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Item 6 of the provisional agenda

Research and systematic observation

Update on developments in research activities relevant to the needs of the Convention

Submissions from regional and international climate change research programmes and organizations

1. The Subsidiary Body for Scientific and Technological Advice (SBSTA), at its twenty-sixth session, invited relevant regional and international climate change research programmes and organizations to regularly inform the SBSTA of developments in research activities relevant to the needs of the Convention.¹
2. At its thirtieth session, the SBSTA agreed that meetings under the research dialogue taking place in the context of decision 9/CP.11 should be continued during the thirty-second and subsequent sessions of the SBSTA.² It invited the research programmes and organizations to continue to provide,³ as part of the research dialogue, information on developments in the research activities outlined in document FCCC/SBSTA/2007/4, paragraph 47 (a–f).
3. The secretariat has received eight such submissions. In accordance with the procedure for miscellaneous documents, these submissions are attached and reproduced* in the language in which they were received and without formal editing.

¹ FCCC/SBSTA/2007/4, paragraph 47.

² FCCC/SBSTA/2009/3, paragraph 49.

³ FCCC/SBSTA/2009/3, paragraph 48.

* These submissions have been electronically imported in order to make them available on electronic systems, including the World Wide Web. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

FCCC/SBSTA/2010/MISC.6

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PAPER NO. 1: ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

Acknowledgment:

The APN welcomes and appreciates the continuing opportunity to inform, and engage in a dialogue with, SBSTA on issues of global change research, capacity development and science-policy interfacing mechanisms within the Asia-Pacific region that is relevant to the convention. The present brief summarises some of the relevant activities undertaken by APN to address some of the issues outlined in the recently published document **FCCC/SBSTA/2010/MISC.4**. regards those topics for discussion at the dialogue meeting to take place during SBSTA 32, taking into account developments in research activities outlined in document **FCCC/SBSTA/2007/4, Paragraph 47 (a–f)**.

APN Third Strategic Phase:

Having dynamically progressed into its Third Strategic Phase (2010-2015), APN fosters the understanding of global environmental change by conducting regional research through collaboration and capacity development. APN's activities, as outlined in its [Third Strategic Plan](#), promote research that improves understanding of the physical, biological and human dimensions of change in the Earth system and science that informs adaptation and mitigation decision-making in the following specific areas:

- Climate Change and Climate Variability;
- Ecosystems, Biodiversity, and Land Use;
- Changes in the Atmospheric, Terrestrial and Marine Domains; and
- Resources Utilisation and Pathways for Sustainable Development

APN serves the scientific and decision-making communities and other users in the Asia-Pacific region. APN invests in the identification of existing methodologies and the development of new methodologies and tools to improve the effectiveness of necessary scientific knowledge transfer to decision-makers in Asia-Pacific communities.

APN New Initiatives:

First, in response to UN-REDD and REDD+ and the issues outlined in the Copenhagen Accord, the APN, through funding secured from the Ministry of the Environment, Japan (MoEJ), launched, in April 2010, a call for focussed activities Theme 2 of the APN's Science Agenda on Ecosystems, Biodiversity and Land Use. This not only covers areas related to Forestry and REDD+, but also other issues in the Land Use, Land-Use Change and Forestry (LULUCF) Sector under the Convention. Please refer to (a).

Second, recognising the interconnectivity of climate change and sustainable development, the promotion of green growth, resources utilisation and establishing sound material cycle societies, the MoEJ is also providing funding for focussed activities in Theme 4 of the APN's Science Agenda: Resources Utilisation and Pathways for Sustainable Development. Please see (b).

Under both themes (a) and (b) below, projects will have characteristics that include:

- Promoting and strengthening *interdisciplinary regional global change research*, particularly addressing novel research, and/or identifying key gaps via synthesis and assessment work;
- identifying and developing existing and/or new methodologies for capacity development, particularly in *effective transfer of scientific know-how and technology* to user communities, both science and non-science;
- *Strengthening interfaces between science and policy* communities and society in general for effective pathways to sustainable development;
- *Encouraging initiatives from developing nations* for place-based, integrative research activities; and
- *Aligning* with programmes of the global change community.

(a) Reducing Emissions from Deforestation and Forest Degradation, Conservation of Forest Carbon Stocks, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks (REDD+)

While previous approaches to curb global deforestation have met with very limited success, REDD+ provides a new framework to allow developing countries to break this historic trend. As has been pointed out¹, REDD+ could simultaneously address climate change, while conserving biodiversity and sustaining vital ecosystem services, all issues of which are considered areas of relevance under the current scientific agenda of the APN. An effective REDD+ mechanism needs to simultaneously address carbon emissions and removals, biodiversity, ecosystem services and rural poverty alleviation. Above all else, it must help assure sustainable livelihoods for forest-dependent communities.

Specific projects envisaged under this new initiative might include:

- Understanding the basic concepts of REDD+, and understanding the methodologies for developing REDD+ projects (e.g. identification of drivers of deforestation and forest degradation, identification of REDD+ activities, establishment of forest reference emission levels and forest reference levels) and for implementing REDD+ activities;
- Building capacities to use the most recent IPCC guidance and guidelines as a basis for estimating anthropogenic emissions and removals, and establishing robust and transparent national forest monitoring systems;
- Using a combination of remote sensing and ground-based forest carbon inventory approaches; and
- Other related areas of forest carbon sequestration and dynamics, sustainable forest management practices, engagement of indigenous peoples and local communities in forest monitoring and reporting, forest conservation and biodiversity, etc.

(b) Resources Utilisation and Pathways for Sustainable Development: Reduce, Reuse, Recycle (3Rs) and Material Flow

In countries within the Asia-Pacific region, scientific knowledge, which is accepted these days as being the main basis to underpin policy- and decision-making, is important to realise the objective of establishing a sound material cycle society, particularly for resource utilisation that promotes sustainable, green growth. However, in order to undertake such an initiative, decisions must be made based on sound scientific evidence, much of which is lacking in the Asia-Pacific region, particularly in developing countries.

It is with this that the APN wishes to promote scientific research and capacity development that might encompass the following activities:

- Understanding the current status of scientific research activities and needs regarding material cycle, efficient resources utilization, and resource and material management;
- Understanding of regional and transboundary flow of materials, resources and wastes;
- Development and analysis of material flow accounting in developing countries and/or Asia and the Pacific region
- Estimation and analysis of indicators on sound material cycle such as resource efficiency, resource productivity in developing countries in the Asia-Pacific region; and
- Understanding the current status of 3R activities (reduce, reuse, recycle) and their effectiveness on the environment, economics and society in the Asia-Pacific region

¹ Global Canopy Programme '[Little REDD-Plus Book](#)'

Scientific Capacity Development for Climate Change Impact and Vulnerability Assessments (SCBCIA):

Following on from the SBSTA30 where APN announced the launch of its focussed activities in Scientific Capacity Development for Climate Impact and Vulnerability Assessments (SCBCIA), seven projects are currently being undertaken, covering a breadth of climate change issues in developing nations of the Asia-Pacific Region. These activities are being conducted in China, Indonesia, Philippines, Pakistan, Viet Nam and Thailand; and cover broad areas of relevance particularly for the Asia-Pacific region. One of these projects focusses on developing the capacity of Local Government Units in climate predictions using modelling software SIMCLIM, while another is a follow-up workshop on the successful [Cities at Risk Project](#) in partnership with START, East-West Center and ICSU, that will take place in Bangkok, Thailand in August 2010.

Systematic Observations and Data Management:

The APN continues to strengthen its relationship with bodies such as GEO and ICSU's CODATA through funding provision, sharing of information, ideas and activities, and special emphasis on partnerships. APN is also strengthening its current policies on DATA management to ensure a mechanism where access is open to all, particularly for metadata. Retrieval and archiving of data is also an area that APN is supporting in terms of technology transfer, which is particularly crucial for the Pacific Island States.

Climate Synthesis:

The APN is undertaking a synthesis of its climate-related activities over 10 years that will synthesise 56 projects undertaken by the APN in climate-related research and capacity development. The focus areas are: I. Food, Agriculture and Climate; II. Seasonal Climate Prediction & Applications; III. Climate Variability, Trends and Extremes; IV. Regional Climate Change Modelling; V. Vulnerability & Adaptation to Climate Change; VI. Climate Change Mitigation; VII. Coastal Cities and Climate Change; VIII. Climate Change Policy and Outreach. The synthesis report will be published in March 2011 and results will be shared with SBSTA and other interested organisations at SBSTA34 in Bonn, 2011.

Contributions of DIVERSITAS to UNFCCC-SBSTA 32

Introduction

DIVERSITAS, under the auspices of ICSU and UNESCO, aims to deliver socially relevant scientific knowledge on biodiversity, to provide the scientific basis for the conservation and sustainable use of biodiversity. Support for the study of the interactions between climate change and biodiversity has become a high priority throughout the DIVERSITAS projects ranging from research on rapid evolution of species in the face of climate change to improving the representation of biodiversity in earth system models that are used to project future climate.

DIVERSITAS along with a wide range of other partners has embarked on several initiatives to improve the observations, experiments and models in order to detect, understand and model *climate change impacts on biodiversity* as well as the *feedbacks of biodiversity change on climate and global biogeochemical cycles*.

Science highlights

Observing climate change impacts on biodiversity and ecosystem services

Substantial progress was made during 2009-10 in developing the implementation plan for a new global biodiversity observing system (GEO BON), to be released at CBD-SBSTTA 14 in May 2010. GEO BON represents the implementation of the biodiversity component of GEOSS, the Global Earth Observing System of Systems. One of the goals of GEO BON is to detect footprints of climate change impacts on biodiversity and ecosystem services, including carbon storage.

Modelling the interactions between biodiversity and climate change:

DIVERSITAS in collaboration with a variety of partners including the IGBP, is facilitating the development of improved regional and global vegetation models through the use of new global plant trait databases ("TRY" and "TraitNet" initiatives) and via a network of researchers working on better representations of migration, mortality and disturbance regimes ("Biome Boundary Shift" = BBS initiative). Recent work has led to substantial improvements of the representation of biodiversity in regional and global models.

Assessing future changes

DIVERSITAS along with the UNEP-WCMC will release at CBD-SBSTTA 14 (Nairobi, May 2010) a synthesis of biodiversity scenarios for the 21st century for the Global Biodiversity Outlook 3 (GBO3) for the Convention on Biological Diversity. This synthesis is a novel assessment of global biodiversity scenarios which focuses on multi-model comparisons and confrontations of model scenarios with observations. This report identifies climate change as one of the main future drivers of biodiversity loss (e.g. species extinctions) and changes in the distribution of species, functional groups and biomes, but also illustrates the large uncertainties that are associated with these projections.

Toward an IPCC-like mechanism for biodiversity and ecosystem services

SBSTA 32 delegates should be aware of efforts to establish an "IPCC-like mechanism for biodiversity and ecosystem services", called *IPBES (Intergovernmental Platform for Biodiversity and Ecosystem Services)*. The 3rd and, in principle, final intergovernmental and multistakeholder negotiation will take place 7-11 June 2010 (Republic of Korea), for a possible launch later this year, during 2010, the International Year of Biodiversity. DIVERSITAS has played a key role in moving this initiative forward

and in engaging and representing the scientific community in this process. This new assessment process, if established, will be of great relevance to the work of UNFCCC and its SBSTA.

Gaps

A variety of projects (e.g. GBO3, BBS) have identified a number of areas where research on the interactions between biodiversity and climate change are urgently needed including: greater use of multi-model analyses of climate change impacts on biodiversity, substantial increases in benchmarking of models with observations, improvements in understanding the links between biodiversity and ecosystem carbon storage at regional scales, etc.

Issues of high relevance to the UNFCCC process

Biodiversity "tipping-points"

The GBO3 Biodiversity Scenarios synthesis highlights a wide range of biodiversity "tipping-points" that may occur in the 21st century. Many of these are partially or entirely driven by climate change or rising CO₂ concentrations and involve strong feedbacks between biodiversity and climate at large regional scales. Some of these tipping points are reasonably well known in the climate change community (e.g., widespread dieback of the Amazonian forest, massive degradation of coral reefs), but others are less known (e.g., interactive effects of climate change and socio-economic drivers on desertification and deforestation in West Africa, interactive effects of overfishing and climate change on marine fisheries). In addition, the impacts of climate-driven "tipping-points" on biodiversity are often less well studied than the impacts on biogeochemical cycles, even though the impacts on ecosystem services via biodiversity are often large.

Research for adaptation

Adaptive management strategies for biodiversity in the face of climate change

Among many initiatives, DIVERSITAS co-sponsored a session on "Biodiversity: Enhancement of Resilience or Facilitating Transformation?" at the IARU International Scientific Congress on Climate Change in March 2009, Copenhagen, Denmark. The objectives were to examine different adaptive management strategies for biodiversity in the face of climate change and also to examine how climate change mitigation and adaptation goals might be in conflict with or complementary to protection of biodiversity. DIVERSITAS is also, through networking and international workshops, facilitating research on the capacity of species to adapt to climate change through "rapid evolutionary" processes and to link this adaptive capacity to models of ecosystem function.

Key publications

A Larigauderie, H Mooney: *The Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services: moving a step closer to an IPCC-like mechanism for biodiversity*. 2010. Current Opinion in Environmental Sustainability, in press.

H. Mooney et al.: *Biodiversity, climate change and ecosystem services*, 2009, Current Opinion in Environmental Sustainability, vol. 1, pp. 46-54.

H Mooney, G Mace: *Biodiversity Policy Challenges, Science editorial*, 2009, Science, vol. 325, no. 5947, p. 1474.

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Earth System Science Partnership (ESSP)

Community building for new insights in climate science and global environmental change research

Introduction

The ESSP is a science partnership of the four international global environmental change research programmes – an international programme of biodiversity science (DIVERSITAS), International Geosphere-Biosphere Programme (IGBP), International Human Dimensions Programme on Global Environmental Change (IHDP), and the World Climate Research Programme (WCRP) - for the integrated study of the Earth system, the ways that it is changing, and the implications for global and regional sustainability.

Science highlights

Global Carbon Project (GCP) launched the *Carbon Budget 2008* at the Conference of Parties (COP 15) in Copenhagen in 2009. It confirms the earlier findings that the fossil fuel CO₂ emissions continues to grow strongly and despite the global financial crisis, and that emissions from land use change contribute on average 15% to the total anthropogenic greenhouse gas emissions. The size of the natural sinks has grown, but at a slower pace than emissions, although year to year variability is large. This implies a decline in the efficiency of the sinks in removing atmospheric CO₂ over time (from 60% fifty years ago down to 55% in recent years). This trend is expected to continue in the future. More information is provided on: <http://www.globalcarbonproject.org/carbonbudget/index.htm>. Moreover, the GCP jointly with the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Scientific Committee on Problems of the Environment (SCOPE), and the United Nations Environment Programme (UNEP), have developed a Policy Brief based on this year's carbon budget release (http://www.globalcarbonproject.org/carbonbudget/08/Policy_brief.htm?pg=publications).

The Global Water System Project (GWSP) continues to work with both global and regional aspects of water quality and availability. One of its recent studies shows that with regards to changing climate, on a global level there will be little shift of the mean annual renewable water resources, however, the temporal and spatial variability will increase. On the regional level, these changes are more evident; there is a strong agreement on (i) *increasing* runoff in Asia and Polar region and (ii) *decreasing* runoff in Latin America and Australia-Oceania. Additionally, GWSP in partnership with DIVERSITAS, focused on water needs for humans and nature. The results indicate that the water shortage problem might grow over the years across many regions. GWSP envisages an extensive work on the role of water systems in climate change mitigation and will explore the link of 'water and human health'.

The Global Environmental Change and Human Health (GECHH) made a substantial progress in 2009-2010 in developing this emerging research area. Recent work on climate change has focused on how to include health issues into current climate decision making for both adaptation and mitigation policies. For example, adaptation costs for the health sectors have been estimated for Kenya. Studies have also shown that employers will need to adapt the work environment to climate change (and improve occupation health) or labour productivity may decline due to temperature increase. The co-benefits of the climate policies on the human health are potentially substantial. The varying costs of implementation of such strategies can be offset, at least partly, by the benefits to human health and as such should be taken into account in international climate change negotiation.

The *Challenge Program on Climate Change, Agriculture and Food Security (CCAFS)* is a new 10-year research initiative of the Consultative Group on International Agricultural Research (CGIAR) and the

Earth System Science Partnership (ESSP). Its development was coordinated by ESSP's *Global Environmental Change and Food Systems (GECAFS)* project.

Capacity Building

The ESSP is developing and implementing a scaled-up capacity-building agenda. See START's abstract for more details about its contribution to advancing climate science, enhancing developing country expertise and its contributions to and interactions with the IPCC and the UNFCCC.

Communications

Knowledge Products

The ESSP provides a mechanism to help promote and deliver knowledge products. As the experience with the carbon budgets released by the Global Carbon Project has shown, integrative and synthetic science products that are released and updated regularly, and have a direct connection with the policy process can generate a lot of visibility and excitement. Several other examples of such knowledge products within the different core and joint projects of the GEC research programmes already exist, including the GWSP digital water atlas (<http://atlas.gwsp.org/>). Additionally, ESSP promotes the results coming from its projects such as synthesis and scientific papers.

Journal

In October 2009, the ESSP launched a high quality, interdisciplinary, peer-reviewed journal entitled 'Current Opinion in Environmental Sustainability' (published by Elsevier). This journal provides a valuable outlet for the science of the programmes and projects. It is an open access journal to developing country scientists. In April, a special edition of this journal will be dedicated to Carbon and Nitrogen cycles, another forthcoming issue will feature climate science (covering climate change, climate risk management, and adaptation).

IPCC

IGBP organized a meeting together with the ESSP and IPCC, in Brazil (November, 2009), on Impacts, Adaptation and Vulnerability (IAV) questions, especially in context of developing countries. One of the main objectives of this meeting was to ensure the central participation of developing country IAV communities in the IPCC fifth Assessment Report (AR-5). For more information see the IGBP abstract.

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PAPER NO. 4: GLOBAL CHANGE SYSTEM FOR ANALYSIS,
RESEARCH AND TRAINING (START)

START's contribution to the research dialogue of the 32nd SBSTA

In noting the views on topics submitted by the European Union, START wishes to highlight its activities in 2009 and 2010 related to strengthening dialogue at the science-policy interface.

Science-policy dialogues: START in partnership with the WMO, UNEP, IPCC, the University of Ghana, the University of Dar es Salaam, and the Bangladesh Centre for Advanced Studies is in the process of implementing country-level science-policy dialogues in West Africa (Ghana, Nigeria, and Senegal), East Africa (Tanzania, Rwanda, and Burundi), and South Asia (Bangladesh, Nepal, and Bhutan). The science-policy dialogues bring together a wide range of stakeholders – scientists, policy-makers, civil society, private sector actors – to discuss climate change issues of national concern and to identify potential options for as well as obstacles to adaptation and mitigation. The dialogues feature presentations from IPCC AR4 authors as well as national experts on such issues as agriculture, health, water, urbanization, biodiversity conservation, land use change, and energy.

Regional knowledge assessments: Climate change knowledge assessments w

ill be undertaken in these three regions to collect and synthesize available knowledge on country and regional specific issues relevant to decision making for managing climate risks and adapting to and mitigating climate change. The results will be used to guide planning and implementation of regional vulnerability and adaptation research, and will lay important groundwork for more extensive treatment of regional-scale issues in the IPCC 5th Assessment Report. The assessment teams will be comprised of academic leaders, sectoral experts, and natural and social scientists from the region, as well as key representatives from civil society and policymaking realms. The science-policy dialogue and regional knowledge assessment activities described above are funded by the European Commission with co-funding from UNEP. For more information: (<http://start.org/programs/ccmap>)

PAPER NO. 5: INTER-AMERICAN INSTITUTE FOR GLOBAL CHANGE RESEARCH

Submission from the Inter-American Institute for Global Change Research (IAI)

The *Inter-American Institute for Global Change Research* (IAI) welcomes the conclusions of the Thirtieth Session of the Subsidiary Body for Scientific and Technological Advice (SBSTA-30) and the invitation to research organizations to provide information on developments in research activities at its thirtieth-second session.

The IAI promotes multi-national, cross-border research on global environmental change, which includes climate change, to present scientific advice to policy makers on critical issues in the Americas. Through its research programs, the IAI is working to provide a regional understanding of global environmental change issues such as carbon sources and sinks, links between global warming, hydrological cycles in the American Cordillera, relations between ocean surface temperature and hurricanes in the Caribbean, biofuels in the La Plata Basin, and vulnerability issues linked to urban pollution¹.

The IAI has begun to provide regular updates on recent scientific findings from its projects, through a series of products such as books² and policy briefs³ targeted at different users.

The present submission highlights research findings from three of the IAI's international research network projects. These projects demonstrate the importance of regional research that will improve CO₂ accounting as well as the understanding of regional hydrological processes. There are gaps in our knowledge, also identified by the IPCC, regarding reliable carbon emission and sequestration data by sectors. To assess the effects of climate change, estimates of glacier mass loss need to be supplemented with monitoring snow and water regimes. Research teams are still facing a lack of long-term measurements and low number of systematic data collections to fully understand processes of climate change. Regional assessments are extremely important to fill those gaps.

The “**International Consortium for the Study of Oceanic Related Global and Climate Changes in South America**”, led by the *Servicio de Hidrografía Naval* of Argentina in collaboration with scientists in Argentina, Brazil, Chile, the USA and Uruguay, is identifying the physical and biological mechanisms that control the exchange of CO₂ between the ocean and the atmosphere. Oceans play a fundamental role in the equilibrium of the climate system by redistributing the heat gained near the equator and controlling the hydrological cycle, and also by sequestering greenhouse gases from the atmosphere. The oceanic sequestration of CO₂, believed to be currently responsible for uptaking about one third of anthropogenic emissions, is associated with the sinking of cold, nutrient-rich waters at high latitudes and the photosynthetic activity of marine algae (phytoplankton). By absorbing large amounts of CO₂ from the atmosphere, biologically active continental margins are among the largest contributors to this global ecosystem service.

However, global carbon models are still highly deficient, due to (1) our lack of understanding of the dynamic processes controlling upwelling and cross-shelf exchanges, and (2) our lack of information about regions away from the highly developed nations of the northern hemisphere. One important shelf region is off Patagonia. The Patagonian shelf occupies a surface area of 1 million km², about 4% of the global continental margins. It absorbs 22 Tg C yr⁻¹ (million metric tons of carbon per year) and emits about 5. The resulting net absorption of 17 Tg C yr⁻¹ is approximately 5% of the carbon absorbed on global continental margins.

The Patagonian shelf break is also one of the most important fisheries regions on earth, with a harvest of millions of tons of fish and squid every year. At present harvest levels, fisheries are not sustainable. This overfishing not only depletes fish but also disrupts marine food webs. For instance, increasing populations of jellyfish are possibly associated with decreased predation by diminishing fish populations.

¹ Link to project descriptions: <http://tinyurl.com/yk2azx6>

² Link to book and publications page: <http://tinyurl.com/yhy7m9c>

³ Link to policy briefs: <http://tinyurl.com/y33hyzk>

Such changes could eventually affect zooplankton and phytoplankton communities - thereby influencing the ability of the ocean to capture CO₂ through phytoplankton photosynthesis. This shows how important those regional assessments are.

The second project summarized in this submission, “**Land use change in the Rio de la Plata Basin: linking biophysical and human factors to predict trends, assess impacts, and support viable landuse strategies for the future**”, led by a team from Argentina, Uruguay, Paraguay, Brazil and the USA, is examining the impact of land cover and land use changes on the carbon balance of the La Plata Basin, the second largest hydrological system in South America. The basin is facing the largest and fastest landuse changes in human history, changes that have affected some 30 million hectares over the past 25 years (the period when annual crops such as corn, wheat, sunflower, and most recently soybean, were introduced). The most important carbon stocks are in soil organic matter. Growing those crops over that period has reduced soil carbon by about 30%, with loss rates of 28 Tg C yr⁻¹. Carbon losses from pastures have already occurred over the last 300 years but at rates 16 times lower.

The regional carbon balance for both ocean and land thus shows a carbon sequestration at the continental shelf of some 17 Tg and carbon release from the continent's soils near 30 Tg per year. Of these, the shelf sequestration is largely beyond human control, but possibly vulnerable to both global change and fisheries management, while the carbon release from soils is directly attributable to agricultural activities. This knowledge carries important implications for decision making in fisheries and land use, and highlights the importance of regional analyses that provide actionable information.

Some of the landuse conversion is now driven by a desire to substitute fossil fuels by "carbon-neutral" biofuels. However, IAI research has demonstrated that letting the natural vegetation recover on former agricultural land is better for the greenhouse gas balance than growing biofuel crops. Carbon released from soil upon conversion from grassland to maize grown for ethanol creates a "carbon debt" that may offset carbon gains from using this biofuel for at least 50 years. Furthermore, carbon stored in soils under recovered grassland was higher than the possible C credits generated with corn for ethanol on the same land for 40 years, and it had equal or even greater economic net present value.

The research group has published maps⁴ of changes in vegetation cover over the past years that may help identify which areas of the continent hold promise for carbon capture, and where the ‘hot spots’ of carbon loss are.

The third project introduced here, “**Documenting, understanding and projecting changes in the hydrological cycle in the American Cordillera**”, is led by a team of scientists from Canada, Argentina, Bolivia, Chile, Mexico and the USA. Glacier losses around the world are perhaps the most obvious signs of climate change. Improving the knowledge on mountain snow and glacier cover remains a priority for developing sustainable water resource management and policies in these regions. The IAI glacier research in the American Cordillera has shown that both the loss of water storage in glaciers and the related reduction in regional snow covers due to increasing temperatures have affected—and will continue to affect—hydrological regimes significantly. Important social and economic activities depend on these water resources. Glaciers are part of the larger hydrological system, and in many cases changes in precipitation and snowpack, which are also temperature dependent, may be more significant to future water supplies. Where this melt runoff is significant for regional hydrological systems, the implications of these changes may be large.

Glacier loss varies considerably throughout the Americas. Most glaciers are melting rapidly, and many small, particularly tropical glaciers will disappear in the next few decades, while others may survive in much smaller size. Exceptions are very few glaciers in the southern Andes, which are growing under increased snow fall.

In Argentina, the Institute of Snow and Ice studies, IANIGLA, part of the IAI network, has developed glacier inventories based on new aerial photography for Southern Patagonia (49°S), and the wet (40°S)

⁴ The maps are available at <http://lechusa.unsl.edu.ar/>

and desert Andes (29°S) further north. In the wet Andes study, the ice cover decreased from about 12%, with individual glaciers losing between 6 and 22% of their area. The southern Patagonian ice field lost 500 km², nearly 4% of its area, and almost all outlet glaciers from the ice field are receding, but there are a few exceptions; e.g., Glaciar Pio XI gained 7.8 km² between 1986 and 2009.

Glacier loss in the tropical Andes has considerably accelerated especially after 1976, not necessarily attributable to steady warming trends. The years 1976/77 saw a change in the atmospheric circulation over the North Pacific Ocean, the Pacific Decadal Oscillation (PDO). An opposite shift of the PDO had previously occurred in 1945. These changes in the atmospheric circulation over the Pacific introduced two significant steps in rainfall, temperature and streamflow patterns over the past 65 years. On shorter time frames, El Niño events affect inter-annual mass balances of glaciers, bringing lower snowfalls to some regions and higher snowfalls to others in a well-defined regional pattern.

IAI-funded glacier studies in Argentina⁵ continue with the reconstruction of glacier fluctuations over the last 2000 years, together with a reconstruction of regional precipitation and temperature histories from which the main components of the regional atmospheric patterns (the Antarctic Oscillation, El Niño and also the PDO) can be reconstructed. These are important controls of the mass balance of glaciers - in different areas of the Andes glacier fluctuations are more strongly controlled by precipitation than by temperature changes. It is important to understand the variability and major controls of rain and snowfall that are inputs to both glaciers and other hydrological systems - and hence to changing water supplies. Strategies for investment in infrastructure should focus on securing water resources, increasing water use efficiencies at all levels to deal with the both the limitations imposed by present, “known” climate variability and by future scenarios of climate change and glacier retreat.

Glacier changes are also a source of hazards in mountain areas, such as outburst floods from mountain lakes or hanging glaciers falling into lakes. For example, five major floods from glaciers have occurred on Rio Colonia in Chile in only 18 months in 2009 and 2010. Similarly, a large flood that occurred on Rio Manso at Tronador in Argentina in May 2009 drained the lake in front of Ventisquero Negro which is the target of current investigations by the IAI research team.

Research findings from these three projects illustrate the importance of acknowledging regional environmental processes in the adaptation to and mitigation of climate change. Through its programs, the IAI continues to promote international interdisciplinary research to better understand carbon and hydrological cycles and to develop regional analyses that will assess environmental risks and impacts of climate change in the Americas.

⁵ <http://www.glaciares.org.ar>

International Geosphere-Biosphere Programme

Introduction

The International Geosphere-Biosphere Programme (IGBP) is a research programme that studies the phenomenon of Global Change (www.IGBP.net). IGBP research addresses the interactive physical, chemical and biological processes that define Earth System dynamics, changes that are occurring in these processes and the role of human activities in these changes. IGBP contributes to new knowledge on climate change, as well as many other global environmental change issues, by coordinating research activities through the IGBP Core Projects and by organizing workshops and synthesis activities that bring together scientists from a wide range of disciplines. The nine Core Projects of IGBP address processes on land, in the atmosphere, and oceans, and the interfaces between these, and include two integrative cross-cutting projects that address future and past global change. Many IGBP activities have considerable collaboration with other partner programs.

Sciences highlights

Ocean acidification

The ocean absorbs approximately 25% of the CO₂ added to the atmosphere from human activities each year. When CO₂ dissolves in seawater, carbonic acid is formed, and pH decrease. If current trends persist, by 2100 the oceans will be more acidic than they have been for 20 million years. The implications for marine life and biological, physical and chemical cycles are poorly understood.

Recent science findings: As pH falls, some marine organisms show reduced rates of calcification but others show more calcification, according to a sixty-day laboratory experiment with 18 species (Ries et al. 2009. *Geology* 37: 1131-1134). Researchers expected to find that marine organisms relying on calcification processes would struggle as the pH of the oceans drops. Net calcification rates decreased for ten species (e.g., temperate corals, hard clams, conchs, bay scallops, oysters, soft clams). In three species (crabs, lobsters, and shrimp), net calcification was greatest under the highest level of acidification. One species, the blue mussel, exhibited no response to elevated CO₂ levels. Additional research is urgently needed on impacts of ocean acidification on organisms and ecosystems and implications for climate and society.

International research coordination: National research efforts now underway in numerous countries (e.g. UK, USA, Australia) call for international coordination of research on ocean acidification. IGBP will lead this international coordination.

Summary for Policymakers: A summary for policymakers on ocean acidification was published by IGBP and co-sponsors (<http://ioc3.unesco.org/oanet/index.html>). The summary outlines the significance of this rapid oceanic change and calls for a global observation network to monitor the pH fall and related changes to ecosystems and cycles. French and Spanish translations will be available soon.

Role of land cover and land use in modulating climate

Changes in land use and land cover directly affect biotic diversity worldwide, contribute to climate change, are the primary source of soil degradation, and affect the ability of ecosystems to support human needs. Such changes determine, in part, the vulnerability of places and people to climatic, economic or socio-political perturbations. The pace, magnitude and spatial reach of human alterations of the Earth's land surface during the past few centuries are unprecedented, but their effect on the planet's climate remains to be comprehensively understood. Recent studies examined the effect of changes in land-cover (crop and pasture fractions) from preindustrial to recent times on simulated global surface temperatures.

Initial results suggest that during summer in temperate regions the land-cover changes alone would decrease ambient air temperature, thus dampening the climate signal, while in lower latitudes the land-cover changes had a minimal effect on air temperature. Further work is needed on land cover change processes, implications and modeling (Pitman et al. 2009. GRL 36; Noblet et al. in prep.).

Deltas under threat

Half a billion people live on the world's deltas, and 24 out of the world's 33 major deltas are sinking (Syvitski et al. 2009 Nature Geoscience 2: 681–686; Overeem and Syvitski 2009 LOICZ report 35). Additionally, 85 percent of these deltas have suffered severe flooding in recent years. Both global sea level rise and subsidence contribute to the sinking. In some deltas the subsidence is greater than the sea level rise. Sediment trapping in dams along with sediment compaction from oil, gas and water extraction contribute to the subsidence. These results demonstrate the need to understand the multiple factors that determine the vulnerability of societies and ecosystems to climate change.

Black carbon assessment underway

An assessment report on the role of black carbon in climate is being led by IGBP and WCRP projects. Black carbon, or soot, absorbs heat and so has a warming effect on the planet. Data suggest that black carbon on Arctic snow also has contributed to a larger than expected warming in the region. Major sources of black carbon are fossil fuel combustion, industry, and biomass burning. Policy makers and scientists have suggested international policies to reduce atmospheric levels of black carbon as a mitigation strategy for climate change. But there are many uncertainties. This assessment will summarize the state of science of black carbon as a climate forcing agent; the implications for mitigation decisions; explain widely varying forcing estimates, especially in the context of IPCC values; and present bounded uncertainties, especially co-emitted species and cloud changes. The report is due to be published in 2010 and will contribute to the assessment of aerosol forcing on climate in the IPCC AR5 and will also be used directly in a black carbon report being prepared by UNEP.

Reversal of 2000-year Arctic cooling trend

Recent research demonstrates a cooling trend in the Arctic extending back 2000 years, with a dramatic reversal of this cooling trend since 1950. Four of the five warmest decades of the last 2000 years have occurred between 1950 and 2000. The Community Climate System Model simulation suggests that the long-term trend was caused by the steady reduction in summer insolation due to a gradually shifting orbital configuration, which however, could not account for the dramatic reversal of the cooling trend. (Kaufman et al. 2009 Science 325:1236-1239)

Impact, adaptation and vulnerability to climate change in the developing world

In November 2009, IGBP, ESSP and IPCC jointly sponsored a workshop in Brazil on impact, adaptation and vulnerability to climate change in the developing world. The workshop brought together leading researchers from the developing world to discuss research requirements. Workshop report in preparation.

Climate Change Index – communicating to policy makers

IGBP launched the Climate-Change Index at COP15. The index brings together four of the most important Earth system parameters that humans are changing: temperature, carbon dioxide, sea-level rise and summer Arctic sea ice. The index will be released annually, for more information please refer to: (<http://www.igbp.net/page.php?pid=504>).

A vision for closer integration: Global Change Open Science Conference 2012

Planet Under Pressure: new knowledge towards solutions, aims to attract 2500 of the world's leading thinkers on global-change research. The conference (London, May 7-10, 2012) is sponsored by the International Council for Science's (ICSU) global environmental change research programmes. It will bring together natural, physical and social scientists, together with economists, engineers, health specialists and many others disciplines, plus national and international policymakers, industry representatives, technologists, NGOs and development experts. The conference also will form a solid scientific foundation for the Earth Summit, Rio +20, also scheduled for 2012.

International synthesis on climate relevant topics

Through a series of consultations with IPCC, ICSU and its global-change programmes, and others, IGBP has identified the areas in Earth system science most requiring synthesis. The synthesis will be published in the peer-reviewed literature, inform policy and pinpoint the knowledge gaps for further exploration. Some of the synthesis themes of particular relevance to climate change are: nitrogen and climate; global nitrogen geoengineering impacts; global environmental change and sustainable development: the needs of least developed nations; megacities in the coastal zone; changing aerosols in the Earth system; air pollution and climate; Earth system impacts from changes in the cryosphere; the role of land cover and land use in modulating climate; and, acting on adaptation to global environmental change. Many of the synthesis themes, while building on IGBP science, will require a high degree of collaboration across natural and social scientists. The outcomes will be highlighted at the Global Change Open Science Conference in 2012. Publication of many of these is anticipated in 2012 in time for use by IPCC in the fifth assessment report.

IGBP statement in support of IPCC

On 3 May 2010, IGBP released a statement that emphasises that the IPCC process for assessing climate change, its causes, its impacts and responses, is reliable and unbiased. Recently, a small number of errors have been reported in the contribution of Working Group II to the IPCC Fourth Assessment. IGBP can state that these errors in no way detract from the substantive findings of the Working Group II contribution to the Fourth Assessment Report.

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International Human Dimensions Programme on Global Environmental Change (IHDP)

Introduction

The future of research on global change will depend heavily on contributions from the social sciences, if it is to be cutting-edge, integrative, problem-driven and policy relevant. This is further supported by a new focus in science and policy that shifts increasingly toward response options and solutions. Some of the following contributions were presented in Copenhagen at COP 15 during a joint side event with the International Geosphere-Biosphere Programme (IGBP) "Science, Society, and Adaptation". This short background paper provides an update for UNFCCC-SBSTA32.

Science highlights

Human Security, Vulnerability and Sustainable Adaptation

The Global Environmental Change and Human Security project (GECHS) contributes to our understanding of how individuals and communities can respond to an assortment of stresses and shocks to their social, environmental and human rights. Issues such as "sustainable adaptation" as well as the interface of "ethics, vulnerability and the poor" introduce a more comprehensive understanding of how climate change is linked to social and economic development pathways and how to build resilience at various levels to cope with changes, including (potentially) abrupt changes. To highlight how we actually create human security in the face of global environmental change will be the main purpose of the film documentary "The Decade that Matters". This film project draws attention to positive examples of social change around the world.

In the past months, special attention was placed on the question of how to emphasize the notion of human security as an important lens for the *IPCC AR 5* as well as for the *IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*.

Matthew et al. 2009. *Global Environmental Change and Human Security*. MIT Press.

Eriksen, Watson (eds.) 2009. Thematic Set: The Sustainability of Southern African Savannas: Threats and Opportunities. *Environmental Science & Policy*. 12(1), pp. 1-102.

Urban Areas: Vulnerability Hot Spots and Effective Responses

The centrality of urban areas in finding solutions to the combined demographic, economic and environmental challenges we will face due to climate change in this century is now undeniable. This is a clear outcome of the proceedings and discussions around COP 15, and is a major building block of the Urbanization and Global Environmental Change project (UGEC).

Several *key questions are still being explored*: we need to alter perspectives on and agendas for sustainability to explicitly incorporate urbanization; identify the most significant opportunities to develop triple-win solutions and strategies for climate change mitigation and adaptation, and urban development; understand how the confluence of contemporary urbanization and global environmental change will exacerbate or accelerate issues of equity – and intervene accordingly; operationalize our knowledge on responses within the context of complex interactions between institutions, governance, energy choices and built space; improve the social outcomes of the built environment; design forms of urban growth with less environmental impact and implement the governance and institutional structures necessary to achieve them.

Seto, Shepherd (2009). Global urban land-use trends and climate impacts. *Current Opinion in Environmental Sustainability* 1(1), 89-95.

Sanchez (2009). Learning to Adapt to Climate Change in Urban Areas. A Review of Recent Contributions. *Current Opinion in Environmental Sustainability*, 1(2), 201–206.

Coastal Vulnerability and Sustainability

Along with fourteen of the world's seventeen largest megacities – most of them in Asia's fastest growing economies – the majority of the world's population lives along the coast. Not only do the coastal inhabitants strongly depend on and influence coastal social-ecological systems, but many more people are indirectly linked through food production and economic trade, recreation and tourism, water and air quality, and biodiversity, among others. Moreover, coastal ecosystems are very dynamic, diverse, and productive, but also extremely vulnerable to drivers such as climate change. However, compared to most other terrestrial habitat types, the changes of coastal ecosystems are still poorly known. New research focuses onto the integrated topic “Coastal vulnerability and sustainability to support adaptation to global change” and is also going to concentrate on the most *rapidly changing coastal hotspots* i.e. coastal megacities (population), Arctic coasts (climate change), Small Island Developing States (vulnerability), and river-mouth systems (fluxes).

Fekete et al. 2010: Millennium Ecosystem Assessment Scenario drivers (1970-2050): Climate and hydrological alterations. *Global Biogeochemical Cycles* (23)

Olsen et al. 2009: The Analysis of Governance Responses to Ecosystem Change: A Handbook for Assembling a Baseline. LOICZ Reports & Studies No. 34. GKSS Research Center, Geesthacht

Industrial Transformation, Sustainability Experiments and Sustainable Development Pathways

One of the major findings of the IHDP-IT project is that *developing countries do not have to follow conventional development trajectories*, due to the specific resource and environmental quality of their economies. However, it is necessary to clarify why sustainability transition does *not* happen and what can possibly be done to empower the transformative potential of local initiatives. Sustainability experiments provide a promising analytical angle for this. They are defined as planned initiatives to embody a highly-novel, socio-technical configuration likely to lead to substantial (environmental) sustainability gains. Their great variety in Asia – the current regional focus of the IHDP-IT project – holds a promise for radical, locally-based innovations, and for creating a new, less environmentally burdensome course of industrialization and urbanization.

The problem of up-scaling can be explained as a coordination problem between the level of experiments and the stabilized, path-dependent regimes. It is argued that the nature and timing of linking and coordination processes can result in different (more or less sustainability oriented) transition pathways. Hence, the failure of the experiments in the Asian context can be understood as a lack of creating linkages or a lack of coordination between processes on these different levels. Creating an enabling environment where internationally-linked sustainability experiments can proliferate and grow across different sectors should be an objective for Governments and international agencies.

Berkhout et al. 2009. Asian development pathways and sustainable socio-technical regimes. *Technological Forecasting and Social Change*, Special issue, Vol 76(2).

Berkhout et al. Sustainability experiments in Asia: innovations shaping alternative development pathways? *Environmental Science and Policy* (Special issue June 2010 in press)

The Governance Challenge

COP 15 has clearly indicated the need for a global, effective architecture for earth system governance, including climate change governance, that is adaptive to changing circumstances, involves different stakeholders, is accountable and legitimate, also beyond the nation state, and that has an emphasis on fairness for everyone. This “starting point for a new global deal” matches with the scientific framework of the Earth System Governance project (ESG) that is addressing, for example, tension between *fragmentation and integration in decision-making in climate governance and its multilateral negotiation system*. By looking into the interplay of different institutional arrangements within an effective or less effective governance architecture, the project helps to understand the horizontal linkages of highly interdependent issue areas, for example between climate change and various fields of sustainable development, and vertical linkages from the global to the local level. Furthermore, important empirical areas of the project are options for post-2012 climate governance.

Oberthür, Stokke. Institutional Interaction and Global Environmental Change. Cambridge, MA: MIT Press. (forthcoming);

Biermann et al. 2009. The Fragmentation of Global Governance Architectures: A Framework for Analysis. *Global Environmental Politics* 9 (4):14-40;

Capacity Development

The IHDP and its projects are continuously developing human dimensions research networks and building capacity, for example, in the thematic areas highlighted above, particularly with a focus on scholars from developing countries. As a global Programme, it pays much attention to the composition of its research groups to ensure a balance in gender, regional and disciplinary backgrounds. It was proven more often than not that the composition of such endeavours has an impact on how science is being conducted and which questions are being asked. For example, to bridge the “North-South Divide” remains a challenge in order to complement the “Western” approach towards science with perspectives from the “Global South”, which often pay more attention to issues of equity and human well-being, or reach out to the development agenda more forcefully.

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World Climate Research Programme: Scientific Foundation for Decision Making

Introduction

WCRP supported a number of high priority scientific research activities during the past year in support of its mission of facilitating analysis and prediction of Earth's climate system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society. These activities enabled progress on: 1) the scientific understanding of climate variability and change on seasonal, decadal and centennial time scales; 2) the analysis, interpretation and synthesis of the scientific knowledge in order to provide the required climate information for decision makers concerned with climate adaptation, mitigation and risk management; and 3) training and development of early career climate scientists, and a dialogue between climate experts and decision makers at the regional and global levels. In the following sessions, we provide some examples of these three categories of activities.

Advancing Climate Science

Under the auspices of the WCRP/CLIVAR Working Group on Coupled Modelling, 21 modelling groups are participating in the latest Climate Model Intercomparison Project (CMIP5, <http://cmip-pcmdi.llnl.gov/cmip5/>) for providing global climate projections to the 5th IPCC Assessment Report (AR5). WCRP will make the results of global climate model runs available to worldwide community through a comprehensive archive. CMIP5 also includes a series of experiments on short-term climate prediction for the next 30 years.

WCRP/CLIVAR is facilitating the advancements in decadal climate prediction by organizing several workshops that address some of the challenges that decadal prediction poses. The WCRP/CLIVAR workshop that took place last year (November 2009) in Utrecht, NL, reviewed the initialization and perturbation techniques in earth system models and developed a roadmap to making skilful decadal predictions (http://eprints.soton.ac.uk/79460/1/145_DecadalPrediction.pdf). Another workshop is being organized jointly by WCRP/CLIVAR working groups on ocean modelling development and global observation synthesis which will address the role of the ocean in decadal variability, predictability and prediction (<http://www.clivar.org/organization/wgomd/decadal/decadal.php>).

Another major ongoing effort within WCRP is the Climate-system Historical Forecast Project (CHFP, <http://www.clivar.org/organization/wgsip/chfp/chfp.php>). This project is a multi-model, multi-institutional experimental framework for the assessment of state-of-the-science seasonal forecast systems, and to evaluate the potential for untapped predictability due to interactions between the components of the climate system that are currently not fully accounted for in seasonal forecasts.

The WCRP core project on Stratospheric Processes and their Role in Climate (SPARC) has just completed Phase 2 of its Climate-Chemistry Model Validation Project (CCMVal), for more information see: http://www.atmosp.physics.utoronto.ca/SPARC/CCMVAL_FINAL/index.php. The in-depth analysis of the climate - chemistry models' capabilities in the area of dynamics and transport, radiation, chemical processes and microphysics has led to very significant progress in representing the observed changes of the stratospheric ozone layer. The CCMVal2 report provides reassessment of the projections of ozone and UV radiation through the 21st century, which will constitute useful and timely contribution to the WMO/UNEP 2010 Scientific Assessment of Stratospheric Ozone Depletion and IPCC AR5.

Last year, WCRP Projects, Working Groups and Panels developed an implementation plan that describes the major research activities and initiatives WCRP will promote and undertake during the next several years. This plan was published in September 2009 and can be found at http://wcrp.wmo.int/documents/WCRP_IP.pdf.

WCRP is planning an Open Science Conference (OSC) entitled “Climate Information in Service of Society”, to be held 24-28 October 2011 in Denver, Colorado (for more information see: www.wcrp-climate.org/conference2011). The purpose of this conference which coincides with the 30th Anniversary of WCRP is to assess our current knowledge of climate variability and change, identify the most urgent scientific issues and research challenges and ascertain how WCRP can best facilitate research and develop partnership critical for progress in addressing these challenges. The OSC will provide an excellent opportunity for exchange and collaboration across the international research communities/programmes (e.g. WCRP, WWRP, IGBP, IHDP), and users of climate information resulting from these research programmes.

Providing Climate Information for Decision Makers

WCRP scientists played a major role in the success of the World Climate Conference-3 (http://www.wmo.int/wcc3/page_en.php) held in Geneva in August 2009. The High Level segment agreed to establish a Global Framework for Climate Services (GFCS) to strengthen production, availability, delivery and application of science-based climate prediction and services. Strengthening of WCRP as well as ESSP partnership is seen as key to a successful GFCS.

The WCRP Task Force on Regional Climate Downscaling has launched the CORDEX project (http://wcrp.ipsl.jussieu.fr/RCD_Projects/CORDEX/CORDEX.html) in order to provide quality-controlled data set and regional climate-based information for the recent historical past and 21st century projections. CORDEX domains cover the majority of populated land regions on the globe with a major focus on Africa. The project is well underway and is becoming a reference for the community. The group is organizing a workshop on facilitating the production of climate information and its use for assessing vulnerabilities, impacts and adaptation 14-16 June 2010 in Lille, France with active participation of the IPCC WG I and WG II communities, for more information see: <http://wcrp.ipsl.jussieu.fr/Workshops/RegionalClimate/index.html>.

The recently established WCRP/IOC Task Group on Sea-Level Variability is tasked to further improve the ability to assess the state of our scientific knowledge of global and regional sea level variability and changes, and the uncertainties associated with the contributions of related environmental factors. The group met for the first time in Bern, Switzerland in March 2010 and reviewed the understanding of the observed sea-level change as well as the progress in quantifying the different causes. WCRP and WMO published a global sea-level rise update for UNFCCC COP15 (http://wcrp.wmo.int/documents/sea_level_4page_en1.pdf) and will contribute to the IPCC workshop on sea level rise and ice sheet instabilities 21-24 June 2010 in Kuala Lumpur, Malaysia (<http://www.ipcc-wg1.unibe.ch/meetings/slr/slr.html>).

WCRP is planning a series of regional workshops focused on the emerging needs for timely access to available scientific knowledge of climate variability and change by decision makers in a wide range of economic sectors:

- Noting the observed rapid loss of sea ice in the Arctic and the large spread of simulated sea-ice extent predictions in present models, WCRP is taking the lead in organizing a workshop on polar predictability on seasonal to multidecadal timescales in October 2010 in Bergen, Norway.
- WCRP is working with the climate community at global, regional and national levels to provide decision makers with the most comprehensive views on South American climate, including the potential for ENSO-Climate Change interactions over South America and related trends, teleconnections and potential impacts, based on the best science available for the region. This is the motivation for the WCRP workshop on ENSO, Decadal Variability and Climate Change in South America that will take place on 12-14 October 2010 in Guayaquil, Ecuador, (<http://www.clivar.org/organization/pacific/meetings/enso/motive.php>)
- WCRP is working with its weather research sister programme at WMO (WWRP) to pursue a seamless approach to predictions of weather and climate on all time scales. Current activities

include the Year of Tropical Convection (YOTC) and the Madden-Julian Oscillation Task Force (MJOTF). A joint workshop is being organized on monsoon intra-seasonal variability on 15-18 June 2010 in Busan, Republic of Korea.

- Recognizing the need for increased understanding of how large scale processes affect regional phenomena such as extreme events a Drought Interest Group (DIG) was formed in 2009 with the purpose of coordinate modeling activities and to establish a link with the users information on droughts. WCRP is also involved in the organization of a workshop on metrics and methodologies of estimating extreme climate events with active engagement of private sector on 27-29 September 2010 in Paris, France (<http://www.extremeworkshop.org/>)

Training Next Generation of Climate Scientists

The WCRP together with the Inter-American Institute for Global Change Research (IAI) and the International Research Institute for Climate and Society (IRI) is organizing a Training Institute for graduate students and young scientists/professionals to support the education and training of local and regional experts for development and use of climate information in different socioeconomic sectors (agriculture, health, water resources, disaster risk reduction, etc) in Latin America. The two-week workshop/course will be hosted by the School of Exact and Natural Sciences of the University of Buenos Aires (FCEN/UBA) in Argentina from 2 to 13 August 2010.

WCRP is partnering with WMO, GCOS and ICPAC to execute a World Bank-sponsored project on climate risk reduction for the Greater Horn of Africa countries. A series of three coordinated workshops this year will bring together climate practitioners and users to assess available climate data and information for water resources and agriculture, and to identify best practices and gaps that need to be filled. A first workshop was held in Nairobi in April and the second one will be held in conjunction with the RCOF in Nairobi in August.

WCRP is also working closely with START on a project entitled "Understanding the Findings of the IPCC Fourth Assessment Report, Climate Change 2007 - Integrating Climate Change Adaptation and Mitigation in Development Planning". The project Integrating Climate Change Mitigation and Adaptation in Development Planning (CCMAP) was developed to address these critical knowledge and communication gaps. The project is a collaborative effort between the WMO, UNEP, the IPCC, START, the Universities of Ghana and Dar es Salaam and the Bangladesh Centre for Advanced Studies. Financial support for the project comes from the European Commission with collateral support from UNEP. The project, which targets the regions of East and West Africa and South Asia, seeks to encourage a dialogue between scientists, policy makers, and other societal decision making groups on climate change risks and potential responses for adaptation and mitigation, and to develop a process for assessing knowledge of climate change at regional, subregional, national, and local scales that can support effective decision making by organizing a series of national and regional climate activities aimed at; 1) regional knowledge sharing strategy; 2) science-policy dialogues; 3) regional training workshop(s); and 4) participatory regional knowledge assessments.

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