ICCS

THE INTERNATIONAL CONFERENCE ON CLIMATE SERVICES

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October 17-19, 2011

CONFERENCE REPORT

The International Research Institute for Climate and Society
The Earth Institute Columbia University
CSC Climate Service Center Germany
Eine Einrichtung des Helmholtz-Zentrums Geesthacht
Met Office
NCAR National Center for Atmospheric Research

International Conference on Climate Services
Conference Report

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Acronyms

AP	Adaptation Partnership
CCAFS	Climate Change Agriculture and Food Security theme of CGIAR
CGIAR	Consultative Group on International Agricultural Research
CRRH	Regional Committee for Hydraulic Resources
CSC	Climate Service Center (Germany)
CSP	Climate Services Partnership
GCM	Global Circulation Model
GFCS	Global Framework for Climate Services
ICCS	International Conference on Climate Services
IFRC	International Federation for the Red Cross
IRI	International Research Institute for Climate and Society
NCAR	National Center for Atmospheric Research (US)
NIDIS	National Integrated Drought Information System (US)
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration (US)
RC RC CC	Red Cross Red Crescent Climate Centre
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USAID	US Agency for International Development
WCC3	World Climate Change Conference 3
WFP	World Food Program
WMO	World Meteorological Organization

Executive Summary

Increasing awareness of the central role that climate plays in human welfare has not been matched with an ability to use climate information to manage climate-related risk. To better address this shortfall, the first International Conference on Climate Services (ICCS 1) created a space for discussion and dialogue among a wide range of organizations involved in the development and provision of climate services.

ICCS 1 was organized by representatives from the US National Oceanic and Atmospheric Administration, the US National Center for Atmospheric Research, the UK Met Office, the German Climate Service Center, Columbia University's Earth Institute, and the International Research Institute for Climate and Society. Building on the intellectual and practical contributions of a range of antecedents, the ICCS was intended to help participants identify challenges and opportunities in the development and provision of climate services. The ICCS was also intended to further the development of institutional mechanisms necessary to gather, generate, exchange, and disseminate climate-related knowledge and information in support of climate-smart development.

To this end, the ICCS culminated in the creation of a Climate Services Partnership (CSP). The CSP will connect disparate climate service initiatives from around the world, providing a forum by which those engaged in climate services development can document progress, share experiences, and compare lessons learned. The CSP will further collaboration on at least three levels:

1. The CSP will encourage and sustain connections between climate information providers, users, donors, and researchers by continuing ICCS process
2. The CSP will promote gathering, synthesizing and dissemination of current knowledge on climate services by way of an online knowledge capture platform.
3. The CSP will facilitate the generation of new knowledge on critical topics in climate service development and provision, through the creation of focused medium-term working groups.

The conference included a mix of talks and breakout sessions to inform the creation of the CSP.

Opening remarks from Stephen E. Zebiak, director-general of the IRI, and Jeffery D. Sachs, director of Columbia University's Earth Institute, set the tone and provided their perspective on the need and role for climate services.

Deputy Secretary-General of the World Meteorological, Jeremiah Lengoasa, also presented the goals and priorities of the Global Framework for Climate Services (GFCS). The GFCS is an international effort to ensure that the availability of user-friendly products to help in decision making and planning for changing climate

conditions. Linking the CSP to the GFCS is an explicit priority of both groups, as they each seek to create a context in which climate information can better enable climate-smart policy and decision-making.

Opening remarks were complemented by a series of talks designed to provide a range of perspectives on the need for and role of climate services. This included perspectives from the developed and developing world, and from both users and researchers.

After these talks, participants engaged in breakout group discussions focused on identifying the elements of successful climate services. Breakout topics included: Identifying the Demand for Climate Services; Creating Accessing, and Using Data; and Facilitating Systematic Knowledge Exchange. Together, these discussions explored challenges and opportunities in these critical requirements for climate services.

A second set of breakout discussions focused on how to create an enabling environment for climate services. These sessions explored how to create an enabling environment for climate services by Engaging the Scientific Community, Designing Policies and Institutional Partnerships, and Establishing Innovative Funding Mechanisms.

The breakout group provided an opportunity for participants to discuss the specific questions mentioned in the conference white paper. They also highlighted challenges and opportunities to climate service development. Importantly, the breakout sessions identified crosscutting issues of interest to participants and the climate service community as whole.

These issues were presented as possible working group topics, and participants were encouraged to join one the group to discuss activities that they could undertake in the next year. These discussions were then folded into the presentation of the Climate Services Partnership Action Plan. This Action Plan includes three parts.

1. *A discussion of the ICCS process, including where/when follow-on meetings might be held, what sorts of themes they should explore, and how we can secure funding.*

The group designated a coordinating committee to guide the CSP, and decided the next ICCS would be held in Hamburg in September 2012.

2. *A discussion of the CSP knowledge management platform, including where this will be housed, who will manage it, and the principles that will guide contributions*.

The group decided that the knowledge management portal would be developed, and that it would take submissions from partners. The portal will be developed at the IRI, in collaboration with partners who will help define the principles that will guide contributions.

3. *An outlining of the most important working group actions.*

These included an examination of the chain of users, a review of methods to value climate services, and efforts to link to the GFCS.

Opening Remarks

Welcome Address

Stephen Zebiak
Director-General
International Research Institute for Climate and Society

Summary points

The provision of timely and tailored climate information in the form of climate services can help society limit the economic, ecological, and social damages caused by climate-related impacts and take advantage of opportunities provided by favorable conditions. But while the need for climate services is increasingly recognized, we are still not able to meet the need.

The goal of this conference is to construct a Climate Services Partnership that will facilitate international collaboration regarding the development and provision of climate services. The intent is to create a dynamic network focused on action. The Partnership will complement the Global Framework for Climate Services.

Keynote Address

Jeffrey D. Sachs
Director
The Earth Institute, Columbia University

Jeff Sachs focused his talk on the issues that we currently face, and are projected to worsen with global climate change. He pointed out that we already have crisis in food supplies, extreme weather events, disasters beyond national capacity, and climate plays the major role in these events.

His focal point example was the drought in the horn of Africa. Due to drought the area has experienced waves of instability that are associated with Climate disaster. These include unstable economies, high inflation, high food prices, famine, growing violence, high mortality and migration. The ripple effect can attributed to the regional backdrop of one poorest and most unstable areas of the world with soaring populations and a 20-25% secular decline in precipitation.

Sachs pointed to the fact that there exists little way to quantify the regional trend in the horn of Africa with current climate services. Governments have no place to turn to get climate information, or even get an understanding of what the scientific debate is about. The result being that climate information takes almost no part in international meetings. He illustrated how policy makers in a situation that clearly

involves the role of future climate, such a prolonged drought, were not seeking out climate information. Even if government or national organizations seek out climate information or forecasting, they have no way of engaging the science community. They have to go to multiple sources, which often provide conflicting information, and disseminate that information. This lack of communication results in climate services not entering the policy debate.

In order to remedy this problem Sachs called for downscaling services to bring global models to a regional level, on temporally relevant scales. He emphasized that the user would ask, what does this climate information mean for me, my city, my country, and my region? These questions are pertinent to decisions in every region of the world and there is a need for an authoritative and trustworthy place to get these answers.

He also suggested that every region needs to have a risk assessment capacity. Each region needs to identify how they are vulnerable and what they are vulnerable to. Once this is defined the region can take the next steps of how they can manage and reduce that risk. Both of these steps are connected strongly to climate services. Sachs also mentioned that even some regions who currently have risk assessments, do not have comprehensive ones as they do not include a changing global climate. By creating the proposed user interface there exists the opportunity to create these assessments with greater ease and more accuracy.

Sachs envisions a "call center" for forecast that would include a portfolio of risk for every region. This call center would be the first step in encouraging policy makers to get involved in the discussion and recognize the risk. It bridges the gap and makes policy makers feel less isolated from the science of Climate prediction.

Presentation of Global Framework for Climate Services

Jeremiah Lengoasa
Deputy Secretary-General
World Meteorological Organization

Jeremiah Lengoasa began his talk by pointing to the fact that society is informed by past experience. However, global climate change will ultimately affect changes in climate extremes. Therefore, societies past experiences are a poor judge of future climate impacts. In contrast, scientific climate knowledge and predication skill is increasing and improving at a high rate. There is a high need to communicate this new knowledge. He expressed particular interest in high impact climate events, even is they are low probability. There is a need to recognize these scenarios in risk assessments.

Lengoasa continued to discuss areas that are at risk for high impact climate events and noted that there is a sharp lack of infrastructure and capacity for climate

services in the countries that need them the most. There is a need for attention to be paid to these areas immediately with current climate information. His vision of this attention would be to create a global system to generate and electronically exchange climate data and products. Such a system would need to be combined with an initiative to have countries upgrade climate service capacities so they can contribute and participate in this discussion. Without this local contribution, regions will be weary of trusting incoming climate information. He suggested that climate scientists should create an initial suite of new knowledge products and apply it in a user based interface. The second step would be to create local and ongoing government mechanisms that guide framework and development of this interface to encourage participation.

While Lengoasa pointed to the importance of building climate service capacities on a regional scale he also emphasized that there has to be an ongoing collaboration worldwide. Partnerships are important to avoid duplications and optimize what data you have. While this idea of climate partnerships seem to be simple, it is one that is hard to implement and maintain, and it is certainly not occurring currently.

In his concluding remarks he again emphasized the system that needs to be implemented. It begins with climate services producing climate information, it proceeds to a global framework that ties together the current and future climate science capabilities, partnerships then maximize the potential of climate services, and a global user platform organizes the information and makes it accessible.

Regional Perspective: Climate Services in Africa

Bruce Hewitson
Professor
University of Capetown

Bruce Hewitson provided insight into climate services in South Africa and the global implications of the work. He emphasized that there exists a great awareness of global climate change, and that scientists are essentially "drowning in data", but these factors have not translated into large-scale action. He pointed to a cycle that is key to follow in the implementation of any action related to climate forecasting and decision-making. The process begins with data, it is translated into knowledge, awareness of the knowledge should be generated, and only then can appropriate action be taken. He alluded to scenarios where action was being taken based solely on data, and warned that such simplistic services can be dangerous and ultimately damaging.

Hewitson proceeded to discuss the multiples challenges that surround this process that ultimately leads to climate action. The first challenge is deciding what information is appropriate to act on. In other words, given the limits of predictability, and what climate information we need, how do we define what is good enough for a forecast? This clearly varies on time, spatial scales, variables, metrics, and applications, but there needs to be some standard that is articulated. If we can fulfill the perceived climate information need, then it can proceed to knowledge, otherwise it is unwise to act on it. Another difficulty that arises is how to inform a situation when there are gaps in knowledge, given that climate forecasts do not extend broadly, and are not absolute. Going along with this idea to improve and increase what information we do have, what are our best investments in knowledge production? What areas stand to benefit us the most and provide the most relevant knowledge?

Hewitson also described current issues with the proliferation of data with multiple motivations, data that is poorly articulated or confusing, and data that is hard to find or access. These difficulties underline why it is so difficult for non-scientists to get reliable and trustworthy climate data, as well as the need to establish a global framework for climate services. The data needs to be reliably and collaboratively translated to knowledge. Specifically knowledge that is written more as a "storyline" that conveys a robust message, instead of numerical conclusions that could be misinterpreted or confusing to the user.

Hewitson also echoed Lengoasa's call for local participation in climate services and analyses. He emphasized that he wants to help develop a sense of ownership in Africa. By building climate information capacities in Africa, and providing training to

build climate knowledge responsibly, it would ensure the ongoing presence of climate information in policy discussions.

Needs Perspective: International Federation of the Red Cross

Maarten Van Aalst
Director
Red Cross Red Crescent Climate Centre (RC/RC CC)

Maarten Van Aalst gave an overview of the Red Cross perspective on the needs relating to climate services. He argues that there should be a focus on not only about what information is possible, rather what information is possible than can be readily applied to decision making. To coincide with this focus on applicable climate forecasting, the climate services community needs to transform the view that policy makers have of climate services. Policy makers must be shown the value that is associated with good quality forecasting. This needs to be communicated well, however, with the limits of forecasting defined alongside potential skill of forecasting.

To bolster trust in climate services and accuracy, Van Aalst called for a method of accountability for climate science. Prediction skill should be discussed, known, and uncertainty understood. If these facts are well articulated then a reasonable decision can be made about the use of climate information in a given situation.

Van Aalst's call for the focus on climate information that has high impact on policy making arises from the need to implement action now on current information. He recognizes that early warning and early action are key to avoiding disaster, and the discussion must start now to affect the future. If a discussion and a regard for climate services is started within the policy realm now, they will be able to gather more forecast, on different time scales, resulting in the most informed decision available.

He urged that contingency plans are not just for when disasters happen any more, they are dynamic and ongoing processes that are essential to reduce regional climate risk.

Van Aalst says that these ideas are not based on the theory of climate services, but on past experience and lessons we have collectively learned from early warming. From such experience it has been demonstrated that "good information is good enough for decision making". While a climate forecast without uncertainty is impossible, there are good practices that can be implemented that are probable. There is a need to disseminate this current climate information and get it to the areas in policy making that will effect change. This continued outreach is key to the development of action in response to early warning.

Research Perspective: International Research Institute for Climate and Society

Simon Mason
Chief Climate Scientist
International Research Institute for Climate and Society

Simon Mason began his presentation with an exploration of not what is the answer, but what is the question? He asserted that there is a need to unambiguously define both questions and answers, which is not currently being done in a broad and effective sense. He suggested two types of questions that are important to ask in relation to climate services. The first type of which are questions that reduce uncertainty in what is going to happen with the climate. If we are able to be more confident in our predictions then climate services can be more helpful. The second question type is questions relating to reducing the misuse of forecast information. It is difficult to make use of different predictions when conditions and probabilities are changing. There needs to be a broader more user friendly forecast that eliminated some of the confusion that occurs when interpreting climate forecasts.

Mason made an important point to distinguish climate from weather. Climate does not translate to weather and the concern here is weather, specifically, extreme weather. Ultimately, how is the future weather, not the time average climate, going to affect us? Since this is one of the major galvanizing questions behind forecasts, what do our current forecasts tell us about extreme weather events? Can we take existing forecasts and use them to tell us anything about possible changes in the extreme weather events we are concerned about? He emphasized the need to make an effort to translate seasonal forecast predictions into questions that are relevant. For example, he argued that the user question is not, will there be heavy rains, rather will there be a flood? In order to communicate climate information better there needs to exist a change in the questions being asked.

He also highlighted that there exists good practice and best practice. Speaking to the scientific community, he understood that there is an ideal scientific way to get the bet possible answer to a problem. While these methods must be continually used to further climate research he questioned if they are the way to pursue action. He argued that we are not currently at the level of bet practice in many cases, but there exists many scenarios where we have a good practice that could be implemented with success. This distinction served to echo the previous calls to action seen throughout the previous sessions.

Mason ended on a discussion of the word uncertainty. He acknowledged the difficulty that has been experienced in the communication of the meaning of uncertainty in climate forecasts. His solution was to define the different types of uncertainty that exist. Perhaps by making this distinction it would be easier for the general public to understand that it does not mean the same thing as, for example, the measurement uncertainty when using a ruler.

National perspective: United States

Thomas R. Karl
Director
National Climatic Data Center
National Oceanic and Atmospheric Administration (NOAA)

Thomas Karl spoke about the US national perspective on climate services. While climate services use is relatively high in the US, he still sees a large capacity for change in the data that is available and the data that is used.

He began by describing the break out of data users, the large data users are in the educational community, 12% are in government, 5% of the users are the "dot-coms" (start up commercial companies), 30% represents international requests. He says that there is a great potential for this to change as climate services step more out of academia and into the mainstream business and government applications. Karl also pointed to the changing nature of the data. Looking at the role that dynamical models currently play in prediction, specifically relating to global climate change, he postulates that the amount of climate data will increase quickly. In very little time the data will be dominated by projections from various models, encouraged by the advent of super computers.

Karl touched briefly on the US Global Change Research Program. He described it as a process, with four major components. These components include, advancing science, informing decision, sustainability assessment, and communication education. Climate services have an integral role in the informing decision aspect of the process. This process served to underline the importance of climate services in global change action. He also mentioned the Global Change information system, which is aimed to make data and information more transparent, and more easily understood. He emphasized that need to for the ability to convey uncertainty and its meaning, as well as the value of the data being provided. He emphasized that is these programs are not functioning well, and the communication between policy makers and scientists breaks down, climate information becomes very poor, very quickly.

Karl tied together the various programs he mentioned in his presentation by highlighting that they effect society. He cited an example of the construction industry, and the cost they put into certain types of insulation, and techniques to make homes more energy efficient. Karl argued that with climate services, and the knowledge of how climate will be changing regionally, construction companies could change the insulation or depths of foundation to ultimately save money for the company and the homeowner. Will improved skill in more areas more opportunities such as this will arrive.

National Perspective: United Kingdom

Chris Hewitt
Head of Climate Services
UK Met Office

This talk addressed the following four questions:

1. Why have climate services?
2. What is a climate service?
3. What kinds of activities are going on in the UK?
4. What are some examples of climate services?

1. Why have climate services?

Climate services supporting decision making; the mitigation of climate impacts is of particular importance. Climate service customers include industry, colleagues, and government. Recent demand has focused on the near-time scales (seasonal and years) and smaller spatial scales (regional and local). We are exposed to weather, not necessarily climate. Impacts of hazardous weather are particularly important. There is a rapidly growing demand for the potential impacts of weather events. There is an on-going risk management process and a need to reformat data to cater it to user needs.

2. What is a climate service?

A climate service involve an end-to-end program:

Observations & Models ↔ Products and Services
Stakeholders and customers ↔ basic R&D ↔ IT ↔ applied R&D ↔ Partners

National weather services should expand to include a national climate services. We need to work with other countries and not for other countries in order to develop long-lasting partnerships.

3. What kinds of activities are going on in the UK?

The UK Met Office has created a Joint Weather and Climate Research Partnerships (JWCRP) to bring the UK community together. This has taken a long time to develop but is helping to engage education, industry, government and other sectors within the UK. This group engages on issues that are global, regional, national, local.

The UK Met Office has activities to move from uncertainty to probabilities (likelihoods). In 2000, GCMs provided projections for national UK projects to inform decision makers (didn't consider uncertainties and emission scenarios). In 2009 they used a large ensemble to take into account the uncertainties so they could then consider probabilities. This was more helpful for decision makers to understand the

likelihood of specific outcomes and their potential effects (used 30 year periods throughout the 21st century). This was used for the UK climate impacts program. The results were made available to the community through the UKCIP. These results were then used extensively within the UK risk assessment. Helped to identify particularly vulnerable parts of society. The Climate Change Act was developed in the UK in 2008 to determine the context of a risk assessment. They are currently looking at the findings of the risk assessment and it will be released to the public at the beginning of next year.

5. *What are some examples of climate services?*

Example 1: Core Climate Service. The UK Met Office coordinates with DECC and DEFRA to help inform policies.

Example 2: Thames Estuary 2100 Project. The aim is to provide advice for a flood risk management plan (specifically from storm surges). A partnership developed wave modeling and river flows and then determined the adaptability of the local area with respect to storms and sea level rise. The conclusion was that under extreme scenarios that the barrier would protect the area. Although following this conclusion it was realized that there was too much uncertainty involved and it was decided that more research needed to be done in order to address the uncertainties and assess in more detail the actual viability of the barrier in future scenarios of climate change.

Example 3: River Nile. The project examines river flow into High Aswan Dam.

Example 4: Global Risk Assessment. In collaboration with other climate scientists, the group received reports, twitter feeds, newsletters, updates about years to decadal predictions.

Example 5: DFID-UKMO. This example was driven by users. They spent a lot of time in Africa determining the needs on the ground and building capacity of scientists within Africa so there will be improved services within the countries.

The key focus of UK Met Office moving forward

Moving forward, the key focus will be to produce higher resolution forecasts to capture processes better on spatial scales that are relevant to the users, potentially using downscaling to do this. From this UK Met will look at probability predictions in order to determine applications for the data. They will deliver added value from the data that is already available. They are also starting to think about the needs of the GFCS and how they can make this program more effective and applicable.

Climate Services Case Study: NIDIS

Roger Pulwarty
Chief, Climate and Societal Interactions Division
NOAA

The goal of climate services is to make sure that information is informing adaptation. This involves an iterative process of learning and redesign. Climate services must also address the question of whether or not short-term decisions are enabling or restricting long-term risk. Different risks are apparent when you look at different scales.

For example, a drought in the Colorado Basin from 2000-2004 brought about the realization that we needed more of a reactive entity to facilitate climate risk management.
This led NOAA to examine a series of questions, specifically:

1. What are the windows of opportunity (i.e., what can we do)?
2. How is leadership at different level involved?
3. What sorts of collaboration between research and management are needed?
4. What kind of pressure for collaboration already exists?

The National Integrated Drought Information System (NIDIS) is a regional entity made up of working groups that feed into each other. These groups are divided up as components of an early warning system: public awareness/education, monitoring and forecasting, research and application. The groups then inform local entities who direct actions.

In order to inform action, they assess and match up the scale of the working group and then the scale of the informing agency that can implement the suggested actions. They then created a website to address specific questions that most directly affect people.

An example is drawn from the Colorado Basin, where collaboration to create a drought mitigation and response plan based on research outlooks.

The National Drought Policy Commission was established under the National Drought Policy Act of 1998 to ensure collaboration between different government agencies on drought-related issues. The Commission issued a groundbreaking report, *Preparing for Drought in the 21st Century*, in 2000. Following the Commission's recommendations, the National Integrated Drought Information System (NIDIS) was envisioned in a Western Governors' Association Report in 2004.

NIDIS involves weekly warning webinars in order to identify risk indicators. These identify critical thresholds in order to be able to identify “risk” in an appropriate

amount of lead time. The designers of NIDIS have made sure to focus on the vulnerabilities and answering questions that are helpful in addressing the risk.

At present, NIDIS is addressing a number of issues. First, there is a need for more locally based researchers to link local knowledge with the research. Other concerns are who provides the standards, who provides the coordination, who provides the funding, and how the local community is engaged.

Breakout sessions

The ICCS included two separate breakout sessions, in which participant split into three groups based on topics of discussion. Breakout groups were facilitated by a chair and were intended to be a forum for active engagement.

Elements of Successful Climate Services

The first breakout session focused on elements of successful climate services. During this session, participants engaged in discussion on:

1. **Identifying the Demand for Climate Services** (addressing issues of needs, evaluation, limitations, etc); *chaired by John Furlow, USAID*

2. **Creating, Accessing and Using Data** (addressing issues of socio-economic, environmental, forecasting, etc); *chaired by Carlo Scaramella, WFP*

3. **Facilitating Systematic Knowledge Exchange** (focusing on issues relating to mechanisms, capacity building, education, etc.); *chaired by Daniela Jacob, CSC*

Identifying the Demand for Climate Services

The breakout session was focused on identifying actionable priorities and ideas. The following question was used to leadoff the conversation: "Who is your target audience for climate services? And, how do identify them?"

Some of the groups that were identified as a target audience included sector specific organizations (e.g. forestry and agriculture), policy makers, decision makers, private sector institutions, the financial services industry, national/local governments, regional governments, the scientific community, the media and the general public. The broad range of target audiences listed shows the variety of institutions represented at ICCS and the wide breadth of demand for climate services. The breakout session participants also recognized that the user community is continuously changing and growing, which presents new opportunities.

In addition, it was highlighted that almost all the institutions represented in the room were both providers and consumers of climate information. The analogy of a climate service chain was used to show that providers, translators and users of climate services all function at different scales and interact with each other.

The next question that was addressed was "How can we understand and address consumer needs?" An example was given from the Senegalese meteorological

department's work with agriculture extension offices in Senegal. The Ag extension offices provided a link between the project and farmer focus groups, and set up in-person discussions. Direct discussions with the farmers helped identify the importance of the onset of the rainy season in Senegal, which allowed scientist to better target farmer vulnerabilities. In this case, the scientists identified a particular pilot region and a local agriculture extension office helped select farmers for group discussion. It was especially important to make sure that women were well represented.

The breakout group agreed that this pilot project served as a "good enough practice." It showed that it is often important to collaborate with groups that already have established networks and that it is necessary to have a dialogue with users to identify needs. However, this approach would not be appropriate at a larger scale. Climate services provide a challenge of both "personalizing" services and achieving scale. It was acknowledged that for service provisions it could be useful to use success cases as guidelines for others.

Along these lines, another good practice example was shared, this time from the financial sector. The example showed how a survey was performed to categorize the climate information demands of financial service providers. However, few of this consumer community could identify what climate needs they had or would have in the future. As a next step, it was suggested that the climate information users organize themselves to better be able to answer the survey questions. This example shows how the responsibility for identifying user needs can also be given to those on the demand side.

The breakout group identified that communication between climate information providers and consumers is not the sole responsibility of one party, but rather should be an iterative, two-way process. It is important to know the decision makers' needs, as well as their timeline for decision making. It was suggested that we need mechanisms to enable consumers to shape the services they need and processes/structures to enable community ownership of and trust in climate services. In addition, the group thought that it would be useful to better identify the role of the research and scientific community in climate services.

The participants also discussed that climate services should be tailored to best meet users needs and better enable strategic decision making. It was suggested that existing tools could serve as a starting point for looking at: What decision support tools have worked well and why? What are the challenges? What are the gaps in tools and how can they be addressed?

The participants' suggestions for next steps are grouped into six main categories:

1. *Sustaining conversation between consumers and providers of climate information*: The breakout group discussed mechanisms for eliciting feedback from the user community, creating an ongoing open dialogue

between producers and consumers, and refining climate services to better meet user needs. In addition, it was suggested that good practices on user/provider interactions could serve as learning opportunities.

2. *Enhancing decision support mechanisms*: Many decision support mechanisms already exist, in a variety of sectors, and this can serve as a starting point for assessing what types of tools are most useful and where challenges exist. It is also important to recognize that climate is one factor in complex decisions.

3. *Sharing knowledge and experience*: We can learn from each others' experiences and "good enough practices", as well as the identification of non-success stories Some useful guiding questions are: What types of partnerships are valuable? How has information successfully been communicated to users? How have users been engaged in product development?

4. *Mapping our roles*: The participants acknowledged the need to identify a "chain" in climate services that could help us learn from each other, share experiences and identify low hanging fruit. This typology could catalogue decisions being made, map provider strengths and consumer needs, and address questions such as, "Who are we?" and "Who do we target?". The mechanism could help us better understand our roles and responsibilities, identify potential opportunities, and connect to users and funders in the future. It is important that this serve as a tool to identify pathways for cooperation.

5. *Creating avenues for investment*: The group recognized that not only was it important to identify short-term goals, but it is also vital to discuss what could be accomplished with effort of a higher order of magnitude. There is a need to articulate a vision that encourages and inspires investment. It is also important to identify and interact with users who become champions for investment.

6. *Linking to other processes*: With a focus on demand issues, it will be useful to link to other process (e.g. GFCS, Rio +20). This connection can serve as a two way street, with the ICCS helping to inform other processes, while also learning from them. It will also be valuable to consider potential funding options when creating and sustaining these connections.

Creating, Accessing and Using Data

This group explored four main questions. Specifically:

1. What kinds of data are necessary for establishing viable climate services? What is good enough info?

The physical climate system is well understood although there are gaps in translating the raw data into viable climate services. Therefore what is important here is not discussing the climate variables and parameters but more so highlighting limitations in the application of the data. Impact Assessments- understanding impact related data that is currently available. It is vital that we understand the end use of the data before we can determine which parameters to use to produce the data/predictions/applications.

As you get closer to the user you need higher resolution data. Since error tends to increase as you decrease the spatial application of climate data, error and uncertainties need to be identified and later addressed before climate services can be integrated into decision making. You cannot simply define an over arching rule for classifying data as "*good enough*". Standards and the quality of data will need to be assessed at a contextual level. (We must consider the end users perspective and needs).

2. What can be done to enhance the ability to downscale and/or foster regional analysis?

The group decided they needed to agree on the fundamentals before we think about downscaling. Establish the scientific basis. (Scientific community must either accept or address the limited understanding of regional dynamics). They decided to take a look at the existing datasets, the statistical and dynamical downscaling approaches and the varying levels of confidence before we can speak to this decision of use.

Questions related to downscaling included how to improve the models or use the existing data and downscale. The group also discussed needs at different levels and how to pursue an end-to-end approach. It is important to consider all of the links in the chain of knowledge, keeping in mind that there is utility for end users to use information at various points in the chain of knowledge depending on the application.

The group also discussed how to assess the qualitative aspects of uncertainty. We should perform diagnostics of GCM vs. current day observations to test their validity before any kind of downscaling is considered. Shorter timescales is where the bigger challenge is and this is where the policy makers and end users are lacking confidence. Real time decision-making needs to be incorporated with climate data but first we must identify the limits of the data.

3. How to operate in data scarce environments – how do you set standards in different contexts/environments?

Data scare environments tend to also be the poorest and most disaster prone. There is a need for standard of transparency in the climate services implemented in these areas since the setting of desperation can sometimes lead to the implementation of

whatever is available rather than the best possible solution (ex. can't just use a model because there is no baseline data). One possible solution is to collect as much data as possible and then look at what models you can apply and assimilate with remote sensing data. For example in Ethiopia a group has coupled sporadic metrological station observations for rainfall and temperature with satellite data to fill in gaps. After realizing the value of this Ethiopia example the group realized the critical need for a forum to share experiences. There is a tremendous potential for value added through sharing experiences of trial and error.

4. What priority investments are necessary in the immediate (globally, locally)?

Rather than continuing to "reinvent the wheel" the group has articulated a desire to recycle, refine and reuse global data sets that are already available rather than investing in new research projects. There is an incredible investment potential in pulling information out of underexploited historical datasets. In order to see where we are going into the future we need to establish a baseline of where we are. We should think about this as a set of building blocks and concentrate on a strong foundation before we get ahead of ourselves, this includes focusing on improving data assimilation techniques and model techniques while continuing to develop tools and techniques (not simply more data).

5. Should climate data be freely accessible?

When asked if climate data should be free and accessible the majority of the group agreed that it should. Experience has shown that when climate data is available for free it is consequentially accessed by 10x more users. According to this group, free and accessible means data gets used, otherwise it hardly gets accessed by people other than the generators of the data themselves (money is prohibitive). Another positive effect is that having it publically available encourages and enables additional research.

The only concern that surfaced relative to freely accessed data was the potential misuse or misrepresentation of data. There are inherently different uses and caveats that come along with model outputs vs. observational data vs. gridded/assimilated data. If data is used without a full understanding of its source and limits it could potentially be harmful to the credibility of the science community as a whole. A suggested solution to these concerns is including a disclaimer when accessing the data.

Facilitating Knowledge Exchange

The goal of knowledge exchange is to communicate between providers of climate data and users; there should be a flow/dialogue of information between these two actors, not a one-way communication.

The breakout session addressed the following questions:

- What is a knowledge management system?
- What is knowledge?
- Is management the best word/philosophy?

What is involved in knowledge management? There are three levels of knowledge management: structure (how the info is organization); management (how we provide guidance to user); and how, through management process, the management system creates new demand for knowledge. Internally to the knowledge management community, it is important to share lessons learned and methodology internal to the climate service community. Concrete suggestion: conduct a survey of existing knowledge management systems, how do they work, are they applicable to this project?

How are we defining knowledge? There was a discussion of information vs. knowledge. David Grimes posited that information is different from knowledge: knowledge is information that has been fused that with other things the user knows, his worldview, history, etc. Knowledge is info that we need to survive (and prosper), and the managers job is to make that information discoverable. The other main discussion was whether the system should be structured around a top-down approach (take the data/information already available and structure it in an appealing way) or bottom up (identify needs of policy makers and then build data/information around that). The general consensus was that both are needed.

What are potential knowledge products? Demand perspective is very broad; could get buried with trying to sort out who needs what. In terms of addressing all stakeholders' needs, a more practical approach is focusing on capacity building so that the communities are able to answer the questions for themselves (ex. Helping farmers to use climate information more sensibly to enhance their productivity; key aspect is to help them create the products they want).

*Potential Models for knowledge management systems include***:**

- NCAR's system: designed for specialists and then re-developed for a broader community through an iterative process.
- IRI's project with the Red Cross: a very specific group of stakeholders came with clearly defined needs/objectives, but the project still has broader

transferability.

- The CSC Climate Navigator: this is basically a portal to provide users with info and contacts. We could have an international website where we highlight some problems that occur in hotspot regions, provide data about those regions and list of people who are involved with studying them, so customer can contact them.

Enabling Successful Climate Services

The second breakout session focused on enabling successful climate services. This session included discussion surrounding the following breakout topics:

1. **Engaging the Scientific Community** (addressing issues of interdisciplinary, cooperation, collaboration, etc.); *chaired by Sylvie Joussaume, Paris Consortium on Climate-Environment-Society*

2. **Designing Policies and Institutional Partnerships** (addressing issues relating to the influence of science on policy makers and their uses, etc); *chaired by Shiv Someshwar, Columbia University*

3. **Establishing Innovative Funding Mechanisms** (addressing issues relating to business models, public support, private funding, adaptation funding, etc); *chaired by Kanta Kumari Rigaud, World Bank*

Engaging the Scientific Community

This breakout session addressed three questions:

1. What is the best way to involve the research community in climate services?
2. What is the best way to encourage interdisciplinary and foster cooperation across disciplines?
3. What is the best way to define a research agenda and set priorities for a global framework of climate services?

The first issue addressed by the group was how to best involve the research community in climate services. The group agreed that climate services must be closely tied to research in order to maintain credibility. To create that link, climate services must have a means to entrain research and address a number of demand-oriented topics. An underappreciated link in this chain is the transition between pure science and a usable project; this often requires more work and money than people initially suspect. The group also found that the evaluation system in universities should recognize the value of demand-oriented research that goes beyond publication. Furthermore, the scientific community must also recognize that is not only a knowledge-provider but a key user of knowledge. Sufficient funding is essential in order to address these issues.

The second issue addressed by the group was how to encourage interdisciplinary and foster cooperation across disciplines. The group found that a need for integrated information that reaches across diverse disciplines. One way to encourage this is to support problem-driven research that seeks to solve a real-world issue. The group also found a need for more interdisciplinary education at all levels, especially master's and PhD programs. A very difficult

issue with interdisciplinary collaboration is technical jargon and the inability for specialists to be receptive to the voices of specialists outside their field of study, or even understand their vocabulary.

The third and final issue addressed by this group was how to define a research agenda and set priorities for a global framework of climate services. The group found that it is essential to define the research agenda in terms of solving real-world problems, using science as a means to an end rather than the end itself. The research agenda must span all disciplines – the natural sciences, social sciences, private and public sectors, journalists, and users of climate service information. The group concluded with the message that the whole of climate services is necessarily user-driven. Researchers must realize their potential as not only academic investigators but real-world problem-solvers, and work together with specialists outside of their discipline to achieve a useable result.

Designing Policies and Institutional Partnerships

This breakout session discussed issues surrounding climate services policies, institutions, and partnerships, related but each distinct. The group considered national, regional, and international scales of servicing, and took into account the global institutions with strong processes already in place. Group members offered recommendations for effective policies and partnerships, and the session concluded with an identification of key roles for ICCS moving forward.

Key policy questions were considered:

- What is the approach for fostering a system that starts with science but interfaces with multiple users and takes into account their needs, values and priorities?
- How do we build on existing institutions?
- What kind of policy capacity building related to regional institutions and countries should be considered as part of a climate service delivery system?
- Given that the process of defining policies, particularly at a national level, can be very long, what can be done in between? How do you begin to frame the right kind of policies?
- What is an effective approach for engaging the relevant policy community?
    - Who initiates?
    - Good practices in developing policy dialogue in promoting wider development of climate services?

Recommended Practices:

Multiple group members expressed the importance of demonstrating the value of climate information to policymakers, and recommending the creation of projects that demonstrate its benefit, thus building trust in the scientific community and

enabling policymaking negotiations to move a step forward. It was noted that looking at specific sectors is an effective way to start identifying needs and capability to meet them. Partnerships can be built out from that, with demand the primary determination. Governments and agencies within a country inform the aspects of climate services that you can be engaged with.

Role of ICCS:

Group members then turned to discussion of the role of ICCS in the context of the policy debate around climate services. Major questions included how to support a vision of creating an enabling environment for climate services, and how to support and empower regional actors. The goal is to enable policy and embed knowledge into existing institutional systems without setting up a new institutional universe. Standards setting for those who are able to address context-specific issues in different contexts was a major theme. Bringing together case studies on regional or sectoral issues and sharing best practices at national, international, and subnational scales was also mentioned.

Possible regional/national/subnational case studies:

- ACMAD is a prototype framework for regional climate services. How well in the policy and institutional sense is it equipped to be a regional component of the global framework for climate services?
- The Victorian government in Australia has worked to better connect with stakeholders. Set up a center for climate change adaptation research; gave grants to universities to support development projects to provide info useful to various portfolio sectors. Operates as a clearinghouse. Links were built to outside expert groups. Facilitates an interface between researchers and government managers; establishing strong links between researchers and policymakers. The model is not yet proven, but something to watch.
- In Africa, Regional Economic Communities develop strategy and policy; issue of climate has become more important. To be able to provide the response to the RECs, have to have partnerships with developed countries. At the national level: regional entities provide climate information for national weather services to help them produce climate services. Also a place to have a dialogue to share strengths and weaknesses. Demand established with RECs; regional entity is empowered to mediate the relationship between national services and international organizations.
- Brazil: climate change legislatures at the state level. Hired scientists from the community to help the local government. Helped promote writing of legislation.

Concrete goals for ICCS:

Concrete goals for ICCS moving forward were identified. There was consensus that Rio+20 is an excellent opportunity to showcase the role of ICCS. ICCS could assemble cases that challenge the world body for action and make a case for the necessity of ICCS at national/international levels. The possibility of focusing on low capacity countries was raised. A demonstration project of how resource requirements can be mobilized to demonstrate the enhancement of capabilities in these critical countries, and associated with the actual value of climate services in enabling economic productivity and/or social dimensions of the country itself, was recommended. The value of investments in national climate services capability is not necessarily clear to policymakers yet; targeted initiatives that demonstrate the value will help with the political organization. There is a very strong correlation with the necessary investments in individual countries and the international community's ability to share resources and knowledge. The possibility of producing a first edition of guidelines on establishing national climate services was raised, although questions of its utility given diversity of national policy systems and arrangements were also brought up. A more productive way of moving that idea forward might be to focus regionally and/or on specific human development oriented aspects.

Overall, there was consensus that the demonstration of collective capacity by focusing on a highly vulnerable region and how capabilities there can be enhanced through coordination, collaboration, and knowledge sharing would be a productive goal for ICCS in anticipation of Rio+20.

Next challenges for ICCS:

- Demonstration of impact of climate services on economic productivity can enable developing partnerships with people who work on economic growth. Develop metrics that include climate. Embed info in finance and planning agencies.
- There are significant economic barriers in developing countries to accessing markets in the West. Link climate info with agricultural productivity, and national governments in these countries will pay attention. Examining twin impacts of globalization and climate risks. Linkages between countries.
- The landscape is incredibly different today. Institutions like IRI have reframed how we talk about the climate challenge. Tremendous opportunity at Rio+20 to showcase what has been accomplished since 1992, and set up the next generation of challenges for this community and for society in learning how to use this climate information. Individual case studies may not be high level enough to establish the broad impact of this community and its accomplishments.
- Targeted initiative to coordinate capabilities for the most vulnerable countries

- Story of West African floods in 2008: the Red Cross put out an international appeal for some funds to take advance action before the rainy season; didn't raise any money. The basic problem is that essentially no country has a policy for providing funding for disaster relief before the disaster actually occurs. We could propose that countries start considering establishing a fund, perhaps targeted primarily for benefit of the LDCs, that would allow advance preparedness measures to be taken on seasonal timescales—a risk transfer mechanism that includes funding, sharing of knowledge.
- Emphasize the capacity to respond. From this perspective, it is not just the LDCs that are most vulnerable. Grand challenges in Rio 1992: brought policy & science communities together in framing those documents. Need a mechanism that connects with and actively engages the policy dimension. Not socioeconomic science, but actually engaging the policy component so that they can start articulating the needs in their countries.
- Rather than this community identifying the most vulnerable, establish communication with organizations that are in the position to respond and can determine how information is being used and what is needed. Enable those that work with the most vulnerable to come to the Met community.

Establishing Innovative Funding Mechanisms

This breakout session explored current business models in climate services. These include:

- engaging the private sector
- public sector funding
- public-private partnerships

The group believed that private sector engagement was useful, but time consuming and that the private sector would not serve many of the most vulnerable. The group also mentioned that businesses want public data to make private sector products.

Public sector funding may be more applicable at smaller scales, where as public sector funding is more applicable at larger scales. In addition, there should be a link between the magnitude of the funding and the magnitude of the climate service, although give the nature of climate services as a global good in some cases, there are limits to this integration.

In terms of partnerships, there are examples in which investment banks help fund private sector (i.e.: European Investment Bank).

Moving forward, the group should work together to develop climate service outlines with private/public sector, and to identify successful business models for public goods (particularly by showing that products are valuable and necessary). This will

allow the group to outline the economic benefits of adaptation. A Stern-like report for adaptation may be in order.

Climate Services Partnership Working Group Discussions

Based on discussions during the conference, participants grouped into five working groups to discuss actions that a voluntary alliance could engage in over the next 14 months. These groups, and a brief treatment of their discussion, is included below.

Knowledge Capture

Steve Zebiak introduced the working group session focusing on managing knowledge amongst the Climate Service Partnership (CSP) and the larger community. He stated that, collectively we have a lot of knowledge, but currently we do not have a way to share this knowledge or benefit from what each other is doing. A knowledge sharing process based in the CSP collaborative effort could help us to better learn from one another. Steve then highlighted the need for the creation and development of a mechanism to facilitate how information is extracted, processed and synthesized. He stated that it will be important for this working group to further discuss what type of knowledge capture mechanism would best suite the CSP and what information should be highlighted (e.g. Who is involved in activities? What tools are being developed? How are users engaged?).

Zebiak then put forward a contribution from the International Research Institute for Climate and Society. He suggested, that if accepted by participants the IRI would like to offer to facilitate the 1st year of activities surrounding knowledge exchange. This would involve providing staff support, coordinating the development of a knowledge management system and working with the CSP to provide content. Steve emphasized that this is a group process and will rely on collaboration with the Partnership and working group.

This potential contribution stimulated further discussion on what a knowledge management system should entail. The group discussed that the knowledge management/capture system could be a portal, Web site, database, etc. The use of social media was also mentioned.

Participants agreed that a good first step in developing this mechanism would be to look at what types of systems and tools already exist. Some important questions to answer are: What already exists? How does it work? What audience does it target? What information does it share? What are the gaps? It is important to keep in mind that there are many knowledge management systems that are not well utilized or developed, and these can serve as learning opportunities. It is also critical to consider that many of the members of the partnership already have portals. The

knowledge management system should not add redundancy, but rather build on what already exists. The working group highlighted the need to look into the European Environmental Agency's Climate Change Clearinghouse project, which is a potentially similar effort.

The working group came to the consensus that many of the organizations present were interested in contributing, but not if the financial and time costs are too significant. This highlighted the need for a mechanism that is valuable, yet not too taxing on partners. Participants reiterated that there would need to be a balance between having a useful system and one that is easy to contribute towards. A couple of suggestions were put forth in order to increase ease of participation. One recommendation was to provide a clear form for contributors. Another idea was that a small team of people could help organizations contribute to the knowledge system.

The application of the system was then discussed. It was suggested that the Partnership should establish an inventory of existing climate services, identifying some interesting activities and listing the persons/groups involved. This inventory should provide information on CSP partners and other institutions relevant to climate services. The system should also be searchable by topic and region. Another recommendation was that the system should provide information on institutional structures and business models. Using the analogy of a climate service chain, participants thought it valuable for the system to highlight how providers, translators and users of climate services all function at different scales and interact with each other. An analysis of these structures could help better define what we are doing as a partnership, if we are addressing climate services and how we can better relate to each other. The working group also agreed that case studies would serve as a good tool for sharing experiences, learning from each other and identifying effective practices.

The question was then posed, "Should case studies only highlight the work of partners or should other projects be considered? What about projects that are outside of our mandate to commit?" The group decided that the knowledge sharing system should include a diversity of partners, be open to new partners and collaborate beyond the partnership. The mechanism needs structure, but also should be positively chaotic and informal. It was also mentioned that case studies might be outdated within a year or two, and a process would be needed to avoid outdated and irrelevant material.

An analytic framework, or systematic approach to assessing case studies was then discussed. One participant pointed out that full evaluations are quite costly and it is difficult to control for biases. A simpler first step is to create an inventory of what currently exists, document and describe case studies, and systematically review and identify states of evidence for each sector.

The working group identified the need to have a standard evaluation process so that the information could be compared across case studies and main messages could more easily be distilled. The method of creating a checklist of questions was proposed (e.g. what types of information are used? How is information communicated to users?) The group emphasized the value of identifying the basic elements of each case study that can most easily be adapted to work in different circumstances. The working group also acknowledged the need for quality control, and a system to verify that case studies are from a trusted source.

The working group was then asked, "Why would an organization want to participate in the CSP and contribute to the knowledge management system?"

The group agreed that both established and emerging climate service institutions, as well as developed and developing country participants would find the CSP and this system beneficial. The Red Cross Red Crescent Climate Centre felt that contribution to the knowledge management system was valuable because it helped them better document their work. In the past, they have documented case studies through the use of young professionals who interact directly with projects to capture information. This also helps to provide a broader dialogue on the issue, as a third party is involved. Other participants mentioned that such a knowledge sharing system would help them learn from other countries and institutions, while providing a sense for the types of activities in a region. It was also suggested that such a system could help connect users with local contacts for projects, sector specific activities and members of the scientific community.

Next some concrete next steps and contributions were proposed:

1. IRI reiterated that it would facilitate the establishment of a knowledge exchange system, with collaboration from the working group and the CSP.

2. Develop collaborative fact sheets and risk maps, pertaining to present and future climate information and potential impact, for different regions and sectors. Members of the CSP could work together to provide consistent and applied information; currently there is a lot of redundant and contrasting information that exists and this is confusing to users. However, some issues were raised regarding this project: Would these fact sheets be supported by the CSP? It may be difficult to draw a consensus on the information distributed and not all organizations may be able to support the effort. The Climate Service Center, Germany, has offered to lead this process.

3. Develop a collection of case studies and other pilot projects, which are quality controlled and reviewed through an analytic framework in order to draw out lessons learnt. The Red Cross Red Crescent Climate Centre proposed to lead the development of disaster risk management case studies that could offer regional or crosscutting perspectives. It was also highlighted that case studies from the food security sector would be particularly useful, however no lead institution came forth.

Identifying User Needs

The identifying user needs breakout group addressed the following questions:

- Who are the clients and what climate services are provided to them?
- Who does your institution rely on for climate information?
- What climate service does your institution use, need, or want?

The group considered *networks and information chains*. It is important to recognize that different organizations have different needs and services that they therefore have different opportunities and challenges. It is also important to consider the users and the mechanisms that they use to communicate back up through the chain. It is important to acknowledge the *two-way nature* of climate services. Our goal should be get past the supply/demand dichotomy and realize that most of the organizations/institutions present at ICCS are both suppliers and users of climate information at different scales. *Case studies* are valuable tools for ICCS. They allow us to understand who is using information, how they are using it, and what information ultimately gets fed back to the provider. They also shed light on what does and does not work and illustrates which practices from the private sector can be transferred to our climate services arena.

In the next 12 months the group can do a survey that asks within our networks:

- Who are you a client of for climate information and services?
- Who are your clients? (Or categories of clients, for bigger institutions like NOAA).
- What services do I want?
- What services can I provide?

Answers to these questions will enable us to map the network and identify a typology of focus areas and users. With this information we can minimize duplication and see where groups fit. No climate service provider can go from end to end, bringing climate science all they way down to the community. We need to figure out where we fit, who's working at what level and where the gaps remain. Some groups may be serving similar clients, but with different information and we'll need to investigate why. We will be able to see how from global to regional to national to local levels different users will need different types of information.

We might also ask:

- How do the users of the information I provide give me feedback on how it works for them?
- Where can we attribute successful use of climate services?
- Where should we be capturing lessons learned?
- How can better tailor products and services to meet user needs?

We also would like to bring a couple of case studies to Rio +20 on good practices and lessons learned in identifying and catering to user needs:

- One case study from the Regional Committee for Hydraulic Resources (CRRH) about how you channel information to one user group without damaging another. And how information can pass through networks in a responsible manner, since climate information is not inherently 'do no harm.'
- One from the Red Cross on a methodology of identifying user needs through climate-smart versions of community Vulnerability Capacity Assessments.
- Good practices from the private sector that might be transferrable.
- Would like to open case study opportunities to others.

Currently climate information is supply driven. We need to flip that so it is demand driven. We need to be more proactive to ensure we are getting the right inputs into the research agenda. An additional strategy to achieve this could be through structured learning dialogues around climate services between information providers and users at global, regional, national and community levels -what information can we generate and how can we use it?

Good Practices in the Use of Climate Information

The discussion of "good practices" touched on both *policy engagement and technical issues* (i.e., downscaling, projections). To establish good practices, we must *identify the gaps* between the research community and the climate services users. We must also identify where more work can be done in seasonal forecasting on the international strategic scale.

Three specific activities are proposed:

1) A simple questionnaire can be sent out to ICCS attendees along with a summary document. Attendees will be asked to identify what links their institution's climate services activity with climate research.
2) In depth case studies can be conducted in order to identify what works well and what can be done differently in the future, especially in the context of emerging information.
3) Workshops on disaster risk reduction can be conducted.

The *Red Cross* explained that partnerships never take off immediately. They require the development of trust on behalf of the local community. The Red Cross then discussed its *partnership with IRI* (as an example of good practice) and presented various aspects of said partnership that have made it a success thus far: face-to-face meetings, shared office space (to ensure that products are both applicable and appropriate), an internship program (which serves to bridge various organizations), joint advocacy, documented experience, and tailored projects, which are supported through a help desk (that is, an international email system that responds to questions regarding products and weather related issues within 24 hours).

The World Food Programme also contributed its perspective toward climate services. It is both a user and provider of climate services: because climate is so relevant in determining food insecurity, WFP is particularly reliant on projections. They also acknowledged the importance of partnerships, and specifically sited that they work with other NGOs in the field. They are very interested in establishing an interface between the scientific community and humanitarian actors.

Economic Valuation of Climate Services

Framing is critical when attempting to determine the value of a climate service. Because climate services encompass a vast range of actions it is important to first determine the appropriate framing in order to assign them monetary value.

For example, some climate services are characterized by their **time scale** – historical, current data, forecast, model projections; because there are different prediction products on different time scales, you would need to consider different financial value models to evaluate them. Other climate services are defined by the **sector** in which they are serving, for example climate services catered to agriculture, health, or water. Lastly you can characterize climate services by the **benefits** they produce. For example, some climate services lead to increased crop yields, decease lives lost in extreme weather events, decrease infrastructural damages and inform investors.

Given the dynamic range of framing techniques, how do we give a value to the multitude of climate services on a single scale? What could this partnership eventually produce of value to help inform the economic evaluation of climate services and policy development?

> **One approach:** start from the service/use (end point) of the data in order to determine what climate data service will be appropriate to address which issue. In order to establish value we need to define the user's needs.
> **Alternative approach**: allow the users to see what climate services are available so they can determine which data would be most applicable. In order to begin this process need to develop a climate services vs. sectors matrix.

*Things to consider***.** In order to determine the metrics of different climate services, you must consider the end user benefits to assign them a value. When thinking about the benefits of climate services it is important to keep in mind that when applying this data, climate intrinsically translates as weather. We must determine how to define "economic value" in terms of benefits vs. avoided damages. There are tools available to determine the value of mitigating loss. EX. Hurricane damage-property damage vs. storm size (GIS tool for the Gulf of Mexico).

We should also consider the incremental benefits of developing these services for example jobs created along the way. Benefits of some climate services don't always go to the sector or region that invests in them. Ex. US brining down carbon profile- other countries would benefit. Population demographics and land use change complicate climate change evaluation. Early warning system: uses ongoing climate services to inform how it works – how do you value a 3-month forecast without looking at how it is used? Ex. How many crops are saved?

There are evaluations already done but they focus mostly on specific case studies and cannot be generalized. Central Asia case study has come to the conclusion that an additional dollar spent on climate services had a payback ratio between 1:4 and 1:50.

Challenges. There will potentially be an issue in attributing/differentiating climate vs. meteorological products. There are also papers about coral bleaching and the future effects on coral reefs and breeding grounds. But how do we evaluate the ocean. Climate services resources compete with other development projects and in some cases are integral parts of development projects although often times they are not identified as "climate services" (ex. Agriculture projects, water management project)

Suggested actions:

1. Pick out key services and user groups and produce case studies to quantify their value by characterizing the benefits identified in these case studies. The actual amounts are not as important as much as the benefits identified. We can currently show what the benefits are for some climate services in developed countries (flooding, hurricanes) t. From these we know that adaptive capacity affects the value of climate services. Ex. The effects of earthquakes on Chile vs. Haiti. (Even though earthquakes are not climatic)
2. Look at how many times people look at data over a month- economic value determine by human contact. This is meteorological.
3. Demonstrate robust features that give a rough estimate of the value (pragmatic approach) and give a range for informing decision makers
4. Possible pass off this study to another organization (possibly funder, financial, monetary) to create process or protocols.
5. Review conclusions from the up and coming "Earth Summit" conference where end users from multiple sectors (academia, energy, agriculture) will explain how climate services have furthered their mission.

In conclusion the group has decided to work towards developing a sector (and inherently temporal) vs. climate service matrix to begin the process of first organizing and later evaluating the metric value of different climate services. The group plans to meet as a working group within coming conferences over the next year. Possible forums for hosting this working group are the EGU, AMS and The Earth Summit.

Linking to the GFCS and Other Processes

This group discussed how to link to the GFCS process. This group can support the implementation planning and process – this is being developed now and our input is welcomed and needed. The group can also identify how specific activities determined at ICCS can be incorporated. This group and process needs to be a mutually reinforcing partnership (ensure systematic links between the two).

The group decided they could illustrate the utility of climate services and how they can be done successfully. Climate services are growing in importance – we can certainly bring that to the table. There are obviously different engagement plans that are already in the works, but if there is a common objective that we want to achieve, then having a roadmap of things we want to achieve would be vital. Lets develop that roadmap… after having solved the existential process of who we are.

When discussing how to link to other processes (Rio+20, UNFCCC, etc.), the group was constrained. The group felt the ICCS/CSP banner was not tangible enough to proceed. In addition, balancing the interests of individual institutions with that of the collective. The group also acknowledged that the ICCS as a partnership of institutions can only go so far to incorporate the concerns of member organizations.

Climate Services Partnership Action Plan

Fostering connections: the ICCS Process

Steve Zebiak
Director
International Research Institute for Climate and Society

In order to move forward, ICCS needs a coordinating group. This group is especially necessary for planning these types of conferences, which take time. Anyone who is interested in getting involved is welcome.

Additionally, we cannot wait for one year to pass before we act again. Rather, we need continuity on a more immediate timeframe. To interact via other relevant processes, we need to be continually engaged with each other's work and we should work in tandem with GFCS in the year before ICCS II in Sept of 2012.

Sharing Lessons Learned: CSP Knowledge Capture Portal

Guy Brasseur
Director
German Climate Service Center

This group identified three actions that can be taken immediately:

1. Developing a knowledge capture portal where participants can share knowledge and lessons learned.
2. Develop fact sheets about present and future climate for different regions of the world.
3. Producing a synopsis of organizations currently developing or using climate services and explaining how they relate.

Creating new knowledge: CSP working group actions

Each working group identified several actions that can be accomplished before the next ICCS meeting, scheduled for September 2012. These actions are included below.

Economic Valuation of Climate Services

This group identified three actions that can be taken over the next year:

1. Expand their ranks to establish a working group with representatives from both climate service practioners and economist
2. Meet both face to face (e.g., AMS in January; at the European Geoscience Union GA in April) and virtually.
3. Complete the climate service user matrix found in your presentation, identify existing research on valuation of climate services, to reach out to others, and to solicit feedback.

Good Practices in Climate Information

This group identified three actions that can be taken over the next year:

1. Questionnaire for meeting participants: What links exist between your climate service activities and a) the climate research community and b) users. This will result in a summary document that will highlight current approaches.
2. An in-depth case study of the IFRC-IRI Partnership to Save Lives.
3. Contribute to a workshop on climate services & disaster risk reduction.

Identifying User Needs

This group identified two activities that can be pursued over the next year:

1. The first of these is a information chain survey. This will allow the group to identify where in the chain different actors fit, and to illuminate the different needs of different groups.
2. The group will also perform case studies to identify any good practices in identifying user needs that may be transferable.

Knowledge Capture, Transfer and Exchange

This group identified three actions that can be taken over the next year:

1. Developing a knowledge capture portal where participants can share knowledge and lessons learned.
2. Develop fact sheets about present and future climate for different regions of the world.
3. Producing a synopsis of organizations currently developing or using climate services and explaining how they relate.

Linking to the GFCS and Other Processes

This group identified two actions that can be taken over the next year:

1. The CSP should support the development of the GFCS implementation plan over the next 12 months. (Note: an outline of the implementation plan is now available).
2. The CSP can provide specific activities to be integrated into the GFCS implementation plan, providing concrete activities for the 2, 4, 6, 10, and longer-term milestones that the plan will include.
3. A systematic link between the CSP and the GFCS at a management and coordination level needs to be established.

Concluding Remarks

Steve Zebiak
Director General
International Research Institute for Climate and Society

The end of ICCS I is the beginning of the Climate Services Partnership. The group has come up with many good ideas but now must organize for future activity. The Coordinating Committee of ICCS will be critical for this, and all institutions are welcome to join. This Committee will take the ideas produced from ICCS I and work to develop them. The Committee will also communicate those ideas with the rest of the conference attendees and IRI will serve as the central point of contact.

The knowledge management process is still developing and the resulting framework will be made known to all attendees, as will future developments with regard to the Conference Statement. The Committee will send out a revision of the statement based on the comments from this morning. Attendees will then have two weeks to submit further inputs. The Committee will distill those comments and communicate the re-revised Statement. Lastly, the Committee will be in touch regarding specific plans and a timeline for the upcoming year. It welcomes ICCS attendee contribution

to planning and would like to get a sense of the activities that each institution is presently involved with that could be of value to the knowledge exchange. The Committee will be in touch with each institution regarding those activities and will begin to compile information.

Appendices

Appendix 1: Conference Statement

The first International Conference on Climate Services met in New York on October 17-19, 2011. Already involved in a range of activities to develop and utilize climate services, participants agreed to form an open and informal Climate Services Partnership (CSP). The CSP is a global partnership that links climate service users and providers, creating a system of knowledge exchange that will help nations and individuals to thrive in the face of a changing climate.

To this end, the CSP will inform climate-smart decision-making for the benefit of society. It will help analyze and foster innovative practice and policy, establishing how effective climate services can help to achieve climate-smart decision-making and ultimately resulting in better development outcomes. The CSP will explore and improve processes of engagement between climate information providers, decision-makers, and policy communities.

The CSP effort will also advance the Global Framework for Climate Services, a formal international system to achieve coordinated support to the development of climate services worldwide.

Over the coming 12 months, the partners in the CSP have agreed to work together to:

- Establish a mechanism to share knowledge and lessons learned. This involves:
  - Outlining an initial framework for knowledge capture
  - Contributing their own experiences to the knowledge capture process in the form of case studies and evaluations
- Identify priority areas for focused attention in the development of new areas of knowledge, and to pursue mutually agreed-upon common work agendas around these areas, including:
  - Methods and structures to provide advice and support in identifying and developing the economic value of climate services and establishing good practices in policy engagement.
  - Establishing useful strategies for identifying user needs, in the use of climate information, and in bridging the gaps between science, practice, and policy communities
- Determine mechanisms and avenues to support the Global Framework for Climate Services and other relevant and interested initiatives, including:

  - Supporting the GFCS implementation plan
  - Providing specific activities to be integrated into the GFCS implementation plan at 2, 4, 6, 10, and longer-term milestones

- Continue the ICCS process to encourage continuing connections between climate information users, providers, researchers and donors.

  - Establish an open CSP coordinating group in order to answer questions of broadening membership, coordinating joint activities, sourcing funding, and planning the next ICCS.
  - Prepare for the next ICCS, which will be held in Hamburg, Germany, to take stock of CSP progress and wider progress on linkages between climate information users, providers, researchers and donors.

Appendix 2: Agenda

International Conference on Climate Services
October 17-19, 2011
NY, NY USA

Monday, October 17

8:00 a.m. Registration and Continental Breakfast

Plenary Sessions: ***Climate services in context***

8:30 a.m. **Welcome and Introduction**
Stephen Zebiak, Director-General
International Research Institute for Climate and Society (IRI)

9:00 a.m. **Keynote: Climate Services for Decision and Policy Making**
Jeffrey D. Sachs, Director
The Earth Institute, Columbia University

9:30 a.m. **Presentation of Global Framework for Climate Services**
Jeremiah Lengoasa, Deputy Secretary-General
World Meteorological Organization (WMO)

10:00 a.m. Coffee break

Panel discussion: ***Climate services in practice***
Moderated by **Chris Hewitt**, Head of Climate Services, UK Met Office

10:30 a.m. **National perspective: South Africa**
Bruce Hewitson, Professor
University of Capetown

10:50 a.m. **National perspective: United States**
Thomas R. Karl, Director
National Climatic Data Center
National Oceanic and Atmospheric Administration (NOAA)

11:10 a.m. **Needs Perspective: IFRC**
Maarten Van Aalst, Director
Red Cross Red Crescent Climate Centre (RC/RC CC)

11:30 a.m.	**Research Perspective: IRI** Simon Mason, Chief Climate Scientist International Research Institute for Climate and Society
11:50 p.m.	Discussion
12:30 p.m.	Lunch
	Side Event **Global Framework on Climate Services:** **Delivering Climate Information for Sustainable Development** World Meteorological Organization

Breakout session: ***Elements of successful climate services***

2:30 p.m.	**Introduction of breakout groups** Guy Brasseur, Director Climate Service Center, Germany
2:45 – 4:45 p.m.	**Identifying the Demand for Climate Services** John Furlow, Climate Change Specialist Global Climate Change Team US Agency for International Development
	Creating, Accessing and Using Data Carlo Scaramella, Coordinator Climate Change and Disaster Risk Reduction World Food Programme
	Facilitating Systematic Knowledge Exchange Daniela Jacob, Head Climate System Department Climate Service Center, Germany
4:45 p.m.	**Closing of Day One** Lawrence Buja, Director Climate Science and Applications Program National Center for Atmospheric Research (NCAR)
5 – 7 p.m.	**Poster session and reception**

Tuesday, October 18

8:00 a.m.	Continental Breakfast

Breakout session recap: ***Elements of successful climate services***

8:30 a.m.	Identifying the Demand for Climate Services
8:45 a.m.	Creating, Accessing and Using Data
9:00 a.m.	Facilitating Systematic Knowledge Exchange
9:15 a.m.	Discussion

New perspectives: ***Climate services in practice***

10 a.m.	UK Perspective Chris Hewitt, Head of Climate Services UK Met Office

Breakout session: ***Enabling successful climate services***

10:30 -12:30 p.m.	**Engaging the Scientific Community** Sylvie Joussaume, Director Paris Consortium on Climate-Environment-Society
	Designing Policies and Institutional Partnerships Shiv Someshwar, Director of Climate Policy Center of Globalization and Sustainable Development Senior Advisor Regional Programs, IRI The Earth Institute, Columbia University
	Establishing Innovative Funding Mechanisms Kanta Kumari Rigaud, Senior Environmental Specialist Environment Department, World Bank
12:30 p.m.	Lunch

Breakout session recap: ***Enabling successful climate services***

2 p.m.	Engaging the Scientific Community
2:15 p.m.	Designing Policies and Institutional Partnerships
2:30 p.m.	Establishing Innovative Funding Mechanisms
2:45 p.m.	Discussion

Climate Services Partnership: ***Identifying priority work areas***

3:15 p.m.	**Proposal of priority work areas** Walter Baethgen, Director of Regional Programs

International Research Institute for Climate and Society (IRI)

3:30 – 5 p.m. **Working group discussions around priority work areas**

5 – 5:15 **Closing of Day Two**
Geoffrey Love
World Meteorological Organization

Wednesday, October 19

8:00 a.m. Continental Breakfast

Climate Services Partnership Action Plan

8:30 a.m. **Presentation of Climate Services Partnership Action Plan**
Stephen Zebiak, Director-General
International Research Institute for Climate and Society (IRI)

9 a.m. **CSP**: ***ICCS Process***
Summary of actions designed to encourage and sustain interactions among different stakeholders

9:30 a.m. **CSP:** ***Knowledge Management System***
Outline of strategy for enabling the distillation and dissemination of existing knowledge

Example of CSP Contributions:

National Integrated Drought Information System (NIDIS)
Roger Pulwarty, Director
NIDIS, NOAA

10:30 Coffee break

10:45 **CSP:** ***Working Groups***
Presentations from working groups on priority issues and possible areas of collaboration

Close of conference

11:30 **Concluding Remarks**
Stephen Zebiak, Director-General
International Research Institute for Climate and Society (IRI)

Appendix 3: Conference Roadmap

Appendix 4: Participant List

Surname	First Name	Institution	Title	Email
Akrawi	May	**British Consulate-General Houston**	HM Consul, Head of Science & Innovation	may.akrawi@gmail.com
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Appendix 5: Speaker Biographies

Walter Baethgen

Walter E. Baethgen is the Director of the Program for Latin America and the Caribbean in the International Research Institute for Climate and Society (IRI - The Earth Institute, Columbia University). In the IRI he has been establishing regional research programs that aim to improve climate risk assessment and risk management in agriculture, health, water resources, and natural ecosystems. Since August 2010 Baethgen has been acting as Distinguished Lead Scholar of the NEXUS program (Fulbright Foundation) that aims to inform the elaboration of policy with scientific research. Before joining the IRI Baethgen was a Senior Scientist in the Research and Development Division of IFDC (International Soil Fertility and Agricultural Development Center) where he worked mainly in Information and Decision Support Systems for the Agricultural Sector (1987-2003). Since 1990 (first with IFDC and now with the IRI) he has been establishing and coordinating regional research programs in Latin America in collaboration with National and International organizations.

Dr Baethgen has acted as a consultant for the Inter-American Development Bank (IDB), the United Nations (UNDP, UNIDO, FAO), the International Atomic Energy Agency (IAEA), the World Bank and the Inter-American Institute for Agricultural Science (IICA). He participated as Principal Investigator in several NOAA and NASA International research programs. He also acted as consultant for the governments of Brazil, Paraguay, Guatemala and Uruguay, and for the private sector in Argentina, Uruguay and Venezuela. He was a lead author for IPCC's Second (1995) and Third (2001) Assessments Reports and contributing author for the Fourth Assessment (2007), as well as the review editor for IPCC's special issue on Technology Transfer (2000). He serves or has served as a member of scientific advisory committees of several International organizations including the CGIAR's Science Council, IAI (Inter-American Institute for Global Change Research) Science Advisory Committee, CIIFEN (Centro Internacional para la Investigacion del Fenomeno de El Nino), IGBP and WMO. He was also reviewer of several International research programs (NOAA, NASA, NSF, IAI, German government, Norwegian government). Baethgen is an Editorial Board Member of the peer-reviewed journals Agricultural Systems (Elsevier Science) and Journal of the International Hydrological Programme (UNESCO).

Guy Brasseur

Since 2009, Guy Brasseur is the director of the Climate Service Center. Before, he was associate director of the National Center for Atmospheric Research (NCAR), Boulder, Colorado, and head of NCARs Earth and Sun Systems Laboratory (ESSL). From 1999 to 2006 he was director at the Max Planck Institute for Meteorology, Hamburg, and the German Climate Computing Center (DKRZ). Guy Brasseur was a Coordinating Lead Author for the fourth Assessment Report (Working Group 1) of

the Intergovernmental Panel for Climate Change (IPCC), which was awarded the Nobel Peace Prize in 2007. The Belgian scientist was chair of the International Geosphere Biosphere Programme (IGBP), he is doctor honoris causa of the universities Paris VII, Oslo and Athens and has been honored for his scientific work several times. Currently he gives lectures at the University of Hamburg and the Free University of Brussels. In the past he was visiting lecturer in Kyoto, São Paulo, Beijing, Wuppertal und Paris, inter alia.

Lawrence Buja

Dr. Lawrence Buja is the Director of the Climate Science and Applications Program (CSAP) at the National Center for Atmospheric Research in Boulder Colorado. CSAP addresses societal vulnerability, impacts and adaptation to climate change through the use of scenarios of projected climate change, development of tools and methods for analyzing current and future vulnerability, and integrated analyses of climate impacts and adaptation at local, regional and global scales. Previously, Dr Buja was scientific project manager for NCAR's simulations of the earth's past, present and future climates with NCAR's Community Climate System Model that made up the joint US NSF/DOE submission to the Intergovernmental Panel on Climate Change (IPCC). Lawrence is a contributing author to both the 2001 IPCC Third Assessment Report (AR3) and the breakthrough IPCC AR4 in 2007 Lawrence also works closely with the World Bank, the InterAmerican Development Bank and other international agencies applying NCAR's climate and social science expertise to help guide sustainable development strategies throughout the developing world.

John Furlow

John Furlow is a Climate Change Specialist in USAID's Office of Environment and Science Policy. John joined the Global Climate Change team in April, 2006 and leads the team's work on adaptation. He is responsible for interagency policy development in this technical area and participates in international deliberations representing USAID and the USG. John led the development of USAID's Climate Change Adaptation Guidance Manual and the Climate Change and Coastal Management Guide. He also led the development of the Climate Mapper, a tool providing map-based access to historical weather data and projected climate data. He is also the USAID lead on the Adaptation Partnership. Prior to joining USAID, John worked with the U.S. Environmental Protection Agency's Global Change Research Program, where he designed and managed projects examining the impacts of climate change on water quality.

Bruce Hewitson

Bruce Hewitson is Professor of Climatology at the University of Cape Town. He obtained his PhD from Penn State University in 1991 and has been instrumental in developing a strong climate change research capacity in South Africa. Professor Hewitson was a coordinating lead author for the regional projections chapter in the

Inter-Governmental Panel on Climate Change Third and Fourth Assessment Reports. His main interests are the development of methodologies for regional scale climate change projections and developing the use of climate modeling within Africa to explore sub-equatorial climate processes, in particular issues related to Africa land-use / land cover. The research has a strong focus on supporting the climate change needs within Africa. He participates in, as well as coordinates, a number of activities on climate change capacity development in Africa, including the development and dissemination of tailored regional projections to support the policy and adaptation communities.

Chris Hewitt

Dr Chris Hewitt is Head of the Climate Service at the Met Office in the UK, responsible for developing strategic relationships with key partners within the UK and overseas to improve, and maximize the use of, climate service capabilities. Chris joined the Met Office in 1990 to undertake climate change research, working in the Hadley Centre for more than 10 years, then from 2002 instigated and led a major program on climate change and climate change impacts on behalf of the European Commission. In 2007 he became a senior manager in the Met Office's business area responsible for providing weather and climate services to industry, before moving into the current position in 2009 to focus on climate services to all sectors of society. He has considerable international experience through research collaborations, project and program management, and international panels, most recently on the World Meteorological Organization's Global Framework for Climate Services, and European Met Services' plans for climate services.

Daniel Jacob

As head of the Climate Systems department of the German Climate Service Center, Prof. Dr. Daniela Jacob gathers information about climate change and supports partners from science, industry and administration in interpreting the data. After studying meteorology in Darmstadt Jacob graduated in Hamburg, working at the Helmholtz-Zentrum Geesthacht Research Centre Geesthacht. Afterwards she worked at the National Center for Atmospheric Research (NCAR) in Boulder, Colorado. Since 1993 she does research at the Max Planck Institute for Meteorology in Hamburg, where she developed the regional climate model REMO, which can be used to calculate the regional impact of climate change. Since 2009 Daniela Jacob is Professor at University of Bergen, Norway. In June 2010 she was appointed to be one of the Leading Authors of the fifth Assessment Report (Working Group 2) of the International Panel for Climate Change (IPCC).

Sylvie Joussaume

Sylvie Joussaume is a senior researcher within CNRS. She is an expert in climate modeling. She has developed an international project on paleoclimate modeling, the "Paleoclimate Modeling Intercomparison Project" aiming at understanding the

mechanisms of climate change and at evaluating climate models using past proxy-data. She has been involved in IPCC assessment reports since the third report. Previously she was appointed as director of the Institut National des Sciences de l'Univers (INSU) from CNRS (http://www.insu.cnrs.fr/) which coordinates national research in the fields covering earth sciences, from the earth interior to the surface, astronomy and astrophysics as well as space research. She is now leading a consortium of laboratories around Paris devoted on "climate, environment and society". This consortium is aiming at developing interdisciplinary researches on climate change and its impacts. She is also chairing the scientific board of the European Network for Earth System modeling (ENES, http://www.enes.org) and coordinates the FP7 infrastructure project IS-ENES, which integrates the European climate models in a common infrastructure (http://is.enes.org) (2009-2013).

Tom Karl

Tom Karl, L.H.D., received his B.S. degree in Meteorology from Northern Illinois University, DeKalb, in 1973, his Masters Degree from the University of Wisconsin, Madison, in 1974, and he was awarded an honorary Doctorate of Humane Letters from North Carolina State University in 2002.Karl has received many awards and recognition for his work in climate, observing systems, and data stewardship including: four Gold Medals from the Department of Commerce and one Bronze Medal; the American Meteorological Society's Suomi Award; National Associate of the National Academy of Sciences; the NOAA Administrator's Award, and several others.

He currently is the Director of NOAA's National Climatic Data Center and NOAA's Program Manager for Climate Observations and Analysis. A Fellow of the American Meteorological Society and of the American Geophysical Union, Karl has published more than 125 peer-reviewed articles and several books as Editor
and Contributor. He has also given numerous testimonies to the U.S. Congress and briefings to Vice President and Presidents of the United States. In 2002, Karl was elected to serve on the Council of the American Meteorological Society. He has also served as Editor of the Journal of Climate (1997-2000) and as Lead Author of several IPCC reports and Co-Chair of the US National Assessment.

Jeremiah Lengoasa

Jeremiah Lengoasa has been Deputy Secretary-General of WMO since 1 March 2010. Prior to this, he was Assistant Secretary-General of WMO since 8 August 2005. He holds Master's degrees in Climatology and Development Management from Witwatersrand University, Johannesburg, South Africa, and for several years worked as a teacher and university lecturer in geography and environmental studies. Mr Lengoasa served in the South African public service in the areas of environment, environmental regulations and environmental quality and protection, followed by a period in the private sector as a senior bank manager. From 2003 to 2005, Mr Lengoasa was Chief Executive Officer of the South African Weather Service and

Permanent Representative of South Africa with WMO and was a member of the WMO Executive Council.

Geoff Love

Dr Geoff Love is currently the Director, Weather and Disaster Risk Reduction Services, of the World Meteorological Organization (WMO), based in Geneva, Switzerland. In this role Dr Love is working to assist in improving the capacity of National Meteorological and Hydrological Services around the globe to provide basic weather services for the public, specialized weather services for weather sensitive industries such as those in the aviation and marine sectors and to improve their response to the full range of weather-related natural disasters such as tropical cyclones, floods, bushfires and the like. This work is a natural continuation of the interests that have driven Dr Love through his 33-year career, largely with the Australian Bureau of Meteorology, as a weather forecaster, climate scientist, researcher and senior administrator.

Dr Love also manages the secretariat of the High-Level Taskforce for the Global Framework for Climate Services. This Taskforce is developing a report that will describe a costed strategy and timeline for the implementation of a new, UN coordinated system for the world-wide production and dissemination of climate services. The Taskforce is to complete its work by 12 January 2011 with its report to be considered by the UN Secretary-General, and by the WMO Congress in May 2011 for action. Dr Love has also participated in the international climate change-related negotiation process, in a variety of capacities, over the past decade. Dr Love has been a senior administrator in the public sector for over two decades, first becoming the Bureau's Regional Director in the Northern Territory in 1984 and finally taking up the post of Director of Meteorology in August 2003. Dr Love has a strong interest in promoting international cooperation in meteorology and, for a large part of his career, worked to see that all aspects of Australian meteorology, including research, systems and services, are constantly benchmarked against the best in North America, Asia and Europe.

Simon Mason

Simon Mason is chief climate scientist at the International Research Institute for Climate and Society (IRI), taking a lead role in international outreach from the IRI's Climate Program, and leading the IRI's disaster work. He was a member of the drafting team for the High-Level Task Force on the Global Framework for Climate Services, and is a focal point for the IRI's Partnership to Save Lives with the International Federation of Red Cross and Red Crescent Societies (IFRC). He has been heavily involved in capacity building activities, including leading the development and support of the Climate Predictability Tool (CPT). Mason has been involved in seasonal climate forecasting research and operations since the early 1990s.

Dr. Mason has published numerous papers on seasonal climate forecasting and verification, climate change, and southern African climate variability. He has extensive experience in the production of seasonal climate forecasts in contexts such as the Regional Climate Outlook Forums, and works closely with the World Meteorological Organization (WMO) to promote the definition and adoption of forecasting and verification standards through engagement in relevant WMO Expert Teams and through the WMO CLIPS Capacity Building Workshops. Mason joined the IRI in 1997, working initially at the Scripps Institution of Oceanography, and moving to Columbia University in 2003. Prior to joining the IRI, Mason was Deputy Director of the Climatology Research Group at the University of the Witwatersrand, in South Africa, where he developed empirical models for predicting southern African rainfall variability. Mason is a Visiting Senior Fellow in the Centre for Analysis of Time Series at the London School of Economics and Political Science.

Roger Pulwarty

Roger Pulwarty is the Climate and Societal Interactions Division Chief, and the Director of the multi-agency National Integrated Drought Information System at NOAA. His research and publications focus on climate, vulnerability assessment and climate services. Dr. Pulwarty is a Convening Lead Author on "Adaptation Implementation" in the forthcoming IPCC Fifth Assessment, the IPCC Special Report on Extremes, and on the UN International Strategy for Disaster Risk Reduction Global Assessment. Roger has acted in advisory and research capacities on climate and natural resources management to several U.S. and international interests including the Western US Governors, Federal agencies, the Caribbean Economic Community (CARICOM), the Organization of American States, United Nations agencies, and the InterAmerican Development and World Banks. Roger led the Vulnerability and Capacity Component of the World Bank/GEF-funded project on Mainstreaming Adaptation to Climate Change in the Caribbean. He is an Adjunct Professor at University of Colorado and the University of the West Indies. Roger has testified before the U.S. Congress on climate adaptation, early warning, and water resources. He was the co-recipient of the 2008 NOAA Administrator and the 2010 Department of Commerce 2010 Gold Medal awards for achievements in integrating science into decision-making.

Kanta Kumari Rigaud

Kanta Kumari Rigaud has more than 25 years professional experience in natural resources management (NRM), environment management, and climate change/adaptation issues and has worked with WWF, at CSERGE a policy think tank in the at the University of East Anglia, the Global Environment Facility and is presently at the World Bank. She is currently the Lead Adaptation Specialist and WB coordinator of the Pilot Program for Climate Resilience where she oversees the adaptation policy work, knowledge exchange and analytical work related to the adaptation agenda. Through the PPCR program she is working through the teams in the 18 participating countries to nurture shared learning, knowledge exchange and

communities of practice to advance the climate resilient agenda. She has worked in a wide range of countries globally, but most recently was in the Middle East North Africa Region of the Bank where she spearheaded several adaptation initiatives related to the coastal zone, rainfed areas and forests. She has a Masters in Ecology and a PhD in Environmental Economics from the United Kingdom.

Jeffrey D. Sachs

Jeffrey D. Sachs is the Director of The Earth Institute, Quetelet Professor of Sustainable Development, and Professor of Health Policy and Management at Columbia University. He is also Special Advisor to United Nations Secretary-General Ban Ki-moon. From 2002 to 2006, he was Director of the UN Millennium Project and Special Advisor to United Nations Secretary-General Kofi Annan on the Millennium Development Goals, the internationally agreed goals to reduce extreme poverty, disease, and hunger by the year 2015. Sachs is also President and Co-Founder of Millennium Promise Alliance, a nonprofit organization aimed at ending extreme global poverty.

Professor Sachs is widely considered to be the leading international economic advisor of his generation. For more than 20 years Professor Sachs has been in the forefront of the challenges of economic development, poverty alleviation, and enlightened globalization, promoting policies to help all parts of the world to benefit from expanding economic opportunities and wellbeing. He is also one of the leading voices for combining economic development with environmental sustainability, and as Director of the Earth Institute leads large-scale efforts to promote the mitigation of human-induced climate change.

He is internationally renowned for his work as economic advisor to governments in Latin America, Eastern Europe, the former Soviet Union, Asia and Africa, and his work with international agencies on problems of poverty reduction, debt cancellation for the poorest countries, and disease control. He is a Research Associate of the National Bureau of Economic Research. Sachs has been an advisor to the IMF, the World Bank, the OECD, the World Health Organization, and the United Nations Development Program, among other international agencies. During 2000-2001, he was Chairman of the Commission on Macroeconomics and Health of the World Health Organization, and from September 1999 through March 2000 he served as a member of the International Financial Institutions Advisory Commission established by the U.S. Congress.

Carlo Scaramella

Carlo Scaramella is the global Coordinator for Climate Change, Environment and Disaster Risk Reduction at the United Nations World Food Programme (WFP), and the leading expert of the organization in this field. WFP is the UN frontline agency in the fight against hunger and the largest UN humanitarian agency. On average, every year WFP reaches over 100 million among the poorest and most vulnerable people

worldwide. Working on the frontline of disasters, WFP delivers food assistance interventions that promote multiple co-benefits in terms of resilience building, climate change adaptation, disaster risk reduction, social protection and natural resource management, among others.

Mr. Scaramella has spent about half of his professional career working in the crisis areas in countries like Sudan, Angola, El Salvador, and Somalia, among others. Mr. Scaramella has also been responsible for establishing and leading WFP's Emergency Preparedness and Response Branch and its global Early warning – Early action services and systems. He led complex interagency programs and initiatives and for several years chaired specialized interagency working groups on disaster preparedness. Mr. Scaramella holds a Doctorate in Political Science and prior to joining the UN has conducted academic work in the areas of development cooperation, humanitarian assistance and food security.

Shiv Someshwar

Dr. Shiv Someshwar is a research faculty member at Columbia University in New York. An expert in climate change adaptation and development policy, Dr. Someshwar has led numerous multidisciplinary projects that build resilience to climate risks in developing countries. He advises governments in identifying adaptation priorities, and serves as an advisor to UNDP's Bureau of Crisis Prevention and Recovery to integrate climate adaptation and disaster risk reduction efforts. He helped develop Columbia s graduate program in Climate and Society, where he also teaches. Previously, he was at the Rockefeller Foundation and at the World Bank. Dr. Someshwar received his Ph.D. in environment and public policy from the University of California, Los Angeles, and was a post-doctoral fellow at Harvard University.

Maarten Van Aalst

As director of the Red Cross/Red Crescent Climate Centre Maarten van Aalst coordinates support to climate risk management across the Red Cross/Red Crescent, analysis and documentation of experience, and links with scientific and policy communities on climate change, disaster risk management and development planning. He has worked on adaptation to climate change and disaster risk reduction since 1999, including at the World Bank, African Development Bank, Inter-American Development Bank, OECD and UNDP. He is Coordinating Lead Author of the forthcoming IPCC Special Report on managing extremes, Lead Author of the IPCC Fifth Assessment Report, and holds an adjunct appointment as Research Scientist at the International Research Institute for Climate and Society, Columbia University. Maarten obtained his Ph.D. in Atmospheric Science from Utrecht University.

Stephen Zebiak

Dr. Stephen E. Zebiak is director general of the International Research Institute for Climate and Society at Columbia University, which uses a science-based approach to enhance society's ability to understand, anticipate and manage climate risk to improve human welfare. As director, he leads an inter-disciplinary team of over 40 scientists specializing in climate prediction, agriculture, health, water, economics and development policy. Dr. Zebiak has worked in the area of ocean-atmosphere interaction and climate variability since completing his Ph.D. at the Massachusetts Institute of Technology in 1984. He and Dr. Mark Cane authored the first dynamical model used to predict El Niño successfully. He has published extensively in journals such as *Science*, *Nature*, the *International Journal of Climatology*, and has served as an advisor to a range of US and international climate research programs.

Appendix 6: WMO Side Event on GFCS

Why a Global Framework for Climate Services?

Dr. Geoff Love
World Meteorological Organization

There is a need for a global focus on climate services. There are differences between what academics identify as a need and what end users identify as a need. Also, 10 countries account for 76% of the World's engineers and scientists. As a result, there are major gaps in the observing system are predominantly in the developing world. There is a need for a north-south transfer of capacity. There is also a need for a local, regional, national, and international focus.

The Global Framework for Climate Services allows for flexibility. The framework focuses on the following elements:

- Inputs
- Mechanisms
- Outcomes

The User Interface Platform (UPS) will:

1. Establish processes to bring people together to continuously monitor the requirements for climate services
2. Monitor the user satisfaction with the overall performance of the GFCS
3. Provide education and training for climate service users

The framework will also focus on the climate observations to meet the publics' need for data and information. There will also be a focus on capacity building efforts; this will have to be north-south, south-south, south-north transfer of knowledge.

No one country, or even regional alliance, can meet the global need for climate services. Many of the required services are public goods in nature, but of course this means that many will be commercial. Governments have a key role to play, but NGOS and the private sector do too. The solution must be a framework and it must be global.

Development of GFCS: The WMO contribution and the need for many partners

David Grimes President, WMO

The GFCS needs to be a partnership initiative. The objective is to establish a globally integrated system for the provision of operational climate prediction and information services. It will operate from 2012-2015, and will produce,

significant socio-economic / environmental benefits especially for the most vulnerable. The factor most critical to success is that it must engage all contributors in the climate arena.

The key implementation mechanisms of the GFCS are:

- To strengthen global cooperative systems for exchange of data information
- To create projects aimed for those least able to provide climate services
- To identify strategies for communications, resource mobilization and capacity building
- To establish mechanism for governance for priority setting
- To establish targets for monitoring and evaluating performance

A special emphasis will be placed on communicating with end users.

The User Interface Platform (UIP) will allow climate services to be delivered through intermediaries. It will also help the diverse range of user communities use different jargon, business models and preferred modes of sharing information. Effective climate services will require a degree of tailoring.

Appendix 7: ICCS List of Vision Paper Topics

Baril, P. Ouranos in the context of the International Conference on Climate Services. Ouranos.

Goodness, C. A climate services pilot program – a vision paper. Climatic Research Unit, University of East Anglia, UK.

Harijono, S.W.B. Call for Partnership to Build Effective Climate Services in Indonesia. Indonesian Agency for Meteorology Climatology and Geophysics.

Helminen, J., Goncalves, J., Gaiani, S. and E. Sutinen. Development of Innovative Community Climate Services for Agriculture in the Chokwe District, Mozambique (DICCLISEAG)

Higgins, W. and W. Thiaw. Vision for Pilot Programs for International Climate Services from the CPC Perspective. Climate Prediction Center: National Oceanic and Atmospheric Administration.

Horsfall, F., Timofeyeva, M. Addressing the Need for Integrated Environmental Services. National Weather Services: Climate Services Division, Silver Spring, MD.

Letson, D. and J.J. O'Brien. Organizing a Pilot Program in Climate Services: the Southeast Climate Consortium.

Ruuhela, R. A Roadmap from Climate Service to Climate Change Service. Some present activities of the Climate Service Centre in Finland. Climate Service Centre, Finnish Meteorological Institute (FMI)

Schwarze, R., Navarra, A., and G. Brasseur. Developing Climate Services in Europe: The Challenges Ahead. German Climate Services Center.

Thomas, W.M. International Conference on Climate Services (ICCS): Vision Paper for Global Climate Network. American Meteorological Society

UNEP FI & SBI. "Advancing adaptation through climate information services: Results of a global survey on the information requirements of the financial sector." UNEP Financial Initiative and Sustainable Business Institute. January 2011.

Appendix 8: List of Posters Presented

Advanced Adaptation through Climate Information Services
Results of a Global Survey on the International Requirements of the Financial Sector
Paschen von Flotow
Sustainable Business Institute

CCAFS Work in Kaffrine, Senegal
Ousmane Ndiaye
Senegalese Meteorological Service

Climate Services and Environmental Services:
German Climate Services Center and its Natural Resources Management Dept.
Michaela Schaeller
Climate Services Center, Germany

Climate Services in the West Coast of South America:
Understanding Our Climate, Learning to Live Together
Juan Jose Nieto
Centro Internacional para la Investigacion del Fenomeno de El Nino

CLIM-RUN: Climate Local Information in the Mediterranean Region Responding to User Needs
Paolo Ruti
Italian National Agency for New Technologies

CSC Panel Experts for the Joint Programing Initiative
Elke Lord
Assistant to the Director
German Climate Service Center

EUMETNET Coordination of Member Climate Services
Arie Kattenberg
Royal Netherlands Meteorological Institute

FAO Desert Early Warning System
Keith Cressmen
Senior Locust Forecasting Officer
UN Food and Agriculture Organisation

German Climate Service Center Overview
Elke Lord
Assistant to the Director
German Climate Service Center

The Impact of Climate Change on the British Rail Network
Hazel Thorton
UK Met Office

KNMI Climate Services to Dutch Policymakers
Arie Kattenberg
Royal Netherlands Meteorological Institute

Online Short Courses as "Climate Services"
Tom Pedersen
Pacific Institute for Climate Solutions

Research Findings for the First EU-Funded Climate Service Project
Melanie Davis
Coordinator, Climate Services
CLIM-RUN

A Roadmap from Climate Services to Climate Change Services:
Some Present Activities of the Climate Service Centre in Finland
Reija Ruuhela
Finish Meteorological Institute

TEPHINET: A Global Network of Epidemiologists
Renee Subramanian
Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET)

The Networks of the Helmholtz Regional Climate Offices
Renate Treffeisen
Program Office for Polar Regions and Sea Level Rise

WMO Regional Climate Centers of RA VI
Arie Kattenberg
Royal Netherlands Meteorological Institute

Appendix 9: CSP Coordinating Committee

Anderson	Glen	**International Resources Group**
Baethgen	Walter	**International Research Institute for Climate and Society (IRI)**
Barring	Lars	**Swedish Meteorological and Hydrological Institute**
Bhojwani	Haresh	**International Research Institute for Climate and Society (IRI)**
Boulahya	Mohammed	**Climate-Insight**
Brasseur	Guy	**Climate Service Center (CSC)**
Buja	Lawrence	**National Center for Atmospheric Research**
Carr	Edward	**USAID/EGAT/GCC**
Chan	Christina	**U.S. Department of State**
Choularton	Richard	**World Food Programme (WFP)**
Farrell	David A.	**Caribbean Institute for Meteorology & Hydrology**
Furlow	John	**USAID**
Gonçalves	Junior	**National Institute of Meteorology, Mozambique**
Hewitt	Chris	**UK Met Office**
Joussaume	Sylvie	**Paris Consortium of Climate-Environment-Society**
Karl	Thomas	**US National Oceanic and Atmospheric Administration (NOAA)**
Kattenberg	Arie	**Royal Netherlands Meteorological Institute (KNMI)**
Lord	Elke	**Climate Service Center Germany**
Lucio	Filipe	**WMO**
Muth	Meredith	**US National Oceanic and Atmospheric Administration (NOAA)**
Nobre	Paulo	**Brazilian National Institute for Space Research (INPE)**
Norton	Kerry	**British Consulate-General Atlanta**
Rigaud	Kanta Kumari	**World Bank**
Scaramella	Carlo	**World Food Programme (WFP)**
Tanner	Michael	**US National Oceanic and Atmospheric Administration (NOAA)**
Van Aalst	Maarten	**Red Cross Red Crescent Climate Centre (RC RC CC)**
Vaughan	Cathy	**IRI**
Zebiak	Steve	**International Research Institute for Climate and Society (IRI)**
Zillman	John	**School of Earth Sciences, University of Melbourne**