

CEOS NEWSLETTER

The Committee on Earth Observation Satellites

August ²⁰²⁰
No. 55

Report of the SIT-35 (Virtual) and Plan for SIT-TW (Virtual)

The COVID-19 crisis has also impacted our CEOS work, forcing us to operate virtually for a while now. In some respects, and due to its international nature, we are already used to operating *virtually* in CEOS, for example with our CEOS secretariat teleconferences throughout the year. However, our three annual face-to-face *rendez-vous* have always been great opportunities to strengthen our personal relationships and also make tangible progress. But obviously we have all had to remain pragmatic and adapt to new circumstances when a global crisis like this dictates how we need to operate.

Since last August, our Team Australia had been meticulously planning our normal SIT-35 meeting, where we wanted to welcome you all in person to Hobart, Tasmania. Everything was ready (main venue, social events, technical tour), and our excitement was mounting as we readied to welcome nearly 70 of you from all over the world! Well, only of course, we couldn't. Two weeks out a 'Special Agent' (i.e. COVID-19) decided to register as well. This 'slightly' disrupted our plans, like many lives and events all over the world over the last few months. So, for the first time in its more than 25-year history, the CEOS SIT meeting went entirely virtual. We quickly transformed the meeting into 2 main online sessions of 4 hours each (starting at 7am EST, and 11PM for us 'down under'). We developed a *Virtual meeting protocols and technical guidance* document, which helped all of us to make the most of the meeting. Interestingly, we almost doubled the number of attendees: over 130 people were online, with no major technical issues (!).

We were delighted to see the meeting enabling CEOS to maintain its business with meaningful and inclusive discussion and good progress. We were grateful for the attention given to those topics that we, as SIT Chair, have identified as priorities:

- CEOS ARD (Analysis Ready Data) Strategy for space agencies,
- Increased coordination of satellite-based observations of Earth's carbon & biomass stocks
- CEOS to continue support for the Sustainable Development Goals (SDGs).

Several decisions and actions (now available as per the minutes) were taken, including:

- Principals acknowledged the tremendous work of Carolin Richter as GCOS Director, noting the critical importance of the GCOS-CEOS relationship. Changes in GCOS structure and

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Adam Lewis,
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leadership were, and continue to be, an important discussion.

- The impressive progress on the COAST activity, a great example of cross-cutting topic amongst several agencies and CEOS groups.
- Discussions really kicked off around the CEOS ARD strategy, and how it might move "beyond land", as well as approaches for better engaging the private sector.
- The streamlining of SDG activities to focus on 3 indicators (water, urbanization, land degradation) plus one on coastal pollution, noting deeper engagement of Space Agencies
- The importance of the Biomass Protocol work. With several Agencies having Biomass missions under development, uptake of that data to have impact for operational and policy purposes will depend on CEOS's work in this area.

As mentioned above, our goal for the SIT Meetings is to take advantage of the valuable time of Principals, by focusing on bringing forward issues and opportunities that require Principal-level debate, discussion and decision. And we believe we achieved this at SIT-35, despite the very challenging circumstances. Even though this format didn't enable us to try innovative ways of presenting new ideas to CEOS (our "pitches"), we are still looking to provide less "formal" opportunities for Principals to engage, and explore new avenues through which CEOS can add value for the work of its Agencies. We also listened to your feedback, including through the post-event survey, as we are now planning the SIT TW as follows:

- it will take place over a two-week period, from 8-18th September
- this will be a federated series of standalone 'focus' sessions. On the last day, we will have a single wrap-up 'all hands' session for all, where:
 - each session will report on focused outcomes, with enough time for discussion;
 - the SIT Chair and CEOS Chair will work with the group to ensure there is a clear roadmap

towards the Plenary for each item

- each of the standalone sessions will be structured to focus on a specific theme (linked closely to items on the Plenary agenda)

We are now consulting with the CEOS Secretariat and the community before announcing a final agenda. Given the present context, we also believe that deep coordination between CEOS Chair and SIT Chair is now even more essential, to ensure we deliver a successful CEOS year. Joint planning meetings between the teams are also being organised.

In parallel, we have been undertaking deep engagement with the CEOS groups and teams that deliver most of CEOS's concrete work: the Virtual Constellations, Working Groups and *Ad Hoc* Teams. Through "informal" calls with each VC, as well as our second 'All Hands' Call, we heard about some key activities and new ideas that could help better frame CEOS' future. We will report on this more thoroughly at SIT TW.

We are very grateful to be working with Kerry Sawyer (NOAA) as the CEO on the CEOS Work Plan and other key external engagement topics. However we encourage Agencies to also continue to engage in current discussions around finding the best mechanism to keep the CEO position active. Given the importance of the role in CEOS, we hope this will soon be.

Despite these difficult times for all, it's reassuring to see how the CEOS community keeps working hard and stepping up to continue delivering quality products and coordinate our activities. But we can't help hoping that we will see you again in person, and even better, welcome you here down under. As we all know especially in CEOS, there is no better way to build genuine, personal relationships and international networks than when talking to each other in the same room, at coffee breaks and over a meal together. So stay well, and let's be optimistic for 2021!

The GEO Community Response to COVID-19

The year 2020 has presented significant global challenges related to the COVID-19 pandemic. The Group on Earth Observations (GEO) community has been adjusting to new ways of working and is supporting the pandemic response and recovery efforts through the use of open Earth observations (EO) data, information and products. EO offers extensive historical and near real-time information that can advance scientific inquiry, inform health decision making, and enhance interventions to address this global health challenge. COVID-19 has offered a unique opportunity to bridge dialogue between the Earth and health science communities. In addition, applications of EO for health have taken on new impetus as this pandemic continues to affect lives and livelihoods of people in every corner of the world.

In April, the GEO Secretariat issued a Call to the GEO Community [http://earthobservations.org/geo_blog_obs.php?id=421] to provide examples of work underway using EO in support of COVID-19 monitoring, response or recovery. There are several initiatives and organizations within the GEO community, for example the GEO Health Community of Practice [<http://www.geohealthcop.org/>], that are using EO to support public health efforts. As we work together to develop and share Earth observation data, information and knowledge for global challenges, GEO encourages such initiatives and aims to bring them together more systematically so that society can benefit from their activities.

The GEO Secretariat received an overwhelming response to the open call, with 41 projects from GEO Members, Participating Organizations and Associates and from across the GEO Work Programme that are using EO to support response and recovery actions. This list is not meant to be exhaustive; however, it is intended as a repository to share information and data from the wider GEO community and is continuously updated. After viewing the projects, please feel free to contact the GEO Secretariat to add your initiative to this growing list here [<http://earthobservations.org/covid19.php>].

Since late March 2020, the GEO Health Community of Practice and the Earth Observations for Health (EO4HEALTH) [<http://www.geohealthcop.org/>] Initiative – chaired by John Haynes (NASA) and Juli Trtanj (NOAA) – have coordinated weekly community teleconferences to leverage expertise across sectors and geographies and share EO data, tools, and knowledge to support COVID-19 responses. Global experts have discussed the direct and indirect impacts of COVID-19 transmission, including air quality, disaster preparedness and management, environmental determinants and seasonality, One Health and

zoonotic disease transmission, and water quality, among other topics.

As a key result of these weekly teleconferences, expanded professional networks have offered small group meetings on specific topics (for example, environmental determinants and seasonality, air and water quality, regional efforts) and event coordination (for example, WMO/WHO Workshop on Climatological, Meteorological, and Environmental Factors in the COVID-19 Pandemic, August 2020). To learn more, please see slide presentations and summary notes from previous teleconferences [<http://www.geohealthcop.org/covid19-telecons>] and participate in upcoming teleconferences here [<http://www.geohealthcop.org/workshops>]. The GEO Health Community of Practice also coordinated the first session of the GEO Virtual Symposium focused on Earth Observations for COVID-19 Response and Recovery [<https://www.earthobservations.org/symposium2020.php?session=1>]. This session – facilitated by John Haynes, Juli Trtanj, Astrid-Christina Koch (European Commission), and Helena Chapman (NASA) – guided participants on a “world tour” to showcase actions taken to leverage global expertise, share resources, and discuss priorities and challenges across geographic regions during the COVID-19 pandemic.

Throughout the months of May and June, GEO launched the Indigenous COVID-19 Hackathon, which was focused on supporting communities to respond to local challenges. From June 5-7, teams joined the GEO Indigenous Alliance, Indigenous leaders and EO experts to produce solutions to crowdsourced challenges developed through a process of co-design. The project involved curating a series of virtual hackathons in various Indigenous and under-represented communities with the intent of co-developing locally relevant EO-based solutions that are culturally appropriate to Indigenous beliefs and conceptions about

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Communications Officer,
GEO Secretariat

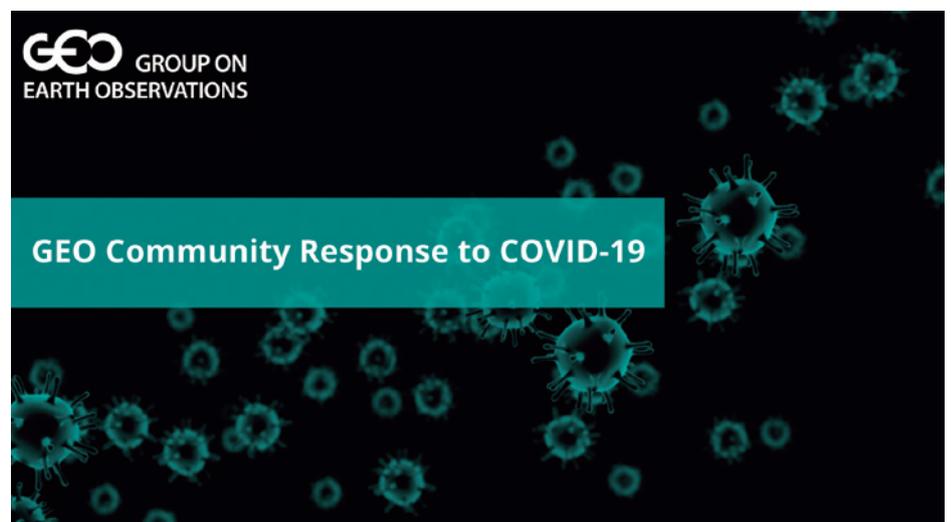


diseases. More information about the Hackathon can be found here [http://www.earthobservations.org/geo_blog_obs.php?id=432].

From Peru to Ghana and all the way to New Zealand, 146 participants signed up from 33 different countries to support Indigenous responses to COVID-19. This incredible mix of knowledge, skills and experience culminated in the production of some very interesting and innovative solutions. GEO is proud to announce the winning teams and their solutions in a blog post here [http://earthobservations.org/geo_blog_obs.php?id=440].

The influence of COVID-19 has had various effects on our activities and GEO, like many other international organizations, has moved towards the use of online meetings to replace annual face-to-face events. The first-ever GEO Virtual Symposium [<http://earthobservations.org/symposium2020.php>] hosted over 1500 registered participants in 14 sessions throughout the week of June 15-19. Sessions covered a number of topics ranging from COVID-19 (as mentioned previously), Ocean and Coastal Monitoring to Resource Mobilization for the GEO Work Programme. All sessions are archived on GEO's YouTube channel and are available for viewing here [https://www.youtube.com/watch?v=VEMAR0x-h7o&list=PLC0cU8-SEsU02YCirH9kc_hgac_dtzyj].

GEO remains committed to providing data and insights for informed decision-making through Earth observations. As the COVID-19 pandemic continues, we will look for new opportunities to support diverse communities, including policy makers around the globe, to enable better decisions to combat and recover from this unprecedented health challenge.



EO Cooperation on COVID-19

Space-based Earth observation is our planetary health monitoring device. It has once again demonstrated its unparalleled capacity and potential during the COVID-19 crisis. Satellite data and imagery has allowed the assessment of the extent and impact of the pandemic and has provided support to communities across the world to manage the crisis. For instance, satellite data showed how the levels of air pollution caused by NO₂ emissions above major cities and industrial areas significantly dropped. This occurred as a consequence of lockdown measures during which traffic was decimated and much of the world's fossil-fuel powered industrial production was put temporarily on hold.

Earth observation contributes to improving human health. In the specific case of viruses, for instance, scientific studies have confirmed that their prevalence and increasing frequency is linked to the accelerating destruction of ecosystems. In this sense, trends observed from space – such as the rate of disappearance of rainforests and wetlands – can help in our assessment of medium and long-term risks and, it can provide data and information to further inform decision making on environmental and agricultural policy. Satellite data is already helping public health officials make predictions of zoonotic diseases such as dengue, malaria, chikungunya, etc. Researchers are studying the possibility that hydroclimatic factors such as temperature, humidity, and precipitation, may influence the spread of COVID-19.

Earth observation also provides indirect indicators for economic activities, for example satellite imagery provided information on grounded planes at airport tarmacs, changes in large-scale agricultural productivity, traffic jams at closed or obstructed borders and ship and oil tankers waiting at sea to deliver their goods onshore. Moreover, Earth observation will play a key role in re-boosting the economy in the aftermath of the current crisis, by enhancing space related industrial and commercial activity as well as by providing general infrastructure.

As the challenges are global by nature, international cooperation in space-based Earth observation as embodied by CEOS is key. The European Space Agency (ESA), National Aeronautics Space Administration (NASA), and Japan Aerospace Exploration Agency (JAXA) are pursuing various activities and projects linked to the COVID-19 pandemic crisis.

As for the European activities, Rapid Action Covid-19 Earth Observation (RACE) is a central element. This initiative is being carried out jointly between ESA and the European Commission. Within RACE, ESA and the European Commission

work together to monitor the impacts of the lockdown and recovery using Copernicus Sentinel data and other Earth Observation capabilities. RACE activities focus on monitoring and analysing environmental parameters such as air and water quality changes, agriculture productivity as well as economic and human activity indicators for the domains of industry, shipping, construction, trade and traffic, over several European locations.

As for worldwide cooperation and in close coordination with RACE in order to make optimal use of the current infrastructure and data streams of the various EO programmes a joint initiative was initiated to expand the capabilities and data exchange between ESA, NASA, and JAXA. The objective is to utilize complementary Earth observation data from its relevant missions, combine resources, technical knowledge and expertise to develop a joint Earth observation data-driven Dashboard to clearly communicate environmental and economic indicators to the general public and decision makers. The cooperation will involve Earth observation data exploitation from relevant missions of the three agencies (e.g. ALOS-2, GOSAT/GOSAT-2, Landsat, OCO-2, Copernicus Sentinels). The coordinated action ensures that the agencies can

Simonetta Cheli,

ESA



Kim Hurst,

NASA

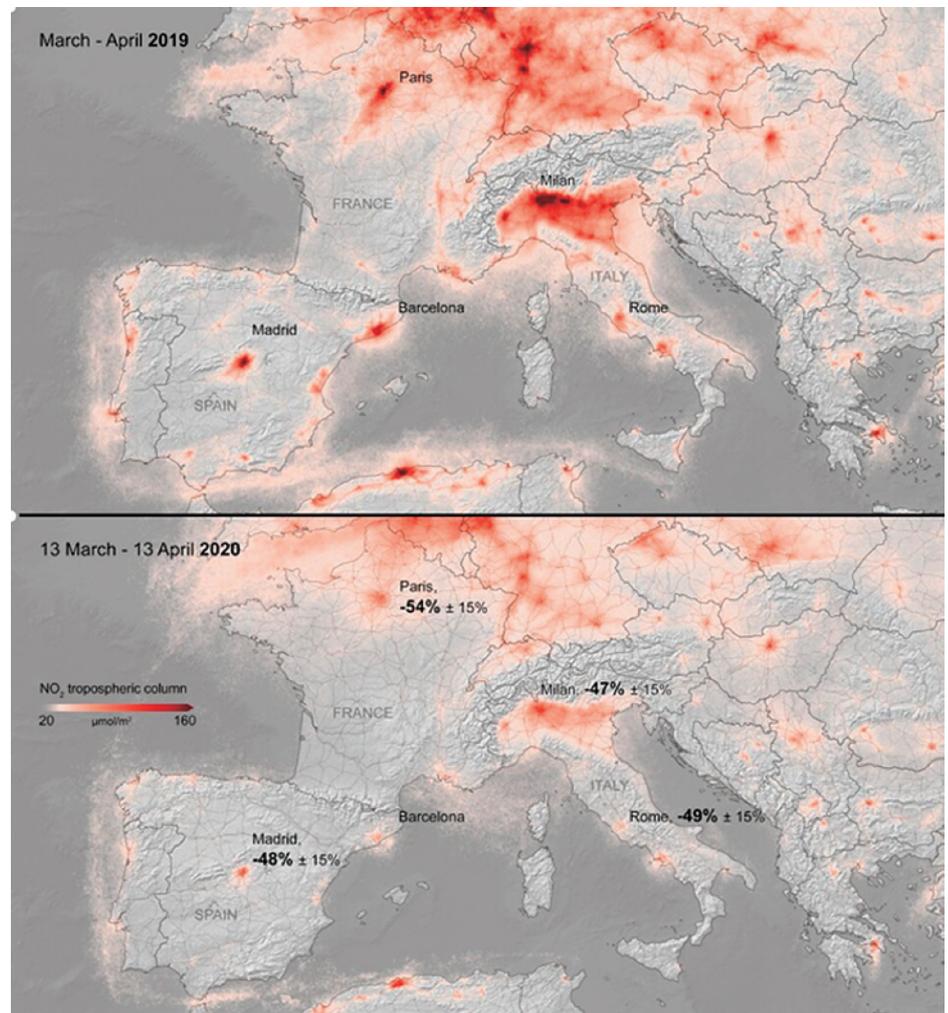


Ko HAMAMOTO,

JAXA



maximise their contributions to the relief efforts and to help support the restart of the economy, sharing relevant Earth observation data, developing joint methodologies and results on topics of common interest and on key selected spotlight areas such as Tokyo, Los Angeles, San Francisco, Dunkerque in France and Gent in Belgium.



Report of 2020 CEOS Chair Initiative and Plan of CEOS Plenary

CEOS Chair Team, ISRO

The unprecedented situation due to Covid-19 is still continuing which forced CEOS Chair Team 2020 to organise the Plenary entirely in virtual mode during October 19-21, 2020. This is the first time that Plenary will not be hosted face-to face however it may bring more opportunity to participate in a larger number as it removes the constraints of travelling. The Plenary will have number of sessions encompassing major CEOS objectives including roadmaps of the various Working Groups and Virtual Constellations. The total time for the daily meetings are being discussed and will be decided based on the convenience of the most of the CEOS agencies. Plenary will have major focus on decisions to be made by Principals to advance and direct the various initiatives underway within the numerous groups which are active to support CEOS objectives.

ISRO as a CEOS Chair for 2020, has taken initiatives in underlining the importance of Actual Constellation of Earth Observation Systems, focus on various themes related to disaster management, renewable energy applications and DataCube for BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) countries. BIMSTEC includes seven countries namely, India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand and Sri Lanka.

Towards Actual Constellation of EO Systems, efforts have been made with discussions on the data acquired from space-based radar scatterometers which have made vital contribution in atmospheric and oceanic research and applications. Presently, scatterometers operating at C or Ku-band provide near real-time observations with internal physical consistency in time and space. However, to generate a long term datasets of the climate quality, the data quality consistency of satellites and sensors are the prerequisite, which can be made through inter-calibration of these systems. Discussions are also underway to develop the standard and metrics of scatterometer measurement calibration, approaches for the wind retrieval and its validation. Deliberations also started on the gaps in the scatterometer observations and requirement by participating CEOS agencies to optimise the constellation required for various meteorological and oceanographic applications ranging from nowcasting to climate applications. The discussions will continue with the involvement of various constituents of CEOS such as Virtual Constellations, WGCV, WGCiimate, as well as International Ocean Vector Winds Science Team. Discussions on global scatterometer constellation including coverage optimisation and data sharing has also been planned in a special session of CGMS Plenary 2020.

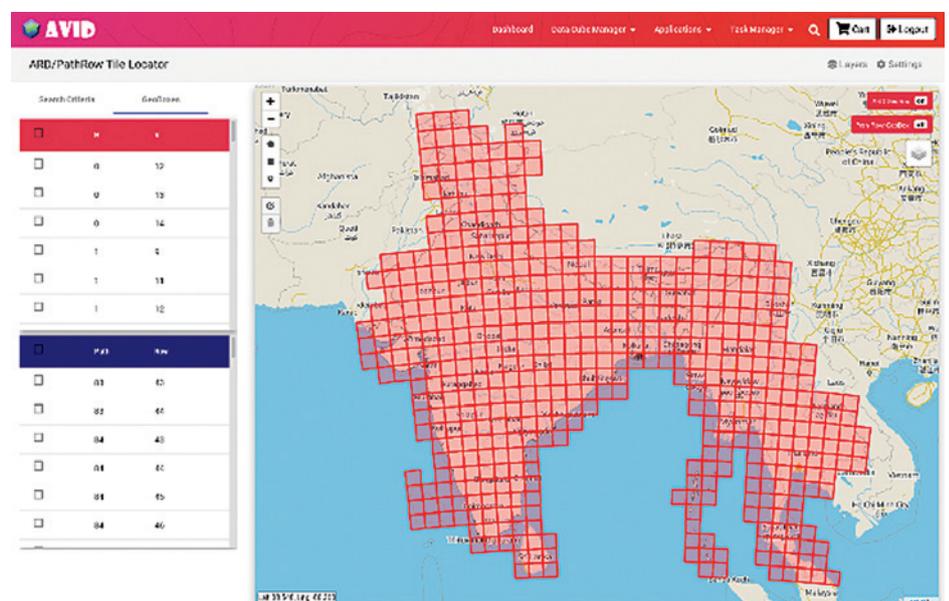
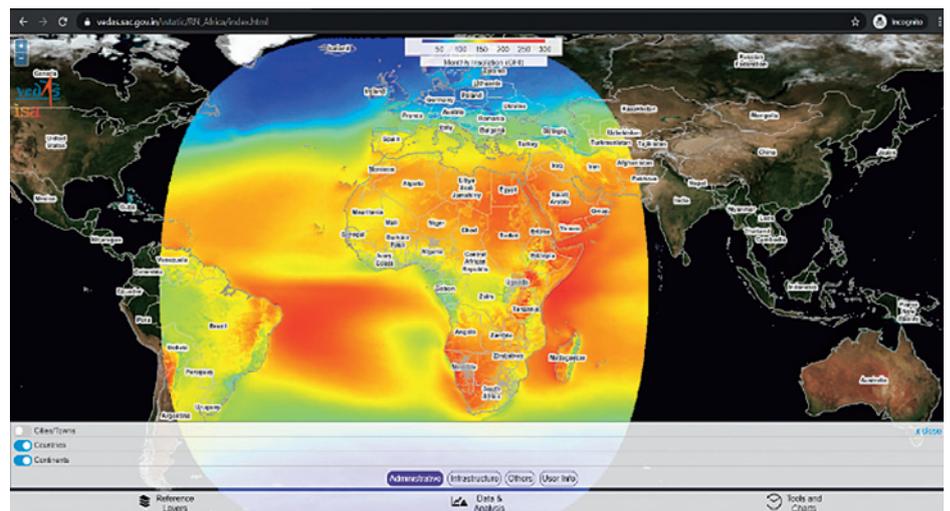
Regional DataCube called as AVID (Analysis and Visualisation for ISRO Datacube), hosting ARD products to facilitate quick visualization,

change detection & on-the-fly application product generation, is being developed for BIMSTEC countries. This is targeted as applications oriented solution for these countries for meeting the critical applications needs towards Sustainable Development Goals (SDGs). AVID targets this challenge by pre-processing and hosting Resourcesat LISS-3 datasets to ARD standards. AVID also targets to host Landsat-8 datasets to boost interoperability and achieve better temporal re-visit. This context presents a number of opportunities for respective countries, including leveraging strong and increased supply of data by combining the capabilities of Landsat-8 and Resourcesat LISS-3 to reach new users, foster data use for decision-making, provide a research oriented platform for users, which allows satellite data processing and information extraction without necessarily building large data storage and compute capabilities. Once operational, AVID will host variety of applications for both Land and Water.

Regarding the new tools for disasters

management, ISRO through Working Group on Disasters, proposed pilots on floods and forest fires.

Renewable Energy (RE) Assessment is one of the important theme focuses on encouraging the use of RE resources. RE such as solar, wind and wave can contribute significantly towards reducing dependency on non-renewable energy. A web-based application has been developed which provides solar energy potential over India and Africa. The geo-visualisation of RE derived from EO systems provides information to users and policy makers in effective utilization of renewable energy potential in order to meet their ever growing energy demand. Furthermore, the Android App is developed which is readily available to everyone interested in installation of solar photovoltaic for electricity generation. WebGIS based RE Application is being developed to provide information on solar energy potential and related parameters for entire world. Datasets from several satellites missions covering different part of earth will be used to disseminate solar energy potential.



Report of CEOS Executive Officer (CEO)

Virtual. Since March 2020, this one word has crept into the title of the majority of our international meetings...well, along with “postponed.” And for good reason... to keep all of us and our loved ones safe during an unprecedented global crisis. In the midst of the crisis and the tragedies, we are expected to continue moving forward with our professions, supporting our Agencies, conducting business as usual, and thinking about how we can develop tools to address the impact COVID-19 is having on the global community. You will find how CEOS Agencies have excelled at developing new tools and products highlighted elsewhere in this Newsletter so I will not address them but I will focus on how the CEOS community is “going virtual.”

From March to October, 25 of our CEOS Meetings, including other meetings where CEOS has a significant role such as Group on Earth Observations (GEO) meetings, have gone virtual and a handful have been postponed. The Working Groups on Disasters and Capacity Building and Data Democracy were the first two meetings to

go virtual and both were complete successes, with more attendees than would have been possible if the meeting had been in-person. The 35th Meeting of the CEOS Strategic Implementation Team was also a huge success for the CEOS community and kudos must be given to the CSIRO and GA Team for their herculean efforts to transition a fully in-person meeting to virtual in just weeks. I know Jono was looking forward to hosting the CEOS community in his hometown and all of us were looking forward to traveling to Hobart (well, most of us). Working Group on Climate, Land Surface Imaging and Atmospheric Composition Virtual Constellations also had very successful and well-attended Virtual meetings. While these meetings were successes, one of the major hurdles of international virtual meetings was crystal clear – the extreme time zone differences and difficulty in finding a convenient time when you have participants from all over the world. Some experimented with different formats to accommodate as many interested participants as possible – meetings planned for one day a week over the course of four weeks or meetings all in one week for just a few hours at a time but scheduled

Kerry Ann Sawyer,

CEO, NOAA



at different times during the day. In addition to the formal meetings, there has been an uptick in the number of telecons and videocons to ensure that projects continue moving forward even though we are grounded at home offices and kitchen tables.

As someone who has spent a significant amount of her professional life engaged in international activities, I know and value and importance of in-person meetings. Not only are they an opportunity to participate directly in the formal presentations and discussions but they allow more personal discussions with colleagues and friends outside of the formal festivities. I look forward to a time when we are together again and can chat over a cup of coffee and a biscuit, smiling as we realize how lucky we are to be together. Until we are together again, please be safe.

Report of Joint CEOS/CGMS Working Group on Climate (JWGClimate)

The Joint CEOS/CGMS Working Group on Climate celebrates its 10th anniversary in 2020. Its major objectives to foster the use of satellite data for climate monitoring and to optimise the planning of future satellite missions and constellations to avoid Earth observation measurement gaps is as important as it was 10 years ago when CEOS established the Working Group.

The COVID-19 crisis caused a massive slow down to some activities of the JWGClimate. The planned publication of the ECV Inventory #3 and the updated gap analysis report and coordinated action plan were postponed to summer/autumn 2020, as contributors to it and the contractors working on it were not fully available during spring 2020. In addition, planned workshops on gap analysis and in the context of greenhouse gases could not be held as planned.

Nevertheless, the JWGClimate conducted its 12th regular meeting as a videoconference from 5-7th of May with 38 participants representing 17 organisations. The major outcomes of the meeting were:

- The Earth Information Day at COP-25/SBSTA-51 is seen to be a very useful mechanism by the UNFCCC for getting messages across from Space Agencies to SBSTA parties and it is likely to be a regular feature of future COP/SBSTA meetings. Unfortunately, it is unlikely that there will be an Earth Information Day this year as the COP-26/SBSTA-53 has been cancelled (due to COVID-19);
- The discussion on the GHG roadmap reviewed

the current status, and discussed the way forward in 3 areas:

1. User engagement, including with UNFCCC and GCOS should move away from the sole focus on the Global Stocktake and engage with users to get more precise information about the routine monitoring needs;
 2. For the operationalisation of the GHG monitoring system, steps need to be defined to a reasonable level of detail for reaching such a system including the involvement of the standing CGMS WGs;
 3. The actual work plan of the GHG Roadmap (Annex C) needs further harmonisation and refinement to include a reasonable level of detail before submitting the roadmap for endorsement by the CEOS and CGMS plenaries.
- JWGClimate will directly support GCOS in drafting space relevant parts of their Status Report planned for 2021. The development of the next GCOS IP for 2022 need further discussion with GCOS on how to accommodate application-specific requirements. Another discussion is planned to take place at the SIT Technical Workshop in September 2020;
 - Use Cases for climate data records were discussed and the JWGClimate is favouring that this area needs to be given more weight, with a long-term action in the CEOS and CGMS work plans. Use cases can be a mechanism for demonstrating the utility of application-specific requirements and they

Jörg Schulz,

EUMETSAT,

Joint Working Group

Climate Chair



Albrecht von Barga,

Joint Working Group

Climate Vice Chair



have the potential for collaborative work with CEOS WGs CapD and Disasters, as well as CGMS capacity building activities.

The 13th meeting of the JWGC is planned to be held between the CEOS Technical Workshop and the Plenary as another virtual meeting.



The Chair of the Joint CEOS-CGMS Working Group Climate (second from right) at the Earth Information Day during COP-25/SBSTA-51 in Madrid, Spain, 3 December 2019.

Report of Systems Engineering Office (SEO)

CEOS forges ahead to make progress on many important activities, despite the impacts of the global COVID pandemic on our community and meeting plans. The CEOS Systems Engineering Office (SEO) is excited about the year ahead as we improve some of our existing tools (e.g. COVE, Open Data Cube) and begin interesting new work. Here is a quick summary of what is coming in 2020.

The COVE (CEOS Visualization Environment) Toolset (ceos-cove.org) continues to be popular for finding satellite mission coverage information from a database of 130 missions. The latest release of COVE includes new features for coverage analysis and multi-mission coincident calculations.

The SEO is collaborating with WGISS to develop a new CEOS Earth Analytics Interoperability Lab.

This cloud-based data exploitation platform will enable prototype testing of interoperable analysis-ready data (ARD) and provide a resource for the initiation of new CEOS activities (e.g. COAST) and new projects within existing CEOS groups (e.g. Working Group on Disasters).

The Open Data Cube (ODC) initiative is continuing to gain global momentum, with 10 country-level operational data cubes and the start of Digital Earth Africa (adding 54 countries). Before the end of 2020, we expect that the ODC will be used by more than 100 countries around the world. In order to enhance collaborative code development, community involvement, and interest, the ODC initiative plans to join the Open Source Geospatial Foundation (OSGeo). With the release of the Landsat archive on the Amazon Cloud, the

Brian Killough,
NASA,
Head of the CEOS SEO



SEO plans to release an ODC "Sandbox" that will enable users to test common algorithms (e.g. spectral products, water detection, land change) anywhere in the world. In an effort to provide Sentinel-1 (S1) radar data to global ODC users, the SEO is partnering with Digital Earth Africa and Sinergise (European contractor) to develop an S1 ARD data pipeline that will provide radar backscatter intensity in a data cube format. Finally, the extensive set of ODC application algorithms continues to grow and improve, and users are learning how Jupyter notebooks and Python programming can yield powerful results.

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

Nancy D. Searby, WGCapD Chair, NASA
Pham Thi Mai Thy, WGCapD Vice-Chair, VNST-VNSC

The overall objective of the CEOS Working Group on Capacity Building and Data Democracy (WGCapD) is to build capacity for the effective use of space-based Earth observation data and to facilitate wider and easier access to those data.

The 9th Annual Meeting of the WGCapD was hosted virtually by NASA on March 10 – 12, 2020. The online meeting venue allowed for broader participation, resulting in 57 participants representing 23 organizations and 19 countries, many of whom were first time attendees. The meeting's theme, "*Identifying Opportunities for Synergies and Innovation*", set the foundation for three dedicated plenary sessions focused respectively on innovation, partnerships, and data democracy; four regionally focused sessions (Americas, Africa, Europe, and Asia); and five collaborative sessions with other CEOS entities (SEO, WGISS, WGDIsasters, AHT-SDG, and LSI-VC). The WGCapD community assessed progress on milestones, advanced collaboration and coordination, and identified opportunities around which to synergize.

WGCapD 2020 achievements to date include:

- WGCapD identified and proposes to accomplish 24 new deliverables in the CEOS 2020 – 2022 Work Plan, and it is continuing work on seven other deliverables that are multi-year efforts. WGCapD is managing a total of 31 deliverables and it is actively tracking complications and changes due to COVID-19.
- WGCapD completed a webinar series on

crop monitoring and assessment using remote sensing and Geographic Information System (GIS) that took place May 19 – June 9, 2020, with nearly 5,000 participants.

- WGCapD completed a webinar series focused on Land Cover Land Use Change (LCLUC) in South and Southeast Asia on April 16 – June 25, 2020.
- The CEOS WGCapD Chair and Vice Chair are collaborating with the GEO Working Group on Capacity Development (GEO WG-CD). The CEOS WGCapD Chair has agreed to serve through 2022 as the Co-Chair of the GEO WG-CD. The collaboration includes being responsible for the subgroup focused on dissemination events and monitoring, evaluation, and impact assessments.
- WGCapD conducted four quarterly coordination calls that focused on specific regions (Africa, Americas, Asia-Oceania, and Europe) to: 1) discuss and coordinate capacity building activities; and 2) engage additional space agencies that are not yet involved in WGCapD.
- WGCapD continues to support the CEOS Training Calendar. (<https://training.ceos.org/>), a global resource of Earth Observation data utilization trainings that continues to grow as additional feeds are ingested.

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- Foundational coordination continues around the establishment of the Space Capacity Development Advisory Board (white paper published in *Space Policy* [<https://www.sciencedirect.com/science/article/pii/S0265964619300761>]).
- WGCapD webpages on the CEOS website (<http://ceos.org/>) have been updated with a renewed focus on resources and e-Learning opportunities.

Dr. Nancy D. Searby (NASA) continues to serve as the WGCapD Chair and Dr. Pham Thy (VAST-VNSC) as the Vice-Chair until October 2021, when Dr. Pham Thy will become the new WGCapD Chair.

Looking ahead, planning discussions have begun for the WGCapD-10 Annual Meeting. However, due to travel restrictions and complications around COVID-19, the date and location are still to be decided.



WGCapD-9 Annual Meeting group photo – virtual edition!

Reports of LSI-VC

The ninth meeting of the CEOS Land Surface Imaging Virtual Constellation (LSI-VC) was held as a series of thematic teleconferences from mid-April to mid-May, covering: CEOS ARD & Standardisation; Industry and CEOS ARD; CARD4L and the Product Family Specifications (PFS); and LSI-GEOGLAM, LSI-Forests & Biomass, and the CEOS ARD Strategy. The focused scope for each call, as well as strong participation, resulted in good discussions and decision making.

We continue with our efforts to engage groups outside CEOS in the CEOS ARD discourse, in particular the commercial sector. We have seen great interest from industry, and there are currently numerous dialogues taking place across several CEOS entities. LSI-VC is working with the SIT Chair Team to ensure CEOS has a coordinated and unified interface to industry on this topic – in line with the CEOS ARD Strategy.

LSI-VC decided to reformat the planned CEOS-Industry ARD Workshop into a series of online webinars, with the first held on July 1. There were 490 registrations, 227 people connected to the live discussion, and more than 580 views of the webinar (live and recorded). The initial webinar was organised as a means to strengthen the dialogue between CEOS and the broader community on the topic of ARD, and to explore what interfaces and cooperative activities are needed to increase data use, choice and flexibility for users. Subsequent webinars will take deeper dives into other aspects of ARD and Future Data Architectures (FDA).

In addition to updating the original three CARD4L PFS (Surface Reflectance, Surface Temperature, Normalised Radar Backscatter) LSI-VC has expanded its portfolio of PFS with the endorsement of the Polarimetric Radar (POL) PFS at LSI-VC-9. CARD4L for SAR is particularly helpful at lowering the barrier of entry for users with SAR data, which is inherently more complex. The LSI-VC Leads thank Takeo Tadono (JAXA), Ake Rosenqvist (JAXA) and the entire CARD4L SAR sub-team for their work on the specification. Good progress is also being made on an Aquatic Reflectance PFS, which is expected to be a timely contribution to the CEOS-COAST initiative. Finally, in response to CEOS feedback, LSI-VC will also seek to add 'Advisory Notes' as a fourth component of the CARD4L Framework to address issues like data policy, data formats, and interoperability.

Landsat Collection 2 (Surface Reflectance and Surface Temperature) has just recently been approved as CARD4L at the 'Threshold' level and Sentinel-2 Level-2A (Surface Reflectance) is expected to follow soon. A number of other assessments are anticipated, including for Synthetic Aperture Radar (JAXA ALOS-2 and Sentinel-1). The LSI-VC Leads would like to thank our WGCV colleagues, in particular Medhavy Thankappan who has served a dual role across both teams, for their assistance with the peer reviews of the CARD4L self-assessments – a critical step in ensuring consistency, accuracy and objectivity in the process.

The LSI-VC Leads would like to extend an open invitation

Adam Lewis,
Geoscience Australia



Steve Labahn,
USGS



Zoltan Szantoi,
EC/JRC



for CEOS Agencies to join the LSI-VC. Should you require information on any of our work, please feel free to get in touch with the LSI-VC Leads or the LSI-VC Secretariat: labahn@usgs.gov; Adam.lewis@ga.gov.au; Zoltan.SZANTOI@ec.europa.eu; matthew@symbioscomms.com

<http://ceos.org/ourwork/virtual-constellations/lsi/>
<http://ceos.org/ard>

CEOS-COAST: A Pathfinder to Address Stakeholder Data, Product and Information Needs in the Coastal Zone

What is COAST and what will it do? The CEOS Coastal Observation and Application Study Team (COAST) will identify how CEOS data can be leveraged and exploited to support coastal zone stakeholders and benefit society. COAST engaged diverse users early on to co-design and co-develop activities bridging CEOS land and aquatic observations, enabling integration of multiple entities and domains, both thematic and technical (e.g., interoperability and analysis ready data for both land and oceans). Focusing on the user-driven value chain, CEOS-COAST identified two initial pilot projects, the first looking at sea impacts to land (flooding and inundation) and then reciprocal land impacts to sea (land cover/use changes and water quality issues, such as coastal eutrophication). The initial focus is environmental data set integration, with a longer-term goal of effective integration with social science data.

Why Now? An increased global focus on coastal zones reflects its importance, both environmentally and socio-economically. Coastal populations reap the benefits of these highly productive ecosystems (e.g., fisheries, port operations) but are threatened by environmental hazards and disasters (e.g., flooding, inundation) as well as anthropogenic impacts to ecosystem health and

function (e.g., eutrophication, hypoxia). Furthermore, the importance of coastal zones and relevance to societal interests and needs was recognized in global initiatives including the U.N. Sustainable Development Goals (SDGs).

Why CEOS? Observing coastal zones is challenging. They are complex, dynamic regions characterized by small-scale, episodic and/or ephemeral events. Satellite observations are mature now with routine and sustained high quality, high resolution measurements, and well-suited to address changes in time and space across the land-sea interface, from local to global scales. New and improved satellite sensors, product development (merged and blended products) and increasingly sophisticated data processing, discovery and distribution approaches (e.g., cloud-based, machine learning) make CEOS the unique entity to focus coordinated space agency efforts on COAST pilot projects.

Who is in COAST and what will be the benefits? Representation is from all CEOS Working Groups, multiple Virtual Constellations (terrestrial and aquatic), agencies and associate partners, and the Group on Earth Observations (GEO) Blue Planet and AquaWatch Initiatives comprise the COAST Study Team. Broadening utilization of Earth Observations within coastal zones for

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greater societal benefits enables CEOS to engage external stakeholders such as GEO, IOC/GOOS, UN Environment and high visibility activities such as the UN Decade of Ocean Science for Sustainable Development (2021-2030) to provide effective management solutions to address compelling challenges such as cross-parameter, trans-boundary and trans-disciplinary data integration. A high priority outcome is to create, demonstrate and transfer satellite applications and required tools and technical infrastructure across the globe, particularly for developing nations, which minimize disaster impact, support coastal sustainable development and maintain healthy ecosystems while enhancing the Blue Economy.

To support the CEOS-COAST pilot project activities, simply contact the authors via email to get involved!

Report of the CEOS Precipitation – Virtual Constellation (P-VC)

The Precipitation Virtual Constellation (P-VC) exists to sustain and enhance a systematic capability to observe and measure global precipitation: knowing when, where, and how precipitation falls is essential for scientific research and for societal impact factors. The P-VC was established in 2005 during the lifetime of the NASA/JAXA Tropical Rainfall Measuring Mission (TRMM, 1997-2015) and prior to the launch in 2014 of the Global Precipitation Measurement (GPM) mission, also a joint NASA-JAXA satellite. TRMM and GPM are the only satellites dedicated to the observations of precipitation from space and have formed a focal point for precipitation research. The P-VC welcomes all interested parties of CEOS with a focus on members from agencies, such as NASA, JAXA, NOAA, EUMETSAT and ISRO, that have or are planning to have satellite sensors capable of measuring any form of precipitation.

Satellite observations of rain and snow are central to understanding the distribution and characteristics of precipitation, its role in the hydrological/water cycle, and its impact on the climate system. Accurate and timely knowledge of global precipitation is needed for improving predictive skills of high-impact weather events such as hurricanes, floods, droughts, and landslides, as well as the management of freshwater resources. The spatial and temporal variability of precipitation necessitates the combination of data from multiple satellites to ensure representative sampling across the range of scales (spatially and temporally) that is required by worldwide research and operational user communities.

TRMM and GPM are extremely capable of providing detailed observations of precipitation. Their sensors include a combination of a passive radiometer (NASA contribution) and an active radar (JAXA contribution). This allows profiles of precipitation characteristics from the radars combined with a global mapping capability of surface precipitation from the radiometers (see Figure 1). Furthermore, the radar+radiometer configuration allows the careful calibration and validation of GPM estimates and a mechanism for transferring this knowledge to other radiometers in a constellation of sensors contributed by international partners. NASA and JAXA currently provide freely-available global precipitation estimates (<https://gpm.nasa.gov/> and <https://sharaku.eorc.jaxa.jp/GSMaP/index.htm>) using 12 partner satellites: this is a real-implementation of the P-VC as an established constellation of satellites through partnerships to obtain global near real-time estimates of precipitation.

The P-VC's strategic objectives over the next work plan time frame are centered on three themes:

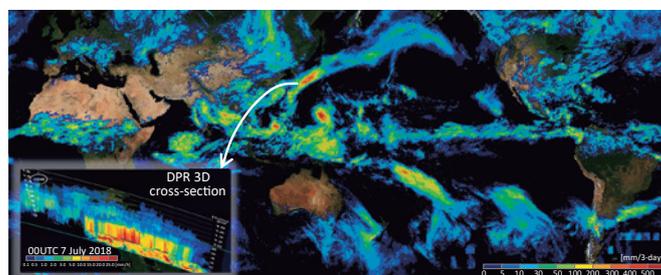
- Generation of status reports on the current and future

Gail Skofronick-Jackson, P-VC Co-Lead (end of term), NASA
Chris Kidd, P-VC Co-Lead, NASA, and **Riko Oki**, Co-Lead, JAXA

precipitation constellation in collaboration GEWEX and the CGMS IPWG;

- Enhancing current precipitation retrievals schemes to improve accuracy of precipitation estimates in marginal situations;
- Preparation for the next generation of precipitation capable sensors, such as the EUMETSAT EPS-SG, EarthCARE and AMSR3

The CEOS P-VC is currently engaging with the CGMS/IPWG to help contribute to the advancement of precipitation observations. This includes the organization of many meetings and sessions each year dedicated to precipitation science at international and domestic conferences which promotes P-VC related work and encourages cross-pollination of our activities and directions.



GSMaP 3-day accumulated precipitation amount on July 5-7th 2018, and the GPM/DPR cross-section of the precipitation around Japan at 00UTC, July 7th 2018.

Meeting Calendar

As of August 2020

| Activities | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---------|----------|-------------------------------------|--|----------------------------------|---|----------------------------------|---|---------------------------------------|---|---|----------|
| CEOS Plenary and CEOS SIT (Strategic Implementation Team) | | | ▲ 24-26 SIT-35 Virtual | | | | | | ▲ 8-17 SIT-TWS Virtual | △ 19-23 34th CEOS Plenary Virtual (TBD) | | |
| CEOS WGs, VCs, AHTs. Others | | | ▲ 9-11 WGDisasters-13 Virtual | ▲ 10-12 WGCapD-9 Virtual | ▲ 21-22 WGISS-49 Virtual | ▲ 22-26 WGCV-46 Virtual | ▲ 8-12 AC-VC Virtual | ▲ 1 CEOS ARD Webinar Virtual | ▲ 14-18 WGISS-50 Virtual | △ TBD LSI-VC-10 Virtual | | |
| GEO related Activities (Group on Earth Observations) | | | ▲ 27-28 LSI-VC-9 Virtual | ▲ 19-20 GEO ExCom-51 Geneva, Switzerland | ▲ 5-7 WGClimate-12 Virtual | ▲ 11-12 GEO PB-17 Virtual | ▲ 7-8 GEO ExCom-52 Virtual | ▲ 14-17 WGCV-47 Virtual | ▲ 1-3 GEO PB-18 Virtual | ▲ 7-11 AmeriGEO Week Virtual | △ TBD Extraordinary ExCom Virtual | |
| Others | | | | | | ▲ 15-19 GEO Virtual Symposium Virtual | | ▲ 25-26 CGMS-48 Plenary Session Virtual | ▲ 9/26-10/2 IGARSS 2020 Virtual | ▲ 12-14 IAC 2020 Virtual | | |

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

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