

CEOS NEWSLETTER

The Committee on Earth Observation Satellites

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CEOS SIT-32 Report

It was a great pleasure to work with all of you at the 32nd meeting of the CEOS Strategic Implementation Team (SIT), hosted by the European Space Agency, at ESA Headquarters (Paris, France) on 26-27 April 2017. Substantive, thoughtful and concrete decisions were taken during that meeting, thanks to the active participation of the entire community present.

SIT-32 Meeting Objectives

Some important strategic decisions were taken at the 30th CEOS Plenary (1-2 November 2016). These included actions in response to emerging challenges such as the Sustainable Development Goals, for the better exploitation of the increasing archives of EO satellite data and developing new information products that serve the real needs of the citizens.

Those CEOS Plenary decisions had been further consolidated in GEO, due in part to the instrumental role played by CEOS in both the GEO Programme Board and the GEO Executive Committee. The decisions of the 13th GEO Plenary of St Petersburg (9-10 November 2016) were consistent with the priorities and approach set by the 30th CEOS Plenary that immediately preceded it, and I believe we can expect a strong resonance between CEOS and GEO in the future. CEOS has also been a major player in the definition of the GEO Engagement Strategy endorsed at the GEO-XIII Plenary, and articulated around the three following priorities related to the three major agreements reached in 2015 (Sendai, SDGs and COP-21):

1. 2030 Agenda for Sustainable Development;
2. Climate Change – Greenhouse Gas Monitoring; and,
3. Disaster Risk Reduction.

The main objectives of the SIT-32 meeting were to address the above priorities as well as other topics that include the successful advancement of ongoing CEOS commitments, the full exploitation of Copernicus Sentinel data, the further development of climate observations, the optimisation of strategic partnerships, and the support to the 2017 CEOS Chair initiatives.

Decisions and achievements

The meeting discussions demonstrated the range of issues CEOS is addressing today, including efforts to improve the access to and the use of Earth observation

(EO) satellite data; CO2 monitoring from space; support for the Paris Agreement (COP-21) and the Sendai Framework for Disaster Risk Reduction 2015-2030; support for the Sustainable Development Goals (SDGs – Agenda 2030); further enhancing coordination of Earth observations; the partnership with GEO and support for its initiatives. The breadth of CEOS activities continues to expand, accentuating the challenge of optimising the contributions of teams, VCs and WGs, and the importance of CEOS leadership continuity across a broad remit. The partnership exercised through CEOS is an invaluable asset, and care should be taken to manage resources in support of the many societal areas which are critically dependent on EO satellite data.

During the SIT-32 meeting, CEOS Principals agreed on the strategic priorities needed to address emerging societal challenges and to support international treaties, in line with the GEO Engagement Strategy:

1. Foster the exploitation of satellite data (new technological solutions to overcome barriers related to data volume are emerging). The Future Data Architecture (FDA) ad hoc Team is pursuing several promising avenues with the support of several other CEOS groups such as the LSI Virtual Constellation and WGISS.
2. Collectively engage with international organisations such as UN agencies, and the International Finance Institutions (IFIs, e.g. World Bank) that have a closer interface to the user communities and a closer association with societal needs than do space agencies. To serve that purpose, a proposal for a way forward on CEOS agency coordination in engaging the IFIs, will be developed and discussed at a dedicated session at the SIT Technical Workshop. (Note that engagement with IFIs will also be a theme for the upcoming 2017 GEO Plenary.)

Several topics were discussed and subsequent actions agreed during the “climate session” in relation to the CEOS’s response to GCOS Implementation Plan, the ECV Inventory, the CEOS Carbon Strategy activities and the increased use of satellites in the IPCC Task Force on National Greenhouse Gas Inventories guidelines focusing on greenhouse gas monitoring.

SIT-32 allowed the assessment and streamlining of the various water- and oceans-related activities such as GEOGLOWS, Blue Planet, COVERAGE, and AquaWatch.

Stephen Briggs,
ESA, SIT Chair



Several key decisions have been taken in response to recommendations expressed by the Virtual Constellations, Working Groups, Thematic Groups, and Ad-Hoc Teams:

- Terms of Reference of SDG *ad hoc* Team were agreed, and the CEOS approach to the SDGs via GEO Programme Board activities and GEO’s EO4SDG activities was confirmed.
- Objectives of the FDA *ad hoc* Team were endorsed.
- Plans for the joint LSI-VC, SDCG for GFOI, GEOGLAM *ad hoc* Working Group trial meeting in September were reviewed and agreed.
- The need to identify co-leads of OSVC-VC and OST-VC was discussed and follow-up agreed.
- All requests from WGDIs had been accepted including the support to the Geohazard Supersites and Natural Laboratory activities for Hawaii and the San Andreas Fault.

The Copernicus session has proven to be very informative and has raised a lot of interest to the European and non-European CEOS agencies, providing the latest news about the Sentinels space and ground segments followed by a presentation of “Space Strategy for Europe” by the European Commission, the next CEOS Chair.

2017 SIT Technical workshop

The SIT Chair team is now focusing its efforts on the preparation of the 2017 SIT Technical Workshop (SIT TWS) (ESA ESRIN, Frascati, 11-14 September 2017), working closely with the CEOS Chair team and the CEO to ensure the maximum opportunity at CEOS Plenary for decision and debate by CEOS Principals. The Workshop has a key role to play to ensure the issues for debate are clearly identified and well prepared. In that scope, the SIT team is contacting individuals and agencies that have a key role to play in the various SIT TWS sessions.

I am looking forward working with you in Frascati.

GEO: Earth Observation insights for Disaster Resilience

In addition to the eight Societal Benefit Areas (SBAs) that have driven the activities of the Group on Earth Observations (GEO) over the last decade, GEO's three engagement focus areas include the United Nations 2030 Agenda for Sustainable Development, the Paris Agreement for Climate Change and the Sendai Framework for Disaster Risk Reduction.

GEO has worked extensively with CEOS in a number of global disaster risk fora over the last several months. During May's Global Platform for Disaster Risk Reduction (GPDRR) in Cancun, Mexico, several thousand participants addressed one of GEO's key priority engagement areas: responding to the Sendai Framework and reducing disaster risk. A key outcome from Cancun was the inclusion of GEO and Earth observations (EO) in the United Nations policy document 'Sendai Framework Data Readiness Review', Section 2.2: <http://www.unisdr.org/we/inform/publications/53080>.

GEO's disaster risk community has also been collaborating with the United Nations Office for Disaster Risk Reduction (UNISDR) to promote the value and applicability of EO for disaster resilience, participating as disaster risk reduction (DRR) experts on the PreventionWeb website and contributing to the 'DRR Voices' blog on the value of EO for disasters.

<http://www.preventionweb.net/experts/oped/view/52971>

A focus activity within GEO's disaster work is the 'GEO - Data Access for Risk Management Initiative' (GEO-DARMA), led by the European Space Agency's Ivan Petiteville. On a trial basis in regions of the developing world, GEO-DARMA is supporting risk reduction activities based on end user priorities in line with the Sendai Framework. The ultimate goal is to establish an inclusive, comprehensive process to address local DRR requirements by using EO technologies efficiently. The GEO-DARMA Steering Committee members met in Cancun and made significant progress in strengthening the GEO-DARMA framework and began planning for the prototype projects (learn more about GEO-DARMA here: <http://ceos.org/ourwork/workinggroups/disasters/geo-darma/>).

At the Earth Observations Summit 2017 in Montreal, Canada, GEO participated in the successful 'One Earth, One Health' workshop. The event was led by the Canadian Space Agency and the Public Health Agency of Canada, in partnership with the Centre National d'Études Spatiales (CNES, France), the CEOS Working Group on Capacity Building and Data Democracy (WGCapD), the department of Applied Geomatics from Université de Sherbrooke (Canada), the Institut de Recherche pour le Développement

Steven Ramage,
Head External Relations,
GEO Secretariat



(IRD, France), and VetAgro Sup (France); with the participation of the UN-COPUOS Space and Global Health team. This workshop was directly aligned with - and in support of - the Sustainable Development Goals and GEO's strategic objectives and public health-related SBAs. A key announcement from the Summit was the revitalization of the GEO Health Community of Practice, supported by NASA and several other CEOS partners: <http://www.geohealthcop.org/>.

Looking forward, a disasters workshop will be held by NASA, CONAE, and AmeriGEOSS in Buenos Aires in September, 2017 (find out more at <https://disasters.nasa.gov/argentina-summit-2017>).

GEO Week 2017 From 23 to 27 October, 2017, the GEO Plenary and side events will take place in Washington DC, USA. GEO Week 2017 will cover a wide range of topics, including strategic engagement priorities, the GEO Work Programme, engagement with the commercial sector and numerous other activities. CEOS will be represented significantly throughout the event. Learn more: <https://www.earthobservations.org/geo14.php>

Working Group on Disasters (WGDisasters)

Ending in 2017, the CEOS Disaster Risk Management (DRM) pilot initiatives on floods, seismic hazards and volcanoes have been quite positive, and now face the challenge of addressing sustainability for successful elements. A vision for regional and eventually global volcano monitoring is being developed and will provide insights to local volcano observatories based on a diverse suite of Earth Observation (EO) data. A regional approach for flood monitoring that builds on existing systems has been articulated and can provide rapid access to critical satellite data in times of crisis. Global seismic monitoring using satellite data has begun,

in combination with existing methodologies, and the creation of a global strain map based solely on EO data is a valuable complement to and calibration for current GPS methods. Although the CEOS pilots have been successful in their aims, more can be done to promote best practices and share the positive results achieved. A number of promising initiatives have developed during the course of the pilot projects, and contacts with end users show strong interest for sustaining the activities in as part of an integrated approach to DRM. Work continues to explore the mechanism by which the successful elements of the pilots can be included in future flood, seismic and volcano work.

Stéphane Chalifoux,
CSA, WGDisasters Chair



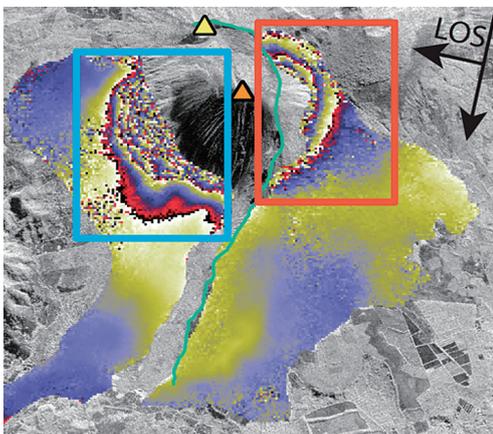
[remote-volcanoes/](#)

In addition to the DRM pilots, CEOS Agencies have continued to provide EO data to Geohazard Supersites and National Laboratories (GSNL) activities and started to support the Landslide Pilot and the Haitian Recovery Observatory.

At SIT-32 in Paris, France, CEOS endorsed the San Andreas Fault Natural Laboratory (GSNL project) and approved the Geohazard Lab Concept to move forward to an implementation plan. The main goals of the Lab are to provide users with a mechanism to access to satellite EO data, as well as a processing environment to exploit EO and in situ data to support DRM and resilience measures.

It is with great pleasure that I welcome JSC Russian Space Systems from Russia as new member in the WGDisasters.

The 8th CEOS WGDisasters meeting, hosted by the Comisión Nacional de Actividades Espaciales (CoNAE) and the National Aeronautics and Space Administration (NASA), will be held in Buenos Aires, Argentina, from September 4th - 6th, 2017.



As an illustration of achievement, the CEOS Volcano Pilot Project has shown that satellite data can be a critical component to monitoring unrest and eruptive activity, especially at remote volcanoes where in-situ instruments are impractical. The pilot has further demonstrated that satellite monitoring can detect deformation at a wide range of volcanic systems and in different environmental settings. This includes at quiescent volcanoes, where deformation can be a precursor to renewed eruptive activity. This figure highlights interferometric synthetic aperture radar data spanning eruptions in January and March of 2014 at Pacaya volcano, Guatemala, showing surface deformation due to magmatic activity and gravitational instability.

Using Satellite Data to Monitor Remote Volcanoes
RADARSAT-2 Data and Products © MacDonald, Dettwiler and Associates Ltd. (2014) - All Rights Reserved. RADARSAT is an official trademark of the Canadian Space Agency.

Link to published article: <http://ceos.org/home-2/ceos-volcano-pilot-using-satellite-data-to-monitor->

The Joint CEOS/CGMS Working Group on Climate (WGClimate)

The WGClimate continues to work along its two main line of activities, the implementation of the Climate Architecture from Space and the Space Agency response to the GCOS IP.

With the invaluable support of EUMETSAT, the work on the second version of the Essential Climate Variable (ECV) inventory continues. The call to support the population of

the Cycle 2 ECV Inventory was made in June 2016. Since then, over 150 people have responded and the inventory now contains 907 verified data record entries. These entries comprise 494 current and 413 planned data records, which address 81 ECV physical products, and span 28 of the GCOS-200 ECVs. 72% of the data records address atmospheric ECVs, 15% land and 13% ocean.

In May of this year, a gap analysis effort to interrogate the data records in this new second version of the ECV Inventory began in earnest. A team of domain-specific experts are currently involved in assessing the data records to identify gaps in data availability, data integrity and/or foreseen gaps in future missions. The aim is to complete the analyses by August 2017 and for the reporting on this activity to be available by CEOS plenary, at which point the Inventory itself will already be made public and accessible to the community.

In parallel the WGClimate is working on the Space Agency Response to the GCOS IP.

The thorough analysis being undertaken by the writing team, and the document structure containing the resulting analysis insight, has been further refined in order to optimally align with the revised structure of the new GCOS IP. The analysis has comprised the following:

Pascal Lecomte,

ESA, WGClimate Chair



- Analysis of the Broad Context of the GCOS IP, including : observations for Adaptation, Mitigation and Climate Monitoring; Climate Services; Climate Indicators; Links to other UN conventions and STGs; Earth System Cycles; Capacity Building. A detailed implementation of "soft actions" and cross-cutting actions.
- Analysis of the Detailed Implementation GCOS IP chapters. These are arranged thematically - Terrestrial, Oceanic, Atmospheric - and require particular assessment on Mission Continuity and new missions, Product evolution, Product generation and intercomparison, Reprocessing needs, Calibration, Assessment, Data integration. Validation, metadata.

The response will also include, in the form of an Annex to be submitted to GCOS in 2018, the results of the implementation of the Climate Architecture, including the progress on the ECV inventory population and the work leading to the Gap Analysis conclusions.

The WGClimate will meet in Frascati in September, just prior to CEOS SIT. This will be opportunity to finalise the draft reports on both activities.



Working Group on Information System and Services (WGISS)

The 43rd WGISS plenary was hosted by the National Aeronautics and Space Administration (NASA) in Annapolis, Maryland USA on April 3-6, 2017. The week-long meeting included a one-day Technology Exploration workshop focusing on Future Data Access (FDA), Analysis Architectures and related cloud computing topics. There was also a second one-day workshop, focusing on Global Earth Observation System of Systems (GEOSS) and WGISS interoperability, as well as a session on Capacity Building.

As a result of the GEOSS-WGISS discussions held during WGISS-43 and at the request of AMERIGEOSS, the CEOS WGISS Integrated Catalog (CWIC) development team participated in the United States Geological Survey (USGS) Community for Data Integration (CDI) Workshop/API Plugfest in Denver, Colorado USA on May 15-17. During the workshop, attendees used geospatial Application Programming Interfaces (APIs) from the Group on Earth Observations (GEO) Data Access Broker (DAB), CWIC and several US agencies to provide various data and service resources of selected thematic areas (Water, Environment, Agriculture and Hazards/Disaster) in the US Federal Geographic Data Committee (FGDC) Geoplatform.

WGISS continues to provide support to GEO in their efforts of reconciling metrics of CEOS data holdings provided

through WGISS interoperable standards and systems. WGISS is working with the GEODAB (GEO Data Access Broker) team to identify and create best practices for GEO to connect to WGISS Connected Data Assets (CWIC, Federated EO Gateway - FedEO, International Directory Network - IDN). On April 20-21 during the GEO Data Providers workshop, WGISS presented techniques on how they are making over 300 million CEOS data resources accessible to GEO via recent developments in the WGISS Connected Data Assets.

WGISS has begun hosting virtual workshops to serve as a forum for exchange of technical information and lessons-learned experience about current, trending and future software technologies and services. The first WGISS Technology Exploration webinar was held on March 14th on 'Relevancy Ranking of Data Search Results'. This webinar discussed some of the techniques being used within Earth Observation data search tools and also included a discussion of possible future directions in relevancy ranking. The second Technology Exploration webinar was held on June 19th with the topic: 'The Concept of Data Cubes to Enable Analysis of Large Earth Observation Data Sets'. Discussions included Data Cubes user needs, key features and basic high-level architecture. Future webinar topics include federated authentication and frameworks used by end-users to analyze Earth

Andrew E. Mitchell,

NASA, WGISS Chair



Observation data.

The 44th WGISS plenary will be hosted by the Chinese Academy of Sciences (CAS) on September 25-29, 2017, in Beijing, China. Similar to WGISS 43, during this meeting, WGISS will convene a Technology Exploration workshop on Future Data Architectures.



Working Group on Capacity Building and Data Democracy (WGCapD)

Our 6th Annual Meeting was hosted by DLR, Oberpfaffenhofen, Germany, 27-29 March, and was represented by 20 institutions with 28 attendees. Amongst the many points of discussions on working group role in various collaborative training programmes, main emphasis of this Meeting was to rigorously go through the CEOS Work Plan for 2017-19 actions on the WG. Jonathon Ross, CEOS CEO, presented activities and priorities of CEOS to provide the way forward to align WG future plan towards these priorities.

This meeting also confirmed our willingness to liaison with other CEOS Working Groups and Virtual



Members of the CEOS WGCapD in Annual Meet #6 at DLR, Oberpfaffenhofen

Constellations by seeking to serve as a training/capacity building resource to them, providing expertise on recommendations, guidance on translating needs into CB activities and best practices. We have initiated discussions with WGISS team to share our experiences in imparting knowledge for different kind of users. In this regard, WGCapD made a presentation on capacity building needs and activities in the 43rd meeting of WGISS in Annapolis during April, 2017. We have also initiated a Learning Center (<http://learningcenter.obt.inpe.br/>) to preserve training material with various experts for future such training needs and also to provide access to all those trainees who can benefit by revisiting these trainings material. Other activities, onsite and online, carried out by our group included:

1. *SAR Summer School*: held before ISRSE-37, in South Africa, May 4-7. A partnership of the Remote Sensing Education Initiative (SAR-EDU) and SANSa, this Summer School aimed to transfer knowledge to participants on how to access, use, and interpret satellite Earth observation radar data for geographic, administrative, and scientific applications.
2. *Course on SAR Technology*: held during AmeriGEOSS Week 2017, in Costa Rica, from July 31 to August 04, was focused on different applications such as land cover change detection, flood monitoring, interferometry and many more.

Phila Sibandze,

SANSa,
WGCapD Chair



3. With the success of last year webinar series conduct by CapD, this year the *Webinar Series on SAR Data Processing and Application* have been taken up from April 17 till June 9. This programme was well received with more than 250 participants from 53 countries covering the wide spectrum across the globe. The survey of this webinar indicates that 67% of working professionals have participate very actively in this series. It was also noted that about 33% female participation was observed.
4. The WG also co-organized a unique workshop on "*One Earth - One Health Workshop*" which took place during 2017 EO submit in Montreal, Canada on June 21, to discuss the use of EO data and services to public health practices. Close to 100 individuals registered for the event onsite and 20 colleagues registered to follow the meeting online - live broadcast element was organized allowing free online participation, from various locations around the world.

Finally, we are glad to inform you that the 7th WGCapD meeting will be hosted at INPE's headquarters, in São José dos Campos, SP, Brazil, in March 6-8, 2018. Hope you can join us!

Working Group on Calibration and Validation (WGCV)

The 42nd Working Group on Calibration and Validation (WGCV) meeting took place in South Dakota from May 16-19, 2017. The USGS hosted the meeting with sessions taking place in downtown Sioux Falls, EROS Data Center, and South Dakota State University in Brookings. Thirty attendees representing 15 institutions attended the meeting that was also the first WGCV meeting chaired by Kurt Thome (NASA) along with Vice Chair Cindy Ong (CSIRO).

The meeting began with a welcome from CEOS Chair Frank Kelly and presentations and discussions included collaborations between WGCV and LSI-VC, MRI, and FDA. Additional highlights included results from the LPV subgroup showing progress on CEOS Carbon Actions, the initial WGCV meeting for new SAR Subgroup Lead, Bruce Chapman from NASA/JPL, and a schedule to make the RadCalNet website open and available for public use.

The RadCalNet web site will provide top-of-atmosphere reflectance over networked sites that can be used to assess the radiometric calibration

of on-orbit imagers. Beta users have been using the site since October 2017 and they presented their results as part of the WGCV/IVOS-29 meeting held in Tucson, Arizona March 13-17, 2017. The RadCalNet team received valuable input on how to improve the data format, web access, and communicating uncertainties while the results from the beta testers confirmed the current estimates for the network's uncertainties.

The Atmospheric Correction Intercomparison (ACIX) Workshop II took place at ESA ESRIN April 11-12. Many lessons were learned on how to improve the atmospheric correction schemes and how to evaluate their uncertainties. A report from the activity is expected before the end of 2017 and results will be available on the CEOS Cal/Val portal once they are finalized. Activities such as ACIX also play a role in data interoperability and WGCV has spent the last several months working with the MRI team on topics of common interest that

Kurtis Thome,
NASA, WGCV Chair



were a result of WGCV-42.

Plans are underway for planning of WGCV-43 to be held in conjunction with WGISS-44 in April 2018. The venue is still under discussion, but both groups are looking forward to a successful follow-on to their joint meeting from March 2016.



Attendees of the WGCV Plenary #42 hosted by USGS are shown in front of the entrance to the EROS Data Center in Sioux Falls, South Dakota.

Global Forest Observation Initiative (GFOI)

It's around 8 years since the GEO Forest Carbon Tracking (GEO-FCT) task was born, becoming the GEO Flagship activity we know now as the Global Forest Observations Initiative (GFOI) after a year or so of initial growth. GFOI continues to grow as an initiative with continued and expanded support from the major donors - including the governments of Norway and Australia. The GFOI Office is well established at the FAO in Rome and plans are afoot to expand its capacity to be able to address the ambitions for an expanded and intensified effort for GFOI in a 'Phase 2'. This new Phase seeks to build on the successes of GFOI to date and in particular to emphasise the uptake of the GFOI Methods and Guidance documentation in developing countries (including through the online REDDCompass tool (<https://www.reddcompass.org/frontpage>) and training courses for forest monitoring personnel in these countries.

Masanobu Shimada, JAXA, CEOS Lead for GFOI

The CEOS accomplishment of guaranteed space data coverage for all countries wishing to report on forest carbon to UNFCCC annually is widely recognised as one of the major accomplishments of GFOI, and credit is due to all space agencies who have actively supported that achievement to date and in future. With this in hand, GFOI now asks us to move our emphasis to the tools and capabilities that will help reporting countries overcome some of the obstacles around the access to and application of that data. Such issues were foreseen by the SDCG several years ago and were the subject of our Global Data Flows study report. This work will continue to help direct our efforts to ensure GFOI countries are able to make best use of the satellite data available to them. CEOS initiatives around Analysis Ready Data (ARD), the Data Cube, and Future Data Architectures (FDA) will all have an important part to play in this direction –

for forest monitoring and for many other applications no doubt.

As the GFOI structure and Work Plan evolve to shape this new Phase, we in CEOS must remain vigilant to ensure that our interests continue to be well represented and that we are positioned to optimise our support to, and ensure benefits from, GFOI. Myself and Stephen Ward (as my alternate in the GFOI Leads) are pleased to continue to represent CEOS in the Leads group for GFOI. The 2018 GFOI Plenary is likely hosted by Colombia, a country where CEOS has been actively engaged in prototyping of the Data Cube, and we look forward to that work coming to fruition in a GFOI context and inspiring other countries present to consider the benefits for their national requirements.

We will keep the CEOS community up to date as GFOI Phase 2 develops.

GEOGLAM

Brad Doorn and Selma Cherchali (CEOS ad hoc Working Group for GEOGLAM Co-Leads)
Juan Guerschman and Flora Kerblat (RAPP Secretariat)

2 017 RAPP International Workshop at ESRIN, 16-17 May

The 5th international RAPP workshop was hosted at ESRIN in May, and featured more than 20 organisations including space agencies, universities, research centres, and international organisations, from all over the world were represented. The workshop was a great opportunity to gather the RAPP community, meet and welcome new collaborators, and engage with new partners to pursue our efforts and improve our global rangelands monitoring system. Several key topics discussed included:

- How to best use the Copernicus-Sentinels satellites products to help monitor or validate EO data for rangelands and pasture lands, including processing of Sentinel-1 data for grassland biomass estimation (e.g. projects in Estonia).
- New data architectures, including Data Cubes, to help process the massive amount of data.
- The integration of RAPP in European projects such as H2020 calls for proposals, and new pilot sites in Africa such as Kenya (ILRI farm site).

- A customised RAPP Map for southern Africa supported by SANSA.
- RAPP coordination: welcoming a new co-lead from SANSA (Clement Adjorlolo).

More information, including the presentations, are available on our RAPP website (<http://www.geo-rapp.org/about/events/5th-geoglam-rapp-workshop-italy-frascati-2017/>). We thank ESA for their fantastic support. Locations for next year's event are being considered, and if your organisation is interested in hosting, please advise the ad hoc Working Group.

GEOGLAM Implementation Team meeting, Rome, 19-21 June

The GEOGLAM Implementation Team met in Rome in June to review progress to date and revised program priorities phase 2 (2017-2022). Several themes of interest to CEOS and CEOS Agencies were discussed, including a shift in emphasis in the agricultural monitoring community from data scarcity to processing and managing large data volumes as the major constraint in the use of EO.

The Implementation Team also considered

the implications of the next generation of sensors and how these can be made to meet the needs of agricultural monitoring users. This includes both governmental missions, as well as developments on the commercial observation and agricultural services sectors, and the ongoing evolution of cloud-based compute and storage capabilities. As a part of addressing future needs, the importance of encouraging more governments to adopt free and open sharing of satellite data was emphasized.

The Implementation Team confirmed the intention to have GEOGLAM continue to represent the observational needs of the agricultural monitoring Community of Practice to CEOS, noting in particular that further effort is required to speed up the transfer of R&D to operational implementation. And through operations, the two Crop Monitors (AMIS and CM4EW) continue to increase the visibility of GEOGLAM and the use of EO.

There is a need to further explore the role of GEOGLAM in contributing to the Sustainable Development Goals (UNSDGs), and here the interaction with CEOS efforts to support the SDGs will be important.

CEOS Ad-Hoc Team on Sustainable Development Goals

Alex Held, CSIRO, Marc Paganini, ESA, and Eric Wood, USGS

At the 2016 CEOS Plenary in Brisbane - Australia, principals resolved to formally establish this new Ad-hoc team to help CEOS support this global process, and promote the effective use of earth observation data and derived products for monitoring progress by countries towards the agreed UN Sustainable Development Goals.

The '2030 Agenda for Sustainable Development', was adopted in 2015 by world leaders calling for establishment of a new global Indicator framework to better measure, monitor and report progress towards 17 UN Sustainable Development Goals (SDGs), 169 associated Targets and 231 quantitative indicators. In their official statement, leaders recognised the critical need to: "...support developing countries and strengthening the capacity of national statistical offices and data systems, to ensure access to **high-quality, timely, reliable and disaggregated data**. To

promote transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, including earth observation and geospatial information, while ensuring national ownership in supporting and tracking progress." For this reason, both GEO (Group on Earth Observation) and CEOS consider this as one of the most important global initiatives at present, where earth observation can demonstrate its pivotal value and impact to society.

The CEOS AHT will align its engagement on the UN SDG agenda in the context of GEO, and its initiative called "EO4SDGs" (EO for Sustainable Development), as well as to support existing direct relationships between individual CEOS Agencies, UN custodian agencies and statistical agencies in their countries.

This Ad-hoc team membership includes nearly all CEOS member agencies, and has adopted the following key responsibilities:

- Coordinate the efforts of CEOS agencies and communicate CEOS support to the SDG processes (use cases, communication materials, etc.).
- Provide a forum for sharing/communicating EO best practices in support to the SDGs.
- Analyse new opportunities for satellite-based EO to support SDGs Targets and Indicators.
- Engage with relevant authoritative SDG stakeholders inside (IAEG-SDGs, WGGI, UN Custodians) and outside the UN system (GPSDD, IISD, WBG, Foundations, etc.).
- Use CEOS assets and bodies (WGCapD, AHT FDA, etc.) to **build and strengthen EO capacities** at all levels of the UN SDGs implementation.

Future Data Access and Analysis Architecture

Consecutive CEOS Chair agencies (CSIRO in 2016, USGS in 2017, and EC coming in 2018) have identified Future Data Architectures (FDA) as a priority for space agencies and for CEOS. As work on this initiative continues in 2017, an FDA strategy for CEOS has evolved that addresses:

- The challenges facing space agencies around the need for new paradigms in information systems to deal with *big data* and the increasing volume, velocity, and variety of Earth observation (EO) data;
- The opportunities being provided by advances in high performance computing, and in cloud storage and processing systems, that are changing user community expectations as to ease of access and use of EO data.

That strategy in relation to the FDA for CEOS and its member agencies continues to take shape in preparation for discussion and ultimately endorsement by the 31st CEOS Plenary this October in Rapid City, South Dakota.

Principals are referred to the

comprehensive report on FDA from October 2016, prepared by the CEOS Ad-hoc Team assembled for that purpose. A thorough review of the context and the evolution of user requirements and the technical possibilities, the report suggests that EO technology has advanced to have significant potential in support of society's grand challenges. The report also notes that the nature of data users has changed as shown by an increasing number and diversity of users. These users are increasingly non-technical and have expectations for ease of access and use of the data.

The 2017 analysis by the Ad-hoc Team has focused on defining the substance for a collaborative strategy within CEOS, and how this would best be accommodated within the CEOS Work Plan and structure. This included a survey of CEOS agencies and groups to establish a common set of priorities from the membership.

The most common topics for collaboration through CEOS suggested by CEOS agencies included the simplification of EO data uptake and application for many users, the definition and automated delivery of interoperable

Steve Labahn,

USGS



ARD, the exploitation of cloud computing for storage and processing, algorithm portability, solutions that enable scalability from local to global, and open source tools that can complement commercial tools.

It was proposed in 2016 that the CEOS strategy achieve simplification of EO data for users, allow those users to make use of ALL available and relevant CEOS agency data, and also to support CEOS ambitions in relation to its chosen grand challenges. The focus of the Ad-hoc Team in 2017 then has centered on preparing a comprehensive CEOS strategy for providing CEOS Analysis Ready Data for Land (CARD4L)-compliant products, the provisioning of open source tools to exploit advances in technology and meeting user demand, capturing user feedback and user statistics, promoting data and processing standards when appropriate, and pursuing architectures that support analytical processing capabilities.

Moderate Resolution Sensor Interoperability

The 2017 CEOS Chair's Moderate Resolution Sensor Interoperability (MRI) initiative builds on and helps consolidate lessons learned within the rapidly growing community of users as they work to extend, increase the density, and otherwise improve the Earth surface observation record through multi-sensor datasets. The value to the space data user community of CEOS agencies working together to cross-calibrate data products has become increasingly clear. New methodologies and models using large volumes of analysis ready data (ARD) are becoming widely available. Therefore, methodologies to assist in achieving interoperability are needed.

The MRI framework document describes threshold requirements for the interoperable use of products, and identifies future targets for continuous improvement of products as well as methodologies for their use. The MRI framework is a living document that needs to grow as products and user methodologies evolve. We are currently in a period of rapid growth within both the producer and user communities as more data become available.

Central to the framework is the need for interoperable metadata with clear, consistent, and unambiguous content and structure. Data products, particularly higher level products such as surface reflectance or classifications, have complex per-pixel metadata, such as cloud cover, view angle, and DEMs, for which standards may not currently exist. Interoperability cannot be achieved unless sufficient provenance of the processing history is available.

Many interoperability decisions revolve around understanding uncertainty. A key user question is whether or not the uncertainty associated with a multi-sensor product meets the uncertainty requirement of specific user applications. Uncertainty is associated with each data product. For high level products, uncertainties are associated with specific corrections, such as atmosphere, view angle, band differences, and topography. Individual product uncertainties are convolved for the merged product. Producer uncertainties need to be evaluated within the perspective of user uncertainty requirements. Methodologies for estimating uncertainty are being developed within the WGCV team.

Eugene Fosnight,
USGS



MRI case studies provide explicit examples of the use of interoperable multi-sensor applications. Lessons learned from the case studies are used to augment the MRI framework, and as guides for the user community. The Harmonized Landsat-Sentinel-2 case study, and the associated agricultural use case, will provide an example.

The importance of feedback from the user community cannot be underestimated. If the products and methodologies do not provide a net benefit, they will not be used or may be used inappropriately. The onus is on the user community to understand their uncertainty and data requirements.

The MRI initiative leverages contributions from the many experts within CEOS agencies and GEO user communities, such as GFOI and GEOGLAM.

Open Data Cube

With each passing year, new generations of Earth Observation (EO) satellites retrieve increasingly significant volumes of data with comprehensive global coverage. Extensive research and development on new data applications increases the potential for these data to profoundly impact the ways that we address important environmental, economic, and social challenges at local, regional, and global scales. These applications highlight the value of EO, despite the challenges we face connecting the data, applications, and users. Much of the archived EO satellite data are also underutilized, despite modern computing and analysis infrastructures. Making good use of these data can be difficult for advanced economies and even more challenging for developing

countries, where traditional data processing and distribution methods are not technically feasible or financially affordable. Fortunately, just as satellite EO technology has advanced, so too, has information technology. The data management and analysis challenges arising from the huge increase in free and open data volumes can be overcome with new computing infrastructures and data architectures, such as the Open Data Cube (ODC), founded and stewarded by the Committee on Earth Observation Satellites (CEOS) and CEOS Agencies.

The ODC, based on the Australian Geoscience Data Cube, is an open source software architecture that allows satellite data pixels to be spatially and temporally

Open Data Cube Team

aligned in "cubes". These data cubes allow time series analyses (e.g. agriculture, water, forests, disasters), permit the use of diverse datasets via interoperable methods, and support connections to common GIS tools (free or commercial) – a solution with great potential to streamline data management for providers while simultaneously lowering technical barriers for users.

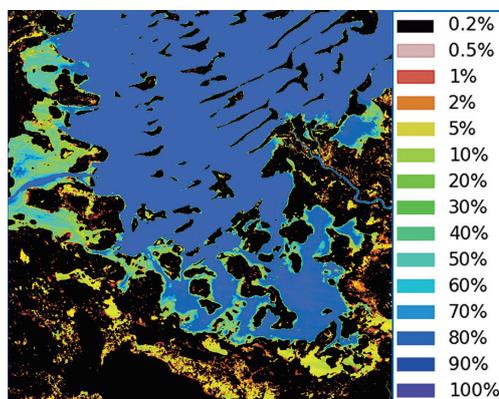
This important data architecture solution supports key CEOS objectives, which include helping users apply satellite data and supporting high priority global initiatives, such as the United Nations 2030 Agenda for Sustainable Development. CEOS has already demonstrated successful Data Cube implementations in Australia, Colombia, and Switzerland over the last few years and is committed to fostering, sustaining, and growing the ODC well into the future. It is well-positioned to do so with a steady supply of analysis-ready data, technical expertise, and ongoing relationships with key international groups and stakeholders (e.g. GEO, World Bank, Amazon) and aims to establish operational data cubes in more than 20 countries by 2022. CEOS will achieve this goal by engaging with its ODC Partners (significant contributing stakeholders and user organizations) to develop documentation and training tools, managing the open source software repository, fostering and growing an active community forum, and providing high quality, ongoing customer service to users.

The CEOS ODC solution has enormous potential to further actualize the unquestionable economic value and societal benefit of satellite Earth observations for societal benefit.

For more information, visit: www.opendatacube.org



Land change detection results over Bediaye, Vietnam from 2000 to 2016. The product shows the number of land class changes over the time period. The region to the east of the lake is a new water dam project. Local decision-makers are able to use this information to track the progress of infrastructure development as well as identify remote regions of illegal deforestation.



Water detection results over Lake Chad in Cameroon, Africa from 2000 through 2016. The product shows the percent of observations detected as water over the time series. Episodic water events can be identified to locate regions of high flood risk thereby providing local decision-makers with critical information to support colonization and agriculture choices.

CEOS Chair Sees Good Progress on Future Data Architectures, Interoperability

Dear CEOS Colleagues and Friends,

When the USGS took on its role as the 2017 CEOS Chair Agency, we committed to providing leadership on numerous initiatives in support of CEOS objectives, including important endeavors that started in 2016. As we draw nearer to the 2017 SIT Technical Workshop this September in Frascati, Italy, and to the 31st CEOS Plenary at Rapid City, South Dakota, in October, we are happy to announce good progress on those initiatives.

As part of its leadership role in 2017, the USGS supported further development of priorities and themes identified under the 2016 CEOS (CSIRO) and SIT Chair (ESA)—a study of future data access and analysis architectures, and a study of non-meteorological applications for next generation geostationary satellites among them.

Given the relevance of several core programs of the USGS, the agency—as CEOS Chair—specifically prioritized several of those topics already under study with the CEOS Future Data Architectures (FDA) Ad Hoc Team—Future Data Architectures Continuation, and Moderate Resolution Sensor Interoperability (MRI).

On the FDA front, the CEOS Strategic Implementation Team-32 has endorsed a number activities that have been

identified for CEOS members to do jointly:

- Pursue CARD4L interoperability
- Develop interoperable Open Source tools to stimulate satellite data use enabling exploitation of Earth observation (EO) data
- Capture user feedback and user statistics on FDA implementations in a structured way
- Ensure availability and promote uptake of data and processing standards when appropriate, and implement standardization when necessary
- Adapt the potential FDA solutions to the profile of diverse users accommodating analytical processing capabilities.

With CEOS SIT-32 concurrence on the “what,” the FDA ad hoc team will work on the “how” and “when” next steps, to be proposed and refined at the 2017 CEOS SIT Technical Workshop, and finalized and briefed at the 2017 CEOS Plenary.

Work continues, too, on the MRI initiative, including a framework document that not only describes threshold requirements for the interoperable use of products, but also identifies future targets for continuous improvement of products as well as methodologies for their use. MRI case studies provide explicit examples of the use of interoperable multi-sensor applications. The importance

Dr. Frank Kelly,

USGS,

2017 CEOS Chair



of requirements from the GEO and other user communities cannot be underestimated.

The USGS and SIT Chair (ESA) teams also are in the process of preparing the substance and structure of both the SIT Technical Workshop Sept. 11-14 in Frascati, and the CEOS Plenary Oct. 18-20 in Rapid City. As we reach out to individuals and agencies with key roles to play in the sessions and topics that comprise the meeting agendas for those two events, we are stressing that the SIT and CEOS Chair teams are working together on a unified process to ensure the maximum opportunity at CEOS Plenary for decision and debate by CEOS Principals.

We plan to use written material, provided in advance of the meeting, as our way to accomplish routine reporting, and to allow more time for discussion at Plenary. The SIT Technical Workshop has an important role to play in ensuring the issues for debate are clearly identified and well prepared. We look forward to the discussion at both the SIT Technical Workshop and the Plenary, as well as acknowledging and celebrating the organization's important accomplishments with FDA, with MRI, and with all the other valuable work done during our year as your CEOS Chair.

Meeting Calendar

As of August 2017

Activities	2017					2018			
	August	September	October	November	December	January	February	March	April
CEOS Plenary and CEOS SIT (Strategic Implementation Team)		▲ 11-14 SIT Technical Workshop Frascati, Italy	▲ 18-20 CEOS 31st Plenary Rapid City, USA						△ SIT-33 USA
CEOS VCs and CEOS TFs (Virtual Constellations and Task Forces)							▲ 21-23 LSI-VC-5 Tokyo, Japan		
CEOS WGs		▲ 4-8 WGDIsasters-8 Buenos Aires, Argentina ▲ 5-8 LSI-VC/GEGLAM/SDCG Meetings Frascati, Italy ▲ 11-12 CEOS-CGMS WGClimat-8 Frascati, Italy ▲ 25-29 WGISS-44 Beijing, China							
GEO related Activities (Group on Earth Observations)			▲ 23-27 GEO XIV Plenary Washington DC, USA						
Others		▲ 25-29 IAC 2017 Adelaide, Australia		▲ 6-17 UNFCCC/COP 23 Bonn, Germany ▲ 14-18 APRSF-24 Bangalore, India					

▲: determined △: to be determined (Date, Host organization/Location) CEOS-related meetings are open only to designated participants.

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