - Better integration and coordination of components
  - Importance of REDD+ & MRV in the Paris Agreement (COP21)
- SDCG
  - New CEOS Lead (Prof Shimada, JAXA)
  - Active & productive
  - GFOI Space Data Strategy progressing routinely
  - New Space Data Portal: <http://www.gfoi.org/space-data/space-data-portal/>
  - Global Data Flows Study
  - Copernicus REDD+ input
  - Updated Work Plan
  - Intensified cooperation with FAO and UN-REDD
  - Data Cube pilots progressing (Kenya and Colombia)
  - UK host in Sept, with UK Govt briefing on GFOI

Stephen Ward (SDCG SEC) reported, noting that SDCG is providing the following documents to SIT-31:

- *SDCG Element-3 Strategy: Satellite Data in Support of Research and Development (R&D) Activities v2.0* (for endorsement);
- Global Data Flows – Progress Report (for information);
- *Baseline Global Acquisition Strategy For Satellite Data 2015 Implementation Report* (for information);
- SDCG 2016-2018 Work Plan Draft (for information, will seek endorsement at 2016 Plenary & renewal of SDCG); and
- GFOI Strategy Document (for information).

Frank Martin Seifert (ESA) summarised the updated *SDCG Element-3 Strategy: Satellite Data in Support of Research and Development (R&D) Activities v2.0* being presented for endorsement. He also reviewed the *Baseline Global Acquisition Strategy For Satellite Data 2015 Implementation Report*, noting that Landsat was the main workhorse again in 2015 and is soon expected to be joined by Sentinel-2A, once its commissioning phase is complete.

**SDCG Implementation Report**

- SDCG Element 3 Strategy:** Satellite Data in support of GFOI R&D Programme. First endorsed by SIT-30. Complement to SDCG Global Baseline (EI-1) and National Space Data Services (EI-2) Strategies.
- GFOI R&D Programme – activities re-started in 2016
  - o GFOI R&D component coordination supported by ESA
  - o 15 R&D teams from REDD countries and int'l research organisations
  - o Multi-disciplinary sites, addressing several GFOI Priority R&D topics
- Element-3 implementation progressing with strong engagement by CEOS agencies with commercial missions (ASI, CNES, CSA, DLR, JAXA). Satellite tasking and data provision to selected R&D groups on-going.
- Implementation plan for 2016 ready for execution; plans for 2017-2018 scoped in SDCG 3YWP. 3-year duration proposed.
- Seeking endorsement of CEOS SIT (@ SIT-31) for the Strategy

**Landsat 7 and 8**  
Again main work horses for GFOI  
Landsat acquired systematically in 2015 over all GFOI countries

**Sentinel-2**  
launched on 23 June opened its data flow on 3 December 2015.

**Sentinel-1**  
in ramp-up phase until June 2015, acquired specifically over heavily clouded areas and areas with a high risk of illegal logging

**ALOS-2 PALSAR-2**  
Annual mosaics are provided by JAXA

**Landsat 8 OLI Number of Images per Scene 2015-01-01 to 2016-01-03**

**SENTINEL-1A - GLOBAL PRODUCT OFFER AT SCENE (10m mode / all polarizations / GRSS product)**

Stephen Ward summarised the status of acquisitions for GFOI, noting that the overall dialogue has shifted from concerns about data availability to how to remove obstacles to data uptake. He raised the following issues from SDCG for the attention of SIT:

1. Due to the growing data volumes, a shift in the approach for the delivery of data to users is required. The Global Data Flows Study, which remains in progress, looks at possible scenarios and solutions. The Study has received positive feedback from countries and The World Bank on the obstacles to uptake of space data.
2. SDCG sees significant strategic value in the working level initiatives in relation to ARD and the Data Cube, and believes these have significant potential to reduce obstacles to data uptake.

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3. The Australian funding cycle for GFOI ends as of 31 December 2016, and potentially impacts all aspects of engagement and support, including Australia's role as a GFOI Lead, the development of the Methods and Guidance Documents (MGD, including the web application REDDCompass), and support to the Space Data Component through provision of the SDCG Secretariat. CEOS (as a GFOI Lead) should be aware, and consider the implications.
4. Part of the focus of SDCG in 2016 is on an end-to-end demonstration of GFOI services with one or two countries in association with FAO and the GFOI Office.
5. In support of the GFOI Global Baseline Acquisition Strategy, more frequent C-band SAR (dual-polarisation) observations over the world's forested areas are required to make an effective contribution to REDD+, as well as to deforestation early warning systems.

A brief discussion followed:

- Einar-Arne Herland (NSC) emphasised the importance of the GFOI activity. He noted the Copernicus User Forum Global Land Service roadmap for future Copernicus services for REDD+. There is reference to GFOI and the MGD in the concept note, which represents a very important achievement for GFOI.
- Steve Volz asked whether the private sector has been engaged. And whether SDCG sees a gap in the approach advocated by GFOI, and that being taken by the private sector and others.
- Stephen Briggs noted that offerings like the Global Forest Products (produced by Matt Hansen) presented by Global Forest Watch are very accessible to users, but are not suitable for REDD+ reporting. Despite clear statements about the limitations of these products, there is confusion as to their suitability in the community, and they are frequently referenced by national forestry officials. He noted that one of the main objectives of GFOI has been to establish the MGD in order to promote approaches and products advocates suitable for formal reporting. Key to promoting update of GFOI approaches is the establishment of partnerships, and the GFOI Office is working in this direction.
- Stephen Ward agreed, noting that GFOI is a leading illustration of the need for GEO and CEOS to consider the collaboration with the big data actors with ambitions in common areas of interest. This also stresses the need for space agencies to consider alternate future data architectures with more emphasis on cloud computing and storage and ease of information extraction by end users.

Stephen Briggs called for endorsement of the *SDCG Element-3 Strategy: Satellite Data in Support of Research & Development (R&D) Activities v2.0*, and it was endorsed.

Frank Martin noted that Stephen Briggs' replacement as the CEOS Lead for GFOI is Shimadasan of JAXA, and thanked Stephen for his years of support and service in fostering and promoting GFOI.

<b>Decision 2</b>	<i>SIT-31 endorsed the SDCG Element-3 Strategy: Satellite Data in Support of Research &amp; Development (R&amp;D) Activities v2.0.</i>
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### *GEOGLAM Status and Issues*

Selma Cherchali (CNES) presented a summary of recent GEOGLAM activities, noting that it will request a renewal of its mandate from the G20 in November. This will include an enhanced focus on food security, and smallholder systems.



- GEOGLAM responded to CEOS' request for high-level guidance via our external **Advisory Committee (AC)**, upon which the CEOS Chair sits.
  - AC recommendation: **Working with CEOS to coordinate satellite data is of the highest priority for GEOGLAM.**
  - Free & open access
- End-users (decision makers) vs. intermediate (remote sensing) analysts
- In November, **GEOGLAM is refreshing its G20 mandate:**
  - Monitoring major production zones
  - An enhanced focus on food security and smallholder systems (small fields, complex landscapes)
    - o Alignment with global development agenda
- GEOGLAM has begun coordinating with CEOS **WGCapDev**
  - Initiated coordination around development of SAR training modules

Brad Doorn (NASA) noted two strategic issues that GEOGLAM is raising for SIT consideration:

1. Improving data access and utilisation (fulfilling GEOGLAM data requirements, and Analysis Ready Data for GEOGLAM); and,
2. Promoting SAR data for agricultural monitoring.

**Strategic Issue #1: Improving data access and utilization**

- GEOGLAM needs sustained access to **analysis-ready** coarse, moderate, and high resolution data including both optical and SAR, with supporting data services/dissemination systems.
- GEOGLAM's enhanced focus on food security requires SAR & fine resolution optical data – both in R&D and national/regional monitoring contexts (*sampled basis*).

**What are the challenges?** Data coverage & access for national-level needs; systematic processing of **analysis ready data**; access to restricted datasets; **R&D activities for value-added products**; dataset cross-calibration

**What are the opportunities?** Expanding the base of users; expanded use of multiple, interoperable datasets; cross-cutting impact for other global initiatives (e.g. water sustainability); ground validation data networks

**What is the expectation?** With proper planning and coordination, CEOS endorsements support will result in enhanced use and impact of EO datasets for global agriculture monitoring.

**GEOGLAM Primary Data Needs and Data Issues**

Mission	Instrument	Agency	Policy	Data Issue	Points of Contact
Terra/Aqua	MODIS	NASA	Open	None	
Suomi-NPP	VIIRS	NASA	Open	None	
Landsat-7/8	ETM+	NASA/USGS	Open	None	
Sentinel-2A	MSI	ESA	Open	Routine ARD	Ben Koetz
HJ-1A	HSI	CRESDA/CAST	Open	Access / Coverage	?
ResourceSat-2	AWiFS/LISS	ISRO	Restricted	Access / Coverage	?
CBERS-4	Imagers	INPE/CAST	TBD	Access / Coverage	?
Pleiades-1A/1B	HRI	CNES	Restricted	Access / Coverage	Steven Hosford
Radarsat-2	SAR C-band	CSA	Restricted	Access / Coverage	Yves Crevier
Sentinel-1A/1B	SAR C-band	ESA	Open	Routine ARD, Coverage	Ben Koetz
RISAT-1	SAR C-band	ISRO	Restricted	Access / Coverage	?
ALOS-2	SAR L-band	JAXA	TBD	Access / Coverage	?
TerraSAR-X	SAR X-band	DLR	Restricted	Access / Coverage	Helmut Staudenrausch

**What is the mechanism for requesting future acquisitions?**

- From near-term (3-18 months) and long-term (mission planning)
- CEOS Ad Hoc? Direct to Space Agencies? Other? (coordination team?)

**What is the mechanism for requesting archival data (already acquired)?**

**What is the feedback mechanism from CEOS/space agencies to GEOGLAM, for data requests?**

Brad noted that a GEOGLAM Data Requirements Submission Tool has been created which allows GEOGLAM users to self-report requirements for satellite data (both new acquisitions and archive data). He also requested that agency points of contact for GEOGLAM data needs and issues be identified.

Brad noted that GEOGLAM requests SIT to consider how CEOS might:

- establish mechanisms and processes for meeting GEOGLAM requirements;
- increase EO data utilisation by non-traditional users, especially in countries with poor internet connectivity, a lack of computational power, and limited experience with EO utilisation;
- facilitate access to data in support of generating improved baseline datasets (crop masks and crop calendars); and
- engage GEOGLAM in mission planning stages.

A brief discussion followed:

- Ivan Petiteville (ESA) suggested that the GEOGLAM *ad hoc* Working Group could consider approaches such as those employed by the SDCG for GFOI and the WGDisasters Data Coordination Team as examples of data coordination.

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- Ivan asked about the GEOGLAM data requirements tool, and how requests are filtered and prioritised. Brad noted the intention is that these requirements are provided directly by the users (only one submission has been received to date), and that there is a follow-up dialogue with the user around preparedness before any data request would be forwarded.
- Osamu Ochiai (GEO Secretariat) noted the recently announced availability of ASTER archive data, and asked how this will impact the GEOGLAM initiative. Selma acknowledged there are several potential uses, and that the data requirements table will be updated accordingly.
- Pascale Ultré-Guérard (CNES) asked about the origin of the data requirements submission tool and whether this was specific to GEOGLAM, and Brad replied that the GEOGLAM Secretariat prepared the tool for GEOGLAM.
- Pascale asked about future planned interaction with the LSI-VC, GEOGLAM, and the SDCG for GFOI, and Stephen Briggs noted that the split of responsibilities between these groups is a key strategic topic for CEOS that remains to be resolved when the time is right.

<b>SIT-31-01</b>	<i>CEOS Agencies asked to co-operate with an anticipated GEOGLAM Secretariat request for identification and confirmation of Points of Contact in relation to data acquisition planning &amp; data access requests for GEOGLAM</i>	<b>GEOGLAM Secretariat</b>	<b>May 2016</b>
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### *Blue Planet Update*

Paul DiGiacomo (NOAA) reviewed the objectives of the GEO Blue Planet Initiative:

**Objective 1:** Provide foundational support to the Earth observing community by bringing together the numerous and diverse ocean, coastal and inland water observation organisations and programmes.

**Objective 2:** Identify gaps in user needs and develop end-to-end services (i.e. support the development of GEO Flagship services).

Paul stressed that Blue Planet needs high-level stakeholder representatives to support implementation. He noted that within the next year the focus will be on strategic communications and engagement, establishment of a management structure, updating the Implementation Plan, and building the Blue Planet community. In the next three years the focus will be on increased communication and coordination within the ocean observing community and with end users, and beginning the development of end-to-end services.

<b>SIT-31-02</b>	<i>Paul DiGiacomo to liaise with Blue Planet in relation to the space data needs associated with their initial implementation phase activities</i>	<b>Paul DiGiacomo</b>	<b>SIT Tech Workshop</b>
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### *Other CEOS Actions in GEO WP*

Jonathon Ross (GA, CEO) presented a summary of CEOS contributions to GEO, with CEOS contributing to more than half of GEO's activities. He noted that CEOS contributes to one third of GEO Initiatives, and almost two thirds of likely GEO Flagships, leads foundational tasks like GD-05, and makes major contributions to other foundational tasks

**The increasing contribution of CEOS to the leadership and governance of GEO is a significant opportunity for CEOS to contribute to the success of GEO. This may not be strictly core ‘CEOS business’, but it reflects the notion that the success of CEOS is closely linked to the success of GEO.5. United Nations Framework Initiatives**

*UN-WCDRR*

Stéphane Chalifoux (CSA) reported, noting that:

- WCDRR 2015 was a very significant event in relation to global action on disaster response and preparedness issues; and
- WGDisasters has three thematic pilots underway (floods, volcanoes, seismic hazards), as well as the Recovery Observatory project.

He reviewed the status of the CEOS Disaster Risk Management Pilots and Recovery Observatory, including the linkage to WCDRR.

Activity	WCDRR Linkage
Flood Pilot	Floods most prevalent disaster globally; compelling satellite-based approach would offer major step forward
Volcano Pilot	Pilot demonstrates clear, measurable ability to reduce risk, but requires global application.
Seismic Hazards Pilot	Pilot shows science can improve hazard understanding; needs closer linkage to WCDRR, possibly through GSNL.
Recovery Observatory (RO)	RO strong tool to promote resilient recovery; requires plan for broader, more systematic application.
Landslides Pilot	Not established.

Four questions were raised for SIT consideration:

1. *Pilots will be reviewed by Plenary in October 2017 – what are the expectations of CEOS for pilot reporting? Are there any specific concerns or interests?*
2. *Pilots are on-track to achieve significant success in some areas – what is the CEOS vision for sustainability of successful activities within or outside CEOS?*
3. *Pilots have formed strong partnerships with organisations outside CEOS (GFDRR/World Bank, UNDP, Universities) – how should CEOS encourage continuity of these relationships outside the pilot activity?*
4. *What is the best mechanism to directly link positive pilot outcomes to sustainable services tied to Sendai Framework implementation?*

Ivan Petiteville (ESA) reviewed the CEOS pilot and lobbying efforts for the 3<sup>rd</sup> UN WCDRR (2015), noting that the *Sendai Framework for Disaster Risk Reduction 2015-2030* marked the first time satellite EO has been explicitly incorporated in such a decadal plan of action. It was also a significant opportunity to raise the profile of satellite EO in the disaster risk management community. Following the Sendai WCDRR, CEOS and GEO SEC developed a new GEO initiative, GEO Data Access for Risk Management (GEO-DARMA), which was incorporated in the GEO Work Programme in 2016.

A brief discussion followed:

- Ivan noted the importance of partner organizations (e.g. UN agencies) contributing according to their competencies and mandates, and that CEOS had observed some conflict with some UN agencies seeking to take on a space agency coordination role. Stephen Briggs (SIT Chair) noted it is important for CEOS to ensure that the right partners are identified with the right roles.

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- Jonathon Ross (GA, CEOS) noted the importance of GEO-DARMA showing concrete progress now that the conceptualization process had been successfully concluded, and that all stakeholders must engage in order to ensure that the GEO Programme Board approves it as a GEO initiative.
- Barbara Ryan (GEO Secretariat) believes GEO can be a vocal advocate for CEOS in the case of disasters, and noted the Secretariat is seeking a secondee to work on the Disaster Resilience SBA. GEO is encouraging UN agencies to engage around the CEOS table, and in some cases these agencies are already CEOS Associate members.
- Steve Volz asked about criteria for determining when and how successful CEOS pilots would transition to operations. Stéphane responded that WGDisasters plans to present the criteria at CEOS Plenary, one year ahead of the end of the pilot activities.
- Stephen Briggs noted the need to define space agencies' role in a DRM pilot once it is deemed 'successful' and that there should be an evolution of the role of space agencies as an activity develops.
- Mark Dowell (EC/JRC) noted that disasters is the only area where there is both a standing CEOS Working Group and a proposed Initiative within GEO. He noted this is in contrast to ad-hoc groups such as the SDCG for GFOI, and the GEOGLAM *ad hoc* Working Group, and asked whether a standing group provides unique value over an ad-hoc group. Stephen Briggs noted that both GFOI and GEOGLAM were initiated within GEO, and CEOS responded with the establishment of the ad-hoc groups. He would hesitate to add any additional standing thematic groups to CEOS at this stage for fear of proliferating unnecessary structure.
- Ivan added that WGDisasters started as an ad-hoc group, but was transitioned to a standing Working Group in an effort to consolidate the many ongoing activities, and to provide more structure - the Group now has between 80 and 90 active contributors.
- Ivan also stressed that it is not the goal of CEOS to lead GEO-DARMA in future, and it is hoped another entity - such as The World Bank - might take over the coordination of the activity.

### *United Nations Sustainable Development Goals*

Marie-Josée Bourassa (CSA) introduced the United Nations Sustainable Development Goals (SDGs). Unlike the Millennium Development Goals (MDGs), SDGs are defined and officially approved by nations. The indicator framework is currently being established and will define the *what, who, and how* of monitoring. The UN Statistical Commission has drafted 231 global indicators organised into three tiers based on conceptual clarity, methodology and standards, and regularity of production generation, and a geospatial information subgroup has been established. (Provisional Proposed Tiers for Global SDG Indicators as of 24 March 2016: <http://unstats.un.org/sdgs/files/meetings/iaeg-sdgs-meeting-03/Provisional-Proposed-Tiers-for-SDG-Indicators-24-03-16.pdf>) To date, CEOS consideration of strategies to ensure space data can support the SDG agenda has taken place in coordination with GEO and UN-GGIM.

Alex Held (CSIRO) noted CSIRO has been working with the Australian Bureau of Statistics as part of the Task Team on Satellite Imagery and Geo-Spatial Data for the Big Data UN Global Working Group, and that they are taking the opportunity to align the work with the CEOS effort on SDGs. He also noted that some development banks are considering aligning funding grants with SDG outcomes, and are becoming more aware that EO can contribute to activities they support through monitoring.

Alex reviewed the outcomes from the SIT-31 SDG side meeting.



**CEOS** The UN SDGs process : SIT-31 SDGs side-meeting outcomes

**Key recommendations**

- **Align with GEO initiative** (GI-18) to coordinate wider EO community efforts
- Prepare **communication strategy and materials**:
  - work with selected partners to develop compelling cases – e.g. connect with Australian representatives already engaged
  - a dedicated CEOS webpage with harmonized examples => CEOS to create a template for agencies to promote SDG examples
- Pursue (incl via GEO) partnerships with World Bank/Asia Development Bank and other global financial institutions interested in investing in programs to monitor SDGs (e.g. via [DataCube](#) projects)
- Monitor EO-related capacity building initiatives and needs through [WGCapD](#)
- Develop an engagement plan for Plenary endorsement

A brief discussion followed:

- Carolin Richter (GCOS) noted that the SDGs are driven from the top-down, while the goals will be realised from the bottom-up. She noted that GCOS was asked to lead the SDG on Climate by UN, and there is a corresponding lead for each SDG within the UN.
- Mark noted that use of satellite data to monitor change has been included in the land degradation-related SDG from the outset.
- Mark added that UN agencies have been identified for the climate, land degradation, and oceans-related SDGs, and Marc Paganini (ESA) confirmed that these leads have been published in the SDG documentation.
- Jonathon noted the potential for confusion around the coordination efforts of CEOS, GEO, UN-GGIM, and Stephen Briggs agreed on the need for these efforts to be well aligned.
- Stephen Briggs suggested that CEOS open a dialogue when appropriate with the relevant UN body on each of the SDGs in a bottom-up effort to establish an appropriate role for satellite EO data. He noted the discussion in the side meeting around the role for the development banks and their potential application of the SDGs in relation to approval of donor aid funds, and Stephen Coulson (ESA) suggested that the role of banks in the SDG context very much remains to be determined.

<b>Decision 3</b>	<i>The CEOS way forward on the Global Goals for Sustainable Development (i.e. UN-SDGs) will be undertaken in collaboration with GEO &amp; UN-GGIM, supplemented by a top-down dialogue with relevant UN Agencies and with individual CEOS Agencies making connections within their governments.</i>
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## 6. Coordination of Climate Observations

### *Coordination of Climate Observations*

Carolin Richter (GCOS) reviewed GCOS’s role in curating and coordinating activities related to the Essential Climate Variables (ECVs) across the community, noting that the GCOS Implementation Plan (IP) will be updated in 2016.



She noted that GCOS delivered a report on the *Status of the Global Observing System for Climate* and a draft outline of the new GCOS IP to COP21, with the final update of the IP to be presented at COP22. The GCOS Open Science Conference was held 2–4 March 2016. Some key outcomes were the:

- need for an extensive set of relevant climate indicators;
- need for long-time series of climate records which will reliably draw up the budgets for energy and carbon;
- continued importance and need for in-situ observations;
- improved observations of ocean and land surface stress, latent heat flux and sensible heat flux;
- need for climate research to exploit the full potential of global climate observing systems; and,
- the need to include biology in any description or modelling of the climate system.

GCOS		UNFCCC NEEDS FROM PARIS AGREEMENT	
UNFCCC	Needs		
Adaptation	Meteorological data e.g. Temp, precipitation, wind, humidity Ecosystem status e.g. Ocean colour, Land cover, soil moisture Coastal zone e.g. Sea level, sea state, topography, subsidence Ocean acidity, Glaciers, Dust, Snow water equivalent...	Also need high resolution local data. Gaps exist in vulnerable areas	
Mitigation	Land cover (e.g. forest monitoring to support REDD+) GHG emissions	Many forest monitoring activities exist	
Transparency	GHG emissions, Land cover, above ground biomass Atmospheric composition	Validation of emission inventories	
Global Stock Taking	GHG emissions, temperature, precipitation Glaciers, Ice Sheets, Sea Ice Land cover/vegetation Ocean heat content, acidity & colour, sea level Atmospheric composition,	Monitoring needs unclear	
Public Awareness	Temperature, sea level, ocean heat content, summer arctic sea ice extent, glacier mass balance, snow cover, specific humidity ...	Indicators to be decided	
Capacity Building	GCOS Cooperation Mechanism currently focussed on meteorological data	Extend to terrestrial area?	

The new GCOS Implementation Plan will broaden its scope to address global environmental cycles (e.g. energy, carbon and water), and take into account the UN Sustainable Development Goals, climate services, climate indicators, and the relevant outcomes of discussions during COP21. It will include recommendations on measurement requirements for both mitigation and adaptation, will lay out a new strategic approach to further implementation, and will introduce a section on cross-cutting disciplines and on scientific and technological challenges.

### Satellite Data Providers

- ① Substantial engagement in IP / status cycle
- ② Strong demand (for ECV spec.) and strong supply
- ③ Important to the space agency coordination mechanisms, individual agencies and their programmes
- ④ Considerable Resources allocated

Traceable to GCOS Guidelines and GCOS Climate Monitoring Principles

Dowell et. al. 2013 Strategy Towards an Architecture for Climate Monitoring from Space

### 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 the New Implementation Plan
- ⑤ Extend ECV product requirements provided in satellite supplement to in-situ data

A brief discussion followed:

- Jane Olwoch (SANSa) asked about the users of the ECVs, and Carolin responded that they are used by the climate community. She also noted that CEOS VCs are responsible for coordinating the production of products and data records based on the ECVs. Jane suggested that CEOS could take a more active role in promoting the ECVs, and Carolin agreed.
- Mark Dowell (EC/JRC) noted that Part 1 of the GCOS Implementation Plan is targeted at policy makers, while Part 2 is a requirements annex intended for technical implementation (e.g. by space agencies). He noted that the intention was to extend the table of ECVs in the annex to include some in-situ requirements, and that the annex would no longer be called the “Satellite Supplement” but would instead be referred to as “ECV Product Requirements.”
- Stephen Briggs (SIT Chair) noted that the GCOS-CEOS relationship is working very well, based on a clearly defined set of requirements for agencies.

### COP21 Outcomes and the Paris Agreement

Pascal Lecomte (ESA, WGClimate Chair) reviewed the main outcomes of COP21, noting that there were several new approaches agreed, and a focus on science and measurable long term outcomes.

#### COP21 – What happened ?

New Approach

- **New approach:** Copenhagen approach of single overall agreement, Paris based on multiple unilateral statements - Intended Nationally Determined Contributions (INDCs) – made pre-COP by nations about future intended emissions. **No centralised agreement – has important consequences for measurements**
- CO<sub>2</sub> measurements must reflect **move from Copenhagen** (“we will validate/verify your reporting”) to Paris (“we will help you improve your reporting”)
- **Developed countries to take lead** in reductions, developing countries enhance mitigation efforts
- Reporting to be **transparent** and based on **‘global stocktake’ every five years, beginning in 2023**, to assess overall effectiveness of NDCs; IPCC to report and recommend on best practice on global stocktake methods.
- Emissions and removals to be accounted for according to **methodologies and common metrics assessed by IPCC** and adopted by CoP, to be applied to second and subsequent INDCs (Parties can apply to first)

#### COP21 – What happened ?

Mitigation & Science

- **Real, measurable and long-term benefits** related to mitigation must be basis for mitigation rules
- **Specific references to REDD+** and the need for verifiable national Measurement, Reporting and Verification (MRV) of associated forest resources
- Specific requirement on Parties to provide **information on climate impacts and adaptation**
- Need to provide **data and services to IPCC Special reports**
- Need to continue to support **basic underlying science – not to be forgotten.**
- Support definition of **metrics and methodologies in IPCC** in emissions analysis

He noted that CEOS was well represented at COP21, and presented a summary of the potential roles for space agencies in climate observations and services arising from discussion there and in the follow-up.





**The Paris Agreement**  
Impact and opportunities for Space Agencies

- **Support stocktaking methods** by provision of anthropogenic emissions data and methods – CO<sub>2</sub>, land use change, integrated field/satellite/transport models/assimilation etc..
- **Support mitigation measures** e.g. REDD+, land use change
- **Support adaptation measures** by providing geo-spatial data locally
- **Provide improved indicators** of change and support definition of risk factors and indicators. (Better support in future for political decision makers to see effects of policies.)
- **Support “loss and damage”** via information on disaster risk reduction and management

- Guide future policy by providing data on **effectiveness of implementations of adaptation** measures –political benefit
- Continue to provide data to support **disaster risk reduction, management and recovery**
- Support indicators and targets of **Sustainable Development Goals** related to climate change (many of them)
- Further support **research in climate change** by enhanced data provision and support development of **climate services**
- **Capacity Building**
- Etc.

A brief discussion followed:

- Ivan Petiteville (ESA) asked whether there is a centralised agency in charge of interfacing with the various actors to foster the execution of the Paris Agreement, and Pascal indicated there is not.
- Mark noted that support to stocktaking, mitigation, and adaptation measures is consistent with the broadened scope of GCOS, and that the Paris Agreement’s outcomes will flow to CEOS through GCOS.
- Josef Aschbacher (ESA) noted that ESA is working with the EC on the study of the future Copernicus space segment, and a future mission (e.g. Sentinel-7) could be related to greenhouse gases like CO<sub>2</sub>.
- Stephen noted that there are a whole range of measures that space agencies can take to support the Paris Agreement, and that GCOS is focusing on what is needed globally rather than locally. He noted that the Paris Agreement is a good opportunity for space agencies to formulate their response, and it is fortunate that it coincides with the update of the GCOS IP and the CEOS response.

#### *Delhi Declaration*

Pascale Ultré-Guérard (CNES) presented a summary of the new Delhi Declaration proposed by Jean-Yves Le Gall (CNES) and Kiran Kumar (ISRO) at the occasion of the Asia-Pacific Remote Sensing (APRS) Symposium in New Delhi, focusing on the role of satellites for climate monitoring (in particular greenhouse gasses). This declaration complements the Mexico Declaration approved by Space Agencies at the IAC in September 2015. She explained that she does not expect major changes from CEOS-SIT since the text has already been submitted to the head of Space Agencies, and that this version is taking into account the main comments received so far.

A brief discussion followed:

- Stephen Briggs (SIT Chair) suggested that some of the post-COP21 opportunities presented by Pascale could be reflected in the declaration.
- Steve Volz (NOAA) noted that item four doesn’t mention operational satellites, and suggested a sample of both operational and research satellites should be referenced. Pascale noted that the list was shortened as it was too long, and was focused on those satellites monitoring greenhouse gases. She also noted that the conclusion of the paragraph was that the current suite of satellites is useful, but not sufficient.
- Alain Ratier (EUMETSAT) suggested that the declaration should be reviewed for consistency with the diplomatic statements coming out of the Paris Agreement, and this should be done by CNES - being closest to the diplomatic process.
- Steve Volz also asked who the intended audience was for the declaration and Pascale answered that the Delhi Declaration was more of a political tool that could be used at



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COP22 as official text, much like the text from the September 2015 Mexico City Declaration.

SIT-31-03	CNES, in coordination with ISRO, to consider comments raised at SIT-31 in providing feedback to finalisation of the Delhi Declaration	CNES	COMPLETE
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### ECV Inventory and Climate Architecture

Pascal Lecomte reviewed the current ECV Inventory development and update cycle.

#### CEOS ECV Inventory Development

- The objectives associated with ECV Inventory development are intrinsic to the fulfilment of the core objectives assigned to WGClimate in its Terms of Reference, and form a pivotal asset in the implementation of the Climate Monitoring Architecture. The activity is predicated on the concept of the "Inventory Development Cycle".
- Each WGClimate Chair has the objective of completing one inventory development cycle within their respective terms, with each development cycle corresponding to a series of CMRS actions, leading to a baseline version of the ECV Inventory.

Joint CEOS/CGMS Working Group on Climate

#### CEOS ECV Inventory - Cycle #2

- Stage #1: Collection of New & Updated Information from Data Providers
- Stage #2: Data Incorporation and Quality Control
- Stage #3: Gap Analysis
- Stage #4: Action Plan

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He noted that ECV Inventory development and release cycles coincide with the two-year term of each WGClimate Chair, correspond to a series of Climate Monitoring, Research and Services (CMRS) actions, and result in a new baseline version of the Inventory. The Inventory describes the current and planned monitoring capability, provides details of the records, attempts to establish traceability consistent with the GCOS principles, requirements and guidelines, and supports gap analysis.

#### CEOS 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.

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#### CEOS Potential Usages of the ECV Inventory beyond 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 ...

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The second cycle of Inventory population is underway, and is available here: <http://climatemonitoring.info/wgclimate>.

**Rationale**

Lessons learnt from Cycle #1	Proposed approach for Cycle #2
<ul style="list-style-type: none"> <li>▶ Unpopulated / poorly populated fields</li> <li>▶ Inconsistent / insufficient input of information</li> <li>▶ Potentially missing data records</li> <li>▶ Difficult assessment for future improvements of questionnaire</li> <li>▶ Clear distinction between current and future partly lost in implementation</li> </ul>	<ul style="list-style-type: none"> <li>▶ Revision of questionnaire Guide to the Questionnaire</li> <li>▶ Direct engagement of POCs per data record</li> <li>▶ Finding right POCs via <a href="#">WGClimate</a> members engagement</li> <li>▶ 1-to-1 interactions between 'questioner' and 'responders'</li> <li>▶ Clear split into two questionnaires</li> </ul>

Joint CEOS/CGMS Working Group on Climate

Pascal reported that a nominee for the 2018-2019 WGClimate Vice Chair needs to be identified by 31 January 2016 to be confirmed at the WGClimate #7 meeting (February 2017), and presented for endorsement at CGMS (May 2017) and CEOS (October 2017) Plenaries. It was noted that the convention agreed was to alternate the WGClimate Chair between the operational and research agencies, and so this next nominee should represent a research agency.

Pascal also noted that the WGClimate gap analysis groups require support from the VCs and other CEOS entities, and that WGClimate will reach out to CEOS and CGMS agencies seeking support for the development of the space agency response to the GCOS IP.

A brief discussion followed:

- Andy Mitchell (NASA) asked about the traceability of the ECV Inventory to missions, and Pascal noted he doesn't believe that this iteration of the Inventory is ready for that level of integration.
- Barbara Ryan (GEO Secretariat) asked if we could take the ECV Inventory approach and apply it to the other thematic areas. Stephen noted that while it would be ideal, building this kind of database is difficult to achieve at present. The current approach is to focus on climate to keep the problem manageable, and because it links to a firm problem that is facing the community. He advocated restricting the effort to a few (approx. 2-4) application areas to keep the challenge manageable before trying to address the question of general analyses.

<b>SIT-31-04</b>	<p><i>Agencies to submit nominations for the WGClimate Vice Chair position to be confirmed at the WGClimate meeting in February 2017, submitted for endorsement at CGMS Plenary 2017 (Q2 2017), and CEOS Plenary 2017 (October 2017), and to assume the WGClimate Vice Chair role as of endorsement from CEOS Plenary 2017 for 2018-2019. By convention, nominations from 'R&amp;D' agencies are to be given preference for this rotation.</i></p>	<b>CEOS Agencies</b>	<b>Nominations by 31 January 2017</b>
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## 7. Data Architectures and Enhanced Exploitation

Stephen Briggs (SIT Chair) summarised some of the current trends in land imagery data architectures, noting that the increasing number of innovative ways to access and exploit satellite data being produced by CEOS Agencies has important implications.



The slide features a dark blue header with the CEOS logo on the left and a collage of satellite and Earth imagery on the right. The title 'Trends & observations' is centered in white. Below the header, four numbered points are listed in a light blue box with a subtle background image of a globe.

1. Many emerging users of EO data use **land surface imagery as a core data set for many purposes**: SDGs, agriculture, forestry, biodiversity, water resources, urban, climate adaptation and mitigation, health etc. etc.
2. They are often **unsophisticated users but represent** a large constituency especially in the emerging sectors and in important policy areas – they are a shallow, but very large user pool.
3. But.. **data size/complexity remain significant obstacles** to uptake of CEOS agency data. Data volumes are increasing and **traditional data access and exploitation are not convenient or easy** for new (or old!) users
4. **'Internet giants' are now very active and are changing expectations** of users in relation to data uptake and application

Four topics were raised for discussion:

**Discussion topic #1:** *Given the increasing activity of commercial cloud storage and processing players (such as Amazon and Google) in the uptake and application of CEOS Agency missions, what should be the reaction of CEOS Agencies? How can agencies take advantage of their entry into the game?*

**Discussion topic #2:** *How will government programmes co-exist with these trends? What is the impact on the nature of agency ground segments? Do we need novel partnerships with commercial sector?*

**Discussion topic #3:** *Analysis Ready Data (ARD) has potential to support CEOS data uptake efforts. SEO has started a draft ARD description document to support effective coordination and standardisation efforts at this early stage. Should CEOS establish a strategic and top-down approach to ARD – supporting SEO activity and building on it?*

**Discussion topic #4:** *If we wish to pursue with SEO, how might CEOS Agencies further support the lead of the CEOS SEO to seize the opportunities ahead?*

### **Analysis Ready Data (ARD)**

Stephen Briggs noted that the current scope for CEOS ARD is limited to land surface imagery, and that we are not seeking the best solution, but an optimised solution that meets the needs of the greatest number of people.

A discussion followed:

- Jenn Lacey (USGS) noted that LSI-VC and the SEO has been working on a draft definition of Analysis Ready Data (ARD), and expects to present this to CEOS Plenary for endorsement.
- Brian Killough (NASA/SEO) noted that he sees the definition as a top-down, high level description to enable the community to communicate around minimum processing levels, without making it overly prescriptive. He noted the goals of increasing ease of data use while achieving suitable accuracy to enable decision-making and facilitate interoperability. Brian noted that within the last year, USGS has started supplying ARD data systematically, and that preliminary discussions are underway to try and achieve the same for Sentinel-2 (and also Sentinel-1) in future.
- Mark Dowell (EC/JRC) confirmed that Sentinel-2 ARD products have been in the Copernicus work programme for a number of years, and includes the development of Level-3 products via the Copernicus Global Land Service (GLS).

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- Albrecht von Barga (DLR) added that ARD products should maintain a clear link to the geophysical parameter.
- Jonathon Ross (GA) noted discussions of ARD within the Australian user community have been challenging, with many users having to agree on a common approach to the systematic generation of surface level products, and having to make 'unpopular' decisions or compromises.
- Stephen Ward (SIT Chair Team) noted that in this current era where data supply is abundant, free, and open, there is a role for space agencies to enable sensor agnostic applications via more pre-processing.
- Tom Cecere (USGS) noted that the space agencies should take on this kind of processing so end users don't have to. He added that ARD is not only helpful for less experienced users but also those that are performing large analyses over very large areas, scales, and time series.
- Henri Laur (ESA) noted that ARD is one solution, but there are other solutions that ESA hopes to see reflected in the Future Data Architectures (FDA) Study. Defining ARD is only one component, and the capacity to process and host the data also need to be considered.

Stephen Briggs summarised the discussion on ARD, noting that there is general agreement that:

- increased user-friendliness through ARD would promote use of EO data;
- CEOS needs to consider a definition of ARD such that agencies can provide compliant data products, and that there are some agencies (e.g. USGS) already doing this;
- other agencies (e.g. ESA) are working toward a definition of ARD; and
- the ability for provider agencies to systematically and sustainably produce ARD needs to be considered as it may lead to additional requirements and a processing burden on their product development chain.

### **Accessibility, Processing, and Infrastructure**

- Rob Woodcock (CSIRO) noted that accessibility should be a key consideration, and that opening up access (e.g. API access) has opened up EO analysis capabilities to a much broader audience.
- Paul DiGiacomo (NOAA) noted that CEOS Agencies should consider (e.g. via the FDA Study) potential efficiencies in processing data where it is stored, rather than having it downloaded for processing.
- It was noted that bringing the algorithm to the data repository is the approach being pursued by ESA.
- Brian noted that big data actors (e.g. Google, Amazon) present a great opportunity to promote uptake of satellite data. He noted that for the Data Cube, the SEO is supporting local infrastructure deployment, deploying to regional data hubs (e.g. SERVIR), and via commercial cloud hosting services. Andy added there may be a business cases for storage and processing of data, but that space agencies should always remain the stewards of the data.
- Alex Held (CSIRO) stressed that when considering possible infrastructure solutions, things will vary greatly by user, and user needs should not be considered static. He suggested that early in development cycles, commercial cloud hosting may allow for rapid deployment, but in time and with successful demonstration of service, investment in local/national infrastructure may make more sense.
- Steve Volz (NOAA) noted that NOAA are partnering with commercial cloud providers to take advantage of their infrastructure, and that in many cases space agencies can't compete with their data distribution capabilities. He noted that in some cases, NOAA



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ends up ‘co-branded’ with some of these distribution partners, and potential brand dilution is a consideration.

- Alain Ratier (EUMETSAT) noted that in the case of emergency information, system reliability and legal issues need to be considered, and Steve stressed that in the US, NOAA issues the official alerts directly via their networks.
- Henri noted that there needs to be certainty around data sovereignty, and to date Europe has maintained in-house data processing and storage capabilities in order to provide this certainty.
- Mark noted that CEOS Agencies are all pushing their own programmes, but the important common denominator is promotion of free and open data.

Stephen Briggs summarised the final conclusions of each of the discussion points, noting that this had been a useful debate to help scope the issues, and that overall addresses a key challenge for an important subcategory of applications and data. He noted that users will make decisions based on whatever data is available, even if it is not processed to an appropriate level, and there is an opportunity to improve the quality of data users are utilising, as well as the user experience by pursuing some of these topics.

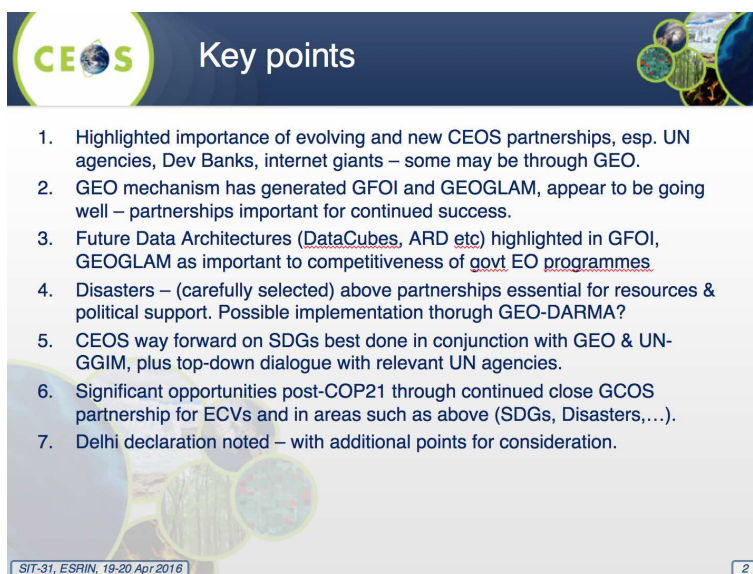
**Discussion topic #1: Commercial cloud storage and processing players and discussion topic #2: Impact on the nature of agency ground segments and partnerships with commercial sector** - overall it is felt that CEOS activities are in alignment with the emergence of these new actors. CEOS Agencies will remain the ultimate stewards of the data, and are best served by providing stable, quality controlled, accessible products that are processed to the furthest extent possible to facilitate user uptake and analysis without attempting to become producers of a wide variety of true ‘end use’ products, where ownership by users (e.g. local government agencies) is critical.

**Discussion topic #3: Potential uptake role for Analysis Ready Data** - it is agreed that there is a strong potential role for ARD, and it noted that efforts are currently underway within CEOS (e.g. LSI-VC, CEOS SEO) to develop a high-level working definition of ARD.

**Discussion topic #4: Further CEOS agency support to the CEOS SEO** - a number of different implementation options were discussed around the issue of data sovereignty (e.g. local hosting, national capacity), and commercial cloud computing services. It is noted that user needs vary case-by-case, and by phase of application development, and that their infrastructure and implementation decisions vary based on these factors, and therefore any solutions developed by CEOS (i.e. SEO) need to be as flexible and adaptable as possible.

<b>SIT-31-05</b>	<i>LSI-VC and SEO to collaborate to further develop the CEOS Analysis Ready Data (ARD) definition document with support from interested CEOS Agencies</i>	<b>LSI-VC Co-Leads, SEO</b>	<b>SIT Tech Workshop</b>
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Stephen Briggs summarised the main discussion points on the first day of SIT-31.



**Key points**

1. Highlighted importance of evolving and new CEOS partnerships, esp. UN agencies, Dev Banks, internet giants – some may be through GEO.
2. GEO mechanism has generated GFOI and GEOGLAM, appear to be going well – partnerships important for continued success.
3. Future Data Architectures ([DataCubes](#), [ARD](#) etc) highlighted in GFOI, GEOGLAM as important to competitiveness of [govt EO programmes](#).
4. Disasters – (carefully selected) above partnerships essential for resources & political support. Possible implementation through GEO-DARMA?
5. CEOS way forward on SDGs best done in conjunction with GEO & UN-GGIM, plus top-down dialogue with relevant UN agencies.
6. Significant opportunities post-COP21 through continued close GCOS partnership for ECVs and in areas such as above (SDGs, Disasters,...).
7. Delhi declaration noted – with additional points for consideration.

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## 8. Thematic Observing Strategies

### *CEOS Carbon Strategy*

Mark Dowell (EC/JRC) reviewed the heritage and status of the *CEOS Strategy for Carbon Observations from Space* which was completed in March 2014, and identified 42 actions for response by CEOS Agencies. Many of these actions are cross-cutting, and coordination of these efforts across VCs and WGs is covered by the 2016-2018 CEOS Work Plan objective CARB-8. In addition, CARB-12 calls for CEOS support to the definition of a potential GEO Carbon Flagship.

Mark noted that as of the 2015 SIT Technical Workshop (last September), limited progress had been reported, in part reflecting the overall large scale of the strategy. The VCs and WGs confirmed that they understand the actions, and that internal planning and resource assessment is under way (with no resource limitations currently identified). The SIT Technical Workshop noted that the broad scope of some of the actions presented challenges for planning a response.

At the 2015 Plenary, VCs and WGs were reassured that Principals understand that finishing many of the actions is a long-term effort and that a flexible approach is appropriate. At Plenary, and stressing the need to build momentum, the SIT Vice Chair suggested that the VCs and WGs focus on achievable near-term (1 year) steps to show some progress, and that Principals be engaged to establish their support for these proposed next steps. VCs and WGs agreed to propose such next steps with a 1-year time horizon, for consideration at SIT-31.

Mark reviewed discussion at the 3<sup>rd</sup> Carbon from Space Workshop (January 2016), and noted that a draft position paper coming out of the Workshop is expected shortly.

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### 3<sup>rd</sup> Carbon from Space Meeting and CEOS Strategy

Responded directly to recommendations from CEOS Strategy:

- Carbon-I-20:** ...CEOS Member agencies to coordinate activities to improve interaction between carbon cycle community and the satellite community through joint workshops targeting specific data needs and invest in mechanisms for community product assessment especially for key inter-comparison exercises (e.g. for IPCC)....
- Carbon-I-27:** CEOS member agencies to identify with the carbon cycle community the priorities in terms of measurements in the context of time (2015-2020-2025) and space (increasing resolution of needs) (e.g. Carbon from Space meeting) ....

### 3<sup>rd</sup> Carbon from Space Priorities from discussion

- Responding to COP21
- Improving the Global Carbon Budget (oceans, FF and especially LAND)
- Traceability of GCB down to Regions – RECCAP-style experiments
- Missing observations/fluxes – land-ocean flows, methane (wetlands, lakes), urban, point sources
- Land Use/Cover Change and Dynamics – high resolution (especially tropics)
- Special Case studies – Arctic, Indonesia, SOCCOM, Indian Ocean
- 3-D structure/mortality – preparation for BIOMASS, GEDI, NISAR
- Verification of decadal predictions/stock changes

**Next step**  
Report/White paper/position paper on outcomes:  
First draft for discussion and further elaboration by end of April.

Mark provided an update on on-going activity within the SST-VC on developing and validating air-sea greenhouse gas exchange products. He also reported that WGCV has setup a small *ad hoc* team to define the way forward on their Carbon Strategy actions, and tasks are being defined based on sub-group inputs.

Mark reviewed recent discussion in WGClimate on their response to the CEOS Carbon Strategy, noting that they expected to be able to address at least three of the actions by taking advantage of the ECV Inventory gap analysis process.

### WGClimate points discussed

- For consistent ECV Carbon products take advantage of inventory output to produce subset of ECV Products contributing to Carbon Strategy**
- Create list of research priorities for Agencies funding programmes**
- Synergies with WDAC and CEOS Agencies on data-model inter-comparison/integration**
- Cross WG-VC longer-term global constellation strategy**

- Dedicated WGClimate Carbon poc (not Mark)**

### Actions assigned to WGClimate

Encourage the production and availability of high-quality, consistent long time series data products based on multiple sensors and missions for carbon and climate science and for model-data and data-data intercomparison exercises.	WGCV AC-VC LSI-VC OCR-VC
Make publicly available all information necessary to document the accuracy, clarity, and traceability of the satellite data and data products they produce.	WGCV VCs
Coordinate efforts to develop compatible (e.g., temporal and spatial resolution, grids, data formats, common auxiliary data, units) carbon data products from multiple missions	OCR-VC AC-VC LSI-VC WGCV
Ensure the long-term accessibility of satellite data and data products for carbon cycle science and policy. This must include arrangement for secure archives, documentation, and metadata as well as for provisions for easy discovery and access	WGISS
Serve as a point-of-contact for appropriate satellite products for major model-data intercomparison exercises related to the carbon cycle.	WGClimate chair membership on WDAC

He noted a proposed joint WGCV-WGClimate validation task looking at, “... each of the relevant variables in each of the domains CEOS will work with the carbon science community to assess the current provision of validation data in terms of quality (defined by protocols (e.g., WGCV LPV protocols) and/or maturity matrices (e.g., WG Climate)) and spatial and temporal coverage”.

Finally, Mark reviewed the CEOS link to the proposed GEO Carbon Flagship (being coordinated under CARB-12), and reviewed the summary and discussion points.

### CEOS link to proposed GEO Carbon Flagship

- GEO Carbon Flagship is an active contribution to the climate component of the GEO 2016-2025 Work Plan to provide decision makers with data, information and products needed to address climate policies and tackle global change
- Represents an umbrella that links relevant different carbon-related initiatives within and beyond GEO, including being an implementing mechanism for the **CEOS Carbon Strategy**.
- Coordinating Team and a Steering Committee for GEO Carbon Flagship set up with Stephen Plummer (ESA) tasked through to represent CEOS.
- Close liaison in this process with SIT Carbon Actions coordinator
- Others involved CMCC, GCP, ICOS, WMO/IG3IS, NEON, US Carbon Cycle Science Program, Active research centres in the GEO Carbon Task
- Implementation Plan (IP) with tasks, roles and teams being written for submission to GEO-XIII Plenary.

### Summary and Discussion

- Justification for CEOS to address Carbon Strategy systematically/coherently is being further re-enforced (e.g. post COP-21)
- Things are “moving” – critical cross-talk between CEOS entities (WGs and VCs) is starting (=> existential debates)
  - Present Priority Actions for each CEOS entity WG and VC
  - Continue emphasis on mid-term milestone i.e. break Actions up into smaller pieces
- Identify Research Priorities for funding programmes – topics linked to Carbon Actions + International dimension
- Try and expose agency level activities (which include international components) – which have not yet been captured
- Through WGs and VCs establish linked with external entities addressing in-situ (e.g. GEO, WCP) and modelling (e.g. WDAC)
- Identify Carbon poc/champions within each WG VC, can be, but not necessarily Chairs/Co-Leads
- Organise CEOS Carbon meeting in September Oxford – attendance across WGs and VCs

My Vote: Perseverance



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A brief discussion followed:

- Albrecht von Barga (DLR) noted that the WGs rely on a large science community and need a bottom-up approach, while during the past five years CEOS has worked its Carbon efforts from the top-down. There is a need for a middle ground, as well as clear links between the scientific efforts and the top down requirements. Stephen Briggs (SIT Chair) noted that establishing these linkages can be complex, and can delay progress.
- Claus Zehner (ESA) noted the two separate actions asking for a GEO and a polar constellation, and that ACC-VC would prefer to have a single action/constellation. Mark noted that if these two actions were addressed in one response, this would be suitable. Barbara Ryan (GEO Secretariat) suggested that representatives from GEO and WMO activities be included in follow up discussions. Claus also indicated that the AC-VC is setting up a greenhouse gases sub-constellation within AC-VC.
- Stephen Briggs proposed to arrange a dedicated meeting focused on the Carbon Strategy in conjunction with the 2016 SIT Technical Workshop.
- Stephen Briggs stressed the clear science community focus of this activity, and Mark suggested this is an example of science being used in a policy context.
- Mark asked if the WGs and VCs had identified any clear obstacles to making progress in time for a Carbon Strategy meeting in September, and none were raised.

<b>SIT-31-06</b>	<i>WGs and VCs to identify a Point of Contact to serve as interface for routine reporting on implementation of the CEOS Strategy for Carbon Observations from Space</i>	<b>WG Chairs, VC Leads</b>	<b>May 2016</b>
<b>SIT-31-07</b>	<i>SIT Chair Team (Pascal Lecomte) will coordinate with Mark Dowell to arrange a Carbon Strategy meeting at the time of the SIT Technical Workshop in Oxford in September 2016</i>	<b>Pascal Lecomte</b>	<b>SIT Tech Workshop</b>

### CEOS Water Strategy

Chu Ishida (JAXA) presented an update on implementation of the *CEOS Strategy for Water Observations from Space*, which was endorsed at CEOS Plenary 2015. The Strategy is based on 22 of the 58 actions identified in the GEO Water Strategy. Chu noted that two feasibility studies were proposed as the focus for 2016 - one on a water constellation (C.1) and the other on a hyperspectral mission for water quality (C.10).

The water constellation Feasibility Study (FS) team has prepared a Work Plan and is working on scoping an achievable approach to the study. Six key water cycle parameters have been identified, with an initial emphasis on synergies between precipitation and soil moisture agreed.

**Water Cycle observation status: requirements vs existing/future capabilities**

Parameter	Horizontal Resolution	Time Resolution	Vertical Resolution	Accuracy	Latency
<b>Precipitation</b>	1-1km R:10km G:50 to 100 km	1-1hr R:1hr D:1d	N/A	0.1mm/5% 0.1h to 6hr	
<b>Soil Moisture</b>	100km R:100km G:100km	LRF: 1 to 6 hrs R:1d to 2d D:1 to 2d to 3 months	0.1m R:10 to 20 D:10 to 20	10% R:10% D:10%	NRT or 0.5d to 1d
<b>Evaporation/ET</b>	100km R:100km G:100km	1-1 hr R:1d D:1d to 1m	Surface (Q), and L2 vegetation or canopy R:100km D:100km	10% R:10% D:10%	NRT
<b>Ground Water</b>	100km R:100km G:100km	1-1 hr R:1d D:1d to 1m	0.1km Vert R:100km D:100km	10% R:10% D:10%	1m to 2m Also stated as TBD
<b>Run-off</b>	100km R:100km G:100km	1-1 hr R:1d D:1d to 1m	N/A	10% R:10% D:10%	1m to 2m Also stated as TBD
<b>Surface Water Storage</b>	100km R:100km G:100km	1-1 hr R:1d D:1d to 1m	N/A	10% R:10% D:10%	1m to 2m Also stated as TBD

Green: satisfied  
yellow: marginal  
red: not satisfied

### Outcomes of the side meeting

The side meeting of April 18 was very useful with guidance and feedbacks from CEOS members and participants;

1. For requirements, we need to check consistency with GCOS ECV requirements and may need to reflect GEO's new SBA requirement consolidation process. We also need to inform GEO of our FS activities.
2. For experts, we welcome any voluntary experts, such as those of run-off and surface water storage. We also need ground water expert(s).
3. For cost-benefit analysis, we may not need to conduct detailed analysis until we identify practical candidate missions. Rather we need strong case to justify the FS.
4. For requirement, we need to consider political requirements, such as COP21 and SDGs. In this context, we need to make linkage with the GEMI water observation system initiative for SDGs within UN (FAO and UNEP)

Chu reviewed the outcomes from the side meeting held prior to SIT-31. He reviewed the resulting requests to SIT:



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- to acknowledge steady progress of the FS and provide any guidance and advice on the FS approach;
- encourage water experts of CEOS Agencies to support the FS; and
- encourage engineering analysis support of CEOS Agencies for the FS.

A brief discussion followed:

- Stephen Briggs noted that water is one of the new GEO SBAs, and future requirements may arise from this GEO activity. He noted the need to link the requirements with political drivers (e.g. UN SDGs), translate those into societal requirements, and then finally into technical requirements, and this parallel activity makes things challenging.
- Mike Freilich (NASA) questioned whether the simultaneity of water cycle observations on a scale of seconds to minutes provided by a 'water train' formation flying constellation is required and preferred. Applying the constellation constraint complicates possible solutions, and he suggested that it could be referred to as a water cycle 'suite' of missions if the constellation requirement didn't apply. Chu noted that the proposed water constellation is different from the A-train in the requirement for simultaneous observations, and that these requirements should be assessed before any final decisions are reached.
- Stephen Briggs noted the importance of water cycle observations is not in dispute, but the linkages between the political drivers and technical requirements need to be articulated. Mike agreed, noting that fresh water, and water quality in particular, are perhaps the most immediate impacts on society arising from changes to the environment. He suggested that the case for the importance of water has been made, and stretching to make linkages to other activities (e.g. atmospheric composition) needn't be a focus.
- Alain Ratier (EUMETSAT) stressed that EUMETSAT hoped that GCOM-W2 will go ahead, but noted that other CEOS Agencies could also implement this technology. He agreed that the 'A-train' arrangement may not necessarily be the best thing for precipitation, and that optimised sampling may be more important and should be included in the feasibility study.
- Mike noted that there have been studies of sampling requirements and these should be reviewed, for example those looking at GPM follow-up missions. He also suggested that the feasibility study should look at the extent to which GPM measurements are currently being put to use.
- Kerry Sawyer (NOAA) noted that the CEOS Water Strategy was responding to the GEOSS Water Strategy Report (WSR), and GEO was supposed to prepare a Water Implementation Plan, following the WSR. Now GEO is moving forward with a new water initiative called GEOGLOWS (GI-20), with no indication that a Water Implementation Plan is expected. Kerry questioned how all these water initiatives and activities are related and suggested there is a need to ensure they are connected, especially when CEOS is in the midst of the Feasibility Study in response to the WSR. Stephen Briggs agreed, noting that there is a need to ensure the CEOS Water Strategy is consistent with the new SBA requirements being developed under GD-08.
- Stephen Ward (SIT Chair Team) asked if a consistent requirements process will be maintained within GEO, and Barbara responded that she hopes this will be the process, but that GEO's limited dedicated resources mean it needs to rely on the community to ensure this consistency.

SIT-31-08	<i>WSIST Water Constellation Feasibility Study team to ensure precipitation sampling requirements are included in their analysis, in coordination with P-VC</i>	WSIST	SIT Tech Workshop
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SIT-31-09	<p><i>WSIST Water Constellation Feasibility Study team to stay connected to the GEO Water Resources Management SBA developments within GEO Work Programme Foundational Task GD-08 and to ensure that new requirements reflect previous efforts on which CEOS response is based</i></p>	WSIST	Plenary
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*Coordination of Thematic Observations*

George Dyke (SIT Chair Team) reviewed a study of thematic acquisition coverage to which has CEOS committed. The study was conducted by the SIT Chair Team and SEO to inform discussion on the following questions:

1. *What are the current and future resource requirements to address those commitments and the adequacy of CEOS resources?*
2. *Does CEOS capacity allow it to take on new commitments?*
3. *What does it mean for CEOS to endorse/commit to one of these strategies?*
4. *What do we mean when we refer to our capacity to respond to them? The capacity of the agency observing systems or of the CEOS management layer to track fulfilment of the requirements?*

George noted that the study looked at acquisition strategies endorsed by CEOS for several initiatives.

Theme Initiative	CEOS Group	User Interface	Domain
Forests GFOI	SDCG	GFOI, FAO	Land
Agriculture GEOGLAM	ad hoc WG	GEOGLAM, JECAM	Land
Disasters Geohazard Super-sites Recovery Observatory Hazard Pilots	WG	- GSNL SAC - World Bank, GFDRR, UNDP and UNOSAT - User reps. on pilot teams	Land
Carbon	SIT Chair		Land, Atm, Ocean
Water	WSIST		Land, Atm, Ocean
Climate	WG	GCOS	Land, Atm, Ocean

+ future GEO SBA (GD-08), Biodiversity, Cryosphere/Polar, others? ...

Theme Initiative	Geographic	Temporal	Revisit	Latency
Forests GFOI	Global forest	Twice annual	Wet + dry season	Weeks - months
Agriculture GEOGLAM	Global crops	Multiple per season	Varies by crop, but up to ~every cycle	Days - weeks
Disasters Geohazard Super-sites Recovery Observatory Hazard Pilots	Sites, Global	Systematic	~Every cycle	Days - weeks
Carbon	Global		Incident-related	Hours
Water	Global		many/various	
Climate	Global			

He noted that this preliminary analysis found that in general that the CEOS response to the more contained requirements of GFOI, GEOGLAM and WGDisasters is working well. These activities also have comparatively clear and engaged counterparts in the user community. Requirements for disasters comprise a big mix of data, which includes a significant commercial component and diverse coverage requirements.

**GFOI, GEOGLAM:**

- Coarse resolution optical global (MODIS/VIIRS, Sentinel-3)
- Medium resolution optical global (Landsat, Sentinel-2)
- High resolution optical test sites (commercial)
- SAR: L-band (ALOS, government/commercial), C-band (Radarsat-2, Sentinel-1) R&D but strong operational potential with time series
- GEOGLAM specific: denser temporal coverage, SAR required for Asian rice crops (C-band preferred)

**Two commercial requirements not addressed by CEOS agencies, but otherwise space and ground segments generally sufficient.**

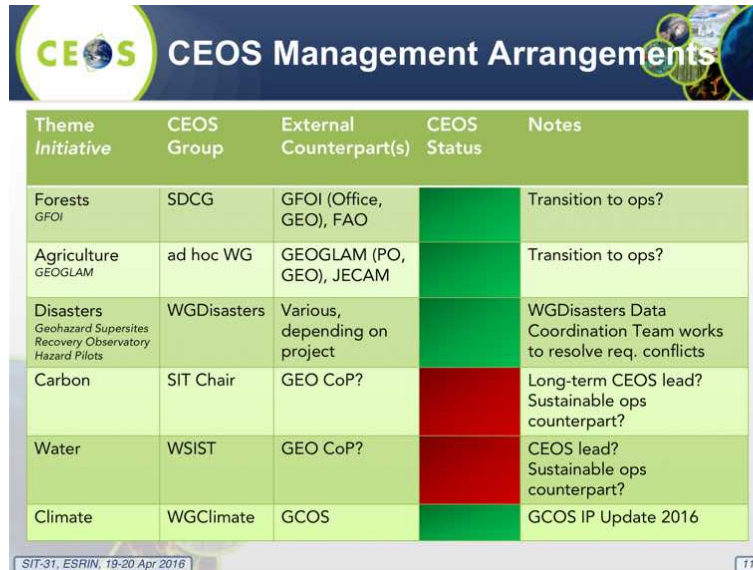
**Disasters:**

- Optical: mixture of public data, with a significant commercial component (high resolution)
- SAR: Interferometry, flood monitoring
- Site targeted, and some regional/global
- Some systematic (e.g. Supersites); some ad hoc (e.g. recovery observatory, pilots)
- Commercial data policy a long-term concern beyond pilots
- Requirements being considered by WGDisasters and GEO-DARMA

**Coordination required to be responsive, space and ground segments generally sufficient, but commercial data challenges beyond pilot phase.**

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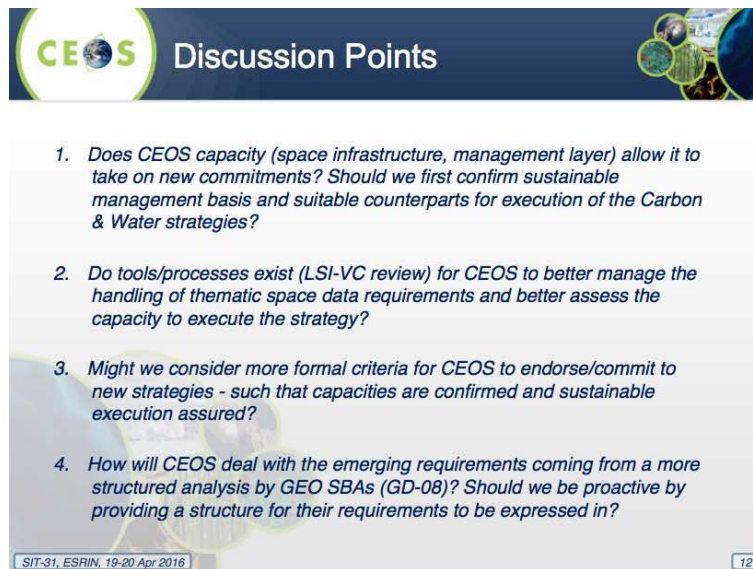
Requirements for water, carbon, and climate are much more heterogeneous, with a diversity of level of detail and requirement types. In the cases of water and carbon, there are also questions around internal CEOS coordination, as well as external counterparts.



Theme Initiative	CEOS Group	External Counterpart(s)	CEOS Status	Notes
Forests GFOI	SDCG	GFOI (Office, GEO), FAO	Green	Transition to ops?
Agriculture GEOGLAM	ad hoc WG	GEOGLAM (PO, GEO), JECAM	Green	Transition to ops?
Disasters Geohazard Supersites Recovery Observatory Hazard Pilots	WGDisasters	Various, depending on project	Green	WGDisasters Data Coordination Team works to resolve req. conflicts
Carbon	SIT Chair	GEO CoP?	Red	Long-term CEOS lead? Sustainable ops counterpart?
Water	WSIST	GEO CoP?	Red	CEOS lead? Sustainable ops counterpart?
Climate	WGClimate	GCOS	Green	GCOS IP Update 2016

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George noted that there may be additional opportunities for synergies, citing an example where data acquired over the Mekong Delta has had uses for both GEOGLAM (Asia-RiCE) as well as flood monitoring. He also stressed that the study concluded CEOS must be clear when interacting with user communities to stress that it generally cannot provide support in accessing commercial data beyond R&D.



### Discussion Points

1. Does CEOS capacity (space infrastructure, management layer) allow it to take on new commitments? Should we first confirm sustainable management basis and suitable counterparts for execution of the Carbon & Water strategies?
2. Do tools/processes exist (LSI-VC review) for CEOS to better manage the handling of thematic space data requirements and better assess the capacity to execute the strategy?
3. Might we consider more formal criteria for CEOS to endorse/commit to new strategies - such that capacities are confirmed and sustainable execution assured?
4. How will CEOS deal with the emerging requirements coming from a more structured analysis by GEO SBAs (GD-08)? Should we be proactive by providing a structure for their requirements to be expressed in?

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A brief discussion followed:

- Stephen Briggs noted the key question is whether CEOS is in a position to deal with new requests, and if so how should it do so.
- Mike suggested that the role of CEOS should be to identify areas where there are synergies between user community requirements, and as a first priority should focus on what small changes could be made to existing capabilities and acquisition strategies to accommodate new requirements. Where gaps are identified, the focus could then be on new capabilities required. He noted that CEOS is the only body that has an overview across this many activities, and it could potentially provide a great service to the community by using this overview to coordinate activities.

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- Mark noted that the space agencies received a very good assessment in the GCOS Update prepared in 2015. He agreed that CEOS should focus on making the most of existing assets before looking at new capabilities - for example where there is overlap, the requirements in the *CEOS Strategy for Carbon Observations from Space* compared to those of the ECVs are almost identical.
- Stephen Briggs agreed, noting that CEOS should differentiate between requirements that can be addressed with existing systems vs. those like the Water Strategy which are raising the need for new missions. Mike noted that in the case of the water study, it's not yet obvious that new missions are necessarily required.
- Kerry noted that CEOS endorsed a New Initiatives Process Paper in May 2014, and this may go a long way to addressing the third discussion point (formal criteria for endorsing new initiatives).
- Ivan Petiteville (ESA) noted that the successful cooperation between CEOS and GCOS has been made possible not only by good and clear requirements, but also that the group has provided a forum that CEOS could interact with closely as the requirements and response were developed. He stressed that it is important to keep this approach in mind as CEOS interacts with GEO on the development of SBA-derived requirements under GD-08. In addition, he noted that the previous example of synergy between GEOGLAM (Asia-RiCE) and flood monitoring demonstrated the advantage of having CEOS people aware of requirements from several projects supported by CEOS instead of those of a single project.
- Frank Martin Seifert (ESA) cited ongoing coordination between GEOGLAM and GFOI (e.g. the need for dual polarisation SAR acquisitions over the Mekong Delta), and also between seismic studies and forestry in South America.
- Stephen Briggs noted that LSI-VC has the potential to serve as a coordination body for new requirements (e.g. biodiversity), and also to help assess conflicts and coverage potential. He is comfortable that CEOS has the capacity to address new requirements, in particular where there is overlap with existing activities. He encouraged GEO to progress GD-08, and suggested that the IGOS-P process and documents could be a good reference. Mike agreed, and cautioned against loading LSI-VC too quickly before it is able to establish itself.
- Stephen Briggs noted that in the case of GFOI and GEOGLAM, CEOS can be confident we are dealing with real users, and Barbara agreed, noting that GEOGLAM is engaged politically and with national departments of agriculture. He noted that with water and carbon, the user community interaction and counterparts for CEOS need to be clarified.

George noted that LSI-VC has been asked to conduct a brief study of how CEOS Agencies managed their requirements internally.

<b>SIT-31-10</b>	<i>SIT Chair team to review the CEOS New Initiatives Process Paper, and consider its applicability, in preparation for discussions of how to handle requirements arising from GEO Work Programme Foundational Task GD-08</i>	<b>SIT Chair team</b>	<b>SIT Tech Workshop</b>
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### *Tools and Processes for Requirements Management and Coordination*

Bianca Hoersch (ESA) introduced a brief analysis based on a short survey on tools or processes used by a selection of agencies to manage multiple requirements in the specification and operation of their missions. She reviewed inputs received so far (from ESA, NASA, CSA, and USGS).



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ESA: Sentinels	NASA: ASTER	NASA: EO-1	CSA: RS2	USGS: Landsat
1.Spacecraft safety (incl. calibration)	1.Spacecraft maneuvers	1.Spacecraft maintenance	1.Spacecraft health	1.Space craft safety/orbit maintenance
2.Emergency Observation (Copernicus Emergency - Security, other)	2.Emergency/Disaster/ Urgent Observations	2.Mission Science Office a.National Emergency	2.National security 3.Emergencies	2.Charter/Emergency special requests
			4.Image quality and calibration	3.Calibration
3.Baseline Obs Scenario a.Copernicus Services b.National c.Other	3.Individual science/user requests: ASTER team, field work 4.Large monitoring requests (e.g., glacier monitoring or volcano monitoring) 5.Global mapping background acquisitions (reset every 3-5 years)	b. Priority Science c. Long term requests d. Large area mapping 3.Requests from JPL, generally for volcanic activity 4.Optimizing orbit use - lower priority MSO if orbit free (e.g. biodiv.) 5.Requests from the general public	5.Time Critical Request 6.Non-Time Critical Request 7.Background mission request	4. United States 5. Coordinated Field Campaigns 6. Day-lit land descending Mid/low Latitudes (54 degrees N to 54 degrees S) 7. Ocean and night special requests 8. Day-lit land ascending High Latitude 9. Day-lit land descending special requests

She noted that Landsat acquisitions are systematic, and Sentinel-2 is progressing towards systematic acquisitions, and there is not much additional capacity available to address requirements not already addressed. She noted that Landsat is operated according to a Long Term Acquisition Plan (LTAP), and that Sentinel-1 and -2 are being focused on a 6- to 12-month acquisition planning processes.

	ESA: Sentinels	NASA: ASTER	NASA: EO-1	CSA: RS2	USGS: Landsat
Consultation intervals	6 months to once a year typically consultation, or event-driven in case of major changes	Constant via database	Constant via database (only until discontinued)	Canadian Government: submitted to Government order desk monthly Other/commercial: daily/sub-daily	LTAP (long-term) plus special requests (short-term)
Turn-around time	Nominal: 3 to 6 months typically from submission of requirements to definition of the observation plans Ad-hoc special request (priority dependent)	Approximately 2-3 weeks	Approximately 2-3 weeks	Depends on user: few hours to month(s)	Nominal: long-term Ad-hoc special request (priority dependent)
Length of nominal ahead planning before revision	One to few cycles ahead (12/24 for S1, 10 for S2, rolling)	27 hours of selected target lists Daily schedule updates for cloud forecast	Weekly selected target lists Daily schedule updates for cloud forecast	Few hours to month(s)	LTAP with 24h-adaptation: < 725 images per day possible: all candidates scheduled. > 725 candidate scenes, then images excluded as a function of cloud cover prediction and long term cloud cover statistics
Length of re-planning	Typically ½ - 1 day for replanning for S1, typically 1 week for S2, exceptionally 2-3 days for e.g. emergency	24-36 hours for time-critical events (e.g., disasters)	1-3 days for time-critical events (e.g., disasters)	Few hours	Daily

Bianca noted that each agency has submitted examples of the software tools used for acquisition planning, taking into account acquisition areas (e.g. shape files), as well as operational and ground station capabilities and constraints.

A brief discussion followed:

- Stephen Briggs agreed that for Sentinel-2 and Landsat, the missions are near capacity and not many additional requirements can be addressed.
- Bianca noted that Sentinel-1 mission planners are already in the process addressing the requirements of GFOI and GEOGLAM. Stephen Briggs noted that with Sentinel-1 there is still the potential for acquisition mode conflicts.

<b>SIT-31-11</b>	<i>SIT Chair to circulate the LSI-VC survey on requirements management tools and processes to CEOS Agencies for their response</i>	<b>SIT Chair team</b>	<b>COMPLETE</b>
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## 9. CEOS Virtual Constellations and Working Groups

### *VC Leads and WG Chairs Issue Reports*

Jean-Louis Fellous (SIT Chair Team) presented a synthesis report of VC and WG achievements and plans. (The following subsections present a brief summary of the key points from each report. For further details, please refer to the presentation file.)

### *WGISS*

WGISS-41 was co-located with WGCV-40 in Canberra, Australia, in March. During the meeting both Working Groups (WGs) agreed to jointly address their CEOS Carbon actions via a work breakdown structure that allows the management of priorities and resources.

WGISS is also supporting the Future Data Architectures (FDA) report as well as the creation of guidelines/standards on Data Cubes and Analysis-Ready Data (ARD). A 1-2 day FDA workshop will be held during WGISS-42 in September 2016. WGISS also continues supporting the WGDisasters Recovery Observatory (RO), and have completed the WGISS Water Portal.

WGISS was added to be a contributor to the 2016 GEO Work Programme Foundational Task GD-07, Subtask 2 (GCI Development), and GD-02 (GCI Operations). As contributors, they will continue to advocate for CEOS agency mission data to be contributed to the implementation of GEOSS via WGISS interoperable systems and standards, as well as maintain the *Connected Data Assets* website to provide up-to-date metrics for IDN, CWIC and FedEO.

### *WGCV*

WGCV-40 included a number of topical sessions on atmosphere, land surface, carbon action items, the CEOS Chair initiatives and validation metrics; and saw significant interaction between the WG and other bodies including WGISS, LSI-VC, SST-VC, OCR-VC, and the FDA AHT. Reports from the WGCV subgroups were positive and indicative that the WGs activities lie somewhere between stable and growing.

The Terms of Reference of the WG are currently being revised and will be submitted for endorsement at the 2016 CEOS Plenary. Eight actions from the 2015-2017 CEOS Work Plan have been closed, four remain open, and two are currently delayed.

WGCV have noted that the definition of new top-down CEOS activities (e.g. Carbon) are sometimes in conflict with the basic activities of WGs, which are staffed on a 'best efforts' basis and often more suited to bottom-up activities (e.g. science communities, subgroups). WGCV and WGISS have discussed this issue, and are exploring approaches to best incorporate top-down CEOS activities into Working Group activities.

The 41st WGCV Plenary will be hosted by JAXA 5-7 September in Tokyo, in conjunction with a meeting of the SAR subgroup.

### *WGDisasters*

The WGDisasters Plenary was held in Bonn, 8-10 March, during which results and achievements from pilots and subgroups were reviewed. New members from ROSKOSMOS, NRSC, and AGEOS have also been welcomed to the WG.

Members of the WG will participate in the *Satellite Data for Enhanced Risk Management and Reduction – Innovative Technologies and Future Applications* side meeting at the 2016 Understanding Risk Forum in order to promote the outputs and results of the WG and to strengthen collaborations with key stakeholders.

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 <b>Accomplishments/Activities since 29<sup>th</sup> WG Disasters Plenary</b>	 <b>Accomplishments/Activities since 29<sup>th</sup> WG Disasters Plenary</b>
<ul style="list-style-type: none"> <li>• <b>Flood Pilot</b> – Mississippi River flood forecast and impact products through U. of Maryland Global Flood Monitoring System and Dartmouth Flood Observatory, and NASA ALOS-2 flood maps (Jan 2016):               <ul style="list-style-type: none"> <li>◦ Feedback from Federal Emergency Management Agency was very positive. Progress on regional dashboards in Caribbean and Southeast Asia.</li> </ul> </li> <li>• <b>Seismic Pilot</b> – Demonstrated value of EO-based science products for response over Nepal, Chile and Lefkada (Greece) earthquakes               <ul style="list-style-type: none"> <li>◦ The Geohazards Exploitation Platform (GEP) is successfully being exploited by scientists as an environment for virtualized and federated processing of EO data; GEP now provides access also to COSMO-SkyMed data; performed first Cloud based processing to support hazard mapping (Chile).</li> </ul> </li> <li>• <b>Volcano Pilot</b> – Demonstrated value of EO data on individual volcanic systems, with results from numerous locations that have been communicated to local volcano observatories               <ul style="list-style-type: none"> <li>◦ Collected feedback and specific needs from users in Costa Rica, Guatemala, Colombia, Peru, Ecuador, and Chile; on going integration between visible/thermal and SAR; work in progress to achieve systematic arc-wide monitoring of volcanoes in Latin America; developing plan for sustained monitoring.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• <b>Landslide Pilot</b> – 1<sup>st</sup> team meeting held with some 30 participants. Developing Implementation Plan and data requests for Plenary.</li> <li>• <b>Recovery Observatory</b> – World Bank/GFDRR has become co-chair of Oversight Team.               <ul style="list-style-type: none"> <li>◦ Working session held December 2015 in Washington with World Bank, GFDRR and UNDP.</li> <li>◦ Demonstrator activity defined early 2016. Proposed focus area in Malawi March to June 2016. Mission to Malawi late March 2016 – Government of Malawi (DoDMA) to fully support recovery demonstrator. Sub-group on data licensing created to address commercial licensing issues.</li> </ul> </li> <li>• <b>GSNL</b> – New proposal for Greek Supersite is under review by the SAC               <ul style="list-style-type: none"> <li>◦ San Andreas fault and Southeast Asia (Indonesia/Philippines) Supersite proposals still under preparation. Good demonstration of EO data value during Iceland eruption.</li> </ul> </li> <li>• <b>GEO-DARMA</b> – Sub-group will be formed within WG Disasters, and secretariat being organised.               <ul style="list-style-type: none"> <li>◦ Proposal being reworked and approach to partners to begin.</li> </ul> </li> </ul>

### WGCapD

WGCapD continues to work to increase access to data, products, and tools (e.g. via targeted training workshops), to build awareness of new mission datasets, and to support CEOS WGs and VCs with their own capacity building initiatives. The group continues to contribute to the GeoCaB Portal, which aims to increase the awareness of the capacity building inventory across both CEOS and GEO.

Other 2016 activities include:

- building awareness and demonstrating the value and applications of EO to teachers, students and practitioners in major conferences (starting with an event during the ESA Living Planet Symposium in 2016 and ISRSE in 2017);
- continuing to identify and provide appropriate e-learning courses in relevant applications;
- surveying CEOS capacity building activities, compiling a task report on capacity building in CEOS, and producing a best practice in capacity building document; and,
- holding two SAR training workshops in Zambia and Gabon (dates TBC), which have been supported financially by ESA and UNOOSA.

### OSVW-VC

The most recent meeting of the VC was in conjunction the International Ocean Vector Winds Science Team (IOVWST) meeting, held 19-21 May in Portland, USA. Questions posed during the meeting included whether the current OSVW constellation is sufficient, what the priority of the OSVW community is (elaboration of data standards, though increased resources are required to do so), and whether there any particular advocacy/actions from the OSVW community that would be helpful for the space agencies (scatterometer/AMSR-3 capability for GCOM-W2).

The IOVWST recommendation for at least three scatterometers in orbits designed to roughly meet WMO requirements, and in addition, one instrument in a non-sun-synchronous orbit to help with the diurnal cycle was reviewed. A user requirements document is being prepared for the next IOVWST meeting to be held in Q2 2016.

In summary, topics of importance identified by OSVW-VC are:

- the need to continue to advocate for open and timely data access commitments from China and Russia for their planned OSVW missions;
- to encourage JAXA and ISRO to continue pursuing a joint scatterometer and AMSR-3 sensor package for GCOM-W2; and,
- the standardisation of data, formats and the representation of measurement uncertainty may benefit from additional resources supporting the IOVWST.

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### LSI-VC

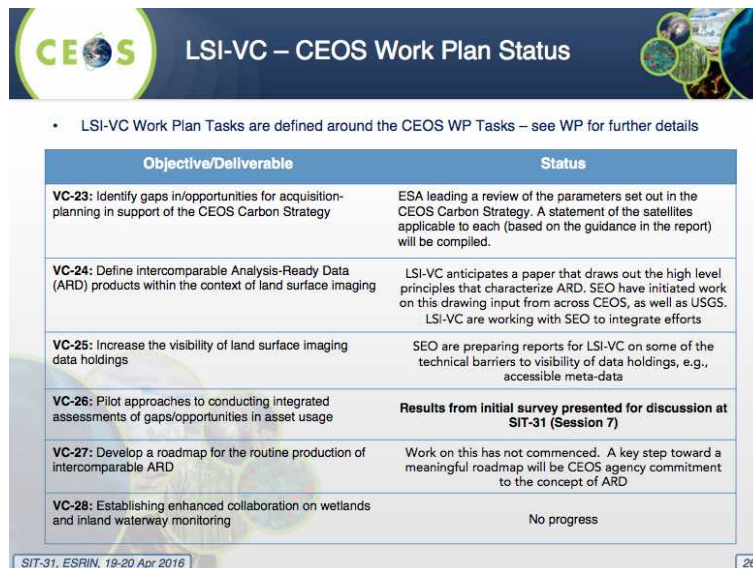
Since the endorsement of its new Implementation Plan and Terms of Reference at CEOS Plenary 2015, LSI-VC has been working to establish a strong and engaged membership, and a clear Work Plan to address its initial objectives.

A successful first meeting (LSI-VC-1) was held 22-24 February 2016 at ESA ESRIN, and included a joint session with the SDCG for GFOI. LSI-VC-2 is tentatively planned for 20-22 July in the US.

One of the first tasks LSI-VC led was a survey and short report (as presented during SIT-31) on the tools/processes used by large space agencies to manage multiple different requirements and stakeholders.

An initial LSI-VC Work Plan has been defined based on the LSI-VC Implementation Plan. The LSI-VC Work Plan consists of five main task areas:

1. Increase the visibility of land surface imaging data holdings.
2. Identify gaps in/opportunities for acquisition planning in support of the CEOS Carbon Strategy.
3. Define inter-comparable Analysis-Ready Data (ARD) products within the context of land surface imaging.
4. Engage in the implementation of trial data cubes.
5. Long-term LSI-VC strategy and vision.



LSI-VC Work Plan Tasks are defined around the CEOS WP Tasks – see WP for further details

Objective/Deliverable	Status
<b>VC-23:</b> Identify gaps in/opportunities for acquisition-planning in support of the CEOS Carbon Strategy	ESA leading a review of the parameters set out in the CEOS Carbon Strategy. A statement of the satellites applicable to each (based on the guidance in the report) will be compiled.
<b>VC-24:</b> Define intercomparable Analysis-Ready Data (ARD) products within the context of land surface imaging	LSI-VC anticipates a paper that draws out the high level principles that characterize ARD. SEO have initiated work on this drawing input from across CEOS, as well as USGS. LSI-VC are working with SEO to integrate efforts
<b>VC-25:</b> Increase the visibility of land surface imaging data holdings	SEO are preparing reports for LSI-VC on some of the technical barriers to visibility of data holdings, e.g., accessible meta-data
<b>VC-26:</b> Pilot approaches to conducting integrated assessments of gaps/opportunities in asset usage	<b>Results from initial survey presented for discussion at SIT-31 (Session 7)</b>
<b>VC-27:</b> Develop a roadmap for the routine production of intercomparable ARD	Work on this has not commenced. A key step toward a meaningful roadmap will be CEOS agency commitment to the concept of ARD
<b>VC-28:</b> Establishing enhanced collaboration on wetlands and inland waterway monitoring	No progress

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### SST-VC

The SST-VC continues to work to address action VC-1, and 81 GHRSSST products are now archived. In response to action VC-19, the first draft of a white paper covering the next generation SST-VC should be ready by May 2016, and will likely be adopted in June following final discussion at the next SST-VC meeting (10 June in Washington D.C.). ISRO joined the SST-VC in October 2015.

SST-VC has identified an issue with the continuity and redundancy of 6-7 GHz channel passive microwave radiometer instruments.

### OST-VC

The Ocean Surface Topography Science Team (OSTST) international meeting was held 20-23 October, 2015 in Reston, USA. Splinter meetings were held on systems performance (orbit, measurements, corrections), altimetry data products, science outcomes, and outreach. In



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addition to the analysis of data from the Topex/Poseidon-Jason series, data analyses from other international missions bringing reciprocal benefits were welcomed.

The recent launches and operationalisation of Jason-3 and Sentinel-3A represent major milestones for the future of the OST constellation, which currently consists of Jason-2 (moving to an interleaved Jason-3 orbit), Saral/Altika (in two-year extended operations), CryoSat (applicable to OST as well as ice topography), and HY-2 (although operations are suspended). This current configuration satisfies the requirements set out in the CEOS OST-VC requirement document.

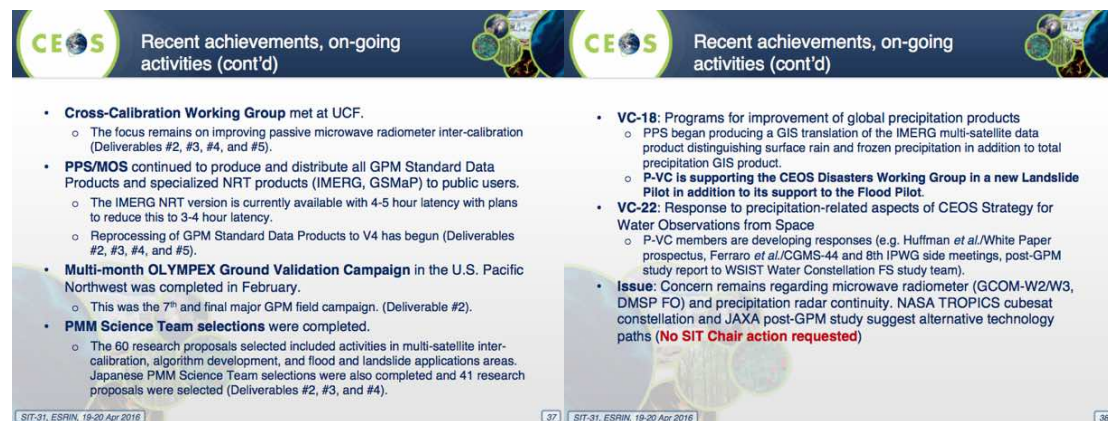
In 2016, new OST-related Announcements of Opportunity are expected from NASA and CNES/EUMETSAT. The OST-VC will next meet at the OSTST meeting, to be held 30 October – 4 November in La Rochelle, France. A catalogue of Cal/Val infrastructure and the strategy for the next generation, high resolution OST-VC will be discussed.

<b>Decision 4</b>	<i>CEOS Agencies agreed to contribute to the development of scenarios for a new generation of high resolution ocean surface topography constellation, following the next meeting of the OSTST and OST-VC in La Rochelle (October 2016).</i>
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### P-VC

The P-VC Data Portal has been released and is being updated with further partner datasets. The portal is accessible at: <http://pvcportal.pps.eosdis.nasa.gov>.

P-VC continues to support the generation of ECV precipitation products, with the GPM constellation remaining stable with full observational capabilities. The next scheduled additions are JPSS-1 and MetOp-C in 2017 and 2018 respectively. P-VC is working to ensure that vital ECV measurements continue in the future, with the submission of U.S. Decadal Survey white papers on a combined cloud and precipitation processes mission concept and an end-to-end water cycle mission concept.



**Recent achievements, on-going activities (cont'd)**

- **Cross-Calibration Working Group** met at UCF.
  - The focus remains on improving passive microwave radiometer inter-calibration (Deliverables #2, #3, #4, and #5).
- **PPS/MOS** continued to produce and distribute all GPM Standard Data Products and specialized NRT products (IMERG, GSMaP) to public users.
  - The IMERG NRT version is currently available with 4-5 hour latency with plans to reduce this to 3-4 hour latency.
  - Reprocessing of GPM Standard Data Products to V4 has begun (Deliverables #2, #3, #4, and #5).
- **Multi-month OLYMPEX Ground Validation Campaign** in the U.S. Pacific Northwest was completed in February.
  - This was the 7<sup>th</sup> and final major GPM field campaign. (Deliverable #2).
- **PMM Science Team selections** were completed.
  - The 60 research proposals selected included activities in multi-satellite inter-calibration, algorithm development, and flood and landslide applications areas. Japanese PMM Science Team selections were also completed and 41 research proposals were selected (Deliverables #2, #3, and #4).
- **VC-18:** Programs for improvement of global precipitation products
  - PPS began producing a GIS translation of the IMERG multi-satellite data product distinguishing surface rain and frozen precipitation in addition to total precipitation GIS product.
  - **P-VC is supporting the CEOS Disasters Working Group in a new Landslide Pilot in addition to its support to the Flood Pilot.**
- **VC-22:** Response to precipitation-related aspects of CEOS Strategy for Water Observations from Space
  - P-VC members are developing responses (e.g. Huffman *et al.*/White Paper prospectus, Ferraro *et al.*/CGMS-44 and 8th IPWG side meetings, post-GPM study report to WSIST Water Constellation FS study team).
- **Issue:** Concern remains regarding microwave radiometer (GCOM-W2/W3, DMSP FO) and precipitation radar continuity. NASA TROPICS cubesat constellation and JAXA post-GPM study suggest alternative technology paths (**No SIT Chair action requested**)

While no SIT action was requested, concern remains around microwave radiometer (GCOM-W2/W3, DMSP follow-on), and precipitation radar continuity. The NASA TROPICS cubesat constellation and JAXA's post-GPM study both suggest alternative technology paths.

### ACC-VC

ACC-VC is addressing total ozone dataset validation and harmonization (VC-2) and in 2015 delivered papers on inter-comparison results and European/U.S. long-term data sets. A new VC-2 deliverable on nadir profile intercomparisons and long term (1979-present) combined (Europe and U.S.) total ozone data sets is scheduled for completion in late 2017. A new white paper defining geophysical validation needs for the air quality constellation is also being written (in response to VC-3) for delivery in mid-2017.

Greenhouse gas constellation coordination continues as an ongoing activity, and ACC-VC (specifically the GHG subgroup) is in the process of deciding specific deliverables based on



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the *CEOS Strategy for Carbon Observations from Space*. ACC-VC has run into obstacles as some of the tasks assigned are directly actionable, while with others ACC-VC can play only a supporting role (e.g. establishing a space-based GHG constellation).

ACC-12 will be held the week of 10 October in Seoul, South Korea, and this will be the first ACC meeting held outside of Europe or the U.S.

### OCR-VC

OCR-VC delivered their overall Blue Planet implementation plan in April 2016 and remains actively engaged in the initiative, including through leadership and participation in the 3<sup>rd</sup> Blue Planet Symposium to be held in the U.S. in Spring/Summer 2017. The OCR-VC will play a significant role in the GEO Blue Planet Initiative, cross-cutting its foundational as well as service components.

 <b>OCR-VC – Final status of previous Work Plan actions</b> 		
VC-7	Catalog of Cal/Val infrastructure and activities	Q2 2015
VC-8	Action Plan for GEO Blue Planet Components	Q4 2015
VC-9	Implementation of the International Network for Sensor Intercomparison and Uncertainty Assessment for Ocean Color Radiometry (INSITU-OCR)	Q1 2015
VC-10	Recommend the creation of a GEO Water Quality of Practice	Q2 2015

- **VC-7:** Agency mapping exercise **complete**; IOCCG has reviewed and is finalizing.
- **VC-8:** Overall Blue Planet Implementation plan **DELIVERED** 15 April 2016; active CEOS engagement, including leadership and participation in the 3<sup>rd</sup> Blue Planet Symposium to be held in the U.S. in Spring/Summer 2017
- **VC-9:** **Moving forward** w/modular implementation; gaps/challenges exist
- **VC-10:** Water Quality CoP **created**; implementation plans now being formulated
- Also: IOCCG Phytoplankton Functional Types and Polar Seas Reports being printed
- Also: Sentinel-3A successfully launched 16 Feb 2016 - first of four Ocean and Land Colour Imagers providing a sustained operational OCR (w/VIIRS) capability to 2030. Complemented by four Sentinel-2 instruments that also have a significant contribution to coastal OCR (S2A was launched June 2015 and S2B will launch later in 2016)

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Ready access to Level 0 and Level 1A ocean colour radiometry data remains a challenge and an item of significant concern for the OCR-VC.

Jean-Louis recalled the letter of July 2015 sent to agencies that have (or plan to have) ocean colour missions requesting they consider distribution of Level 0 and Level 1A mission data. Jean-Louis added that NASA already fulfils this requirement. Formal replies were only received from ESA and NOAA (and from CNES via email). The NOAA and CNES responses were in the affirmative, and ESA indicated there was no plan or resources to deliver this data. The SIT Chair will follow up with EC per guidance received from ESA.

<b>SIT-31-12</b>	<i>CEOS Agencies to complete the outstanding OCR-VC request to reply with regard to L0/1A ocean colour data access</i>	<b>CEOS Agencies</b>	<b>June 2016 SIT Chair (Jean-Louis Follous) preparing draft letter to agencies</b>
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### SST-VC: Passive Microwave Redundancy/Continuity Issue

Anne O'Carroll (EUMETSAT) presented on behalf of SST-VC, reporting that the use of Passive Microwave Radiometers (PMW) for Sea Surface Temperature (SST) retrievals is an essential component of the global SST constellation. PWM facilitates the retrieval of SST despite cloud cover, which is not possible using infrared sensors (albeit with poorer spatial resolution). PWM SST measurements are also particularly important in high-latitude regions and in cases of large volcanic events.

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PMW gaps have been identified in the future of the SST constellation, and SST-VC seeks to raise awareness and set in motion efforts to ensure the continuity and redundancy of PMW instruments for SST. Anne added that both the 7 and 11 GHz channels are required, and the outlook for continuity is summarised in the following chart.



The timeline shows that many of the global missions (those with a 6-7 GHz channel) are coming to an end very shortly. The 6-7 GHz channel is particularly important for the higher latitudes, as this channel results in a much more stable response across all temperatures – particularly important for cooler temperatures. The 6.9 and 7.3 GHz frequencies are also critical to alleviating issues with Radio Frequency Interference (RFI).

CEOS Summary

- Uncertain future for PMW SSTs, especially at high latitudes where the PMW SSTs provide valuable through-cloud data in the region where the climate is changing most rapidly.
- The current outlook means there is a high risk of a gap, particularly for SSTs using the ~7GHz channel.
- The GHRSSST science team meeting will be in Qingdao in June 2017 and should facilitate closer collaboration with China on the HY-2 and FY-3 series towards PMW SST capabilities. There is a need to work together on lower level data to ensure sensors are well calibrated and to tie in to existing records.
- Presentation to CGMS-44 planned for 7<sup>th</sup> June 2016. For example the operational availability of PMW data from HY-2 and in the future from Meteor is a CGMS consideration.

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Given the current risk to the current and continued PMW constellation for SST and the need for a redundant capability of PMW with ~7 GHz, CEOS is requested to coordinate and encourage its agencies to ensure the continuation of the existing capability and to facilitate the coordination of agencies to ensure continuity and redundancy of PMW for SST.

### Discussion:

- Craig Donlon (ESA) noted that in some parts of the world, PMW is the only option due to persistent cloud cover, and that it is a major input to Climate Data Records.
- Mike Freilich (NASA) asked whether a wide-swath microwave radiometer that does not have 7 GHz channels would be useful in the 2020 timeframe, and it was confirmed that

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it would be useful, though the 7GHz measurements are critical, especially at higher latitudes.

- Mike noted that GMI-2 is in planning, and asked if it would be a significant contribution despite not including the 7 GHz channel, and Anne confirmed it would be very useful.
- Weiyang Cai (NSMC/CMA) noted that an upcoming meeting in Qingdao would be a good opportunity to discuss further. He noted that FY-3 only has 10 GHz, and that derived SST products will be distributed by CMA.

Jean-Louis summarised the discussion, noting that CEOS Agencies are requested to consider how to resolve this issue. The SST-VC is urged to use every opportunity, including CGMS-44 and the planned meeting in Qingdao, China in 2017, to progress toward a solution, and to report on status at the next SIT Technical Workshop and/or CEOS Plenary.

SIT-31-13	<i>CEOS Agencies to consider the need for continuity and redundancy of Passive Microwave Radiometers for SST highlighted by SST-VC, providing relevant input to and SST-VC to enable them to provide an update on the 6-7 GHz PMW continuity situation at SIT Technical Workshop, and/or CEOS Plenary.</i>	CEOS Agencies	SIT Tech Workshop
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### *OST-VC New Generation of Altimetry Constellation*

Phillipe Escudier (CNES) reported that implementation of the OST-VC constellation is well underway, fulfilling the needs of large-scale and larger meso-scale monitoring which is adequate to feed the current configuration of the Copernicus Marine Environment Monitoring Service as well as scientific uses. However new societal, scientific and operational uses are emerging which will require a breakthrough improvement of the space and time resolution (currently approx. 100 km, 10 days, which misses a significant portion of ocean dynamics) of the altimetry Virtual Constellation.

A new generation of constellation has to be defined and CNES, ESA and other agencies have initiated preliminary analyses. An encouragement from SIT Chair to EUMETSAT to support the development of this updated URD would be helpful.



- **Next steps**
  - **Confirmation by CEOS SIT of the interest to move forward to a higher resolution Ocean Surface Topography monitoring system** to support the future generation of operational oceanography and new science and applications objectives
    - Analysis by various agencies of the different possible configurations: instrument technology, orbit configurations...
    - Analysis of these configurations and coordination by OST-VC group
      - Preliminary discussion at La Rochelle meeting
  - **Encouragement from SIT Chair to EUMETSAT to support the development of an updated URD** that would document this new configuration

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A brief discussion followed:

- It was noted that direct (i.e. *in situ*) measurements of ocean current are valuable, and that altimetry is just one component of ocean surface topography.



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- Craig Donlon (ESA) supported the proposed way forward, and encouraged analysis of the numerous technologies under consideration to try and find the best compromise between user requirements and technical capacity.
- Jean-Louis raised the question of what new societal, scientific and operational uses are emerging, and how these are addressed by what can be modelled.
- Barbara Ryan (GEO Secretariat) noted that the GD-06 task now addresses *in-situ* coordination, and they would welcome additional examples where coordination is required.
- Alain Ratier (EUMETSAT) noted they are ready to support the process but require involvement of other groups, including the scientific community.

Jean-Louis summarised the discussion, highlighting the importance of substantiating the user needs, recognising the value in the collaborative study of user requirements (and the resulting document), and encouraging contributions by EUMETSAT and other agencies involved in the OST-VC to this discussion.

## 10. Copernicus Sentinel Data Uptake and Application

### *Sentinels Space and Ground Segment Status*

Alessandra Tassa (ESA) gave a brief introduction to Copernicus and the Sentinel series of satellites. Some example products were demonstrated, including interferometry, agriculture, polar ice drift, and the application of Sentinel-1A time series for rice monitoring in the Mekong Delta. It was noted that ESA provides access to near-real time data (from 3 hours after acquisition), as well as non time-critical data (within 24 hours) via the Sentinels Scientific Data Hub (<https://scihub.copernicus.eu/>). All data is provided on a free and open basis, with 500,000 products available to date.

Paul Counet (EUMETSAT) reviewed Sentinel-3 activities, including support to ESA during the on-orbit commissioning phase, as well as maintenance and evolution of flight operations (including mission planning), and operation of the Sentinel-3 Marine Data Centre following on-orbit commissioning.

For Sentinel-3, the Level 1 data is generated and distributed both by ESA and EUMETSAT, and there is a split of responsibility at Level 2 (Marine by EUMETSAT, Land by ESA). Level 2 products are expected to be available online in early 2017, with NRT EUMETCast products broadcast over commercial telecommunication satellites, with full coverage of Europe and Africa. A terrestrial distribution approach will also be used, with agreements signed with NOAA and Geoscience Australia to date.

CEOS initiatives were invited to provide their feedback on the access and uptake of Sentinel data in CEOS activities.

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GFOI, GEOGLAM



**GFOI Input**

- GFOI's Method and Guidance Document REDDCompass: increasingly used by REDD+ countries within the UN-REDD framework and World Bank.  
→ The planned Copernicus REDD+ Service should strongly encourage its use in applying Sentinel data in National Forest Monitoring Systems.
- Global Baseline Acquisition Strategy: frequent repetitive dual-polarisation observations over world's forested areas are needed for C-band SAR data sources to make an effective contribution.  
→ increase dual pol acquisitions of Sentinel-1A and -1B (after successful launch) to build up a **dense systematic C-band data archive** over the pan-tropics.
- Sentinel-2 potentially new gold standard MS optical land surface data. To realise its full potential it needs a **gold standard ground segment**. Countries still report difficulty in accessing data from SciHub.  
→ International mirrors will help (US, Australia...)
- Global Data Flows study..
- Welcome prompt and unified approach to SR products

**GEOGLAM Experiences with Accessing and Utilizing Sentinel Data**

- Sentinel-1 and Sentinel-2 data are of very high value to GEOGLAM**
- Excellent radiometric and geometric quality
  - Some issues identified by users (in STEP forum) could be resolved: file-naming, metadata content, duplication of scenes, BB, etc.
- 10m fused Sentinel-2/Landsat-8 product** (cross-calibrated, georeferenced time series) needed for Medium and Small fields
- Dissemination of "analysis ready data" is encouraged (e.g. cloud-masked surface reflectance for S2; sigma\_0 for S1)
  - Request access through scripting (OData, OpenSearch) to SciHub/APIHub
  - Request for increased open source tools for Sentinel-2 (e.g. atmospheric adjustment) or provide a fully-documented global systematic production of surface reflectance for S2 (current plans within Copernicus program)
  - Request increased Sentinel-1 acquisitions over agricultural areas to produce time series
    - Systematic acquisition over JECAM sites is highly desired.
    - Coordination with other SAR instruments for multi-frequency experimentation preferential

Stephen Briggs (SIT Chair) noted that from the GFOI and GEOGLAM inputs, it is clear that there is a demand for the supply of higher-level products (e.g. ARD).

*USGS*

Steve Labahn (USGS) noted the internet connection to the Sentinel-2 archive is problematic, and has slowed the progress.

Bianca Hoersch (ESA) suggested there are other options for downloading large volumes of data, such as API Hub. Sentinel-2 is in the process of decreasing revisit from 30 to 20 days. Systematic production of surface reflectance products from Sentinel-2 is the intention and is in progress.

*Geoscience Australia*

Jonathon Ross (GA) reported that Australia has signed agreements with the European Commission and ESA to establish a regional data access and analysis hub. It has three objectives: support internal government requirements; enhance access to satellite EO data for research, industry and civil society; and to facilitate regional access to data – reducing the burden on the European archive. The data will be co-located with MODIS, Landsat and Himawari; creating a rich resource of data for the user community. Jonathon thanked ESA/EC for their support and cooperation.

A brief discussion followed:

- Steve Volz (NOAA) noted that Sentinel-1 has proven very useful for ice and oil spills.
- Jonathon noted that in future, file redistribution stats will not give us the full picture of data use as the reliance on 'downloading' of data decreases with the emergence of Data Cube and similar infrastructures.
- Mark Dowell (EC/JRC) noted that the Copernicus Global Land Service will be working on the generation of some level 3 global mosaic products, and possibly thematic products, and that implementation arrangements are currently being put in place.
- Josef Aschbacher (ESA) said he was happy to see the uptake of data by various initiatives worldwide. He noted data distribution capacity is expected to grow via deployment of Collaborative Ground Segments, as well as via national distributors. He stressed that the EC is the point of contact for countries interested in getting access to Copernicus Sentinel data beyond the regular web interface and portals.

## 11. SIT-31 AOB, Action Item Review, and Closing

*GOOS G7 initiative report*

Albert Fischer (UNESCO) reviewed the heritage of GOOS, noting they work closely with GCOS, and have the same sponsors. GOOS has developed a *Framework for Ocean*

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*Observation* which specifies a set of Essential Ocean Variables derived from requirements, and negotiated by feasibility.

Driven by requirements, negotiated with feasibility

### Essential Ocean Variables

- We cannot measure everything, nor do we need to
- basis for including new elements of the system, for expressing requirements at a high level
- Driven by requirements, negotiated with feasibility
- Allows for innovation in the observing system over time

### EOVs and readiness level

CONCEPT PILOT MATURE \*also ECV

Physics	Biogeochemistry	Biology and Ecosystems
<ul style="list-style-type: none"> <li>• Sea State*</li> <li>• Ocean surface vector stress*</li> <li>• Sea Ice*</li> <li>• Sea level*</li> <li>• SST*</li> <li>• Subsurface temperature*</li> <li>• Surface currents*</li> <li>• Subsurface currents*</li> <li>• SSS*</li> <li>• Subsurface salinity*</li> <li>• [Heat flux/radiation*]</li> </ul>	<ul style="list-style-type: none"> <li>• Oxygen*</li> <li>• Inorganic macro nutrients*</li> <li>• Carbonate system*</li> <li>• Transient tracers*</li> <li>• Suspended particulates</li> <li>• Nitrous oxide*</li> <li>• Carbon isotope (<sup>13</sup>C)</li> <li>• Dissolved organic carbon</li> <li>• Ocean colour*</li> </ul>	<ul style="list-style-type: none"> <li>• Phytoplankton* biomass and productivity</li> <li>• HAB incidences</li> <li>• Zooplankton diversity</li> <li>• Fish abundance and distribution</li> <li>• Apex predator abundance and distribution</li> <li>• Live coral cover</li> <li>• Seagrass cover</li> <li>• Mangrove cover</li> <li>• Macroalgal canopy cover</li> </ul>

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Albert reviewed the G7 Oceans Initiative, which aims to provide a sound international framework to provide international access to data, and to produce regular authoritative assessments of the state of the ocean, in order to:

- make sense and improve projections of global and regional-scale long-term change and variability;
- sustain the productive capacity of ocean ecosystems under increasing human pressure;
- promote the sustainable use of marine ecosystem services; and,
- increase resilience of human population and economic infrastructure to marine-related disasters.

He reviewed potential recommendations that are being formulated (but not yet final) for the G7 Science and Technology Ministers meeting (15-17 May 2016, Tsukuba, Japan) and at the G7 Summit (26-27 May 2016, Ise-Shima):

1. Enhanced global sustained ocean observing system.
2. Improved and resourced World Ocean Assessment.
3. Promotion of data and information sharing, using the GEOSS data infrastructure.
4. Strengthen collaborative approaches to managing regional seas, including developing sustained observing capacity.
5. Streamline legal access for marine scientific research in areas under national jurisdiction (starting with G7).
6. Engage commercial shipping industry in ocean observation.

He suggested a potential role for CEOS for discussion.

**Potential CEOS role**

- Provides additional motivation and possibly momentum for GEO Blue Planet / development of flagship(s):
  - Along with SDGs, Sendai Framework for DRR, operational ocean services, UNFCCC, GEO Societal Benefit Areas
- **Sustained ocean observations** (space and in situ, global regional and local) are a **foundational component**
- Reminder that we would like **CEOS leadership engaged in an interim Board for GEO Blue Planet**, putting in place a permanent Board focused on strategy and a Technical Steering Committee dealing with implementation, as Blue Planet evolves along with GEO and in response to user needs.

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A brief discussion followed:

- Stephen asked how this fits with the Blue Planet initiative, and Albert noted that he hopes if the G7 countries support this initiative, then they will put some resources behind that commitment, and that those resources would be aligned with the Blue Planet initiative.
- Paul DiGiacomo (NOAA) noted that the G7 initiative is a good opportunity to provide the means to enhance observing capabilities by expanding and broadening networks, and adding capabilities. He noted he has worked within the US to try and ensure the G7 initiative is linked to Blue Planet. He suggested that this should be discussed within the Blue Planet *ad-hoc* steering committee, before moving forward with CEOS engagement.
- Kerry Sawyer (NOAA) compared the G7's role in Blue Planet to the role the G20 is playing for GEOGLAM in providing political backing.
- Carolin Richter (GCOS) noted that without GOOS, and without the atmospheric component of the WMO, there would not be any GCOS. She noted that no analogous coordination framework exists for terrestrial observations with the demise of the Global Terrestrial Observing System (GTOS), and this is an issue she is working to address.
- Stephen noted that GTOS hasn't been effective for the past 10 years, and so the community (e.g. GEO, WMO, FAO) need to consider suggestions for appropriate vehicles to take the lead on this.
- Paul noted the importance of terrestrial observations for coastal zone work, to understand coastal watershed.

<b>SIT-31-14</b>	<i>SIT Chair team, in cooperation with GCOS, to prepare a short paper for SIT Technical Workshop on how to mitigate the loss of the Global Terrestrial Observing System (GTOS)</i>	<b>SIT Chair team</b>	<b>SIT Tech Workshop</b>
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*2016 SIT Technical Workshop*

Stephen noted that the 2016 SIT Technical Workshop will take place Wednesday-Thursday 14-15 September in Oxford, UK. There will be meetings of the *ad hoc* Teams on Monday 12, and a dedicated VC/WG day on Tuesday 13.

Stephen explained the overall purpose for the SIT Technical Workshop in the context of the CEOS calendar. CEOS Plenary is a forum where whole of CEOS ('holistic') issues are discussed, whilst the SIT meetings (e.g. SIT-31) are strategic in nature, and the SIT Technical



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Workshop is technical in nature and intended as preparation for Plenary. The Workshop is also an opportunity to take stock of progress before the various important meetings at the end of the calendar year (e.g. SBSTA, COP).

***Finally, Stephen noted that there is a block booking for Workshop accommodation in Oxford which is being booked on a first-come, first-served basis - with a deadline of 30th June.*** Booking information can be found on the CEOS website: <http://ceos.org/2016-sit-technical-workshopaccomodation/>.

### *30th CEOS Plenary*

Caroline Bruce (CSIRO) gave a brief overview of the 30<sup>th</sup> CEOS Plenary, which will be held Tuesday-Wednesday 1-2 November 2016 at the Brisbane Convention & Exhibition Centre (BCEC) in Brisbane, Australia. Side meetings will take place on Monday 31 October (30 also available if necessary).

Caroline noted that the Chair Team will circulate a draft agenda and call for inputs in time, and asked that any special requests for agenda topics be made well in advance. She noted that a CEOS 'Town Hall' Event and Panel Discussion is being organised for 3<sup>rd</sup> November in collaboration with Geoscience Australia and University of Queensland, and asked those interested to consider participating when making travel arrangements. Further details will be announced and made available on the CEOS Plenary website in due course.

Caroline encouraged participants to begin making visa and travel arrangements, and noted that further information is available on the CEOS website: <http://ceos.org/meetings/30th-ceos-plenary/>. She invited any questions via email ([caroline.bruce@csiro.au](mailto:caroline.bruce@csiro.au)).

### ***Review of Actions***

Stephen reviewed the draft table of actions, noting the importance of sustaining efforts and themes over the long-term, and that ESA and SIT Vice Chair (NOAA) will work together closely to ensure the necessary continuity.

Barbara Ryan (GEO Secretariat) noted the importance of encouraging agencies to make linkages within their own national statistical organisations and UN-GGIM contacts in relation to the UN-SDGs.

### ***SIT-31 Closing Remarks***

Stephen closed the meeting, noting that increased understanding of the CEOS-GEO future relationship will continue to be important moving forward. The relationship is strong, and he looks forward to working together with GEO over the next couple of years to implement the Work Programme. He noted that GEO has responded to many of the key points raised by CEOS, and this is appreciated.

He noted that:

- the discussion about how CEOS might improve its handling of requirements has been useful, and the renaissance of the LSI-VC very important, and positive;
- the VCs and WGs session was good, and the key messages on SST and OST received;
- the Copernicus session was positive and encouraging, with several common ideas identified between the European approach, and the approach of other agencies; and
- the discussion between GOOS and the Blue Planet initiative was important and pleasing.

Stephen thanked everyone for their attendance and participation, and Alex Held (CSIRO) thanked ESA for their generous hospitality.



**List of Participants**

Organization	Participant	Organization	Participant
CNES	Pascale Ultré-Guérard	GEOGLAM/GEO Secretariat	Michel Deshayes
CNES	Selma Cherchali	GEOGLAM/UMD	Alyssa Whitcraft
CNES	Phillipe Escudier (WebEx)	GEOGLAM/JECAM	Ian Jarvis
CONAE	Laura Frulla	ISRO	Ali Khan Imtiaz
CSA/DCEO	Marie-Josée Bourassa	JAXA	Yoshimura Yoshinori
CSA	Stéphane Chalifoux	JAXA	Naoko Matsuo
CSIRO/CEOS Chair	Alex Held	JAXA	Kei Ohyoshi
CSIRO	Flora Kerblat	JAXA	Chu Ishida (WebEx)
CSIRO	Caroline Bruce	JAXA/RESTEC	Masatoshi Kamei
CSIRO	Rob Woodcock	NASA	Mike Freilich
CSIRO	Matthew Steventon	NASA	Christine Bognar
DLR	Albrecht von Bargaen	NASA	Brad Doorn
EC/JRC	Mark Dowell	NASA	Steven Neeck
ESA	Stephen Briggs	NASA	Ruth Neilan
ESA	Simonetta Cheli	NASA	Kurtis Thome
ESA	Ivan Petiteville	NASA	Wenying Su
ESA	Craig Donlon	NASA	Andrew Mitchell
ESA	Claus Zehner	NASA	David Jarrett (WebEx)
ESA	Pascal Lecomte	NASA/CEOS SEO	Brian Killough
ESA	Jean-Louis Fellous	NASA/CEOS SEO	Kim Holloway
ESA	Josef Aschbacher	NOAA	Steve Volz
ESA	Stephen Coulson	NOAA	Kerry Sawyer
ESA	Bianca Hoersch	NOAA	Paul DiGiacomo
ESA	Frank Martin Seifert	NOAA	Chuck Wooldridge
ESA	Henri Laur	NSC	Einar-Arne Herland
ESA	Mirko Albani	NSMC/CMA	Weiyang Cai
ESA	Stephen Ward	NSMC/CMA	Jinlong Fan
ESA	George Dyke	NSMC/CMA	Fang Xiang
EUMETSAT	Alain Ratier	SANSA	Jane Olwoch
EUMETSAT	Paul Counet	UKSA	Emily Gravestock
EUMETSAT	Robert Husband	UKSA	Chris Hall (WebEx)
EUMETSAT	Anne O'Carroll (WebEx)	UNESCO/GOOS	Albert Fischer
GA/CEO	Jonathon Ross	US Dep. of State	Fernando Echavarria
GCOS	Carolin Richter	USGS	Jenn Lacey
GEO Secretariat	Barbara Ryan	USGS	Steve Labahn
GEO Secretariat	Osamu Ochiai	USGS	Tom Cecere

(WebEx) indicates remote participation via WebEx.

**Record of Actions and Decisions from CEOS SIT-31**

No.	Action	Actionee	Due Date
SIT-31-01	<i>CEOS Agencies asked to co-operate with an anticipated GEOGLAM Secretariat request for identification and confirmation of Points of Contact in relation to data acquisition planning &amp; data access requests for GEOGLAM</i>	<b>GEOGLAM Secretariat</b>	<b>May 2016</b>
SIT-31-02	<i>Paul DiGiacomo to liaise with Blue Planet in relation to the space data needs associated with their initial implementation phase activities</i>	<b>Paul DiGiacomo</b>	<b>SIT Tech Workshop</b>
SIT-31-03	<i>CNES, in coordination with ISRO, to consider comments raised at SIT-31 in providing feedback to finalisation of the Delhi Declaration</i>	<b>CNES</b>	<b>COMPLETE</b>
SIT-31-04	<i>Agencies to submit nominations for the WGClimate Vice Chair position to be confirmed at the WGClimate meeting in February 2017, submitted for endorsement at CGMS Plenary 2017 (Q2 2017), and CEOS Plenary 2017 (October 2017), and to assume the WGClimate Vice Chair role as of endorsement from CEOS Plenary 2017 for 2018-2019. By convention, nominations from 'R&amp;D' agencies are to be given preference for this rotation.</i>	<b>CEOS Agenices</b>	<b>Nominations by 31 January 2017</b>
SIT-31-05	<i>LSI-VC and SEO to further develop the CEOS Analysis Ready Data (ARD) definition document with support from interested CEOS Agencies</i>	<b>LSI-VC Co-Leads, SEO</b>	<b>SIT Tech Workshop</b>
SIT-31-06	<i>WGs and VCs to identify a Point of Contact to serve as interface for routine reporting on implementation of the CEOS Strategy for Carbon Observations from Space</i>	<b>WG Chairs, VC Leads</b>	<b>May 2016</b>
SIT-31-07	<i>SIT Chair Team (Pascal Lecomte) will coordinate with Mark Dowell to arrange a Carbon Strategy meeting at the time of the SIT Technical Workshop in Oxford in September 2016</i>	<b>Pascal Lecomte</b>	<b>SIT Tech Workshop</b>
SIT-31-08	<i>WSIST Water Constellation Feasibility Study team to ensure precipitation sampling requirements are included in their analysis, in coordination with P-VC</i>	<b>WSIST</b>	<b>SIT Tech Workshop</b>
SIT-31-09	<i>WSIST Water Constellation Feasibility Study team to stay connected to the GEO Water Resources Management SBA developments within GEO Work Programme Foundational Task GD-08 and to ensure that new requirements reflect previous efforts on which CEOS response is based</i>	<b>WSIST</b>	<b>Plenary</b>
SIT-31-10	<i>SIT Chair team to review the CEOS New Initiatives Process Paper, and consider its applicability, in preparation for discussions of how to handle requirements arising from GEO Work Programme Foundational Task GD-08</i>	<b>SIT Chair team</b>	<b>SIT Tech Workshop</b>
SIT-31-11	<i>SIT Chair to circulate the LSI-VC survey on requirements management tools and processes to CEOS Agencies for their response</i>	<b>SIT Chair team</b>	<b>COMPLETE</b>
SIT-31-12	<i>CEOS Agencies to complete the outstanding OCR-VC request to reply with regard to LO/1A ocean colour data access</i>	<b>CEOS Agencies</b>	<b>June 2016 SIT Chair (Jean-Louis Follous) preparing draft letter to agencies</b>

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<b>SIT-31-13</b>	<i>CEOS Agencies to consider the need for continuity and redundancy of Passive Microwave Radiometers for SST highlighted by SST-VC, providing relevant input to SST-VC to enable them to provide an update on the 6-7 GHz PMW continuity situation at SIT Technical Workshop, and/or CEOS Plenary.</i>	<b>CEOS Agencies</b>	<b>SIT Tech Workshop</b>
<b>SIT-31-14</b>	<i>SIT Chair team, in cooperation with GCOS, to prepare a short paper for SIT Technical Workshop on how to mitigate the loss of the Global Terrestrial Observing System (GTOS)</i>	<b>SIT Chair team</b>	<b>SIT Tech Workshop</b>

**31<sup>st</sup> CEOS STRATEGIC IMPLEMENTATION TEAM MEETING  
v0.1h**

**19<sup>th</sup> - 20<sup>th</sup> April 2016**

**Frascati, Italy**

<b>No.</b>	<b>Decision/Outcome</b>
<b>Decision 1</b>	<i>During a dedicated CEOS Plenary session, NOAA was endorsed as the SIT Vice Chair for 2016-2017 and subsequently SIT Chair for 2018-2019. Steve Volz will serve as SIT Vice Chair and subsequently SIT Chair for NOAA.</i>
<b>Decision 2</b>	<i>SIT-31 endorsed the SDCG Element-3 Strategy: Satellite Data in Support of Research &amp; Development (R&amp;D) Activities v2.0.</i>
<b>Decision 3</b>	<i>The CEOS way forward on the Global Goals for Sustainable Development (i.e. UN-SDGs) will be undertaken in collaboration with GEO &amp; UN-GGIM, supplemented by a top-down dialogue with relevant UN Agencies and with individual CEOS Agencies making connections within their governments.</i>
<b>Decision 4</b>	<i>CEOS Agencies agreed to contribute to the development of scenarios for a new generation of high resolution ocean surface topography constellation, following the next meeting of the OSTST and OST-VC in La Rochelle (October 2016).</i>