

The Committee on Earth Observation Satellites (CEOS)



CEOS Committee on Earth Observation Satellites



1 March 2013

CEOS Background

- Established in 1984 under auspices of G-7 Economic Summit of Industrialized Nations
 - Focal point for international coordination of space-related Earth Observation (EO) activities
 - Optimize benefits through cooperation of members in mission planning and in development of compatible data products, formats, services, applications, and policies
- Operates through best efforts of Members and Associates via voluntary contributions
- 30 Members (Space Agencies), 23 Associates (UN Agencies, Phase A programs or supporting ground facility programs)
- As the space component of the Global Earth Observation System of Systems (GEOSS), CEOS is implementing high priority actions in support of Group on Earth Observation (GEO) Tasks

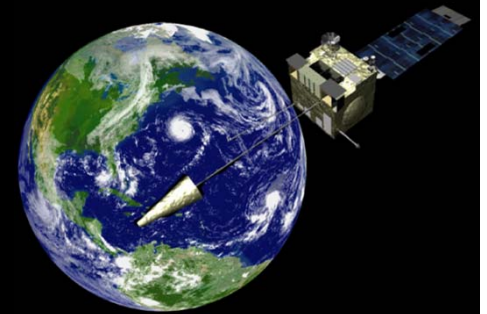
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CEOS Committee on Earth Observation Satellites



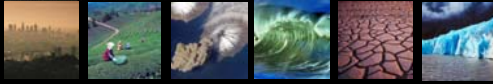
Primary Objectives of CEOS

1. To optimize benefits of space-borne Earth observations through:
 - Cooperation of its Members in mission planning
 - Development of compatible data products, formats, services, applications, and policies;
2. To serve as a focal point for international coordination of space-related Earth observation activities;
3. To exchange policy and technical information to encourage complementarity and compatibility of observation and data exchange systems.

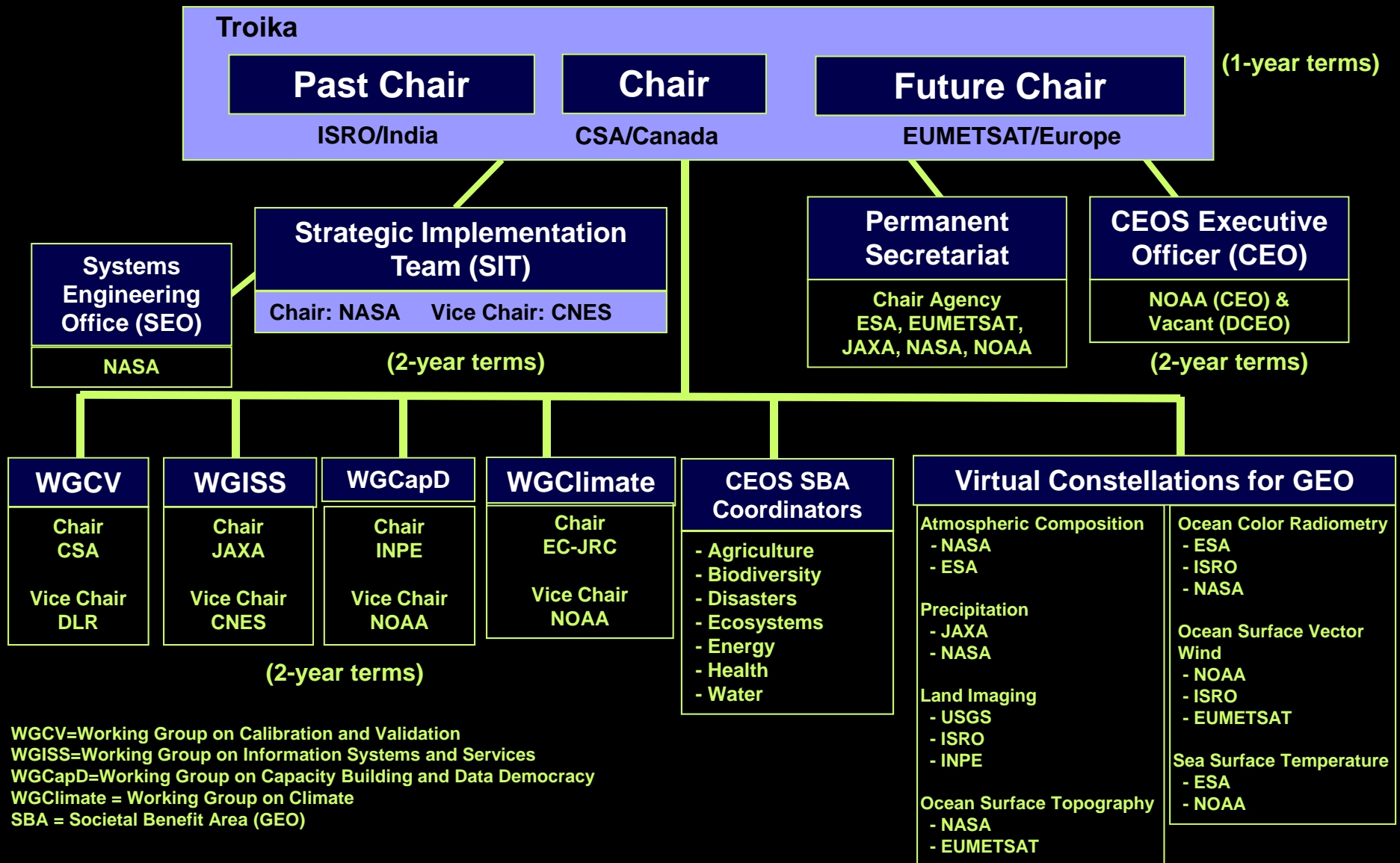


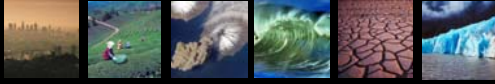
CEOS  **Committee on Earth Observation Satellites**





CEOS Structure 2012-2013

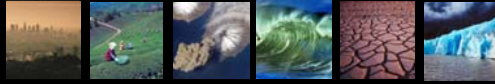




Strategic Implementation Team (SIT)

- Created in 1996 to advance the involvement of CEOS in the development of the Integrated Global Observing System (IGOS)
- Plays a central role in coordination of existing and future missions of CEOS Agencies in support of GEO, GCOS, WMO, UNFCCC, etc.
- Comprised of the Principals of CEOS Member Agencies and some Associates with the authority to commit Agency support to initiatives
- SIT Chair Key Responsibilities
 - Lead CEOS interaction with GEO/GEOSS and strengthen linkages to GEO and GEOSS
 - Lead CEOS Virtual Constellation for GEO development and implementation activities
 - Assist CEOS interaction with GEO Committees

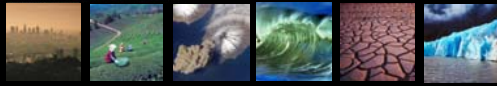
SIT Objective: To define, characterize, and develop the vision for CEOS participation in GEO and strengthen CEOS linkages to GEOSS



CEOS Virtual Constellations for GEO

- CEOS Virtual Constellations for GEO demonstrate the value of collaborative partnerships in addressing key observational gaps and bridging multiple GEO Societal Benefit Areas while maintaining the independence of individual contributions
- Focus dialogue from “all topics/all agencies” to smaller, more specialized groups
- Guidance for design and development of future systems to meet the broad spectrum of EO requirements
 - Avoid duplication and overlap in EO efforts
 - Close information gaps for GEO SBAs
 - Establish and sustain global EO coverage and data availability

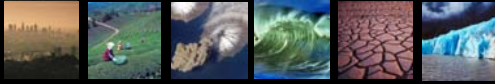
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|-------------------------|--------------------------------|-----------------------------|-------------------------|-------------------------------|------------------------------------|
| Atmospheric Composition | Land Surface Imaging (LSI) | Ocean Surface Topography | Precipitation | Ocean Colour Radiometry | Ocean Surface Vector Wind |
| Co-Leads: NASA and ESA | Co-Leads: USGS, ISRO, and INPE | Co-Leads: NASA and EUMETSAT | Co-Leads: NASA and JAXA | Co-Leads: ESA, ISRO, and NASA | Co-Leads: NOAA, ISRO, and EUMETSAT |
| Sea Surface Temperature | | | | | |
| Co-Leads: ESA and NOAA | | | | | |



CEOS Working Groups

Working groups enhance technical cooperation among CEOS Agencies in specific topical areas with broad international benefit.

- **Working Group on Calibration and Validation (WGCV)**
 - To ensure long-term confidence in the accuracy and quality of Earth observation data and products
- **Working Group on Information Systems and Services (WGISS)**
 - To coordinate the development of Earth observation satellite systems and services which manage and supply the data and information from CEOS Agencies' missions
- **Working Group on Capacity Building and Data Democracy (WGCapD)**
 - To increase the capacity of institutions in less developed countries for effective use of Earth Observation data for the benefit of society and to achieve sustainable development
- **Working Group on Climate (WGClimate)**
 - To facilitate the use of Essential Climate Variable (ECV) time-series through coordination Member Agencies' initiatives and activities



Bangalore Statement - 2012

CEOS Agencies will continue and enhance their cooperation to support more effective societal decision-making in the areas of climate change, forest monitoring, sustainable development, food and water security, and disaster risk management.

- **Development and provision of climate data records, in support of climate monitoring and research**
- **Coordinated observations to support the effective monitoring and management of the worlds' forested regions**
- **Development of a strategy for observing and assessing the global carbon cycle**
- **The application of space-based Earth observations to support research in agricultural productivity and an improved understanding of the global water cycle**
- **Development of a more integrated approach in the application of Earth observations for the purposes of disaster risk management**
- **Close collaboration with all countries, especially developing countries, to share new sources of EO satellite data and enhance their governments' capacity to apply these data for societal benefit**



Bangalore Statement

26 October 2012

We, the assembled participants of the 26th Plenary meeting of the Committee on Earth Observation Satellites (CEOS), taking place in Bangalore, India, on 25-26 October 2012:

Building upon our collective commitments to coordinate our Earth observation satellite missions in response to needs expressed by the United Nations Commission on Sustainable Development (UNCSD), the UN Framework Convention on Climate Change (UNFCCC), the Intergovernmental Group on Earth Observations (IGEO) and the Group of 20 Industrialized Nations (G20):

Confirming our commitments to advance the use of space-based Earth observations to advance scientific knowledge, economic and social development, and environmental protection of all societies; and:

Recognizing the major investments made by CEOS agencies in developing the space-based components of the Global Earth Observation System of Systems, and global observing systems operated under the auspices of the United Nations:

Declare that:

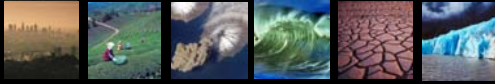
CEOS Agencies will continue and enhance their cooperation to support more effective societal decision-making in the areas of climate change, forest monitoring, sustainable development, food and water security, and disaster risk management. This cooperation will be expressed through a number of global-level initiatives and projects, including:

- Development and provision of climate data records, in support of climate monitoring and research
- Coordinated observations to support the effective monitoring and management of the worlds' forested regions
- Development of a strategy for observing and assessing the global carbon cycle
- The application of space-based Earth observations to support research in agricultural productivity and an improved understanding of the global water cycle;
- Development of a more integrated approach in the application of Earth observations for the purposes of disaster risk management; and,
- Close collaboration with all countries, especially developing countries, to share new sources of EO satellite data and enhance their governments' capacity to apply these data for societal benefit.

CEOS will accomplish these activities through its Virtual Constellations of satellite missions focused on seven thematic areas: atmospheric composition, land surface imaging, ocean colour, ocean surface topography, ocean surface wind, precipitation, and sea surface temperature. Specialized Working Groups will continue to address user needs for data quality, data discovery and access, climate applications, and capacity building.

CEOS plays a vital role in ensuring coordination of Earth observations to enable decisions for securing a prosperous and sustainable future for humankind.

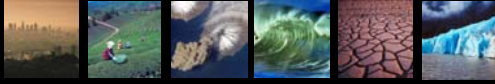
<http://www.ceos.org>



Priority Objectives for 2013

2013 CEOS Work Plan: 2 FEB 2013 FINAL

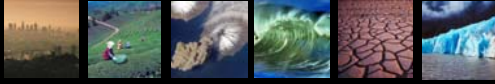
- **CEOS Agencies will continue to enhance their cooperation to support more effective societal decision-making in the areas of climate monitoring and research, carbon observations, including observations to support the effective monitoring and management of the world's forested regions, food security, disaster risk management, capacity building, and data availability and access.**
- **CEOS Working Groups and Virtual Constellations will expand their technical and scientific coordination to support these objectives, and improve the overall level of complementarity and compatibility of their Earth observation and data management systems for societal benefit.**
- **CEOS will consider other requests from external stakeholders and determine what, if any, support is possible and appropriate. CEOS will also continue its outreach and communications efforts.**
- **CEOS will continue its consideration of 2011 CEOS Self-Study recommendations, with near-term (e.g., 1-3 years) decisions anticipated on its organization, structure, decision-making processes, and stakeholder relations.**



Priority Objectives for 2013

Climate Monitoring and Research

- Development of Climate Data Records (CDRs) and related datasets addressing Essential Climate Variables established by the Global Climate Observing System (GCOS);
- Continued cooperation with GEO, GCOS, the World Meteorological Organization (WMO), and the Coordination Group for Meteorological Satellites (CGMS) in the development of a space-based system to support climate information and adaptation; and,
- Further alignment of the Virtual Constellations objectives as building blocks of the space-based climate information strategy and as contributions to facilitating the observation of ECVs, as defined in the *CEOS Response to the Satellite Supplement of the 2010 GCOS IP*.



Priority Objectives for 2013

Carbon Observations, including Observations to Support the Effective Monitoring and Management of the World's Forested Regions

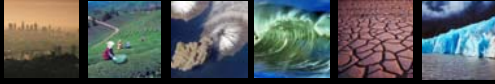
- CEOS leadership within and support to GEO Global Forest Observation Initiative (GFOI); and
- Publication of the *CEOS Strategy for Carbon Observations from Space*.

Food Security

- Continued support to the Joint Experiments on Crop Assessment and Monitoring (JECAM) initiative.

Disaster Risk Management

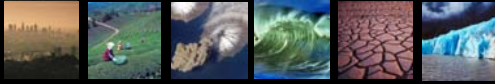
- Enhanced support for Disaster Risk Management (DRM); and
- Continued support to the Geohazards Supersites and Natural Laboratories initiative



Priority Objectives for 2013

Capacity Building and Data Availability and Access

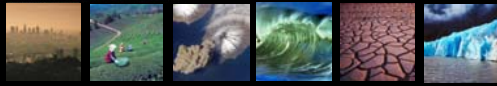
- Advancement of CEOS Data Democracy activities;
- Continued support to the development and operationalization of the GEOSS Common Infrastructure (GCI) and its CEOS-related elements; and,
- Continued CEOS leadership of, and support to, the Quality Assurance for Earth Observations (QA4EO) initiative.



Priority Objectives for 2013

CEOS Support to Further Key Stakeholder Initiatives

- Decision on whether and how CEOS Agencies may provide coordinated data acquisition support to the GEO Global Agricultural Monitoring (GEOGLAM) initiative;
- Continued dialogue on potential CEOS contributions to Integrated Water Cycle products and services;
- Continued dialogue on potential CEOS contributions to the GEO Biodiversity Observation Network (GEO BON);
- Dialogue on potential enhanced CEOS-level coordination to support improved research and monitoring of the Earth's polar regions; and,
- Determine the level and scope of engagement of the four ocean-related Virtual Constellations in the GEO Blue Planet Task



Priority Objectives for 2013

Continued and Enhanced CEOS Outreach to Key Stakeholders: GEO, UNFCCC, UN ISDR, UN CBD, G8/G20, and Others

- Engagement, attendance, and where appropriate, strategic involvement , reporting on CEOS achievements, and presentations at key meetings
- Maintenance to CEOS online services such as the CEOS website and Missions, Instruments and Measurements (MIM) database
- Publication of the CEOS Newsletter

Adoption of Recommendations from the 2011 CEOS Self-Study

- Development of strategic guidance documents, stemming from participative analysis and options proposed by the CEOS Self-Study Implementation Initiative (CSSII) Topical Teams
- Plenary review and adoption of CSSII proposed options for refinement

CEOS and Group on Earth Observations (GEO)

- CEOS is a GEO Participating Organization
- Unique and important role in space-based observations
 - Integrate observing systems to benefit from the increased number and distribution of observations of any given event
 - Minimize data gaps – toward a comprehensive, coordinated, and sustained GEOSS
 - *CEOS Implementation Plan for Space-based Observations for GEOSS*
- Routine and detailed consultations among CEOS technical experts and GEO Secretariat staff



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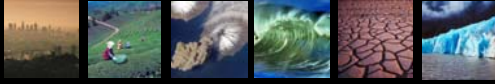




CEOS and the Global Climate Observing System (GCOS)

| Domain | GCOS Essential Climate Variables |
|--|--|
| Atmospheric (over land, sea and ice) | <p>Surface: <u>Air temperature</u>, <u>Wind speed and direction [over the oceans]</u>, <u>Water vapour</u>, <u>Pressure</u>, <u>Precipitation</u>, Surface radiation budget</p> <p>Upper-air: <u>Temperature</u>, <u>Wind speed and direction</u>, <u>Water vapour</u>, Cloud properties, Earth radiation budget (including solar irradiance)</p> <p><u>Composition: Carbon dioxide, Methane, and other long-lived greenhouse gases, Ozone and Aerosol, supported by their precursors.</u></p> |
| Oceanic | <p>Surface: <u>Sea-surface temperature</u>, Sea-surface salinity, <u>Sea level</u>, Sea state, Sea ice, Surface current, <u>Ocean colour</u>, Carbon dioxide partial pressure, Ocean acidity, Phytoplankton</p> <p>Sub-surface: Temperature, Salinity, Current, Nutrients, Carbon dioxide partial pressure, Ocean acidity, Oxygen, Tracers</p> |
| Terrestrial | <p>River discharge, Water use, Groundwater, Lakes, Snow cover, Glaciers and ice caps, Ice sheets, Permafrost, Albedo, <u>Land cover (including vegetation type)</u>, Fraction of absorbed photosynthetically active radiation (fAPAR), Leaf area index (LAI), Above-ground biomass, Soil carbon, Fire disturbance, Soil moisture.</p> |

Observations being collected by current Virtual Constellations are underlined
Observations that could be collected by new Virtual Constellations are in red font



International Coordination Mechanisms

- 1972** **Coordination Group for Meteorological Satellites (CGMS)**
- 1984** **Committee on Earth Observation Satellites (CEOS)**
- 1986-1996** **International Coordination Working Group (ICWG) of the Space Station Partners**
- 1998-2008** **Integrated Global Observing Strategy (IGOS)**
- 2000** **International Charter on Space and Major Disasters**
- 2000** **World Meteorological Organization Consultative Meetings on High-Level Policy on Satellite Matters**
- 2003** **Group on Earth Observations (GEO); established as an Intergovernmental GEO in 2005**



CGMS



Committee on Earth Observation Satellites



IGOS

Integrated Global Observing Strategy



**GROUP ON
EARTH OBSERVATIONS**

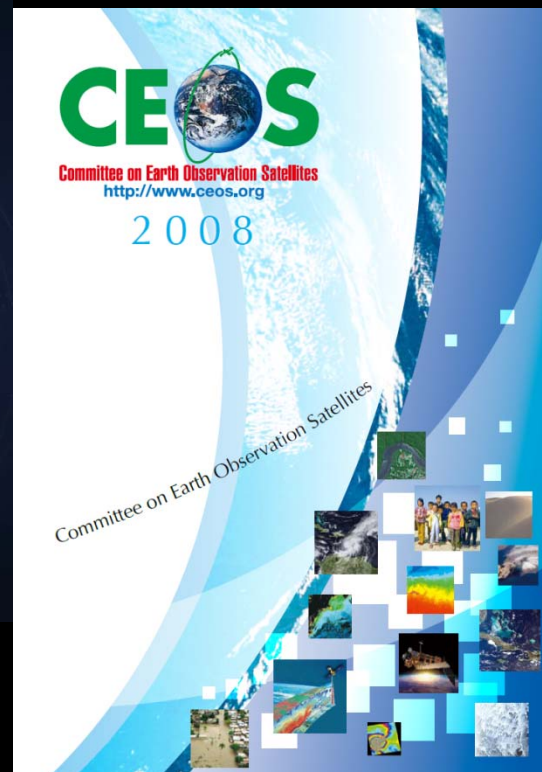
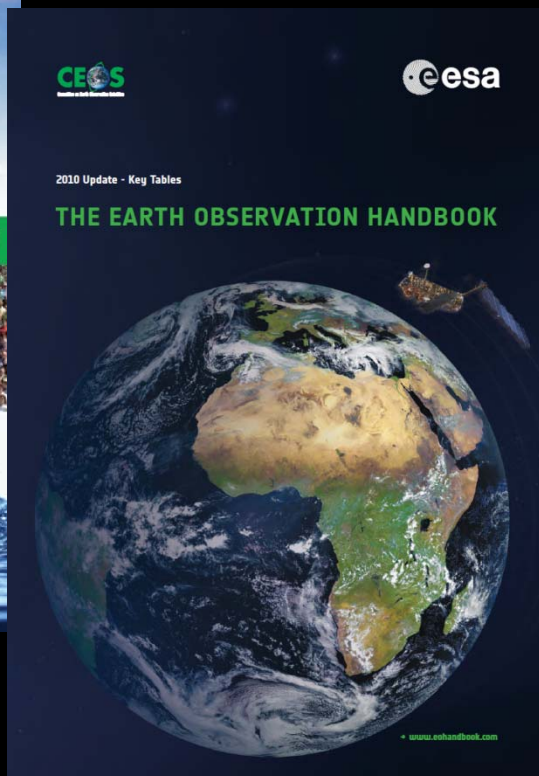
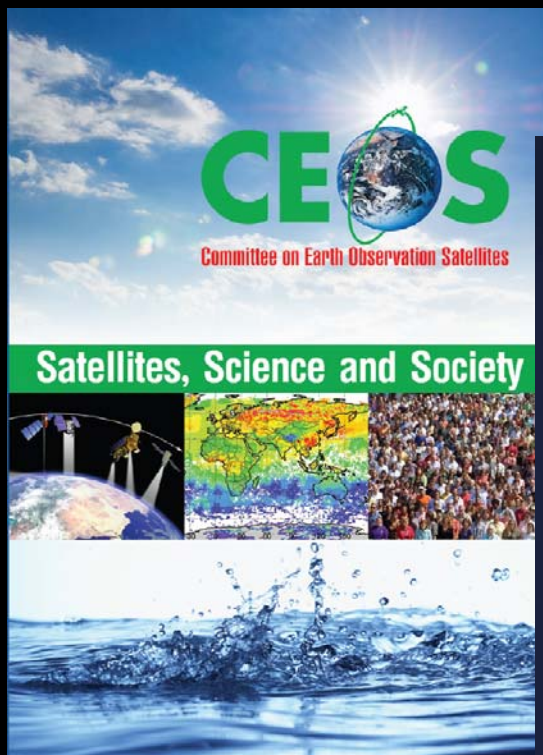
Achieving and Maintaining International Partnerships

- CEOS Virtual Constellations support to Global Climate Observing System (GCOS) Essential Climate Variables (ECVs)
- Respond to critical needs of the global user community
- More coordinated Earth observations for enhanced societal benefit

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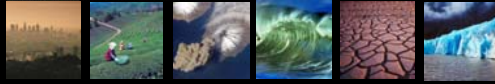


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CEOS Committee on Earth Observation Satellites





CEOS Members and Associates

MEMBERS

Agenzia Spaziale Italiana (ASI)
 Canadian Space Agency (CSA)
 Centre National d'Etudes Spatiales (CNES), France
 Centro para Desarrollo Tecnológico Industrial (CDTI), Spain
 China Center for Resources Satellite Data and Applications (CRESDA)
 Chinese Academy of Space Technology (CAST)
 Comisión Nacional de Actividades Espaciales (CONAE), Argentina
 Commonwealth Scientific & Industrial Research Organisation (CSIRO), Australia
 Deutsches Zentrum für Luft- und Raumfahrt (DLR), Germany
 European Commission (EC)
 European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT)
 European Space Agency (ESA)
 Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand
 Indian Space Research Organisation (ISRO)
 Instituto Nacional de Pesquisas Espaciais (INPE), Brazil
 Japan Aerospace Exploration Agency/Ministry of Education, Culture, Sports, Science, and Technology (JAXA/MEXT)
 Korea Aerospace Research Institute (KARI)
 National Aeronautics and Space Administration (NASA), USA
 National Oceanic and Atmospheric Administration (NOAA), USA
 National Remote Sensing Center of China (NRSCC)
 National Satellite Meteorological Center/Chinese Meteorological Administration (NSMC/CMA)
 National Space Agency of Ukraine (NKAU)
 National Space Research Agency of Nigeria (NASRDA)
 Netherlands Space Office (NSO)
 Russian Federal Space Agency (ROSKOSMOS)
 Russian Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET)
 South African National Space Agency (SANSA)
 Scientific and Technological Research Council of Turkey (TÜBİTAK)
 United Kingdom Space Agency (UKSA)
 United States Geological Survey (USGS)

ASSOCIATES

Belgian Federal Science Policy Office (BELSPO)
 Canada Centre for Remote Sensing (CCRS)
 Council for Scientific and Industrial Research (CSIR)
 Crown Research Institute (CRI), New Zealand
 Earth Systems Science Organisation (ESSO), India
 Global Climate Observing System (GCOS)
 Global Geodetic Observing System (GGOS)
 Global Ocean Observing System (GOOS)
 Global Terrestrial Observing System (GTOS)
 Intergovernmental Oceanographic Commission (IOC)
 International Council for Science (ICSU)
 International Geosphere-Biosphere Programme (IGBP)
 International Ocean Colour Coordinating Group (IOCCG)
 International Society of Photogrammetry and Remote Sensing (ISPRS)
 Norwegian Space Center (NSC)
 Swedish National Space Board (SNSB)
 United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)
 United Nations Educational, Scientific and Cultural Organization (UNESCO)
 United Nations Environment Programme (UNEP)
 United Nations Food and Agriculture Organization (FAO)
 United Nations Office for Outer Space Affairs (UNOOSA)
 World Climate Research Programme (WCRP)
 World Meteorological Organization (WMO)



CEOS Plenaries

| Plenary | Year | Venue | Host | | Plenary | Year | Venue | Host |
|------------------|------|-----------------------------|------------|--|------------------|------|-------------------------|------------|
| 1 st | 1984 | Washington DC, USA | NOAA | | 15 th | 2001 | Kyoto, Japan | MEXT/NASDA |
| 2 nd | 1986 | Frascati, Italy | ESA | | 16 th | 2002 | Frascati, Italy | ESA |
| 3 rd | 1988 | Ottawa, Canada | CSA | | 17 th | 2003 | Colorado Springs, USA | NOAA |
| 4 th | 1990 | Sao Jose dos Campos, Brazil | INPE | | 18 th | 2004 | Beijing, China | NRSCC |
| 5 th | 1991 | Washington DC, USA | NASA/NOAA | | 19 th | 2005 | London, UK | BNSC |
| 6 th | 1992 | London, UK | BNSC | | 20 th | 2006 | Buenos Aires, Argentina | CONAE |
| 7 th | 1993 | Tsukuba, Japan | MEXT/NASDA | | 21 st | 2007 | Kona, Hawaii, USA | USGS |
| 8 th | 1994 | Berlin, Germany | DARA | | 22 nd | 2008 | George, South Africa | CSIR |
| 9 th | 1995 | Montreal, Canada | CSA | | 23 rd | 2009 | Phuket, Thailand | GISTDA |
| 10 th | 1996 | Canberra, Australia | CSIRO | | 24 th | 2010 | Rio de Janeiro, Brazil | INPE |
| 11 th | 1997 | Toulouse, France | CNES | | 25 th | 2011 | Lucca, Italy | ASI |
| 12 th | 1998 | Bangalore, India | ISRO | | 26 th | 2012 | Bangalore, India | ISRO |
| 13 th | 1999 | Stockholm, Sweden | EUMETSAT | | 27 th | 2013 | Montreal, Canada | CSA |
| 14 th | 2000 | Rio de Janeiro, Brazil | INPE | | | | | |