

CEOS NEWSLETTER

The Committee on Earth Observation Satellites

50th Anniversary Edition

March 2018
No. 50

History of CEOS Newsletter

CEOS was formally established in 1984 as a result of G7 Summit meetings. CEOS Plenary meets on an annual basis with Principals of space agencies and international organizations which are conducting Earth observation activities and undertakes coordination and decisions. CEOS has working groups to address common technical issues; the Working Group on Data (WGD) was established in 1984 (which later evolved to the Working Group on Information Systems and Services (WGISS)) and the Working Group on Calibration/Validation (WGCV) in 1991. The standing CEOS Secretariat was established in 1992 and ESA was responsible for issuing the CEOS Dossier (now known as the CEOS EO Handbook and MIM Database), NASA for the CEOS Annual Report and STA/NASDA for the CEOS Newsletter.

The CEOS Newsletter has been issued to provide latest status and major activities of CEOS to Earth observation communities, policy makers and other stakeholders. Contents of the Newsletter are coordinated within the CEOS Secretariat. The first CEOS Newsletter was issued in summer 1993 and issued twice a year.

CEOS major activities introduced by the Newsletter are as follows;

- The Climate Change Summit meeting was held in 1992 and CEOS discussed data policy to effectively use satellite data for climate change research - which resulted in adoption of CEOS Data Exchange Principles by CEOS Plenary in 1992.
- The CEOS High Level Meeting was held in March 1996 in Seattle to launch the Integrated Global Observing Strategy (IGOS). The 1996 CEOS Plenary was held in Australia and the Strategic Implementation Team (SIT) to promote IGOS was established.
- The first SIT meeting was held in February 1997. The Analysis Group made gap analysis on 6 themes of IGOS: Global Ocean Data Assimilation Experiment, Upper Air Measurements, Long-Term Continuity of Ozone Measurements, Ocean Biology, Global Observation of Forest Cover, Disaster Management Support, was reported to the Plenary.
- 1997 CEOS Plenary discussed the IGOS

Partnership (IGOS-P) and the establishment of the IGOS Partnership to promote discussion with space segment of G3OS (GCOS, GOOS, GTOS) by G3OS and its sponsoring international organizations (FAO, ICSU, UNESCO-IOC, WMO, IGBP, IGFA, UNEP, WCRP) and CEOS was agreed. The first IGOS-P meeting was held in June 1998 in Paris and the activities continued till IGOS-P15 in May 2008.

- CEOS actively participated in the 2002 World Summit on Sustainable Development (WSSD) which was held 10 years after the 1992 Rio Earth Summit. CEOS carried out water resource management, capacity building, global mapping projects as follow-up to the WSSD.
- The first Earth Observation Summit was held in July 2003 in Washington DC and the second Summit in April 2004 in Tokyo with participation by Prime Minister Koizumi. The third Earth Observation Summit was held in February 2005 in Brussels and approved the establishment of the intergovernmental Group on Earth Observation (GEO) and the 10-year Implementation Plan of the Global Earth Observation System of Systems (GEOSS). CEOS became the space arm of GEO to promote the space component of GEOSS.
- CEOS's IGOS/IGOS-P activities contributed to the establishment of GEO/GEOSS. Studies on transition of IGOS Themes were made between CEOS and GEO and the CEOS Virtual Constellations for GEO evolved; Land-Surface Imaging, Precipitation, Ocean

Yukio Haruyama, Chu Ishida,
JAXA Team for CEOS



Surface Topography, Ocean Surface Vector Winds, Ocean Color Radiometry, Sea Surface Temperature, and Atmospheric Composition.

- In addition to the Virtual Constellations, CEOS contributes to GEO-SBAs, Flagships and Initiatives. CEOS coordinate global observation strategies for the Global Forest Observations Initiative (GFOI), Global Agriculture Monitoring (GEOGLAM) and disasters. CEOS actively participates in GEO Plenary and GEO Program Board. SIT Chair and CEOS Executive Officer (CEO) are supporting CEOS-GEO activities.
- In 2015, three major international conferences were held; the World Conference on Disaster Risk Reduction (WCDRR) in Japan, The UN sustainable Development Goals (SDGs) Summit in NY, the Paris Climate Conference (COP-21). The GEO Ministerial meeting in Mexico approved the second GEO/GEOSS 10-year Implementation Plan. These global agendas (WCDRR, COP-21, SDGs) are of high priority within CEOS and addressed actively not only by the Plenary and SIT, but also by the Working Group on Disasters (WGDisasters), the Working Group on Climate (WGClimat) and the Working Group on Capacity Building and Data Democracy (WGCapD).

CEOS Newsletters are distributed by mail (400 copies in Japan and 500 copies abroad) and by email (50 copies). Thanks to the CEOS Systems Engineering Office (SEO) supported by NASA, the Newsletter is uploaded to the CEOS Home Page and can be downloaded by users (<http://ceos.org/about-ceos/publications-2/>).

Milestones - Path of CEOS Newsletter



CEOS was created in 1984 as a result of the International Summit of Industrialized Nations and serves as the international coordination of space-related Earth activities.

Policy and technical issues of concern to the whole spectrum of Earth observations and data received from such an encourages complementarity and cost space-borne Earth observing system nation in mission planning, promote discriminatory data access, setting of data, and development of compatible uses, and applications. The user can directly from this international committee. Members are those national and instrument agencies with funding and priorities for a satellite Earth observation system or in the later stages of space-borne Earth observing system. CEOS members include CSIRO (Australia), ESA (Canada), CAST (China), ESA (France), CNES (France), DLR (Germany), ASI (Italy), STN (Japan), ROSCOSMOS (Russia), SNSB (Sweden), BNSC (United States), NOAA (United States). Govern a space-based Earth observation program stages of development or with a significant activity that supports CEOS mission goals may be invited to participate as observers are BOST (Belgium), CCR (China), CEC (Commission of the European Communities), and NSC (New Zealand), and NSC (New Zealand), and NSC (New Zealand).

Affiliate status for other international organizations and for international governmental bodies was approved in November 1990. The intention was to interact with these organizations and to take of scientific and other user requirements and instrument providers. To date, the Observing System, Global Ocean Observing System, Global Ocean Observing System of Scientific Units at Geophysical Research Program (GEO), Oceanographic Commission, U.N. Programme, World Climate Research Programme, World Meteorological Organization have all been invited to participate in CEOS group meetings.

CEOS Plenary meets at least once a year. The Plenary has been a key element in the coordination, make consensus decisions can be carried out across agency group direction in the technical working group for three times a year. There are CEOS

look imagery, as well as raw data sets or derived data sets.

The Auxiliary Data Subgroup, formed in October 1992, is focusing on auxiliary (i.e., non-satellite) data sets, strengthening interaction with CEOS affiliates in special fields of global change research.

Another important activity of the Working Group on Data is coordination with the International Geosphere-Biosphere Programme on the Global Land HAN AVHRR Data Set Project, being conducted by the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, the U.S. Geological Survey, and the European Space Agency, with participation by the Commonwealth Scientific and Industrial Research Organization of Australia.

The international cooperation and coordination that has taken place at and through CEOS has been of benefit not only to those space Earth observation agencies that comprise CEOS, but also to the global community that uses satellite data. One item that has been well received in the CEOS dossier of all CEOS agency space and ground-segment assets, with cross-references to global change research requirements for respective satellite Earth observations. One affiliate member described the volume as the single most valuable document he has ever read for

satellite data. CEOS members have agreed to issue an annual yearbook, i.e., an updated Executive Summary, of the space-segment and ground-segment dossier. The first of these yearbooks was issued and distributed to delegations at the U.N. Conference on Environment and Development in June 1992.

In summary, CEOS is a consultative organization—striving for information exchange, coordination, and consensus on policy issues. Findings and recommendations of CEOS are acted upon at the discretion of each member. CEOS deliberations and recommendations help members to come to agreement on issues and to ensure appropriate coordination among national programs and across the spectrum of space-based Earth observation missions and data management activities.

NL 1 (1993): CEOS WGs



CEOS Holds Meeting on Integrated Global Observing Strategy

Lisa R. Shaffer

Mission to Planet Earth Division, Office of External Relations, NASA HQ



On March 27-29, 1996, CEOS Members, Affiliates, and Observers met in Seattle, Washington, hosted by NOAA and NASA, to discuss the desirability, feasibility, and potential role for CEOS in an integrated global observing strategy (IGOS). This meeting fulfilled CEOS Plenary action item 9-19 from the Montreal plenary in 1985. An organizing committee, comprising NOAA, NASA, STN, ASI, ESA, EUMETSAT, GEOS, and CSIRO, planned the meeting, which was chaired by CEOS Chair Dr. Brian Esbensen of CSIRO. All CEOS participating agencies were invited to attend and to provide input to the discussion. Papers were circulated in advance to all CEOS participating agencies to solicit their input regardless of their actual attendance in Seattle.

The meeting focused on the space component of a possible IGOS, while noting that a fully integrated strategy would necessarily include provisions for incorporating observations made by non-space-based instrumentation, and would involve organizations beyond the scope of CEOS. The interest in exploring the elements of a long-term, integrated strategy was sparked by the general realization that many research and operational endeavors can make effective use of Earth observations from space and non-space sources, but there exists no strategic framework within which observational requirements can be presented and addressed.

The consideration of an IGOS addresses the need for much closer coordination and integration of the observing and analysis programs in place and planned for the next decade. Better coordination is required within the space-based and non-space-based components, as well as between space-based and non-space-based components. The term "strategy" implies that CEOS and other organizations could make more effective use of existing and future instrumentation by developing and evolving an international strategy to avoid unnecessary redundancies, fill data gaps, and integrate research results. It also implies the integration of both operational and research systems for studying the Earth and managing its resources, while responding to progress in science and in observation.

The meeting considered several major topics pertaining to a viable integrated global observing strategy, including:

- the need for an IGOS
- defining characteristics of an IGOS
- implementation mechanisms and the role of CEOS
- next steps

Many social, economic, and environmental issues, such as sustainable development and environmental security, could benefit from development of an IGOS. Participants agreed that the existing and planned space-based systems could fulfill user needs more effectively if agencies achieved better coordination and cooperation. It is for this purpose that participants generally supported the concept of an IGOS. The strategy should integrate planning among agencies leading to cost-effective space-based systems, inter-calibration, compatibility of data delivery systems, and better links between users and providers. Participants noted that the report of the CEOS Task Force on Planning and Analysis will be instrumental in assessing how well existing and planned systems meet user requirements.

The group agreed on several recommendations. In preparation for the November 1996 CEOS Plenary in Canberra, Australia, the group recommended:

- 1. The outcome of the Seattle Ad Hoc CEOS Meeting on an Integrated Global Observing Strategy should be fully discussed at the 1996 CEOS Plenary in Canberra.
- 2. The CEOS Chairman and Secretariat undertake a review of the CEOS Terms of Reference with regard to: (1) the status of Affiliates within CEOS; and (2) any changes necessary to accommodate an IGOS, and report as appropriate at the Plenary.

(to be continued on page 7)

NL 7 (1996): IGOS



CEOS and WSSD 2002

Dr. Josef Aschbacher, ESA
Ms. Linda Moodie, NOAA
Mr. Naomasa Murakoshi, NASDA

As one of the major themes for its Chairmanship of CEOS during 2002, CEOS has co-ordinated the promotion of CEOS with international bodies and conventions – building on the efforts of the previous Chair, MEXT/NASDA, and their achievements in developing links with UNFCCC and IPCC. Our Observers have focused this year on visibility efforts for the World Summit on Sustainable Development (WSSD 2002) in Johannesburg will bring together tens of thousands of participants, including heads of State and Government, national delegates and leaders from non-governmental organizations (NGOs), businesses and other major groups to focus the world's attention and direct action toward solving difficult challenges, including improving people's lives and saving our natural resources in a world that is growing in population, with ever-increasing demands for food, water, shelter, sanitation, energy, health services and economic security.

The official website for the summit (<http://www.johannesburgsummit.org>) explains that "At the 1992 Earth Summit in Rio, the international community adopted Agenda 21, an unprecedented global plan of action for sustainable development. But the best strategies are only as good as their implementation. Ten years later, the Johannesburg Summit presents an exciting opportunity for today's leaders to adopt concrete steps and identify quantifiable targets for better implementing Agenda 21." The Summit will take place from 26 August to 4 September 2002.

Thanks to the enthusiastic efforts of a number of CEOS colleagues throughout the preparatory process (including NOAA, NASDA, and ESA), particularly in preparing statements and side events for the main Preparatory Committee (PrepCom) meetings – the Chairman's report contains a number of high profile references to the benefits of global Earth observations, and their value in providing information in support of sustainable development (refer to the panel on page 2 for details).

ESA has arranged for an exhibition space for CEOS at WSSD 2002 and will also have the opportunity to showcase many of the new CEOS publications which have been developed during 2002, including:

- The CEOS brochure developed specifically for WSSD 2002
- The CEOS Handbook and CD-ROM
- The 2002 CEOS Annual Report
- The CEOS Newsletter
- As well as materials promoting the IGOS Partnership.

A "WSSD follow up event" is planned by CEOS for Nov (the day before the CEOS Plenary), and it is planned to include officials involved in the WSSD process. All CEOS Plenary participants are actively encouraged to participate and in the way ahead for efforts to promote Earth observation in the implementation plan which will arise from WSSD. It is provided on the CEOS web site (<http://www.ceos.org>) become available.



The Second Earth Observation Summit held in A for Adoption of the Framework Document for the

Mr. Hiroshi Fukui, Director, Office of Earth and Environmental Science, Ministry of Education, Culture, Sports, Science

The Second Earth Observation Summit was held in Tokyo on April 25th of this year with the attendance of Japanese Prime Minister Junichiro Koizumi. The success of this Summit marks a crucial step in the development of the 10-Year Implementation Plan for Earth Observations.

The Ad Hoc Group on Earth Observations (GEO) was established by the commitment from the Washington Declaration of the First Earth Observation Summit on July 31st, 2003) to undertake the extremely important task of developing a 10-Year Implementation Plan for Earth Observations. Based on the Declaration, and the Terms of Reference of GEO, countries and international organizations – including CEOS – are discussing how to establish a comprehensive, co-ordinated, and sustained Global Earth Observation System of Systems (GEOSS) in the framework of GEO.

Since the First Summit in Washington DC, four GEO meetings have been held. On April 25th, 2004, 350 ministers and high-ranking officials from 43 countries and the European Commission, and 25 organizations – including CEOS – met for the Second Earth Observation Summit in Tokyo, Japan. The Commitment and the Framework Document for a 10-Year Implementation Plan were adopted at the Summit, as major achievements.

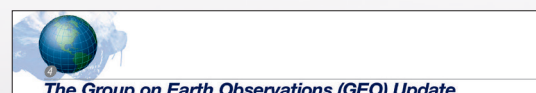
The Framework Document states at the outset that understanding the Earth system – its weather, climate, oceans,



Photo of the participants of Earth Observation Summit II (Center: Japanese Prime Minister Junichiro Koizumi)

NL 19 (2002): WSSD

NL 23 (2004): EO Summit in Tokyo



The Group on Earth Observations (GEO) Update

Ms. Helen M. Wood
NOAA, GEO Secretariat Director

In February 2005, the ad hoc international Group on Earth Observations (GEO) presented ministers at the third Earth Observation Summit the Global Earth Observation System of Systems (GEOSS) 10-year Implementation Plan, now endorsed by nearly 60 countries and the European Commission. The plan summarizes the steps to be taken over the next decade by a growing community of nations and intergovernmental, international and regional organizations, to put in place the GEOSS. The ministers also established the intergovernmental Group on Earth Observations (no longer "ad hoc") to take those steps necessary to implement GEOSS. Specific attention was given to the importance of consultation with intergovernmental and other sponsors of component systems of GEOSS, and to seeking the assistance of relevant international and regional organizations (e.g., CEOS) in the work of GEO.



First session of the Group on Earth Observations (GEO-1) Geneva, 3 May 2005

The first formal meeting of the "new" GEO (GEO-1), was held at the headquarters of the World Meteorological Organization (WMO), Geneva, Switzerland, on May 3-4, 2005. The primary focus was GEO governance and the formation of the GEO Executive Committee. A 12-member Executive Committee was approved, with the following regional allocation of members: Africa (Morocco, Republic of South Africa), Americas (Brazil, Honduras, United States), Asia and Oceania (Japan, China, Thailand), CS (Russia), and Europe/European Commission, Germany, Italy). Four co-chairs were selected, two representing developed countries (the European Commission and the United States), and two representing developing countries (China and the Republic of South Africa).

In conjunction with GEO-1, the new GEO Secretariat Office, located in the headquarters building of the World Meteorological Organization in Geneva, was officially opened.

The GEO Executive Committee convened its first meeting in Geneva, to discuss the implementation of the GEO-1 plan, and its second meeting on 1-4 June at the WMO.

Headquarters in Geneva, Switzerland. At this meeting, the GEO Executive Committee approved a draft proposed structure for GEO subsidiary bodies (e.g., committees) based on the decisions and guidance provided by GEO-1.

At the 2nd Executive Committee meeting, Professor José Achache, of French nationality, was selected to fill the post of GEO Secretariat Director. Achache has extensive experience with systems and applications comprising both in situ and remote sensing observations. In 1996, he joined the French Geological Survey (BRGM) as deputy director of the Research Division and the following year became its director. In 1999, he was named advisor to the President of the French Space Agency (CNES) and in 2000, was appointed to the post of deputy director general for Ocean.

In 2002 he was appointed Director of Earth Observation for the European Space Agency (ESA). Achache is currently Professor at the Institut de Physique du Globe de Paris. He will take up his duties in September 2005, succeeding Helen Wood (USNOAA), who served as Director for the ad hoc GEO Secretariat from its inception in 2003.

For more information contact:

Group on Earth Observations (GEO)
Case postale 2300
CH - 1211 Geneva 2
Switzerland

Tel: +41 22 730 8505
Fax: +41 22 730 8520
E-mail: secretariat@geossec.org
<http://earthobservations.org>

4 June at the WMO

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NL 25 (2005): GEO

Messages from CEOS Agencies - Past, Current, and Future

ASI

The many wonders of our Earth have a different and charming aspect from satellite perspective. Thanks to the Earth Observation technologies, we can see the extraordinary patterns of lands, oceans, sands and glaciers. Fragmented with brilliant and unnatural colors, they resemble Cubist landscapes conjured from the brushes of a Braque or Picasso. These data also represent the unmatched mines of information. For a long time now, space has been a super infrastructure pervasive and without borders by definition, and an approach to space as a "system of systems" is therefore necessary, based on integration between various elements, technologies and services, both "terrestrial" and those of the space programs. In this context, the services and applications arising from Earth Observation are destined to grow, creating a formidable new value chain capable of reaching all users (institutional, commercial and private citizens).

The Italian COSMO-SkyMed constellation represents truly cutting-edge technology in radar observation application. Funded by the Italian Space Agency (ASI) in partnership with the Ministry of Defence, COSMO-SkyMed is built and run by the Italian space industry – namely, Leonardo and its joint ventures Thales Alenia Space, Telespazio and e-Geos. It is the first system of its kind designed for both civil and military use. Its many applications include: land and sea security; prevention and management of natural or man-made disasters; providing data on climate change, coastal monitoring, polar ice and agricultural and forestry resources; and urban control of buildings. It also guarantees the State Administration a high-performance system for needs of crisis management, security, defence and disaster monitoring. Thanks to a successful "dual" development formula, the CoSMo-SkyMed programme, of which the second

Roberto Battiston,

President



generation is under construction, the role played by Italy in European programs is consolidated. For example, the Copernicus program, of which Italy is one of the national "contributing missions". SIASGE is based on the combined use of CoSMo-SkyMed and the Argentine SAoCoM, for managing emergencies. MuSIS envisages interconnection between CoS- Mo-SkyMed and the French military system CSo (Helios follow-on). ASI's PRISMA hy-perspectral mission, planned to be launched in 2018, is equipped with a combination of exclusive spatial and spectral resolution.

CSIRO

CSIRO has been a member of CEOS since inception. Together with our fellow CEOS member agencies Geoscience Australia and the Bureau of Meteorology, we have benefited much from our participation in CEOS. We have served CEOS as Chair twice (1996 and 2016), and currently act as the vice-Chair of the CEOS Strategic Implementation Team (SIT).

Australia as a whole, has also benefitted from the direct support provided by fellow agencies in the CEOS family, such as in the development

and launch of our most recent satellite in the early 2000's, called "FedSAT", and also from CEOS' focus around open data sharing principles and information on upcoming EO missions by our fellow agencies. The use of the free and open EO data that we receive from fellow space agencies, underpins over \$5 Bn of Australia's economy in the form of various national government programs, geospatial industry activities and associated jobs.

In recent times, we have taken up increased leadership roles associated perhaps less to the

Alex Held, *CEOS Principal for CSIRO*

provision of EO data and spacecraft development, but more on down-stream services and activities, including satellite cal/val, which further help CEOS promote the use of the EO data we produce from over 130 EO satellites. Australia therefore co-leads key CEOS working groups, as well as new initiatives such as the "Future Data Architectures" study team, and the current ad-hoc team on Sustainable Development Goals. We look forward to a long and mutually beneficial ongoing relationship with CEOS, as we now establish a new Australian space agency...."

EUMETSAT

At 50, CEOS may have reached the age of wisdom. Indeed, more than ever CEOS looks like a true community, covering all areas of Earth observation from space, with virtual constellations integrating the assets of its members in all areas. CEOS' close links with GEO and the Sendai Framework support their strategies, contributing to the 17 Sustainable Development Goals through a number of flagship initiatives. Since 2013, CEOS has partnered with CGMS on the coordination of the implementation of global architecture for monitoring climate from space, that is increasingly relevant to policy making with the entry into force of the Paris Agreement.

CEOS is now a mature organisation able to deliver a swift collective response to new challenges emerging on our unique planet, taking advantage of advances in science and technology.

We need to acknowledge that the next 50 years are largely unpredictable. We operate in a rapidly changing, high-tech environment and, at the same time, contribute to changes. In the next decade,

CEOS, together with CGMS, will need to define, reply and continuously improve an architecture for monitoring greenhouse gases from a variety of orbits, and build the science base for using it to monitor anthropogenic emissions as well as natural fluxes, building on other measurements available from space, in particular on land use, forestry and natural sinks, sources and fluxes across the Earth systems. This is one very attractive challenge that requires a structured, science-based and responsible approach, with stronger links with the modelling and in-situ observation communities. EUMETSAT is ready to undertake its own share of this effort with its own missions and within Copernicus, in cooperation with ESA and the European Commission, but will also continue to promote within the indispensable global partnership CEOS and CGMS.

In the current decade, constellations of low Earth observation satellites will be deployed by the private sector and connected to data platforms, and this cannot be ignored by CEOS, although the long-term sustainability of these systems in relation to business models cannot be taken for granted, based on past

Alain Ratier,

*Director General
2014 CEOS Chair*



experience. In this rapidly evolving and somewhat uncertain context, CEOS and its assets must be an element of stability and resilience in the next decade to prepare for the convergence towards a possibly very different Earth observation landscape in a longer term future, based on a thorough and objective assessment of the value of more versus better observations to different applications. The deployment of many, including large constellations of shorter lived low Earth orbit satellites, may also require a reassessment of how frequencies, orbits and space situational awareness information are shared and managed. These matters go far beyond the remit of CEOS, but will inevitably impact its coordination mission and the operations of its in-orbit assets.

In short, the next 50 years of CEOS will start with two exciting and challenging decades.

ESA

The world has significantly changed in the last 30 years; new instruments and approaches are urgently needed to tackle the emerging major societal, political, technological and economic global challenges such as climate change and growing population. In parallel, observing systems and information technology have considerably improved, all creating conditions to provide better information to decision-makers.

For the coming decades, major stakeholders have to adopt coordinated approaches to adapt to this changing world; this has implications also on the way public and commercial EO and geospatial actors will evolve in a concerted and more user-oriented approach. Partnership with entities that

are closer to the user communities such as the UN Agencies, the NGOs, the Development Banks are necessary in order to create opportunities for EO and to optimize our efforts. New paradigms of relationship between public and commercial sectors (both EO & IT) based on complementarities of capabilities and capacities are needed.

Since 1984, ESA has invested a significant amount of resources to support this adaptation, contributing to all major CEOS activities, leading several Working Groups, Virtual Constellations and Ad Hoc teams, ensuring in several occasions the chairmanship (both CEOS and SIT), and the role of CEOS Executive Officer. Besides, ESA has the responsibility to represent several

Ivan Petiteville,
2016-2017 CEOS SIT Team



European space agencies in CEOS. Two of the main challenges ahead of CEOS are a) to consider how best to support our international commitments with the capacity available within CEOS and agencies, and b) to convince the main stakeholders not familiar yet with EO on the future benefits they could draw from the regular use of EO-based information.

ISRO

The Indian Space Programme is driven by the vision of "Harnessing space technology for national development". Through an application-centric space programme, India has established a strong set of operational applications of space systems to meet the fundamental priorities of the Government, improving the quality of life of citizens and enabling societal transformation.

India is having a unique mechanism of institutionalization known as National Natural Resources Management System (NNRMS) which started way back in 1983. CEOS and NNRMS started in the same time frame contributing globally and nationally. In fact, nine themes of NNRMS are similar to GEOSS nine Societal Benefit Areas. ISRO is having an operational Remote Sensing Programme built over the past three decades and many of its satellites are contributing to the global observations to achieve CEOS objectives.

ISRO is a key Member of CEOS since its

Tapan Misra,
Director, Space Applications Centre, CEOS Principal of ISRO



inception. Dr K Kasturirangan, former Chairman ISRO was the Chair of 12th CEOS Plenary in 1998 and Mr A S Kiran Kumar chaired the 26th CEOS Plenary in 2012 and hosted its Plenary in Bangalore.

With ISRO as chair, the Bangalore Plenary of 1998 endorsed the Integrated Global Observing Strategy (IGOS) Partnership and prepared its own strategy for the development of the space component strategy in support of IGOS, re-categorised the CEOS membership from earlier 3 categories of agencies (Members, Observers and Affiliates) to 2 categories (Members and Associates) etc. Similarly, the Bangalore Plenary of 2012 defined the role of CEOS in future of the Post-2015 Group on Earth Observations (GEO)

and the reviewed its own working arrangement through the CEOS Self Study (CSS) conducted by the CEOS Strategic Implementation Team (SIT) etc.

ISRO took many responsibilities of CEOS in furthering the goals of space agencies. ISRO is active in its Working Groups, like chairing the WGEdu, WGCapD, actively contributed for the WGClimat, WGCv, WGISS and hosted its meetings in India. Apart from this, ISRO is contributing for many of the CEOS Virtual Constellations of satellites, viz., LSI, OST, PC, OCR, OSVW, support to FCT, JECAM, etc. ISRO continue to play an important role in CEOS including plans to take-up leadership of CEOS for 2020.

INPE

Brazilian space program, in spite of facing budget cuts, managed to continue important missions such as **CBERS** (China-Brazil Earth-Resources Satellite) and **Amazonia**, which is expected to provide images to observe and monitor the deforestation in the Amazon region, as well as, the diversified agriculture throughout the country. **Amazonia-1** will be the first Earth Observation satellite to be completely designed, integrated, tested and operated by Brazil. The launching of CBERS-4A is foreseen to May 2019, and negotiations with our Chinese partners are undergoing for the development of CBERS 5 and 6.

Very recently, INPE signed an agreement with the European Commission for the Copernicus Program, which will allow Brazil to have access to the Sentinel satellites, being a regional hub of Latin America.

For the next years, besides being an EO data provider, INPE shall explore its ability to transform data from missions such as CBERS, LANDSAT-8 and SENTINEL into products of interest to the Brazilian society. For INPE and Brazil, working close to the CEOS agencies, since 1994, has

Antonio Divino Moura,
Deputy Director



been of great importance, for the exchange of experiences and collaboration, for the opportunity to obtain technological benefits and in the use of EO satellite data and capacity development.

Lubia Vinhas & Hilceia Ferreira
(Earth Observation Coordination, INPE)

NASA

Congratulations to JAXA on the 50th Edition of the CEOS Newsletter, and for its longstanding commitment to inform the CEOS community and stakeholders of the fruits of our international cooperation.

2018 marks the 5th anniversary since CEOS reaffirmed four overarching goals now enshrined in its Strategic Guidance document:

- Close important observational gaps;
- Achieve better integration across the full range of Earth observations;
- Promote Data Democracy by improving access to and use of CEOS Agency data; and
- Remain responsive to Earth observation users' needs globally.

Such goals require a strong and stable organization to advance, and for this, CEOS has become more crosscutting. The Joint CEOS-CGMS Working Group (WG) on Climate, the Atmospheric Composition Virtual Constellation (VC), the Precipitation VC, the WG on Calibration and Validation, the WG on Information Systems and Services (WGISS), and the Systems Engineering Office (SEO) continue to identify and close climate related observational gaps. Together, WGISS, the SEO, and GEO have established seamless access to and use of remote sensing data in greater orders of magnitude by users worldwide. Crosscutting remote sensing efforts in Disaster Risk Reduction, Global Agricultural Monitoring, Data Utilization

Capacity Building, Global Forest and Ocean Observations are accomplishing important benchmarks with GEO and other stakeholders to further support UN Sustainable Development Goals.

With the growing number of missions in operation and development, CEOS Agencies are also dynamically exploring approaches to big data storage and utilization challenges. Consistent with the Data Exchange Principles CEOS adopted more than 20 years ago and the work of the UN, GEO, and other inter-governmental bodies, more data providers are optimizing and accelerating what is possible for societal benefit through open source data.

NASA Team for CEOS

NOAA

The National Oceanic and Atmospheric Administration (NOAA) has been a key contributing partner to CEOS since its inception in 1984 and has thus been fortunate to be a witness to and participant in the growth and impact of the organization on the international Earth observation (EO) community. Years ago, the Panel of Experts on Remote Sensing from Space of the G7 Economic Summit of Industrial Nations Working Group on Growth, Technology and Employment addressed "the importance of coordinating and the sharing the collection of satellite data on Earth and its atmosphere" and charged CEOS with executing this vision.

Over the past thirty-four years, CEOS and its

members have advanced the value and benefits of earth observations from space, and anticipated the changing needs of the international community and making key contributions to overarching external organizations. Working as the space coordination arm of the Group on Earth Observations (GEO) CEOS, along with the Coordination Group for Meteorological Satellites (CGMS), is the focal point for the space-based climate-related requirements of the Global Climate Observing System and the UNFCCC/SBSTA.

In 1984, CEOS was a group of eight space agencies and in 2018, we are now more than sixty space agencies and associated

Stephen Volz,

*NOAA Assistant Administrator,
Satellite and Information Service
2018-2019 SIT Chair*

organizations, still striving to meet our mission of international coordination of civil space-based EO missions. The Committee is actually more a Community of dedicated professionals who tirelessly work to advance the objectives of CEOS on best efforts basis, whilst dutifully accomplishing agency mission objectives. NOAA looks forward to continuing our active engagement in the Committee on Earth Observation Satellites; the Community of Earth Observation Satellites.

NSMC/CMA

NSMC/CMA brought the Chinese meteorological satellites to the CEOS satellite family since 2010 as a formal member agency. NSMC was founded in 1971 with a mission to develop the Chinese meteorological satellites and the satellite meteorology, is at present the operator of both polar-orbiting and geostationary meteorological satellites.

The Chinese meteorological satellites, Fengyun, or FY in acronym, take place in series. The Chinese meteorological satellites are currently in second generation stage for both polar and geostationary series. FY-4 has made breakthrough in some aspect that Atmospheric Interference Sounder is the first sensor flying onboard the geostationary satellite in the world to measure the vertical profile of temperature and humidity of the atmosphere with improved detection accuracy and vertical

resolution. In addition, NSMC is also involving in the development of Tansat and GF satellite to enhance the global atmospheric observations. The Chinese meteorological satellites have become an integral part of the global observation system, in cooperation with other satellite operators in the world, pursuing the maximized benefit of meteorological satellites for the interest of mankind in protecting lives and property of people from natural disasters.

Looking ahead to the next 50 years satellite observations, CEOS member agencies should

work together toward a comprehensive and seamless Earth observation system as the protection and restoration of Earth resources is the mandate of all countries. NSMC will definitely take its part responsibility in building the satellite Earth observation and promote the satellite data applications. Satellite data sharing and applications with cloud computing is booming and inspiring in the big data era. However the easy use of long term historical satellite data severing the global change is still challenging which requires the implementation of climate architecture from space and new architecture for data access and analysis.

Yang Jun,

*Director General
CEOS Principal for NSMC/CMA
China Meteorological Administration*



NSO

NSO is the “executive branch” of the Netherlands’ Space Policy. We are CEOS member since 2011. For us, CEOS is the environment for the worlds’ Space Agencies to share information about each others Earth Observation programs, and to team up to identify and eliminate gaps in the world wide Earth Observation capabilities. The Netherlands are proud to have contributed the line of Sciamachy, OMI and TROPOMI instrument in various partnerships to enhance mankind’s atmospheric monitoring capabilities.

The coming fifty years will see huge technical evolutions in the world wide space sector, with increased capabilities of the commercial sector,

of newly emerging space nations and of smaller and of smaller instruments and satellites. Our observing capabilities will also be enhanced using the revolutions in the field of ICT, big data analytics, machine learning and artificial intelligence.

The challenges ahead of us are obviously to meet the ever increasing needs for more information from space, in a coherent, consistent and continuous way. This should be done by purchasing information on the market where possible and developing and launching satellites where the commercial market is not (yet) capable or willing to provide the information. Further developing the scientific knowledge of

Joost Carpay,
*Coordinator ESA
PB EO chairman
SPC Delegate*



system Earth while ensuring that this knowledge becomes available to the policy makers, executive branches and the market where relevant remains an important task of Space Agencies.

Finally, making these increasing numbers of petabytes of information available to the users could well be the biggest challenge of all ahead of us!

UKSA

Congratulations on the 50th edition. Communication between Space Agencies is very important. We have many shared goals and ambitions and this is particularly true when measuring our one shared planet. We have already learned so much from one another and I hope this continues long into the future.

The future of EO is very exciting. I believe the sector is at a tipping point. We have seen the discussions at CEOS shift from the satellites themselves to the data

policies and the applications of the data they provide. This cultural shift reflects the wider EO sector. When CEOS started, EO was focused on interoperability of the national missions monitoring the planet. Now, as the size and cost of satellites reduce and as the market wakes up to the potential uses for EO, we are about to witness many privately funded constellations take to the skies. This will offer users many opportunities as well as challenges. Perhaps the greatest challenge CEOS could help to meet is how to embed the same rigour and

Beth Greenaway,
Head of EO and Climate



standards to missions funded and managed in the new commercial space era in a way that does not hinder new and evolving business models. This will ensure the data is just as trusted and useful for science and public policy evidence and business applications as it is today.

USGS

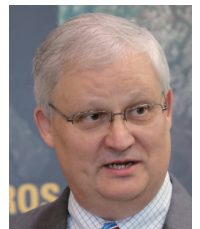
Fundamental to land remote sensing activities is the need for continuity in the observation record. Landsat has led the way in many respects since it launched in 1972, but it is not alone in providing data and information essential to keeping a record of changes on the planet’s surface. Land remote sensing has shown more capacity as other moderate-resolution systems have emerged across the globe, as well as smaller systems, whether from satellites or autonomous aerial vehicles. Going forward, continuity of data and information will be enhanced with the future data architectures effort; a proliferation of data cubes leveraging the existing temporal record; and global scale applications providing analysis ready data

to new processing engines in the Cloud.

The biggest challenges ahead center on sustaining the planet under ever increasing stresses from our exploitation of non-renewable resources. Our global ecosystem is finite in its capacity. Systems invaluable for data and information need to continue to provide that temporal information record so we can identify and understand how and why changes have occurred. We have great opportunities to leverage long-term records in dynamic ways so we can get a handle on the rates, causes, and consequences of land change.

The partnership USGS enjoys with CEOS helps to

Frank Kelly,
*USGS EROS Director &
Space Policy Advisor
2017 CEOS Chair*



ensure not only the use of existing land remote sensing systems but also the need for similar systems in the future with a fundamental need for free and open data policies. Knowing there is a global community of experienced, engaged collaborators worldwide assists in making sure our sometimes myopic perspectives broaden to meet the sustainable development goals of a global community.

VAST

In 2013, Vietnam National Space Center (VNSC) under the Vietnam Academy of Science and Technology (VAST) officially became a member of Committee on Earth Observation Satellites (CEOS) and has been actively participating the Organization’s activities and initiatives. Has been developing space technology applications since 1980s and implementing the “Strategy for Research and Applications of Space Technology until 2020” approved by the Prime Minister in 2006, many earth observation satellite applications has made through co-operations

with international space organizations especially CEOS and contributed to the socio-economic development of Vietnam. Deriving from Open Data Cube initiative of CEOS, VNSC has been cooperating with CSIRO (Australia) and I.M. System Group (USA), as well as satellite data contributing and processing from JAXA (Japan), USGS (USA) and CNES (France) to develop Vietnam Data Cube system for applications in Vietnam, firstly in forest and rice monitoring and water management from 2017. In the coming time, Vietnam will cooperate with regional

Pham Anh Tuan,
Director General of VNSC



organizations and members of CEOS to expand Vietnam Data Cube system into Mekong Data Cube system for the sustainable development of Mekong sub region. This is also the initiative to be adopted as Vietnam assuming its CEOS Chair and hosting CEOS Plenary in 2019.

CEOS Chair USGS Sees Tremendous Progress Made in 2017

It was with great pleasure that the U.S. Geological Survey (USGS) hosted our many CEOS colleagues and friends at the 31st Plenary 18-20 October 2017, near the grand Mount Rushmore and Crazy Horse mountain carvings outside of Rapid City, South Dakota, USA.

While the Plenary saw a lot of good work done—from reviewing various CEOS climate activities, to assessing progress and providing direction on CEOS carbon efforts and CEOS thematic acquisition strategies—the USGS as CEOS Chair for 2017 also would like to acknowledge all that was accomplished this past year with the help of many CEOS members.

Chief among those accomplishments was the USGS goal of progressing on work and themes started by the 2016 CEOS Chair, Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO), and the 2016 Strategic Implementation Team (SIT) headed up by the European Space Agency (ESA).

CSIRO and ESA had established the study of future data access and analysis architectures (FDA) as priorities of their leadership roles. Given the relevance of several core programs of the USGS, the agency decided as 2017 Chair to further develop several of the topics taken up in that FDA study; namely, FDA Continuation and Moderate Resolution Sensor Interoperability (MRI).

In that vein, work progressed in 2017 on:

- Pursuing CEOS Analysis-Ready Data for Land (CARD4L interoperability);
- Developing interoperable Open Source tools to stimulate satellite data use enabling exploitation of Earth observation (EO) data;
- Capturing user feedback and user statistics on FDA implementations in a structured way;
- Ensuring availability and promoting the uptake of data and processing standards when appropriate, and implementing standardization when necessary;
- And adapting the potential FDA solutions to the profile of diverse users.

Included in the FDA Continuation initiative were actions to support the development, production of, and access to compatible analysis ready data (ARD) from multiple CEOS agencies.

Much progress was made as well 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, and methodologies for their use. With a focus on Landsat and Sentinel-2, foundational efforts continued to ensure interoperability, including work aimed at pre-flight and on-orbit cross-calibration of Sentinel-2 that was carried out by NASA, USGS, and ESA.

As the 2017 CEOS Chair, the USGS looks forward to

the continuation of work on these themes and initiatives in 2018. It continues to be the USGS belief that EO satellite data must compete with easily accessible and ingested sources of data and information. Sophisticated EO data visualization and analysis systems provided by the big data industry players are raising expectations of users as to how easy it could and should be to access and apply EO satellite data.

Removal of the complexity and difficulty of handling large and technical data sets, often with unique quirks and characteristics, is essential for government-sponsored EO satellite programs to maximize their impact on society.

We move forward on this work with great confidence under the leadership of the European Commission, the 2018 CEOS Chair. Again, we hope your time in South Dakota was a memorable one, and we look forward to seeing many of you again at the CEOS SIT-33 meeting 23-25 April 2018 in Boulder, Colorado USA and the 32nd CEOS Plenary 16-18 October 2018 in Brussels, Belgium.



Meeting Calendar

As of March 2018

Activities	March	April	May	June	July	August	September	October	November	December
CEOS Plenary and CEOS SIT (Strategic Implementation Team)		▲ 23-25 SIT-33 Colorado, USA						▲ 10-14 SIT Technical Workshop Darmstadt, Germany	▲ 16-18 CEOS 32nd Plenary Brussels, Belgium	
CEOS VCs and CEOS TFs (Virtual Constellations and Task Forces)							△ 3-7 LSI-VC/GEOGLAM/SDCG for GFOI Meetings			
CEOS WGs	▲ 6-8 WGCapD-7 São José dos Campos, Brazil ▲ 9-13 WGISS-45 WGCV-43 São José dos Campos, Brazil ▲ 13-15 WGDisasters-9 Brussels, Belgium ▲ 27-29 CEOS-CGMS WGClimat-9 Geneva, Switzerland									
GEO related Activities (Group on Earth Observations)	▲ 12-16 GFOI Plenary Bogota, Colombia								▲ 10/31-11/1 GEO-XV Plenary Kyoto, Japan	
Others		▲ 26 CEOS FDA Big Data WS Colorado, USA			▲ 14-22 42nd COSPAR Pasadena, USA ▲ 23-27 IGARSS 2018 Valencia, Spain			▲ 1-5 IAC 2018 Bremen, Germany	△ APRSAF-25 Singapore	▲ 3-14 UNFCCC/COP 24 Katowice, Poland

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

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Japan Aerospace Exploration Agency (JAXA)
Satellite Applications and Operations Center (SAOC)
Tsukuba Space Center,
2-1-1 Sengen, Tsukuba City,
Ibaraki Prefecture, 305-8505, JAPAN
For inquiry:
K.Akiyama, RESTEC
CEOSNL@restec.or.jp

For further information contact in each area allocated:

[Asia, Pacific]

O. Ochiai
JAXA
TEL: +81-50-3362-6960
FAX: +81-29-868-5987
ochiai.osamu@jaxa.jp

[North & South America]

C. Bogner
NASA
TEL: +1-202-358 2066
FAX: +1-202-358 2919
christine.mcmahonbogner@nasa.gov

K. Sawyer

NOAA
TEL: +1-301 713 7074
FAX: +1-301 713 2032
kerry.sawyer@noaa.gov

[Europe, Africa]

I. Petiteville
ESA/ESRIN
TEL: +39 06 94 180 567
FAX: +39 06 94 180 353
Ivan.Petiteville@esa.int

P. Counet

EUMETSAT
TEL: +49-6151 807 603
FAX: +49-6151 807 866
Paul.Counet@eumetsat.int