Executive Summary of
The CEOS Response the GCOS Implementation Plan 2010

> **Reliable space-based observations can provide the authoritative records of climate change needed to empower governments and the private sector to make informed decisions on prevention, mitigation, and adaptation strategies.**

At the sixteenth session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2010, the 33rd session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) invited CEOS to provide, at SBSTA 37 at the COP in November 2012, an updated report on progress made on major achievements in relevant areas, such as in relation to responding to space-related needs of the *2010 Update to the Implementation Plan for the Global Climate Observing System in Support of the UNFCCC* (*GCOS IP-10*). This report represents the CEOS response to the requirements for space-based observations in GCOS IP-10 and the *Systematic Observation Requirements for Satellite-Based Data Products for Climate 2011 Update: Supplemental details to the satellite-based component of GCOS-IP10*.

CEOS responded to the *2004 GCOS Implementation Plan* in its 2006 report, *Satellite Observation of the Climate System: The CEOS Response to the 2004 GCOS Implementation Plan.* CEOS prepared and submitted the *Coordinated Response from Space Agencies Involved in Global Observations to the Needs Expressed in the Global Climate Observing System (GCOS) Implementation Plan: Update on Climate Actions* at SBSTA's 29th session in 2008. The SBSTA requested another update for its 33rd session in 2010, which CEOS prepared and submitted, titled *2010 Progress Report: Coordinated Response from Parties that Support Space Agencies Involved in Global Observations to the Needs Expressed in the GCOS Implementation Plan of 2004.* In addition to the implementation of 59 climate actions plans, a major initiative – CEOS Virtual Constellations – resulted in part from these activities. These virtual, space-based Constellations provide critical information on changes in land cover, precipitation, atmospheric composition, global sea level, ocean surface vector wind, ocean colour, and sea surface temperature. A CEOS Virtual Constellation is a set of space and ground segment capabilities operating together in a coordinated manner, in effect a virtual system that overlaps in coverage in order to meet a combined and common set of Earth Observation requirements. The individual satellites and ground segments can belong to a single or to multiple owners.

Earth observation satellites provide a vital means of obtaining measurements of the climate system from a global perspective and comparing the behaviour of different parts of the globe for many of the Essential Climate Variables (ECVs) listed in GCOS IP-10. Their global nature distinguishes satellite observations from ground-based and airborne measurements that are more limited in spatial coverage, but nevertheless necessary to validate information derived from space and provide additional data, especially on variables not accessible from space.

Satellite climate data records that meet the GCOS requirements enable: climate monitoring, studies of trends and variability, climate research, assimilation into numerical weather prediction models to produce long-term reanalyses of the atmosphere and the Earth's surface, provision of boundary conditions for and verification of climate models, climate impacts, and, ultimately, decision-making in many societal sectors including agriculture, water resource and coastal management, forestry, transportation, and insurance applications.

GCOS IP-10 specifies the Actions required to implement a comprehensive observing system for the ECVs. The Plan includes some 138 specific Actions to be undertaken, mostly over the period 2011-2015, across the atmospheric, oceanic, and terrestrial domains. Of these, 47 involve space-based observations.

The Satellite Supplement to GCOS IP-10 provides additional technical detail related to satellite-based observations for each of the ECVs. It details the specific satellite data records that should be sustained in accordance with the GCOS Guidelines for Satellite-based Datasets and Products. In particular, for each ECV, the Satellite Supplement provides requirements for horizontal, vertical and temporal resolutions, accuracy, and stability. In addition, information is presented on benefits of meeting the requirements, rationale for the requirements, the requirements for satellite instruments and satellite datasets, calibration, validation and data archiving needs, adequacy/inadequacy of current datasets, immediate actions, partnerships and international coordination, links to the GCOS IP, and other applications.

The current CEOS response is a significant step forward in defining a program to carry out the space-based contributions to the GCOS IP. It represents a blueprint comprised of detailed plans for all of the ECVs accessible from space. For the actions specified for each ECV in GCOS IP-10 and its Satellite Supplement, CEOS has made an unprecedented effort to develop a roadmap with specificity, actionability, responsibility, and desired outcomes in terms of quantitative metrics. The plans for each action include the lead and cooperating CEOS Member Agencies responsible for carrying out the action, descriptions of the specific deliverables, and activities planned for implementation over the next five years. It was prepared by the scientific and technical experts who, with the teams they have assembled, will be responsible for leading the implementation of the action plans.

Going beyond its response to the previous GCOS IP (GCOS IP-04), CEOS has made a concerted attempt to address the quantitative target metrics established by GCOS IP-10 for each ECV's accuracy, stability, and spatial resolutions; this CEOS response includes these target metrics and the metrics that CEOS plans to achieve for each ECV. The specification of metrics places the entire enterprise on a much firmer foundation.

Achieving the metrics laid out in this response represents a significant challenge to the CEOS community and will require a degree of coordination and collaboration never achieved before. CEOS, at its 24th Plenary meeting in 2010, responded to this challenge by establishing a new Working Group on Climate (WGClimate), to coordinate and encourage collaborative activities among the world's space agencies in the area of climate monitoring. The continued development and implementation of the CEOS Virtual Constellations are vital to success. Close collaboration among CEOS, the GCOS program, World Climate Research Programme (WCRP) satellite observational and data programs, and national climate programs is also essential.

Compiling the detailed action plans since the December 2011 release of the update to the Satellite Supplement represented a significant undertaking. In some cases, action plans are still incomplete. The process and metrics defined provide a useful mechanism for updating and monitoring the actions. Even if the current action plans are not exhaustively completed, they can be updated over time as more information becomes available. This report should be considered a living, working document.

Please visit the CEOS website www.ceos.org to download the full text of the *Response of the Committee on Earth Observation Satellites (CEOS) to the Global Climate Observing System Implementation Plan 2010 (GCOS IP-10).*

CEOS was established in 1984 at the request of the Economic Summit of Industrialised Nations Working Group (G7), as the international forum for Earth observing space agencies. CEOS contributes the space component of the Global Earth Observation System of Systems (GEOSS) and supports key stakeholders with a wide range of Earth observation data, products, and expertise. CEOS has 30 Member Agencies and 22 Associate Agencies.

CEOS plays a vital role in coordinating Earth observations, enabling improved societal decision-making for a prosperous and sustainable future. Please visit www.ceos.org for more information.