

**The Role of Observations in Support of Adaptation:
The GCOS¹ Contribution to the Nairobi Work Programme
(In Cooperation with the WCRP and WMO)**

Executive Summary

Adequate high-quality observations of climate and climate-related variables are essential if adaptation to climate change is to be based on deliberate planning leading to better adaptation policies. Good observations acquired over extended periods make possible an understanding of the frequency of extreme events as well as average climate conditions. They thereby contribute to better planning and decision making related to agriculture, coastal zone management, water resources management, health, tourism, and disaster risk management.

Observations also play a key role in initializing models to enable weather forecasting and longer range statistical predictions of seasonal, inter-annual, and decadal climate. While observations provide a factual basis for assessing current climate change and an indication of shorter term future change, climate models provide a basis for improved guidance and an ability to assess possible climate change over longer time scales. Global climate models are vital because a global scale is essential to represent the complex interactions and processes of the climate system. Regional models using boundary conditions derived from global models are an important supplement, as they provide much higher resolution projections about changes at the regional and national scales at which adaptation responses will be considered. Statistical downscaling models are another way to provide the needed regional detail and are viewed by some as currently a more reliable approach. Such models can, however, only be used when detailed regional observations are available. Thus, regional models--and adaptation responses--require denser observing networks than needed for global models. The companion paper submitted by the World Climate Research Programme (WCRP) discusses in more detail the issues and needs related to using regional models and other downscaling techniques for providing greater spatial detail in climate projections.

Whether in conjunction with models or otherwise, an important GCOS objective is to ensure that climate observations are used to maximum benefit to support adaptation. *At the present time, in many countries neither the quality nor quantity of observations needed by global and regional models is adequate to support and verify climate models so as to allow the reliable projections needed for adaptation purposes. In order to meet adaptation needs, models will need to be improved and observation networks and data use will need to be strengthened, especially in vulnerable areas.*

To address the need for observations required for adaptation under the Nairobi Work Programme, the GCOS Steering Committee recommends the development and implementation of a programme of regional workshops concerned with three important linked activities. A series of three workshops in each of ten regions would be organized to take these activities forward. The first activity would assess the adequacy of global and regional climate observations for determining regional climate trends and for adaptation planning. The second would use the available observations to evaluate the adequacy and reliability of regional climate models for adaptation needs and provide qualified projections of likely future changes in climate at the regional level. And the third, which would include policy-level representation, would consider the assessments provided by the first two workshops and provide advice on how model outputs could best be used to develop effective adaptation strategies. These activities are discussed in more detail in the final section of this paper.

¹ See Annex for background on the Global Climate Observing System (GCOS).

The proposed programme of activities is aligned with the mission of GCOS to promote the availability and quality of climate observations needed to support research and the provision of climate services. Since observations, research, and services are interlinked, a joint programme is suggested involving GCOS, the World Climate Research Programme (WCRP), and the WMO World Climate Programme (WCP). This programme would, in addition, draw on the expertise of key interested bodies, such as the main numerical modeling centres. Other key participants, including space agencies and global data analysis centres, would be engaged in ensuring that the best possible data are available to support the programme. The UNFCCC/SBSTA may wish to be directly involved in helping to organize the final set of workshop activities, which would be more policy-oriented, and which would consider possible adaptation responses to expected regional climate change. The GCOS Steering Committee believes that this activity would help ensure attention to observation and data record needs, make available the latest climate projections, provide research programmes with advice on model limitations, and give an improved regional understanding of, and capability for, using both data records and model projections in support of adaptation planning.

1. The Need for Climate Observations for Adaptation

The issue of adaptation to climate change is not new,² and, as the inevitability of man-made climate change has become more certain, it has become increasingly important to the achievement of the ultimate objectives of the UNFCCC. It is now recognized that the Earth's climate is generally warming and is likely to continue to warm. Hence adaptation to climate change will be necessary no matter how successful countries are at reducing greenhouse gas emissions. Mitigation and adaptation are now seen as necessary and complementary approaches to dealing with the challenge of climate change.

Climate information, such as precipitation and land cover data, is essential for planning purposes in a wide variety of human activities. These include water resources management, agriculture, energy supply planning, and planning involving the built environment. Moreover, climate information is essential for optimal economic development even in the absence of a human impact on climate. For example, it is evident from the impacts associated with current climate that many societies are not well organized to cope with extreme events such as droughts and floods. Added to the challenges to planning posed by the current natural climate and its variability, societies now face the challenge of adapting to a changing climate.

Both natural and human systems will be required to adapt to climate change. Societies and nature may have to cope with various changes, including rising sea levels, more frequent or intense droughts and floods, periods of extreme temperature, and precipitation. The consequences may include changes in water supplies; impacts on agriculture, human health, and energy production; disruption of ecosystems; and changes in many climate-sensitive natural resources.

Good observations acquired over extended periods make possible an understanding of both the frequency of occurrence of significant extreme events and also the identification of climate trends in such extremes and in average conditions. Thus, if current climate trends are continued, these observational records provide an important basis for considering short term adaptation. In contrast, climate models provide a basis for improved guidance and an ability to assess possible climate change over longer time scales. The use of climate models does not, however, reduce the need for observations. The observational climate record is essential to underpin climate models and, where that observational record is lacking, the information on both the planning needs in the current climate as well as measures of the

² See, for example, U.S. Congress, Office of Technology Assessment, *Preparing for an Uncertain Climate* (Washington, DC: U.S. Government Printing Office, October 1993).

reliability of projections of climate will also be lacking. Thus, in order to understand and adapt to these potential changes, there is a need to ensure an adequate quantity and quality of climate observations. Without adequate climate observations, confidence in future projections is limited and substantial resources could be wasted by implementing adaptation policies that may prove unreliable. Additionally, without planned adaptation and development of appropriate strategies that build in societal resilience to climate perturbations, disruptions and losses from extreme events can be expected to rise steadily. The African Development Bank, the World Bank, and others have already recognized the potentially significant costs associated with either a failure to respond to climate risk or with responding inappropriately, and these organizations are beginning to consider how to “climate proof” their investment portfolios.

The management of current climate risks and adaptation to climate change are thus intimately linked: both require the same high-quality data. It is evident that many countries lack the capacity to manage current climate risks effectively. They lack adequate historical records, and many of the historical climate records they possess are not computerized, and thus effectively unavailable for use. It is equally clear that these countries may not be able to devise effective strategies to adapt to future climate change because of the lack of the available data records to support the development and verification of the models needed to provide future climate projections. The GCOS Second Adequacy Report³ sought in its chapter on the scientific rationale to explain these issues and to consider overall needs for climate observations in support of the UNFCCC. The Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC⁴ (IP) considered all UNFCCC needs for systematic observation, including the support to adaptation noted here, and provided a plan for meeting them. This plan notes that regional models and adaptation strategies require denser observing networks than needed for global models, but that the measurements needed on a regional scale can be limited to those variables of direct relevance to climate impacts. As noted in the IP, adequate observations of both global and regional scales are equally essential for use in weather and disaster warnings and in supporting other environmental services that allow society to best cope with the prevailing climate.

It is also important to mention the use of the same observations in initializing models to enable weather forecasts and extended-range statistical forecasts of seasonal, inter-annual, and even decadal variations in climate. Significant economic value is associated with planning that is based on weather and longer period forecasts. The global exchange of data to support such forecasts and the international dissemination of the resulting forecasts are primary functions of the WMO. The adverse affects of longer time scale climate change will often be felt through extreme weather events, and such forecasts allow important short term actions to avoid some of the impacts of these events.

2. Climate on Global and Regional Scales

The climate in any region is the result of a complex set of processes taking place in the global climate system that involves the atmosphere, the land surface, and the oceans. The starting point for climate projections is thus usually a global model. The check on the ability of global climate models to represent the earth system involves inevitably global scale measurements of all 44 Essential Climate Variables (ECVs) considered in the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC. This ability to verify the performance of global models over as long a time scale

³ Global Climate Observing System, *Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC* (GCOS-82) April, 2003.

⁴ Global Climate Observing System, *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC*, (GCOS-92), October 2004.

as possible is critical, and, in regions where this global scale check on past model performance is not possible or where it suggests errors, the basis for projections is lacking.

Global models further enable the synthesis of observations through data assimilation into physically consistent gridded products. With initial conditions, these can be used to give predictions of seasonal climate variations that are of value in tactical responses to climate extremes.

In most regions of the globe the climate varies on shorter length scales than those described in current global models, and this is especially so in regions containing coast lines, large water bodies, and mountains. The finer scale regional projections that deal with these features and are needed for adaptation are usually provided through the use regional models, "statistical downscaling" models, or (ideally) both. Regional models are dependant on global models for their large-scale patterns of change but add much higher resolution model responses to regional geographic features. The projections of regional models, like those of global models, need verification over the past century and especially over recent decades. Statistical downscaling models require good regional data on key atmospheric surface variables to establish past relationships between atmospheric observation analyses and then use these relationships with global model projections to add the regional details. This approach provides an important alternative to regional models and is viewed by some as currently a more reliable approach. Such models are also recommended as an additional check on results from regional models but can, however, only be used when detailed regional observations are available. Furthermore if such data are not available, then although regional models can be applied, they cannot be adequately verified. With both approaches, good regional observations are fundamental to achieving regional projections that can be viewed with any confidence.

For the purposes of achieving regional projections the ideal of detailed measurement and use of all ECVs on a fine regional scale may be too challenging to achieve in most regions and perhaps is not cost effective. The hope is that measurement of a smaller number of key variables on finer national and regional scales will suffice and will be realistically attainable by all countries. These include the key atmospheric surface variables, such as precipitation, temperature, humidity, and wind speed and direction; ocean features such as sea surface temperature, sea ice, and sea level rise; and a range of terrestrial variables, such as land cover, streamflow, and glacier characteristics. In the case of ocean and terrestrial variables this need for detail also applies to global scale needs. It is fortunate that satellite observations, if maintained, should, with needed *in situ* support, meet some of the needs. In the case of the key atmospheric surface variables *in situ* measurements are essential and cannot be replaced. In view of these needs, it is unfortunate that, in many developing countries, capacity remains deficient for undertaking the needed observations in sufficient quantity and quality and for transforming them into records that can meet regional model verification needs. The deficiencies are both in the recovery of irreplaceable historical records, in the adequacy of current observing systems, and in data archiving and access capabilities. These deficiencies are in urgent need of remediation if the Nairobi Work Programme is to succeed.

The Global Climate Observing System (GCOS; see Annex) has a special role to play in helping to ensure that the observations necessary to adapt to climate change, and thus to promote sustainable development, are available. The GCOS is built on the WMO World Weather Watch (WWW), the WMO Global Atmosphere Watch (GAW), the Global Ocean Observing System (GOOS) led by the Intergovernmental Oceanographic Commission (IOC), and the Global Terrestrial Observing System (GTOS) led by the Food and Agriculture Organization (FAO). It supports the World Climate Research Programme (WCRP), which promotes research into how to optimize and utilize observations and analyze them into gridded fields appropriate for use as initial conditions for model-based projections. Research

into improved models, data assimilation, observation simulation experiments, data processing, and model validation and improvement will help in the development of new products for routine use. The GCOS also supports the World Climate Programme (WCP), which is implemented through WMO constituent bodies, such as the Commission for Climatology, to assist National Meteorological and Hydrological Services in maintaining the end-to-end process of data collection, data management, product generation, and service provision.⁵

3. Adaptation, the UNFCCC, and Systematic Observation

Article 4 of the 1992 UN Framework Convention on Climate Change (UNFCCC) commits Parties to the Convention to cooperate in preparing for adaptation to the impacts of climate change. In December 2004, however, the Conference of the Parties (COP) requested its Subsidiary Body for Scientific and Technological Advice (SBSTA) to develop a structured five-year programme of work on impacts, vulnerability, and adaptation to climate change (Decision 1/CP.10). This programme was adopted at COP-12 in November 2006 and renamed the Nairobi Work Programme in honor of the city in which it was approved.

The 2006 Nairobi Work Programme identified *data and observations* as one of the nine areas of work related to adaptation needs to be undertaken in the next five years and indicated that activities in this area were to be undertaken in line with the objectives in the Annex to Decision 2/CP.11. A related area of work included in the Nairobi Work Programme addressed *climate modeling, scenarios, and downscaling*.

In the data and observations section of the Nairobi Work Programme GCOS, WMO, and other relevant organizations were specifically invited to indicate “how their work could contribute to improved understanding of current and historical climate, and its impacts, including the identification of gaps and deficiencies in data and observations, stakeholder data and capacity needs, especially at regional and national levels, and ways to improve technical infrastructure.” In the climate modeling, scenarios, and downscaling section, relevant organizations were asked to provide similar information, e.g., on how their work contributed to the development, availability and use of climate models, and development of, access to, and use of, climate change scenarios, especially those that provide subregional and regional specificity, including data downscaled from general circulation models.

4. The GCOS Strategy and Interaction with the UNFCCC

The GCOS strategy is to build on and strengthen climate-relevant observing systems. The GCOS Secretariat⁶ seeks to initiate and facilitate activities, especially in developing countries, that lead to improvements in undertaking and making use of climate observations. In recent years, the GCOS Secretariat has undertaken several major initiatives both in line with this strategy and responsive to the needs of the UNFCCC. The GCOS Steering Committee delivered the first and second reports on the adequacy of the global observing systems for climate in 1998 and 2003, respectively, and prepared the IP in 2004 in response to the needs identified in the Second Adequacy Report. These documents were prepared in cooperation with the sponsors of GCOS and other GCOS partners and benefited from open review and comments through the UNFCCC SBSTA. The GCOS Steering Committee also oversaw the execution, at the invitation of the COP, of the GCOS Regional Workshop Programme (RWP) between 2000 and 2006.

⁵ See World Meteorological Organization, Climate Information for Adaptation and Development Needs, WMO No. 1025, 2007.

⁶ In this document, the term GCOS Secretariat is used to denote the actions of the GCOS Secretariat working under the guidance of the GCOS Steering Committee with assistance from panel members, experts, and national representatives.

The IP focuses on global-scale actions needed to improve global observing networks measuring 44 ECVs in atmospheric, oceanic, and terrestrial domains. For the key networks concerned, it also notes the additional regional observation needs that are important to impacts and adaptation. Overall, some 131 needed actions are specified, and Parties and coordinating bodies with particular responsibilities are identified. If the IP is fully implemented,⁷ those global observations of the ECVs, and their associated products, will be available to assist Parties in meeting their responsibilities under Articles 4 and 5 of the UNFCCC. Implementation of the IP will also provide many of the essential observations needed by the World Climate Research Programme and Intergovernmental Panel on Climate Change, including those needed for:

- Characterizing the state of the global climate system and its variability;
- Monitoring the forcing of the climate system, including both natural and anthropogenic contributions;
- Supporting attribution of the causes of climate change;
- Supporting prediction of global climate change; and
- Enabling the characterization of extreme events important in impact assessment, the assessment of risk and vulnerability, and adaptation.

The actions in the plan have been adopted by many subsidiary bodies of the GCOS sponsors and by other partners, and some encouraging progress has been made. Progress in ensuring coverage in developing countries has also occurred but remains perhaps the greatest challenge.

The GCOS RWP was supported by the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), and contributions from a number of developed countries. It was designed to bring together key stakeholders in developing regions to both explain observation related needs and benefits and to facilitate the establishment of Regional Action Plans (RAPs). In all, ten regionally-endorsed RAPs were completed with the assistance of the GCOS Secretariat. Although the primary focus of the RAPs is on needed improvements in the components of global-scale networks within each of the ten regions, the RAPs also address more region-specific concerns and recognize the importance of improving observations for regional as well as global needs. Although some valuable progress has been made to date, most of the observing system improvement projects contained in the RAPs have not yet been implemented, or have been implemented only in piecemeal fashion, due to lack of resources.

The Climate for Development in Africa Programme (ClimDev Africa), the first major follow-up initiative to the GCOS Regional Workshop Programme, was envisaged originally as an initiative to mobilize the resources needed in Africa to implement the several GCOS RAPs for African subregions. In working with development partners, however, as well as with sectoral users of climate information, the programme has evolved into an integrated programme addressing needs in four separate but associated areas: climate observations, climate services, climate risk management, and national policies related to climate in Africa. The ultimate objective of the programme is to promote sustainable development and achievement of the Millennium Development Goals (MDGs) through better management of climate risks. Implementing improvements in climate observing networks at both global and regional scales is fundamental to, and underpins, the three other programme elements. Thus, improved observing networks will enable the development of improved sector-specific climate services, including more reliable climate projections. Improved regional climate projections will assist climate risk management and more effective adaptation to climate

⁷ Although progress on measuring many ECVs has been made, estimates of the annual incremental costs to fully implement all actions amount to over \$630 million.

change. Establishing strengthened observing networks in other regions through development of initiatives similar to ClimDev Africa is part of the long-term GCOS strategy. These will both help to implement the priority needs set out in the GCOS Regional Action Plans and respond to observational requirements for adaptation.

The proposed initiative described in the final section of this document is consistent with the overall GCOS strategy and the respective strategies of the WCRP and the WCP. It also encourages those actions in the IP with particular relevance for adaptation, and is a logical follow-on activity to the GCOS Regional Workshop Programme.

5. The Actions Needed

Actions needed to support reliable model projections of climate that can assist climate risk management and adaptation planning fall into three broad classes:

1. Support for GCOS global-scale networks. Adequate global-scale data are required for testing and verification, and thus improvement of global climate models. The output of global models is subsequently required to drive regional models. All Parties to the UNFCCC benefit by ensuring that sufficient global data are available to allow global models to produce reliable projections of future climate.
2. Support for additional finer scale networks dealing with variables critical for adaptation. In particular, support is needed for regional and national meteorological networks for obtaining precipitation, temperature, humidity, wind speed, and other adaptation-related data at high frequency. These data form the basis of the description of prevailing climate and the record of past climate.
3. Support for analysis and research leading to more reliable model results, particularly at regional scales, and for effective use of such results in adaptation policy development. Analysis and research is needed in at least four related activities:
 - In placing historical climate records in computer readable form and extending existing observation time series;
 - In recovering and reprocessing of historical observations to create reliable climate data records;
 - In the improvement and application of regional models and the use of data to verify models and in the application of statistical downscaling models;
 - In the use of model outputs in practical applications.

It is evident that improvements in global and regional networks (classes 1 and 2 above) will be advanced through vigorous commitment to the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC and of GCOS Regional Action Plans. The Implementation Plan works with the mandates and responsibilities of the various bodies which coordinate the activities of individual countries in implementing and operating the respective observing systems. These include the WMO Global Observing System, the IOC-led GOOS, and the FAO-led GTOS. These key observations, if fully provided, would provide benefits not only to adaptation, but also to the many other applications which they serve, such as weather forecasting and ocean and terrestrial environmental services. These additional application areas are indeed in many cases the most immediate users of the data.

The willingness to make global scale data available for research use is implicit in the above needs. This availability of global data has improved slowly, but, as noted in a recent GCOS report to the UNFCCC,⁸ it remains less than adequate.

⁸ See Global Climate Observing System, *Analysis of Data Exchange Problems in Global Atmospheric and Hydrological Networks*, GCOS-96, February, 2005.

As with global-scale data, regional and national data should also be *available* for research and analysis if regional model development and projection is to progress. Pragmatically, progress and improvement is still possible with regional models using data from only those regions for which they are made available. However, in regions in which Parties do not make regional data records available, there is a risk that climate modellers will not be fully aware of regional scale deficiencies. All Parties are therefore encouraged to make their data available. At the least, it is vital for Parties not sharing data to undertake their own verification of output from models in their region and advise modellers of any limits that may be identified. Verification is, however, a matter for careful checks on the data records and the statistical reliability of the comparisons that can be made. Open research community use of data is best. The general actions discussed in this section lead to some specific recommendations in the final section.

6. Specific Recommendations

Support for achieving the needed improvements to climate observations would be assisted by rigorous assessment of the value of observations for use in adaptation applications. The RWP has built useful planning around such needs but did not have the scope to significantly strengthen capacity in the use of the data.

Given this background and the need to consider adaptation, consideration should be given to the establishment of a workshop programme concerning the use available records in the assessment of global and regional projections of climate. Such a programme would be of great value to policy and planning activities in each region. It would serve to provide information of immediate use in adaptation. An inevitable and important consequence of this work would be an assessment of the adequacy of currently available climate observations. The workshop programme would thus encourage needed improvements in global and regional observing networks, the rescue of existing historical data that are not now in useable form, and the free exchange of data for adaptation and other climate purposes. Activities would build on the previous GCOS Regional Action Plans and on such progress as has been possible to date. A key benefit to each region would also be improved capacity to use model based outputs in designing effective adaptation strategies. The scope of the overall activity extends beyond the remit of GCOS, and GCOS is pleased to have been able to develop this proposal in cooperation with WCRP and WCP. The GCOS, WCRP, and WCP secretariats have made a concerted effort to develop an integrated programme of activities, as is reflected in the companion WCRP paper focusing on climate modeling, scenarios, and downscaling.

This approach would require a significant, multi-year effort, to be carried out at the regional level. The effort could consist of three workshops in each of ten regions.⁹

The first workshop, which would be carried out under the primary management and coordination of GCOS and in collaboration with WCRP and WMO's WCP, would:

- a) Assess the adequacy of national and regional networks for detection of climate variability and trends and use available national and regional records, and available global assessments of climate change, to help provide an assessment of regional climate change;
- b) Assist developing countries and regions to assemble the available regional climate records required for the verification and use of regional climate and statistical downscaling models (this would include regional meteorological data for the past few decades and relevant satellite data, including information on aerosols, sea surface temperature, sea ice, land cover, and albedo);

⁹ The regions could be the same ten regions addressed in the GCOS Regional Workshop Programme.

- c) Assess data deficiencies and the difficulties and weaknesses of regions to provide the required regional and global data, thus following up the GCOS Regional Workshop Programme to secure initiation of needed observations and data records; and
- d) Encourage the recovery of available valuable historical data that are not in a form useable by global and regional models.

The second workshop, which would proceed under the primary management and coordination of the WCRP, with contributions from WCP and GCOS, would:

- a) Use the assembled climate records from the first workshop and work with regional experts in all regions to help assess the capability of regional models to simulate the climate record to the present day; and
- b) Use available regional models and, when practical, statistical downscaling models (and, implicitly, results from global models) to undertake projections of climate change in each region and use the evidence of model performance over past decades to qualify the reliability of these projections.

Organization for the third and final workshop would need wider representation and would need to involve experts from the GCOS, WCRP, WCP, and SBSTA communities in particular. It would be policy oriented and would bring together representatives of the user community and impact and adaptation experts to:

- a) Consider how global and regional climate projections and their qualifications could best be used to develop effective adaptation strategies; and
- b) Build regional capacity to use climate model projections in the design of adaptation policies.

From the perspective of GCOS it is considered that this activity would help ensure attention to observation and data record needs, make available with qualification the latest climate projections, provide research programmes with advice on model limitations, and give an improved regional understanding of, and capability for, using both data records and model projections in supporting adaptation. While the GCOS, WCRP, and WCP communities have expertise to contribute to these needs, implementation of this programme will not be possible with available resources. As with the GCOS regional workshops, this programme will require the provision of financial or other assistance. The GCOS, WCRP, and WCP Secretariats would welcome being involved in the elaboration and implementation of this programme and/or of other activities that respond to the needs of the Nairobi Work Programme.

ANNEX

The Global Climate Observing System (GCOS)

The mission of GCOS is to ensure the availability and quality of the atmospheric, oceanic, and terrestrial data needed for climate system monitoring, research, prediction, impact assessment, and response actions. Such data, obtained both *in situ* and from space, are required by a wide variety of users for:

- Climate system monitoring;
- Climate change detection and attribution;
- Research to improve understanding, modelling and prediction of the climate system;
- Operational climate prediction on seasonal-to-interannual timescales;
- Assessment of the impacts of, and vulnerability and adaptation to, natural climate variability and human-induced climate change;
- Applications and services for sustainable economic development; and
- Requirements of the UNFCCC and other international conventions and agreements.

GCOS is sponsored by the World Meteorological Organization (WMO), the International Oceanographic Commission (IOC) of UNESCO, the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU). The GCOS programme is being progressively implemented by its sponsors through coordination and strengthening of the climate-relevant components of their individually and jointly sponsored observing systems. These systems include WMO's World Weather Watch and Global Atmosphere Watch and the jointly sponsored Global Ocean Observing System (GOOS) and Global Terrestrial Observing System (GTOS). For satellite observations, the Committee on Earth Observation Systems (CEOS) and the Coordination Group for Meteorological Satellites (CGMS) play an important coordination and facilitation role in GCOS implementation. The GCOS Steering Committee and Secretariat participate in the Group on Earth Observations (GEO) mechanism to ensure the coordinated development of GCOS as part of the Global Earth Observation System of Systems (GEOSS).

The observing systems that comprise GCOS operate and serve climate observing needs at global, regional, national, and local scales. These needs for the Essential Climate Variables (ECVs), identified in the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (IP), are in turn used to support the many climate and climate-related products that are needed for the wide range of climate and other applications in numerous climate-sensitive socioeconomic sectors. The GCOS Secretariat aims to facilitate actions that help developing countries establish and use the observations needed to support achievement of the Millennium Development Goals.

The overall guidance for the development and implementation of GCOS is provided by a Steering Committee which advises the GCOS sponsors and those responsible for their component systems and programmes. It is assisted by three scientific panels (focusing on atmospheric, terrestrial, and oceanic observations respectively) and a small Secretariat. A key challenge in the GCOS strategy is to mobilize resources to address the considerable observing system needs in all countries. It will be primarily at the national level that the GCOS will need to be implemented if the adaptation agenda is to succeed.