



## Workshop Report



CIIFEN

### Strategy Meeting for the Implementation of the Global Climate Observing System in South America

*Improving climate observations to improve climate services and  
adaptation strategies*

**GCOS-159 (English)**



CIIFEN, Guayaquil - Ecuador  
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## Table of Contents

Introduction .....	3
Session I: An overview.....	4
Session II: The Role of Regional Climate Centers on GCOS Implementation.....	9
Plenary discussion on Session I and II issues.....	11
Session III: Review and updating of South America GCOS Action Plan 2003.....	12
Session IV: The vision of international cooperation and the regional climate observation needs .....	15
Session V: Plenary discussion on regional priorities.....	17
Regional Action Plan 2012.....	18
ANNEX A. List of participants.....	21
ANNEXB. Agenda.....	23
ANNEX C. Official Photo.....	26

## INTRODUCTION

Timely and sustainable acquisition of high-quality climate observations is critical to support decision making, risk management, and to design climate change strategies. Sectors such as agriculture and food security, water resources, and health have been identified as a priority for the South American region. There is no way to pursue sustainable development without integrating climate observations with socioeconomic and other types of information required by climate sensitive sectors such as agriculture and health. In order to reduce the increasing social and economical impacts from climate variability and climate change, as well as from extreme events, the monitoring, processing, and delivery of Essential Climate Variables (ECV), defined by the Global Climate Observing System (GCOS), must be assured.

The GCOS Secretariat and the International Research Center on El Niño (CIIFEN), with the financial support of the Swiss Government through MétéoSwiss, the Spanish Government through the Spanish Climate Change Office (OECC), and the Spanish Meteorology Agency (AEMET), designed and organized a Regional Workshop to identify gaps, update the assessment of needs, and establish climate observing priorities for the upcoming years in South America.

Although the principal focus for the meeting was on observations, the goal was not to help South America improve observing systems as an end in itself. The organizers sought to facilitate the integration of atmospheric, terrestrial, and oceanic observations into existing and future risk management and climate change adaptation initiatives so that the countries of South America can derive more benefit from the current and planned national and international funds being expended to address development concerns. This goal is consistent with the aims of the Global Framework for Climate Services (GFCS), approved by the WMO Congress for development in May 2011. The conveners recognized that improving observing systems is of great importance for, among other things, developing climate change scenarios, studying climate change and climate variability, and developing climate services, in particular for the benefit of vulnerable communities. To address these issues, both observing systems and the dissemination of data and information to stakeholders need to be improved. Although international cooperation agencies can help spur these improvements, when national governments understand that their countries will benefit substantially, they can be expected to take the lead to sustain improvements with national resources.

The Ibero-American National Meteorological and Hydrological Services (NMHSs), through CIMHET (the Conference of Directors of the NMHSs), have already made progress in the assessment of needs to improve observation networks through the Ibero-American Climate (CLIBER) projects, through collaboration between meteorological services and users, and in various pilot projects that demonstrate the economic benefits of meteorological information. These experiences can be built upon to avoid repeating efforts already made. To address the goal of rational integration of observation systems, the workshop convened producers and users of climate information and representatives of international cooperation organizations to discuss priorities for improving climate observing systems and climate services in South America to help meet development goals. The workshop was a logical and timely follow-up to the September 2004 Regional Action Plan for South America that GCOS helped the thirteen countries of the continent develop. Some of the projects to improve observing systems introduced in this Plan have been implemented or partially implemented, but others have received little attention.

Meanwhile, some circumstances have changed in the seven years since the Plan was developed, and additional priorities are beginning to emerge. Chief among these is the growing attention now being given to adaptation to climate change and the role climate observations and climate services can play in the design of effective adaptation strategies. For this reason, this workshop can also be seen as a follow up action of the September 2010 "Adaptation Partnership Workshop" held in Montevideo, Uruguay as part of the Adaptation Partnership conceived by Costa Rica, Spain, and the USA to facilitate rapid action to adapt to climate change.

The workshop also followed the release of the 2010 update of the GCOS *Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC*. The plan contains some 138 global-scale actions needed to fully implement the Global Climate Observing System. Although the Implementation Plan does not specify actions by region, many of the actions are necessarily relevant to South America, and an examination

of this relevance at the workshop was of value. A workshop discussion of the relevance of the GFCS initiative to South American societal needs was also of value. This discussion considered two existing relevant associations, the Ibero-American Network of Climate Change Offices (RIOCC) and CIMHET, that convene both producers and users of climate information. Finally, the workshop sought to achieve the following specific objectives:

- 1) To discuss and agree on the regional priorities for integrated projects with climate information providers, sectoral users, and technical cooperation agencies;
- 2) To identify possible pilot initiatives to demonstrate the benefits of an integrated approach and thus make it easier for national governments to use national resources to sustain improvements; and
- 3) To determine observational requirements for improving sector-specific climate services and climate change adaptation strategies, in support of ongoing and emerging sustainable development initiatives.

The workshop was held from 13-15 March 2012 in the Conferences Room in Hampton Inn Hotel, Guayaquil, Ecuador. It was attended by Directors and Institutional representatives from 12 South American National Meteorological and Hydrological Services (NMHSs), AEMET, MétéoSwiss, a number of Development and Cooperation agencies, and representatives of the GCOS programme and CIIFEN staff.

The Agenda is included as Annex “A,” the list of participants as Annex “B,” and the official photo as Annex “C.”

## **Opening ceremony**

The opening ceremony started at 09h00. Mr. Carlos Naranjo, Permanent Representative of Ecuador to WMO, welcomed to all participants and Directors of NMHSs from South America. He expressed his appreciation on behalf the Ecuadorian government for the choice of Guayaquil as the venue for this important regional activity. He noted the importance of regional coordination and synergy to improve climate observation capabilities in South America. The region has many differences between countries, and thus it is critical to foster horizontal cooperation to cope with emerging challenges, such as the Global Framework of Climate Services and the current climate change adaptation initiatives in the region.

The second opening statement was given by Dr. Adrian Simmons, Chairman of the GCOS Steering Committee. He thanked CIIFEN for its contribution in co-organizing this workshop, MétéoSwiss and the Spanish Government for their financial support, and all participants from the region and from the international cooperation agencies. He mentioned the GCOS Implementation Plan, approved in 2011, and the urgent need to articulate efforts within the region to sustain and extend climate observation networks and ensure the generation of high-quality data and integrated dissemination systems to improve tailored climate services. He commented on the importance of this workshop for South America in order to update and/or establish regional priorities, cooperation mechanisms, and funding possibilities so as to sustain GCOS efforts in the region.

At the end of the opening ceremony, participants were invited to introduce themselves.

## **Session I: An overview**

### **Presentation 1: Regional cooperation and regional cooperative networks related to climate adaptation and systematic observation in Ibero-America: Partnership for Adaptation, RIOCC and CIMHET**

This item of the agenda was presented by Mr. José Antonio Fernández. He described the different components of Spanish cooperation in Ibero-America and noted specific contributions to GCOS within the region. The Ibero-American Conference of Directors from Meteorological Services (CIMHET) ([www.cimhet.org](http://www.cimhet.org)) and the Ibero-American Network of Climate Change Offices (RIOCC) (<http://www.lariocc.net>) were introduced. In both cases the geographic scope includes Central America, South America, and the Spanish speaking Caribbean countries.

The CIMHET has developed a very fruitful framework that fosters horizontal cooperation among NMHSs in diverse operational areas, including observation networks, data management, forecasting, remote sensing, technical maintenance, project design, and a strong capacity building component.

The RIOCC has enabled a coordinated and sustained framework where the National Climate Change offices can work together, complement efforts, and share capacities. The RIOCC has supported capacity building, fostered horizontal cooperation, and fostered a mechanism in which capabilities among members can be shared. The RIOCC is involved in the Adaptation Partnership, which is an initiative lead by Costa Rica, Spain, and the United States. It was the outcome of the UNFCCC meeting held in Bonn in 2010 and was conceived as a platform to catalyze actions and efforts among institutions and stakeholders involved in adaptation. The meeting of the Adaptation Partnership in Montevideo, Uruguay in 2010, concluded as main opportunities and challenges a need for a regional focus, shared regulatory frameworks, identification of priority sectors, and identification of differences between subregions. The existing coordination and cooperation mechanisms were identified as a main strength of South America.

The speaker explained that without good climate observations it is complicated to make impact and vulnerability assessments and evaluate the effectiveness of adaptation actions. The Ibero-American Program on Climate Change Adaptation (PIACC) and the Adaptation Partnership (PA) represent opportunities for capacity building of national institutions and for supporting the short-term improvement of climate services in South America.

The Ibero-American Programme on Meteorological Cooperation, which is implemented through CIMHET with the trust fund of Spain in WMO, presented the results for the 2003-2010 period. Some of the most relevant accomplishments are institutional development through CLIBER pilot projects. These projects led to, clear positive responses from Governments to increase financial resources for NMHSs after Governments recognized the strategic role of NMHSs in development. This led to a strengthening of the concept of quality and diversity of products and services, leading to greater visibility and further support from Governments. This is called a virtuous cycle for NMHSs, which is showed in Figure 1.

Finally, regarding the Global Framework of Climate Services (GFCS), it is necessary to strengthen NMHSs and the functioning of the Regional Climate Centers (RCCs) to avoid having the virtuous cycle turn to a vicious one.

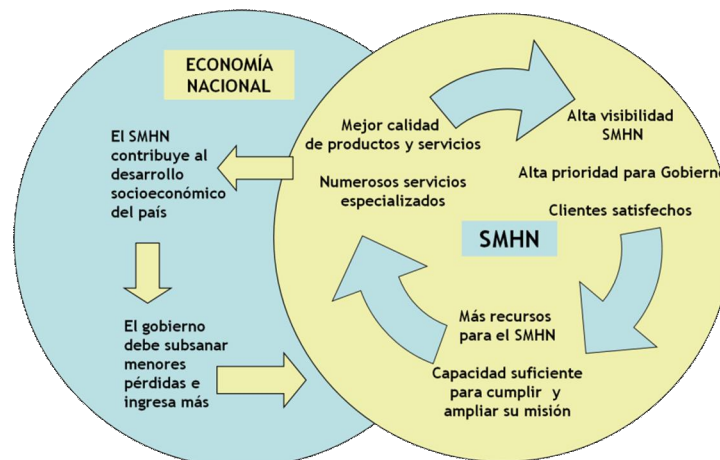


Figure 1. Double "virtuous" circle of NMHSs

## Presentation 2. Role of GCOS in support of climate services and climate change adaptation

Dr. Adrian Simmons, the Chairman of the GCOS Steering Committee, introduced the relationships between GCOS and other programmes. GCOS facilitates the development and improvement of climate observing networks. The availability of high-quality data allows improved climate services, and the design of tailored products. He outlined the substantial effort needed to sustain climate observations and the challenge to keep them operational, especially in the oceans where the substantial increase of ocean drifters and ARGO sensors have significantly contributed to the improvement of global models and prediction capabilities. Another challenge is to maintain and increase observations from voluntary observing vessels and from GCOS upper air stations.

The 2004-2010 period saw an increase of meteorological reports from South America, which reflected progress in the regional contribution to GCOS (Fig. 2). However, for sectoral applications it is necessary to increase the exchange of other variables related to soils, stream flows, lake levels, glaciers, dust, forest fires, and urban climate, among others. The number of retreating glaciers is increasing, and more specific responses are needed to cope with their impacts on water supply, agriculture, and ecosystems conservation.

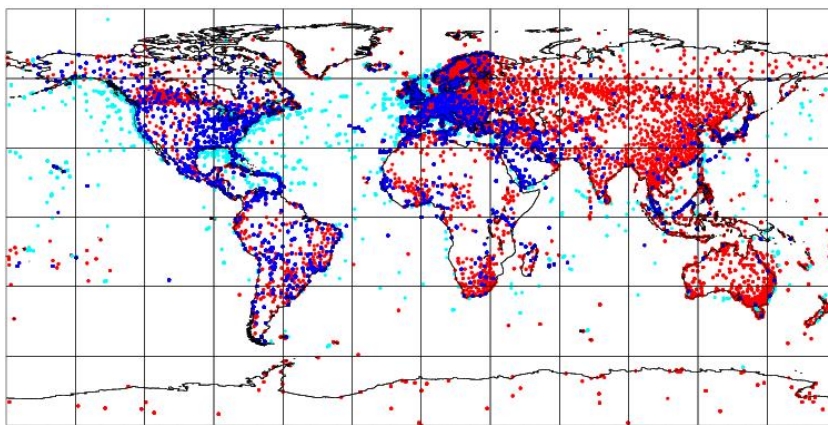


Figure 2. Locations of 35010 surface weather observations received by ECMWF 0900-1500 UTC 14 November 2011. Red: Conventional synoptic met reports from land stations Blue: Reports, mostly from airports, received in aviation code Cyan: Reports from ships

The social and economic data required by the GFCS will mostly be supplied by users. To develop a suitable climate user interface, climate monitoring and modeling are critical to develop effective climate services based on the past, current and future conditions. GCOS will be focused in the coming years on sustaining and improving the GCOS networks and the associated ECV data, emphasizing less developed regions.

Finally, work on climate observing needs for adaptation is necessary to fulfill the requirements for data and services needed by the Parties to the UNFCCC, the GFCS, and other initiatives. For the 2014-2015 period, new progress and adequacy assessments will be necessary and will form the basis for an updated GCOS Implementation Plan that will be developed in the 2015-2016 period.

## Presentation 3: GCOS Regional Action Plan for South America and GCOS IP-10, a brief overview

This agenda item was presented by Dr. William Westermeyer from the GCOS Secretariat. He explained the general vision of GCOS for South America and remarked on the benefit derived from climate observations for adaptation, risk management, and sustainable development. The focus and composition of GCOS includes ocean, atmosphere, and terrestrial domains. Moreover, the GCOS encompasses both *in situ* and space based observations. GCOS has a Steering Committee and three scientific panels, including the Ocean

Observations Panel for Climate, the Atmospheric Observations Panel for Climate, and the Terrestrial Observations Panel for Climate. These are supported by the GCOS Secretariat, based at WMO Headquarters in Geneva.

GCOS organized a regional workshop for the countries of South America in 2003. This workshop was hosted by the Chilean Meteorological Service and held in Santiago, Chile. Following this workshop, an Action Plan was developed by a group of experts at a 2004 meeting at the National Meteorological Service of Argentina. The Action Plan contained 11 projects that addressed the priorities identified at the Santiago workshop. (An assessment of the implementation status of the projects in the Action Plan was prepared as a separate document prior to the workshop. This assessment is reviewed in Presentation 7).

All the GCOS systems are cross-cutting and interconnected. Although the components are basic and specific (meteorology, hydrology, coastal oceanography, etc), the main challenge remains to improve networks so that the observations needed for climate services in the region are available. Efforts like this meeting contribute to this goal and help to produce a consensus on the actions that are needed for mutual benefit of all countries in the region.

#### **Presentation 4. Challenges to the improvement of climate observing systems in Ibero-America, Ibero-America NMHS Directors Conference**

Mr. Carlos Naranjo, on behalf CIMHET, presented the agreements reached during last meeting in Brasilia, Brazil in 2010. He explained the role of CIMHET as a sustained mechanism for discussion, coordination, and mutual support among NMHSs from Ibero-America. During the last decade one of the main and recurrent issues has been the need to improve the quality of data and access to it for better climate services.

In the case of Ecuador, as result of the CLIBER Project in 2009, a comprehensive assessment of gaps, needs, and priorities of INAMHI (the Ecuadorian NMHS) was conducted. This document was presented to the Ecuadorian Government and, as a result, an important increase in the regular budget was obtained.

Another achievement of CIMHET through the financial support of the Ibero-American Programme of Meteorological Cooperation has been the development and implementation of a hydro meteorological database management system. This system improves overall data management capabilities and has been implemented in several Latin American NMHSs and by CIIFEN.

The CIMHET has stated in a position paper that NMHSs are a fundamental basis for the provision of climate services. The social and economic benefits of better climate information are directly related with development sectors. The priority sectors in the region are agriculture, water resources, disaster risk reduction, health, ecosystem management, energy, and tourism. To provide better tailored climate services to these specific sectors the improvement of observation networks is necessary. It is also necessary to strengthen data management capabilities, to improve dissemination of information, and to integrate the emerging Regional Climate Centres so that they can complement each other and share capabilities.

#### **Presentation 5. Challenges to climate data rescue and management in South America**

The challenges for climate rescue and management in the region were presented by Mr. Rodney Martinez on behalf Dr. Divino Moura, Director of INMET, the National Meteorological Institute of Brazil.

Dr. Moura's presentation described the data rescue process ongoing at INMET, where more than 12 million documents with climate data from 1886 to 1960 are being recovered. In Brazil, data beginning in 1961 have already been digitized. This process includes examination of folders, graphics, sheets, and books. It starts with the rescue and cleaning of the documents. The documents are then imaged and digital data are extracted. Both hardcopy and digital versions are preserved. The final goal is to optimize and hasten the availability of data useful for research on climate variability and change, in particular as a contribution to the next IPCC assessment. Data quality assurance will contribute to the robustness of scientific publications.

Historical data are important for reanalysis and for adjustment of global circulation models, enabling improved future climate scenarios and reduced uncertainty of climate projections. However, most important of all is to improve understanding of local physical processes and atmosphere dynamics. The speaker emphasized the use and analysis of historical data from ground stations. He noted that it is important to keep in mind that the most credible source of climate information is from observations in which standards and quality control procedures are rigorously followed.

### **Presentation 6. Observation needs for sectoral climate risk management**

This presentation was given by Mr. Rodney Martinez. He began by explaining the conceptual framework of climate risk management and how the risk is constructed as a result of an unbalanced relationship between community dynamics and ecosystems dynamics.

Climate risk management and adaptation meet where the environmental, social, and economic dimensions of an issue come together. Climate risk management as it is now practiced can be considered as the first step to effective adaptation to climate change. During the different stages of disaster management, there are specific observation needs. Thus, accurate and timely climate information is needed during the early preparedness and response period, while accurate monitoring and historical data analysis is critical for risk transference. Although climate data are critical, risk management systems integrate vulnerability assessments, risk mapping, information systems, and adequate response mechanisms at different levels.

For disaster risk management, the decision making process is continuous. Climate information flow should be in accordance with the evolution of the situation and must be complemented not only with observed data but with remote sensing products and modeling. One of the main challenges is to ensure a communication chain between the information providers and the decision makers or emergency managers.

In the Western South America region, as one of the main outcomes of a regional project, a climate data base was implemented with daily climate data from the NMHSs of Bolivia, Colombia, Chile, Ecuador, Peru, and Venezuela. This data base was complemented with seasonal forecast improvements and climate services for agriculture sector by the design of climate-agriculture risk maps in pilot zones of the participating countries. Special efforts were made to build up dissemination networks involving the media, the private sector, and other key stakeholders.

One key application of climate information is food security management, where the assessment includes aspects such as use, access, availability, and a stable supply of food. The key challenges are focused on informing decision makers about uncertainty and in the design and implementation of friendly, sustainable, and integrated information systems.

Another important need is ecosystems management. In Andean environments, fragile ecosystems such as paramo are increasingly being affected by climate variability and change. Climate observations in different altitudes are critical to improve the understanding of physical processes and their potential changes. The responses derived from this research will support the best options for conservation priorities and management. One good example is the GLORIA network (<http://www.gloria.ac.at/>).

Finally, it is important to note the increasing need for other variables, such as humidity, solar radiation, albedo, and cloudiness.

### **Presentation 7. A review of critical observing system needs in South America (based on the GCOS Regional Action Plan for South America, a recent assessment report, and a review of relevant IP-10 actions**

The review was presented by Mr. Juan Jose Nieto. He explained that GCOS and CIIFEN coordinated an assessment on the status of implementation of GCOS in South America. This evaluation included the evolution of observation networks (GSN and GUAN) in South America, the number of stations, and the number of CLIMAT reports. The reference was the previous assessment done in 2003 and the projects proposed in the 2004 GCOS Regional Action Plan for South America.



The assessment suggests a general improvement in most of South America. Observation networks have increased the number of stations and reports. However, key challenges remain in relation to GCOS coordination at national level and for the integration of systems for the provision of climate services.

It is highly recommended for South America to foster interaction among Regional Climate Centers, NMHSs, the Global Prediction Centers, and key institutions dealing with agriculture, water resources, risk management, health, and energy.

## **Session II: The Role of South American Regional Climate Centers in GCOS Implementation**

### **Presentation 8. The Northeastern South America Regional Climate Center**

This presentation was made by Mr. Miguel Rabiolo on behalf Dr. Divino Moura, Director of INMET. Some examples of climate products currently in use and others in development for South America were described. These products include plots of precipitation pattern anomalies, evolution of precipitation during the last 90 days, climate normals for precipitation and temperature, seasonal forecasts, long- and medium-term prediction, and maps showing the availability and demand for water resources. Additional examples of climate forecasts using statistical and dynamical models with applications for agriculture and water resources were also shown. Finally, coordination and negotiation efforts with local governments, farmers, and other stakeholders were mentioned as a step forward to improve climate services. The presentation emphasized the need for cooperation among the Global Prediction Centers, the Regional climate Centers, and the NMHSs in each country.

### **Presentation 9. The Southeastern South America Regional Climate Center**

This agenda item was presented by Dr. Hector Ciappesoni, Director of the NMHS from Argentina. He described the current contribution of his institution in the pilot phase of the Southeastern South America Regional Climate Center. In Argentina, a climate database is undergoing quality control in order to improve climate information services. Significant progress has been made in developing visualization tools. The update frequency for the information is currently hourly. One of the operational tasks at the Regional Climate Center is climate surveillance through climate diagnostics, variability analysis, and extreme events reports.

The presenter emphasized the importance of climate services in the decision making process. One of the main challenges is to improve the process of delivering high quality and timely information in accordance with specific needs. A climate observation network is not enough to ensure effective risk management. The sectors are increasingly demanding accuracy of climate services, not just access to climate products. Specific decision tools are needed in each sector, for instance, a tool describing the relationship between expected precipitation and energy availability in the marketplace.

As a Regional Climate Center, current operations still have some weaknesses that are expected to be solved in the near term. Some of them are the small regular budget, few specialized staff, limits on access to satellite information, limited financial resources to sustain the observation network, and lack of remote sensors.

Regarding funding, the speaker remarked that Green Funds are difficult to access individually. NMHSs have been systematically denied access to climate change funds and opportunities. It is important to demonstrate the needs for more funding from governments so as to enhance the operations of NMHSs and improve climate services and adaptation strategies.

## **Presentation 10. The Western South America Regional Climate Center**

This agenda item was presented by Mr. Rodney Martinez, Scientific Coordinator of CIIFEN. He explained that the implementation of the Western South America RCC is being done in accordance with WMO guidelines for RCC implementation. Regarding mandatory functions, most are ongoing with exception of the operational verification procedures for seasonal forecasts.

As part of the strategic plan for RCC operations, the mission of CIIFEN is to promote, complement, and initiate basic and applied research activities related with climate variability and change, with special emphasis on ENSO in order to contribute to the permanent strengthening of the NMHSs of Western South America, the development of new climate services, and horizontal cooperation and synergy with other regions.

The presentation detailed the current status of operational products for the region, such as the monthly ENSO Bulletin, the Ocean Analysis Bulletin, the seasonal forecast, and the weekly SST anomalies for the Eastern Pacific. Capacity building efforts and regional coordination in the region have made possible some regional actions, including analysis of climate extreme events in South America, seasonal hydrological outlooks, and operational verification of seasonal forecasts.

There is still considerable work to do on climate prediction, downscaling techniques (especially in the Andean Cordillera), data rescue, and improving the national capabilities of climate data bases. One common challenge for the region is the design and implementation of tailored climate services for development sectors such as agriculture, water resources, risk management, and health.

Finally, the main lines of action for the WSA RCC were presented:

- a) Improvement of seasonal forecast capabilities;
- b) Improvement of climate analysis and data management;
- c) Development of climate applications, tools, and methodologies for disaster prevention, agriculture, and water resources;
- d) Implementation of the Regional Action Plan for Seasonal Hydrological Outlooks;
- e) Coordination of a new regional initiative for drought monitoring;
- f) Development and implementation of e-learning and training on climate modeling, data management, and applications;
- g) Research on regional impacts of ENSO; and
- h) Implementation of a Sustainability and Resources Mobilization Plan.

## **Presentation 11. Operational aspects of GCOS in South America**

This agenda item was presented by Mr. Richard Thigpen, the GCOS Implementation Officer. He described the current status of GCOS networks in South America. In general terms, GSN and GUAN networks have experienced progress and improvement in the region, although some specific problems remain in some stations where the equipment to launch radiosondes has fallen into disrepair. The number of CLIMAT reports from the region has increased, according to the statistics available on the GCOS web site. He noted the excellent work conducted by the DMC from Chile as the CBS Lead Centre for GCOS for the region.

He explained some of the modalities used by GCOS to support countries. One of them is a technical support project (TSP) that provides direct technical assistance in areas such as maintenance and support. A TSP for South America could support training, equipment calibration, equipment operation, and problem diagnosis. Portable equipment calibration is provided to countries in the area of responsibility as are direct site visits by technical experts. Such a project should be established for at least one year, preferably longer if funding is sufficient. Such projects have been established in the past and have proved extremely useful. The presenter discussed the cooperation mechanisms managed by GCOS through funding provided by different developed countries in different regions. Spanish Cooperation has traditionally supported GCOS activities in Latin America and other initiatives indirectly related to the GCOS programme.

Mr. Thigpen recommended that South American NMHSs take advantage of existing opportunities and mechanisms to obtain operational support and to improve coordination mechanisms. He also recommended the nomination of GCOS focal points in all countries.

## **Presentation 12. Swiss Contribution to GCOS, lessons learned**

Dr. Gabriela Seiz from MétéoSwiss presented the national GCOS programme of Switzerland. She showed the different national reports that have been produced, which are available in several languages. One report included information about the processing of time series of Essential Climate variables, maps with the station, locations, and metadata. She remarked that these reports have led to greater understanding of climate observing needs in Switzerland and thus to additional funding from the Federal Council for sustaining observation networks in Switzerland. She described the important role of satellite information and gave some examples of applications to studies of glacier dynamics associated with climate change.

Switzerland implements some international activities through the GCOS Cooperation Mechanism. The presenter detailed some projects implemented in Africa, South East Asia, and South America. The work done in Colombia, Chile, and Ecuador on aerosols and greenhouse gas measurements was presented. Special attention was given to an upcoming project in Peru to improve the elaboration and dissemination of climate products. Finally, Dr. Seiz commented on the continuity of Swiss support to GCOS-related activities.

## **Plenary discussion on Session I and II issues**

- Improving observations is not an end in itself. However, it is important to improve observations so as address the needs of agriculture, water resources management, health, the cross-cutting disaster risk management, and other sectors for improved climate services.
- The GCOS Regional Action Plan (RAP) for South America was a detailed and ambitious plan, but no one had the responsibility to lead the effort to implement it or to raise funds for projects. The challenge is to prepare a realistic plan, or identify a set of key actions, and assign responsibility to someone (or to one or more organizations) to ensure follow-up.
- Some issues addressed in the GCOS RAP for South America have seen moderate to good progress, but others have seen little progress. Much remains to be done. Key challenges include a need for greater coordination and effective provision of climate services.
- There have nevertheless already been significant advances in cooperation throughout the region, in particular in the context of the Ibero-American initiatives CIMHET, CLIBER and RIOCC, and it is important that these continue. Larger projects are needed however, and Spain can only shoulder a reasonable share of the costs.
- The need to improve data exchange remains, notwithstanding some progress in this area.
- GCOS implementation should be aligned with the region's strategic and operational plans. Constraints on GCOS assessment and planning make it difficult to align its planning cycle with that of the region's planning under the WMO cycle.
- Maintenance of AWSs is difficult and costly. Technical assistance is required to ensure that many of these stations continue to operate. Translation of the CIMO guidance document into Spanish would be helpful.
- There is a problem in maintaining radiosonde operation. Countries have difficulties purchasing station equipment and consumables.
- Many of the impacts of climate are felt through its natural variability rather than as long-term changes. Long data records are needed to distinguish between the two, especially at regional and local levels. The importance of climate variability needs to be recognised in cooperation agreements. NMSs must respond to the immediate needs of government, and climate change is only one of many specific issues they face.
- Data rescue is a priority for the region. Although several initiatives have been made, some through international cooperation, there remains much to do, and this work demands substantial resources. Over 150 years of data are available to be recovered. Progress within an individual country may need collaboration between the NMS and other institutions. This work is important for establishing the variability of climate.

- Many meteorological services in South America are losing (and not always replacing) qualified staff, thus increasing needs for training.
- Deployment of meteorological instruments by projects or institutions that are independent of the NMS of the country involved should be done in consultation with the NMS to ensure that standards are followed and to facilitate sharing of the data both nationally and internationally.
- There are continuing needs for observations with better spatial resolution, for sampling the altitude range, and for measuring a wider range of variables associated with vulnerability, risk, and the provision of services. Issues also remain related to precision, calibration, frequency of observation, and data storage and transmission, which are linked to running costs and sustainability.
- In supplying information to decision makers it is important to appreciate how information will be used and to recognize that the meteorological community does not provide all the elements that will be taken into account in reaching a decision. Information often needs to be available in real time to answer questions, and historical context may be important. The user (or client) will develop trust and return to us for information if the benefit of earlier informed decisions is clear.

### Session III: Updating a GCOS Regional Action Plan for South America to Support Better Climate Services and Adaptation Strategies

#### Working groups on review of regional priorities

Three working groups composed of diverse experts were requested to review current progress, gaps, and needs in order to establish priorities with emphasis in three sectors: risk management, agriculture/food security, and water resources. The resultant tables were prepared by the leaders of each group and received the feedback from the meeting participants.

#### **RISK MANAGEMENT**

RECOMMENDED ACTIONS (Sorted by priority)	Regional / subregional scope	Potential support (institutional, financial, technical)
Inventory of methodologies to issue climate alerts in each country.	Regional and subregional	<ul style="list-style-type: none"> <li>• National emergency Offices and associated institutions (health, public security, environment, others)</li> <li>• Global Framework for Climate Services (when funds become available)</li> <li>• National Governments (decision makers)</li> </ul>
Identify extremes in meteorological variables and correlate them with impacts in health, economy, and environment in order to have a parameterization of risks for alert generation.		
Generate an integrated information and alert system for extreme events, sharing among countries satellite derived products and numerical modeling capabilities.		
Develop a Cooperation Plan among countries.		
Develop and/or enhance plans for voluntary observers and reception of climate information.		

Strengthen observation systems with automatic stations for basic climate variables useful for risk management integrating private or other networks.	Regional	<ul style="list-style-type: none"> <li>• AECID</li> <li>• Horizontal Cooperation</li> <li>• WMO</li> <li>• German Cooperation</li> <li>• European Commission</li> <li>• Public institutions</li> <li>• Universities</li> <li>• CIIFEN</li> <li>• CPTC</li> <li>• NOAA</li> </ul>
Elaborate risk maps for flooding, droughts and frosts through GIS tools.	Subregional	
Provide technological Innovation for the generation of bulletins and warnings for decision makers.	Regional and subregional	
Foster coordination between NMHSs and Civil Protection agencies.	Regional and subregional	

## AGRICULTURE SECTOR AND FOOD SECURITY

RECOMMENDED ACTIONS (Sorted by priority)	Regional/subregional scope	Potential support (institutional, financial, technical)
Generate strategic alliances with specialized agricultural and cattle raising centers for climate surveillance.	Regional	<ul style="list-style-type: none"> <li>• International funds for agriculture research</li> <li>• Adaptation funds.</li> <li>• AECID</li> <li>• Horizontal Cooperation</li> <li>• WMO</li> <li>• German Cooperation</li> <li>• European Commission</li> <li>• Public Institutions</li> <li>• Universities</li> <li>• ICCA</li> <li>• USAID</li> <li>• GIZ</li> <li>• FAO</li> <li>• Agriculture Ministries</li> <li>• NOAA</li> <li>• ECMWF</li> <li>• Private sector</li> <li>• Farmers association</li> <li>• Regional Training centers</li> <li>• Others</li> </ul>
Evaluate climate change models to alert governments about risks and decision making related to agriculture and food security	Regional and subregional	
Improve and increase the number of agrometeorological stations	Regional	
Implement methodologies for elaboration of agricultural products, such as an agricultural calendar, risk maps, and training strategies.	Regional, adjusted to each country and productive sector	
Predict extreme events harmful for the agriculture sector	Regional and subregional	
Enhance information delivery mechanisms to end users	Regional and subregional	
Train providers and users of climate information and improve understanding of the generation and interpretation of products	Regional and subregional	
Liaison with water resources sector	Individual countries	

Strengthen NMHSs as authorities to validate and certify information for agricultural insurance.	Individual countries	
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### WATER RESOURCES SECTOR (irrigation, potable water, hydropower)

RECOMMENDED ACTIONS (Sorted by priority)	Regional / subregional scope	Potential support (institutional, financial, technical)
Implement policies and actions for hydrological data rescue.	Regional and subregional	<ul style="list-style-type: none"> <li>• National Water Agencies</li> <li>• GLORIA Network</li> <li>• Research centers</li> <li>• World bank</li> <li>• WMO</li> <li>• Private sector</li> <li>• Regional Climate Centers</li> <li>• Universities</li> </ul>
Institute climate watch in high mountain zones, considering their importance as water reservoirs.	Regional and subregional	
Implement a virtual information system, to include research projects, a library, and a repository of reference documents.	Regional and subregional	
Identify zones with high potential for hydropower generation.	Regional and subregional	
Establish early warning systems in multinational basins.	Regional and subregional	
Strengthen observing systems with automated and conventional stations	Regional and subregional	
Integrate other hydrological monitoring networks with national networks.	Regional and subregional	
Provide technological innovation for bulletin transmission.	Subregional	
Provide tailored products for different users	Regional y subregional	
Recover streamflow monitoring capacities in relevant basins.	Regional and subregional	

## OTHER SPECIFIC ACTIONS

RECOMMENDED ACTIONS (Sorted by priority)	Regional/su bregional scope	Potential support (institutional, financial, technical)
Provide professional education for meteorologists.	Regional	<ul style="list-style-type: none"> <li>• WMO</li> <li>• AEMET</li> <li>• National Governments</li> <li>• GCOS</li> </ul>
Promote technical exchange among countries.		
Increase salaries of technical staff in order to keep experienced staff.		
Establish horizontal cooperation to improve equipment procurement and reduce costs		
Increase measurement stations for solar radiation.		
Update inventories of hydro-meteorological stations in the region.		
Consolidate Regional Climate Centers		

### **Session IV. Perspectives of International Cooperation Agencies on Climate Observing and Climate Services Needs**

#### **Presentation 13. The Climate Services Partnership and potential opportunities for South America**

This presentation was made via Skype by Dr. Stephen Zebiak from the International Research Institute for Climate and Society (IRI). He introduced the Climate Services Partnership (CSP) that was launched last year and which has now seen significant progress. The first meeting had as its objective to facilitate an exchange of experiences and catalyze partnerships. The CSP is an informal and open mechanism serving a diverse group of organizations. It is based on voluntary efforts and existent resources and is mainly focused on capturing new knowledge and fostering linkages with other relevant programmes and initiatives. Dr. Zebiak detailed the different activities that will be undertaken to compile case studies and good practices to be shared and widely disseminated as a contribution to the Global Framework of Climate Services. In the case of South America, Brazil and CIIFEN have contributed case studies, and all the institutions from the region are kindly invited to provide additional case studies and to be involved in the CSP.

#### **Presentation 14. The Finnish cooperation in South America**

This agenda item was presented by Ms. Outi Myatt-Hirvonen from the Finnish Embassy in Peru. She explained the Finnish cooperation programs in the Andean region, which focus on public institutions, the private sector, NGOs, and civil society. Contributions are now focused on climate change, renewable energy, biodiversity, forestry, meteorology, and human rights as a cross-cutting issue. There are several regional programmes currently being implemented, such as BioCAN, biodiversity in the Amazonia region, sustainable forest management in the Andean Region, the Andean Alliance of Energy and Environment, intercultural bilingual education in Amazonia, and other projects conducted by international NGOs.

The speaker commented on the inter-institutional cooperation instrument, which promotes exchange between the public sector in the region and the equivalent Finnish institutions in order to enhance capacities and share experiences. The amounts for this kind of cooperation are between 50,000 and 500,000 euros for projects which are for longer than one year.

Ms. Outi Myatt-Hirvonen presented the current projects with SENAMHI and other institutions from Peru under this modality and others in the planning phase to be implemented in Ecuador and Colombia. Finally, she commented on the technical assistance and consultancy services that the Finnish Meteorological Institute provides worldwide in more than 50 countries.

### **Presentation 15. USAID initiatives on climate change in South America**

Dr. Esther Zeledon reviewed U.S. Agency for International Development (USAID) activities in the more than 100 countries in which it operates. She focused on the USAID climate change programme and detailed assistance in areas such as clean energy, sustainable landscapes, and adaptation in several countries. She explained briefly the case of Ethiopia and the critical need to work on adaptation, in particular considering the high climate sensitivity of the traditional agriculture which is the main livelihood of many Ethiopians.

She presented an early warning system for food crisis in Africa, which used maps to show zones with high probabilities of hunger. She introduced a conceptual framework for assessing vulnerability and adaptive capacity from the perspective of climate change and development. She introduced work that IRI has done in cooperation with the Red Cross and Red Crescent to implement a global monitoring system for emergencies associated with rainfall. Finally, she mentioned several case studies on climate change adaptation and introduced some upcoming initiatives for the Andean region.

### **Presentation 16. Corporación Andina de Fomento: Opportunities for cooperation on climate matters**

This presentation was made by Mr. Mauricio Velasquez, representative of the Corporación Andina de Fomento (CAF). He explained the evolution of this regional financial institution, noting that CAF has increased the geographical coverage from the Andean countries initially to more than 12 countries in Latin America today. CAF offers technical cooperation co-financing for different kind of operations, loans, and contingency funds. The Corporation has become one of the major sources of funds for infrastructure and energy projects in Latin America. Social and environmental sectors represent the biggest components within the credits portfolio of the institution.

Some of CAF's main lines of action related to the environment are climate change, solid waste management, hydrographic basin management, forest resources management, and contingency funds for natural disasters. The speaker reviewed the recent increase of operations and discussed the available amounts of financing. CAF is allocating, as a matter of priority, financial resources for response to natural disasters, although prevention is being emphasized. Finally, Mr. Velasquez mentioned the contribution of CAF following the 1997-1998 El Niño, noting that a publication on the lessons learned in the 5 Andean countries has been produced.

### **Presentation 17. Europe Aid cooperation on climate related issues in South America**

This agenda item was presented by Ms. Anna Routsalainen, who explained the historical linkages between Latin American Governments and the European Union. She referred to the Development and Cooperation Instrument, which is the basis for other documents and regional cooperation strategies. Regarding climate change, she mentioned the EUROCLIMA programme, which is in the last stage of implementation. She noted good outcomes in several different components, including the social and economic, scientific, and communication to policymaker components. Other important results were obtained for projects related to soils, water, bio-energy, drought, desertification, and food security.



Ms. Routsalainen also mentioned the EUROSOLAR Project, which will provide electric energy to isolated communities using solar or wind power. More than 300,000 people in 8 countries have benefited so far, with financial support of more than 28,000,000 euros. She also commented on the Environment and Natural Resources Programme, which cuts across the climate change issue. She remarked on the importance of actions for coping with climate change at the highest political level and on the need to work at regional and local scales with coordinated and complementary initiatives. Finally, she showed a list with different links to the European Union cooperation programmes in different thematic areas.

### **Presentation 18. The Climate Change Andean Project GIZ- CAN**

This presentation was made by Mr. Manuel Rojas who described the Climate Change Andean Project (GIZ-CAN). The project has 3,000,000 euros for five years and has the following components: climate change vulnerability, economy of climate change, monitoring and evaluation tools, and agro-meteorological information management.

The project intends to improve the exchange of information between regional, national and local levels. The governments of the Andean Community have designated representatives for the different components. The plan of activities includes technical workshops, training courses, and short stays in institutions to promote the exchange of experiences and experts among countries.

A workshop in June 2012 in Cali, Colombia has been announced. Participants of the meeting were invited to stay informed about the capacity building elements of this regional programme.

### **Session V: Plenary Discussion on the Regional Action Plan**

As result of the discussions following each presentation, the working group discussions, and the final plenary discussion, the following Action Plan for regional implementation of GCOS in South America was proposed and provisionally approved.

### **COORDINATION AND FOLLOW UP**

1. All NMHSs will designate and/or update their GCOS Focal Points.
2. The WMO Regional Office for the Americas will facilitate the coordination between the GCOS focal points, NMHSs, the WMO Commission for Basic Services (CBS), and the RA III Working Groups on Climate Services, Hydrology and Infrastructure, and Technological Development (Subgroup on Observations and Telecommunications).
3. Update the e-mail list of GCOS Focal Points in South America and organize at least two conferences per year using available communications means like Skype, video- or telephone for Action Plan follow up.
4. The Regional Climate Centers (once the pilot phase is accepted) will contribute to the implementation of the Action Plan in the areas related to their functions.
5. Foster the use of the GCOS web portal and provide a link to it in all South American NMHS web sites.
6. The GCOS Secretariat, in coordination with the WMO Regional Office for the Americas, should request annually a report on the progress of the Action Plan from the national GCOS Focal Points. The consolidation of the reports will be posted in GCOS web site.

### **RESOURCES MOBILIZATION**

1. The WMO Regional Office for the Americas, in coordination with the WMO Resource Mobilization Office and with the technical support of NMHSs and the RCCs, will promote the preparation of pilot projects to address actions in the Regional Action Plan for submission to appropriate funding agencies.
2. Resource mobilization efforts by the WMO Regional Office for the Americas and RCCs will be reported annually to the NMHSs.

### **DATA MANAGEMENT**

1. Each country to inventory climate data to be digitized.
2. A compilation of options for data rescue will be posted and disseminated through the GCOS web site.
3. Seek voluntary assistance and support for data rescue initiatives.
4. Design a regional project to assist with historical data rescue (in accordance with the agreement of the last CIMHET meeting).
5. Extend the use of the MCH data base to the NMHSs and the RCCs with the support of CIMHET.
6. Develop and expand web based tools for data access and interoperability with other national systems.
7. Promote training courses on data management and advanced climatology.
8. Prepare a policy brief to communicate to decision makers and financial entities the benefits of climate monitoring, historical data analysis for risk management, and climate change adaptation.

### **SURFACE NETWORK**

1. Promote horizontal cooperation among NMHSs for maintenance of observation networks.
2. Seek, in close coordination with the GCOS Secretariat and its Implementation Manager, opportunities for Technical Assistance projects, e.g., to provide portable calibration kits in coordination with Regional Calibration Centers.
3. Seek a small grant for the translation to Spanish of CIMO Document No. 8.
4. Make available through the web dynamic maps showing GSN and GUAN stations and associated metadata, including their risk of loss of functionality.
5. Promote the inclusion of automatic stations from the region to WMO Volume A.
6. Promote the installation of new stations in high altitude Andean zones.
7. Foster interaction with existent initiatives, such as GLORIA and the Hydrological Programme of UNESCO.
8. Promote interaction with glaciology and agro-meteorology groups and the integration of their networks with NMHS networks.

9. Foster the organization of regional or national meetings with the private and public sectors (e.g., with insurance, energy, agriculture, and tourism groups) to explore new funding sources to improve and sustain national observing networks for mutual benefit.

### **UPPER AIR NETWORKS**

1. Prepare an inventory of needs to fix, modernize, or reactivate stations and radiosonde equipment.
2. Promote, through GCOS and WMO, the procurement of radiosondes for climate-dedicated upper-air stations (i.e., GUAN stations) of individual NMHSs.
3. Explore through GCOS funding possibilities for upper air networks.
4. Strengthen the support to established reference networks.
5. Request WMO technical assistance to help maintain upper air networks.

### **HYDROLOGICAL NETWORKS**

1. Recover capacity to generate hydrological information, such as stream flow and water level data.
2. Update and make available through the web the inventory of hydrological stations, including operability levels and the risk of discontinuance.
3. Identify priority sites for installation of new stations, considering vulnerable ecosystems and potential water conflict locations.
4. Promote the installation of stations and the shared and coordinated use of hydro-meteorological information in transboundary basins.

### **UV RADIATION MONITORING**

1. Foster the installation of more stations for aerosols and UV radiation in sensitive zones in South America, in particular where aerosols and UV radiation could be significant for human health.
2. Identify any new UV radiation monitoring stations and facilitate their integration into the global observing networks for climate through the NMHSs.
3. Promote regional horizontal cooperation to improve determination of UV radiation Indices.
4. Promote remote sensing use and application for monitoring atmospheric parameters.

### **OCEAN OBSERVATIONS**

1. Add links to the GCOS web site for the two GOOS Regional Alliances in South America, GRASP and OCEATLAN.
2. Coordinate specific actions in South America (e.g., development of ocean normals for the South Eastern Pacific) among the GCOS Secretariat, the GOOS Secretariat, the WMO Ocean Affairs Division, and the WMO Regional Offices for the Americas.
3. Promote the use and application of the products and services of ARGO (<http://www.argo.ucsd.edu/>) to support ENSO early warning, seasonal forecasts, and climate watch activities.

### **TRAINING AND CAPACITY BUILDING**

1. Promote the use of existing training modules for climate observations in the region.
2. Promote alliances with universities and public and private research centers aimed at developing technology that reduces maintenance and promotes sustainability of observation networks.
3. Encourage NMHSs to designate experts for the WMO Meteorology Training Programme in Lima, Peru.

## **CLIMATE SERVICES AND SOCIAL-ECONOMIC BENEFITS DEMONSTRATION**

1. Develop a methodology and guide for the design of risk indicators and early warning systems based on good practices in South America.
2. Strengthen the development of climate services in the agriculture sector, integrating climate information (monitoring, climate analysis, prediction) with satellite information, such as soil moisture.
3. Develop a compendium of good practices and case studies with end-to-end systems that include observation, data management, climate services, and decision support systems for the water resources and agriculture sectors.
4. Promote the dissemination and replication of projects showing significant progress and demonstrating the social and economical benefits of observations and climate services.
5. Continue the development and standardization (with the support of RCCs) of tools for the presentation of climate information in a user-friendly way to specific users in priority sectors.

## ANNEX A.

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## ANNEX B

### Agenda of the meeting

#### **Strategy Meeting for the Implementation of the Global Climate Observing System in South America: Improving Observations to Support Better Climate Services And Adaptation Strategies**

Boulevard Conference Room, Hampton Inn Hotel  
Guayaquil, Ecuador  
13-15 March 2012

<b>Tuesday 13 March 2012</b>
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08h30-9h00      Registration

#### **Opening session**

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09h00-09h30 Welcome by Mr. Carlos Naranjo, WMO Permanent Representative from Ecuador

09h30-09h40    Opening Statements by Co-Chairs

- *Vice President RA-III*
- *Dr. Adrian Simmons, Chairman, GCOS Steering Committee*

09h40-10h00    Participant Introductions

#### **Session I: Overview**

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10h00-10h40    Regional cooperation and regional cooperative networks related to climate adaptation and systematic observation in Ibero-America: Partnership for Adaptation, RIOCC and CIMHET  
- *José Antonio Fernández, AEMET, Spain*

10h40-11h10    Coffee Break

11h10-11h30    Role of GCOS in support of climate services and climate change adaptation  
- *Adrian Simmons, Chairman, GCOS Steering Committee*

11h30-11h50    GCOS Regional action Plan for South America and GCOS IP-10, a brief overview  
- *William Westermeyer, GCOS Secretariat*

11h50-12h10    Challenges to the improvement of climate observing systems in Ibero-America, *Ibero-America NMHS Directors Conference*  
- *Carlos Naranjo, Ecuador*

12h10-12h30    Challenges to climate data rescue and management in South America  
- *Divino Moura, INMET, Brazil*

12h30-13h00    Observation needs for sectoral climate risk management  
- *Rodney Martinez, CIIFEN*

- Disaster Risk reduction
- Water Resources
- Agriculture

- Health
- Biodiversity

14h00-14h40 A review of critical observing system needs in South America (based on the GCOS Regional Action Plan for South America, a recent assessment report, and a review of relevant IP-10 actions  
 - *Juan José Nieto, CIIFEN*

14h40-15h30 Discussion of Critical Observing Needs  
 - *Co-chairs*

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**Session II      The Role of South American Regional Climate Centers in GCOS Implementation**

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15h30-15h50 Presentation of the Northeastern South America Regional Climate Center  
 - *Divino Moura, INMET, Brazil*

15h50-16h20 Coffee Break

16h20-16h40 Presentation of the Southeastern South America Regional Climate Center  
 - *Hector Ciappesoni, SMN, Argentina*

16h40-17h00 Presentation of the Western South America Regional Climate Center  
 - *Rodney Martinez, CIIFEN*

17h00-17h30 Plenary Discussion on coordination among subregions and importance of designating GCOS National Coordinators  
 - *Chair: Vice President RA III*

20h00–23h00 Welcome Dinner

<b>Wednesday 14 March 2012</b>
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09h00-09h10 Review of Day 1 *GCOS-CIIFEN*

09h10-09h30 Operational aspects of GCOS in South America  
 - *Dick Thigpen, GCOS*

09h30-09h50 Swiss Contribution to GCOS, lessons learnt  
 - *Gabriela Seiz, MétéoSwiss*

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**SESSION III      Updating a GCOS Regional Action Plan for South America to Support Better Climate Services and Adaptation Strategies**

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09h50-13h00 Working Group review of priorities

Three working groups to consider progress and current priorities for observations and climate services, bearing in mind the 2003 GCOS Regional Action Plan and the 2010 update of the GCOS Implementation Plan

- Agriculture/Food security
- Water resources management, including glaciers
- Disaster risk reduction

13h00-14h00 Lunch

14h00-15h30 Presentations of chairs of the 3 Working Groups



- 15h30-16h00 Coffee Break
- 16h00-17h00 Plenary discussion about priorities and on updating the GCOS Action Plan for South America with respect to GCOS IP-10 and GFCS considerations  
 - Chair: To be designated

<b>Thursday 15 March 2012</b>
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- 09h00-09h15 Review of day 2 and introduction of Session IV. *Co-Chairpersons*

**SESSION IV Perspectives of International Cooperation Agencies on Climate Observing and Climate Services Needs**

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- 09h30-09h50 The Climate Services Partnership and Potential Opportunities for South America  
 - Steve Zebiak, *IRI*
- 09h50-10h10 The Finnish Cooperation in South America  
 - Outi Myatt-Hirvonen
- 10h10-10h30 USAID initiatives on Climate Change in South America  
 - Esther Zeledon
- 10h30-11h00 Coffee Break
- 11h00-11h20 Corporación Andina de Fomento: Opportunities of Cooperation on Climate matters  
 - Mauricio Velásquez
- 11h20-11h40 Europe Aid Cooperation on climate related issues in South America  
 - Anna Ruotsalainen
- 11h40-12h00 Inter American Development Bank: Cooperation on climate related issues  
 - To be confirmed
- 12h00-12h20 GIZ-CAN  
 Andean project on Climate Change  
 - Stefanie Enssle
- 12h20-13h00 Plenary discussion: Implementation issues and potential synergies between regional priorities and the priorities of International Cooperation Agencies  
 (Discussion based on a list of main actions or projects and potential financial opportunities)
- 13h00-14h00 Lunch
- SESSION V Final Plenary Discussion**  
 - The Co-chairs
- 14h00-15h00 Prioritized list of actions and potential opportunities
- 15h00- 15h30 Next steps
- 15h30-16h00 Final remarks and closure of the meeting

**Annex C**  
**Official Photo**

