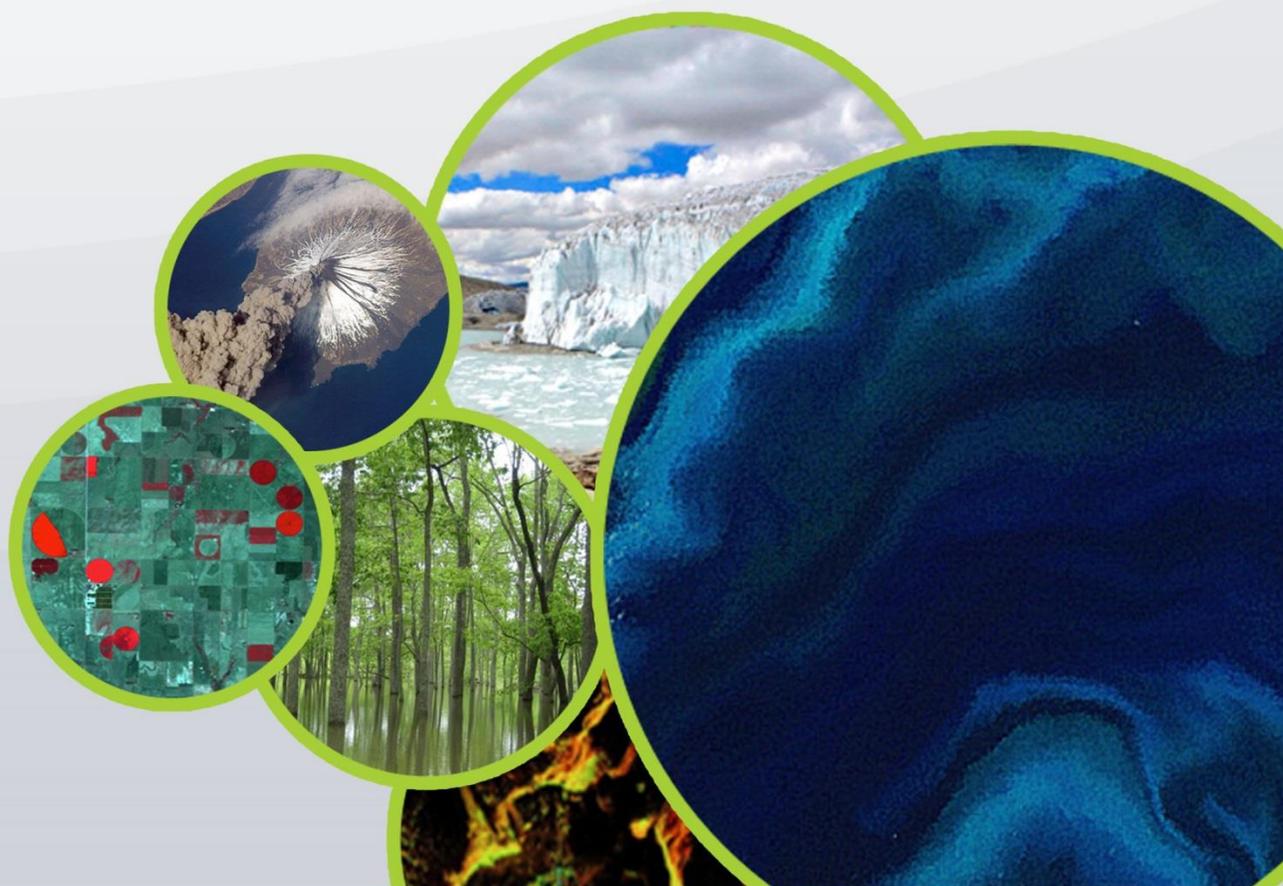




Committee on Earth Observation Satellites



# 2017-2019 Work Plan

May 2017 (Version 1.1.1)

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## 1 Introduction and Overview

The *2017-2019 CEOS Work Plan* has been developed by the CEOS Executive Officer (CEO) under direction of the CEOS Chair (United States Geological Survey [USGS]), in consultation with the CEOS Strategic Implementation Team (SIT) Chair (European Space Agency [ESA]), CEOS Secretariat (SEC), CEOS Working Groups (WG), CEOS Virtual Constellations (VC), CEOS Ad Hoc Teams, the CEOS Systems Engineering Office (SEO), CEOS Agencies at large, and CEOS's external stakeholders. The purpose of this document is to set forth near-term objectives and deliverables designed to achieve the goals outlined in the *CEOS Strategic Guidance* document. It includes a description of CEOS activities to be executed in the current calendar year (2017), and summarizes anticipated activities for the subsequent two years (2018-2019). Additional documents contributing information to this plan are located on the CEOS website (<http://ceos.org/>) and include: *The Kyoto Statement*, issued at the 29<sup>th</sup> CEOS Plenary Meeting held in 2015; the *2016-2018 CEOS Work Plan*; the terms of reference for the CEOS Virtual Constellations and Working Groups; and a number of thematic observation strategies adopted by the CEOS Plenary. This Work Plan will be revised annually; however, the priorities and activities outlined herein are expected to remain fairly consistent from year to year. CEOS will revise this Work Plan each year, as current activities are completed, planned activities are executed, and new initiatives are projected.

### CEOS Mission Statement:

**CEOS ensures international coordination of civil space-based Earth observation programs and promotes exchange of data to optimize societal benefit and inform decision making for securing a prosperous and sustainable future for humankind.**

To this end, the primary objectives of CEOS are:

- To optimize the benefits of space-based Earth observation through cooperation of CEOS Agencies in mission planning and in the development of compatible data products, formats, services, applications and policies
- To aid both CEOS Agencies and the international user community by, among other things, serving as the focal point for international coordination of space-based Earth observation activities, including the Group on Earth Observations and entities related to global change
- To exchange policy and technical information to encourage complementarity and compatibility among space-based Earth observation systems currently in service or development, and the data received from them, as well as address issues of common interest across the spectrum of Earth observation satellite missions

Achievement of these three objectives requires significant internal and interagency coordination, and external consultation and coordination of outputs to respond to the needs of key stakeholders. These stakeholders consist of national governments, including the Group of Eight (G8) and the Group of 20 (G20), the intergovernmental Group on Earth Observations (GEO), and organizations participating in treaties and global programs affiliated with the United Nations (UN)<sup>1</sup>.

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<sup>1</sup> These treaties, international organizations, and international programs include the UN Framework Convention on Climate Change (UNFCCC), the 2030 Agenda for Sustainable Development (the SDGs), the UN Office for Disaster Risk Reduction (UNISDR), the United Nations Convention to Combat Desertification, and the Convention on Biodiversity (CBD), among others.

## 2 CEOS Priorities

This Work Plan has been developed in the context of long-term CEOS priorities as described in the CEOS Governing Documents and specific priorities identified in the *Kyoto Statement* issued at the 29<sup>th</sup> CEOS Plenary Meeting held in Kyoto, Japan in 2015.

In this Statement, CEOS Agencies affirmed their intent to work together to:

- Ensure that climate observation requirements identified by the Global Climate Observing System (GCOS) – and implications of the Paris Climate Agreement – are addressed.
- Ensure, in the context of the *Sendai Framework for Disaster Risk Reduction 2015-2030*, that CEOS Agency data are made available in support of disaster risk reduction and that CEOS continues engagement with UN agencies and authorities.
- Ensure that space-based Earth observations support the success of the next decade of the Group on Earth Observations (GEO), and that CEOS engagement in GEO governance and leadership is enhanced.
- Proactively engage in global discussions on the critical challenges that face society, including the achievement of the *2030 Agenda for Sustainable Development*.

At the 30<sup>th</sup> CEOS Plenary Meeting held in Brisbane, Australia in 2016, CEOS Agencies also agreed on the need for a cross-cutting effort to engage with the strategic implications of new approaches to exploitation of satellite Earth observation data: “Future Data Architectures”. CEOS will build on exploratory work completed in 2016. Additionally, 2017 CEOS Chair, USGS, introduced a related initiative on “Moderate Resolution Sensor Interoperability”.

CEOS Agencies also affirmed their intention to continue to enhance their cooperation to respond effectively to Earth observation user needs by achieving integration across the full range of Earth observations, by closing important observational gaps, by promoting the sharing of CEOS Agency data, and by improving access to and use of such data. CEOS will continue to support more effective societal decision making in the areas of climate monitoring and research; carbon observations, including observations to support the effective monitoring and management of the world’s forested regions; water, including observations to support the effective monitoring and management of the world’s water resources; food security; disaster risk management; oceans; biodiversity; capacity building; and data availability and access. Satellite mission coordination will be strengthened, particularly through the CEOS Virtual Constellation activities. CEOS Working Groups and Virtual Constellations will expand their technical and scientific coordination to support these priorities, and improve the overall level of complementarity and compatibility of CEOS Agency Earth observation and data management systems for societal benefit.

CEOS will consider other requests from external stakeholders and determine what, if any, support is possible and appropriate. CEOS will also continue its outreach and communications efforts. As it executes these activities, CEOS will operate in accordance with the guidance provided in the *CEOS Governance and Processes* document regarding the organization’s structure, processes, and stakeholder relations.

CEOS’ internal and external coordination involves a considerable number of tasks supported by the full range of CEOS participants. This document is intended to provide overall guidance for CEOS on expected outcomes for CEOS and its stakeholders for 2017-2019.

For 2017, the plan addresses CEOS initiatives at a general level. Specific details regarding support required to achieve these outcomes will be maintained by the respective responsible CEOS Entities (e.g. CEOS Agencies, Working Groups, Virtual Constellations, Ad Hoc Teams), and reported as appropriate via updates to the online CEOS Deliverable Tracking Tool.

For subsequent years (2018-2019) this document summarizes planned CEOS activities more broadly; details regarding these future activities will be established in forthcoming updates of this document, as the activities near implementation. Virtual Constellations, Working Groups, and Ad Hoc Teams may prepare separate, more detailed Work Plans that complement this overall guiding Work Plan.

### 3 Expected Outcomes for 2017-2019

The expected outcomes for 2017-2019 reflect the ongoing and emerging priorities of CEOS, as characterized by its internal decision-making and external commitments. They are intended to focus on improved Earth observation (EO) systems coordination and enhanced data access for key global programs and initiatives.

The main outcomes are described for the following thematic areas for the period 2017-2019:

- 3.1. Climate Monitoring, Research, and Services
- 3.2. Carbon Observations, Including Forested Regions
- 3.3. Observations for Agriculture
- 3.4. Observations for Disasters
- 3.5. Observations for Water
- 3.6. Future Data Architectures
- 3.7. Capacity Building, Data Access, Availability and Quality
- 3.8. Advancement of the CEOS Virtual Constellations
- 3.9. Support to Other Key Stakeholder Initiatives
- 3.10. Outreach to Key Stakeholders
- 3.11. Organizational Issues

The outcomes for each thematic area are summarized in tables that list the objectives/deliverables to be pursued in that area, projected completion dates (typically indicated by quarter of the calendar year), background information, and responsible CEOS Entities.

CEOS operates on a best-efforts basis. Responsible CEOS entities are expected to accomplish the objectives and deliverables identified in this document to the best of their abilities, but there is no formal commitment to achieve the projected completion date.

### 3.1 Climate Monitoring, Research, and Services

CEOS and the Coordination Group for Meteorological Satellites (CGMS) have committed to work together, through the Joint CEOS/CGMS Working Group on Climate (WGClimate), to monitor climate from space through the coordinated planning, production, improvement, and availability of space-based climate data records on a global scale. This work is focused towards implementation of the *Strategy Towards an Architecture for Climate Monitoring from Space* developed and endorsed by CEOS, CGMS and the World Meteorological Organization (WMO). The following sections summarize activity from the perspective of CEOS contributions to the joint effort, as well as CEOS-specific activities in the climate domain.

A key focus of work during the 2017-2019 period will be to contribute to development of a comprehensive and integrated space response to the Global Climate Observing System (GCOS) Implementation Plan 2016, adopted at the 22<sup>nd</sup> Conference of the Parties to the UN Framework Convention on Climate Change, held in Marrakech, Morocco in November, 2016.

This work will be underpinned by ongoing efforts to create an up-to-date and comprehensive Essential Climate Variable Inventory that identifies data gaps and opportunities for improvement along the climate information value chain, as well as efforts to communicate progress of the satellite coordination community within the United Nations system and more broadly.

**I. Continue cooperation with GEO, GCOS, WMO, and CGMS in the development of a space-based system to support climate change information and adaptation.**

**2016-2018:** CEOS Agencies will continue to cooperate with GEO, GCOS, WMO, and CGMS by implementing Agency actions to achieve the socio-economic benefits described in the CEOS-CGMS-WMO *Strategy Towards an Architecture for Climate Monitoring from Space*, with emphasis on the strategy's Applications and Decision-Making pillars. CEOS will consider how to address and contribute to WMO's Global Framework for Climate Services (GFCS).

This coordination will be supported by the development and promotion of case studies, and the development and maintenance of a Joint CEOS/CGMS WGClimate presence on the CEOS website that provides the single authoritative location for information about the Working Group's activities.

**II. Continued implementation of the Architecture for Climate Monitoring from Space**

**2017:** Following on from successful delivery of the first inventory of Essential Climate Variables completed in 2015, the Joint CEOS/CGMS WGClimate will complete a second iteration during 2017.

This will involve: collating updated information from data providers on Climate Data Record holdings; incorporating updated information in the ECV Inventory; quality control to verify completeness and consistency of the ECV Inventory contents, as well as to critically analyze the relevance of the various records; generating a coordinated action plan to address gaps/opportunities; and communicating the results on completion of the cycle. A key element of the work will be reviewing the compliance of satellite missions

and products with the GCOS Climate Monitoring Principles and with the *Guideline for the Generation of Datasets and Products meeting GCOS Requirements*.

Building on lessons learnt from the first iteration, this iteration will focus on achieving buy-in from Climate Data Record programme managers and will employ a strictly limited time window for updates by record providers.

This activity will be complemented by hosting of a computerised ECV inventory and development of further ECV inventory capabilities. The ECV Inventory will be located on the Joint CEOS/CGMS WGClimate web presence to ensure accessibility.

**2018-2019:** Following completion of a full update cycle during 2016-2017, another update cycle will commence, aimed at further improving the currency, quality and completeness of available information. This cycle will build on lessons learned from the 2016-2017 cycle, and is expected to take into consideration the new GCOS-IP.

**III. Continued strong engagement with UNFCCC/SBSTA and GCOS processes**

**2017-2019:** The Joint CEOS/CGMS WGClimate ensures the planning and development of a coordinated space agency response to climate information needs through its relations with GCOS and the Subsidiary Body for Scientific and Technological Advice (SBSTA). The group will continue these strong linkages during 2017-2019, including:

- developing a comprehensive space agency response to the GCOS Implementation Plan 2016 for report at UNFCCC COP-23 in November 2017.
- providing, on request, updates on progress in implementation of the Architecture for Climate Monitoring from Space to both GCOS and SBSTA.

Climate Monitoring, Research, and Services Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>Information dissemination and communication</b>			
<b>CMRS-12:</b> Establishment of a WGClimate website	Q3 2017	The website will provide the single authoritative location for Joint CEOS/CGMS WGClimate-related information including the Climate Monitoring Architecture definition and the ECV Inventory, and will be used as the working area for members from both CGMS and CEOS. This will include development of enhanced tools to increase the efficiency and utility of the ECV Inventory.	WGClimate

<b>Climate Monitoring, Research, and Services Objectives/Deliverables: 2017-2019</b>			
<b>Objective/Deliverable</b>	<b>Projected Completion Date</b>	<b>Background Information</b>	<b>Responsible CEOS Entity</b>
<b>CMRS-13:</b> Development and Promotion of Case Studies	Q3 2017	Previous work, supervised by the EC JRC and WMO, has already produced WMO 1192 <i>Case Studies for Establishing an Architecture for Climate Monitoring from Space</i> . The possibility exists for further involvement by an expanded team. The output of previous and potential future work is to be supported by the dedicated Joint CEOS/CGMS WGClimate website.	WGClimate
<b>Delivery of a second iteration of the Essential Climate Variable Inventory</b>			
<b>CMRS-14:</b> Collection, incorporation, and quality control of new & updated information from data providers	Q1 2017	For the purposes of this iteration, the set of questionnaires using for data collection during the first iteration will be re-used. The announcement of the process to request updates to the inventory records was made at the 29 <sup>th</sup> CEOS Plenary Meeting.	WGClimate
<b>CMRS-15:</b> Gap analysis	Q2 2017	Several teams will perform the cycle 2 gap analysis in parallel, with the work organized by thematic area. To ensure consistency of approach across the full inventory, the gap analysis work of the individual teams will be overseen/coordinated by ESA and USGS.	WGClimate
<b>CMRS-16:</b> Action plan	Q4 2017	The action plan will identify agreed actions that CEOS and CGMS Members and Associates intend to take to address priority gaps. The action plan will be endorsed and released to the CEOS community at the 31 <sup>st</sup> CEOS Plenary Meeting.	WGClimate
<b>Delivery of a third iteration of the Essential Climate Variable inventory</b>			
<b>CMRS-17:</b> Collection, incorporation, and quality control of new & updated information from data providers	Q3 2018	It is expected that the third iteration will enhance the questionnaire, and potentially the inventory structure, to accommodate for example: The 2016 GCOS IP; any requirements stemming from C3S; and experiences from applicable projects.	WGClimate
<b>CMRS-20:</b> Gap analysis	Q1 2019	Several teams will perform the cycle 3 gap analysis in parallel, with the work organized by thematic area. To ensure consistency of approach across the full inventory, the gap analysis work of the individual teams will be undertaken in a coordinated manner.	WGClimate
<b>CMRS-21:</b> Action plan	Q4 2019	The action plan will identify agreed actions that CEOS and CGMS Members and Associates intend to take to address priority gaps. The action plan will be endorsed and released to the CEOS community at a suitable meeting.	WGClimate

Climate Monitoring, Research, and Services Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>Engagement with GCOS</b>			
<b>CMRS-19:</b> Joint CEOS/CGMS response to the new GCOS IP	Q4 2017	<p>The GCOS IP 2016 includes information on observation requirements that requires a response from space agencies. Reflecting the partnership, this document will be developed jointly by CEOS and CGMS.</p> <p>UNFCCC SBSTA encouraged CEOS to submit its comprehensive space agency response to the GCOS IP 2016 at SBSTA 47 during COP-23 in November 2017.</p>	WGClimate

### 3.2 Carbon Observations, Including Forested Regions

- I. **Coordinate space-based observations to support the effective monitoring and management of the world’s forested regions in support of international climate agreements and the Space Data Component of the GEO Global Forest Observations Initiative (GFOI).**

**2017:** Through its Ad Hoc Space Data Coordination Group (SDCG) for GFOI, CEOS is developing and coordinating the implementation of *the CEOS Strategy for Space Data for GFOI* (endorsed by CEOS Plenary in 2011) for the provision of satellite observations in support of the development of national forest monitoring and measurement, reporting, and verification (MRV) systems.

In 2017, the SDCG will build on previous activity by continuing to implement the first element of the CEOS Space Data Strategy for GFOI — the *Global Baseline Data Acquisition Strategy for GFOI*, endorsed in 2013 and updated in 2015. The SDCG will also continue to work to update the strategy to reflect new data stream availability.

The SDCG will also work to implement the *Space Data Services Strategy for GFOI*, endorsed in 2014. Through this strategy, SDCG seeks to provide a coordinated strategy for national data acquisition that will accommodate countries that have specific technical requirements or heritage and experience with working with a particular EO data source or type. The SDCG, with support from the CEOS Systems Engineering Office (SEO), will continue to work with several countries to develop pilot data services based on a new Data Cube architecture, in coordination with FDA and Moderate Resolution Interoperability, with regular reports to be provided.

The SDCG will also continue work in cooperation with GOF-C-GOLD to implement the *Strategy for Satellite Data in support of GFOI R&D* endorsed at the 29<sup>th</sup> CEOS Plenary.

**2018-2019:** The SDCG will deliver annual implementation updates to the *Global Baseline Data Acquisition Strategy for GFOI* and the *Space Data Services Strategy for GFOI* at the annual SIT meetings.

**II. Progress implementation of the CEOS Strategy for Carbon Observations from Space**

**2017:** In 2014, CEOS endorsed the *CEOS Strategy for Carbon Observations from Space* in response to the *GEO Carbon Strategy*. The CEOS strategy addresses the three domains— atmospheric, oceanic and terrestrial — and their interfaces, and identified a number of recommended actions to be completed by space agencies.

At the 30<sup>th</sup> CEOS Plenary Meeting, CEOS determined a number of targeted initiatives to advance to implementation of the *CEOS Strategy for Carbon Observations from Space*. These initiatives are cross-cutting in nature and address numerous Actions in the strategy. The first set of initiatives cover a broad range of CEOS WGs and VCs, and are addressed by the CARB objectives/deliverables proposed over the 2017-2018 period.

**2018-2019:** CEOS will approach implementation of the strategy opportunistically: identifying opportunities to leverage CEOS Agency priorities and interests to establish concrete activities that progress the identified actions.

<b>Carbon Observations, Including Forested Regions Objectives/Deliverables: 2017-2019</b>			
<b>Objective/Deliverable</b>	<b>Projected Completion Date</b>	<b>Background Information</b>	<b>Responsible CEOS Entity</b>
<b>CARB-4:</b> CEOS delivery of coordinated land surface observations for GFOI countries	Q2 2017	CEOS will acquire coordinated land surface observations for GFOI countries in accordance with the endorsed strategies.	SDCG for GFOI
<b>CARB-5:</b> Updated <i>Global Baseline Data Acquisition Strategy for GFOI</i> , <i>Space Data Services Strategy for GFOI</i> , and <i>Strategy for Satellite Data in support of GFOI R&amp;D</i>	Q4 2017	Element-1 (baseline data acquisition strategy), Element-2 (data services) and Element-3 (R&D) will require annual updates to reflect changes in space data assets and national implementation plans. It is expected that GFOI will reach full operational capability after 2017.	SDCG for GFOI
<b>CARB-12:</b> White paper on a carbon observation constellation	Q3 2018	White paper on coordinated detailed planning/preparation of a constellation of instruments to measure CO <sub>2</sub> and CH <sub>4</sub> from space.	AC-VC
<b>CARB-13:</b> Assessment of Terrestrial Carbon Strategy variables	Q4 2017	In support of the CEOS Carbon Strategy, LSI-VC will analyze validated land carbon observation requirements and identify the gaps in and opportunities for optimization across CEOS Agency missions. This work will leverage GEOGLAM requirements 'matrix' as a framework.  A status report will be provided at the 2017 SIT Technical Workshop.	LSI-VC

Carbon Observations, Including Forested Regions Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>CARB-14:</b> Extraction of ECV gap-analysis outcomes for carbon-relevant ECVs	Q4 2017	Analyze the output of the WGClimate ECV Gap Analysis for those variables where there is overlap with those identified in the CEOS Carbon Strategy, i.e. a meta gap analysis for carbon relevant ECVs	WGClimate
<b>CARB-15:</b> Carbon data portal	Q4 2017	Implement a carbon data portal to facilitate the discoverability and accessibility of ECV products and space-borne CDRs. The portal is designed with a service-oriented architecture and follows the principles outlined by the GEOSS Community Portal white paper. The portal will seamlessly access data both in CWIC and FedEO to provide necessary data and services to the carbon science community of both CEOS and GEOSS.	WGISS
<b>CARB-16:</b> Cal/val and production of biomass products from CEOS missions	Q4 2019	Development of a coordinated cal/val strategy across NASA and ESA biomass missions that rationalizes protocols, data sharing, and the establishment of ground-based carbon super-sites.	NASA and ESA
<b>CARB-17:</b> Engaging with IPCC inventories and promoting satellite EO	Q4 2019	<p>The <i>2006 IPCC Guidelines for National GHG Inventories</i> currently indicates that satellite data has limitations in spatial, vertical and temporal resolution. However, the IPCC Guidelines will be updated and released in 2019, and update of verification guidance with respect to atmospheric measurement and new datasets is expected. This creates the possibility that the update will include use of GHG observation data from satellites.</p> <p>CEOS has accumulated GHG scientific data by satellites such as GOSAT and OCO-2, and more satellites will follow. Thus, CEOS engagement with IPCC and efforts to support this update are important for EO data uptake in Climate actions.</p>	JAXA
<b>CARB-18:</b> Colombia Data Cube Prototype for Forest Mapping and Carbon Stock Assessments	Q4 2018	The SEO initiated a Data Cube prototype in Colombia in 2016. This project will demonstrate an end-to-end approach for Carbon stock assessments of forests to support UNFCCC reporting. Coordination with FAO and the GFOI Office will be essential.	SEO (with support from SDCG for GFOI)
<b>CARB-19:</b> Land products validation listing and framework	Q4 2017	Summarize current list of validated land data products relevant to Carbon Strategy, documenting validation framework and protocols and providing guidance for online platform for intercomparison of terrestrial carbon products.	WGCV

### 3.3 Observations for Agriculture

- I. **Develop and implement a data acquisition strategy to provide satellite observations that will facilitate the monitoring of agricultural production in support of the GEO Global Agricultural Monitoring (GEOGLAM) initiative.**

**2017:** GEOGLAM aims to enhance agricultural production estimates through the use of Earth observations in order to address concerns raised by the G20 Agricultural Ministers about market volatility for the world’s major crops as well as to provide early warnings of crop shortages and failures in countries most at risk of food insecurity. Through the CEOS Ad Hoc Working Group on GEOGLAM, CEOS has developed, and continues to coordinate the implementation of, strategies for the provision of satellite observations to GEOGLAM. GEOGLAM is a system of systems, and components of it are already in the operational phase, including both contributing activities/partners and the GEOGLAM Crop Monitor activities. GEOGLAM’s implementation is continuous and responsive to the needs of GEOGLAM’s growing list of national, regional, and global monitoring partners. These operational systems, as well as emerging national and regional monitoring activities, can be further enhanced by CEOS efforts to support the provision of timely and appropriate satellite observations at “analysis-ready” levels (consistent with LSI-VC efforts).

At the 29<sup>th</sup> CEOS Plenary Meeting, CEOS endorsed the *CEOS Strategic Response to GEOGLAM Requirements*, describing how CEOS Agencies will coordinate to support information requirements arising from GEOGLAM. This strategy, together with the CEOS Ad Hoc Working Group’s Scope of Work document, will continue to guide the work of the CEOS Ad Hoc Working Group on GEOGLAM in 2017 and will be updated as necessary.

In 2017, the GEOGLAM Secretariat is leading an effort to refresh its information and EO data requirements characterization based on a compendium on “best-practices” arising from GEOGLAM’s R&D activities. Accordingly, in 2017, a more significant update of the Strategic Response is expected.

In addition to its work implementing the endorsed strategy, the CEOS Ad Hoc Working Group on GEOGLAM will continue working with GEOGLAM to define their space data requirements, identify potential CEOS inputs, and track/report on the application of data provided by CEOS Agencies. The CEOS Ad Hoc Working Group on GEOGLAM will also continue to monitor updates to the overarching GEOGLAM implementation plan, including emerging requirements from GEOGLAM’s regional activities: Asia-RiCE, GEOGLAM Latinoamérica (launched in 2015), and AfriGAM (launched in 2016). While the latter two regional networks are still in foundational stages for 2017, Asia-RiCE is in a mature state and as such its team’s requirements as well as those of the Rangelands and Pasture Productivity initiative (RAPP) will be updated. The CEOS Ad Hoc WG for GEOGLAM will gather and review these needs and advise the broader CEOS community on appropriate responses. A key focus will be potential practical (sustainable) operational use of CEOS data, especially SAR, for rice crop monitoring in Asia, Latin America, Africa, and other areas (particularly those impacted by cloud cover). The CEOS Ad Hoc Working Group on GEOGLAM will consult with the Asia-RiCE team to upscale target area from one province to major rice crop areas (wall-to-wall country-wide) in selected countries.

Through the CEOS Systems Engineering Office (SEO), CEOS will continue to work with GEOGLAM to deliver data services prototype projects and investigate common data sharing policies. In addition, the SEO will continue to support the Asia-RiCE team to undertake bench mark tests to improve data and information accessibility.

Lastly, CEOS will consider GEOGLAM's requests for guidance on engagement of the commercial space sector. GEOGLAM has been regularly contacted by commercial data providers and believes CEOS can provide valuable insight on this matter.

**2018-2019:** GEOGLAM will continue to expand its efforts by increasing the number of supported countries, expanding its use of mission data by utilizing new mission datasets (i.e. optical and radar), continuing development of sampling strategies, and continuing to investigate methods for data management and distribution. The CEOS Ad Hoc Working Group on GEOGLAM will further update the *CEOS Strategic Response to GEOGLAM Requirements* as well as the *CEOS Ad Hoc WG for GEOGLAM Scope of Work Document* to reflect the expansion of effort and changes to data supply arrangements.

## II. **Continue support to the Joint Experiments on Crop Assessment and Monitoring (JECAM) initiative.**

**2017:** JECAM was initiated in 2009 by the GEO Agriculture Monitoring Community of Practice (CoP) to enhance collaborative international research on agriculture through use of remotely-sensed EO. In 2011, CEOS initiated efforts to supply JECAM users with relevant remote sensing data through a coordinated Earth observations from space data acquisition program involving CEOS Agencies and commercial data providers. In recent years, other activities have received significant funding to carry out operational research and development in support of GEOGLAM, for example the European Commission's FP7 supported Stimulating Innovation for the Global Monitoring of Agriculture (SIGMA) project and the European Space Agency funded Sentinel-2 for Agriculture and GEORICE activities. These activities contribute to GEOGLAM's broader operational R&D efforts, collaborating with and often having complementary test site locations with JECAM sites.

CEOS Agencies will continue data acquisitions for support to JECAM and GEOGLAM R&D activities at selected sites for both Northern Hemisphere and Southern Hemisphere growing seasons. It is expected that these acquisitions will continue at least through the end of 2017, and be described in an annual report. CEOS Agencies will continue to liaise with the GEOGLAM R&D Co-Leads and the GEOGLAM EO Data Coordination Lead on data requirements related to this matter.

Observations for Agriculture Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>AGRI-4:</b> <i>CEOS Strategic Response to GEOGLAM Requirements</i>	Annually Q4	<p>The <i>CEOS Strategic Response to GEOGLAM Requirements</i> identifies how CEOS Agencies will coordinate their relevant Earth observing satellite systems to acquire data to support information requirements arising from GEOGLAM.</p> <p>Annual updates to this document include the addition of new mission datasets, updates to primary and contributing datasets, updates to sampling approaches, adjustments to the strategy that improve GEOGLAM coverage, and updates to country coverage.</p> <p>In addition, this task will include updates to the Scope Document, which reflects the high-level plans for the Ad Hoc GEOGLAM team and addresses new requirements evolving from the Rangelands (RAPP) project and upscaling of SAR coverage in support of Asia-RiCE (eventual goal: national coverage).</p> <p>An interim report of the updated strategy will be presented at the annual SIT meeting. The final updated strategy will be presented for endorsement at the annual CEOS Plenary Meeting.</p>	CEOS Ad Hoc Working Group on GEOGLAM
<b>AGRI-8:</b> Vietnam Data Services Prototype	Q3 2017	Complete initial deployment of a Vietnam Data Cube with a particular emphasis on data interoperability (optical and radar) and agriculture applications including rice crop monitoring.	SEO
<b>AGRI-9:</b> RAPP (Rangelands) Data Cube Demonstrations and Application Testing	Q4 2017	Complete a Data Cube demonstration for one or more test sites to support RAPP (rangelands). This demo will explore steps for data cube creation at local test sites and explore applications targeted toward rangelands agriculture (fractional cover, custom cloud-free mosaics, NDVI anomaly).	SEO

### 3.4 Observations for Disasters

CEOS is committed to supporting disaster risk management in the context of the *2030 Agenda for Sustainable Development* and the *Sendai Framework for Disaster Risk Reduction 2015-2030*, and enhancing the contribution of space-based Earth observations in support of disaster risk reduction. CEOS representatives will work closely with key stakeholders (e.g. GEO, UN agencies, donor institutions like the Asian Development Bank, World Bank Global Fund for Disaster Risk Reduction, scientific community, national resource management agencies, civil protection agencies, local decision makers and others) to foster the use of satellite EO data. The disaster-related activities described below serve that goal.

#### I. **Strengthen support to the disaster management community through the sustained coordination of disaster-related activities undertaken by CEOS Agencies.**

**2017: Thematic Pilots:** CEOS Agencies, through the Working Group on Disasters (WGDisasters), will continue to respond to the three Disaster Risk Management (DRM) pilots defined in the 2013 *CEOS Disaster Risk Management Observation Strategy*: floods, seismic hazards, and volcanoes. WGDisasters will also continue to implement a fourth pilot, on Landslides, as endorsed at the 29<sup>th</sup> CEOS Plenary Meeting.

Specific Earth Observation (EO) requirements have been identified for each pilot, in close cooperation with representatives from the user communities (stakeholders, scientists, civil protection organizations, local authorities, resources management national authorities, etc.). Through WGDisasters, CEOS Agencies will provide data for other entities to develop new end products and services to better deliver flood-related information (floods), map active faults at global scale (seismic hazards), operationally monitor potentially active volcanoes (volcanoes), and detect, map and monitor landslides in different physiographic and climatic regions (landslides).

WGDisasters will also finalize reports describing follow-on actions recommended once the initial term of the thematic pilots concludes in 2017 for consideration by Plenary. The multi-hazard landslide pilot will have only begun in 2016 and will have only preliminary follow-on actions recommended in the report.

Both the seismic hazard and volcanoes pilots also have regional and local objectives that are directly related to the ongoing Geohazard Supersites and Natural Laboratories GEO initiative (see 3.4, section III).

**Recovery Observatory:** The CEOS Recovery Observatory was triggered on 22nd December 2016 covering the area devastated by Hurricane Matthew in Southwest Haiti. CEOS Agencies engaged in the project team and their partners will implement the Recovery Observatory as a one-time demonstration over a three to four-year period. The main objective of the Recovery Observatory is to work with reconstruction professionals to develop the use of Earth Observation in the reconstruction phase after a major disaster. This will involve: working closely with the reconstruction community consisting of both local and international stakeholders to determine where EO data can make a difference; making data available; and developing required information products.

An information system infrastructure that will support the Recovery Observatory has been implemented through a joint WGISS and WGDisasters activity. Following triggering, the project team was constituted, composed of local and international stakeholders and space agencies lead by Global Facility for Disaster Reduction and Recovery (GFDRR) and CNES.

**2018-2019:** CEOS will implement the follow-on actions agreed in relation to the Pilots at the 31<sup>st</sup> CEOS Plenary Meeting.

**II. Support implementation of a coordinated approach, convened through the Group on Earth Observations, to implementation of priority recommendations in the Sendai Framework for Disaster Risk Reduction 2015-2030 (GEO-DARMA)**

GEO-DARMA, a CEOS-led and supported initiative in the frame of the intergovernmental Group on Earth Observations (GEO), aims to address priorities of the *Sendai Framework for Disaster Risk Reduction 2015-2030* using Earth observations (EO).

GEO-DARMA (Data Access for Risk Management) will facilitate the sustained provision of accurate EO-based risk information products and services to national and local decision-makers in political and socio-economic sectors, to implement disaster risk reduction and resilience measures, during all disaster risk management phases, whenever those products and services require satellite EO combined with other sources of data (in-situ ground observations, socio-economic, model outputs).

The broad goal is to define and implement end-to-end solutions that respond to the real needs of the user community. Space EO technology presents new opportunities in this area of work; the challenge is matching such capabilities to those end users most in need. The goal is to establish an inclusive, comprehensive process to address local disaster risk reduction requirements by using EO technologies efficiently. Long-term outcomes of GEO-DARMA are to foster the use of EO data and EO-based risk information by end-users (e.g. civil protection agencies and other agencies and ministries at the national level) and to increase awareness within donor agencies of the value of space solutions.

**2017:** A Concept Phase will focus on the identification of regional priorities. This phase will select the regions to start with and the regional Institutions (ideally 2 or 3 per region) with whom to partner. The role of space agencies will be to assess those regional priorities at high level to see whether satellite EO could contribute, and define a series of projects that could realistically address the priorities within the frame of available resources and for which external stakeholders are willing to contribute. The WGDisasters Data Coordination Team will play a key role in identifying the satellite resources that could be made available without affecting the on-going activities of WGDisasters. A GEO-DARMA Kick-off workshop is scheduled for March 2017 to review possible paths forward for the project, and a Concept Workshop planned during the May 2017 Global Platform Meeting will finalize the content of the first GEO-DARMA projects.

**2018-2019:** A Prototyping ('pilot') Phase will be implemented based on the results of the Concept phase. The Pilot projects to be implemented will depend on the regional priorities identified. To ensure alignment with CEOS Agency capacity, detailed proposals will be developed for each potential Pilot project, with each proposal identifying the CEOS and

external resources necessary for the implementation. The proposals will be presented to CEOS Plenary and/or SIT as appropriate for endorsement in order to secure approval to proceed to implementation.

**III. Continue support to the GEO Geohazard Supersites and Natural Laboratories Initiative.**

**2017:** The GEO Geohazards Supersites and Natural Laboratories (GSNL) Initiative aims to improve our knowledge of geophysical processes posing geohazards, with an initial focus on earthquakes and volcanoes. The effort is led by a global partnership of scientists and satellite (SAR and optical) and in situ (seismic, geologic, geodetic, etc.) data providers, and is compiling comprehensive data sets for selected sites affected by high hazard levels. The much improved data availability, the openly shared research products, and the local coordination by scientific institutions directly involved in DRR activities all ensure that the new scientific results obtained by the global scientific community are rapidly taken up by the risk management community, effectively satisfying the CEOS and GEO objectives for improved societal benefit of Earth observation.

CEOS has officially endorsed Hawaii, Iceland, Turkey (Marmara Sea/North Anatolian Fault Zone), Italy (Mt. Etna Volcano and Mt. Vesuvius/Campi Flegreii), New Zealand, Central Greece (Gulf of Corinth) and Ecuador (Cotopaxi, Tungurahua volcanoes) to receive coordinated space-based EO data acquisitions. A key priority for 2017 will be ensuring the data needs for these permanent supersites are met. The WGDisasters Data Coordination Team will continue to assess incoming requests from the scientific community to increase the number of both permanent and event Supersites and, in case of positive assessment, will provide the related satellite data to the Supersites scientific teams.

WGDisasters will continue to convene discussions between CEOS Agencies on the potential to support a Natural Laboratory in South-East Asia. Support to the proposed San Andreas Fault (USA) Natural Laboratory will be reviewed.

The WGDisasters will continue to operate and develop the Data Coordination Team, which supports other activities, including the GSNL, by providing a single point of contact through which to request and access data from space agencies.

**2018-2019:** In complement to—or as part of—the current CEOS DRM Pilots related to the GSNL initiative, CEOS Agencies will also regularly monitor the use of space data by the scientific community involved in GSNL and will assess the potential extension of the number of sites supported by CEOS Agencies. Event Supersites, which are agreed and supported for a limited time immediately following a major disaster, will be considered and supported as approved during this time frame.

Observations for Disasters Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>DIS-10:</b> Implementation of Data Acquisition Plan in support to DRM pilots and data coordination for GNSL supersites	Q4 2019	<p>Potential proposals for new GSNL activities (i.e. new permanent &amp; event Supersites) aiming at expanding the objectives of the current pilots will be assessed by the Data Coordination Team and the various pilot teams in due time. The assessment will be done following the procedures endorsed by CEOS.</p> <p>The status of implementation of the plan, and of the pilots and supersites being supported, will be reported at CEOS SIT and Plenary meetings.</p>	WGDisasters
<b>DIS-12:</b> Report on survey of donors for post-2017 operation of a Recovery Observatory	Q2 2018	<p>WGDisasters will develop a survey of initial results of the Recovery Observatory from the perspective of institutional donors, and include outlooks on possible inclusion of additional hazards and the sustainability of Recovery Observatory activities for 2017 onwards. The survey will commence nine months after the triggering of the Recovery Observatory.</p> <p>The findings of this survey will be presented in a lessons learned report to SIT in 2018 to enable timely consideration by CEOS Agencies.</p>	WGDisasters
<b>DIS-13:</b> Report on follow-on actions to DRM Pilots	Q4 2017	<p>The DRM Pilots are expected to provide important insights into where, and how, Earth observations from space can support the disaster risk reduction community. A report will be prepared to summarize the learnings from these pilots, and to recommend pathways forward. In particular the report will focus on the elements necessary to the sustainability of operational solutions post 2017.</p>	WGDisasters
<b>DIS-15:</b> Support for GEO-DARMA identification of major hazards and DRR issues for each selected region	Q2 2018	<p>GEO-DARMA will seek independent identification of disaster risk management priorities at regional level (e.g. most prevalent hazards and most severe impact; hurdles in implementing effective DRR and resilience measures in the region) by authoritative regional institutions, in line with the priorities from the <i>Sendai Framework for Disaster Risk Reduction 2015-2030</i>.</p> <p>This task will require the active support of major stakeholders in the field of disaster risk management at global, regional and national levels in order to implement a series of pilot projects.</p>	WGDisasters

### 3.5 Observations for Water

#### I. Implement the CEOS Strategy for Water Observations from Space

**2017-2019:** Planning and coordination of space agency support to global initiatives for monitoring of water resources will be a focus for CEOS over coming years.

At the 29<sup>th</sup> CEOS Plenary Meeting, CEOS adopted the *CEOS Strategy for Water Observations from Space*. This strategy describes what CEOS will do in support of water observations generally, and GEO-identified water observation requirements specifically.

At the end of 2015, GEO entered its second decade under a new Strategic Plan with new organizational arrangements. In 2016, GEO endorsed a new Work Programme which highlights that water-related activities within GEO are evolving rapidly, potentially creating a need for CEOS to clarify the ‘reference point’ for its water-focused actions over coming years. Noting this, CEOS will:

- Continue to implement the *CEOS Strategy for Water Observations from Space*, through activities of existing CEOS Entities;  
Monitor developments within GEO to determine the most appropriate reference points for water observation requirements, and CEOS responses, in the future.

Observations for Water Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>WAT-3:</b> Feasibility study on satellite missions/instruments focused on water quality measurements	Q2 2017	This study will assess the benefits and technological difficulties of designing a hyperspectral satellite mission focused on inland, estuarine, deltaic and near coastal waters. It will also examine the potential of establishing threshold and baseline observation requirements for sensors suitable for water quality applications.	CSIRO and DLR
<b>WAT-4:</b> Updates on implementation of the CEOS Strategy for Water Observations from Space, including consideration of required adjustments based on activity in GEO	Ongoing	CEOS, through the SIT Chair, will continue to monitor progress on GEO water-related activities.  The SIT Chair will also engage with GEO to determine when, and if, the strategy should be revisited. Regular updates will be provided at SIT meetings.	SIT Chair
<b>WAT-6:</b> Response to satellite-related aspects of the GEO AquaWatch Initiative Implementation Plan	Q4 2017	CEOS support for the implementation of the GEO AquaWatch (monitoring and forecasting of water quality of inland and coastal waters) community activity is crucial, as satellite observations are an integral component. AquaWatch will be submitted as a formal GEO Initiative in 2017.	NOAA and CSIRO (with OCR-VC)

### 3.6 Future Data Architectures

In 2016, CEOS completed an interim report that highlighted the significant opportunities presented by new and emerging approaches to exploitation of satellite data: the so-called “future data architectures” (FDA).

In 2017, CEOS will engage with this theme in more detail across a number of threads, with the objective of an in-depth discussion at the 31<sup>st</sup> CEOS Plenary Meeting to develop an agreed forward strategy for CEOS to capitalize on these opportunities.

CEOS will also start to embed follow-on activity, primarily aimed at supporting Agencies to share lessons learned and discuss best practices in these areas, into existing structures.

Coordination across activities will be managed by the CEOS Chair (USGS), with responsibility for specific activities being identified in the following table.

#### I. **Preparing to discuss the strategic dimensions of ‘FDA’.**

**2017:** Through an extended and more strategically focused Ad Hoc Team on Future Data Architectures, material will be prepared to enable CEOS to discuss how Agencies wish to work together to capitalize on the opportunities presented by future data architectures.

The extended Ad Hoc Team on Future Data Architectures will be co-lead by ESA, USGS and 2016 CEOS Chair CSIRO.

The Ad Hoc Team will work to frame a discussion that enables CEOS Agencies to consider:

- Areas in which CEOS Agencies wish to work together in a close collaboration to, for example, develop integrated CEOS-branded tools for users, or coordinate implementation of common protocols.
- Topics on which CEOS Agencies wish to focus on information sharing and exchange of best practices, with implementation taken forward at an agency or bi-lateral partnership level.
- What opportunities are seen a matter for CEOS Agencies to progress independently, for example because they will not benefit from coordination.

#### II. **Learning by doing - through pilot projects.**

**2017:** Pilot projects will be undertaken to ensure the discussions on the strategic dimensions of FDA are informed by practical evidence, including evidence of how practical it is for CEOS Agencies to work together on technical activities in this area.

The criteria for FDA pilot projects are:

- Clear governance and resourcing.
- User feedback and engagement are incorporated.
- Lessons learned will be relevant to FDA themes, and inform strategic discussions.

- Multiple agencies are engaged, e.g. through:
  - The data that is being used; and/or
  - Contributions to development; and/or
  - Engagement in implementation.

At the time of endorsement of the *CEOS Work Plan 2017-2019*, the CEOS Data Cube activity and the Geohazards Exploitation Platform were accepted as the first FDA pilot projects.

The open source CEOS Data Cube approach, leveraging Analysis-Ready Data, lowers technical barriers to the utilization of satellite data for developed and developing nations in support of many application areas.

The CEOS Data Cube activity will be supported by LSI-VC, in collaboration with WGCV, providing sample Analysis-Ready Data to support trial implementations of the CEOS Data Cube technology.

Additional activities may be proposed as pilot projects under the Future Data Architectures theme at any time, subject to them meeting the above criteria, and according to suitable CEOS governance and process requirements.

**III. Supporting CEOS Agencies to benefit from future data architectures.**

**2017-2019:** Existing CEOS Entities will take forward streams of technical work to enable CEOS Agencies to share learnings and support each other to benefit from the opportunities future data architectures within their own internal activities.

Future Data Architectures Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
Preparing to discuss the strategic dimensions of 'FDA'.			

Future Data Architectures Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>FDA-1:</b> Papers and workshops to facilitate strategic discussion of the way forward on future data architectures	Q4 2017  (updates at SIT-32 and SIT Tech Workshop 2017)	In 2017, the extended Ad Hoc Team on Future Data Architectures will develop the necessary material to enable CEOS Agencies to discuss, and agree on, the way forward on the FDA topic at the 31 <sup>st</sup> CEOS Plenary Meeting.  Interim discussions/workshops will be undertaken at the SIT-32 meeting and 2017 SIT Technical Workshop to ensure CEOS Agencies are engaged throughout 2017.	FDA AHT
<b>Learning by doing - through pilot projects</b>			
<b>FDA-2:</b> Collaborative development of CEOS Data Cube technology	Ongoing	CEOS Agencies will develop the CEOS Data Cube as a piece of re-usable and customizable open source technology that lowers the barriers to use of satellite Earth observation data. Activity will be undertaken in accordance with the CEOS Data Cube Work Plan.	SEO (with GA, CSIRO and USGS)
<b>FDA-3:</b> CEOS Data Cube technology governance strategy	Q2 2017	A governance strategy will be developed aimed at supporting the CEOS Data Cube to become an inclusive, collaborative, open source project including encouraging contributions from additional CEOS Agencies (e.g. to include data from their missions) and inviting contributions from the broader EO community (e.g. to contribute tools and applications) via GEO.	SEO (with GA, CSIRO, USGS and ESA)
<b>FDA-4:</b> Regional pilot installations of the CEOS Data Cube technology	Q4 2017 (Interim reports)	Regional pilots will generate lessons learnt on how the CEOS Data Cube technology performs in particular contexts (for example High Performance Computing vs cloud, sophisticated vs new users). Where possible, regional pilots will provide evidence of potential value towards GEO strategic priorities (e.g. GEO Flagships/Initiatives).  Pilot installations will include: a pilot in Colombia focused on uptake of GFOI outputs (SEO+CSIRO); a project in Australia focused on the nation's largest food-bowl - the Murray-Darling Basin (GA); a project in Vietnam focused on rice monitoring (CSIRO); a project in the United States (USGS); and a project in Switzerland (SEO).  Through production/provision of datasets in support of the pilots, LSI-VC will gather evidence on the technical challenges associated with the CEOS Analysis Ready Data For Land (CARD4L) initiative. Where possible, capacity development capabilities will be leveraged through WGCapD.	SEO (coord.)  Regional pilot leads (NASA SEO, CSIRO, GA, ...)  Support from LSI-VC and WGCapD

Future Data Architectures Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>FDA-5:</b> Promote awareness of the CEOS Data Cube technology	Q4 2017 (Interim reports)	With growing interest in the CEOS Data Cube technology, WGCapD will identify required CB material to support rollout of the technology. Materials will range from basic introductions to information relevant to decision makers.	WGCapD
<b>Supporting CEOS Agencies to benefit from future data architectures</b>			
<b>FDA-6:</b> Technical best practices relating to future data architectures opportunities	Q4 2017	WGISS will ensure necessary structures are established to enable sharing of lessons learned and practices relating to the exploitation of the technical opportunities identified in the interim FDA report. WGISS will present at least one 'best practice' document for endorsement at the 31 <sup>st</sup> CEOS Plenary Meeting.	WGISS
<b>FDA-7:</b> Product Specifications in accordance with the CARD4L Framework	Q4 2017	CEOS Analysis Ready Data for Land (CARD4L) will be satellite data that have been processed to a minimum set of requirements and organized into a form that allows immediate analysis with a minimum of additional user effort, and interoperability both through time and with other datasets.  LSI-VC will commence development of the first concrete specifications for CARD4L-branded products, with at least two such specification documents presented for endorsement at the 31 <sup>st</sup> CEOS Plenary Meeting. Draft versions of these specifications will be used to inform LSI-VC contributions to <b>FDA-4</b> .	LSI-VC (with WGCV)

### 3.7 Capacity Building, Data Access, Availability and Quality

#### I. Advance CEOS Data Democracy activities.

Through the Working Group for Capacity Building and Data Democracy (WGCapD), CEOS Agencies raise awareness of the value of EO data products and services to user communities, including support to locate and access data, products, and tools, and targeted training workshops. WGCapD also supports CEOS initiatives and helps WGs and VCs undertake their own capacity building initiatives, by providing guidance on best practices. WGCapD will collaborate with UNOOSA, UNESCAP and other UN agencies in bringing out the benefits of EO tools and services; and helping to collect, coordinate, and synergize capacity building resources.

**2017-2019:** WGCapD has a variety of training and capacity building activities planned, including in-person training workshops, webinars, and efforts to better collect, coordinate, synergize and make available existing capacity-building resources for satellite Earth observation users in developing countries.

Specifically, WGCapD will continue delivering SAR training workshops for users in developing countries on data access, awareness, processing, and applications. Two workshops are currently planned for 2017: one in Gabon (February) and one in South Africa (May). WGCapD also plans to develop and/or deliver advanced, application-focused webinars on various other topics.

Recognizing a global need for the collection and coordination of disparate capacity building resources to synergize training resources and increase user awareness of and access to those resources, WGCapD plans to explore methods and tools that (and resources required to) address that need in the most manageable and sustainable way.

In support of broader capacity building and training activities led/organized by the other CEOS Working Groups and Virtual Constellations, WGCapD will draw upon its collective training and capacity building experiences to develop a best practices checklist for both in-person and online training programs that they can use for guidance.

Further, WGCapD plans to collaborate with GEO to strengthen AmeriGEOSS, AfriGEOSS, and Asia-Oceania GEOSS (AO GEOSS) by continuing its contributions to training topics for AmeriGEOSS Week, similar to the Remote Sensing (Optical and Radar) for Disaster Response training offered in 2016, and the SAR trainings that contribute to AfriGEOSS objectives. Potential training contributions to AO GEOSS will be explored.

**II. Continue to support the development and operationalization of the GEOSS Common Infrastructure (GCI) and its CEOS-related elements.**

**2017:** Through the Working Group on Information Systems and Services (WGISS), CEOS Agencies will foster the implementation and enhancement of the GCI through continued development and coordination of tools that improve discovery, interoperability, and access to satellite data. Such tools include the CEOS WGISS Integrated Catalogue (CWIC), the International Directory Network (IDN) and the Federated Earth Observation (FedEO) gateway system.

WGISS will also support adoption of supported WGISS standards (e.g. OGC CSW 2.0.2 and CEOS OpenSearch Best Practices) with the aim of connecting as many CEOS Agencies as possible into the federated system. WGISS will also work with the SEO to explore opportunities to integrate systems such as the CEOS Visualization Environment (COVE) and the EO Handbook Database to streamline data management processes and improve consistency.

In addition, WGISS will continue its core activity of promoting and exchanging technical information and lessons-learned experience about current and trending data system technologies/services impacting CEOS Agencies, with the aim of preparing CEOS and CEOS Agencies for the future.

**2018-2019:** WGISS will support data access for the CEOS Virtual Constellations, Working Groups, and GCI through the use of the supported WGISS standards (e.g. OGC CSW 2.0.2 and *CEOS OpenSearch Best Practices*), which will make CWIC and FedEO accessible from external clients such as the GCI. WGISS will also ensure that the IDN will be used as a dataset registration system for CEOS Agencies.

**III. Coordinate the development of suitable methodologies for the on-ground characterization of satellite-based EO sensors, the on-orbit calibration of EO missions, and the validation of satellite-based Level 1 and Level 2 products.**

**2017-2019:** The Working Group on Calibration and Validation (WGCV) continue to evaluate and recommend best practices for the characterization/calibration of satellite-based sensors and the validation of satellite-based Earth observation data products. The results of this work are the building blocks for data and tools needed by the VCs and other WGs in terms of calibration and validation. For these broad applications, different tasks are focused in several sub-groups dealing with specific areas of interest. Three sub-groups serve, in particular, the calibration of sensors and their link to international acknowledged standards. Another three sub-groups are related to topical subjects concerning validation of data products.

WGCV will maintain the CEOS Cal/Val portal, including the activities of its sub-groups, to provide users with information about achievements in calibration and validation, including the Cal/Val supersites, and to share results from recent efforts that impact interoperability.

**IV. Continue cooperation with GEO, Global Space-based Inter-calibration System (GSICS), and WMO and ground-based networks in the provision of high quality EO data products.**

**2017:** WGCV will strengthen its cooperation with GSICS in the topic of sensor calibration by continuing to identify opportunities for cooperation. The working-level framework established between the two to address corrections for sensor differences and traceability will be used to coordinate activities to address interoperability.

**2018-2019:** WGCV will continue working with the GEO Secretariat, including work to support relevant GEO activities, mainly by extending leadership in Quality Assurance for Earth Observations (QA4EO) to encourage widespread adoption of QA4EO Principles within current and future CEOS activities. WGCV will address the needs of science users and data product providers, by considering the needs of the Atmosphere, Terrestrial, and Ocean communities. The development of calibration infrastructure and comparison campaigns within the frame of WGCV will be used to promote the adoption of QA4EO Principles and best practices. WGCV will continue to foster cooperation with WMO, ground-based networks, and CEOS WGs and VCs through dedicated presence during WGCV meetings.

**V. Maintain the Missions, Instruments and Measurements (MIM) database as a key tool to enhance understanding of Earth observations from space missions and data.**

**2017-2019:** The CEOS Database (a.k.a., the Missions, Instruments and Measurements Database, or MIM) is the only official consolidated statement of CEOS Agency programs and plans. Each year, the database will be updated based on survey inputs provided by all CEOS Agencies to reflect the current status of CEOS Agency missions and instruments. The European Space Agency (ESA) and the SEO have developed a number of analysis and visualization tools to apply this information in support of gap assessments, and the database is used by the SEO as the basis for missions, instruments and measurements references in the ECV Inventory.

Together, these resources represent the cornerstone of CEOS’ capability to undertake informed coordination decisions. CEOS will continue development of these resources each year, with a particular focus on engaging them for ECV development and observational gap analyses. New enhancements for advanced search capabilities will be added, as well as links to other CEOS resources (e.g. COVE, CWIC, IDN) or to external information systems, such as WMO’s Observing Systems Capability Analysis and Review Tool (OSCAR) and the Global Change Information System (GCIS, <http://data.globalchange.gov/lexicon/ceos>).

In 2017, the ESA CEOS Database team will continue work on the development and promotion of new tools for, and in collaboration and coordination with, the community to discover and browse the information contained in the MIM, including content on GCOS, carbon, water, and other CEOS thematic activities.

<b>Capacity Building, Data Access, Availability and Quality Objectives/Deliverables: 2017-2019</b>			
<b>Objective/Deliverable</b>	<b>Projected Completion Date</b>	<b>Background Information</b>	<b>Responsible CEOS Entity</b>
<b>CB-4:</b> Contribute to Capacity Building Portal (GEOCaB Portal)	Ongoing	Populate the GEO Capacity Building Portal. This portal aims at increasing the awareness of the Capacity Building Inventory across CEOS and GEO. See GEONetCab site at <a href="http://www.geocab.org/">http://www.geocab.org/</a> .	WGCapD
<b>CB-10:</b> CEOS Database update survey and release of online version	Survey Q2, release Q4	CEOS Agencies provide resources to support their responses to the update survey issued in the April-May timeframe; release of the updated CEOS Database will be online prior to the annual CEOS Plenary Meeting.	ESA, with support from CEOS Agencies
<b>CB-11:</b> Build awareness and demonstrate the value of EO applications through major conferences	Ongoing	WGCapD members will target major Earth observation and other relevant conferences and workshops, engaging and providing training sessions for academic and other user communities.  For example, WGCapD will actively participate in the Public Health and EO Workshop to be held in Montreal in June 2017. This will help clarify the linkage between environment, climate, society and public health and EO data.	WGCapD
<b>CB-12:</b> Build awareness of new CEOS missions and datasets	Ongoing	Within the context of support to CEOS/GEO projects, using webinars, the CEOS Website, newsletters, mailing list server, social media, etc. to improve access to new CEOS Agency missions and datasets.	WGCapD
<b>CB-13:</b> Develop and/or deliver webinars for users in developing countries	Ongoing	Webinars will provide information and training on advanced satellite Earth observation topics, such as data access/availability, data processing, and more. A SAR webinar is planned for Q3/Q4 2017.	WGCapD

Capacity Building, Data Access, Availability and Quality Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>CB-15:</b> Updated good practices guidance document for in-person and online training and capacity building	Q2 2017	The WGCapD developed a good practices guidance document highlighting key points, areas of consideration, suggestions, and good practices for online and in-person capacity building meant as a resource for other CEOS Working Groups and Virtual Constellations. The WGCapD plans to add more content to this report.	WGCapD
<b>CB-17:</b> SAR Training Workshops	Q2 2017	The WGCapD will deliver two SAR Training Workshops in 2017: one in Gabon (February, 2017) and one in Pretoria (May, 2017). The WGCapD plans to continue providing SAR workshops (on data access, awareness, processing, and applications) to users in developing countries as long as CEOS Agencies continue to release more SAR data.	WGCapD
<b>CB-19:</b> Promote the role of space-based EO in meeting the challenges of the <i>2030 Agenda for Sustainable Development</i>	Ongoing	WGCapD is participating in the CEOS SDG Ad Hoc Team which will support GEO in promoting use of EO to track progress towards, and achieve, the Global Sustainable Development Goals (SDGs).	WGCapD
<b>CB-20</b> Provide CB support to regional and thematic GEO initiatives	Ongoing	Includes ongoing support to AfriGEOSS, additional support to AmeriGEOSS and engagement with Asia-Oceania (AO) GEOSS initiative. This would also include other GEO initiatives e.g. with WMO, CGMS, and WGClimat on essential climate variables (ECVs) and with the CEOS Ad Hoc Working Group on GEOGLAM.	WGCapD
<b>CB-21:</b> Explore future options for providing portal-based access to capacity building and training resources	Q4 2017	Conduct a study of existing and potential new approaches to collect, coordinate, and synergize available capacity building and training resources related to satellite Earth observations, e.g. GEOCAB, VLab training calendar and methods, and other alternate approaches.	WGCapD
<b>CB-22:</b> Provide capacity building support to WGCV activities	Q2 2018	Collaborate with WGCV to develop materials to promote e.g. QA4EO, LandNet, optical and SAR calibration/validation. The 2017 meeting of the WGCapD will be a key event in defining specific priorities.	WGCapD with WGCV
<b>DATA-2:</b> Full representation of CEOS Agency datasets in the IDN and accessible via supported WGISS standards	Ongoing	As the IDN contains OpenSearch endpoints for data access and is also the link with GCI, it is essential that all CEOS Agencies keep information on the data up-to-date in the IDN.	WGISS

<b>Capacity Building, Data Access, Availability and Quality Objectives/Deliverables: 2017-2019</b>			
<b>Objective/Deliverable</b>	<b>Projected Completion Date</b>	<b>Background Information</b>	<b>Responsible CEOS Entity</b>
<b>DATA-8:</b> Improve WGISS Interoperability Standards Architecture	Q3 2017	Consolidation of current CWIC/FedEO/IDN overall architecture to address identified issues including duplicate datasets holdings	WGISS
<b>DATA-9:</b> ECVs/CDRs Discovery and Access through WGISS Systems	Q3 2017	Facilitate discoverability and accessibility of ECV Products and space-born CDRs relevant for the CEOS Carbon Action via WGISS Interoperability Systems & Standards (FedEO/CWIC/IDN, OpenSearch).	WGISS
<b>DATA-10:</b> Reference model for data stewardship planning and implementation	Q4 2017	Consolidate a reference model that provides guidelines and recommendations for the preservation and improvement of data including a roadmap for scientific data stewardship improvement;	WGISS
<b>DATA-11:</b> Technology Exploration webinars and workshops	Ongoing	WGISS will host at least one workshop annually to serve as a forum for exchange of technical information and lessons-learned experience about current, trending and future software technologies, services and other Internet-related software technologies.	WGISS
<b>DATA-12:</b> CEOS data holdings reported in GEO	Ongoing	Provide support to GEO in their efforts of reconciling metrics of CEOS data holdings provided through WGISS interoperable standards and systems.	WGISS
<b>CV-1:</b> Update of general WGCV website to enhance better communication across CEOS and users	Q3 2017	Re-organization of WGCV website concept which includes on one side the entry to the CEOS portal, the CEOS CalVal portal, and the different subgroup web-sites in order to achieve a better outreach and communication strategy.	WGCV
<b>CV-3:</b> Workshop on state of the art for pre-flight calibration techniques	Q4 2017	Hold an open-invitation workshop to discuss and promote best practices on pre-flight and onboard calibration of sensors, initially focusing on optical.	WGCV
<b>CV-9:</b> Radiometric Calibration Network (RADCALNET)	Q4 2017	Establish an automated network via a multi-agency project, including coordination infrastructure, and land-based test-sites for post-launch traceable calibration of sensor radiometric gain, initially for <50 m resolution sensors. Progress will follow the developed project plan.	WGCV
<b>CV-13:</b> Intercomparison of atmospheric correction models	Q4 2018	The WGCV task team “Atmospheric Correction” will carry out several comparison measures between models and report about their findings including recommendations with respect to EO applications.	WGCV

Capacity Building, Data Access, Availability and Quality Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>CV-14:</b> Report on application of approaches for cloud masking	Q4 2018	The WGCV task team “Cloud Masking” will research different cloud masking approaches for different sensors and spectral areas in order to deliver a report about their findings including recommendations for the applications of cloud masking in EO applications.	WGCV
<b>CV-15:</b> L1 top-of-atmosphere interoperability	Q4 2017	Develop an initial recommendation of a community reference in collaboration with GSICS.	WGCV
<b>CV-16:</b> Report on outcomes from GSICS/CEOS reference Solar Spectrum evaluation	Q2 2018	Cooperation through a series of virtual meetings to evaluate recent advances to recommend a solar spectra for GSICS and CEOS to ensure interoperability.	WGCV

### 3.8 Advancement of the CEOS Virtual Constellations

- I. **Characterize the Virtual Constellations in the context of both the development of the space segment for GEOSS and of the multitude of outcomes and deliverables that CEOS seeks to provide for GEO and other users and frameworks.**

**2017-2019:** Ensure that the Virtual Constellations (VCs) — Atmospheric Composition (AC-VC), Land Surface Imaging (LSI-VC), Ocean Colour Radiometry (OCR-VC), Ocean Surface Topography (OST-VC), Ocean Surface Vector Wind (OSVW-VC), Precipitation (P-VC), Sea Surface Temperature (SST-VC) — are accomplishing the outcomes and deliverables associated with the activities documented in the *CEOS Virtual Constellations Process Paper* and their respective terms of reference and implementation plans.

Advancement of the CEOS Virtual Constellations: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>VC-2:</b> Total ozone dataset validation and harmonization	Q4 2017	Production of peer-reviewed papers on nadir profile intercomparisons and of long term (1979-now) combined total ozone data sets.	AC-VC
<b>VC-3:</b> Air quality constellation coordination	Q2 2017	Prepare document on validation needs for the AQ Constellation.	AC-VC

Advancement of the CEOS Virtual Constellations: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>VC-9:</b> Implementation of the International Network for Sensor InTercomparison and Uncertainty Assessment for Ocean Colour Radiometry (INSITU-OCR)	Ongoing	Implementation of the International Network for Sensor InTercomparison and Uncertainty Assessment for Ocean Colour Radiometry (INSITU-OCR), including recommendations of the INSITU-OCR White Paper ( <a href="http://www.ioccg.org/groups/INSITU-OCR_White-Paper.pdf">www.ioccg.org/groups/INSITU-OCR_White-Paper.pdf</a> ) and establishment of the INSITU-OCR Secretariat (EUMETSAT, NASA and NOAA). Implementation is following a modular approach.	OCR-VC (with EUMETSAT, NASA and NOAA)
<b>VC-14:</b> Vision for an OSVW Constellation	Q4 2017	White Paper describing and justifying the oceanography and climate requirements for an OSVW constellation.  The International Ocean Vector Winds Science Team (IOVWST) meeting held in 2016 strongly recommended: at least three scatterometers in orbits designed to roughly meet the WMO requirements; and one instrument in a non-sun-synchronous orbit to help with the diurnal cycle, better sampling at mid-latitudes, and to improve inter-calibration. It has been proposed that a User Requirements Document be developed. An interim report will be presented to CEOS at SIT-31, and a more in-depth analysis will be prepared for the next IOVWST meeting to be held in Q2 2017.	OSVW-VC
<b>VC-15:</b> OSVW Standards and Metrics	Q4 2018	Standards and metrics for OSVW services and products, including standard Cal/Val methods. Cal/Val methods will be addressed by the IOVWST Climate Working Group.	OSVW-VC
<b>VC-17:</b> Support to ECV precipitation parameters	Q4 2017	Precipitation ECV support: Provide the CEOS Response to GCOS Action A-8; ensure continuity of satellite precipitation products through five deliverables.	P-VC
<b>VC-18:</b> Programs for improvement of global precipitation products	Q4 2017	Precipitation products (with respect to algorithm development, outputs, and user requirements) using multi-satellite and multi-agency data through coordination between Precipitation Virtual Constellation (P-VC) partners.	P-VC

Advancement of the CEOS Virtual Constellations: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>VC-19:</b> Documented plan for the SST Virtual Constellation	Q2 2017	Building on Donlon, et al (2010) <i>Successes and Challenges for the Modern Sea Surface Temperature Observing System</i> , the SST-VC will describe and justify the requirements and design for the modern virtual constellation for SST. This description of an optimal SST constellation will prove useful to CEOS Agencies in planning and implementing a globally coordinated and cost-effective observing capability for SST.	SST-VC
<b>VC-26:</b> Pilot approaches to conducting integrated assessments of gaps/opportunities in asset usage	Q4 2017	The LSI-VC will, building on the work for land carbon, work towards establishing suitable approaches for analyzing multiple sets of domain-specific requirements and identifying gaps/opportunities for optimization.  A joint session of LSI-VC, SDCG for GFOI and the CEOS Ad Hoc Working Group on GEOGLAM will be scheduled for Q3 2017 to progress discussions on this topic.	LSI-VC and SEO with Ad Hoc Teams for GFOI and GEOGLAM
<b>VC-27:</b> Develop a roadmap for the routine production of intercomparable CARD4L	Q4 2018	Building on agreed specifications of CARD4L products, LSI-VC will develop a roadmap for how interested CEOS Agency missions and programs can start processing land surface imaging data with geometrically and radiometrically intercomparable surface reflectance, surface temperature, and analogous radar products.	LSI-VC with WGCV
<b>VC-29:</b> Framework for moderate resolution land sensor interoperability	Q2 2018	Increasing numbers of users are interested in the development of product pipelines that are not completely dependent on the characteristics of a single sensor, when a number of different sensors may be able to provide data that is fit for purpose.  Interoperability, however, is challenging to define in a manner that enables such users to move beyond theory and in to practice.  The framework to be developed will be generally applicable and address factors including radiometry, geometry, data formats, browse information, metadata, data access, metrics and reporting.	LSI-VC (with WGCV and WGISS)
<b>VC-30:</b> Interoperability case study for Landsat and Sentinel-2	Q4 2017	The framework for moderate resolution land sensor interoperability (refer <b>VC-29</b> ) will be applied to the Landsat and Sentinel-2 missions.	LSI-VC (with WGCV)

### 3.9 Support to Other Key Stakeholder Initiatives

#### I. Promote the use of satellite data in the 2030 Agenda for Sustainable Development

**2017:** CEOS Agencies will work, through an Ad-hoc Team on the Sustainable Development Goals (SDGs), to ensure the potential value of space-based EO data in support of the Sustainable Development Goals SDGs is maximized through the various SDG-related actions driven by GEO.

This will include:

- Developing Terms of Reference for the Team and a work plan to be presented at SIT-32.
- Coordinating input from CEOS Agencies to support the CEOS Representative on GEO Programme Board.
- Establishing the Ad Hoc Team as the liaison point between CEOS and the SDG-targeted GEO Initiative “Earth Observations in Service of the 2030 Agenda for Sustainable Development”.
- Supporting CEOS Agencies to share experiences of engagement with stakeholders in relation to the Sustainable Development Goals, including best practices, lessons learned, etc.

**2018-19:** Pending continuation of the Ad Hoc Team, it will continue to:

- Support GEO in its SDG-related initiatives.
- Collect and centralize information from individual CEOS Agency work programmes relevant to SDGs.
- Promote space-based EO data as a key source of data for use by national statistic offices (NSOs) to monitor specific SDG indicators.
- Develop activities – including capacity building - with external stakeholders (GEO, NGOs, UN entities, development banks or financial institutions) to join the efforts in the space world to help monitor and achieve the SDGs.

#### II. Continue CEOS contributions and maintain leadership role in the GEO Blue Planet Initiative.

**2017:** As multi-sensor oceanographic satellite observations continue to be successfully transitioned from research into routine and sustained operations (supporting a diverse suite of research, applications and services) there are significant opportunities to support the components and associated priority actions identified in the GEO Blue Planet Initiative. The Ocean Colour Radiometry, Ocean Surface Topography, Ocean Surface Vector Wind, and Sea Surface Temperature VCs will all play significant roles in the sustainment, continuation and harmonization of essential ocean variables to develop coordinated, multi-

sensor ocean products. Individual VCs will likewise continue to identify their own specific contributions to the various Blue Planet Components.

The proposed *CEOS Ocean Variables Enabling Research and Applications for GEO (COVERAGE)* initiative, as well as other associated data coordination and integration activities that coordinate across the ocean VCs, will offer substantial support to Blue Planet goals. Engagement between such CEOS activities and Blue Planet will be driven by the CEOS Blue Planet Expert through the Blue Planet Steering Committee.

In June 2017, the 3<sup>rd</sup> Blue Planet Symposium is scheduled to be held College Park, Maryland, USA, hosted by NOAA and the University of Maryland. CEOS and CEOS Agencies will have a key role in the planning and execution of the symposium. The symposium presents an opportunity to gather momentum from across the ocean observing community, and more broadly will also continue to enable and facilitate Blue Planet support for the SDGs.

**III. 2018-2019:** CEOS Agencies will continue to develop and distribute experimental and operational data, products, and services, along with the further evolution of the proposed COVERAGE model to facilitate distributed access to collocated, synergistic datasets with fit-for-purpose latency, quality, coverage and content for applied, commercial, and research utilization.

**IV. Further develop CEOS contributions to meet biodiversity observation requirements.**

**2017:** The CEOS Biodiversity activity will continue to work closely with the GEO Biodiversity Observation Network (GEO BON) to foster the development of remotely sensed Essential Biodiversity Variables (EBVs). Over the past year NASA and ESA released competitive calls for proposals to solicit community research on the definition and development of remotely sensed EBVs. These efforts build on existing observational products from CEOS Agencies and selections will take place in 2017. GEO BON reorganized in 2016, and several of the new working groups (particularly Ecosystem Structure and Ecosystem Function) are actively working to define remotely sensed EBVs and identify the requirements.

**2018-2019:** The CEOS Biodiversity activity will continue to work with GEO BON and the broader community. The objective will be to create connectivity among the EBV projects to define common observational remote sensing requirements, work to vet these with the community, and communicate the requirements to space agencies. This is a gradual process that has both a technical as well as a social component.

**V. Continue dialogue on enhanced CEOS-level coordination to support improved research and monitoring of the Earth's Polar Regions.**

**2017:** CEOS Agencies will maintain a dialogue with GEO, CGMS, and the World Meteorological Organization (WMO) on their respective interests and coordination initiatives relating to polar observations. Following a request from IOC at the CGMS Plenary, CEOS considered whether a specific CEOS body such as a Virtual Constellation for polar regions should be constituted, but concluded that the WMO Polar Space Task Group (PSTG) represents a competent body for the coordination of polar space observations. CEOS

Agencies will continue to interact with the PSTG to facilitate acquisition and distribution of fundamental satellite datasets for the development of specific information products for polar research and applications (e.g., cryospheric, atmospheric, etc.).

CEOS Agencies, through their participation in PSTG, will also continue to support the SAR Coordination Working Group acquisition strategy over the polar regions; collaborate with the WMO Global Cryosphere Watch Programme, approved at the WMO congress in 2015; provide support to the Year of Polar Prediction (YOPP) with a specific focus to support the plans for a Drift Experiment (MOSAIC); and continue to nurture the relationship with the GEO Cold Region Initiative and the U.S. White House Arctic Science Initiative as important high-level activities underway in 2017.

**2018-2019:** CEOS Agencies will continue to maintain a dialogue with GEO, CGMS, and the WMO on their respective interests and coordination initiatives relating to polar observations. CEOS, in conjunction with PSTG, will continue to facilitate acquisition and distribution of fundamental satellite datasets for the development of specific information products for polar research and applications (e.g. cryospheric, atmospheric, etc.). CEOS Agencies will support the development of key science products under their own respective science programs. The PSTG, charged with prioritizing requirements, engaging in a dialogue with polar science authorities, and supporting the development of satellite sensor derived products for cryospheric research and applications, will encourage formal submission of science requirements documents from the cryosphere communities (permafrost, sea ice, snow cover, ice sheets, and glaciers). CEOS, in conjunction with PSTG, will develop observation strategies to avoid observational gaps over polar regions.

## **VI. CEOS Ocean Variables Enabling Research and Applications for GEO**

**2017:** COVERAGE (CEOS Ocean Variables Enabling Research and Applications for GEO) is a new CEOS initiative, proposed by NASA and endorsed at the SIT32 meeting in Paris as a three year, collaborative pilot project involving CEOS Agency and international stakeholder participation. It seeks to provide a coherent set of data products from the four Ocean VCs and implement a technology platform providing value-added services for improved, more integrated ocean data access in support of marine GEO initiatives, including MBON and Blue Planet.

The first phase of COVERAGE, spanning 2017, will focus on important preliminary arrangements, including assembly of the execution team and advisory board, and the establishment of the collaborative framework for stakeholder participation (COV-1). This phase will also involve the compilation of use cases and functional requirements for the COVERAGE system based on priority set of community driven applications, derived through a process of ongoing stakeholder engagement (COV-2).

**2018-2019:** A detailed COVERAGE project implementation plan and schedule will be formulated within the first quarter of 2018 (COV-3). Associated technical work will involve development of a system architectural design, which will include specifications of source data streams and interfaces.

The second phase of COVERAGE (1 year duration) will involve technical implementation of a prototype system demonstrating core functionality for a limited range of data types, with an emphasis on collocated, multi-parameter satellite products from the 4 Ocean VCs (COV-4) Ongoing stakeholder engagement and the solicitation feedback will integral to this and subsequent phases of the project.

The third phase of the COVERAGE project will commence within 2019 and is also expected to be 1 year in duration. Technical work will address peer review comment and involve development of the fully featured COVERAGE system, demonstrating functionality for the suite of datasets in support of target GEO applications.

Support to Other Key Stakeholder Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>SDG-1:</b> CEOS engagement with the <i>2030 Agenda for Sustainable Development</i>	Q4 2017	<p>The CEOS Ad Hoc Team on Sustainable Development Goals, established at the 30<sup>th</sup> CEOS Plenary Meeting, will act as a single point of contact between CEOS Agencies and various GEO-led activities relevant to the Sustainable Development Goal (SDG) agenda.</p> <p>This will include efforts by the GEO Programme Board to promote alignment of the GEO Work Programme with the SDGs, as well as efforts to engage statistical agencies, and connect with UN and national processes.</p> <p>The Ad Hoc Team will present a draft Work Plan along with Terms of Reference for discussion at the CEOS SIT-32 meeting in Paris.</p> <p>The Ad Hoc Team will present recommendations on how CEOS engagement with the SDG agenda should be managed beyond 2017, for discussion at the 31<sup>st</sup> CEOS Plenary Meeting.</p>	AHT SDG
<b>BP-1:</b> Development, compilation and distribution of ocean variables into collocated, synergistic datasets and associated work packages supporting Blue Planet services	Q3 2018	Leveraging suitable activities, such as the proposed COVERAGE initiative, there will be coordinated development, compilation and distribution of ocean variables and facilitated access to collocated, synergistic datasets with fit-for-purpose latency, quality, coverage and information content. The four ocean VCs (in coordination with Blue Planet Steering Committee) will support the sustainment, continuation, and harmonization of (essential) physical, biological and biogeochemical ocean variables.	CEOS Blue Planet Expert (NOAA) with NASA and Ocean VCs

Support to Other Key Stakeholder Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>BP-2:</b> Support the 3 <sup>rd</sup> Blue Planet Symposium	Q2 2017	CEOS will support and coordinate activities for the 3 <sup>rd</sup> Blue Planet Symposium, which comes at an important time in the early stages of the second decade of GEO.	CEOS Blue Planet Expert (NOAA) with NOAA and CSIRO
<b>BP-3:</b> Paper on CEOS involvement in Blue Planet governance structures	Q2 2017	A brief position paper will be delivered for SIT-32 to help coordinate and decide upon appropriate long-term CEOS representation in Blue Planet governance structures (Advisory Board et al.)	CEOS Blue Planet Expert (NOAA)
<b>BP-4:</b> CEOS Action Plan for GEO Blue Planet Initiative Components Implementation Plan	Q4 2017	Building upon the GEO Blue Planet Initiative Implementation Plan (September 2016) and the 3 <sup>rd</sup> Blue Planet Symposium (June 2017), coordinate efforts across the CEOS Ocean VCs and develop action plan for CEOS contributions to Blue Planet activities.	CEOS Blue Planet Expert (NOAA) (with Ocean VCs)
<b>BON-4:</b> Increase the visibility of remote sensing for biodiversity related applications	Ongoing	In September 2016, CEOS and GEO BON biodiversity experts held a knowledge café discussion at the IUCN World Conservation Congress that had over 10,000 attendees. The café presented the concept of EBVs to the conservation community and solicited feedback, with the final summary to be released in early 2017. There was an EBV session at the ESA Living Planet Symposium in May 2016, and a session will be organized at ISRSE in 2017. The Wiley journal <i>“Remote Sensing in Ecology and Conservation”</i> has a special issue on remotely sensed EBVs and includes a perspective from space agencies. The group will continue to initiate and participate in symposia to maintain a community base for biodiversity and conservation remote sensing, focusing on EBVs and exploring links to other CEOS activities.	CEOS Biodiversity Experts (DLR and NASA)
<b>BON-5:</b> Develop improved descriptions of candidate remotely sensed EBVs and their sub-variables	Q4 2017	EBVs—both those for which remote sensing can play a role and those for which it cannot—are still under development. The GEO BON Ecosystem Structure and Ecosystem Function working groups in particular are focused largely on development of the remote sensing EBVs and they will make recommendations to the broader biodiversity community.	CEOS Biodiversity Experts (DLR and NASA)
<b>POL-1:</b> Annual status report	Q4 2017	Facilitate communication between PSTG and CEOS through provision of an annual status report on polar activities and develop a formal collaboration approach with PSTG.	CEOS Polar Expert (CSA)

Support to Other Key Stakeholder Objectives/Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>COV-1:</b> Collaborative framework for COVERAGE	Q3 2017	Establish collaborative framework describing how CEOS Agencies, CEOS Entities and stakeholder groups intend to (VCs, GEO-MBON, GEO-Blue Planet) participate in COVERAGE	COVERAGE Lead (NASA)
<b>COV-2:</b> COVERAGE use cases & focal pilot application	Q4 2017	Determine priority application for COVERAGE via stakeholders engagement and compile use cases/requirements	COVERAGE Lead (NASA)
<b>COV-3:</b> COVERAGE Project Implementation Plan	Q1 2018	Develop detailed project implementation plan and schedule	COVERAGE Lead (NASA)
<b>COV-4:</b> COVERAGE Phase I prototype system	Q1 2019	Development of prototype COVERAGE system demonstrating core functionality for limited datasets	COVERAGE Lead (NASA)

### 3.10 Outreach to Key Stakeholders

- I. **Engage, attend, be strategically involved (where appropriate), report on CEOS achievements, and present at key meetings.**

**2017-2019:** CEOS desires to increase and improve the connections between CEOS and its stakeholders during deliverable development. CEOS leadership and the national delegations of CEOS Agencies will expand links with stakeholders to inform ministers of CEOS Earth observation products and coordination efforts and to enlist appropriate G20/G8 support for enhanced Earth observation coordination. CEOS should highlight CEOS achievements in global change monitoring and the significance of long-term satellite observation capabilities in statements at key high-level meetings.

Key 2017 meetings will be identified as they are announced, and the CEOS SEC will develop strategic plans to ensure CEOS is positioned to participate as appropriate.

- II. **Maintain the CEOS Website and enhance currency and relevance of content**

**2017-2019:** CEOS released a new website, with a modern user interface and updated appearance, in 2014. CEOS, with coordination through the SEO, will build on the “content management” approach underpinning this new website to promote more up-to-date and relevant information for users. For example, the website will be proactively used to promote CEOS Agency launches.

- III. **Publish the CEOS Newsletter.**

**2017-2019:** CEOS, through contributions of JAXA, will continue the publication of this valuable, long-standing communication tool. It will be issued twice per year.

- IV. **Highlight the value of Earth observations from space in delivering societal benefit**

**2017:** Building on the Applications report presented at the 29<sup>th</sup> CEOS Plenary Meeting, CEOS Agencies will continue to share their national approaches to EO data exploitation and build on their common interests all along the supply chain.

Outreach to Key Stakeholders: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>OUT-1:</b> CEOS awareness and promotional material delivered at key meetings	Ongoing	The CEOS calendar will be used to confirm CEOS representation at key international and stakeholder meetings, as updated throughout the three-year term.	CEOS Chair with support from CEO, SIT Chair and CEOS SEC
<b>OUT-2:</b> CEOS Newsletter	Q1 and Q3 of each year	Call for information input in December and June; newsletters released in February and August.	JAXA, with support from CEOS Agencies

### 3.11 Organizational Matters

#### I. Updated and refreshed Terms of Reference for CEOS Working Groups

**2017:** CEOS has completed the development of its complete set of Guiding Documents, which provide a comprehensive description of CEOS priorities and processes and will enhance consistency amongst the various CEOS entities in key areas, while retaining flexibility for those entities to organize themselves as appropriate.

One area where consistency is important, is in the structure and content of the Terms of Reference of Working Groups. In 2015, CEOS commenced work to translate the current Working Group Terms of Reference into the new format, taking the opportunity to refresh them where appropriate. In 2016, updated Terms of Reference started to be endorsed. In 2017, CEOS Working Groups will complete this task.

Organizational Issues Deliverables: 2017-2019			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
<b>ORG-7:</b> Refreshed Terms of Reference for Working Groups	Q4 2017	As a result of the updated Governing Documents, work is required to reformat/translate existing Terms of Reference into the new structure to ensure consistency. A status update will be provided by each Working Group at SIT-32.	Working Groups with support from CEO

*This CEOS Work Plan will be updated annually by the CEO under the guidance of the CEOS Chair, and in consultation with the CEOS Strategic Implementation Team Chair, CEOS Secretariat, CEOS Working Groups, Virtual Constellations, Ad Hoc Teams, the CEOS membership at large, and CEOS' external stakeholders. This document shall be consistent with and mutually supporting of other CEOS guiding documents.*