Conference Declaration

We, Heads of State and Government, Ministers and Heads of Delegation present at the High-level segment of the World Climate Conference-3 (WCC-3) in Geneva, noting the findings of the Expert Segment of the Conference:

Decide to establish a Global Framework for Climate Services (hereafter referred to as "the Framework") to strengthen the production, availability, delivery and application of science-based climate prediction and services;

Working together towards a Global Framework for Climate Services

Request the Secretary-General of the World Meteorological Organization (WMO) to convene, within four months of the adoption of the Declaration, an intergovernmental meeting of Member States of the WMO to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors to be appointed by the Secretary-General of the WMO with due consideration to expertise, geographical and gender balance;

Decide that the task force will, after wide consultation with governments, partner organizations and relevant stakeholders, prepare a report, including recommendations on proposed elements of the Framework, to the Secretary-General of WMO within 12 months of the task force being set up. The report should contain findings and proposed next steps for developing and implementing the Framework. In the development of their report, the task force will take into account the concepts outlined in the annexed Brief Note;

Decid of t rcul ener States of the at s in e a rk and a plan and

Invite the Secretary-General of WMO to provide the report to relevant organizations and to the United Nations Secretary-General.

World Meteorological Organization
Weather • Climate • Water

Report of the World Climate Conference-3

UN SYSTEM
DELIVERING AS ONE ON
CLIMATE KNOWLEDGE

WMO-No. 1048

Report of the
World Climate Conference-3
Better climate information for a better future

Geneva, Switzerland
31 August–4 September 2009

WCC · 3

WMO UNESCO IOC UNEP FAO ICSU International Council for Science

The World Climate Conference-3 was an initiative of the World Meteorological Organization (WMO) in partnership with the United Nations Educational, Scientific and Cultural Organization (UNESCO) in support of the United Nations system "Delivering as One on Climate Knowledge". It was co-sponsored by the United Nations system sponsors of the World Climate Programme, the International Council for Science (ICSU) and other governmental and non-governmental partner organizations.

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Report of the World Climate Conference-3
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"Now is the time to invest in science, and to commit to rigorous and sustained climate observation, research, assessments and the provision of information. The establishment of the Global Framework for Climate Services will be an important step toward strengthening the application of climate knowledge in local, regional, national and international decision-making".

Ban Ki-moon
Secretary-General of the United Nations

Foreword

from the Secretary-General of the United Nations, Ban Ki-moon

The World Climate Conference-3 (WCC-3) was a landmark event at which leaders and senior government officials discussed the scientific tools and services needed to improve the world's ability to adapt to a changing climate.

Scientific knowledge must be the basis for global climate policy on mitigation and adaptation alike. Now, more than ever, we need to invest in rigorous climate monitoring, assessments and information provision. The decision by more than 150 countries at WCC-3 to establish a Global Framework for Climate Services is an important step toward strengthening the application of climate science in decision-making at all levels. Tools such as this will enable governments to better prepare for and protect their populations from climate risks while safeguarding important development gains.

I thank the World Meteorological Organization, donor countries, international partners and the host country, Switzerland, for their generous contributions in ensuring a successful WCC-3. As this timely event demonstrated, and as this summary report also makes clear, it is imperative to work together with unity of purpose to meet one of the most fundamental challenges of our time, climate change.

Preface

from the Secretary-General of WMO, Michel Jarraud, and from the Director-General of UNESCO, Koïchiro Matsuura

The World Climate Conference-3 (WCC-3) saw an unprecedented response by world leaders and the international scientific community to the call by the World Meteorological Organization and its long-standing partners in the World Climate Programme for the establishment of a framework to provide society with the climate services it needs to address the challenges of climate variability and change, now and in the future. Climate has emerged as one of the most challenging issues for the global community in the twenty-first century. Coping with the impacts posed by climate variability and change will require countries and societies to be equipped with new tools and capacities, including better observation and understanding of climate variability and risks; increased awareness, education and dissemination of information; as well as improved prediction and information services to enable the identification and management of a wide variety of climate risks and opportunities, including for nationally appropriate mitigation actions and adaptation.

The Secretary-General of the United Nations has made clear that the United Nations system is committed to delivering as one on climate change. As the two United Nations specialized agencies assigned convening responsibility for the "climate knowledge" component of the United Nations system-wide strategy, the World Meteorological Organization (WMO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) were delighted to receive this strong support.

WMO and UNESCO have greatly welcomed the recent scientific advances to interannual prediction and multidecadal climate projection and the developments in high-resolution regional climate models which offer a sound basis for the continued development and application of new tools and climate services. It is recognized that improved climate prediction and information services and broad assessment of climate impacts are essential for targeted adaptation and risk management measures and strategies, and would facilitate the mainstreaming of adaptation into sustainable development strategies at local, national and regional scales.

Taking place some 30 years after the historic First World Climate Conference and 19 years after the Second World Climate Conference, WCC-3 represents another landmark in the practical application of climate science, giving birth to the idea of a truly global framework for climate services available to all people.

We have a very solid foundation for building on the great progress that has been made since the First and Second World Climate Conferences, in particular through the establishment, inter alia, of the World Climate Programme (WCP), the World Climate Research Programme (WCRP), the Intergovernmental Panel on Climate Change (IPCC) and the Global Climate Observing System (GCOS). The second Conference also provided decisive momentum to the negotiations leading to the establishment of the United Nations Framework Convention on Climate Change.

The Global Framework for Climate Services (GFCS), initiated by WCC-3, will address the challenges of climate variability and change both today and into the future. Successful implementation of the Framework will lead to enhanced climate observations, research, monitoring and modelling, a transformation of that information into sector-specific products and applications, and their widest possible use by all sectors of society in decision-making. In so doing, it will contribute to disaster risk reduction and socio-economic development, including achievement of

the United Nations Millennium Development Goals and be another concrete illustration of the United Nations system delivering as one.

Moreover, the Gender and Climate Forum of WCC-3 stressed that neither climate change nor climate information is gender-neutral. After considering an extensive body of knowledge and expertise in the area of gender and climate variability and change, the Forum concluded that the GFCS should reflect a gender perspective in all its components, from observation, monitoring, research, and modelling to outreach and capacity-building.

WMO and UNESCO are committed to following up the WCC-3 decisions, taken by over 150 governments, through the mechanism set down in the Conference Declaration. In this, the support of governments and strong partnerships across all sectors will be essential. Collaboration at all levels will be necessary to foster the development of sector-targeted climate services for decision-making.

Our sincere gratitude goes to the Swiss Confederation for hosting the Conference, and to the Heads of State and Government, and more than 100 ministers and agency heads, as well as user sector high-level representatives who, despite their busy schedules, felt it important to participate in the World Climate Conference-3. We also wish to thank the international scientific communities for their commitment, as well as all governments and institutions that sponsored the Conference. We look forward to their continued support in the further development and implementation of the Framework.

Conference Declaration

We, Heads of State and Government, Ministers and Heads of Delegation present at the High-level segment of the World Climate Conference-3 (WCC-3) in Geneva, noting the findings of the Expert Segment of the Conference:

Decide to establish a Global Framework for Climate Services (hereafter referred to as "the Framework") to strengthen the production, availability, delivery and application of science-based climate prediction and services;

Request the Secretary-General of the World Meteorological Organization (WMO) to convene, within four months of the adoption of the Declaration, an intergovernmental meeting of Member States of the WMO to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors to be appointed by the Secretary-General of the WMO with due consideration to expertise, geographical and gender balance;

Decide that the task force will, after wide consultation with governments, partner organizations and relevant stakeholders, prepare a report, including recommendations on proposed elements of the Framework, to the Secretary-General of WMO within 12 months of the task force being set up. The report should contain findings and proposed next steps for developing and implementing the Framework. In the development of their report, the task force will take into account the concepts outlined in the annexed Brief Note;

Decide further that the report of the task force shall be circulated by the Secretary-General of WMO to Member States of the WMO for consideration at the next WMO Congress in 2011, with a view to the adoption of the Framework and a plan for its implementation; and

Invite the Secretary-General of WMO to provide the report to relevant organizations and to the United Nations Secretary-General.

Adopted by acclamation by the
High-level Segment of the Conference
on 3 September 2009

The Brief Note referred to above is at Annex 6.

Executive Summary

Peoples around the world are facing multi-faceted challenges of climate variability and climate change, challenges that require wise and well-informed decision-making at every level, from households and communities to countries and regions. World Climate Conference-3 (WCC-3), held in Geneva from 31 August to 4 September 2009, considered these challenges and guided the development of an international framework for climate services that will link science-based climate prediction and information with the management of climate-related risks and opportunities in support of adaptation to climate variability and change in both developed and developing countries.

The Expert Segment of WCC-3 reviewed the various challenges facing the climate service provider and user communities; considered the needs and capabilities for applying climate information in key climate-sensitive sectors, as well as for social and economic benefits; examined the scientific bases for climate information and prediction services; and concluded that:

- Great scientific progress has been made over the past 30 years, especially through the World Climate Programme and its associated activities, which already provide a firm basis for the delivery of a wide range of climate services; but that
- Present capabilities to provide effective climate services fall far short of meeting present and future needs and of delivering the full potential benefits, particularly in developing countries;
- The most urgent need is for much closer partnerships between the providers and users of climate services;
- Major new and strengthened research efforts are required to increase the time-range and skill of climate prediction through new research and modelling initiatives; to improve the observational basis for climate prediction and services; and to improve the availability and quality control of climate data.

The scientific community present at the Conference supported the development of the proposed Global Framework for Climate Services, and called for major strengthening of climate observing systems; the climate research programme; climate services information systems; climate user interface mechanisms; and capacity-building through education, training, and strengthened outreach and communication.

The Secretary-General of the United Nations opened the High-level Segment of the Conference, with supporting keynote addresses by Heads of State and Government and other dignitaries. The High-level Segment, noting the findings of the Expert Segment, adopted a Conference Declaration establishing a Global Framework for Climate Services. (See previous page for full text.) The High-level Segment also requested the Secretary-General of the World Meteorological Organization (WMO) to convene, within four months of the adoption of the Declaration, an intergovernmental meeting of Members of WMO to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors with due consideration to expertise, geographical and gender balance.

The task force shall, after wide consultation with governments, partner organizations and relevant stakeholders, prepare a report, including recommendations on proposed elements of the Framework, to the Secretary-General of WMO within 12 months of the task force being set up, along with the proposed next steps for developing and implementing the Framework. The report of the task force shall be circulated by the Secretary-General of WMO to WMO Members for consideration at the next WMO Congress in 2011, with a view to the adoption of the Framework and a plan for its implementation.

1. INTRODUCTION

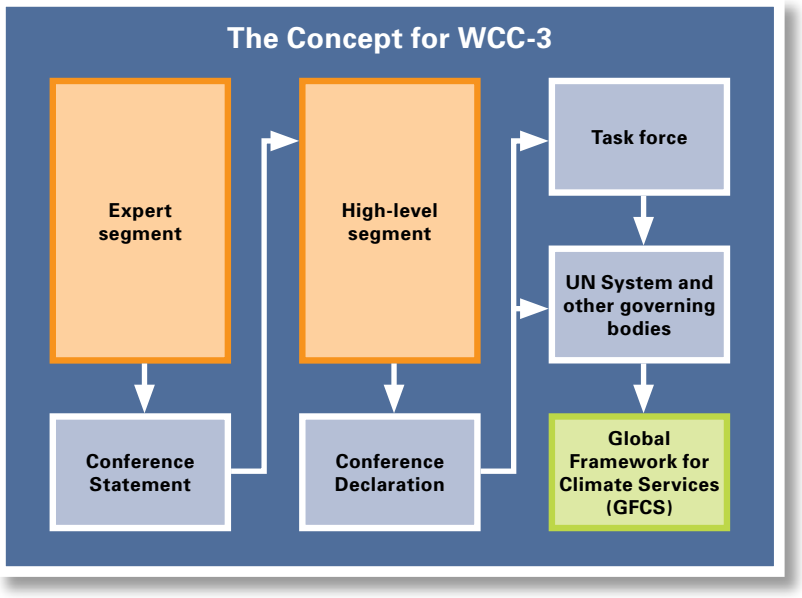
At the invitation of the Government of Switzerland, the World Climate Conference-3 (WCC-3) was held in Geneva, from 31 August to 4 September 2009. The Conference brought together some 2 500 participants, including delegates from more than 150 countries, 13 Heads of State and Government, 81 ministers, 34 United Nations organizations, and 36 other governmental and non-governmental international organizations. WCC-3 was organized by the World Meteorological Organization (WMO), in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the International Council for Science (ICSU) and other intergovernmental and non-governmental partners.

The theme of the Conference was "Climate prediction and information for decision-making" and its vision was for establishing "An international framework for climate services that links science-based climate predictions and information with the management of climate-related risks and opportunities in support of adaptation to climate variability and change in both developed and developing countries".

The Conference was organized in two parts, a three-day Expert Segment followed by a two-day High-level Segment. The Expert Segment of the Conference reviewed a wide range of individual and community-based papers and presentations from climate science, service, application and user communities as well as the results of deliberations by a number of other major climate service stakeholder and community groups. The High-level Segment was addressed by Heads of State and Government, major sponsors, ministers, and heads and representatives of international organizations.

1.1 Background

The World Climate Conference-3 (WCC-3) was the third such conference organized by the World Meteorological Organization and its United Nations system and other international partners in the last 30 years, and represented the first major initiative of the United Nations system "Delivering as One on Climate Knowledge".

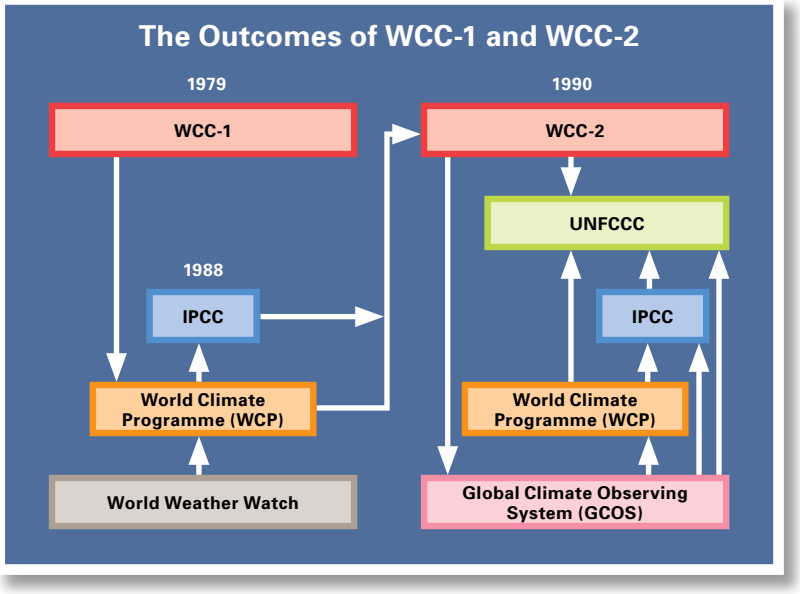


The First World Climate Conference (WCC-1), in 1979, examined the rapidly increasing influence of climate on society and called for urgent international action by all nations regarding the threat of climate change. This appeal led to the establishment by WMO, in May 1979, of the World Climate Programme (WCP), including the World Climate Research Programme (WCRP), co-sponsored by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the non-governmental International Council for Science (ICSU). In 1988, WMO and UNEP, on the basis of the early work under the World Climate Programme, jointly established the Intergovernmental Panel on Climate Change (IPCC) to take stock of the scientific knowledge of the threat of human-induced climate change.

The Second World Climate Conference (WCC-2), in October/November 1990, undertook a comprehensive evaluation of progress under the WCP and of the findings of the IPCC First Assessment Report. It found that the observational networks for monitoring the global climate systems were inadequate and deteriorating, and called for urgent political action to arrest the rapid build-up of greenhouse gases in the atmosphere. It triggered the establishment of the Global Climate Observing System (GCOS) as a joint initiative of WMO, UNEP, ICSU and the Intergovernmental Oceanographic Commission of UNESCO. The Conference also provided the scientific foundation and political endorsement for the negotiation of the United Nations Framework Convention on Climate Change (UNFCCC).

Over the 19 years since the Second World Climate Conference, international and national awareness of the need for comprehensive knowledge to address climate change has increased dramatically, along with a corresponding increase in awareness of the need for better application of that knowledge to decision-making in virtually every area of society.

Climate adaptation and risk management, in particular, became urgent and immediate priorities for all countries, especially developing countries, Least Developed Countries (LDCs), Small Island Developing States (SIDS) and other structurally weak and small economies that are highly vulnerable to the adverse impacts of climate variability and change. Coping with the consequences of climate variability and change challenged people, especially the poorest and the



most vulnerable, to become empowered with new tools and capacities. In response to this important need, WMO and its international partners decided to convene WCC-3.

1.2 Objectives

The ultimate objectives of WCC-3 were to accelerate global action on climate-related risks that threaten the well-being of society, and to capitalize on associated opportunities in support of sustainable socio-economic growth, especially in developing and Least Developed Countries. The specific objectives of the Conference were to:

- Identify and assess the global and sectoral end-user needs for climate information and prediction services;
- Mobilize climate science globally to advance the skill of seasonal-to-multidecadal climate prediction;
- Assess the current state of knowledge and adaptive capacity with regard to climate variability and change across communities;
- Identify principles and mechanisms for sharing new advances in science and information provision and application through a cooperative global framework;
- Propose solutions that will enable end-users to benefit from improved climate prediction and information services.

2. OPENING OF THE CONFERENCE

In welcoming the participants to the Opening of the Conference, the Secretary-General of WMO, Michel Jarraud, recalled the achievements of the First and Second World Climate Conferences and expressed his hope that WCC-3 would lead to an even more broadly based contribution to the wise handling of the climate issue by providing far-sighted guidance on the optimum arrangements for the provision of climate services in support of national and international decision-making over the coming decades.

The President of the Swiss Confederation, H.E. Hans-Rudolph Merz, President of the Conference, welcomed the participants to WCC-3, stressed the widespread impacts of weather and climate, and expressed his confidence that WCC-3 would lay the foundation for a better future due to better climate information.

Alexander Bedritsky, President of WMO and Chair of the Expert Segment of the Conference, noted that improved climate services are now capable of addressing a broad range of user needs. He urged the global community to come together to provide the needed information and predictions based on the best available science, and suggested that the large number of organizations attending the Conference should be seen as a testament to the high level of commitment that now exists to providing improved climate services. Dr Bedritsky emphasized that WMO Members have provided, and will continue to provide, data and predictions that are essential for climate services.

Gro Harlem Brundtland, the United Nations Secretary-General's Special Envoy on Climate Change, represented the Secretary-General at the opening of the Conference. She noted that the Secretary-General has called climate change the defining challenge of our generation and that, today, it is in our hands to make WCC-3 an important milestone in the quest for peace and security. Dr Brundtland advocated that climate politics be based on clear and credible scientific data, and encouraged WCC-3 Conference participants to make their voices heard as the world needs the knowledge and initiative of the scientific community now more than ever.

Kofi Annan, President of the Global Humanitarian Forum and former United Nations Secretary-General, spoke of the need for concerted political action on climate change. Saying that there was no room for complacency, Mr Annan noted that deliberations at

Opening of the Conference

From left to right: John Zillman, Kofi Annan, Michel Jarraud, Hans-Rudolf Merz, Alexander Bedritsky, Gro Harlem Brundtland, Sergei Ordzhonikidze and Buruhani Nyenzi (Director of the Conference)

WCC-3 must provide the impetus to help decision-makers reach a new agreement in Copenhagen. He observed that those most threatened by climate change have done the least to cause the problem, and therefore, developed countries should take the lead in cutting greenhouse gas emissions. Mr Annan suggested that Weather Information for All, a new initiative by the Global Humanitarian Forum, WMO, and the private sector to establish in African countries surface stations communicating by cell phone technology, will help facilitate the sharing of essential data and the provision of threat alerts.

2.1 Expert Segment

After the formal opening of the Conference, Dr Bedritsky invited participants to join in the opening of the Expert Segment. He welcomed the following representatives of WMO international partners who addressed the Conference:

- Walter Erdelen, Assistant Director-General, United Nations Educational, Scientific and Cultural Organization;
- Manzoor Ahmad, Director, Geneva Office, Food and Agriculture Organization of the United Nations;
- Joseph Alcamo, Chief Scientist, United Nations Environment Programme;
- Deliang Chen, Executive Director, International Council for Science;
- Julia Marton-Lefèvre, Director General, International Union for Conservation of Nature;
- Jean-Jacques Dordain, Director General of the European Space Agency;
- Houlin Zhao, Deputy Secretary-General, International Telecommunication Union (ITU);
- Reid Basher, Special Advisor to the United Nations Assistant Secretary-General for Disaster Risk Reduction.

Dr Bedritsky also acknowledged a message of support for the Conference from the World Health Organization (WHO). Thomas Stocker, Co-Chair of Working Group I of the Intergovernmental Panel on Climate Change, set the science scene for the Conference in terms of new approaches and methods that

Opening of the Expert Segment

From left to right: Buruhani Nyenzi, Thomas Stocker, Manzoor Ahmad, Walter Erdelen, John Zillman, Deliang Chen, Michel Jarraud, Alexander Bedritsky, Julia Marton-Lefèvre, Jean-Jacques Dordain, Houlin Zhao, Joseph Alcamo, Reid Basher (speaking)

will be available for use in the IPCC Fifth Assessment Report. These include:

- Improved short-term predictions that will be available to IPCC Working Groups II and III;
- Improved understanding of the several factors that influence sea-level rise;
- Reduced uncertainties on climate impacts;
- Improved understanding of hazards resulting from human-induced climate change.

John Zillman, Chair of the WCC-3 International Organizing Committee, concluded the opening session by elaborating on the Sponsors' Vision for the Conference.

2.2 High-level Segment

At the opening of the High-level Segment on 3 September 2009, the representative of the host country and Co-Chair of the Conference and the High-level Segment, Moritz Leuenberger, Minister of the Environment, Transport, Energy and Communications, Switzerland, underscored the conference goal of developing the Global Framework for Climate Services (GFCS) and called for an entry into a century of climate enlightenment.

United Nations Secretary-General Ban Ki-moon stressed the need for an ambitious, comprehensive and fair agreement in Copenhagen based on sound science, and reminded the participants that only 15 negotiating days remain before the fifteenth session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP15). He reported that investment to meet climate targets represents 2 per cent of global Gross Domestic Product (GDP) between now and 2030. The Secretary-General said the answers lie in policies that put a price on carbon, that contemplate global public programs for renewable energy, and that offer creative solutions to protect forests and ecosystems. He called for action in the following areas: adaptation to impacts of climate change with fast-tracked funding for Least Developed Countries and Small Island

Opening of the High-level Segment
From left to right: Rajendra Pachauri, Alexander Bedritsky, Michel Jarraud, Armando E. Guebuza, Moritz Leuenberger, Sergei Ordzhonikidze, Ban Ki-moon (speaking)

Developing States; ambitious mid-term targets by developed countries; action by developing countries to slow emissions growth; predictable financial and technical support; and institutional relationships to address developing country needs.

Ban Ki-moon, Secretary-General, United Nations

Armando E. Guebuza, President of Mozambique

Rajendra Pachauri, IPCC Chair, stressed that climate information and observations need more detail and should be broader in focus. He also highlighted the need for continuous data, as well as the monitoring of climate impacts. Alexander Bedritsky, President of WMO and Chair of the Expert Segment, in presenting the Conference Statement, stressed the need for the establishment of linkages at the local, national and international levels, for continued capacity-building, and for outreach to the public. On the proposal of the host country Co-Chair, the participants adopted the Conference Declaration by acclamation.

Immediately after the formal opening and the adoption of the Declaration, the Conference was addressed by Heads of State and Government. H.E. Armando Emílio Guebuza, President of Mozambique and Co-Chair of the Conference and the High-level Segment, stressed the importance of strengthening early warning systems and improving water management. He urged developed countries to fulfil all relevant international commitments. H.E. Emomali Rakhmon, President of Tajikistan, discussed the impacts of climate change on water resources, particularly in central Asia. He stressed the need for an international effort to save glaciers, and for greater use of hydropower to meet energy needs.

Heads of State and Government with the United Nations Secretary-General and WMO Secretary-General
From left to right: Idi Nadhoim, Vice President of the Comoros; Girma Wolde Giorgis, President of Ethiopia; Prince Albert II of Monaco; Michel Jarraud, Secretary-General of WMO; Moritz Leuenberger, Minister of the Environment, Transport, Energy and Communications, Switzerland; Armando E. Guebuza, President of Mozambique; Ban Ki-moon, Secretary-General of the United Nations; Hui Liangyu, Vice Premier of China; Ali Mohamed Shein, Vice President of the United Republic of Tanzania; Sheikh Hasina, Prime Minister of Bangladesh; Toke Tufukia Talagi, Premier of Niue and Jim Marurai, Prime Minister, Cook Islands

H.S.H. Prince Albert II of Monaco noted that science had made many advances that allow for an expanded knowledge base for Copenhagen. H.E. Girma Wolde Giorgis, President of Ethiopia, noted areas for action, including the establishment of adaptation and mitigation efforts, and the preparation of national action plans. He stressed the need for effective communication of extreme weather events and for capacity-building. H.E. Danilo Türk, President of Slovenia, spoke of the importance of accurate and timely information, and called for user needs to drive the systems for addressing climate change. He noted that strong commitment and cooperation among stakeholders was imperative. H.E. Ali Mohamed Shein, Vice President of the United Republic of Tanzania, noted that the impact of disasters highlights the importance of climate services, and called for increasing the number of meteorological stations, for developing capacity and for creating effective and efficient interaction between providers and users.

H.E. Sheikh Hasina, Prime Minister of Bangladesh, highlighted the advantages that could be brought by enhancing the technological delivery and capacity of climate services, particularly in Least Developed Countries. She said US$ 2 billion is needed for adaptation funds for LDCs over the next five years.

H.E. Hui Liangyu, Vice Premier of China, stressed the need to improve climate service capabilities and systems. Emphasizing a commitment to the United Nations Framework Convention on Climate Change,

From left to right: Emomali Rakhmon, President of Tajikistan; Ayikoe Kossivi, on behalf of the President of Togo and Danilo Türk, President of Slovenia

Antouman Saho, on behalf of the President of The Gambia and Pierre Hele, on behalf of the President of Cameroon

he underscored the principle of "common but differentiated responsibilities". He also said that China will be firmly committed to sustainable development and will work with the international community to look after planet Earth – the common home of all mankind. H.E. Toke Tufukia Talagi, Premier of Niue, highlighted the urgent need for the Pacific Island States, already facing increased sea levels, to obtain adaptation funds. He also expressed concern for the future of Pacific Islanders, as many are dependent on the sea for their livelihoods. H.E. Jim Marurai, Prime Minister, Cook Islands, noted that Small Island Developing States need an urgent commitment to reducing greenhouse gases. He called for the Global Framework for Climate Services to address the vulnerability of SIDS to extreme climate events.

H.E. Antouman Saho, Minister of Fisheries, Water Resources and National Assembly Matters, The Gambia, delivered his statement on behalf of the President of his country. He stressed that adaptation measures to climate variability and change are a right for all people. H.E. Pierre Hele, Minister of Environment and Protection of Nature, Cameroon, on behalf of his President, highlighted Africa's vulnerability to climate change impacts and called for more financing for the support of technological innovations for conservation. Hon. Ayikoe Kossivi, Minister of Environment and Forestry Resources, Togo, on behalf of his President noted the challenges of accessing effective climate observation equipment.

3. THE EXPERT SEGMENT

3.1 Programme

The Expert Segment of WCC-3 consisted of 5 plenary sessions; 12 parallel working sessions; 3 plenary round-table sessions; 4 forums, in parallel with the working sessions; 4 workshops on implementing climate services; and 3 poster sessions. Annex 1 provides the full programme of the Conference. At the end of the Expert Segment on Wednesday, 2 September, the Conference Statement was finalized by the Conference International Organizing

Committee, Session Chairs, Theme leaders and Rapporteurs on the basis of the discussions that came from the various sessions.

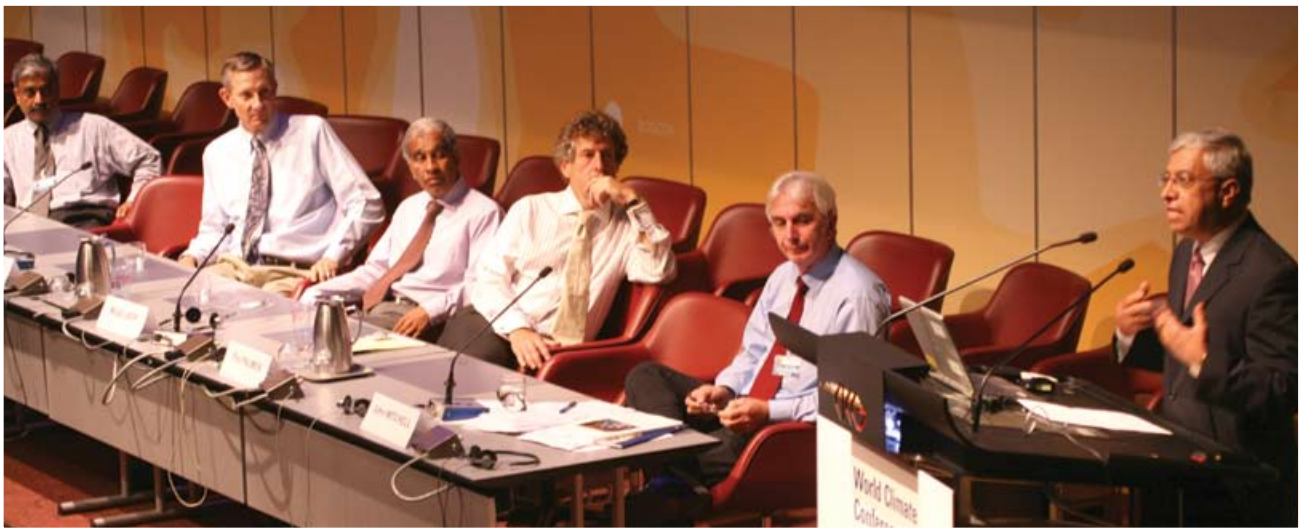
3.2 Outcomes

The outcomes of WCC-3 include a greatly increased understanding of the scientific and practical issues involved in the implementation of improved global, regional and national arrangements for the provision and application of climate services. In addition, WCC-3 generated a shared understanding of a strategy for implementing a new Global Framework for Climate Services that is built on the established international climate observation and research programmes, and that complements and supports the existing climate change assessment and policy mechanisms of the IPCC and the United Nations Framework Convention on Climate Change. The unanimous endorsement of the participants foreshadows vigorous national and international follow-up action on implementation of the GFCS leading to:

- Strengthened national observational networks and information management systems for climate and climate-related variables;
- Enhanced climate modelling and prediction capabilities through strengthened international climate research focused on seasonal-to-decadal timescales;
- Improved national climate service provision arrangements based on improved observation networks, enhanced prediction models and greatly increased user interaction;
- More effective use of global, regional and national climate information and prediction services in all climate-sensitive sectors in all countries;
- Widespread social, economic and environmental benefits through better informed climate risk management and improved capability for adaptation to climate variability and change.

3.3 Conference Statement

Peoples around the world are facing multi-faceted challenges of climate variability and climate change, challenges that require wise and well-informed decision-making at every level, from households



Plenary session 3: Advancing climate prediction science
From left to right: Arun Kumar, Jerry Meehl, Mojib Latif, Tim Palmer, John Mitchell, Ghassem Asrar (speaking)

and communities to countries and regions, and to international forums such as the United Nations Framework Convention on Climate Change. Wise and well-informed decision-making, in turn, will require, directly or indirectly, access to the best possible climate science and information, together with the effective application of the information through climate services.

The first two World Climate Conferences, in 1979 and 1990, laid the foundation for building research and observational activities to understand the nature of the climate challenges, and to provide the scientific bases for developing the comprehensive and sound climate services that are now being sought by all countries and in virtually every sector of society. The World Meteorological Organization and its partners convened World Climate Conference-3 to provide nations with the opportunity to consider together an appropriate global framework for climate services over the coming decades, a framework that would help ensure that every country and every climate-sensitive sector of society is well equipped to access and apply the growing array of climate prediction and information services made possible by recent and emerging developments in international climate science and technology.

The purpose of the Expert Segment of WCC-3 was to engage a wide cross-section of climate scientists, expert providers of climate information and the users of climate information and services in a wide-ranging discussion on the essential elements of a new Global Framework for Climate Services for consideration by the High-level Segment of the Conference.

The 200 speakers and 1 800 participants in the Expert Segment reviewed the various challenges facing the climate service provider and user communities; considered the needs and capabilities for applying climate information in key climate-sensitive sectors, as well as for social and economic benefits; and examined the scientific bases for climate information and prediction services. A number of scientific, environmental and socio-economic groups and organizations informed the Expert Segment of their needs and perspectives, and a wide range of countries and climate-sensitive sectors reported on their experiences in the implementation of climate services. On the basis of these deliberations, the Expert Segment concluded that:

- Great scientific progress has been made over the past 30 years, especially through the World Climate Programme and its associated activities, which already provide a firm basis for the delivery of a wide range of climate services; but that

- Present capabilities to provide effective climate services fall far short of meeting present and future needs and of delivering the full potential benefits, particularly in developing countries;

- The most urgent need is for much closer partnerships between the providers and users of climate services;

- Major new and strengthened research efforts are required to increase the time range and skill of climate prediction through new research and modelling initiatives; to improve the observational basis for climate prediction and services; and to improve the availability and quality control of climate data.

The Expert Segment then called for major strengthening and implementing, as appropriate, of the following essential elements of a global framework for climate services:

- The Global Climate Observing System and all its components and associated activities; and provision of free and unrestricted exchange and access to climate data;

- The World Climate Research Programme, underpinned by adequate computing resources and increased interaction with other global climate relevant research initiatives;

- Climate services information systems taking advantage of enhanced existing national and international climate service arrangements in the delivery of products, including sector-oriented information to support adaptation activities;

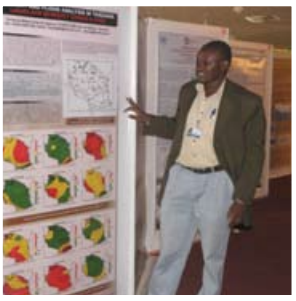
- Climate user interface mechanisms that are focused on building linkages and integrating information, at all levels, between the providers and users of climate services, and that are aimed at the development and efficient use of climate information products including the support of adaptation activities;

- Efficient and enduring capacity-building through education, training, and strengthened outreach and communication.

The Expert Segment concluded by supporting the development of the proposed Global Framework for Climate Services. The WCC-3 Sponsoring Agencies agreed, therefore, that the essential findings of the Expert Segment, as summarized in this Statement, should be transmitted to the High-level Segment of the Conference for the information of delegates and other Conference participants; and be referred to their individual and joint executive and coordination bodies for follow-up action, in particular, in the context of the United Nations Chief Executives Board initiative on the United Nations system "Delivering as One on Climate Knowledge".

Annex 5 presents the complete Conference Statement, including its detailed recommendations.

Poster participant: Raphael Jos



Poster participant: Ladislaus Chang'a

4. THE HIGH-LEVEL SEGMENT

The Secretary-General of the United Nations officially opened the High-level Segment. The Chair of the Expert Segment gave a brief report and the Co-Chair of the High-level Segment introduced the draft Conference Declaration, which was adopted by acclamation. This was followed by further addresses from Heads of State and Government, agency heads, ministers and senior representatives of end-user communities (see section 2.2).

4.1 Addresses by major Conference sponsors

H.E. Jane Lubchenco, Under Secretary of Commerce for Oceans and Atmosphere, United States of America, noted that improving the development and delivery of climate services offers benefits to society in such areas as health, economic development and food security. Hon. Åsa-Britt Karlsson, State Secretary, Ministry of the Environment, Sweden, on behalf of the European Union, welcomed the adoption of the Global Framework for Climate Services and highlighted the need for the provision of information to be driven by user needs, a strategy requiring coordination among agencies. Hon. Håkon Gulbrandsen, State Secretary for International Development, Norway, noted that efforts to address climate change should take a multi-sectoral approach. Hon. Gernot Erler, Minister of State at the Federal Foreign Office, Germany, stressed the need for a consensus on goals, and noted the potential for a follow-up conference in Germany.

Hon. Paavo Väyrynen, Minister for Foreign Trade and Development, Finland, underscored the need for climate services to enable long-term development and natural disaster preparation, and highlighted Finland's responsibility for sharing climate service knowledge. Roberto Menia, Under Secretary of State, Ministry of Environment, Italy, called for maintaining momentum to make the GFCS operational as soon as possible. Kunio Sakurai, Director-General, Japan Meteorological Agency, noted that the GFCS will promote the application of countermeasures against adverse climate events.

H.E. Teresa Ribera Rodríguez, Secretary of State for Climate Change, Spain, called attention to the link between addressing climate change and reaching the Millennium Development Goals and stressed that a Copenhagen agreement should be effective, equitable and flexible. Shailesh Nayak, Deputy Minister, Science and Technology and Earth Sciences, India, noted that his country had taken steps to improve its surface climate observation network. Brian T. Gray, Assistant Deputy Minister, Science and Technology, Environment Canada, stressed the importance of building stronger international linkages between the providers and users of climate information. Hon. Ishfaq Ahmad, Adviser, Minister of State, Pakistan,

From left to right: Jane Lubchenco, United States of America; Åsa-Britt Karlsson, Sweden; Gernot Erler, Germany; Paavo Väyrynen, Finland and Roberto Menia, Italy

From left to right: Kunio Sakurai, Japan; John Njoroge Michuki, Kenya; Alexander Bedritsky, Russian Federation; Ishfaq Ahmad, Pakistan and Peter Gooderham, UK

From left to right: Brian T. Gray, Canada; J.M. Silva Rodríguez, European Commission; Teresa Ribera Rodríguez, Spain; Stavros Kalogiannis, Greece and Shailesh Nayak, India

From left to right: Jean-Baptiste Mattéi, France and Håkon Gulbrandsen, Norway

said there was an urgent need to address the lack of climate information in the region. Gary Foley, the Permanent Representative of Australia with WMO, suggested that the objective of an effective climate service should be to ensure that the correct information reaches the correct users for effective decision-making.

Hon. John Njoroge Michuki, Minister for Environment and Mineral Resources, Kenya, called upon the international community to support global atmospheric weather stations, early warning systems, programs for enhancing forest cover, and development of national climate change strategies in developing countries. H.E. Jean-Baptiste Mattéi, Ambassador of France to the United Nations Office at Geneva, stressed the need of financing for national adaptation strategies and for observation and monitoring. He also stressed the key role WMO and NMHSs play in addressing the main components of the Framework. Alexander Bedritsky, Head of Roshydromet, Russian Federation, highlighted that the GFCS will act as the basis for specifying opportunities and risks for political decisions. H.E. Peter Gooderham, Ambassador of the United Kingdom of Great Britain and Northern Ireland to the United Nations Office at Geneva, noted that engagement between the users and providers of climate information would lead to the availability of new products. Ioannis Ziomas, Secretary General for International Economic Relations and Development Cooperation, Greece, suggested that adoption of sectoral targets could be a realistic short-term approach for Annex I countries under the UNFCCC, and stressed the need to strengthen financing and technology transfer for mitigation and adaptation.

4.2 Addresses by ministers

Several ministers spoke of the upcoming fifteenth session of the Conference of the Parties to the United Nations Climate Change Convention to be held in Copenhagen in December 2009. Hon. Humberto Rosa, Secretary of State for the Environment, Portugal, stressed the need for long-term adaptation financing and for accurate meteorological data as outcomes of COP15. Hon. Paul Magnette, Minister for Climate and Energy, Belgium, underscored that an agreement in Copenhagen should not be perceived as a burden or constraint but as an opportunity. H.E. Robert Persaud, Minister of Agriculture, Guyana, called for holistic approaches that strengthen climate services, increase adaptation, protect ecosystems and realize economic development, while providing incentives to avoid deforestation. Tumusiime Rhoda Peace, Commissioner, African Union, underscored the vulnerability of Africa and called attention to the decision that Africa would speak with one voice at COP15.

Robert Persaud, Guyana

Tumusiime Rhoda Peace, African Union

Heherson Alvarez, Secretary of Global Warming and Climate Change, Philippines, noted that adaptation will only be feasible if there is an agreement on mitigation. Hon. Mahinda Samarasinghe, Secretary of State for the Environment, Sri Lanka, suggested that the multi-stakeholder approach of the Global Framework for Climate Services will encourage a wide range of inputs that improve eventual outcomes. Jan Dusík, First Deputy Minister of the Environment, Czech Republic, spoke about the phased approach to establishing an adaptation framework adopted by the European Union in 2009. Hon. John Odey, Minister of Environment, Nigeria, stressed the need to mainstream climate change considerations into development policies, to increase climate data observations in Africa and to strengthen centres of excellence. Hon. Kawkab Al Sabah Daya, Minister of State for Environmental Affairs, Syrian Arab Republic, called for sustainable development, but stressed that developing countries cannot be asked to sacrifice their growth for the environment.

Hon. Carlos Costa Posada, Minister of Environment, Housing and Territorial Development, Colombia, called for more cost-effective measures to respond to climate change. Hon. Narmin Barzingy, Minister of Environment, Iraq, described plans to establish a national meteorological service and identified the need for financial and technical support. Maria Evarista De Sousa, Minister of Agriculture and Rural Development, Guinea-Bissau, called for strategic sustainable development policies that are based on low environmental impact and on the use of appropriate technology. Hon. Tibor Faragó, State Secretary, Hungary, noted that public awareness and the will to combat climate change have become global. H.E. Maria Nazareth Farani Azevêdo, Ambassador of Brazil to the United Nations Office at Geneva, said her country was prepared to engage in efforts at the local, national and international levels to improve climate information. H.E. Dian Triansyah Djani, Ambassador of Indonesia to the United Nations Office at Geneva, stressed that concerted efforts were needed to address long-term adaptation programs for coastal areas.

Heherson Alvarez, Philippines

Carlos Costa Posada, Colombia

El-Hadj Mamady Kaba, Minister of Transport, Guinea, called attention to the adverse impacts of climate change on African agriculture. Hon. Nicolae Nemirschi, Minister of Environment, Romania, emphasized the importance of the Global Framework for Climate Services in bridging the gaps among scientists, users, and policymakers. Hon. Khamis Bin Mubarak Bin Isa Al-Alawi, Minister of Transport and Communications, Oman, noted that the GFCS should boost current efforts, capabilities and research for combating climate change. Hon. Nicholas T. Goche, Minister of Transport, Communications and Infrastructural Development, Zimbabwe, spoke of the need to shore up efforts to bridge the information and awareness gaps that exist between the users and providers of climate information. Tan Yong Soon, Permanent Secretary, Ministry of the Environment and Water Resources, Singapore, stressed that the GFCS will aid countries to build up their knowledge bases and to enable more informed decisions and policies.

Gilbert Noël Ouédraogo, Burkina Faso

Catherine Namugala, Zambia

Hon. Catherine Namugala, Minister of Tourism, Environment and Natural Resources, Zambia, told the Conference that in Africa timely climate information can be the difference between life and death. Rahma Salih Elobied, Ambassador of Sudan to the United Nations Office at Geneva, presented mechanisms to enhance African and Arab coordination on climate change research and action. Eldana Sadvakassova, Vice-Minister for Environment Protection, Kazakhstan, underscored the importance of coordination and the utility of a road map for climate services. Siniša Stanković, Deputy Minister for Spatial Planning and Environment, Montenegro, expressed support for the GFCS and a readiness to offer concrete contributions to abating negative consequences of climate change. Hon. Nikola Ruzinski, State Secretary, Croatia, highlighted the principle of common but differentiated responsibility and action based on respective capabilities.

Hon. Lyonpo Pema Gyamtsho, Minister for Agriculture, Bhutan, questioned his country's capacity to adapt to climate impacts without assistance.

Hon. Jessica Eriyo, Minister of State for the Environment, Uganda, pointed out that a lack of climate data has led to greater uncertainty on climate forecasts for developing countries than for the rest of the world. Khomoatsana Tau, Ministry of Natural Resources, Lesotho, spoke of the limited ability to adapt to climate change without outside aid. Hon. Rashed Ahmed Ben Fahd, Minister of Environment and Water, United Arab Emirates, noted the cross-sectoral risks from climate change and adverse climate events. Hon. Nadhir Hamada, Minister of Environment and Sustainable Development, Tunisia, stressed that global initiatives undertaken for adaptation to climate change should place particular emphasis on developing countries. Sharifah Zarah Syed Ahmad, Deputy Secretary-General, Ministry of Science, Technology and Innovation, Malaysia, reported that Malaysia has mainstreamed climate information into their sectoral planning.

Lyonpo Pema Gyamtsho, Bhutan

Jessica Eriyo, Uganda

Hon. Gilbert Noël Ouédraogo, Minister of Transport, Burkina Faso, underscored the importance of information and noted that African countries have taken steps to emphasize this in their policies. Mustapha Geanah, Secretary-General, Ministry of Energy, Mining, Water and Environment, Morocco, stressed the importance of national strategies for climate change and water and called for mechanisms for national meteorological services to be integrated into regional and international efforts. Gideon Quarcoo, Deputy Minister of Communications, Ghana, reminded the Conference that addressing climate change requires global cooperation. Thomas Becker, Deputy Permanent Secretary, Ministry of the Environment, Denmark, said his country is eager to see the task force of the GFCS begin its work. Frits Brouwer, Permanent Representative of the Netherlands with WMO, advocated for international cooperation on information for policymaking and underscored the need for global climate monitoring. Julián Baez Benitez, Permanent Representative of Paraguay with WMO, called for cooperation to improve data-handling and for services to achieve the goal of better climate prediction for users. H.E. Selma Ashipala-Musavyi, Ambassador of Namibia to the United Nations Office at Vienna, stressed that the gender dimension of the impacts of climate change should not be overlooked.

Emile Ouosso, Congo

Tiémoko Sangare, Mali

J.M. Silva Rodríguez, Director-General of Research, European Commission, suggested that the common understanding of the impacts of climate change needs to be improved significantly. Hon. Lormus Bundhoo, Minister of Environment and National Development, Mauritius, informed the Conference that the impacts of climate change are already evident in his country, and he advocated for the consolidation of Regional Climate Outlook Forums, particularly in Southern Africa. Hon. Emile Ouosso, Minister of Transport and Civil Aviation, Congo, underscored the role of forests in climate change, and said that ensuring the preservation of the Congo Basin forest would require funding of US$ 25 billion. Hon. Tiémoko Sangare, Minister of Environment and Sanitation, Mali, emphasized the role for technology transfer in the implementation of climate strategies. Jean Marie Claude Germain, Minister of Environment, Haiti, reminded the Conference that his country was hit

by four tropical cyclones in 2008, and stressed that the financial crisis is affecting the capability of countries to respond to mounting climate impacts. Hon. Antoine Karam, Minister of Environment, Lebanon, noted that climate change affects all, and that there is a need for all to make an exceptional effort in the medium term. H.E. Glaudine Mtshali, Ambassador of South Africa to the United Nations Office at Geneva, noted that many developing country policies aim to deliver basic services, but that these efforts are being persistently undermined by the short-, medium- and long-term impacts of climate change.

H.E. Maged George Elias Ghatas, Minister of State for Environmental Affairs, Egypt, discussed regional vulnerabilities and offered to host a regional climate centre. Ali Mohammad Noorian, Vice-Minister of Roads and Transportation, Islamic Republic of Iran, called on the Global Framework for Climate Services to apply predictions to the management of climate-related risk, and to take account of the benefits resulting from financial and technical support. Hon. Nantsagiin Batsuuri, State Secretary of Nature, Environment and Tourism, Mongolia, reported on efforts to coordinate high-level climate-change meetings of East Asian nations. Nguyen Van Duc, First Vice-Minister of Natural Resources and Environment, Viet Nam, highlighted the role of cooperation in creating a successful GFCS. H.E. Idriss Jazaïry, Ambassador of Algeria to the United Nations Office at Geneva, pointed out that the implementation of the GFCS will enhance the level of regional climate modelling, and appealed for sufficient funding for the programme.

4.3 Addresses by heads and senior representatives of international organizations

Michel Jarraud, Secretary-General of WMO, discussed the importance of providing decision-makers with the climate tools they require to make decisions for effective action against climate change. Koïchiro Matsuura, Director-General of UNESCO, stressed that a key outcome of a Global Framework

From left to right: Michel Jarraud, Secretary-General, WMO; Koïchiro Matsuura, Director-General, UNESCO; Achim Steiner, Executive Director, UNEP; and Alexander Müller, Assistant Director-General, FAO

From left to right: Catherine Bréchignac, President and Director-General, ICSU; Margaret Chan, Director-General, WHO; Helen Clark, Administrator, UNDP; and Otaviano Canuto, Vice President, World Bank

for Climate Services should be the dissemination of climate information to enable effective action against climate change, and emphasized the importance of capacity-building.

Achim Steiner, Executive Director of UNEP, highlighted the role of science in informing management and decision-making. Alexander Müller, Assistant Director-General of FAO, called attention to the significant mitigation options offered by agriculture and to the benefits agriculture can receive from enhanced climate services. Catherine Bréchignac, President of ICSU, emphasized the need for North-South cooperation in establishing the GFCS.

Margaret Chan, Director-General of WHO, stressed the adverse health effects that climate change will have on humans, particularly those in marginalized communities. Helen Clark, Administrator of the United Nations Development Programme (UNDP), said UNDP believes that it is necessary to bring climate challenges into the heart of development strategies.

Otaviano Canuto, Vice President of the World Bank, noted that investment in knowledge improvement is most important as it greatly reduces uncertainties in climate prediction. Efthimios Mitropoulos, Secretary-General of the International Maritime Organization, suggested that the melting of polar ice caps is both an advantage in terms of increased tourism, transport and trade, and a disadvantage because the increased sea levels may adversely affect vital shipping lines. Francis Gurry, Director General of the World Intellectual Property Organization (WIPO), stressed that resolving intellectual property issues is a part of the solution for addressing climate change, not a part of the problem.

Hamadoun Touré, Secretary-General of ITU, argued that his organization's work on digital broadcasting and next-generation networks would aid the fight against climate change through reduced power consumption and increased efficiency. Yasemin Aysan, Under Secretary-General of the International Federation of Red Cross and Red Crescent Societies, noted that

From left to right: Margareta Wahlström, Special Representative of the Secretary-General of the United Nations, ISDR; Francis Gurry, Director General, WIPO; Efthimios Mitropoulos, Secretary-General, IMO; and Hamadoun Touré, Secretary-General, ITU

From left to right: Yasemin Aysan, Under Secretary-General, IFRC; Taleb Rifai, Secretary-General, UNWTO; Ján Kubiš, Executive Secretary, UNECE; and Harsha V. Singh, Deputy Director-General, WTO

preparedness for hazardous climate events results from helping communities to understand the problem, to trust the information provided and to know how best to react. Taleb Rifai, Secretary-General, United Nations World Tourism Organization, challenged the tourism sector to acknowledge its contribution to climate change. Ján Kubiš, Executive Secretary, United Nations Economic Commission for Europe (UNECE), informed the Conference that in assisting the establishment of the Global Framework for Climate Services, UNECE has legal instruments that can contribute to the timely access to information. Harsha V. Singh, Deputy Director-General of the World Trade Organization, underscored the importance of multilateral cooperation in combating climate change.

Anada Tiéga, Secretary General, Ramsar Convention, said that a better understanding of wetlands will contribute to climate prediction and modelling activities. Ahmed Djoghlaf, Executive Secretary, United Nations Convention on Biological Diversity, called for a greater understanding of the interaction of climate change and biodiversity loss. Grégoire de Kalbermatten, Deputy Executive Secretary, United Nations Convention to Combat Desertification (UNCCD), noted that UNCCD will contribute to GFCS through their thematic programme at the regional level, and by establishing desertification monitoring centres.

Grégoire de Kalbermatten, UNCCD

Roberto Acosta, UNFCCC

Laurent Corbier, World Business Council for Sustainable Development, called for an agreement at COP15 so that business has a clear framework

Some senior representatives of international organizations at WCC-3

From left to right: Jerry Lengoasa, Assistant Secretary-General, WMO; Jan Egeland, Director, Norwegian Institute of International Affairs; Efthimios Mitropoulos, Secretary-General, IMO; Hamadoun Touré, Secretary-General, ITU; Michel Jarraud, Secretary-General, WMO; Sergei Ordzhonikidze, Director-General, UNOG; Taleb Rifai, Secretary-General, UNWTO; and Hong Yan, Deputy Secretary-General, WMO

within which to make investment decisions. George Deikun, Senior Advisor, United Nations Human Settlements Programme (UN–HABITAT), noted the importance of recognizing that cities and urban residents are not only victims of, but also contributors to, climate change, and that cities should contribute to the solution as well. Roberto Acosta, Coordinator, Adaptation, Technology and Science Programme, UNFCCC, suggested that the GFCS can further develop climate models and predictions especially at the regional level. Gonzalo Pereira, Secretary General of the Permanent Commission for the South Pacific, reported on his organization's programme on the study of El Niño. René Dändliker, Representative, Council of Academies of Engineering and Technological Sciences, advocated for free exchange of climate data and information.

4.4 Outcome

The High-level Segment culminated with the adoption by acclamation of the Conference Declaration establishing the Global Framework for Climate Services. The complete Conference Declaration appears opposite the Executive Summary at the beginning of this report.

5. CLOSING OF THE CONFERENCE

Hon. Maciej Nowicki, Minister of Environment, Poland, and current President of COP14, highlighted the scientific contributions of the Conference and the importance of the Global Framework for Climate Services as a tool for connecting user groups to science. He called for delegates to do all they can to reach an effective agreement in Copenhagen. Marie-Louise Overvad, Ambassador of Denmark to the United Nations Office at Geneva, underscored the role of the GFCS in providing tools to empower people to assess vulnerability, to understand risk and to make well-informed decisions. She called for global leadership to realize an ambitious climate agreement. John Zillman, Chair of the WCC-3 International Organizing Committee, recalled that

Closing of the Conference

From left to right in the front: Alexander Bedritsky, Michel Jarraud, Armando E. Guebuza, Moritz Leuenberger, Maciej Nowicki (vignette), Marie-Louise Overvad and Buruhani Nyenzi

the Conference was organized to bring about a paradigm shift towards delivering user-oriented climate information and services. He welcomed the strong support from governments and international organizations for the proposed GFCS.

Michel Jarraud, Secretary-General of WMO, stressed that the declaration adopted at the Conference was concise and offered a clear path forward for establishing the Global Framework for Climate Services. He noted that the tools and services to be provided by the GFCS were cross-sectoral and would contribute to the achievement of the Millennium Development Goals.

H.E. Moritz Leuenberger, Minister of the Environment, Transport, Energy and Communications, Switzerland, noted that the Conference Declaration allowed for a structure that will enhance the ability to provide information to meet current needs. H.E. Armando Emílio Guebuza, President of Mozambique and Co-Chair of the Conference and the High-level Segment, noted that the GFCS demonstrates a commitment to address climate change and capacity-building in developing countries, contributes to the international commitment to reach the Millennium Development Goals, and establishes a foundation for a Copenhagen agreement.

6. ACKNOWLEDGEMENTS

The success of World Climate Conference-3 is directly attributable to the many individuals and organizations dedicated to advancing science-based climate prediction and services, and the WCC-3 co-sponsors gratefully acknowledge their contributions.

The high profile enjoyed by the Conference reflects the stature of the participants, and the co-sponsors deeply appreciate the overwhelming response and interest of the experts, user community representatives and policymakers who participated in WCC-3.

World Climate Conference-3 was more than 10 years in the making, and the Conference co-sponsors recognize the early contributions of the members of the provisional organizing committee. Through their constructive engagement and clear understanding of the climate challenges to society, they formulated the concept for WCC-3, and earned the approval of the WMO Congress for the organization of the Conference.

The dedication and commitment of purpose by the WCC-3 International Organizing Committee contributed immensely to the success of the Conference. Through the leadership, first of Don MacIver, and then of John Zillman, the committee did a wonderful job that led to the realization of one of the biggest events in the history of WMO. The persons responsible for each session also played important roles in coordinating the various experts involved in the development of white papers, and in representing the views of the sessions.

The generous financial contributions from governments and institutions to the WCC-3 Trust Fund were essential. These contributions also enabled experts from developing and Least Developed Countries to attend the Conference and to contribute to the discussions. The sponsors, the members of the WCC-3 International Organizing Committee and the session experts are listed in the Annexes.

The WCC-3 Secretariat

From left to right: William Nyakwada, Andreas Obrecht, Alessia Solari, Corinna Schermer, Buruhani Nyenzi, Narissa Carandang, Aeree Baik and Lisa Muñoz

Annexes

Annex 1 Programme of the World Climate Conference-3

Expert Segment programme

<table>
<tr><th></th><th>Monday, 31 August</th><th colspan="4">Tuesday, 1 September</th></tr>
<tr><td>9:00–10:30</td><td rowspan="2">Opening of the Conference</td><td colspan="4">Economic and social benefits of climate information</td></tr>
<tr><td rowspan="2">10:30–12:00</td><td colspan="4" rowspan="2">Advancing climate prediction science</td></tr>
<tr><td>Vision for the Conference</td></tr>
<tr><td></td><td>The shared challenge</td><td colspan="4"></td></tr>
<tr><td></td><td>Break</td><td colspan="3">Break</td><td></td></tr>
<tr><td rowspan="2">13:30–15:00</td><td rowspan="2">The shared challenge (continued)</td><td colspan="3">Working sessions</td><td>Forum</td></tr>
<tr><td>Climate and human health</td><td>Climate and sustainable energy</td><td>Seasonal-to-interannual climate variability</td><td>Gender and climate</td></tr>
<tr><td></td><td>Break</td><td colspan="4">Break</td></tr>
<tr><td rowspan="2">15:30–17:00</td><td rowspan="2">Round-table discussion
Climate risk management</td><td colspan="3">Working sessions</td><td>Forum</td></tr>
<tr><td>Climate and water</td><td>Climate, transportation and tourism</td><td>Climate observations</td><td>Climate and communities</td></tr>
<tr><td>17:00–19:00</td><td>Poster session</td><td colspan="2">Poster session</td><td colspan="2">Round-table discussion
Climate adaptation and the Copenhagen process</td></tr>
<tr><td>19:00–end</td><td>Reception</td><td colspan="4"></td></tr>
</table>

Opening and closing sessions	Formal addresses and elaboration of the vision and objectives for the Conference; adoption of the Conference Declaration
Plenary sessions	Introduce the challenges and opportunities for various economic sectors and society at large to use climate predictions and information to adapt their activities to climate variability and change and manage the associated risks.
Working sessions (user focus)	Consist of two presentations: one on climate service needs and one on capabilities within the identified applications areas.
Working sessions (scientific focus)	Focus on needs and capabilities in specific scientific rather than application areas.

	Wednesday, 2 September				
	Climate extremes, warning systems and disaster risk reduction				
	Mainstreaming climate information				
	Break				
Implementing climate services	**Working sessions**			**Forum**	**Implementing climate services**
From observations to predictions	Climate and biodiversity and natural resource management	Climate and more sustainable cities	Decadal climate variability	Business and industry	Nations and regions
	Break				
Implementing climate services	**Working sessions**			**Forum**	**Implementing climate services**
Research engagement	Climate and food security	Climate of oceans and coasts	Regional climate information for risk management	Capacity-building, education and training	Nations and regions
	Poster session	**Round-table discussion** Communicating climate information			

	Forums	Provide an opportunity for individuals, groups and institutions, who may be outside the specific scientific and user communities organizing WCC-3, to enrich the Conference outcomes.
	Workshop on Implementing climate services	Focuses on the demonstration of the best practices in delivery and application of climate services.
	Round-table discussions	Focus on the processes and issues in the application and communication of climate information and services.
	Poster sessions	Organized to communicate scientific findings and other climate information to Conference participants. Posters are invited from interested university scientists and graduate students, scientists at government agencies and research laboratories and from other interested individuals or groups (e.g. non-governmental organizations).

High-level Segment programme

Thursday, 3 September	Friday, 4 September
09:00–10:00 **Opening**	09:00–11:30 **High-level addresses and national statements**
10:00–10:15 **Conclusions from Expert Segment** (by the Chair of the Expert Segment)	
10:15–10:30 **Introduction of draft Declaration** (by the Chair of the High-level Segment)	
10:30–12:00 **High-level addresses** Heads of State and/or Government	11:30–12:00 Break
12:00–12:30 **Addresses by end-user representatives**	12:00–13:00 **Conference Declaration and closing addresses**
12:30–13:00 Group photo	
13:00–15:00 Break	
15:00–18:00 **High-level addresses and national statements**	
Concert	

Annex 2 Sponsors and budget

1. Sponsors

The major financial sponsors of the Conference were Australia, Canada, China, the European Commission, Finland, France, Germany, India, Japan, Kenya, Norway, the Russian Federation, Saudi Arabia, Spain, Switzerland, the United Kingdom of Great Britain and Northern Ireland, and the United States of America.

The other financial sponsors were Denmark, the Food and Agriculture Organization of the United Nations (FAO), Greece, Ireland, Italy, Namibia, Pakistan, the United Nations Environment Programme (UNEP) and the European Space Agency (ESA).

2. Contributions

Voluntary contributions to WCC-3
as of 9 October 2009
Amounts in Swiss francs (see table)

In addition to these financial contributions, WCC-3 also received in-kind contributions, including the following:

- The announcement of the first Conference was printed by Canada;
- The United States seconded Alan Thomas as a part-time expert to the WCC-3 Secretariat;
- Switzerland supported the office of the Chair of the High-level Subcommittee and seconded Andreas Obrecht as an expert to the WCC-3 Secretariat;
- Germany supported the office of the Chair of the Programme Subcommittee;
- Several other countries and international organizations supported the participation of their representatives to the WCC-3 International Organizing Committee meetings.

	Source	Pledge
1	Australia	100 000
2	Canada	158 128
3	China	104 800
4	Denmark	50 000
5	European Commission	485 758
6	FAO	22 980
7	Finland	116 565
8	France	100 000
9	Germany	243 779
10	Greece	45 738
11	India	100 000
12	Ireland	31 451
13	Italy	50 000
14	Italy (ESA-ESRIN)	30 674
15	Japan	660 364
16	Kenya	76 032
17	Namibia	10 000
18	Norway	100 000
19	Pakistan	1 108
20	Russian Federation	97 275
21	Saudi Arabia	100 000
22	Spain	149 642
23	Switzerland	1 400 000
24	United Kingdom	94 967
25	UNEP	10 890
26	United States	527 500
	Total	**4 867 651**

Annex 3 WCC-3 International Organizing Committee (WIOC)

Executive Committee

J. Zillman, Chair (Australia)
D. MacIver, Former Chair (Canada)
B. Nyenzi, Secretary (WMO)
M. Visbeck, Chair, Programme Subcommittee (Germany)
J. Romero, Chair, High-level Subcommittee (Switzerland)
M. Williams, Chair, Linkages and Interactions
Subcommittee (Group on Earth Observations)
M. Power, Chair, Resources Mobilization
Subcommittee (WMO)
M. Coughlan (Australia)
A.D. Moura (Brazil)

Other members

S. Wang (China)
P. Aakjaer (Denmark)
E. Lipiatou (European Commission)
S.B. Harijono (Indonesia)
A.M. Noorian (Islamic Republic of Iran)
K. Takano (Japan)
V. Kattsov (Russian Federation)
I. Niang (Senegal)
W. Nyakwada (Kenya)
L. Kajfez-Bogataj (Slovenia)
J. Mitchell (United Kingdom)
C. Koblinsky (United States of America)

Representatives of WMO technical commissions and co-sponsored scientific panels and committees

L.S. Rathore (WMO Commission for Agricultural Meteorology)
P. Bessemoulin (WMO Commission for Climatology)
C. Pearson (WMO Commission for Hydrology)
R. Pachauri (WMO/UNEP Intergovernmental Panel on Climate Change)
V. Ramaswamy (WMO/IOC/ICSU World Climate Research Programme)
S. Rösner (WMO/IOC/UNEP/ICSU Global Climate Observing System)

Partner organizations represented on WIOC

African Centre of Meteorological Applications for Development (ACMAD)
Food and Agriculture Organization of the United Nations (FAO)
International Chamber of Commerce (ICC)
International Council for Science (ICSU)
International Federation of Red Cross and Red Crescent Societies (IFRC)
Intergovernmental Oceanographic Commission (IOC) of UNESCO
International Civil Aviation Organization (ICAO)
International Maritime Organization (IMO)
International Research Institute for Climate and Society (IRI)
International Fund for Agricultural Development (IFAD)
International Strategy for Disaster Reduction (ISDR)
International Union for Conservation of Nature (IUCN)
United Nations Convention on Biological Diversity (UNCBD)
United Nations Convention to Combat Desertification (UNCCD)
United Nations Department of Economic and Social Affairs (UN-DESA)
United Nations Development Programme (UNDP)
United Nations Educational, Scientific and Cultural Organization (UNESCO)
United Nations Environment Programme (UNEP)
United Nations Framework Convention on Climate Change (UNFCCC)
United Nations Industrial Development Organization (UNIDO)
United Nations Human Settlements Programme (UN–HABITAT)
United Nations World Tourism Organization (UNWTO)
Universal Postal Union (UPU)
World Bank
World Business Council for Sustainable Development (WBCSD)
World Food Programme (WFP)
World Health Organization (WHO)

Annex 4 Lists of the Expert Sessions and High-level Sessions

1. List of Expert Sessions

Many experts played different roles in the preparation of the Conference and the Expert Segment sessions. The following list shows the various sessions and experts that served them.

Plenary sessions

PS-1: The shared challenge – meeting user needs

Responsible Person	Martin VISBECK
Session Chair	Martin VISBECK
Speaker	Carlo SCARAMELLA
Speaker	Letitia OBENG
Speaker	Peter HÖPPE
Speaker	Guy BRASSEUR
Speaker	Shere ABBOTT

PS-2: Economic and social benefits of climate information

Responsible Person	Rick ROSEN
Session Chair	Gordon MCBEAN
Speaker	Don GUNASEKERA
Speaker	Holger MEINKE
Speaker	Matthias RUTH
Discussant	Mohammed Sadeck BOULAHYA
Discussant	Vladimir TSIRKUNOV
Discussant	Akimasa SUMI

PS-3: Advancing climate prediction science

Responsible Person	John MITCHELL
Session Chair	John MITCHELL
Speaker	Tim PALMER
Speaker	Mojib LATIF
Speaker	Jerry MEEHL
Discussant	B.N. GOSWAMI
Discussant	Arun KUMAR

PS-4: Climate extremes, warning systems and disaster risk reduction

Responsible Person	Maryam GOLNARAGHI
Session Chair	Margareta WAHLSTRÖM
Speaker	Paulo ZUCULA
Speaker	Hasan MAHMUD
Speaker	Maxx DILLEY
Speaker	Madeleen HELMER
Speaker	Ulrich HESS
Discussant	Maryam GOLNARAGHI
Discussant	Walter BAETHGEN
Discussant	Lianchun SONG

PS-5: Mainstreaming climate information

Responsible Person	Elisabeth LIPIATOU
Responsible Person	Lars MÜLLER
Session Chair	Martin PARRY
Speaker	Thomas E. DOWNING
Speaker	Laban OGALLO
Discussant	Amadou GAYE
Discussant	Anand PATWARDHAN
Discussant	Tara SHINE
Discussant	Jürgen LEFEVERE

Working sessions

WS-1: Climate and human health

Responsible Person	Steve ZEBIAK
Organizer	Madeleine THOMSON
Session Chair	Roberto BERTOLLINI
Theme Leader	Madeleine THOMSON
Speaker (Needs)	Judy OMUMBO
Speaker (Capability)	David ROGERS
Discussant	Samson KATIKITI
Discussant	Glenn MCGREGOR
Discussant	Giampiero RENZONI
British council global changemaker	Ellie HOPKINS

WS-2: Climate and sustainable energy

Responsible Person	Antonio MOURA
Session Chair	Lucka KAJFEZ BOGATAJ
Speaker	Ivan VERA
Speaker	Christopher OLUDHE
Discussant	Dolf GIELEN
Discussant	A.A. RAMADAN
Discussant	Alberto TROCCOLI
Discussant	Vladimir TSIRKUNOV
British council global changemaker	Amare Abebaw WORETA

WS-3: Seasonal-to-interannual climate variability

Responsible Person	Pierre BESSEMOULIN
Session Chair	Christof APPENZELLER
Theme Leader	Ben KIRTMAN
Speaker (Needs)	Lisa GODDARD
Speaker (Capability)	Tim STOCKDALE
Discussant	Leonard NJAU
Discussant	Jagadish SHUKLA
Discussant	In-Sik KANG

WS-4: Climate and water

Responsible Person	Avinash TYAGI
Session Chair	Pavel KABAT
Theme Leader	Taikan OKI
Speaker (Capability)	Kapil Dev SHARMA
Speaker (Needs)	Eugene STAKHIV
Discussant	Upmanu LALL
Discussant	Cecilia TORTAJADA
Discussant	Igor A. SHIKLOMANOV
Discussant	Ziniou XIAO

WS-5: Climate, transportation and tourism

Responsible Person	Luigi CABRINI
Session Chair	Luigi CABRINI
Speaker (Tourism)	Daniel SCOTT
Speaker (Transport)	Geoffrey LOVE
Discussant	Sibylle RUPPRECHT
Discussant	Alain DUPEYRAS
Discussant	Jean ANDREY
Discussant	Ulric TROTZ
Discussant	Jean-Paul CERON
Discussant	Margrethe SAGEVIK
British council global changemaker	Carolina FIGUEROA

WS-6: Climate observations

Responsible Person	Stefan RÖSNER
Session Chair	Carolin RICHTER
Theme Leader	Adrian SIMMONS
Speaker (Capability)	Thomas R. KARL
Speaker (Needs)	Alan BELWARD
Discussant	D. E. HARRISON
Discussant	Han DOLMAN
Discussant	Anthony Okon NYONG
Discussant	Gabriela SEIZ
Discussant	Jochem MAROTZKE

WS-7: Climate and biodiversity and natural resource management

Responsible Person	Michael J. COUGHLAN
Session Chair	Anne LARIGAUDERIE
Theme Leader	Brendan MACKEY
Speaker	Eduard MUELLER
Discussant	Jian LIU
Discussant	Eugene TACKLE
Discussant	Mike RIVINGTON
Discussant	Lynda CHAMBERS
Discussant	Mama KONATE
British council global changemaker	David LAWLESS

WS-8: Climate and more sustainable cities

Responsible Person	Pierre BESSEMOULIN
Session Chair	Matthias ROTH
Theme Leader	Timothy R. OKE
Speaker (Needs)	Gerald MILLS
Speaker (Capability)	Sue GRIMMOND
Discussant	Yinka ADEBAYO
Discussant	Zifa WANG
Discussant	Michael HEBBERT
Discussant	Paola DEDA
Discussant	Mathias ROTACH

WS-9: Decadal climate variability

Responsible Person	Vladimir KATTSOV
Session Chair	Vladimir KATTSOV
Theme Leader	James HURREL
Speaker (Needs)	Carolina VERA
Speaker (Capability)	James MURPHY
Discussant	Panmao ZHAI
Discussant	Rowan SUTTON
Discussant	Antony ROSATI

WS-10: Climate and food security

Responsible Person	Mannava SIVAKUMAR
Theme Leader	Jerry HATFIELD
Speaker (Needs)	Pramod Kumar AGGARWAL
Session Chair	Alexander MÜLLER
Discussant	Giampiero MARACCHI
Discussant	James SALINGER
Discussant	Jan DELBAERE
Discussant	Beatriz LOZADA GARCÍA
Discussant	Juan GONZALEZ-VALERO

WS-11: Climate of oceans and coasts

Responsible Person	Martin VISBECK
Session Chair	Ed HILL
Theme Leader	Martin VISBECK
Speaker (Capability)	Nathan BINDOFF
Speaker (Needs)	Thomas C. MALONE
Discussant	Poul DEGNBOL
Discussant	Ralph RAYNER
Discussant	Isabelle NIANG
Discussant	Keith ALVERSON

WS-12: Regional climate information for risk management

Responsible Person	Kiyoharu TAKANO
Session Chair	Yap Kok SENG
Theme Leader	Kiyoharu TAKANO
Speaker (Needs)	Edvin ALDRIAN
Speaker (Capability)	Rodney MARTINEZ
Discussant	Joanna WIBIG
Discussant	Christopher CUNNINGHAM
Discussant	Abdellah MOKSSIT
Discussant	Richard GRAHAM

Round tables

R-1: Climate risk management

Responsible Person	Martin VISBECK
Session Chair	Heidi CULLEN
Discussant	Steve ZEBIAK
Discussant	Kuniyoshi TAKEUCHI
Discussant	José ACHACHE
Discussant	Shourong WANG
Discussant	Daniel KEUERLEBER
Discussant	Thomas ROSSWALL
Discussant	Vicky POPE

R-2: Climate adaptation and the Copenhagen process

Responsible Person	José ROMERO
Organizer	Rocio LICHTE
Session Chair	Helen PLUME
Discussant	Minoru KURIKI
Discussant	Ko BARRETT
Discussant	Avinash TYAGI
Discussant	Jian LIU
Discussant	Veerle VANDEWEERD
Discussant	Richard MUYUNGI
Discussant	Roberto ACOSTA
Discussant	Alain LAMBERT

R-3: Communicating climate information

Responsible Person	Carine RICHARD-VAN MAELE
Session Chair	Claire MARTIN
Discussant	Gordon MCBEAN
Discussant	Susan POWELL
Discussant	Jay TROBEC
Discussant	Mario Sánchez HERRERA
Discussant	Patrick LUGANDA

Discussant	Dilrukshi HANDUNNETTI
Discussant	Donna CHARLEVOIX

Workshops on implementing climate services

I-1: From observations to predictions

Responsible Person	Michael WILLIAMS
Session Chair	José ACHACHE
Speaker	Wilco HAZELEGER
Speaker	Andi Eka SAKYA
Speaker	Stephen BRIGGS
Speaker	José ACHACHE
Speaker	Mikael RATTENBORG
Speaker	Lars PRAHM

I-2: Research engagement

Responsible Person	Ghassem ASRAR
Session Chair	Ghassem ASRAR
Speaker	Carlos NOBRE
Speaker	Antony BUSALACCHI
Speaker	Rik LEEMANS
Speaker	Anand PATWARDHAN
Speaker	John MITCHELL

I-3: Nations and regions

Responsible Person	Pierre BESSEMOULIN
Speaker	Aryan F.V. VAN ENGELEN
Speaker	Christopher GORDON
Speaker	Serhat SENSOY
Speaker	Philip OMONDI
Speaker	Paul BECKER
Speaker	Juddy OKPARA
Speaker	Colin JONES
Speaker	Fatima KASSAM
Speaker	Mohamed KADI
Speaker	Rodney MARTINEZ
Speaker	Roger PULWARTY
Speaker	Sri Woro B.HARIJONO
Speaker	Abdallah MOKSSIT
Speaker	Petteri TAALAS
Speaker	André MUSY
Speaker	Kumi HAYASHI

Forums

F-1: Gender and climate

Responsible Person	Saniye Gülser CORAT
Moderator	Joni SAEGER
Speaker	Thais CORRAL
Speaker	Emma ARCHER
Speaker	Ashbindu SINGH

F-2: Climate and communities

Responsible Person	Maarten VAN AALST
Moderator	Maarten VAN AALST
Speaker	Roger STREET
Speaker	Arame TALL
Speaker	Maksha Ram MAHARJAN
Speaker	Felipe LUCIO

F-3: Business and industry

Responsible Person	Jacqueline COTÉ
Organizer	Carlos BUSQUET
Organizer	Barbara BLACK
Session Chair	Jacqueline COTÉ
Speaker	Juan GONZALEZ-VALERO
Speaker	Dominique HÉRON
Speaker	Juan Carlos CASTILLA-RUBIO
Speaker	Christophe NUTTALL

F-4: Capacity-building, education and training

Responsible Person	Anathea BROOKS
Session Chair	Gordon MCBEAN
Speaker	Bruce HEWITSON
Speaker	Shailesh NAYAK
Speaker	Ehrlich DESA
Discussant	Maxx DILLEY
Discussant	Walter BAETHGEN
Discussant	Eduard MUELLER

Poster sessions

Chair Monday	Mamadou Lamine BAH
Chair Tuesday	Penehuro LEFALE
Chair Wednesday	Stefan RÖSNER

2. List of High-level Sessions

There were six plenary sessions during the High-level Segment which were co-chaired through observing regional balance.

Opening session

Co-Chair	Armando Emílio GUEBUZA (President of Mozambique)
Co-Chair	Moritz LEUENBERGER (Minister of the Environment, Transport, Energy and Communications, Switzerland)
Speaker	Ban KI-MOON (United Nations Secretary-General)
Speaker	Rajendra PACHAURI (IPCC Chair)
Speaker	Alexander BEDRITSKY (Chair of the Expert Segment)

First plenary session

Co-Chair	Armando Emílio GUEBUZA (President of Mozambique)
Co-Chair	Moritz LEUENBERGER (Minister of the Environment, Transport, Energy and Communications, Switzerland)

Second plenary session

Co-Chair	Batlida S. BURIAN (Minister of State in the Vice President's Office for Environment, United Republic of Tanzania)
Co-Chair	Yong ZHANG (Vice Minister, China)

Third plenary session

Co-Chair	Lyonpo Pema GYAMTSHO (Minister for Agriculture, Bhutan)
Co-Chair	Åsa-Britt KARLSSON (State Secretary, Ministry of the Environment, Sweden)

Fourth plenary session

Co-Chair	Robert PERSAUD (Minister of Agriculture, Guyana)
Co-Chair	Cristina Maria Fernandes DIAS (Minister of Natural Resources, Sao Tome and Principe)

Fifth plenary session

Co-Chair	Sheikh HASINA (Prime Minister of Bangladesh)
Co-Chair	Jane LUBCHENCO (Under Secretary of Commerce for Oceans and Atmosphere, United States)

Sixth plenary session

Co-Chair	Rashed Ahmed Ben FAHD (Minister of Environment and Water, United Arab Emirates)
Co-Chair	Brian T. GRAY (Assistant Deputy Minister, Science and Technology, Environment Canada)

Closing session

Co-Chair	Armando Emílio GUEBUZA (President of Mozambique)
Co-Chair	Moritz LEUENBERGER (Minister of the Environment, Transport, Energy and Communications, Switzerland)

Annex 5 Conference Statement of the World Climate Conference-3

Summary

Peoples around the world are facing multi-faceted challenges of climate variability and climate change, challenges that require wise and well-informed decision-making at every level, from households and communities to countries and regions, and to international forums such as the United Nations Framework Convention on Climate Change. Wise and well-informed decision-making, in turn, will require, directly or indirectly, access to the best possible climate science and information, together with the effective application of the information through climate services.

The first two World Climate Conferences, in 1979 and 1990, laid the foundation for building research and observational activities to understand the nature of the climate challenges, and to provide the scientific bases for developing the comprehensive and sound climate services that are now being sought by all countries and in virtually every sector of society. The World Meteorological Organization and its partners convened World Climate Conference-3 to provide nations with the opportunity to consider together an appropriate global framework for climate services over the coming decades, a framework that would help ensure that every country and every climate-sensitive sector of society is well equipped to access and apply the growing array of climate prediction and information services made possible by recent and emerging developments in international climate science and technology.

The purpose of the Expert Segment of WCC-3 was to engage a wide cross-section of climate scientists, expert providers of climate information and the users of climate information and services in a wide-ranging discussion on the essential elements of a new Global Framework for Climate Services for consideration by the High-level Segment of the Conference.

The 200 speakers and 1 800 participants in the Expert Segment reviewed the various challenges facing the climate service provider and user communities; considered the needs and capabilities for applying climate information in key climate-sensitive sectors, as well as for social and economic benefits; and examined the scientific bases for climate information and prediction services. A number of scientific, environmental and socio-economic groups and organizations informed the Expert Segment of their needs and perspectives, and a wide range of countries and climate-sensitive sectors reported on their experiences in the implementation of climate services. On the basis of these deliberations, the Expert Segment concluded that:

- Great scientific progress has been made over the past 30 years, especially through the World Climate Programme and its associated activities, which already provide a firm basis for the delivery of a wide range of climate services; but that
- Present capabilities to provide effective climate services fall far short of meeting present and future needs and of delivering the full potential benefits, particularly in developing countries;
- The most urgent need is for much closer partnerships between the providers and users of climate services;
- Major new and strengthened research efforts are required to increase the time range and skill of climate prediction through new research and modelling initiatives; to improve the observational basis for climate prediction and services; and to improve the availability and quality control of climate data.

The Expert Segment then called for major strengthening and implementing, as appropriate, of the

following essential elements of a global framework for climate services:

- The Global Climate Observing System and all its components and associated activities; and provision of free and unrestricted exchange and access to climate data;

- The World Climate Research Programme, underpinned by adequate computing resources and increased interaction with other global climate relevant research initiatives;

- Climate services information systems taking advantage of enhanced existing national and international climate service arrangements in the delivery of products, including sector-oriented information to support adaptation activities;

- Climate user interface mechanisms that are focused on building linkages and integrating information, at all levels, between the providers and users of climate services, and that are aimed at the development and efficient use of climate information products including the support of adaptation activities;

- Efficient and enduring capacity-building through education, training, and strengthened outreach and communication.

The Expert Segment concluded by supporting the development of the proposed Global Framework for Climate Services. The WCC-3 Sponsoring Agencies agreed, therefore, that the essential findings of the Expert Segment, as summarized in this Statement, should be transmitted to the High-level Segment of the Conference for the information of delegates and other Conference participants; and be referred to their individual and joint executive and coordination bodies for follow-up action, in particular, in the context of the United Nations Chief Executives Board initiative on the United Nations system "Delivering as One on Climate Knowledge".

Preamble

1. At the invitation of the Government of Switzerland, World Climate Conference-3 (WCC-3) was held in Geneva, Switzerland, from 31 August to 4 September 2009. It was organized by the World Meteorological Organization (WMO), in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the Food and Agriculture Organization of the United Nations (FAO), the International Council for Science (ICSU) and other intergovernmental and non-governmental partners. The Conference was generously supported by the governments of Australia, Canada, China, Denmark, Finland, France, Germany, Greece, India, Ireland, Italy, Japan, Kenya, Namibia, Norway, Pakistan, Russian Federation, Saudi Arabia, Spain, Switzerland, the United Kingdom of Great Britain and Northern Ireland, and the United States of America, and by the European Union, the European Space Agency, the United Nations Environment Programme and FAO. Additional in-kind support was received from many other countries and organizations. Some 2 500 participants from 150 countries and 70 international organizations attended the Conference, with approximately 2 000 participating in the first three days of expert presentations and discussions.

2. The theme of the Conference was "Climate prediction and information for decision-making" and its vision was for "An international framework for climate services that links science-based climate predictions and information with the management of climate-related risks and opportunities in support of adaptation to climate variability and change in both developed and developing countries". In giving effect to the decision of the 2007 Fifteenth World Meteorological Congress to build on the legacy of the First (1979) and Second (1990) World Climate Conferences to establish a new international framework for climate services which will complement and support the work

of the WMO/UNEP Intergovernmental Panel on Climate Change (IPCC) and the United Nations Framework Convention on Climate Change (UNFCCC), the WCC-3 sponsors agreed to partition the Conference into two segments:

- *Expert Segment* (31 August–2 September) at which climate scientists and other experts from climate service provider and user communities would examine global, sectoral and national needs and capabilities for the provision and application of climate services and identify the essential elements of a new global framework to be elaborated in a Conference Statement; and

- *High-level Segment* (3–4 September) at which Heads of State and Government and other invited dignitaries would express their views on the proposed framework and ministers and other national representatives would adopt a High-level Conference Declaration calling on WMO and its partner organizations to implement the proposed framework without delay.

3. The Expert Segment of the Conference reviewed a wide range of individual and community-based papers and presentations from climate science, service, application and user communities as well as the results of deliberations by a number of other major climate service stakeholder and community groups. The conclusions and recommendations from the various sessions, forums, workshops and round-tables of the Expert Segment of the Conference are summarized below. More details on the community-based input to the Conference and the discussions during the Expert Segment are included in the full Conference Proceedings.

I Opening of the Conference

4. In welcoming the participants to the Opening of the Conference, the Secretary-General of WMO, Michel Jarraud, recalled the achievements of the First and Second World Climate Conferences and expressed his hope that WCC-3 would lead to an even more broadly based contribution to the wise handling of the climate issue by providing far sighted guidance on the optimum arrangements for the provision of climate services in support of national and international decision-making over the coming decades.

5. The President of the Swiss Confederation, H.E. Hans-Rudolph Merz, President of the Conference, welcomed the participants to WCC-3, stressed the widespread impacts of weather and climate, and expressed his confidence that WCC-3 would lay the foundation for a better future due to better climate information.

6. Alexander Bedritsky, President of WMO and Chair of the Expert Segment of the Conference, noted that improved climate services are now possible to address a broad range of user needs. The global community must now come together to provide the needed information and predictions based on the best available science. The large number of organizations attending the Conference should be seen as a testament to the high level of commitment that now exists to providing improved climate services. Dr Bedritsky emphasized that WMO Members have provided, and will continue to provide, data, information and predictions that are essential for climate services.

7. Gro Harlem Brundtland, the United Nations Secretary-General's Special Envoy on Climate Change, represented the Secretary-General at the Opening of the Conference. She noted that the Secretary-General has called climate change the defining challenge of our generation and that, today, it is in our hands to make WCC-3 an important milestone in the quest for peace and security. Climate politics must be based on clear and credible scientific data, so WCC-3 Conference participants should make their voices heard. The world needs the knowledge and initiative of the scientific community now more than ever.

8. Kofi Annan, President of the Global Humanitarian Forum, noted the need for concerted political action on climate change. There is no room for complacency, and deliberations at WCC-3 must provide the impetus to help decision-makers reach a new agreement in Copenhagen. Those who are most threatened by climate change have done the least to cause the problem. Therefore, developed countries should take the lead in cutting greenhouse gas emissions. Weather Information for All, a new initiative by the Global Humanitarian Forum, WMO, and the private sector, to establish surface stations communicating by cell phone technology, will help facilitate the sharing of essential data and the provision of threat alerts.

9. Following the formal opening of the Conference, Dr Bedritsky invited participants to join in the opening of the Expert Segment. He welcomed the following representatives of WMO international partners who addressed the Conference:

- Walter Erdelen, Assistant Director-General, United Nations Educational, Scientific and Cultural Organization (UNESCO)
- Manzoor Ahmad, Director, Geneva Office, Food and Agriculture Organization of the United Nations (FAO)
- Joseph Alcamo, Chief Scientist of the United Nations Environment Programme (UNEP)
- Deliang Chen, Executive Director of the International Council for Science (ICSU)
- Julia Marton-Lefèvre, Director General of the International Union for Conservation of Nature (IUCN)
- Jean-Jacques Dordain, Director General of the European Space Agency
- Houlin Zhao, Deputy Secretary-General, International Telecommunication Union (ITU)
- Reid Basher, Special Advisor to the United Nations Assistant Secretary-General for Disaster Risk Reduction

Dr Bedritsky also acknowledged a message of support for the Conference from the World Health Organization (WHO).

10. Thomas Stocker, Co-Chair of Working Group I of the Intergovernmental Panel on Climate Change, set the science scene for the Conference in terms of new approaches and methods that will be available for use in the IPCC Fifth Assessment Report. These include:

- Improved short-term predictions that will be available to IPCC Working Groups II and III;
- Improved understanding of the several factors that influence sea-level rise;
- Reduced uncertainties on climate impacts;
- Hazards as a result of human-induced climate change.

11. John Zillman, Chair of the WCC-3 International Organizing Committee (WIOC), concluded the opening session by elaborating the Sponsors' Vision for the Conference.

II The shared challenge for climate science, services and applications

12. The Conference undertook a comprehensive review of the individual and shared challenges faced by those involved in advancing the frontiers of climate science, in turning scientific progress into useful climate services and in applying climate services for social, economic and environmental benefit.

13. It noted that the original 1979 World Climate Programme (WCP) was designed as an integrated framework for climate data, research, applications and impact assessment and that

much progress has been achieved over the past 30 years through the four components of the WCP, namely the World Climate Data and Monitoring Programme (WCDMP), the World Climate Applications and Services Programme (WCASP), the World Climate Impact Assessment and Response Strategies Programme (WCIRP) and the World Climate Research Programme (WCRP), and through the Intergovernmental Panel on Climate Change and the Global Climate Observing System (GCOS) in providing society with reliable and useful climate information. The Conference agreed, however, that apart from the role of the IPCC in providing comprehensive user-friendly assessments of the state of knowledge of climate change, less progress has been made in translating scientific progress into user-oriented climate services and their application for the benefit of society.

14. Climate science has a rich history of rising to the challenges of weather and climate prediction, providing the society irrefutable evidence on the reality of climate change and human contributions to it. Climate research is now tasked with even a greater challenge to understand the Earth as a complex, non-linear interactive system, and to assess the impacts of anthropogenic climate change on coupled human and natural systems. Important attributes of climate services include provision of balanced, credible, cutting-edge scientific and user-targeted information that effectively informs policy options.

15. Mitigation of, and adaptation to, climate change is a shared challenge and, in order to address the evolving vulnerabilities of human and natural systems, climate science needs to continue its efforts to resolve the outstanding uncertainties and support climate-resilient development. Assessments must be made of emergency preparedness and response systems; efforts are needed to raise awareness of climate risks and opportunities in climate-sensitive communities; and new tools and products, relevant to decision-making, are urgently needed.

16. Climate change is a risk multiplier, and actionable climate information is a great resource for society. Climate information is about people, and its key role is in saving lives and protecting livelihoods, and, therefore, it is important to integrate it into policy frameworks and development discourse.

17. Climate services are too complex to be undertaken with a fragmented approach, and it is crucial for all stakeholders to work closely together. Integrated water resources management, for example, must achieve balance among economic efficiency, social equity and environmental sustainability.

18. The insurance industry has, for decades, been concerned with climate change, climate extremes and catastrophic events, and is an important user of climate information. The risks of extreme weather and climate events are rising, especially in developing countries. Various insurance options are helping developing countries manage the impacts of climate change. High quality weather and climate data are the prerequisites for proper insurance risk management. In many developing countries lack of appropriate climate data is the main obstacle for introducing the required insurance systems.

19. The speakers in the session highlighted the following key issues:

- The challenge of climate modelling and prediction needs to be addressed by an unprecedented multinational effort, with massive supercomputing, infrastructural and human resource deployment, in order to produce reliable high-resolution climate information for the entire planet;

- The proposed Global Framework for Climate Services (GFCS) must address the shared challenge of climate change with due consideration to

all scientific and societal issues, closely involving all the stakeholders:

- Developing more climate-information based decision support tools to meet the needs of food security;
- Working with the climate and water resource management communities to ensure that climate information is integrated into planning activities at local, national and regional levels;
- Taking the needs of the insurance sector into account as an integral component of climate risk management.

Advancing climate prediction science

20. Climate services depend critically on predictions of time-evolving regional climate on timescales from seasonal-to-interannual, to multidecadal, century and beyond. Climate prediction science must be an important part of any organized climate service. The speakers on 'advancing climate prediction science' focused on current capabilities and plans for scientific research and climate predictions on these different timescales, and also emphasized the key role the World Climate Research Programme plays in organizing and coordinating the science behind these predictions and their application.

21. The experts directed particular attention to the current state of seasonal to interannual forecasting and the opportunities for improvement, and to the results from experimental decadal predictions. They uniformly agreed on the need to better understand the modes of natural climate variability.

22. The WCRP is organizing a new set of climate change simulations using mitigation scenarios. These experiments will rely on new climate modelling capabilities: initialized decadal predictions focusing on adaptation out to about 2035, and longer term experiments out to 2100 and beyond where the magnitude of climate change will be related directly to which mitigation scenario the world follows.

23. The experts identified a number of recommendations for advancing climate prediction:

- *Seamless prediction.* Adopt a more seamless approach to climate prediction by using a modelling framework that includes assimilation of high quality climate observations, which are required for the initial conditions. Where appropriate, these climate predictions should include coupling directly to applications (for example, hydrological models);
- *Reduction of model biases.* Reduce model biases through better representation of physical processes and higher spatial resolution;
- *Mechanisms leading to variability.* Improve the understanding of the mechanisms that lead to the variability on the different timescales;
- *Computing capacity.* Significantly increase the computing capacity available to the world's weather and climate centres in order to accelerate progress in improving predictions. The World Modelling Summit for Climate Prediction in 2008 recommended computing systems dedicated to climate at least a thousand times more powerful than those currently available;
- *Closer collaboration.* Ensure closer collaboration between scientific research, operations and users to ensure that climate services receive the benefits of research as soon as possible, and that research covers the needs of users;
- *Limitations and uncertainties.* Communicate clearly to users of climate services the limitations and uncertainties involved with climate change model predictions/projections.

Economic and social benefits of climate information

24. Climate information delivers economic value by providing users, whose activities are sensitive to climate conditions, with a basis for making decisions. The plenary presentations in the Expert Segment provided examples of the effective use of climate information to deliver economic value in different sectors. Seasonal climate prediction and information, for example, can prove valuable for agricultural planning and drought mitigation strategies. The estimates of the economic value of improved El Niño-Southern Oscillation predictions for the agricultural sector are not insubstantial.

25. With respect to longer timescales, the Conference was advised to consider climate change as a "threat multiplier", amplifying other potential stresses on economic and social systems. Climate variability and change can exacerbate existing vulnerabilities to the point of tipping systems into critical states. In this context, it is important to recognize costs associated not only with responding to climate change, but also with decisions not to act.

26. There are, however, many impediments to the effective use of climate information for socio-economic benefit. The Conference learned these impediments include a lack of understanding about climate impacts, what climate information is most relevant, and how best to engage with users to define the right questions and involve them in the solutions. Several speakers stressed the challenges associated with acquiring, and sustaining resources.

27. The speakers and discussants canvassed the various challenges in removing the impediments to delivering greater socio-economic benefits from the use of climate services. Among the approaches advocated are the systematic application of "adaptation science" that is solution-focused, and the encouragement of multidisciplinary research. In addition, there was strong support for the following recommendations:

- *Madrid Action Plan.* High priority should be given to completing the actions identified in the March 2007 Madrid Action Plan on the Social and Economic Benefits of Weather, Climate and Water Services, incorporating the principles of climate risk management developed at the July 2006 Espoo Conference on 'Living with Climate Variability and Change';

- *Economic valuation of climate services.* The international agencies participating at WCC-3 should collaborate on assessing the value of various types of climate services and on ways and means of enhancing that value in the various climate-sensitive sectors of society;

- *Connecting with users.* Boundary organizations with sufficient capacity to integrate information from producers and mainstream services to users should be provided with sustained, cross-institutional support. Regional support institutions like development banks and insurers should be mobilized.

Climate extremes, warning systems and disaster reduction

28. Nearly 80 per cent of disasters caused by natural hazards are linked to climate extremes. The IPCC Fourth Assessment Report has provided scientific evidence on the increasing risks associated with these hazards as a result of human-induced climate change. Traditionally, many countries have been reactive to disasters. The adoption by 168 countries of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, however, has led to a new paradigm in disaster risk management focused on prevention and preparedness. The UNFCCC Bali Action Plan has stressed the need for disaster risk management as a critical component of climate risk management in all countries. Since the adoption of the Hyogo Framework for

Action, initiatives are underway to bring together the scientific and technical agencies, disaster risk management and other relevant ministries and sectors (such as agriculture, health, environment, development) to coordinate the development of national disaster risk management strategies.

29. The Conference discussed that effective disaster risk management must be founded on quantification and understanding of risks associated with natural hazards. In many countries, institutional capacities and cooperation for risk identification need to be developed. Climate information is critical for the analysis of hazard patterns and trends. This must be augmented, however, with socio-economic data and analysis for vulnerability assessment (for example, casualties, construction damages, crop yield reduction, water shortages). With this risk knowledge, countries can manage risks using: (1) early warning systems and preparedness; (2) medium and long-term sectoral planning (such as land zoning, infrastructure development, agricultural management); and (3) weather-indexed insurance and financing mechanisms. Early warning systems are effective tools for reducing loss of life. Climate forecasting tools could, however, be used to develop warnings with longer lead times for improved sectoral planning. Analysis of hazard patterns from historical data is necessary; but changing patterns of climate hazards are posing challenges with longer-term investments in areas such as infrastructure planning and retrofitting based on building codes and specifications, derived only from historical records (a 100-year flood may become a 30-year flood, for example).

30. In light of various experiences, the experts recommended:

- *Identification of requirements.* There is need for a systematic demand-driven approach to identify requirements of various user-communities including the level of integration of climate services in disaster management policies within different sectors of disaster risk management. This would require partnership and two-way cooperation between the climate information providers and targeted users. The coordinated framework of disaster risk management under the Hyogo Framework for Action is crucial for bridging the user interface;

- *Scaling up of pilot studies.* Development and utilization of relevant climate information for managing risks in some sectors have been piloted. These efforts need to be identified, evaluated and scaled up through a coordinated and operational institutional framework;

- *Increased investments in data.* Historical and real-time climate data are critical, but there is a pressing need for increased investments in National Meteorological and Hydrological Services (NMHSs) for strengthening observing networks, and data maintenance systems);

- *Climate forecasting technologies.* Climate forecasting technologies (seasonal, interannual, decadal) provide an unprecedented opportunity for improved sectoral planning for disaster risk reduction at different timescales (tactical to strategic planning). There is need, however, for coordinated research to improve these tools for providing relevant information for disaster risk management (such as predictions of trends and patterns of droughts, tropical cyclones, floods and heat waves at longer timescales). There is a need to make these tools operational to ensure sustainable delivery and utilization of information in sectoral planning;

- *Decision-maker awareness.* Utilization of climate information must be augmented with systematic public and decision-maker awareness programmes;

- *Developing tools to support the application of climate services in disaster risk reduction.* Appropriate tools to help decision-makers integrate climate services into disaster response

and prevention (disaster risk maps, indices for monitoring hazards, signals for appropriate response, for example) need to be developed.

Mainstreaming climate information

31. Climate information is already widely used in many countries and in many socio-economic sectors, and at many levels of society. Nevertheless, the urgency of adaptation to climate change, to which there is no alternative, elevates a need for climate information to a new level. In the absence of adaptation, scarce resources planned for national development activities will continue to be massively redirected to disaster response and recovery actions. Of paramount importance for policy and decision-makers are the following questions:

- What is the "adaptation field", that is, where are the likely impacts that can probably not be avoided by mitigation?
- How much of this adaptation field can we afford to adapt, and how much would different levels of adaptation cost?
- How should we handle 'residual impacts' not addressed by adaptation?

32. A broad framing of the adaptation processes from awareness to mainstreaming in current activities, together with reorganization due to transformations in risk, suggests different entry points for information for decision-makers and for vulnerable populations. Conditions of vulnerability and available financial mechanisms are relevant factors. This approach includes the practical involvement of communities and governments in the implementation of climate risk reduction strategies and in the improvement of resilience to climate risks. Each country will have to develop its own adaptation policies, actions plans, programmes and measures. These must be integrated into the ongoing development processes and might also involve the coordination of needs between neighbouring countries. The efficient use of climate information becomes an essential requirement in mainstreaming climate change into policy and development.

33. The experts in this session highlighted:

- *Mainstream climate information.* The urgent need to assist developing countries in mainstreaming local and regional information on climate change and variability into planning and policy development;
- *Availability of adequate information.* Existing challenges related to availability of adequate information for adaptation to climate change in the most vulnerable regions such as Africa, low-lying Asian mega-deltas, and small islands;
- *Learning from experience.* The importance of learning from the successes and positive and negative experiences of addressing challenges in the use of the available climate information;
- *Integrating knowledge.* The value of creating and integrating knowledge bases on local and regional climate hazards, on impacts, and especially on the economics of adaptation;
- *Improved understanding and data.* The central role of accurate and detailed prediction of the consequences of climate change at timescales and geographical scales corresponding to society and people's needs, and the corresponding requirement for improved understanding of the climate change and for sustained efforts in climate research and observation.

III User needs and applications

34. The climate services needed by society embrace past, present and future climate information, research, investigation, assessment and advice on climate-related issues. They include an extensive array of general and user-specific data, prediction, warning and advisory services

focused on the individual needs of the many climate-sensitive sectors of the community. All countries, all governments, all socio-economic sectors and almost all individual members of society are in need of climate services in one form or other.

35. Recognizing that individual countries' needs for climate services would be clearly expressed by national delegations in their Statements to the High-level Segment of the Conference, the Expert Segment focused particular attention on the overall needs and capabilities of the following set of climate-sensitive sectors:

- Human health;
- Sustainable energy;
- Water;
- Transport;
- Tourism;
- Biodiversity and natural resource management;
- Sustainable cities;
- Food security;
- Oceans and coasts.

Climate and human health

36. Good health status is one of the primary aspirations of human social development. As a result, health outcomes and indicators are key components of the Millennium Development Goals (MDGs). Many infectious and chronic diseases, including malnutrition, are directly or indirectly sensitive to the climate, and their control is a primary focus of the MDGs. Climate change is recognized as one of the defining challenges of the twenty-first century and protecting health from its impacts is a priority for the public health community as was recognized during the World Health Assembly in 2008.

37. New opportunities exist for better management of climate-related health risks in the context of both development goals and climate change. These opportunities are made available through advances in climate science, rapidly advancing communication technology (affecting the sharing of data and knowledge) and through a new global focus on effective management, and even elimination of, certain infectious diseases. New partnerships involving the public and private sectors and civil society, and a substantial increase in funding support these developments.

38. On the basis of the development of two white papers (on needs and opportunities), followed by substantive discussions and the working session on climate and human health, the experts proposed the following recommendations:

- *Climate services for the health sector.* There should be full engagement of the public health community, through the World Health Organization, in the establishment of a Global Framework for Climate Services in order to enable the inclusion of climate information in public health decision-making;
- *Capacity-building in use of climate information.* Research and training opportunities, designed to build capacity and provide evidence for policy and practice, should be developed through effective collaboration across relevant disciplines;
- *Cross-sectoral interaction.* Investment is required in a public service platform within WMO Member and partner institutions to encourage cross-sectoral interaction including cooperation on the establishment of observing and monitoring networks, the development of decision support tools and systems, and the development of "one stop" health sector advisory services that will

strengthen health surveillance and response systems;

- *Resource sharing.* The sharing of data, information and capacity (at local, regional and global scales) is necessary for improving health monitoring and surveillance systems to achieve "the most elementary public health adaptation" as stated in the IPCC Fourth Assessment Report. This effort is especially critical for Least Developed Countries (LDCs), which have the weakest surveillance systems. It is imperative that resources are provided for collecting, managing and applying climate data to the creation of evidence-based policy and practice in the development of early warning and adaptation strategies related to health;

- *Partnerships and priorities.* Existing programmes, initiatives and organizations working in climate and health should jointly prioritize the development of the Global Framework for Climate Services as it relates to health. Institutional mechanisms that link outputs and responsible actors to the recommendations above are required, and a clear framework for activities is essential. Partnerships are not always easy to establish, so new and innovative mechanisms should be envisioned to make this development possible at all levels.

Climate and sustainable energy

39. Climate information is essential for ensuring the most efficient production and consumption of essentially all traditional forms of energy including coal and gas-fired generation and the distribution and utilization of electricity, and is especially important for the design and operation of infrastructure and facilities for renewable energy sources such as hydro, wind, solar, tidal and bioenergy. Seasonal-to-multi-decadal climate variations give rise to changes in energy demand but also in energy availability and supply. Primary energy is traded globally and often delivered within complex energy grids. In particular, the generation of renewable energies is often itself climate dependent. Energy prices may also be affected by climate variations. The discussions on sustainable energy highlighted the climate information that is currently available, the extent to which it is already being used, and the current and future needs of climate information from the energy sector.

40. The energy and climate experts stressed the following needs:

- *Historical and quality observations.* Historical and high quality weather and climate observations are needed for the energy sector especially in developing countries;

- *Seamless predictions.* Seamless predictions from global climate models (monthly to seasonal to decadal timescales) with much improved resolution are needed;

- *Updated reanalysis.* There is need for quality reanalysis of meteorological data that is regularly updated;

- *Reliable access.* Reliable access to climate information using readily available servers and grid technology is important;

- *Joint partnerships.* Establishment of joint partnerships between the energy sector and climate service providers is desirable;

- *Mainstreaming climate information.* It is vital to mainstream climate information into long-term development plans, in particular for the energy sector;

- *Vulnerability assessments.* Assessments of vulnerability to severe weather and extreme climate events are needed for energy infrastructures including generation, transmission, transformation, processing, distribution, and extraction;

- *Strengthening partnerships.* Partnerships should be strengthened between the energy sector and the climate service community;

- *Active participation.* Active participation by civil society is needed to improve decision-making in issues linking climate services and energy;

- *Capacity-building and technical cooperation.* The transfer of energy and climate technology between developed and developing countries requires capacity-building and technical cooperation.

Climate and water

41. The increasing use of freshwater has greatly stressed the world water availability. Changes in freshwater availability and demand due to demographic, economic, and climatic changes will exacerbate existing problems in such areas as health, agriculture, sustainable energy, and biodiversity. Sea-level rise, temperature increase, and the changes in the hydrological cycle, including the cryosphere, as well as a risk of increased frequency of extreme events, such as flash floods, storm surges, and landslides, will all add stress.

42. Managing climate risks for humans and for ecological systems has attained an unprecedented urgency. Addressing these risks through provision of targeted information on seasonal to decadal and longer term climate variability must become a key element in a suite of climate services. Technological and societal innovations in how to use the evolving climate information to inform freshwater management are urgently needed and should be stimulated. Participants in the session agreed on the following main recommendations:

- *Hydrological networks.* The continuing degradation of hydrometeorological networks and databases has resulted in the crisis in our ability to generate information needed for managing climate risk in the water sector. Hydrological networks are the essential foundations for future adaptation to climate uncertainties. A focused priority effort is needed to reverse this decline and to develop reanalysis products so that a diverse suite of climate and hydrological information can be made available across much of the world;

- *Partnership and communication.* Full partnership and sustained communication between the climate community and the end users from the water sector such as flood managers, utilities operators, irrigation managers, and agriculture and health specialists, is a condition sine qua non for the development of the Global Framework for Climate Services. Under this partnership key attention should be placed on:

    - Data quality, availability and data sharing;

    - Climatic information with higher spatial and temporal resolutions, such as the catchment scale and monthly or weekly timescales;

    - Substantial improvements of forecasting skills for seasonal, interannual and decadal variability for better reservoir operation and flood and drought emergency preparedness;

    - Reduction and quantification of uncertainties and biases in future projections;

    - Quantification of climate impacts on both water quantity and water quality, including low flows, ground water, high surface water temperatures, salinity and pollution, sediment transport, and effects on aquatic ecosystems;

- *Integrated models.* There is need for development, benchmarking and application of integrated hydrological and water resource models that include natural and anthropogenic water cycles, and are coupled with crop models and reservoir

operation models to provide more realistic impact assessments and to support decision-making in designing adaptation measures;

- *User interface programme.* Existing programmes, initiatives, and organizations working in water resources management should join hands to facilitate the development of the Global Framework for Climate Services, particularly its User Interface Programme component.

Climate and transportation

43. Transportation is an important component of the tourism industry and represents a major economic sector. It contributes significantly to humankind's greenhouse gas emissions and is significantly affected by global warming. The implementation of a range of new climate-related services will be essential if implementers and managers of transportation systems are to make the best decisions. Furthermore, decisions made at one particular time, on the basis of the best available existing information, will need to be constantly re-evaluated. In essence, an adaptive management approach, underpinned by a Global Framework for Climate Services, will be required. This approach needs to be:

- Accessible to all;

- Driven by ongoing research and build on current collaborations between the meteorology and transport communities in dealing with chronic risks;

- Constantly improving climate forecasts for specific regions and localities and expressed in a way that makes them easily used by all manner of decision-makers;

- Improving the range and geographical extent of the collection of Earth system data, and the exchange of these data between agencies undertaking research and infrastructure development related to climate change;

- Creating information that facilitates accessibility and mobility options that are robust in terms of climate information, and also consider mitigation, both generally and in specific reference to travel related to tourism.

44. The experts in climate and transportation recommended the following:

- *Climate resilience.* Planning and design of infrastructure needs to account for climate uncertainties to enable more resilient responses to climate changes;

- *Multidisciplinary information.* It is necessary to inform professionals from a wide variety of disciplines such as meteorology, hydrology, engineering, statistics, ecology, biology, economics and financial management, and to inform the broad community as well;

- *Whole-of-life approach.* It is important to take a whole-of-life approach to the management of infrastructure;

- *Risk assessments.* Risk assessments and the cost-benefit analyses of adaptive strategies should be continually updated;

- *Extreme events.* It is necessary to strengthen emergency response planning and management for extreme events, which current science indicates are likely to increase in frequency under the range of generally accepted climate change scenarios.

Climate and tourism

45. Climate has a complex influence on the sustainability of the global tourism economy. It is an important driver of major international tourism flows and is the principal resource for some destinations, particularly Small Island Developing States (SIDS). Climate variability affects many facets of tourism operations and environmental conditions, and can either attract

or deter tourists from destinations. Climate also has broad significance for tourist decision-making, expenditures and travel satisfaction. Consequently, it is expected that the integrated effects of climate change will have profound impacts on tourism businesses and destinations in the decades ahead. The climate and tourism experts concluded that scientific understanding of the climate and tourism interface has improved in the last decade, especially in the research on climate change impacts and on adaptation and mitigation measures within the sector. Key knowledge gaps remain, however, and limit climate information from being used as effectively as it could be by travellers worldwide, and by the tourism industry in the pursuit of sustainable tourism and adaptation to climate change.

46. Upon assessing the present use and future needs of climate information by both tourists and the tourism sector in developed and developing countries, the tourism and climate experts agreed on the following main recommendations:

- *Interdisciplinary and sector-wide collaboration on research and practice.* Increased investment and strengthened collaboration between the climate and tourism and transport communities are required to address key knowledge gaps in the climate sensitivity of major tourism segments, in transport systems and destinations, in the salience of climate in travel decision-making contexts, and in the economic and non-market societal value of climate information for the sector. Cooperation is also vital to develop the decision support tools and standards for specialized climate products, to ensure consistent communication to international travellers and to facilitate objective destination comparisons in a global tourism marketplace;

- *Capacity-building in the application of climate information.* Major initiatives are needed to advance the application of climate information in the tourism sector significantly. These initiatives include a series of professional capacity-building workshops in major tourism regions around the world (in order to adequately represent specific end-user information needs and the capabilities of regional providers), and the development of climate information training modules for use by tourism and hospitality schools around the world;

- *Improved observation networks.* Investment is required to enhance observation networks and climate information provision in areas where tourism is vital to local economies, specifically rural areas and many developing countries, particularly Small Island Developing States, in order to improve climate risk management and climate change adaptation in the tourism sector.

Climate and biodiversity and natural resource management

47. Biodiversity, ecosystems, and the services they provide (climate regulation, food security, freshwater supply and disaster risk reduction, for example), are the fundamental units of life support on Earth.

48. Biodiversity and ecosystems play a vital role in both ecosystem based mitigation (carbon sequestration and storage) and ecosystem based adaptation (societal adaptation to climate change impacts). An example of a societal adaptation is the buffering of climate hazards such as flooding.

49. Climate change is significantly affecting biodiversity and ecosystems, and climate information is required to assess vulnerability and to identify adaptation options. Managing for current threats will increase ecosystem resilience and adaptive capacity.

50. To meet the expectations of the Global Framework for Climate Services, the experts on

biodiversity and natural resource management recommended:

- *Interdisciplinary dialogue between scientists.* It is important to organize a continuous dialogue between climate scientists and biodiversity and ecosystem scientists to translate climate data into impacts on biodiversity and ecosystem services (that is, climate services) for the benefit of users;

- *Model improvement.* Improving the representation of the functional role of biodiversity and ecosystem processes in Earth system models (research and modelling component of the GFCS) is needed;

- *Biodiversity monitoring.* It is necessary to enhance and integrate biodiversity observing and monitoring activities and systems, such as Long Term Ecological Research networks, through the GFCS, through support to the Group on Earth Observations (GEO) Biodiversity Observation Network (BON) and through other relevant initiatives;

- *Indigenous knowledge.* It is important to integrate data and knowledge from indigenous and local communities, including citizen based observations, about ecosystem responses and approaches to adaptation, into the design and implementation of climate information systems;

- *Sharing of information.* It is important to facilitate the sharing of information and good practices on ecosystem-based adaptation to climate change through collaborative international systems such as the UNFCCC *Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change*, and the proposed Global Adaptation Network.

Climate and more sustainable cities

51. Cities affect, and are affected by, climate change in many ways and at many scales. Climate knowledge should be used more effectively to ensure more sustainable cities.

52. The scientific understanding of urban climates has advanced substantially over the past two decades including conceptualization, field observations, analysis of processes and model building. The field is still young, however, and much more research is needed to equal the understanding of that acquired for other environments. At the same time, there is growing demand for urban climate information in the design and management of more sustainable cities. Implications of global climate change for cities have not been adequately assessed to date. In general, few National Meteorological Services (NMSs) have appropriate expertise in urban meteorology.

53. The experts in the session encourage WMO, through its NMSs, to introduce urban-related climate services by establishing relations to the political and socio-economic stakeholders and urban developers. These service should include:

- *Improving urban climate observation networks.* Urban climate stations and networks should be greatly improved, including vertical information, in all countries. This should be done in line with WMO urban guidelines. International archives of urban climate, morphological and land cover data should be established;

- *Climate research for hot cities.* Highest priority should be given to strengthening observational networks and establishing urban climate research programmes for tropical cities where population growth is greatest and vulnerability to excess heat and inundation is highest;

- *Urban climate modelling.* Improved numerical models should be developed to forecast weather, air quality and climate in cities. The focuses should be to incorporate urban land surface schemes into global climate models,

to downscale regional climate predictions and projections to the urban scale, and to assess their impact on urban health, safety and management;

- *Education, training and knowledge transfer in urban climatology.* Much greater effort should be directed to increase understanding among climatologists, NMSs and urban stakeholders.

Climate, land degradation, agriculture and food security

54. Food security is dependent upon many socio-economic and environmental factors, including agricultural systems which are resilient to climate variation and extremes in climate. The impact of climate on agricultural production is increased in fragile environments. The indirect impacts of climate on insects, diseases, and weeds increase when there is climate stress imposed on the plant or animal. Water and food are two sides of the same coin; hence, it is important to place emphasis on water management to enhance agricultural productivity. In order to reduce the risk of crop failure and increase the resilience of agronomic and horticultural systems for feed, food, fibre, and fuel production there is an urgent need to develop an improved understanding of the complex interactions between climate and agricultural systems and to implement production systems that can adapt to climate variation and climate extremes, especially in developing countries.

55. Agricultural and land management experts reviewed the needs to enhance the contribution of climate information to land management, agriculture and food security, and agreed on the following recommendations:

- *Risk evaluation and information delivery.* An intensive effort is needed on the use of climate forecasts to reduce the risks to crop and animal production, especially in areas where the risks are greatest. Such efforts should include the development of effective dissemination tools for timely provision of this information to decision-makers. Climate information should be adapted and actionable to meet the needs of users;

- *Cooperation and partnerships.* For a holistic management of climate risks in agriculture, new and innovative models of cooperation and partnerships are needed among several groups including WMO, FAO, NMHSs, the Consultative Group on International Agricultural Research (CGIAR), National Agricultural Research Systems and Extension Services, national entities dealing with agriculture, food security and policy issues, the United Nations Convention to Combat Desertification (UNCCD) and Soil Conservation Services. Linkages between producers of climate information and applications and various end users should be enhanced through appropriate mechanisms such as awareness raising, capacity-building for intermediaries and end-users and strengthening institutional partnerships, especially in developing countries;

- *Adaptation strategies for resilient agricultural systems.* Adaptation strategies to cope with climate variation and extreme events need to be developed and the information transferred to producers in a timely manner so they can adopt these practices to reduce their risk;

- *Climate change mitigation.* It is important to recognize that agriculture is also part of the solution to mitigate climate change and hence adequate investments should be made in strategies that reduce greenhouse gas emissions while maintaining agricultural productivity.

Climate in oceans and coasts

56. The ocean covers two thirds of the planet, and hosts the largest biosphere on earth. It plays a dominant role in the global climate system through the transport and storage of heat, water, nutrients and other climate variables such as carbon. The ocean mitigates surface

warming through the absorption of heat and greenhouse gases. It provides important living and non-living resources and other ecosystem services for humans. It contributes to the global economy, trade and food, and to national security. Its impacts on society are particularly strong within 100 kilometres of the coastline where 40 per cent of the world population live, and where ecosystem goods and services are most concentrated.

57. Climate change on timescales from decades to centuries has profound consequences for the marine, coastal and littoral environments with potentially devastating effects through: rising sea level; increasing heat content; increasing sea surface temperature; changes in strength and spatial distribution of the hydrological cycle; ocean acidification; ocean deoxygenation; and decreasing sea ice volume. Together these effects lead to changes in the distribution and abundance of marine life, altered food webs and changed biodiversity in marine ecosystems. Strategies and governance frameworks for risk management and adaptation responding to these changes need to be developed. This includes coastal defence strategies to cope with sea-level rise and storm surge rises; and responsive fisheries management, which rebuilds ecosystem resilience. The implementation of such strategies is critically dependent on climate, ocean and coastal observing, information, and prediction systems.

58. The global and coastal ocean experts at the Conference agreed that ocean information is integral and essential to the Global Framework for Climate Services and, in view of that, expressed strong support for the following key recommendations:

- *Comprehensive ocean observing system.* The Global Ocean Observing System (GOOS) should be a major part of the Global Framework for Climate Services and should be fully implemented in the open ocean and coasts, and further enhanced to include biogeochemical and ecosystem parameters, in line with international agreements and conventions (such as UNFCCC, GCOS, and the Convention on Biological Diversity) and including free and open data access. Such an observing system should be informed by the recommendations from the OceanObs'09 Conference;

- *Coastal and global ocean research.* National and international research should be strengthened to improve our understanding of ocean processes on global, regional and local scales, and should be an integral part of the Global Framework for Climate Services. There is a need for a better understanding of ocean–atmosphere interactions and the role of the ocean in predicting climate change on timescales from seasons to millennia. Further, quantification of the impact and interaction between climate and ecosystems, and particularly the connection between changes in the open ocean and their impacts on coastal systems, needs to be understood;

- *Assessments of ocean climate and marine ecosystems in response to user needs.* Sustained and timely operational assessments of the physical, biochemical and ecosystem states of the oceans should be implemented;

- *Comprehensive ocean climate prediction.* Operational systems should be developed and implemented for predicting changes in the ocean climate system on timescales of days to decades, including the development of operational marine ecology;

- *Capacity-building.* Developing nations and economies in transition need to be supported to develop national capabilities that contribute to and benefit from ocean observations, research, information, assessment and prediction. A particular need is to develop the local capability to take ocean observations, interpret the information and thus provide knowledge for local decision-making in support of creating

sustainable ecosystem goods and services for local social and economic benefit.

IV The scientific basis for climate services

59. For most of the past century, the main focus of climate services, whether provided by National Meteorological and Hydrological Services, research institutions or the meteorological private sector has been on the processing and provision of historical climate records for a wide range of planning and design purposes. Though genuine scientifically based attempts at climate prediction date back to the first half of the twentieth century, it is only since the establishment of the Global Atmospheric Research Programme (GARP) in 1967 and the World Climate Research Programme in 1980 that significant progress has been made on the scientific basis for climate prediction and the provision of integrated climate services in some countries.

60. The Conference reviewed the underpinning role of observations for essentially all types of climate services and the contribution of the Global Climate Observing System following its establishment in response to the exhortations of the 1990 Second World Climate Conference. It also reviewed the substantial progress under the auspices of the World Climate Research Programme over the past 30 years in providing a scientific basis for the climate prediction and information services already in place around the world under the general umbrella of the World Climate Applications and Services Programme and its Climate Information and Prediction Services (CLIPS) Project.

The essential role of climate observations

61. Long-term observation of the atmosphere, land and ocean is vital for all countries, and must be funded for the public good as economies and societies become increasingly affected by climate variability and change. The climate-relevant components of the various global, regional and national observing networks that have been incorporated under the auspices of the GCOS since 1991 have provided most of the data used for climate analysis, prediction and change detection. They have demonstrated that warming of the global climate system is unequivocal and have provided information on climate patterns and trends at regional and national scale.

62. The networks must be strengthened and sustained in order to monitor climate variability and change, and to evaluate the effectiveness of the policies implemented to mitigate change. Observations are needed to support improvement of climate models, to initialize and enable effective use of model predictions for decades ahead, and to guide the use of models for longer-term scenario based projections. Observations are needed to assess social and economic vulnerabilities and develop the many actions that must be taken to adapt to climate variability and unavoidable change. They must be recognized as essential public goods where the value of global availability of data exceeds any economic or strategic value of withholding national data.

63. Full implementation of GCOS is essential for supporting both the adaptation and the mitigation objectives of the UNFCCC, and for ensuring that all countries will be able to manage their response to climate variations and change through the twenty-first century.

64. The observational experts at the Conference accordingly agreed on the following recommendations:

- *Long-term sustenance of observing systems.* The established in situ and space-based components of GCOS should be sustained and operated with continued attention to data quality and application of the GCOS Climate Monitoring Principles;

- *Improvement of operation and planning.* The operation and planning of observing systems should be improved, so as better to identify deficiencies, achieve resilience, and assure reliable and timely delivery of good quality data, traceable to international standards;

- *Enhancement of observing systems.* Enhancements to observing systems should be implemented wherever feasible, filling gaps in spatial coverage and in the range of variables measured, improving measurement accuracy and frequency where needed, increasing use of operational platforms for satellite sensors, ensuring adequate monitoring of urban and coastal conditions, and establishing key high-quality reference networks;

- *Improvement of data services.* Improvements should be made to the rescue, exchange, archiving and cataloguing of data, and to the recalibration, reprocessing and reanalysis of long-term records, working towards full and unrestricted access to data and products;

- *Observations for adaptation planning.* All countries should give high priority to the observational needs for adaptation planning, identifying their needs in National Adaptation Programmes of Action where applicable;

- *Regional implementation of GCOS.* Developed countries should commit to assist developing countries to maintain and strengthen their observing networks through support for updating, refining and, most important, implementing the GCOS Regional Action Plans and other regional observational and service initiatives such as ClimDev Africa, GOOS Africa, and Pacific Islands GCOS.

Seasonal to interannual climate variability, predictability and prediction

65. Seasonal prediction is based on changes in the probability of weather events due to changes in slowly varying forcings such as sea surface temperature anomalies, as occurs during El Niño. Since seasonal weather is influenced by many factors, including internal variability of the atmosphere and not all sources of potential predictability are properly understood, forecast systems, based on comprehensive models, are still a long way from producing consistently useful results. Opportunities for progress exist through greater convergence of weather and climate forecast models.

66. The experts with a wide range of experiences made the following recommendations:

- *Model quality.* Seasonal prediction information depends critically on the quality of models, and current seasonal prediction models have serious deficiencies. Although these cannot be transformed overnight, long-term commitment of substantial resources for model and assimilation system development, and the supporting research, is required;

- *Climate prediction systems*. Developing and testing models and forecast systems across a range of timescales is essential. Indeed, it is critical that our climate prediction systems simulate the statistics of regional weather with sufficient fidelity. Provision of computer resources to allow development of extremely high-resolution global modelling should be pursued. In particular a priority is to implement the recommendations from the World Modelling Summit for Climate Prediction (2008). There is a compelling need for dedicated computational facilities that are 1 000 to 10 000 times more powerful than those available today;

- *Road map to quality improvement.* Seasonal forecast quality can also be improved by taking into account processes in the cryosphere, land surface, and stratosphere. In essence, the "road map" for improving seasonal prediction as developed at the first WCRP Seasonal Prediction Workshop (2007) in Barcelona should be implemented;

- *Improved observations and assimilation.* The maintenance and improvement of observing systems, data assimilation systems and reanalysis must also all be supported for improved seasonal prediction;

- *Local and regional forecasts.* Much more effort must be invested in demonstrating the use and increasing utility of these forecasts at the local and regional level;

- *Interpretation and tailoring of climate products.* The increased use and benefit of seasonal forecasts will occur only with the appropriate interpretation and tailoring of climate predictions, and the development of more explicit and real-time links with application models (such as crop yield prediction). This requires real-time access to model forecast data and relevant observations, both of which should be freely available as a public good;

- *Culture change.* Building a "chain of communication" that can benefit from advances in climate predictions to society is required. The chain must target decision-makers responsible for national infrastructures and welfare, and should include climate intermediaries and NMHSs, sectoral experts, government, business sectors, media and others. This will enable NMHSs and local climate services to respond to local users by providing locally relevant information.

Decadal climate variability, predictability and prediction

67. The indisputable evidence of global warming and the knowledge that surface temperatures will continue to rise over the next several decades under any plausible emission scenario is now a factor in the planning of many organizations and governments. It does not imply, however, that future changes will be uniform around the globe. Regional and seasonal variations in climate associated with natural variability will have large impacts, especially over periods of a few decades or less. An important challenge is, thus, to predict regional scale climate variability and change. The decadal timescale is also widely recognized as a key planning horizon for governments, businesses and many socio-economic sectors for which climate sensitivity and vulnerability are high.

68. Decadal prediction efforts are underway, but they are in their infancy and many challenges exist. The experts stressed these major recommendations to address the challenges:

- *Enhancement of observing systems.* Dedicated efforts are necessary to maintain and enhance the Global Climate Observing System, which is essential for initializing and validating decadal prediction systems. Of particular importance is the Global Ocean Observing System since the feasibility of decadal predictions largely stems from the role the ocean plays in the predictability of slowly evolving modes of variability;

- *Predictability and prediction on decadal timescales.* Increased investment in the research, computing and modelling systems to be used for decadal predictions is needed in order to reduce model biases that limit prediction skill and present significant difficulties in the development and testing of the data assimilation schemes; to improve the understanding and representation of the important mechanisms of decadal climate variability and change; and to establish the inherent predictability;

- *User–expert communication.* Mechanisms to increase dialogue between the climate information providers and those in the sector communities are required to make appropriate and best use of experimental predictions, to define requirements more effectively, and to drive improvements in predictive systems;

- *Cost-effective investment.* The cost of implementing these recommendations will be substantial. It is likely to be very small, however, in the context

of the overall costs of adaptation. Furthermore, reduced uncertainty in predictions can be expected to reduce the cost of adaptation.

Regional climate information for risk management

69. Because of regionally unique climate characteristic and socio-economic structures, focused and relevant climate information and services are needed for many purposes especially disaster risk reduction, protection against disease, environmental protection, enhanced agricultural production, water resource management and infrastructure planning. In order to meet end-users needs for climate information and services, it is necessary to improve technological capabilities continually through further research and development on key climate processes and climate prediction models and methods. This requires strong regional cooperation in capacity-building and provider–user dialogue.

70. The Regional Climate Outlook Forums (RCOFs) conducted in many regions over the past decade have contributed to the improvement of regional climate services through the production of consensus forecasts, exchange of technical information among National Meteorological and Hydrological Services and regionally based interaction between climate service provider and user communities. The emerging WMO framework for climate service provision includes the WMO Global Producing Centres (GPCs) and a network of regional centres including Regional Climate Centres (RCCs) supporting the role of the NMHSs.

71. In order to enhance the satisfaction of demands for regional climate information and services for risk management, regional climate services experts at the Conference expressed strong support for:

- *Provider-user partnerships.* Partnerships should be fostered between NMSs and user communities to promote effective user-oriented climate information and services and decision support system;

- *Integrated weather–climate information.* NMSs should be enabled to promote the production and provision of seamless weather and climate information on daily to centennial timescales;

- *Regional capacity-building.* Designation, establishment and development of mechanisms such as RCCs, RCOFs and participation in user planning forums such as Malaria Outlook Forums should be supported and strengthened as important means of providing user-tailored climate services including climate change projections for the development of adaptation strategies. Regional cooperation with a wide range of sectors is essential to improving the capacity to provide and use climate information;

- *Observation, monitoring and research.* Continued efforts on climate observation, monitoring and research are needed to improve the basis for provision of regional and national climate information and services continuously. Research efforts should be informed through dialogue with climate service providers and users.

V Adaptation to climate variability and change

72. The Conference recognized that the principal international forum for coordination of national action on both the adaptation and mitigation responses to climate change is provided by the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change and that the Intergovernmental Panel on Climate Change provides the critical role of analysing the available climate data and information and producing policy-relevant assessments for the Parties to the UNFCCC. It also noted that under the auspices of its Chief Executives Board, the United Nations system is committed to "Delivering as One on Climate Knowledge".

73. The Conference further noted the urgency of establishing a Global Framework for Climate Services as an effective means to address user needs for information on shorter term (seasonal to decadal scales) climate variability and change that affect societies at the national level, and for the development of common policies and actions internationally. The results of the three essential issues, discussed below, address factors to consider in providing effective national and international responses to climate variability and change.

Climate risk management

74. The most dominant message coming from the Conference Round Table on Climate Risk Management was that the proposed Global Framework for Climate Services must engage user communities in developing services tailored to meet their needs for climate risk management. If this is not done, a real danger exists that the services will not be used.

75. The Round Table also noted that there is a lack of critical data available for use in development of climate services. This includes data that are not collected as well as data that are collected but not exchanged because of inadequate data policies. Ownership of data at local scales was seen as being particularly important and this included, as a key priority, making data widely available to engineers and scientists in the developing world.

76. A number of speakers stressed that important science challenges must be overcome, including improved broad scale climate predictions and downscaling to regional and local spatial scales. Scientists and engineers in the developing world need access to and training in the use of models that assist in local climate prediction and the development of services to meet local needs. It was seen as particularly important that users of services provided through the proposed Global Framework for Climate Services understand the capabilities and limitations of this information and the concepts of probabilities and uncertainties associated with this climate information.

77. Climate was seen as only one component of environmental risk management, that is, as a compounding factor in an already stressed environment. Therefore climate scientists need to work with a broad community of engineers, social scientists, biologists and the like in developing information that fully meets the needs of decision-makers.

78. Finally, the participants in the Round Table noted that many climate services are already being provided to a broad range of users, and that the proposed Global Framework for Climate Services should build on, not duplicate, these activities.

Climate adaptation and the Copenhagen process

79. The Round Table on Climate Adaptation and the Copenhagen Process discussed how the proposed Global Framework for Climate Services could support the implementation of relevant elements on adaptation of a Copenhagen agreed outcome, in particular as they relate to the needs for climate information and services to inform decision-making on adaptation.

80. In order to enhance climate service support for the work of the UNFCCC, there was strong support for the following recommendations:

- *Priority on adaptation.* Adaptation has become an important priority, requiring enhanced action towards implementation at all levels and across all sectors, based on a solid knowledge and information base;

- *Action on adaptation.* A robust outcome on enhanced action on adaptation in Copenhagen that will catalyse action on adaptation will be of benefit to all countries, but, in particular, will help the most vulnerable to adapt to the impacts of climate change. Assessment, planning and

implementation of adaptation actions needs to be based on, and supported by, strengthened research; systematic observations; monitoring and modelling; and improvements to the collection, reliability, provision, dissemination and application of climate data, information and knowledge;

- *Information for adaptation.* Improved climate data and information, including data on extreme events, are critical to adaptation. This would enable more robust assessments of vulnerabilities and prediction of impacts, adaptation planning and practices, and reduction and management of risks through consideration of climate information in decision-making, and thereby enable a proactive approach for adaptation;

- *Need for international cooperation.* The UNFCCC has expressed a need for the type of information and services that a Global Framework for Climate Services is expected to deliver, in particular to support adaptation activities, and has made calls upon the international community to address those needs. In developing a Global Framework for Climate Services, existing global, regional and national initiatives and knowledge, including work and expertise of United Nations agencies as well as regional centres should be used. At the same time, cooperation needs to be fostered among all countries in sharing knowledge, data, methods and tools for adaptation purposes, as well as between the meteorological and broader climate change communities;

- *Benefits of a Global Framework for Climate Services.* A Global Framework for Climate Services can and should support many of the needs already identified under the UNFCCC. It has the potential to assist Parties to the Convention in their adaptation efforts in the upcoming years, including in the implementation of relevant elements under a Copenhagen agreement. At the same time, a Global Framework for Climate Services can address many of the needs and priorities identified by countries under the ongoing work on adaptation under the UNFCCC, such as on research and systematic global climate observations, the Nairobi Work Programme, and National Adaptation Programmes of Actions of Least Developed Countries;

- *User interface.* A Global Framework for Climate Services that facilitates strong linkages between developers and users of climate information can provide the information base that decision-makers at all levels and across sectors need to act upon, and as such can become a powerful tool to support adaptation efforts.

Communicating climate information for adaptation and risk management

81. The successful communication of climate change and variability information to the world's public remains one of the least resolved issues within climate change. Disseminators and communicators of climate change information come from a wide background within science and the humanities, but generally with a strong presence from the world of television broadcast meteorology. This group of people is made up primarily (but not exclusively) of broadcast meteorologists, skilled weather presenters, and environmental journalists. It is not, however, a cohesive group, and there are varying levels of comprehension of the core science within this group of people. It is, however, the daily broadcast meteorologist or weather presenter who is recognized as the most trusted, credible and talented person capable of delivering the complex message of climate change.

82. The Conference Round Table on Communicating Climate Information agreed that there was not enough dialogue between scientists and communicators, and that the development of climate services were not being advanced quickly enough, especially in light of the recent accelerated rate of climate change and variability noted by many climate scientists.

83. The Round Table participants, together with the audience, voiced agreement on the following main recommendations:

- *Climate communicators.* The NMHSs should involve those who communicate the daily weather messages from within their own organizations when planning for the mass distribution of timely climatological information. The climate change message must be delivered efficiently and effectively irrespective of any prevailing political persuasion;

- *Access to climate information.* There is a pressing societal need for climate change information. It is necessary to make sure that weather and climate communicators themselves remain at the very forefront of the science. Researchers, scientists, climatologists and academics within the field are urged to share their knowledge freely, willingly, and in a timely manner to further the process of dissemination. Access to information remains the single biggest hurdle for many weather and climate communicators;

- *Best practices and training.* Best practices in regards to "delivering the message" range widely from country to country, because of differences in the varying regional threats, and difference in the delivery mechanisms around the world. There are a few rules and techniques, however, that can aid effective delivery of the message. These techniques need to be shared among all broadcasters. Weather broadcasters should have access to training in these techniques and be empowered to use them. The World Meteorological Organization has a lead role in this task. It should tap into the professional broadcast organizations to facilitate broadcast and presentation training for those who require it;

- *Unbiased communication of climate information.* Communicators of climate change must remain independent. Every socio-economic sector will potentially be affected by our changing weather, and the communicator should not be aligned with any one single group. It is of the utmost importance that broadcasters who discuss climate change and variability are not perceived by the audience to be unduly influenced by political ideology nor economic considerations;

- *Dialogues with communicators.* There should be a much greater degree of dialogue between climate change scientists and those who communicate to end-users;

- *Outreach by climate communicators.* Weather broadcasters should take a lead in reaching out to other communities, in particular the education and health communities, in promoting discourse over climate change and variability.

VI Societal perspectives on climate services

84. Many different communities, in addition to the established climate service providers, have become increasingly engaged over the years since the 1990 Second World Climate Conference with the various scientific, operational, social and policy issues involved in providing and using climate services.

85. It was agreed that these diverse perspectives are extremely important to the design of an effective Global Framework for Climate Services and four different stakeholder groups were invited to conduct forums related to climate and gender; climate and communities; business and industry; and capacity-building, education and training. The most important conclusions from these forums were as follows.

Climate and gender

86. The experts and participants of the Gender and Climate Forum of the WCC-3, having considered an extensive body of knowledge and expertise in the area of gender and climate variability and change, recognized that women and men around

the globe are distinct carriers, providers and users of climate information, and that mounting evidence shows that drivers and consequences of climate change are not gender neutral. The experts placed priority on:

- *Mainstreaming gender equality.* Gender equality must be mainstreamed into climate science, mechanisms and activities, and into climate institutions, particularly the World Meteorological Organization and National Meteorological and Hydrological Services, and into the Global Framework for Climate Services.

87. The Forum participants concluded that the proposed Global Framework for Climate Services should reflect a gender perspective in all its components, namely:

- *Observation and monitoring.* Involvement of local communities, particularly local women in environmental change and climate observations, and the provision of adequate preparation and training of women and men is necessary for their full participation as providers and users of climate information;

- *Research and modelling.* Gender parity and equal participation of women researchers in climate research should be ensured at the national, regional and international levels. The role of social scientists and the human dimension in climate research should be enhanced;

- *Climate service information system.* Information on gender aspects of climate and health, energy, water and agriculture for mitigation and adaptation, particularly through the collection of gender disaggregated data, at both the country and regional levels needs to be enhanced. National statistics divisions should be trained in gender disaggregated data collection, in collaboration with United Nations agencies, and legal guarantees for the regular and continuous production of a minimum set of gender-specific data in situations of climate change, should be promoted;

- *Climate services application programme.* Recognizing the level of knowledge and taking into account the realities of access to information for women, it is necessary not only to ensure accessibility and benefits from climate information for scientists and decision-makers in all regions, but particularly for local communities, especially local women.

88. The Gender and Climate Forum further recommended:

- *User-oriented information.* Climate information and practical prediction services, including those designed by users, is important to assist in empowering local women;

- *Outreach and capacity-building.* It is important to ensure and support outreach and capacity-building for a broad user community, including local women and men of different age groups.

Climate and communities

89. Local communities are at the frontline of the impacts of climate change, climate variability and extremes. The community level is a key entry point for better climate risk management. The most vulnerable communities, however, rarely benefit from our growing ability to anticipate future conditions and are often missing in national adaptation plans and programmes.

90. The Forum on Climate and Communities was informed by practical experiences on community-based risk management from a range of perspectives, including people working directly with local communities and indigenous peoples, boundary organizations, development and humanitarian organizations, meteorological agencies and academia. They demonstrated that community-based risk management is a very effective, and in fact essential, component of national and international efforts to better manage climate variability and change.

91. Practitioners and experts at the Forum agreed that:

- Empowerment of communities is essential;
- Climate is seldom communities' first concern, so climate risk management needs to be integrated into community development, security and practice;
- Local communities are holders of complex knowledge about local weather, climate, biodiversity, ecosystems and have a history of adaptation to climate variations. Climate risk management should draw on socio-economic data and local vulnerability and capacity assessments to assess and address differential vulnerabilities among and within communities, including gender, age and income differences, and recognize potential trade-offs;
- Communities will accept and use external information when they trust the source and there is a supportive partnership context;
- Much can be achieved by adapting to the current climate, and reducing the current adaptation deficit by including short-, medium- and long-term risk planning.

92. The Forum agreed that science-based climate information can effectively support climate risk management at the community level, and made the following recommendations to achieve this at a wider scale:

- *Local knowledge and decision-making.* It is necessary to recognize the central role of local communities in decision-making at the local level, and to draw on their existing traditional knowledge, values, skills and cultural systems;
- *Build local capacity.* Building capacity at the local level empowers communities and strengthens the link between local practice and national policy frameworks;
- *Start now.* Better application of climate information can be generated right now, rather than just on longer-term efforts to enhance observations and predictions;
- *Context-specific climate risk management.* Provision of generic climate information is not enough. Climate risk management is highly context-specific. There is no one-size-fits-all climate information product, and actionable information, as well as guidance and tools, supportive rather than prescriptive, are needed;
- *Expectations of users.* It is essential to be transparent on uncertainties and inform local users on what can be expected. Effective communication can ensure that information gets to the right level and is understood, trusted and actionable;
- *Best practices.* Best practice examples and peer-to-peer learning should be fostered, including through modern media and stakeholder forums;
- *Partnerships.* Benefit can be gained by investing in partnerships and instituting effective engagement based on dialogues among users and suppliers of information and services, often through local champions and boundary organizations.

Climate and capacity-building, education and training

93. Capacity-building is much more than training. It requires institutional strengthening in governance, management and funding as well as human resources development, in areas such as weather, climate and water. Capacity-building activities for improving adaptation require that the stakeholders demand that they should be service-oriented and driven by the outcomes that stakeholders request. The capacity to use climate information then becomes part of a larger effort to achieve a specific goal. The capacity-building experts developed the following recommendations for action:

- *Capacity development.* Capacity development works best when politicians and scientific leadership have the same vision. Strong leadership is critical for effectiveness;

- *Climate change education.* Mainstreaming of climate change education in curricula at all educational levels is a priority;

- *Interaction between science and communities.* Due to the site-specific nature of resilience and adaptation to climate change, local community and indigenous knowledge of ecosystems, natural hazards and adaptation mechanisms has been developed over long time periods. Yet climate change and variability may overwhelm these traditional adaptation mechanisms. It is therefore urgent to enhance the human and institutional capacity to increase the interaction between scientific knowledge and local community and indigenous understanding at all levels;

- *Adapting to current variability.* Focusing adaptation to climate change scenarios that are far in the future (over 50 years) with large uncertainties strongly reduces the interest of most stakeholder groups. Climate change must be promoted as an issue of the present. Societies need to improve adaptation to current climate variability and extremes, and, by doing so, will improve their adaptive capacity to future climate scenarios. Efforts should therefore be focused in building the capacity to identify and promote actions that improve adaptation today and reduce vulnerabilities in the future;

- *Accessibility.* Climate information services should be accessible by users, useful in national and regional contexts, and assimilate local inputs and accept feedback. Such information services will be developed through capacity-building at the policy, institutional and individual levels. External players should abide by clear principles of engagement when undertaking capacity development work;

- *Long-term partnerships.* Capacity-building and training must be seen as a long-term provider–user relationship of listening and learning. Such a relationship requires access to data and information, the ability to generate knowledge, and community collaboration. It is essential that programmes are monitored and evaluated, and that lessons learned feed back into the programme and to demonstrated useful results;

- *Adapting to high risks.* Managing climate-related risks to sustainable development is already a requirement in high-risk environments. The tools developed for managing climate-related risks are relevant for climate change adaptation, and provide a useful and necessary starting point for capacity development;

- *Mainstreaming climate information.* Climate information products will be optimized when all links in the existing information chain, from information producers to users at various levels, are competent.

Climate, business and industry

94. Climate change is a cross cutting issue, threatening energy, food and water security; undermining human health and biodiversity; and affecting key economic sectors such as transport and tourism. Global coordination and collaboration between the private sector and the public sector are essential to address these interrelated challenges.

95. Better climate information helps business to focus our research and make the right long-term investments. The viability of businesses depends on their vulnerability to the impacts of climate change and their ability to adapt. Predictive services and climate modelling can help them adjust their business model and open the door to new opportunities. The WCC-3 will help raise awareness and develop climate-related services that can assist governments and businesses in making

better decisions. The business and industry experts made the following recommendations:

- *Public–private partnerships.* Innovative partnerships that foster rapid development of advanced technologies to reduce emissions are critical. It is important to bring in all key stakeholders including subnational actors, to find innovative solutions to climate change;

- *Role of the private sector.* The Global Framework for Climate Services will help companies benefit from enhanced climate services and provide better accessibility to climate information. The expertise of the private sector should be utilized to the fullest.

VII Implementing climate services

96. The Conference reviewed a wide range of experiences from developed and developing countries, from the research and operational communities and from many different parts of the world, in the implementation of climate services. The workshops on "Implementing Climate Services" were focused particularly on:

- The end-to-end process of making better use of climate observations in support of model development and use for operational prediction;

- The role of national and international research programmes in supporting the development and improvement of climate services;

- The diverse experiences of different regions, countries and institutions in the implementation of climate services.

From observations to predictions

97. This workshop explored the value chain leading from Earth observation data via processing and modelling to climate information services for decision-makers. It addressed climate adaptation services through two case studies on local and regional sea-level rise, and it highlighted climate mitigation services by presenting an emerging forest carbon monitoring system. It also explored the range of activities involved in converting raw satellite observations into final climate products and services for end-users.

98. The two case studies reached the following conclusions:

- For sea-level rise, global scenarios need to be translated into local and regional scenarios, requiring the incorporating of the impacts of topography, land subsidence, river and delta dynamics and other local variables. Developing more effective information services will also require improved observations, which in turn will lead to improved models and scenarios; more coordination of observations and integration of data; and rapid and effective dissemination of user-friendly information, including to the general public via warning systems.

- For a robust forest carbon monitoring with wall-to-wall coverage, governments, space agencies and other organizations are working through the GEO framework to integrate in situ observations, remotely sensed observations, and methodologies for estimating carbon content. The aim is to allow governments and the emerging carbon markets to measure and certify forest carbon flows more accurately than ever before.

99. End-users are not always fully aware of the vast amount of behind-the-scenes work that goes into preparing remotely sensed and in situ observations so that these data can be reprocessed, analysed and transformed into climate information products. Broadening the scope and cross-cutting nature of the data entering the processing stream, and strengthening and sustaining the world's diverse Earth observation systems, is critical for the future of climate services.

100. The experts at the workshop made the following recommendations:

- *Sustained observations.* The climate community should, as a top priority, seek to ensure that climate service providers obtain easy access to sustained and cross-cutting observations and information;

- *Robust scenario development.* Recognizing that predicting climate changes and impacts remains a real challenge, climate service providers should focus on delivering robust scenarios that allow decision-makers to consider a range of options and policy responses;

- *Sector-specific information.* Because both climate change science and the needs of decision-makers are so complex, climate information providers should craft their services to meet a diversity of needs, including for local scenarios with short timescales and global scenarios based on longer timescales.

Research engagement

101. Climate science has advanced significantly during the past three decades, yet many scientific challenges remain. The essential need is to make quantitative climate predictions on timescales from seasons to decades and spatial scales of local to regional to global. The ultimate goal is to create integrative science. This integration must include the identification of the users' needs from the outset. This will provide climate information and services in a timely manner to decision-makers and operational organizations.

102. The societal need for authoritative information on climate variability and change demands increased research and development efforts. These include: improved understanding of climate processes and feedbacks; better emissions scenarios; advanced modelling at high spatial resolutions to capture the regional aspects of climate variations and changes and for realistic representation of crucial climate processes; capacity for gathering, processing, and sharing observational data for model evaluation and initialization; development of hardware and software capabilities for analysing and interpreting the model and observational results; the quantification of uncertainties in a probabilistic manner including recognition of the high-impact-end of the distributions; streamlined transition to an operational mode including the generation of climate products and services; facilitation of feedback from the user community and providing inputs into the research priorities; and resources and skills to synthesize the information and meet user needs for decision-making at the global, regional and local levels.

103. There is a clear recognition that the full understanding of climate requires a holistic approach that accounts for all processes of the Earth system, including socio-economic processes. To meet the expectations of the proposed Global Framework for Climate Services, there is, therefore, a need for:

- *End-user focus.* The end-users should be identified, and the products and services should be re-evaluated to meet the needs of the user community more effectively;

- *Earth system approach.* An Earth system approach to observations, monitoring, modelling, analysis and prediction should be adopted. The coordination and acceleration of prediction research is essential;

- *Data integration.* Success requires the integration of space-based and in situ observational systems that accurately capture key climate variables, and are sustained over decades for a robust determination of trends and variations at the regional and global level;

- *Interactions between models and observations.* The synthesis of observations and model outputs to provide accurate regional and global

climate information, and the utilization of model-based uncertainties to plan better observing system strategies constitute important scientific underpinnings of any new climate information system and services (that is, linking research with operations, services and delivery);

- *Significantly enhanced high performance computing.* Significant enhancements (by at least a factor of 1 000) in high performance computing and telecommunications networks are necessary;

- *Capacity-building.* The infusion of highly skilled human scientific talent via training and capacity-building, especially through young scientists and, importantly, in the developing regions of the world is crucial. Developed countries must work with developing countries in transferring capacity, technology, education and computing. The initiative, however, should come from experts at the local level, where the service will be installed.

Nations and regions

104. The national and regional workshops on implementing climate services developed a set of recommendations as follows:

- *Communication strategies.* The development of strategies to communicate relevant and tailored climate information (including measures of uncertainties) effectively to stakeholders, decision-makers, the general public and the media are needed;

- *Ownership.* Development of "ownership" by the population and the users, including translation of products into local language, is important for the effective use of information;

- *Capacity-building.* To ensure sustainability of services, capacity-building and effective in-country training are necessary, as is funding for Climate Outlook Forums. The development of appropriate tools (such as numerical models) and adequate human resources to develop these tools is an important element in climate application;

- *National activities.* National level information on climate change as well as early warning services are needed for preparation of national adaptation strategies. Matching capability to user requirements requires effective dialogue;

- *Regional climate services*. These services are very important to contribute to enhanced social and economic resilience and decision-making in many climate-sensitive sectors (water resources, agriculture, fisheries, health, energy, and disaster risk management, for example);

- *Climate in development.* Climate information is essential for socio-economic development. Conscious efforts are needed by stakeholders and key players in climate-sensitive sectors to understand the full potential and usefulness of this information;

- *Integration.* Good linkages between Global Climate Prediction Centres (GCPCs) and Regional Climate Centres are needed for the best use of products at the regional and national levels. Regional coordination is needed to foster improvements at the national level. Lessons learned to tailor information from GCPCs, RCCs and National Climate Centres (NCCs) should be applied.

VIII Exploiting new developments in climate science and services

105. The Expert Segment of the Conference had the opportunity, through plenary poster sessions and other briefings, to preview a wide range of innovative research, service provision and application projects that promise to contribute to the quality, range and utility of climate services in future years. The Conference participants expressed appreciation to all those had contributed scientific and technical presentations during the Expert Segment and were especially

appreciative of the information provided on new developments.

106. The three poster sessions provided the opportunity for participants to communicate original scientific findings and other information.

Posters were invited from those experts who wished to contribute their ideas and work, including scientists at government agencies and research laboratories, climate service practitioners, students and other interested individuals or groups such as non-governmental organizations. Areas of special interest included the science base, information systems, computational needs, demonstration of successful best practices and regional issues.

One-page abstracts for the poster sessions had to be submitted to the Conference Secretariat before 15 June 2009. Poster submissions were reviewed and notice of acceptance was provided by 30 June 2009.

A total of 200 posters were grouped under three general topic areas:

- Community and environmental sectors
- Climate science
- National or regional examples of climate service provision and application

Those submitting abstracts had clearly indicated the category in which they would like their posters to be included and whether they wished to make a short introductory presentation (two minutes; one or two slides).

107. Areas of particular interest in the poster presentations on "Community and Environment" included:

- Climate issues that are already spurring a call to action, such as:
  - Analyses of complex systems showing subtle sensitivities to climate;
  - Application of the most basic weather and climate information as the season unfolds to natural resource utilization and management;
- Assessing how well communities were indeed adapting to climate change. The most vulnerable regions of a country, for example, were often not the most proactive in adaptation planning to a particular hazard, be it flood, storm or drought;
- The need for a systematic framework for climate services. The diversity of the posters suggested that effective adaptation to climate variability and change at country, regional and indeed the global level would benefit from a systematic framework for the delivery and uptake of generalized and targeted climate information services;
- The critical importance of ongoing climate data for the assessment of fluctuations and trends in risks arising from exposure and vulnerability to natural hazards.

108. Areas of particular interest in the poster presentations on "Climate Science" included:

- Use of climate observations to identify regional trends;
- High resolution modelling at global and regional scales;
- Studies of regional climate change and climate impacts.

109. Areas of particular interest in the poster presentations on "Regional and National Examples of the Provision of Climate Services" included:

- Variety of fields of services for ecological applications, including agriculture;

- The role of the media in communicating climate information (especially prominent in the hydrological posters);

- Existing activities at the national level to enhance a country's capacities to develop tailored user-oriented climate services;

- Good knowledge of the user needs on the spatial and temporal resolution for successful climate services. It was noted that the civil society could provide helpful guidance for the development of climate information and services at local levels;

- Demonstration that the good exchange of knowledge and experiences at regional and sub-regional levels would be beneficial for all involved in delivering climate services.

110. The Conference participants strongly encouraged all of those who had contributed their work to the Expert Segment to continue to support the progressive implementation of the proposed Global Framework for Climate Services over the coming years.

IX A Global Framework for Climate Services

111. The Conference recognized that great progress has been made over the past 30 years towards an integrated global approach to the development, implementation, operation and application of climate services in support of a wide range of societal needs in all countries and in all major socio-economic sectors. It particularly recognized the achievements under the World Climate Programme, especially its World Climate Applications and Services Programme and the Climate Information and Prediction Services Project in the successful implementation of the Regional Climate Outlook Forums and their support for enhanced national climate services in many countries.

112. The presentations and discussions made clear, however, that the present arrangements for the provision of climate services fall far short of meeting the identified needs and that there is vast, as yet largely untapped, potential to improve these arrangements and enhance the quality and utility of climate services for the benefit of all countries and all sectors of society. There was widespread agreement among both provider and user community representatives that a new global framework is required to enable better management of the risks of climate variability and change, and to promote the adaptation to climate change at all levels through development and incorporation of science-based climate information into planning, policy and practice.

113. The participants in the Expert Segment welcomed the extensive preparatory work by WMO and its partner organizations on the design of the proposed Global Framework for Climate Services and the consultations that had already taken place with governments through both technical and diplomatic channels. They were in full agreement that, from the scientific and operational perspective, the proposed Framework should reinforce and complement the established international organizations for the provision and application of weather, climate, water and related environmental information, forecasts and warnings; and should build on and integrate the existing international systems and programmes for climate observations and research that are co-sponsored by WMO, other United Nations system partner organizations, and ICSU. WMO and user sector organizations should enhance collaboration in the development of practical guidance on the preparation and use of climate products in different sectors and regions.

114. The participants in the Expert Segment of the Conference called for major strengthening and implementing, as appropriate, of the essential elements of the proposed global framework for climate services:

- The Global Climate Observing System and all its components and associated activities; and provision of free and unrestricted exchange and access to climate data;

- The World Climate Research Programme, underpinned by adequate computing resources and enhancing interaction with other global climate relevant research initiatives;

- Climate services information systems taking advantage of enhanced existing national and international climate service arrangements in the delivery of products, including sector-oriented information to support adaptation activities;

- Climate user interface mechanisms focused on building linkages and integrating information, at all levels, between the providers and users of climate services aimed at developing efficient use of climate information products, including the support of adaptation activities;

- Efficient and enduring capacity-building through education, training, and strengthened outreach and communication.

115. On the basis of the three days of discussion and deliberations during the Expert Segment, the participants supported the development and implementation of the proposed Global Framework for Climate Services.

Annex 6 Brief Note (Annex to the Declaration)

The World Climate Conference-3 proposes to create a Global Framework for Climate Services through which the developers and providers of climate information, predictions and services, and the climate-sensitive sectors around the world, will work together, to help the global community better adapt to the challenges of climate variability and change. This Brief Note presents an overview of the Framework, by answering a series of key questions.

Why is a Global Framework for Climate Services necessary?

1. Many socio-economic sectors, including water, agriculture, fisheries, health, forestry, transport, tourism and energy, are highly sensitive to weather and climate extremes such as droughts, floods, cyclones and storms, heat waves or cold waves. Decision-makers in these sectors are increasingly concerned by the adverse impacts of climate variability and change, but are not sufficiently equipped to make effective use of climate information to manage current and future climate risks as well as ecosystems. Consequently, there is not only an urgent need for enhanced global cooperation in the development of accurate and timely climate information but an equally urgent need for its exchange between the providers and users of climate services, thus ensuring that relevant climate information is integrated into planning, policy and practice at various levels.

2. Recent advances in science and technology offer the prospect of further improvements in the quality of climate information and prediction services. Integrating seasonal to multi-decadal predictions and long-term climate projections into decision-making in all socio-economic sectors, through an effective two-way dialogue between providers and users on the range, timing, quality and content of climate products and services, will ensure that decisions relating to managing climate risks are well informed, more effective and better targeted.

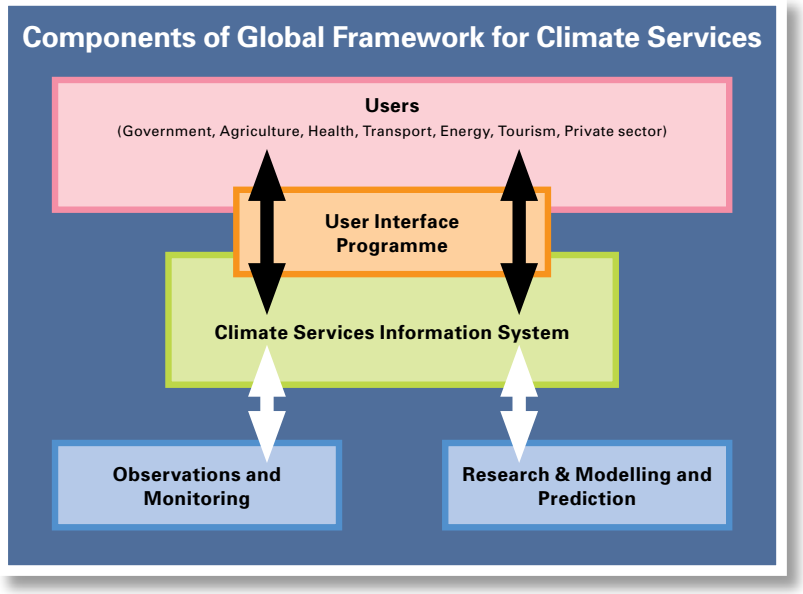
3. In order to address the need for improved climate information and to provide an effective interface between scientists, service providers and decision-makers, the World Meteorological Organization and its partner organizations for the World Climate Conference-3 propose the development of a new Global Framework for Climate Services (also referred to as the 'Framework') with the goal to: *"Enable better management of the risks of climate variability and change and adaptation to climate change at all levels, through development and incorporation of science-based climate information and prediction into planning, policy and practice".*

What is the Global Framework for Climate Services?

4. The Global Framework for Climate Services is proposed as a long-term cooperative arrangement through which the international community and relevant stakeholders will work together to achieve its stated goal.

5. The Framework will have four major components: Observations and Monitoring; Research and Modelling and Prediction; a Climate Services Information System; and a User Interface Programme (see figure). The first two components are well established but are in need of strengthening. The latter two components together constitute a "World Climate Service System".

6. The User Interface Programme, which presents a relatively new concept, will develop ways to



bridge the gap between the climate information being developed by climate scientists and service providers and the practical information needs of users. Recognizing that the needs of the user communities are diverse and complex, it will support and foster necessary institutional partnerships, cross-disciplinary research, innovation, development of decision support tools and climate risk management practices, generation and capture of knowledge, evaluation and establishment of best practices, education, capacity-building and service application for decision-making. The outcomes of the User Interface Programme will be reflected in the operational services of the Climate Services Information System (CSIS).

7. The Climate Services Information System will build on established global programmes such as the World Climate Programme and will reinforce, strengthen and better coordinate the existing institutions, infrastructure and mechanisms but, importantly, will focus on user-driven activities and outputs, while continuing to implement science- and technology-driven ones.

8. The CSIS, through a network of global, regional and national institutions, will synthesize information streaming from the Observations and Monitoring and Research & Modelling and Prediction components of the Framework, and will create information, products, predictions and services in an operational mode at various spatial scales. These services will be enhanced by feedback from users and other components of the system, and by the outputs of the User Interface Programme, thereby ensuring the development and delivery of user-oriented climate information and prediction services. It will focus, in addition, on standardization, exchange and quality assurance of information and on communicating the highest quality information, products and services possible to decision-makers from global to local scales. Through enhanced international cooperation for development and transfer of technology related to meteorological services and mobilization of resources, this System will also build capacity among national and regional meteorological service providers in developing and Least Developed Countries, whose contributions are essential for improved climate information products at global, regional and national scales.

What will be achieved through the Global Framework for Climate Services?

9. The Framework, when fully implemented, will support disaster risk management and climate risk management practices, and will contribute to achieving the objectives of various Multilateral Environmental Agreements such as the United Nations Framework Convention on Climate Change (UNFCCC), and of internationally agreed upon goals including the Millennium Development Goals. Effective implementation of the four components of the Framework would lead to the following:

- Strengthened local, national, regional and global observational networks and information management systems for climate and climate-related variables;

- Enhanced climate modelling and prediction capabilities through strengthened international climate research focused on seasonal to decadal timescales;

- Improved national climate service provision arrangements based on enhanced observation networks and prediction models, and greatly increased user interaction;

- More effective use of global, regional and national climate information and prediction services by all stakeholders in climate-sensitive sectors in all countries (leading to improved planning and investment in sectors vital to national economies and livelihoods); and thereby

- Widespread social, economic and environmental benefits through more effective climate risk management and increased capacities for adaptation to climate variability and change.

Who will participate in the Global Framework for Climate Services?

10. The Framework will build on and strengthen existing local, national, regional and global networks of climate observation, monitoring, research, modelling and service programmes, including those of WMO. It aims to achieve its goal through the enhanced role and involvement of national meteorological services and regional and global centres, as well as through greater participation of other stakeholders and centres of excellence across relevant socio-economic sectors, particularly those in developing countries, Least Developed Countries and Small Island Developing States.

11. To meet its objectives, the Framework would require extensive collaboration among national and local governments, agencies, non-governmental organizations, civil society, the private sector, as well as universities and research institutions around the world, and would also require outreach to communities in all socio-economic sectors benefiting from the application of climate data and information in planning, policy and practice. This outreach will be facilitated through participation of relevant organizations and institutions in coordination with governments. Implementing and operating the Framework will therefore require continuation and enhancement of the broad collaboration and partnerships, centred around these entities, which underpin and improve on its technical strengths. As such the Framework will be supported by the entire United Nations system and other organizations.

What are the next steps in developing a Global Framework for Climate Services?

12. Taking into account the outcomes of WCC-3, the Framework will be further developed under the guidance of an ad hoc task force consisting of high-level independent advisors, with inputs from a broad-based network of experts and in consultation with governments, partnering organizations and relevant stakeholders. The outcomes of the fifteenth session of the Conference of the Parties to the UNFCCC (COP15), as well as the special requirements

and vulnerabilities of developing countries, especially Least Developed Countries and Small Island Developing States, will also be taken into consideration in further development of the Framework.

13. An Action Plan with timelines for establishment and implementation of the components of the Framework will be developed along with measurable indicators for the progress in the implementation of the framework. It will also address aspects of governance and resource requirements. The Action Plan will also address the development, deployment and transfer of technology and capacity-building of meteorological services in developing and Least Developed Countries.

How will the Global Framework for Climate Services be supported?

14. The ad hoc task force to be established to further develop the Framework following WCC-3 will examine and make proposals on resource implications related to the implementation of the Framework and the cooperation of governments, organizations, institutions and relevant stakeholders in the mobilization of resources.

Acronyms

BON	Biodiversity Observation Network
CGIAR	Consultative Group on International Agricultural Research
CLIPS	Climate Information and Prediction Services
COP	Conference of the Parties (to the UNFCCC)
CSIS	Climate Services Information System
ESA	European Space Agency
FAO	Food and Agriculture Organization of the United Nations
GARP	Global Atmospheric Research Programme
GCOS	Global Climate Observing System
GCPCs	Global Climate Prediction Centres
GEO	Group on Earth Observations
GFCS	Global Framework for Climate Services
GOOS	Global Ocean Observing System
GPCs	Global Producing Centres
ICSU	International Council for Science
IFRC	International Federation of Red Cross and Red Crescent Societies
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunication Union
IUCN	International Union for Conservation of Nature
LDCs	Least Developed Countries
MDGs	Millennium Development Goals
NCCs	National Climate Centres
NMHSs	National Meteorological and Hydrological Services
NMSs	National Meteorological Services
RCCs	Regional Climate Centres
RCOFs	Regional Climate Outlook Forums
SIDS	Small Island Developing States
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNOG	United Nations Office at Geneva
UNWTO	United Nations World Tourism Organization
WCASP	World Climate Applications and Services Programme
WCC-1	World Climate Conference-1
WCC-2	World Climate Conference-2
WCC-3	World Climate Conference-3
WCP	World Climate Programme
WCRP	World Climate Research Programme
WHO	World Health Organization
WIOC	WCC-3 International Organizing Committee
WIPO	World Intellectual Property Organization
WMO	World Meteorological Organization
WTO	World Trade Organization

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