

Planning the CEOS Response to the new GCOS Implementation Plan 2010

Mitch Goldberg, CEOS Climate Coordinator
Pascal Lecomte, Co-Coordinator

Background

- GCOS Implementation Plans provides the requirements for climate quality observations, products and cal/val.
 - GCOS-92: GCOS IP released in 2004
 - GCOS-107: 2005 GCOS Satellite Supplement contains the attributes associated with satellite-based climate products
 - New GCOS IP for 2010.

2480 Satellite radiances provide measurements of several global atmospheric upper air variables, temperature and water vapour in particular. However they can be subject to biases from uncertainties in the sensor calibration and data pre-processing (e.g. cloud removal). The Climate Absolute Radiance and Refractivity Observatory (CLARREO) Mission has been proposed as a key component of the future climate observing system providing an absolute calibration traceable to SI standards. It will underfly the satellites used for climate monitoring and will serve as a tool for satellite intercalibration to provide a climate benchmark radiance dataset. One component of CLARREO

*Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC
(2010 Update, DRAFT v1.0, 13 November 2009)*

2485 involves the measurement of spectrally resolved thermal infrared and reflected solar radiation at high absolute accuracy. Coupled with measurements from on-board GPS radio occultation receivers, this will provide a long-term benchmarking data record for the detection, projection, and attribution of changes in the climate system. It will also provide a source of absolute calibration for a wide range of visible and infrared Earth observing sensors, increasing their value for climate monitoring. The second component of CLARREO involves ensuring the continuity of measurements of incident solar
2490 irradiance and Earth radiation budget data which is specifically addressed in A24 below.

Action A18

Action: Implement and evaluate a satellite climate calibration mission, e.g. CLARREO .
Who: Space agencies (e.g., NOAA, NASA, etc)
Time-Frame: Ongoing
Performance Indicator: Improved quality of satellite radiance data for climate monitoring.
Annual Cost Implications: 100-300M USD (Mainly by Annex-I Parties).

New GCOS Satellite Supplement?

Product O.4 Ocean colour, and oceanic chlorophyll-a concentration derived from ocean colour

Benefits

- Climate monitoring
- Chlorophyll-a linked to carbon-cycling, including between the ocean and the atmosphere
- Ocean particulate carbon estimated from ocean colour

Target requirements (for ocean colour)

- Accuracy: 5%
- Spatial and temporal resolution: 1 km horizontal resolution, daily observing cycle
- Stability: 1%/decade

Requirements for satellite instruments and satellite datasets

FCDR of appropriate multispectral VIS imagery, for example through:

- Extension of current provision of MODIS and MERIS-class, followed by development of a strategy based on advances beyond MODIS, MERIS and SeaWiFS-class capabilities

Adequacy/inadequacy of current holdings

There is no current consolidation of a global FCDR based on existing data from SeaWiFS, MODIS and MERIS, and activities to address this need and to derive products should be encouraged

Calibration, validation and data archiving needs

- Improved access to ocean colour data is required
- Improve the network of *in situ* measurements for calibration purposes

Immediate action, partnerships and international coordination

- Coordination through user groups of ocean-colour data, such as IOCCG, IOCCP, CASIX, CARBOOCEAN and GLOBCOLOUR
- Research should continue in the development of new products, making use of water-leaving radiances
- Research should continue in assimilation of ocean-colour products into ocean climate models, in order to improve carbon-cycle products such as pCO_2 and air-sea CO_2 fluxes

CEOS 59 Climate Actions in response to GCOS-92 (IP2004) and GCOS-107 (satellite supplement)

- Action plan adopted by CEOS in September 2006
- Overall goals
 - Ensuring continuity of climate-relevant satellite measurements (13 actions);
 - Taking a systematic approach to generating fundamental climate data records (FCDRs) (11 actions);
 - Preserving climate data records (4 actions);
 - Ensuring access to climate data products (10 actions);
 - Coordinating international communities and interaction with users (10 actions); and
 - Addressing future measurement needs (11 actions).



CEOS 59 Climate Actions

- A first round of climate actions assessment, in coordination with GCOS, led in 2007 to identify:
 - 22 "Priority 1 actions"
 - Deemed to be progressed immediately
 - Capable of delivering significant outcomes within a 1-2 year timescale.
 - 32 "Priority 2 actions"
 - Continuous, on-going, or require additional information from potential contributors in order to be suitably defined
 - will not necessarily deliver significant results in the 1-2 year timescale.
 - 5 "Priority 3 actions"
 - Considered premature at this stage.

CEOS UNFCCC 2008 Report

- The status of the Priority 1 actions and plans for new tasks were detailed in the CEOS UNFCCC report.
- The updated progress report was presented to the UNFCCC Subsidiary Body on Scientific and Technological Advice (SBSTA) at its 29th session in December 2008.

UNFCCC SBSTA Response

- *Encourages* the Committee on Earth Observation Satellites to continue coordinating and supporting the implementation of the satellite component of the Global Climate Observing System;
- The SBSTA invited CEOS to report at its thirty-third session on progress made in its efforts to meet the relevant needs of the Convention.
- SBSTA also interested in terrestrial domain, particularly forest carbon tracking.

GCOS Independent Assessment of Space Agency Progress is very favorable

Assessment of Progress involving Space Agencies after 5 years into 10-year plan (88% above moderate)

Progress	Low	Moderate /Low	Moderate	Good/ moderate	Good
Number of Actions	2	1	5	8	9
Percentage of Actions	8%	4%	20%	32%	36%

Initiated Priority 2 Actions

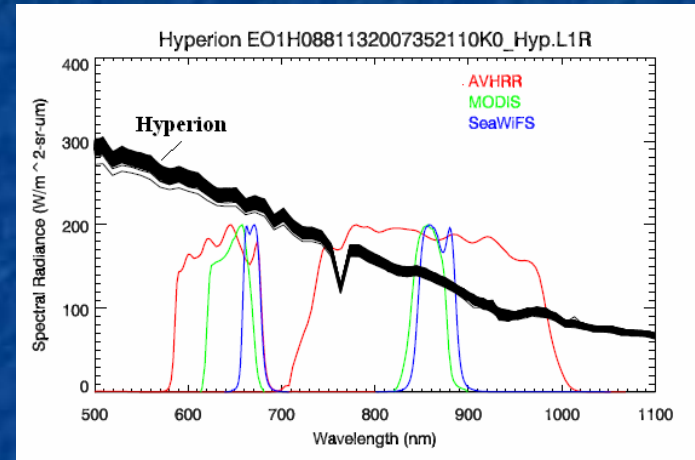
- Initiated 17 CEOS-GCOS climate actions based on readiness and critical mass from CEOS in working these actions
- Progress reports are provided to GCOS and GEO Sec

Challenges with 2006 CEOS Actions and new opportunities

- A number of CEOS Climate Actions were developed without the prior commitment of the groups needed to do the work.
- CEOS 2006 response document did always mapped CEOS actions with the GCOS actions
- New opportunity to respond to the new GCOS IP report with actionable actions with a team assigned and with the necessary resources
- Since 2006, CEOS is considerably more capable

CEOS Working Groups

- Working Group on Cal/Val
 - GEO Data Quality Assurance Guideline document
 - Antarctic Dome C calibration campaign
 - verified Dome C as excellent satellite intercalibration and long term monitoring site,
 - transfer SeaWiFS stable lunar calibration to AVHRR and other sensors at Dome C
- Working Group on Information Systems and Services
 - Developing a portal for easy access to climate diagnostics
- Working Group on Education
 - Workshops/training for data utilization



CEOS Virtual Constellations

- Precipitation
- Land Surface Imaging
- Atmospheric Composition
- Ocean Surface Topography
- Ocean Color
- Ocean Surface Vector Winds

Organizational groups where CEOS agencies are members

- GSICS
- SCOPE-CM
- CGMS
- International Working Groups
- WCRP

New Approach

- Good opportunity for a new CEOS response with actionable actions
- New actions can supersede the existing actions
- Use 2006 CEOS response as a template
- Estimate level of effort and completion time
- Begin with development of actionable actions

The current 59 Actions



= new actions (at least 10, goal of 20)

Atmospheric Domain



= priority 1 actions



Action A-1: In 2007 CEOS agencies will review the capability of passive microwave sensors to make scatterometer-quality measurements and will work to ensure A.M. and P.M. satellite coverage of surface wind speed and direction by 2015.



Action A-2: CEOS will strive to ensure continuity of GPS RO measurements with, at a minimum, the spatial and temporal coverage established by COSMIC by 2011. CEOS will continue efforts in 2007 to exploit the complementary aspects of radiometric and geometric upper-air determinations of temperature and moisture.



Action A-3: CEOS will support in 2007 investigations of cloud properties and cloud trends from combined satellite imager plus sounder measurements of clouds (with horizontal as well as vertical information) using Cloudsat/CALIPSO for validation.



Action A-4: CEOS agencies will ensure continued improvements to precipitation determinations demonstrated by TRMM and planned by GPM in 2010. The Japan Aerospace Exploration Agency (JAXA) and the National Aeronautics and Space Administration (NASA) will lead a CEOS study team to establish, by 2007, the basis for a future Global Precipitation Constellation.



Action A-5: CEOS will plan by 2011 to make absolute, spectrally resolved measurements of radiance emitted and reflected by the Earth to space for information on variations in both climate forcings and responses.



Action A-6: CEOS agencies will participate in re-planning, by 2007, the Earth Radiation Budget Sensor (ERBS) removed from the planned payload of NPOESS.



Action A-7: CEOS agencies will participate in re-planning, by 2007, the Total Solar Irradiance Sensor (TSIS) removed from the planned payload of NPOESS.

Action A-8: CEOS agencies will participate in re-planning, by 2007, the OMPS limb instrument removed from the planned payload of NPOESS.

Atmospheric Domain



Action A-9: CEOS agencies will participate in re-planning, by 2007, the APS instrument removed from the planned payload of NPOESS.



Action A-10: CEOS agencies will participate in planning, by 2011, the operational follow-on to the chemistry missions planned for the next 5 to 7 years.




Action A-11: CEOS agencies will commit in 2007 to reprocessing the geostationary satellite data for use in reanalyses projects before the end of the decade.




Action A-12: CEOS will determine options by 2010 for continuing improvements to wind determinations demonstrated by MODIS and to be demonstrated by ADM Aeolus.

Ocean Domain




Action O-1: CEOS agencies will examine their respective plans to maintain provision of microwave brightness temperatures and visible/infrared radiances for the sea ice ECV.




Action O-2: Relevant CEOS space agencies will consult with the science community on appropriate retrieval algorithms of passive microwave observation for reprocessing sea-ice products. Norway has expressed interest in committing to operational production of a global sea ice ECV (an initiative by the Norwegian Meteorological Institute, and coordinated by the Norwegian Space Center). The European Space Agency (ESA) is currently reprocessing the relevant ERS and Envisat archive to complement Canada's Radarsat in the context of WCRP's Climate and the Cryosphere (CLiC) core project.


Action O-3: New space-based measurements and products, including ice thickness and ice drift, will be considered by CEOS agencies as part of their future research missions.



Action O-4: The National Oceanic and Atmospheric Administration (NOAA) and EUMETSAT will lead a CEOS study team to establish, by 2007, the basis for a future Ocean Surface Topography Constellation that satisfies the threshold requirements for the sea level ECV (and those of the sea state ECV). This will include consideration of a future Jason-3 mission and requirements for new altimeter technologies to improve spatial resolution and extend observations in coastal regions (and over lakes and rivers for the lakes ECV).



Action O-5: The Centre National d'Etudes Spatiales (CNES) and the Indian Space Research Organization (ISRO) will cooperate on a new polar-orbiting altimeter aimed at filling a potential data gap beyond 2008. ESA and the European Union (EU) will lead planning for Sentinel-3 carrying an altimeter to complement spatial/temporal coverage of the sea level (and sea state) ECVs (and possibly sea ice extent and thickness, river, and lake level with the altimeter operating in Synthetic Aperture Radar (SAR) mode beyond 2012).



Action O-6: An ATSR-like instrument is planned on ESA's Sentinel 3, presently scheduled for launch in 2012. JAXA will lead planning for Global Change Observation Mission-Water (GCOM-W) and GCOM-C (Climate) to maintain continuity of the sea surface temperature ECV.

Ocean Domain

Action O-7: CEOS agencies will examine their respective plans to maintain provision of microwave brightness temperatures for the sea surface temperature ECV.

Action O-8: Relevant CEOS agencies will examine their respective plans to maintain continuity of a 10-km-resolution sea surface temperature data sets global product.

Action O-9: CEOS agencies will cooperate to support the combination of all existing sea surface temperature data sets into a global FCDR.

Action O-10: ISRO will lead planning of Oceansat-2, ESA and the EU of Sentinel-3, and JAXA of GCOM-C, which are all new missions planned to carry an ocean colour sensor.

Action O-11: Relevant CEOS agencies will examine their respective plans to maintain continuity of the 25-km-resolution ocean colour global product.

Action O-12: CEOS agencies will cooperate to support the combination of all existing ocean colour data sets into a global FCDR.

Action O-13: In consultation with GCOS and the relevant user communities, CEOS agencies will explore the means to secure, by 2011, continuity of the 1-km-resolution global ocean colour product needed to fulfil the target GCOS requirements.

Action O-14: CEOS agencies will cooperate with the user community to support efforts aimed at building on the decade-long satellite sea state records and making a comprehensive use of future altimeter- and SAR-bearing missions.

Action O-15: ESA will fly SMOS in 2007 to demonstrate measurement of the sea surface salinity (and soil moisture) ECV; NASA/CONAE will fly Aquarius/SAC-D in 2009 to demonstrate measurement of the sea surface salinity ECV.

Action O-16: CEOS agencies will cooperate in developing future plans for an Ocean Salinity Constellation.


Ocean Domain

Action O-17: CEOS agencies will undertake planning for reprocessing past data to improve FCDRs and legacy databases (e.g., AVHRR Pathfinder, ATSR, Sea Level Pathfinder, and the sea ice ECV) in close coordination and partnership with existing advisory groups and reanalysis centres. All Level 2 data products for use in reanalysis should be properly accompanied by estimates of their uncertainty.

Action O-18: CEOS, through its Working Group on Calibration and Validation (WGCV) and in the context of developing standards for on-going missions and for the Constellations, will recommend best practices for pre-launch and onboard calibration of ocean sensors and for validation of space-based ocean observations with in situ sensors, including the establishment and maintenance of calibration and validation sites and networks. This will facilitate the combination of data from different sources and enable the establishment of global data sets and long-term series.


Action O-19: CEOS agencies, in cooperation with other partners, will support planning for a follow-on to GODAE by 2007.

Terrestrial Domain




Action T-1: CEOS agencies will determine which alternative approach best fills the current Landsat-class data gap and will explore the potential of integrating high-resolution data from multiple platforms (e.g., China-Brazil Earth Resources Satellite (CBERS), Indian Remote Sensing (IRS) satellite, Landsat, Satellite Pour l'Observation de la Terre (SPOT), and others) based on the results of a CEOS study team led by the United States Geological Survey (USGS) that will establish, by 2007, the basis for a future Land-Surface Imaging Constellation.


Action T-2: CEOS agencies will assess the feasibility of generating global historic and continuing ECVs at fine resolutions for land cover and glacier change.



Action T-3: CEOS (led by USGS and NOAA), in cooperation with relevant stakeholders, will explore the feasibility, by 2007, of retrieving and reprocessing the 1-km AVHRR data record from various centralized archives (NOAA and High Resolution Picture Transmission (HRPT) stations).




Action T-4: CEOS will work to enhance the quality of the FCDRs and the ECVs generated from the AVHRR record to meet threshold requirements.




Action T-5: CEOS agencies will undertake research to support satellite technology development, such as lidar or P-band sensors, that are capable of retrieving biomass and LAI globally that meet GCOS requirements. CEOS agencies will also support research to improve algorithms that do not currently meet GCOS threshold requirements. New satellite technology and algorithms should be available by 2015.

Action T-6: CEOS will assess the feasibility of collecting operational multi-angle observations. Research will be carried out by CEOS agencies to improve radiation transfer schemes for albedo and fAPAR, especially under cloudy conditions.


Cross Cutting



Action C-1: CEOS will review the prevailing institutional arrangements in place for the planning and implementation of cooperative efforts by space agencies in the domain of climate (among others) by 2007. In particular CEOS agencies will review the ways to improve coordination of future remote sensing tasks that address the upcoming space-based measurement challenges, so as to avoid duplication of efforts while taking cooperation between the international partners to a higher level.




Action C-2: CEOS agencies will work with GEO to leverage progress and results from the implementation actions for climate to benefit all other relevant SBAs.




Action C-3: CEOS will work with GCOS to periodically evaluate climate needs and their realization.

Action C-4: CEOS agencies will adjust their internal procedures and mechanisms relative to satellite mission planning and operating processes in order to ensure adequate adherence to the GCMPs.


Action C-5: CEOS agencies will review their respective satellite data records with particular attention to adherence to the GCMPs and will consider undertaking necessary corrective actions within available resources.



Action C-6: CEOS will consider the GCMPs and relevant ECV requirements in defining criteria that will serve as the foundation for the CEOS Constellation studies being initiated in 2006 and beyond.




Action C-7: CEOS agencies will increase their cooperation in ensuring stability, accuracy, and inter-comparability of their respective satellite observations. These observations will be tied to irrefutable international standards in order to enhance the utility of space programmes for climate applications.



Action C-8: CEOS agencies will contribute to development of GSICS under development by CGMS and WMO to better integrate calibration efforts. Furthermore, CEOS agencies will continuously pursue establishment of reference measurements in space, complementing those on the ground and in the air, which will enable absolute inter-calibration of radiance measurements.

Action C-9: CEOS will charge its WGCV to promote existing in situ networks, identify new opportunities for product validation, and support both validation research and operational validation projects at an adequate level.

Cross Cutting




Action C-10: CEOS agencies will coordinate their efforts in designing future data archives and data dissemination systems, ensuring that past data holdings (including associated metadata) are preserved, assessing standards and protocols, and incorporating new information technology (IT) developments as much as possible. Practical actions in response to this cross-cutting need will be developed by CEOS' Working Group on Information Systems and Services (WGISS) in line with the technical solutions adopted by GEO.

Action C-11: CEOS agencies will systematically consult with appropriate scientific and user advisory groups in establishing detailed specifications for each FCDR and derived products, including associated uncertainties.


Action C-12: CEOS agencies will consult on appropriate rules to ensure sustained, open accessibility to FCDRs in order to allow the periodic reprocessing and generation of homogeneous products.

Action C-13: CEOS agencies will generate, within available resources, independently processed data sets and products.

Action C-14: Recognising that space agencies are responsible for only a portion of the value chain involved in the generation of FCDRs, CEOS will explore ways to strengthen linkages to the communities involved in climate product generation and use, e.g., through framework agreements with major reanalysis centres.



Action C-15: CEOS agencies will encourage funding of climate change research at an adequate level for multiple groups to analyze data records, reprocess climate variables, and perform reanalysis.




Action C-16: CEOS agencies will consider, in the context of the Constellations, ways and means to support the transfer of demonstrated observations from research satellites into operational capabilities. In particular, CEOS will encourage “convergence” of climate-observing requirements (usually for high-quality data) with operational requirements (usually for rapid and ensured data availability), and support institutional arrangements that would help transfer ECVs from research to operations

Cross Cutting


Action C-17: CEOS agencies will maintain R&D efforts aimed at confronting the knowledge challenge posed by climate and climate change, and strive to overcome the current scientific and technical limitations of climate-quality measurements.

Action C-18: CEOS agencies will ensure that data acquired through research satellites are fully used for the benefit of creating and/or improving the FCDRs of all ECVs.

Action C-19: CEOS agencies will continue to devote particular efforts to the reprocessing and improvement of these fundamental data sets.

 **Action C-20:** CEOS agencies will endeavour to ensure global, easy, and timely access to climate-related products, including by developing countries.

Action C-21: CEOS will establish a programme in 2007 to document the data archive and access arrangements in place for each of the FCDRs contributed by space agencies. WGISS will lead this effort in order to evaluate practical solutions to current obstacles and issues.

 **Action C-22:** CEOS agencies will continue their efforts, both individually and through the CEOS Working Group on Education and Training (WGEdu), to build capacity.

ACTION #	DESCRIPTION	Space Agencies Action?	(GCOS 92) Reference	GCOS 107 Product #	CEOS 59 Climate Action #	Assignee
1	C1 Participating international and intergovernmental organizations are invited to review and update their plans in light of this document in order to ensure they better serve the needs of the UNFCCC.	X				ALL
2	C2 Designate national coordinators and/or committees, achieve national coordination, and produce national plans for contributions to the global observing system for climate in the context of this Plan.	X				All
4	C4 Report to the UNFCCC on systematic climate observations using current guidelines.	X	C4			All
6	C6 Ensure an orderly process for sustained operation of research-based networks and systems for ECVs.	X	C7	C.6		All
7	C7 Ensure all climate observing activities adhere to the GCMPs.	X	C8	C.3 C.4		All
8	C8 Support the implementation of the global observing system for climate in developing countries and countries with economies in transition through membership in the GCOS Cooperation Mechanism and contributions to the GCOS Cooperation Fund.	X	C9			ALL
9	C9 Ensure continuity and over-lap of key satellite sensors; recording and archiving of all satellite metadata; maintaining currently adopted data formats for all archived data; providing data service systems that ensure accessibility; undertaking reprocessing of all data relevant to climate for inclusion in integrated climate analyses and reanalyses.	X	C10	C.0 C.1 C.3 C.4 C.7 C.8	C-1 C-2 C-3	WGISS, Maiden, Pakorn
26	C10 Achieve adoption of the GCOS dataset and product guidelines, critical comparison of datasets/products and advice on product generation for all ECVs by the climate community.	X				All

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A7	Ensure continuity of satellite precipitation products.	X				Neeck, Riko
A10	Ensure continuous generation of wind-related products from AM and PM satellite scatterometers or equivalent observations.	X	A11	A.1	A-1	Wilson, Bonekamp
A18	Implement and evaluate a satellite climate calibration mission, e.g. CLARREO .	X			A-5	SBA Team
A19	Ensure the continued derivation of MSU-like radiance data and establish FCDRs from the high-resolution IR sounders, following the GCMPs.	X	A19	A.2		SBA Team
A20	Ensure the continuity of the constellation of GNSS RO satellites.	X				Ector, VonEngen
A22	Ensure continuation of the measurements needed to extend the climate data record of visible and infrared radiances, e.g., from the International Satellite Cloud Climatology Project, and include additional data streams as they become available. Pursue reprocessing as continuous activity taking into account lessons learnt from preceding research.	X	A22	A.4	A-3	SBA Team
A23	Research to improve observations of the three-dimensional spatial and temporal distribution of cloud properties.	X	A23	A.4	A-3	SBA Team
A24	Ensure continuation of Earth Radiation Budget observations.	X	A24	A.6	A-5 A-6	SBA Team
A25	Establish long-term series of limb-scanning satellite measurements of profiles of water vapour, ozone and other important species from the UT/LS up to 50km.	X				Hilsenrath, Eckman
A26	Establish a network of ground stations (MAXDOAS, lidar, FTIR) capable of validating satellite remote sensing of the troposphere.	X				
A27	Maintain and enhance the GCOS Comprehensive Networks for CO2 and CH4 coordinated by WMO GAW.	X	A27	A.9	A-10	Hilsenrath, Eckman

ACTION #	DESCRIPTION	Space Agencies Action?	(GCOS 92) Reference	GCOS 107 Product #	CEOS 59 Climate Action #	Assignee
A28	Assess the value of the data provided by current space-based measurements of CO2 and CH4, and develop and implement proposals for follow-on missions accordingly.	X				Hilsenrath, Eck
A31	Continue production of satellite ozone data records (column, tropospheric ozone and ozone profiles) suitable for studies of interannual variability and trend analysis. Reconcile residual differences between ozone data sets produced different satellite systems.	X				Hilsenrath, Eck
A32	Develop and implement a coordinated strategy to monitor and analyze the distribution of aerosols and aerosol properties. The strategy should address the definition of a baseline GCOS network or networks for in-situ measurements, assess the needs and capabilities for operational and research satellite missions for the next two decades, and propose arrangements for coordinated mission planning.	X	A31	A.8 C.7	A-9 C-1 C-2 C-3	SBA Team
A33	Ensure continuity of products based on space-based measurement of the precursors (NO2, SO2, HCHO and CO in particular) of ozone and aerosols and derive consistent emission databases, seeking to improve temporal and spatial resolution.	X				Hilsenrath, Eck

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O4	Ensure coordinated implementation of CEOS Virtual Constellations for each ocean surface ECV, in relation to in-situ ocean observing systems.	X	O7			Wilson, Bonekamp
O7	Continue the provision of best possible SST fields based on a continuous coverage-mix of polar orbiting IR and geostationary IR measurements, combined with passive microwave coverage, and appropriate linkage with the comprehensive in situ networks noted in O8.	X	O9	O.3	O-6 O-7 O-8 O-9	Wilson, Dowell, SBA Team
O10	Ensure continuous coverage from one high-precision altimeter and two sunsynchronous, higher-resolution altimeters	X	O12	O.2	O-4 O-5	Wilson, Bonekamp
O12	Research programmes to demonstrate feasibility of utilizing satellite data to help resolve global fields of SSS.	X	O16			SBA Team
O15	Implement plans for an Ocean Colour Radiometry (OCR) Virtual Constellation (VC)	X	O18	O.4	O-10 O-11 O-12 O-13	Dowell, Hiroshi
O20	Ensure sustained satellite-based (microwave, SAR, visible and IR) sea-ice products.	X	O23	O.1	O-1 O-2 O-3	SBA Team
O28	Develop projects designed to assemble the in situ and satellite data into a composite reference reanalysis dataset, and to sustain projects to assimilate the data into models in ocean reanalysis projects.	X	O29			Dowell, Hiroshi, Wilson, Bonekamp
O41	Promote and facilitate research and development (new improved technologies in particular), in support of the global ocean observing system for climate.	X	O3			Dowell, Hiroshi, Wilson, Bonekamp

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T3	Development of a subset of current LTER and FLUXNET sites into a global reference network for ecological monitoring sites with sustained funding perspective.	X	T3 T29			Lecomte, WGCV
T6	Submit weekly/monthly lake level/area data to the International Data Centre; submission of weekly/monthly altimeter-derived lake levels by space agencies to HYDROLARE.	X	T6	T.1.1 T.1.2		Wilson, Bonekamp
T8	Submit weekly surface and sub-surface water temperature, date of freeze-up and date of break-up of lakes in GTN-L to HYDROLARE.	X	T8	T.1.3		SBA Team
T11	Develop a record of validated globally gridded near surface soil moisture from satellites	X				SBA Team
T12	Develop Global Terrestrial Network on Soil Moisture	X				SBA Team
T14	Obtain integrated analyses of snow cover over both hemispheres.	X	T11	T.3		SBA Team
T16	Ensure continuity of laser, altimetry and gravity satellite missions adequate to monitor ice masses over decadal timeframe.	X	T14	T.2.2		SBA Team
T21	Implement operational mapping of seasonal soil freeze/thaw through an international initiative for monitoring seasonally-frozen ground in non-permafrost regions	X	T17	T.3		SBA Team
T22	Obtain, archive and make available in-situ calibration/validation measurements and collocated albedo products from all space agencies generating such products, and promote benchmarking activities to assess the quality and reliability of albedo products.	X	T19			Lecomte, WGCV
T23	Implement globally coordinated and linked data processing to retrieve land surface albedo from a range of sensors on a daily and global basis, using both archived and current Earth Observation systems.	X	T21	T.4		Holm, LSI
	Produce reliable accepted methods for land cover map					

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T24	Produce reliable accepted methods for land-cover map accuracy assessment.	X	T23			Holm, LSI
T25	Develop an in situ reference network and apply CEOS WGCV validation protocols for land cover.	X	T25			Lecomte, WGCV
T26	Generate annual products documenting global land-cover characteristics at resolutions between 250m and 1km, according to internationally-agreed standards and accompanied by statistical descriptions of their accuracy.	X	T26	T.5.1		Holm, LSI
T27	Generate maps documenting global land cover based on continuous 10-30m land surface imagery every 5 years, according to internationally-agreed standards and accompanied by statistical descriptions of their accuracy	X	T27	T.5.1 T.5.2		Holm, LSI
T28	Establish a calibration/validation network of in situ observing sites for FAPAR and LAI (reference sites) and conduct systematic, comprehensive evaluation campaigns to understand and resolve differences between the products and increase their accuracy.	X	T29			Lecomte, WGCV
T29	Evaluate the various LAI satellite products and benchmark them against in situ measurements to arrive at an agreed operational product.	X	T30			Lecomte, WGCV
T30	Operationalize the generation of FAPAR and LAI products as gridded global products at spatial resolution of 2 km or better over time periods as long as possible.	X	T28	T.6 T.7		Holm, LSI, Csiszar
T31	Develop globally gridded demonstration datasets of above ground biomass across all biomes	X				Holm, LSI, Csiszar
T33	Develop globally gridded estimates of terrestrial carbon flux from in situ observations and satellite products and assimilation/inversions models.	X				Holm, LSI, Csiszar
T34	Reanalyze the historical fire disturbance satellite data (1982 to present).	X	T32			Csiszar
	Continue generation of burnt area, active fire and FRP products from low orbit satellites consistent, including	X				

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T35	Continue generation of burnt area, active fire and FRP products from low orbit satellites consistent, including version intercomparisons to allow un-biased, long-term record development.	X	T33	T.9		Csiszar
T36	Apply CEOS WGCV and GOFC-GOLD validation protocol to fire disturbance data.	X	T34			Lecomte, WGCV, Holm

How to proceed

- Identify domain leads
- Assign groups to develop actions responding to the GCOS IP10 actions using a template.
- The groups need to reach into the expert community.
- Action must be actionable with resources identified.

2480 Satellite radiances provide measurements of several global atmospheric upper air variables, temperature and water vapour in particular. However they can be subject to biases from uncertainties in the sensor calibration and data pre-processing (e.g. cloud removal). The Climate Absolute Radiance and Refractivity Observatory (CLARREO) Mission has been proposed as a key component of the future climate observing system providing an absolute calibration traceable to SI standards. It will underfly the satellites used for climate monitoring and will serve as a tool for satellite intercalibration to provide a climate benchmark radiance dataset. One component of CLARREO

*Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC
(2010 Update, DRAFT v1.0, 13 November 2009)*

2485 involves the measurement of spectrally resolved thermal infrared and reflected solar radiation at high absolute accuracy. Coupled with measurements from on-board GPS radio occultation receivers, this will provide a long-term benchmarking data record for the detection, projection, and attribution of changes in the climate system. It will also provide a source of absolute calibration for a wide range of visible and infrared Earth observing sensors, increasing their value for climate monitoring. The second component of CLARREO involves ensuring the continuity of measurements of incident solar
2490 irradiance and Earth radiation budget data which is specifically addressed in A24 below.

Action A18

Action: Implement and evaluate a satellite climate calibration mission, e.g. CLARREO .
Who: Space agencies (e.g., NOAA, NASA, etc)
Time-Frame: Ongoing
Performance Indicator: Improved quality of satellite radiance data for climate monitoring.
Annual Cost Implications: 100-300M USD (Mainly by Annex-I Parties).

A18 - Implement and evaluate a satellite climate calibration mission, e.g. CLARREO

- Point of Contact
- Contributors: NASA, NOAA, WGCV (Nigel Fox)
- Significance
- Current Status: CLARREO project proceeding. Need status of TRUTHS (Nigel Fox)
- Accuracy requirements (target (desired) and planned)
- CEOS Action with current and planned resources:
 - Supersede any existing CEOS climate actions?
- CEOS Action with additional resources:
 - Include significance of the shortfall without additional resources

Required Document Resources

- GCOS92 - original GCOS IP
- GCOSIP-10 - updated GCOS IP
- GCOS107 Satellite Supplement
- CEOS 2006 Response Document