CEOS Contributions to Climate Change Science and Applications

A report for the United Nations Framework Convention on Climate Change
Conference of the Parties (COP15), Copenhagen, Denmark - December 7-18, 2009

Established in 1984, the Committee on Earth Observation Satellites (CEOS) coordinates civil space-borne observations of the Earth's climate system among many other measurements. Participating agencies strive to enhance international coordination and data exchange and to optimize societal benefit as the people of the world respond to a changing climate. Currently 28 space agencies along with 20 other national and international organizations participate in CEOS. CEOS agencies are currently operating and/or planning ~240 Earth observation satellites over the next 15 years which will carry ~385 different remote sensing instruments. Given the significance of the issues and the unique role of satellite Earth observations, many of the planned missions will be dedicated to different aspects of climate change science and applications.

CEOS coordinates a variety of projects among its member agencies that are focused on understanding and adapting to climate change. Many of these projects provide active and ongoing support to the intergovernmental Group on Earth Observations (**GEO**) with a particular focus on the space component of the Global Earth Observation Systems of Systems (**GEOSS**). A brief summary of these projects is described below. Additional information on each of these projects can be found on the CEOS website (**www.ceos.org**) or by contacting Mitch Goldberg (CEOS Climate Societal Benefit Area Lead, NOAA, Mitch.Goldberg@noaa.gov) or Brian Killough (CEOS Systems Engineering Office, NASA, Brian.D.Killough@nasa.gov).

Climate Diagnostics Portal

http://idn.ceos.org/climdiag/Home.do?Portal=climatediagnostics

The CEOS Working Group on Information Systems and Services (WGISS) developed a Climate Diagnostic Portal following a meeting held in Sanya, China in February 2008. The target audience is decision makers, as this portal offers visualizations of data that emphasize long-term climatic trends that are searchable through Societal Benefit Areas (SBAs) as defined by GEO. The climate visualizations are targeted to address several SBAs: Disasters, Health, Energy, Climate, Water, Weather, Ecosystems, Agriculture, and Biodiversity. The visualizations are created from scientific data by a multitude of providers. The site is designed to offer visualizations that could be readily interpreted by decision makers. If a better understanding of the significance of the science can be achieved, the societal benefits of scientific research would be enhanced by providing these visualizations for long-term diagnostic analyses. The visualizations, also known as "Climate Diagnostics", are expected to be supportive and useful in decision-making processes.

CEOS Response to the GCOS Implementation Plan

In response to the Global Climate Observing System (GCOS) Implementation Plan, CEOS has developed a set of 59 critical climate actions. These actions are being addressed over a period of years with the intention that CEOS will continue to provide a significant contribution to the GCOS plans. These actions have been organized into atmosphere, ocean and terrestrial domains along with a set of "cross-cutting" actions for more universal benefit. In line with CEOS efforts, the European Space Agency (ESA) has initiated an activity in deriving relevant Essential Climate Variables (ECVs) specified by GCOS, based on ESA current and archived Earth Observation data. CEOS will work with ESA and agencies worldwide to ensure as complete a coverage of the entire suite of ECVs as possible.

Carbon Task Force

With the advent of the technical means to provide new monitoring and measurement of greenhouse gas (GHG) from space in 2009, CEOS has identified the coordination of these measurements and their application as a top priority for the coming years. NASA, NOAA and ESA are working with JAXA to establish the necessary international framework to facilitate this coordination, aimed at expanding access to the data, accelerating applications, and solidifying security of future supply. The CEOS Carbon Task Force will ensure the necessary integration and coordination of activities within several key carbon initiatives including **Forest Carbon Tracking** (**http://task.geo-fct.org/**) and **Global Monitoring of Greenhouse Gases from Space**. One specific activity is developing a Forest Carbon Portal (**http://www.geo-fct.org/**) to collect and improve efficient access to satellite data sets focused on these topics.

United Nations Framework Convention on Climate Change (UNFCCC)

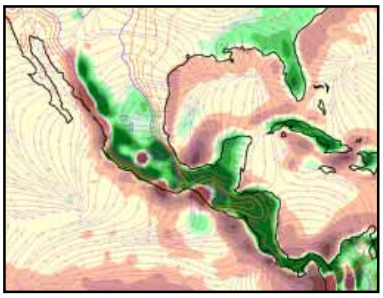
In June 2009, the 30th Meeting of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) agreed to a set of conclusions and a draft decision for consideration by Parties at the December 2009 UNFCCC Conference of the Parties (COP-15). These conclusions welcome the commitment of CEOS agencies toward improved availability of current and future data for forest carbon monitoring and encouraged CEOS and Parties supporting space agencies to continue, and if possible, accelerate, development and methodologies, as well as validation and intercomparison of satellite-based applications for the terrestrial domain. In addition, the draft decision encourages CEOS to continue coordinating and supporting the implementation of the satellite component of the Global Climate Observing System (GCOS) and urges Parties that support space agencies to enable those agencies to continue to implement, in a coordinated manner through CEOS, the actions identified in the CEOS report, in particular by ensuring long–term continuity of observations and data availability.

Quality Assurance Framework for Earth Observation (QA4EO)

The fundamental principle of the Quality Assurance Framework for Earth Observation (QA4EO: **http://qa4eo.org/**) is that all EO data and derived products have associated with them a documented and fully traceable quality indicator. This principle is universally applicable to all disciplines and is already being practiced by many. QA4EO seeks to ensure this principle is implemented in a harmonious and consistent manner throughout all EO communities to the benefit of all stakeholders. Implementation of QA4EO will be driven by a dedicated task team that will contain representatives from the wider GEOSS community and, in particular, from the Societal Benefit Areas. A high level implementation and action plan is currently being compiled to define the specific route and goals necessary to allow effective implementation of QA4EO throughout GEOSS.

Climate Services Demonstration Pilot Project

The CEOS Systems Engineering Office (SEO) is sponsoring a pilot project called "Responding to Climate Variability and Change: A Rapid Prototype for Assessing Impacts of Uncertainty in Climate Observations and Model Projections on Decision Support". There has been a recent significant increase in the use of Integrated Assessment Models (IAMs) across the Earth-science disciplines in an attempt to understand climate variability and change and the associated impacts to decision support systems and policy making. A rapid prototype project utilizing Global Circulation Models (GCMs) and a Regional Climate Model (RCM) with agricultural decision support in Central America is under development. This project is focused on assessing uncertainty in climate observations and the impact of those uncertainties on decision support tools and key issues confronting local decision-makers.



CEOS Mission, Instruments and Measurement (MIM) Database

The European Space Agency (ESA), in cooperation with NASA's CEOS Systems Engineering Office (SEO) and the World Meteorological Organization (WMO), are developing a database of Earth Science Mission, Instrument, and Measurement (MIM) data to support strategic planning, gap assessments, and enhanced collaboration.

CEOS Virtual Constellations

CEOS has established the concept of Virtual Constellations for GEO to harmonize and maximize efforts among space agencies. These groups will coordinate Earth observation missions as part of GEOSS, make maximum use of existing assets, address emerging data gaps, and avoid unnecessary overlap among future observing systems. A Virtual Constellation consists of multiple satellites, ground systems and related delivery systems mobilized in a coordinated manner and focused on a particular set of important variables and products, for greater positive impact with increased efficiency. Six Virtual Constellations currently exist and make significant contributions to the study of global climate change: Land Surface Imaging, Ocean Surface Topography, Atmospheric Composition, Precipitation, Ocean Color Radiometry, and Ocean Surface Vector Wind.

CEOS Working Groups

The three CEOS Working Groups enhance coordination and cooperation among CEOS agencies in specific topical areas with broad international benefit. These Working Groups include: the Working Group on Information Systems and Services (WGISS), the Working Group on Calibration and Validation (WGCV), and the Working Group on Education, Training and Capacity Building (WGEdu). WGISS provides a range of data and information services to enhance the access and use of Earth observation data while employing common standards for effective interoperability. WGCV addresses issues related to sensor system calibration and validation and their derived products to enable reliable comparison and synergistic use of information across global Earth observing systems. WGEdu is focused on coordinating existing and planned education and training activities to maximize societal benefit of Earth observation data, products and services.