

WCRP ANNUAL REPORT 2006-2007

Providing the Science for Climate Change Solutions

World Climate Research Programme
Improving climate predictions and understanding human influence on climate

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MESSAGE FROM THE CHAIR



NIKO NAMI

Undoubtedly the climate science highlight of the last year was the completion of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4). WCRP's research is central to IPCC Working Group I. WCRP scientists were prominent as authors, contributors and reviewers. In broader terms, WCRP is working to reduce uncertainties in climate change projections through a coherent pan-WCRP climate change effort. One important element of this plan is a workshop (Sydney, Australia, October 2007), in partnership with the Global Climate Observing System (GCOS), the International Geosphere-Biosphere Programme (IGBP) and the IPCC, to begin activities to resolve key uncertainties evident in and arising from the AR4.

Climate change is only one of a series of cross-cutting activities being pursued by WCRP's projects, panels and working groups. Others are improving seasonal and monsoon predictions, understanding extreme events, contributions to the International Polar Year (IPY) 2007-2008, atmospheric chemistry and climate (in partnership with IGBP), sea-level rise and the initiation of a decadal climate prediction experiment. The Congress of the World Meteorological Organization (WMO, May 2007) and the Assembly of the Intergovernmental Oceanographic Commission (IOC) of UNESCO (June 2007) were pleased to hear of progress in these activities and enthusiastically endorsed WCRP's continued development of these cross-cutting activities. WCRP's third sponsor, the International Council for Science (ICSU), supported many talks highlighting implementation of the WCRP Strategic Framework during the International Union of Geodesy and Geophysics (IUGG) session (July 2007) at which Dr Guxiong Wu (an officer of the Joint Scientific Committee (JSC)) was elected as the President of the International Association of Meteorology and Atmospheric Sciences (IAMAS).

WCRP is reaching out to many organizations. Parties to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to establish a dialogue with climate scientists at meetings of the Subsidiary Body for Scientific and Technological Advice (SBSTA). This is a forum for Parties to be informed about the latest advances in climate science and to hear of research gaps and priorities that require national investment, and for WCRP to better understand the Parties' concerns and needs.

There has never been a greater demand for information on climate and WCRP plays a critical role in the development of many climate services. Despite this demand, WCRP is suffering from a significant and worsening shortfall in financial resources. In addition to strengthening its great climate science, WCRP also needs to increase its impact by delivering more complete science solutions. As a result, WCRP and IGBP have established a joint committee to examine whether a greater integration of their activities is desirable and if so how this should be done. In the broader Earth system research arena, the second Earth System Science Partnership (ESSP) Open Science Conference, organized by WCRP on behalf of all ESSP partners in Beijing, in November 2006, launched a new joint project on Human Health and also one in the Monsoon Asia Region.

Finally, many awards and honours were bestowed on WCRP scientists during the year. On behalf of the Joint Scientific Committee, I would like to congratulate all recipients, including Sir Brian Hoskins, Dr Jagadish Shukla, Dr Paola Salio, Dr Tetsuzo Yasunari and Dr Mous Chahine for their well-deserved recognition.

John Church

Chair of the WCRP Joint Scientific Committee, July 2007

BENEFITS DELIVERED IN 2006-2007



TORVALD LEKVAM

World's Largest Global Warming Database

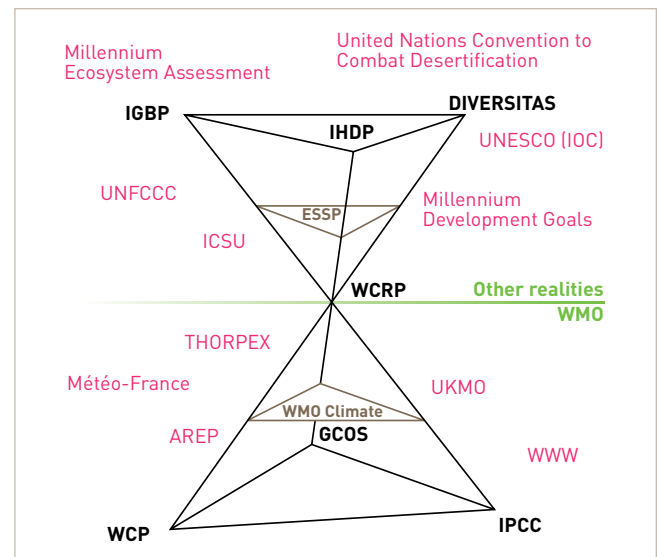
The Coupled Model Intercomparison Project 3 (CMIP3) archive was initiated by WCRP scientists working on coupled climate modelling to help the Intergovernmental Panel on Climate Change consolidate predictions made for the recently published IPCC Fourth Assessment Report. More than one thousand users are already working in over 1,100 separate subprojects on such diverse topics as African monsoon variability, drought in Australia, hydrology of the Mekong River, Pacific Island's climate change detection, the Arctic contribution to sea-level rise and anthropogenic impact on Antarctic oceanography. CMIP3 is by far the largest undertaking of its kind to date resulting in over 250 papers published in scientific journals with many more in preparation. The project continues to register users for a variety of climate science and climate impact assessment projects beyond those reported by the IPCC. The Program for Climate Model Diagnosis and Intercomparison (PCMDI) in Livermore, California, volunteered to archive and organize the data under the auspices of the US Department of Energy's Office of Science (http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php).

Leading the Earth System Science–UNFCCC Dialogue

A giant step forward in achieving a common platform for broad-scale integration in Earth system science was a joint workshop in Aspen, Colorado, USA, in July 2006, convened by the modelling groups of the WCRP and the International Geosphere-Biosphere Programme with the aim to construct a unified position of the modelling community with respect to the possible scenarios to be used in future IPCC assessments. The breakthrough in the understanding of model forcings will help to

decide what form next generation models will take for future climate change projections (see WCRP Informal Report No. 3/2007, http://wcrp.wmo.int/documents/Aspen_WhitePaper_1final.pdf).

WCRP with the three other programmes in the Earth System Science Partnership (ESSP) is seeking to strengthen the dialogue between scientists and climate



WCRP is linked closely with the three other global environmental change organizations (IHDP, IGBP and DIVERSITAS—inverted pyramid) and, with them in the Earth System Science Partnership (ESSP), addresses research needs described in, for example, United Nations conventions and the United Nations Millennium Development Goals. WCRP operates within the structure of each of its three sponsors. The pyramid in the lower half illustrates for the WMO WCRP drawing on internal and contributing groups.

change policymakers so as to increase the value of climate change science for policy. At the twenty-sixth session of the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the United Nations Framework Convention on Climate Change in May 2007, WCRP participated in discussions to enable a more effective dialogue between Parties and regional and international climate change research programmes and organizations. As a result of these discussions, the SBSTA invited WCRP and other relevant research programmes and organizations to regularly inform it of developments in research activities relevant to the needs of the Convention. The SBSTA also noted the importance of this dialogue as a way of identifying research gaps and research capacity constraints in developing countries. As a means of engaging and informing Parties of current research activities, WCRP and its partners in the ESSP held a Side Event entitled Connecting Earth System Science Research to Climate Change Policy. Presenters discussed a range of topics including regional analysis of future climate projections, downscaling of global to regional climate models, visualizing interactions between climate and society and the consequences of extreme climatic events (see the Chair's draft conclusions on research and systematic observation at <http://unfccc.int/resource/docs/2007/sbsta/eng/l04.pdf>).

Enhancing Africa-wide Climate Research Network

In cooperation with the World Climate Programme (WCP) and the SysTEM for Analysis, Research and Training (START), the WCRP Variability of the African Climate System (VACS) panel organized a training workshop in Dar es Salaam, United Republic of Tanzania, in July 2006. One of the main outcomes was that each of the 45 participants from regional meteorological services

and ocean agencies was able to put together a seasonal forecast of rainfall and temperature for their countries based on the climate prediction tools developed for operational use by the International Research Institute for Climate and Society (IRI, more: http://www.clivar.org/organization/vacs/VACS_workshop.php).

WCRP held an Africa Climate Research Networking day in March 2007 that focused on young scientists, which was organized jointly with WCP and START in conjunction with the twenty-eighth session of the Joint Scientific Committee for the WCRP (Zanzibar, United Republic of Tanzania, 26-30 March). The event aimed to involve the next generation of scientists in Africa.



An Africa Climate Research Networking day was held in March 2007 in Zanzibar inviting regional and young local scientists to discussions on regional research needs.

The resulting DVD (see back-cover DVD) describes the continent's vulnerability, resilience and adaptation to present day and past global changes in Africa, and advances in African climate prediction. Presentations and the agenda for this event can be downloaded from http://wcrp.wmo.int/PG_Presentations.html.

Climate-Cryosphere Research and the International Polar Year 2007-2008

As confirmed by the IPCC Fourth Assessment Report, the world knows that global warming threatens the stability of ice- and snow-covered regions and, hence, affects water availability and sea level in many parts of the world. To create a framework for, and facilitate improved coordination of, cryospheric observations, and to generate the data and information needed for both operational services and research, the WCRP Climate and Cryosphere (CliC) project together with the Scientific Committee on Antarctic Research (SCAR) initiated in 2004 the Cryosphere Theme of the Integrated Global Observing System (IGOS) Partnership. The work was completed in May 2007 and the report approved by the IGOS partners. The IGOS-Cryo report recommends the development and maintenance of cryospheric data and products that will ultimately result in a more comprehensive, coordinated and sustained understanding of the cryosphere (report available at http://cryos.ssec.wisc.edu/docs/cryos_theme_report.pdf). The report provides background for the development of a major legacy of the ongoing International Polar Year, in which WCRP leads over 30 international projects.

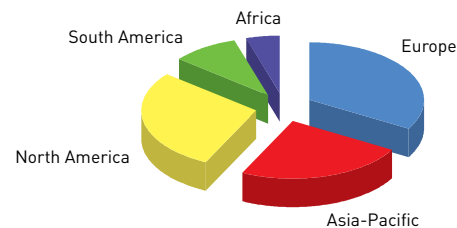
Investing in Malaria Early Warning Systems for Africa

The 2006 Norbert Gerbier-Mumm International Award was given to Dr Tim Palmer, co-chair, WCRP CLiimate

VARiability and predictability (CLIVAR), and 24 of his collaborators in recognition of their major contribution to ensemble climate prediction applications that significantly improve early-warning techniques including those for malaria outbreaks (published in 2004 in the *Bulletin of the American Meteorological Society*, Volume 85). The Award's prize money was recently invested in a project led by the Tanzania Meteorological Agency studying the impacts of climate variability on malaria in the United Republic of Tanzania. The main objective of the project was to further develop and apply the DEMETER methodology of integrating seasonal forecasts and malaria statistics into an end-to-end early warning system for malaria outbreaks. A new Tanzanian database of clinical cases was collected and made available for the wider scientific community, the seasonal and interannual cycle of malaria outbreaks since the year 2000 determined, and the high risk areas in the country identified.

2006 Survey

WCRP surveyed recipients of the Annual Report 2005–2006 and other stakeholders on communications. Responses were received from people around the world that indicated that: 95% appreciated the new Annual Report; 62% believe the new WCRP website to be valuable to them; and 64% believe the WCRP quarterly e-zine to be an excellent form of regular updates on WCRP news. The origin of responses is as follows:



New 2006-2007 Research Products

- World Ocean Circulation Experiment (WOCE) (August 2006). Pacific Ocean Atlas (Volume 2), Indian Ocean Atlas (Volume 4). Digital atlases available at http://www.woce.org/atlas_webpage/links.html. The Pacific Ocean Atlas is currently being printed.



- A Strategy for Climate Change Stabilization Experiments with Atmosphere–Ocean General Circulation Models and Earth System Models (June 2007). Aspen Global Change Institute 2006 session, Aspen, Colorado, USA, 30 July–5 August 2006. Download WCRP Informal Report No. 3/2007 from http://wcrp.wmo.int/documents/Aspen_WhitePaper_1final.pdf [pdf, 0.4 MB].
- Summary Statement for the WCRP Workshop Understanding Sea-level Rise and Variability (June 2006). Download from http://wcrp.wmo.int/pdf/summary%20statement%202006-1004_low-res.pdf [pdf, 1.6 MB] or send request for a hard copy to wcrp@wmo.int.
- For the Monitoring of our Environment from Space and from Earth (July 2007). Cryosphere Theme Report of the Integrated Global Observing System (IGOS-Cryo). Download from http://cryos.ssec.wisc.edu/docs/cryos_theme_report.pdf [pdf, 4.2 MB].
- Global Precipitation Climatology Project (GPCP) Version 2 Satellite–Gauge Combined Precipitation Product (2007). Monthly data sets on global distribution of precipitation, available at http://www.gewex.org/GLDAS_data_product_4-2006.pdf [pdf, 0.1 MB].
- A Guide to Making Climate Quality Meteorological and Flux Measurements at Sea (2006). Edited by C. Fairall and F. Bradley. Available for download from ftp://ftp.etl.noaa.gov/user/cfairall/wcrp_wgfs/flux_handbook/fluxhandbook_NOAA-TECH%20PSD-311v3.pdf [pdf, 3.3 MB].
- First WCRP CLIVAR Science Conference (2006). *Journal of Climate*, Volume 19(20), see <http://ams.allenpress.com/perlserv/?request=get-toc&issn=1520-0442&volume=19&issue=20>.
- CLIVAR Workshop on Atlantic Climate Predictability (2006). *Journal of Climate* 19(23), see <http://ams.allenpress.com/perlserv/?request=get-toc&issn=1520-0442&volume=19&issue=23>.
- Advances in Applying Climate Prediction to Agriculture (2006). *Climate Research* Special Issue 16, see <http://www.int-res.com/abstracts/cr/v33/n1/>.

COMMUNICATING CLIMATE RESEARCH TO DECISION MAKERS



CHRIS COCKRAM



WCRP's research in advancing the frontiers of climate science has been a bedrock of credible information for the climate change science assessments of the IPCC.

Prof. V. Ramaswamy, Vice-Chair WCRP Joint Scientific Committee, Reviewer and Contributing Author to TAR, Coordinating Lead Author to AR4

The World Climate Research Programme, as the premier body for promoting, facilitating and coordinating international climate research, contributes to the Intergovernmental Panel on Climate Change. The Panel was established by the World Meteorological Organization and the United Nations Environment Programme (UNEP) to assess the scientific information related to anthropogenic climate change. WCRP interests in, for example, emissions of major greenhouse gases; the Earth's radiation balance; observation, detection and attribution of human-induced change; and future projections of climate change contribute to IPCC evaluations of the science and socio-economic consequences of climate change and aid its formulation of response strategies for the management of climate change. The IPCC mandate is to make policy-relevant assessments comprising carefully reviewed evidence and consensus on its interpretation. By virtue of their leading roles in international climate research, scientists associated with WCRP and the International Geosphere-Biosphere Programme have been at the forefront in providing the essential scientific bases for all four IPCC assessments.

A total of 127 scientists from 25 countries was involved in the writing and over 200 scientists peer reviewed the First Assessment Report (FAR), which was completed in 1990. Many of the contributing scientists were also engaged in the international climate research organized by WCRP through its core projects, working groups and panels. WCRP's coordinating efforts contributed to: reliable quantification of the radiative forcing due to carbon dioxide and feedbacks in the climate system, for example, water vapour; equilibrium climate response to carbon dioxide changes (with inputs from the WMO 1986 Assessment); and climate data sets, especially on clouds and land surface. FAR concluded that it was certain that "emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases" (notably carbon dioxide), with model simulations using emission scenarios projecting warming into the future. WCRP's significance to FAR lay in the identification of key scientific uncertainties: the control of greenhouse gases by the Earth's systems; cloud radiative processes, precipitation and evaporation; ocean transport and storage of heat; and ecosystem processes. At the end of FAR, it became clear that, while IPCC would continue to have responsibility for



WCRP serves an irreplaceable role for coordination within the science community, which in turn is invaluable to the IPCC.

Dr S. Solomon, Co-Chair IPCC Working Group (WG) I AR4, past Member WCRP Joint Scientific Committee, Contributing IPCC Author



WCRP organized the largest international coordinated climate change modelling experiment and model analysis effort ever attempted, and this was crucial in the IPCC Fourth Assessment Report for quantifying future climate change in ways never before possible.

Dr G. Meehl, Co-Chair WCRP Working Group on Coupled Modelling, Contributing IPCC Author, Coordinating Lead Author to AR4

assessing the current state of scientific knowledge of climate and climatic changes resulting from human influences, WCRP, with its emphasis on the physical climate, would lead scientific research on physical climate processes and develop the capability for predicting climate variations, while the newly formed IGBP would emphasize the biogeochemistry-climate linkages. FAR was the first internationally achieved compendium communicating state-of-the-art climate research advances relevant to decision making.

Evidence for Discernible Human Influence on Global Climate

In the IPCC Second Assessment Report (SAR) issued in 1995, WCRP contributions again included observational data sets and metrics from model intercomparison projects. A major accomplishment was that the results from the Atmospheric Model Intercomparison Project (AMIP) enabled a detailed assessment of the model-simulated climate variables. Data sets on clouds and land surface proved

useful in the verification and calibration of climate models.

SAR demonstrated significant advances relative to FAR, with atmospheric models portraying reasonably well the seasonal march of the distribution of temperature, pressure, circulation and the response to large-scale sea-surface temperature patterns. However, uncertainties existed in cloud simulations and the land-surface component. Also, ocean and sea-ice models agreed with the observed large-scale distribution of temperature, salinity and sea ice but there were obvious limitations owing to the coarseness of the spatial scales. Overall, through model intercomparisons, SAR characterized the advances by stating that “current models are able to simulate many aspects of the observed climate with a useful level of skill”, and “model simulations are more accurate at large (for example, hemispheric or continental) space scales; at regional scales, the skill is lower”. The SAR conclusions reflected both the state of confidence and limitations concerning climate models.



WCRP research programmes have provided invaluable input to all the IPCC Assessments. IPCC Assessments in turn have provided essential guidance and inspiration for the development of WCRP programmes.

Sir John Houghton, Co-Chair IPCC WG I Assessments FAR, SAR and TAR, past Chair WCRP Joint Scientific Committee



WCRP must continue to identify and pursue new areas of science that will be central to future IPCC Assessments as well as continue research to narrow uncertainties revealed in IPCC Assessments.

Dr J. Church, Chair WCRP Joint Scientific Committee, Reviewer and Contributing IPCC Author

A highlight of SAR was the conclusion that the “balance of evidence suggests a discernible human influence on global climate”. The paper providing the basis for this key finding received the 1998 International Norbert Gerbier-Mumm Award and included several WCRP-associated scientists. Facilitation of international research activities by WCRP and IGBP, too large in human, technical and financial requirements to be performed by a single nation, and the delivery of standardized methods and model intercomparison results, grew visibly in the SAR. The value of international coordination of observing and monitoring important climate variables (with the Global Climate Observing System, GCOS), in providing more than the sum of the individual nations’ contributions, was considered a critical part of the assessment process.

Breakthroughs in Coupled Ocean-Atmosphere Modelling

The various WCRP model intercomparison projects matured further by the IPCC Third Assessment Report (TAR), with many more climate model runs and increased sophistication of analyses both of inter-model and

model-observation comparisons. The WCRP core project on Climate Variability and Predictability and its Working Group on Coupled Modelling (WGCM) co-organized the Coupled Model Intercomparison Project (CMIP), which led to the: evaluation of atmosphere–ocean general circulation models; model runs for an assumed 1% per year steady increase in carbon dioxide enabling comparison of the models’ climate sensitivities; and intercomparison of models running the newly formulated IPCC emissions scenarios to make future climate projections. WCRP-coordinated observational products, such as the satellite-related cloud data generated through the Global Energy and Water cycle EXperiment (GEWEX), were widely used in assessing the models’ simulations.

The Third Assessment Report, issued in 2001, received significant inputs from the WMO/UNEP Assessment on Ozone Depletion (1999) and the WCRP project on Stratospheric Processes And their Role in Climate (SPARC). SPARC led the initiative on the attribution of the observed stratospheric cooling trends to ozone depletion and long-lived greenhouse gas increases (recognized by the 2003 International Norbert Gerbier-Mumm Award) and on radiative forcings originating from the stratosphere, used in some TAR simulations.



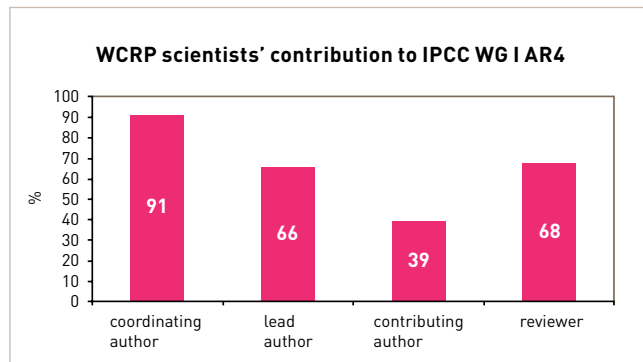
WCRP is becoming the think-tank for the IPCC process, and IPCC the sole agency for an authentic voice.

Dr G.B. Pant, past Member WCRP Joint Scientific Committee, Reviewer to AR4

The hallmarks of the TAR were the far-reaching conclusions: “an increasing body of observations gives a collective picture of a warming world”; “emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect the climate”; “natural factors have made small contributions to radiative forcing over the past century”; and “there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities”.

Largest Ever Global Warming Database for Climate Projections

The Fourth IPCC Assessment Report, *Climate Change 2007: The Physical Science Basis*, was published in February 2007. Perhaps the most notable milestone in the annals of climate model results’ collection and analyses has been the creation of the archive of AR4 simulations of the climate from pre-industrial times to 2100, performed as an outcome of WCRP activities. This archive, managed by the Program for Climate Model



Almost half of the contributors to IPCC AR4 are WCRP-associated scientists.



WCRP activities have been particularly important to IPCC in addressing the issue of detection and attribution of climate change, and the evaluation and projection of global and regional climate changes.

Dr Y. Ding, past Officer WCRP Joint Scientific Committee, Co-Chair IPCC WG I Technical Summary TAR, Lead Author to TAR and AR4

Diagnosis and Intercomparison under the generous auspices of the US Department of Energy’s Office of Science, is open to all researchers around the world. The number of CMIP3-derived papers to date, several of which formed the core conclusions of AR4, is astonishing.

A second very important feature of AR4 was the sheer number of WCRP scientists involved as coordinating, lead and contributing authors and reviewers of the various chapters in the Working Group I report. Almost half of the contributors are WCRP-associated scientists, as also are over 90% of the coordinating authors and some 70% of the reviewers. The majority of researchers within the contributing global WCRP community were climate modellers, diagnosticians and cryospheric scientists.¹ In contrast to earlier IPCC Working Group I reports,

¹ For statistical purposes, we considered those climate researchers as WCRP-associated that are or were (at some stage of their career and the existence of the WCRP) active in any of the WCRP working groups, panels, core projects or cross-cutting activities, or otherwise involved in WCRP activities, or WCRP-sponsored participants at workshops/seminars/conferences.

AR4 provides much more uniform and consistent applications of the phrasings of uncertainties across all chapters.

WCRP activities contributed significantly to the scientific basis for the landmark findings in the AR4, each one of which represents a major advance in knowledge: observed “warming of the climate system is unequivocal”; “there is a very high confidence that the globally-averaged net effect of human activities since 1750 has been one of warming”; “most of the observed increase in globally-averaged temperatures since the mid-20th century is very likely due to the observed increases in greenhouse gas concentrations”; improved quantification of and confidence in the Earth’s climate sensitivity provides “increased confidence in the understanding of the climate system response to radiative forcing”; model projections of future climate change indicate that “continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century”; and there is now



WCRP and IPCC have discussed together the policy-relevant science that is needed and possible and then worked together to see that it is undertaken in a timely and scientifically effective way.

*Prof. G. McBean, past Chair
WCRP Joint Scientific Committee,
Contributing IPCC Author*



WCRP played a vital role for the IPCC AR4 assessment in detailing the important role of patterns and modes of behaviour in the climate system that are vital for understanding regional climate variability and change.

*Dr K. Trenberth, past Officer WCRP
Joint Scientific Committee, Reviewer
and IPCC Author, Coordinating Lead
Author to AR4*

“higher confidence in projected patterns of warming and other regional-scale features”.

The AR4 demonstrates how climate research has grown and matured. For example, the joint IGBP-WCRP Coupled Carbon Cycle Climate Model Intercomparison Project (C4MIP) experiment was the source of the very worrying positive carbon feedback with global warming. Scientific rigour, to which WCRP has contributed measurably, has steadily increased our understanding of climate change and anthropogenic influences on climate to higher planes of confidence.

Unravelling the Complexity of Climate Change in the Twenty-First Century and Beyond

Following upon the remarkable successes delivered by the world’s climate science community in the AR4, WCRP and IGBP are pursuing newer pathways to consolidate and achieve even greater advances in future assessments. WCRP, IGBP and GCOS plan to grasp the lessons learned from AR4, identify the gaps and tackle the remaining uncertainties, thus further



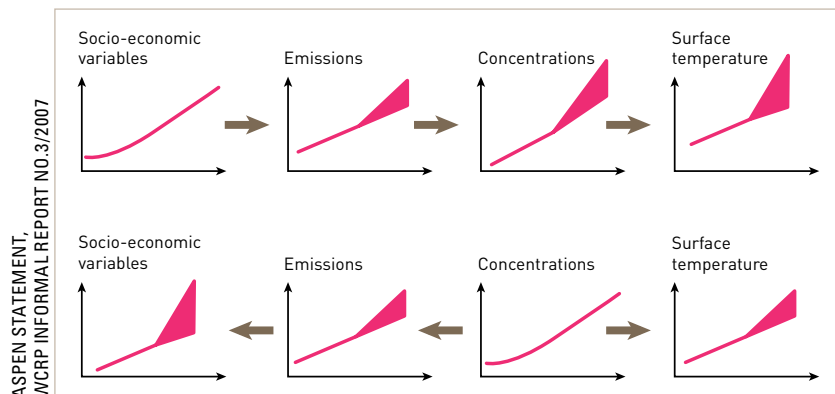
WCRP and IPCC have a highly symbiotic relationship. The programmes of WCRP provide a lot of the underpinning science on which IPCC assessments are based and in turn the resulting gaps in knowledge identified by IPCC then form the basis of future WCRP research.

Dr D. Griggs, Officer WCRP Joint Scientific Committee, Head Technical Support Unit, Reviewer and Lead Author to TAR, Reviewer to AR4

WCRP is focused now on synthesizing its science for applications relevant to society (for example, extremes, regional climate change) and to deliver the outcomes to bodies like the IPCC, United Nations Framework Convention on Climate Change, policymakers and other societal sectors. Many of the activities are with international partners such as IGBP and the Earth System Science Partnership, and with stronger linkages to national scientific research organizations and governments (through National Hydrological and Meteorological Services). WCRP's cross-cutting activities relevant to anthropogenic climate change include:

- Improved quantification of the climate forcing exerted by various chemical species (including pollutants) (jointly with IGBP);
- Transient climate change and evolution of mean climate through improved global-scale modelling with higher spatial resolution;

advancing climate change science. An important step in this regard has been the initiation of cross-cutting activities in WCRP, based on the fundamental science done by all projects, working groups and panels.



Schematic of traditional forward approach (top panel) beginning with socio-economic variables to derive emissions, concentrations and then temperature and other climate changes from climate models, and newly proposed methodology where the starting point is concentrations run in climate models, which are used to derive emissions and then socio-economic factors to achieve those emissions (bottom panel).

- Better integration of biogeochemical and physical climate systems (with IGBP);
- Climate impacts on glaciers, ice sheets and sea-level rise;
- Decadal predictability;
- Quantifying regional climate change with more accurate and reliable techniques so that the impacts can be understood on the scales of interest to society and adaptation pursued;
- Quantifying extremes such as heat waves, intense precipitation and tropical cyclones;
- Understanding monsoon variability, predictability and trends.

A framework presenting a unified picture of the future emission scenarios across the IPCC Working Groups I, II and III and thus the entire climate community has been defined in the 'Aspen Statement' (WCRP Informal Report No. 3/2007) facilitated by the modelling groups of WCRP and IGBP. Among the important recommendations is the need to have an integrated effort to produce past-to-future emissions of aerosols and ozone precursors that would ensure the use of consistent and documented data relevant to communities working on climate, carbon, aerosols and chemistry. WCRP has also recognized the need for regionalization of future climate

prediction utilizing the concept of seamless prediction that spans all space and time scales feeding into the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change. An important part of future developments is the need to invest in capacity building around the globe to develop personnel skilled in climate science and its applications, for example, as in the partnership between WCRP and the International Centre for Theoretical Physics.

With the emergence of human-induced climate change as one of the most important scientific problems confronting society, and with the increasing requirement of reliable predictions of climate over a vast range (from global to regional spatial scales and from daily to decadal time scales and beyond), the leadership role of WCRP (and other international research bodies) and the responsibility of delivering robust information about climate has increased multi-fold. One challenge for the future is to continuously advance the frontiers of global climate sciences. A second challenge, of increasing importance, is to channel the scientific output into substantive, relevant information for society as it seeks to learn about the impacts of climate variations and change and calls for answers concerning climate mitigation and adaptation.

THIS YEAR'S WCRP HIGHLIGHTS



KELLEY HINDSLEY

Earth System Scientists Urge Governments for Action

The more than 900 participants attending the Second Open Science Conference (OSC) on Global Environmental Change—Regional Challenges organized by the Earth System Science Partnership in Beijing, China, 9-12 November 2006, urged society and, in particular, policymakers to collaborate in the face of an ever faster changing environment.



CMA

WCRP together with the other three ESSP partners held a very successful ESSP Open Science Conference in Beijing, November 2006.

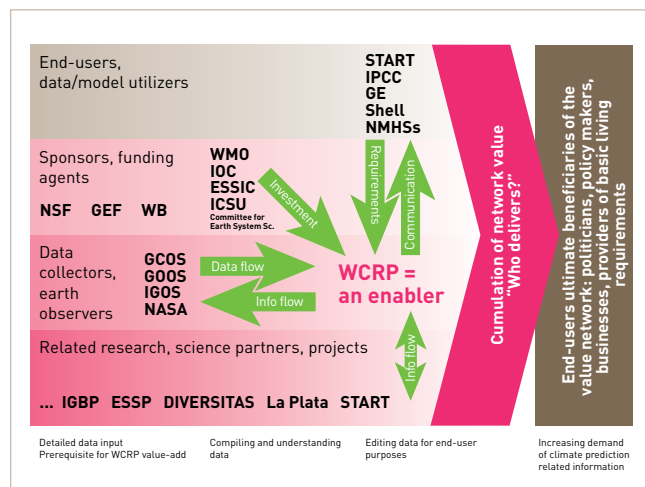
Governments worldwide are asked to abandon business-as-usual and undertake actions “to reduce the impact of human activities on the environment in order to ensure sustainable development”. The ESSP declaration invites us all to “take responsibility to mobilize knowledge for action, and provide society with the scientific information to better meet present and future needs”.

In view of the importance of the impacts on human health, OSC launched the joint Global Environmental Change and Human Health Project (GEC-HH). Three projects

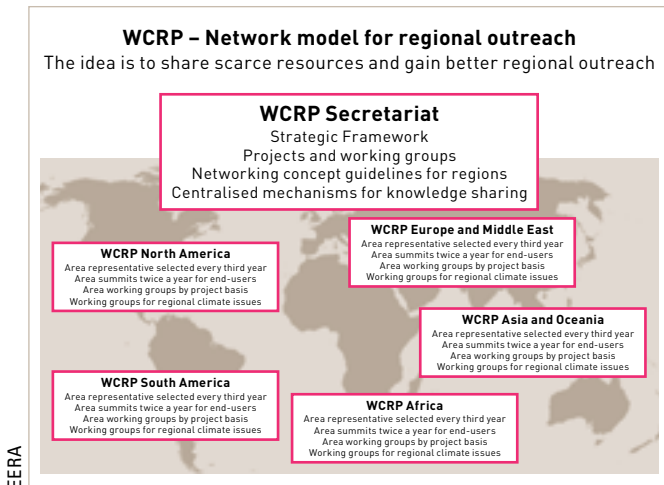
launched earlier on the global carbon cycle, food security and water resources are being implemented jointly by the ESSP. Recognizing that region-specific issues exist, the Conference also initiated the Monsoon Asia Integrated Regional Study (MAIRS) to examine the threats posed to populations and ecosystems in Asia. See more at <http://www.essp.org>.

World Network of Climate Researchers

As a crucial step in developing and implementing the WCRP Strategic Framework 2005–2015 and extending its role from analysing and modelling the climate system into a more active interaction with its broad



WCRP works with research partners including individuals and projects; it draws on data from a wide variety of providers; it responds to the needs of sponsors and other funders; and aims to deliver end-user value. The interactions in a very large and complex value network are illustrated by example flows (arrowed).



As part of the networking project during 2006-2007 the WCRP goal to deliver end-user value has been considered in terms of a regionalized global delivery network.

community of stakeholders, WCRP commissioned a network survey in 2006. The survey enabled WCRP to map the opportunities and possibilities for enhancing its effectiveness as well as to develop paths to improve its cooperation with key stakeholders. The results of the survey indicated that sponsors, funding agencies and researchers continue to see WCRP as an invaluable facilitator for international coordination of climate research. WCRP is renowned around the globe for its objectivity, impartiality and the quality of the research that is generated as a result of its coordination efforts. Of those surveyed, 89% responded positively to the question “Do you see a role for WCRP in supporting your organizational goals today?” Respondents called for integrated climate and Earth system solutions for researchers across disciplines and between developed

and less developed countries in order to leverage scientific know-how and expertise.

Advancing Seasonal Prediction

A WCRP goal is to determine the predictability of the complete coupled climate system on seasonal time scales. The Workshop on Seasonal Prediction in Barcelona, Spain, 4-7 June 2007, had the objective of assessing the current skill in seasonal prediction, with particular emphasis on surface temperature and precipitation. The Workshop was used as an opportunity to launch the upcoming WCRP multi-model and multi-institutional Seasonal Prediction Experiment. For an overview of the proposed experiment, see http://www.clivar.org/organization/wgsip/spw/TFSP_Experiment.doc. A WCRP statement of the state-of-the-art of seasonal forecasting together with recommendations for the seasonal forecasting community will be released shortly as an end-user benefit from the Workshop.

Sponsors Value WCRP Achievements

At the Fifteenth Congress of the World Meteorological Organization (Geneva, 7 to 25 May 2007), the achievements made by WCRP in the past four years in advancing the two WCRP objectives, improving climate prediction and enhancing understanding of human interactions with climate, were praised. Congress also “strongly urged Members to find ways to increase support to WCRP”. At the subsequent fifty-ninth session of the WMO Executive Council (28-30 May, 2007), the WMO Secretary General was urged to “find ways and means for maintaining the momentum of WCRP activities in implementing its new Strategy for 2005–2015”.

The Twenty-Fourth Assembly of the Intergovernmental Oceanographic Commission of UNESCO (Paris, 19 to

28 June) noted that “climate observations and research underpin virtually every decision depending on future environmental conditions” and “that the most recent IPCC Assessment made it clear that climate research is



WCRP Director Ann Henderson-Sellers, John Gould, past CLIVAR and WOCE International Project Office Director and Catherine Michaut at the WCRP booth at the IUGG General Assembly in Perugia, July 2007

developing successfully and that climate change impact on all aspects of the life of society makes its facilitation and coordination by WCRP needed even more now and in the future”. Despite its own significant budgetary pressure, IOC confirmed continuing support as agreed in 2005 and 2006, while noting that “extension of ocean climate research with inclusion of more activities aimed at adaptation and mitigation of climate change on the oceans will require additional contributions”.

The Twenty-Fourth General Assembly of the International Union of Geodesy and Geophysics of the International Council for Science (Perugia, 2-13 July, 2007) offered

an excellent opportunity for individuals and organizations to demonstrate a strong commitment to climate and climate change research. WCRP welcomes the opportunity to collaborate with private industries, non-governmental and intergovernmental organizations, foundations and associations. Get involved by contacting wcrp@wmo.int or through our website <http://wcrp.wmo.int>.

Award Congratulations



Sir Brian Hoskins, Deputy Chair of the WCRP Joint Scientific Committee (2001-2004) and Professor at Reading University, UK, was knighted by Her Majesty Queen Elizabeth II in her birthday honours in June 2007.

Dr Jagadish Shukla, Professor and Chair of the Department of Climate Dynamics in the College of Science, George Mason University, Maryland, USA, was awarded the Fifty-Second International Meteorological Organization (IMO) Prize. Dr Shukla has been a member of the WCRP Joint Scientific Committee and Chair of the WCRP Modelling Panel since 2001. The previous IMO Prize was awarded to Professor Olof Lennart Bengtsson from the Stockholm University in Sweden, a leader and active member in many WCRP efforts.



Dr Paola Salio from the University of Buenos Aires, Argentina, won the 2007 WMO Research Award for Young Scientists for her paper entitled “Mesoscale convective systems over south-eastern South America and their relationship with the South American low-level jet” published

in *Monthly Weather Review* (Vol. 135) in 2007. The South American Low Level Jet EXperiment (SALLJEX) was conducted by WCRP/CLIVAR-VAMOS (the Variability of the American MONsoon System study) and greatly improved our understanding of the role of the atmospheric jet along the lee of the Andes Mountains.

Dr John Church, Chair of the WCRP Joint Scientific Committee, won the 2006 CSIRO Medal for Research Achievements for research that has significantly improved our understanding of the rate of sea-level rise and its impacts on society worldwide.

In August 2006, the International Award of the Japan Society of Hydrology and Water Resources was presented to Dr Tetsuzo Yasunari from the Nagoya University in Japan, for his long-term contribution toward the activities in the GEWEX Asian Monsoon Experiment (GAME).

Dr Moustafa (Mous) Chahine, a Senior Research Scientist at NASA's Jet Propulsion Laboratory, California, USA, was awarded NASA's Exceptional Scientific Achievements Medal in June 2007 for his work on atmospheric carbon dioxide. His studies on the Earth's water and energy cycle significantly contributed to WCRP/GEWEX research since its early stages. Dr Chahine served as GEWEX Chair for many years.

WCRP sponsored numerous students and young scientists to attend events and conferences during the year including Kei Yoshimura and Molly Hellmuth at the ICSU Seventy-Fifth anniversary congress "Global Scientific Challenges: Perspectives from Young Scientists" in April 2007 and Albert Martis of the Meteorological Service of the Netherlands Antilles and Aruba to attend the First International Summit on Hurricanes and Climate Change in June 2007.

CROSS-CUTTING ACTIVITIES IN WCRP

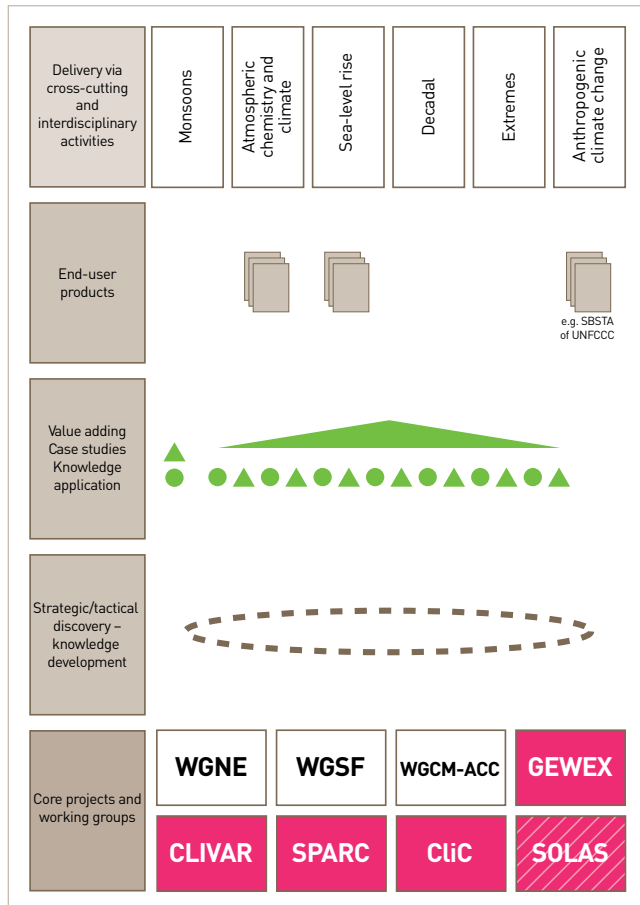


PAVEL JEDLIČKA

Anthropogenic Climate Change

The 2007 IPCC Fourth Assessment Report, to which WCRP made very significant input, marks a crucial stage for major developments in anthropogenic climate change by stating that global warming is “unequivocal” and will have major consequences on human societies and natural

ecosystems. The WCRP Anthropogenic Climate Change (ACC) initiative, a pan-WCRP effort, seeks interactions with all partners in the Earth System Science Partnership and other agencies and institutions at national and international levels. While the current focus is on process and modelling investigations and projections of human-induced climate change, the long-term vision is that, over time, WCRP/ACC will expand in scope.



WCRP organization builds on Core Projects and Working Groups into end-user delivery and cross-cutting efforts (across the top).

Through the ACC initiative, WCRP significantly contributes to (and helps advance) the research related to anthropogenic climate change and, hence, provides input to the United Nations Framework Convention on Climate Change and its technical bodies. At the **Twenty-Sixth session of the Subsidiary Body of Scientific and Technical Advice of the UNFCCC** in Bonn, Germany, May 2007, WCRP participated in discussions aimed at creating a more effective dialogue between Parties and regional and international climate change programmes and organizations, and jointly identified research gaps and research capacity constraints in developing countries. WCRP together with its partners in the ESSP convened a side event on how to connect Earth system science research to climate change policy. In addition, a brochure on the implementation of the UNFCCC SBSTA five-year Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change was prepared by WCRP jointly with the World Climate Programme (http://wcrp.wmo.int/pdf/WMO1025_CIADN_LowRes_E.pdf).

Responsible:

Professor H. Le Treut, IPSL Université de Paris, France
 Dr V. Ramaswamy, NOAA Geophysical Fluid Dynamics Laboratory, USA

Dr G. Flato, Environment Canada, Canada

Dr D.J. Griggs, Hadley Centre, Met Office, UK
Dr J. Church, Antarctic CRC and CSIRO Marine and
Atmospheric Research, Australia

ACC

http://wcrp.ipsl.jussieu.fr/SF_ACC.html

Modelling

The Aspen Statement proposes a new set of experiments for the next generation of global coupled climate models. This statement, which has great potential to feed into climate policy, arose from the **Aspen Workshop**, held in Aspen, Colorado, USA, from 30 July to 5 August 2006, co-hosted by the modelling groups of WCRP and the International Geosphere-Biosphere Programme.

At the **second meeting of the WCRP Modelling Panel (WMP)** held in Boulder, USA, 23-24 October 2006, WMP identified significant challenges in climate modelling. These include the process of downscaling of high resolution IPCC models to give reliable estimates of regional climate change; the representation of planetary waves and storms and blocking; and the availability of sufficient computing power to build and develop the next generation of cloud system resolving models. In addition, WMP noted that persistent errors in coupled ocean-atmosphere models, both in the initial conditions and in the evolution of the coupled system, hinder further progress in the prediction of, for example, the El Niño Southern Oscillation. WCRP aims to address these priorities.

The **WCRP Working Group on Coupled Modelling** has contributed significantly to the IPCC AR4 Working Group I. Current WGCM activities are in line with many of the

AR4 chapters' leading topics, for example, scenarios, forcing data sets, climate processes, feedbacks, climate responses, detection and attribution, and future projections. Elements from other WCRP projects, task teams, working groups and panels are also contributing through a wide variety of observational, modelling and process studies.

The **WCRP Working Group on Numerical Experimentation (WGNE)** further developed climate model diagnostics and metrics at the **Workshop on Systematic Errors in Climate Models**, San Francisco, USA, 12-16 February 2007. The goal of such metrics is to measure model quality or skill objectively. WGNE routinely reviews the skill of daily forecasts from a number of the main operational centres in terms of verification scores (such as anomaly correlation and root mean square error) for various fields at different lead times.

Responsible:

Professor J. Shukla (Chair, WMP), George Mason University, USA

Professor J. Mitchell (Co-Chair, WGCM), Met Office, UK

Dr G. Meehl (Co-Chair, WGCM), National Center for Atmospheric Research, USA

Dr M. Miller (Chair, WGNE), European Centre for Medium-Range Weather Forecasts, UK

WGCM

<http://www.clivar.org/organization/wgcm/wgcm.php>

WGNE

<http://collaboration.cmc.ec.gc.ca/science/wgne> [password protected]

WMP

http://wcrp.wmo.int/AP_Modelling.html

International Polar Year 2007–2008

The International Polar Year, one of the most ambitious coordinated international science programmes, was launched on 1 March 2007. This WMO- and ICSU-led initiative includes intensive field investigations both in the Arctic and Antarctic. Many of the IPY leaders and participants are members of WCRP projects and groups. Climate issues are at the forefront of the majority of IPY studies. CliC, on behalf of WCRP, coordinated the preparations of IPY projects of which more than 200 were endorsed, 34 of these with WCRP involvement or leadership. The main goal of WCRP in IPY is to close (or significantly reduce) the existing gaps in the knowledge of polar processes and in our ability to predict polar climate and their influence on the rest of the globe at a variety of important time scales (see http://wcrp.wmo.int/Special_IPY.html).

As part of the IPY legacy, WCRP together with the Scientific Committee on Antarctic Research completed the IGOS-Cryo report (see http://cryos.ssec.wisc.edu/docs/cryos_theme_report.pdf). For WCRP/CliC-led initiatives (such as on the State and Fate of the Cryosphere project) see <http://stratus.ssec.wisc.edu/ipy-cryos/>.

Responsible:

Dr B. Goodison, Meteorological Service of Canada, Canada

Dr S. Gulev, P.P. Shirshov Institute of Oceanology, Russian Federation

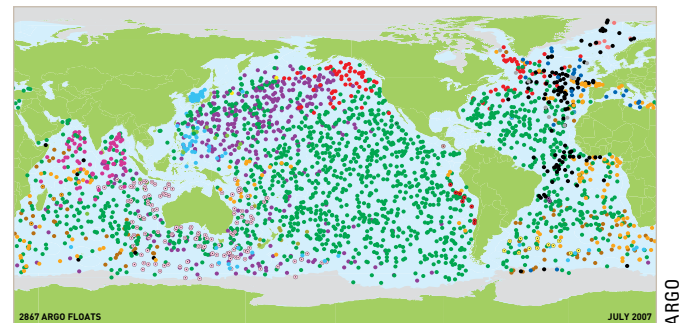
Dr I. Wainer, Universidade de São Paulo, Brazil

IPY

<http://www.ipy.org>

Oceans and Climate

Sea-level rise will have a severe impact on socio-economic systems worldwide as 250 million people live within 5 metres of high tide. The **WCRP Workshop on Understanding Sea-level Rise and Variability**, held at the UNESCO headquarters in Paris, in June 2006, and conducted in support of the Global Earth Observation System of Systems (GEOSS) 10-year Implementation Plan, helped develop international and interdisciplinary scientific consensus for those observational requirements needed to address sea-level rise and its variability. The workshop brought together 163 scientists from 29 countries to identify uncertainties associated with sea-level rise and the research and observational activities needed to narrow their range (for workshop statement



Almost 3,000 free-drifting profiling floats continuously monitor temperature and salinity of the upper ocean (to 2,000 m). The ARGO project is a major contributor to WCRP/CLIVAR and to the Global Ocean Data Assimilation Experiment (GODAE).

see <http://wcrp.wmo.int/pdf/summary%20statement%202006-1004%20-%20high-res.pdf>). A book publication is imminent.

A pilot assessment of some 20 ocean reanalyses has been carried out through a WCRP/CLIVAR-GODAE **Ocean Synthesis Evaluation Workshop** held at the European Centre for Medium-Range Weather Forecasts (ECMWF) in August 2006. The meeting provided a quantitative statement of the skill of available global ocean synthesis products, identified common strengths and weaknesses of present systems and produced recommendations with regard to future synthesis resource planning, data processing and management (workshop presentations are available at <http://www.clivar.org/organization/gso/synthesis/synthesis.php>).

The WCRP/CLIVAR ocean initiative on reanalysis serves as the basis for studying dynamics of the oceans, assessing thermal expansion of the ocean waters in sea-level rise research and providing initial conditions for climate predictions with coupled models. The combination of ocean models and ocean data assimilation has made ocean reanalysis possible for the first time. The report of the First **CLIVAR Workshop on Ocean Reanalysis** was recently made available at http://eprints.soton.ac.uk/35479/01/93_Ocean_Reanalysis_Stammer.pdf (WCRP Informal Report No. 9/2006).

WCRP/CLIVAR leads WCRP research on the ocean's role in the climate system. Through the activities of its ocean basin, modelling and observational groups it links, in particular, with the Intergovernmental Oceanographic Commission of UNESCO in areas such as ocean hydrography and carbon, and research

requirements for, and development of, the global ocean observing system.

The Hydrographic Programme Atlas Series of the World Ocean Circulation Experiment published volume 2 on the Pacific Ocean in hard copy in 2007 complementing volume 1 on the Southern Ocean (request copy from http://www.woce.org/atlas_webpage/links.html).

Responsible (Sea-level Rise):

Dr J. Church, Antarctic CRC and CSIRO Marine and Atmospheric Research, Australia

Responsible (Ocean Reanalysis):

Dr D. Stammer, Institut für Meereskunde, Germany

Sea-level Rise

http://wcrp.wmo.int/AP_SeaLevel.html

Ocean and Climate

http://wcrp.ipsl.jussieu.fr/SF_OceanClimate.html

Observations and Analysis

The **WCRP Observation and Assimilation Panel (WOAP)**, co-sponsored by the Global Climate Observing System, works closely with the joint WCRP/GCOS panels AOPC (Atmospheric Observation Panel for Climate) and OOPC (Ocean Observation Panel for Climate) to establish the requirements of climate research and operations for in situ as well as satellite observation networks and systems.

WOAP is the WCRP interface with space agencies and with the intergovernmental Group on Earth Observations (GEO). Its approach includes sustained reprocessing and reanalysis, a coordinated reinforcement of both in

situ and space-based systems and the development of a “seamless” weather and climate prediction capability. WCRP together with GCOS has a strong impact on the policy of the Committee on Earth Observation Satellites (CEOS), which encompasses the world’s government agencies responsible for civil Earth observation satellite programmes, by underlining the need for sustained, well-calibrated and validated space observations, for research as well as operational purposes.

Through WOAP, WCRP is coordinating global reanalyses and the development of new reanalysis efforts, including those of the oceans. The global atmospheric Japanese 25-year Reanalysis (JRA-25) for the period 1979 to 2004 was completed in 2006 using the Japan Meteorology Agency numerical assimilation and forecast system (<http://www.jreap.org/>). The European 40-year Reanalysis (ERA-40) for the period 1957 to 2002 was also completed in early 2006 (<http://www.ecmwf.int/research/era/>). Both global atmospheric analyses make a new synthesis of in situ and remotely-sensed measurements that significantly contribute to validating climate and seasonal prediction models.

Responsible:

Dr K. Trenberth (Chair, WOAP), National Center for Atmospheric Research, USA

Dr D.E. Harrison (Chair, OOPC), NOAA Pacific Marine Environmental Laboratory, USA

Dr A. Simmons (Chair, AOPC), European Centre for Medium-Range Weather Forecasts, UK

WOAP

http://wcrp.wmo.int/AP_Observation.html

http://wcrp.ipsl.jussieu.fr/SF_WOAP.html

Monsoons

More than 60% of the world’s population is affected by monsoons. Monsoons are responsible for floods leading to deaths and extensive damage. The failure of monsoon events gives rise to drought and crop failures leading to agricultural and community stresses. The capability to predict the onset and intensity of monsoons would enable societies to mitigate some of the negative impacts of monsoons and to maximize their benefits.

WCRP addresses monsoon prediction through regional as well as global studies aimed at a comprehensive understanding of the role of monsoons in the climate system and an assessment of the vulnerability of these regional monsoon systems to global change. The monsoon cross-cutting activities is led by the WCRP core projects CLIVAR and GEWEX and their regional monsoon panels in Africa, the Americas, Indo-Australia and Asia, with participation of SPARC, CliC and the WCRP Working Group on Numerical Experimentation and several activities outside WCRP (particularly in the World Weather Research Programme’s THORPEX).

The International Monsoon Study 2007–2011, the WCRP 5-year strategy for monsoon research, incorporates an Asian Monsoon Year, the International Year of Tropical Convection and issues related to the East African Monsoon, capacity building and application of observations and predictions in monsoon regions for the benefit of society.

Responsible:

Professor G. Wu, Chinese Academy of Sciences, China

Professor J. Slingo, University of Reading, UK

Professor T. Yasunari, Nagoya University, Japan

Professor C. Vera, University of Buenos Aires, Argentina
Professor L.A. Ogallo, IGAD Climate Prediction and Applications Centre, Kenya

Professor J. Shukla, George Mason University, USA

Monsoons

http://wcrp.ipsl.jussieu.fr/SF_Monsoon.html

Extremes

The 2007 IPCC Fourth Assessment Report projects more frequent heat waves and heavy precipitation events and more intense future tropical cyclones. The expected

changes in climate extremes are based on analyses of the outputs of the WCRP AR4 model archive. WCRP is now developing an initiative, led by CLIVAR and GEWEX, to identify potential research activities and products of interest to stakeholders and to develop joint efforts to meet these requirements. This includes a possible inventory of agreed definitions on what constitutes a climate extreme and facilitating community consensus on the most useful definitions. This development is evolving through discussions with Swiss Re, Munich Re and the Lighthill Network, all major players in the evaluation of climate risks and extremes. In addition, WCRP is designing an overarching intercomparison framework under which observations and projections of climate extremes can be assessed. Ongoing efforts of general importance to the study of climate extremes can be found in almost all WCRP activities including model development and parameterizations, reanalyses, reprocessing of climate data, in the Coupled Model Intercomparison Project 3 and analyses to detect anthropogenic influence on extremes.

Responsible:

Professor A. Busalacchi, ESSIC, University of Maryland, USA

Dr K.A. Anaman, Institute of Economic Affairs, Ghana

Dr D. Griggs, Hadley Centre, Met Office, UK

Professor L.A. Ogallo, IGAD Climate Prediction and Applications Centre, Kenya

Seasonal to Decadal Prediction

The WCRP has a long-standing commitment to coordinating international seasonal prediction activities. Recent breakthroughs in seasonal prediction include the recognition that seasonal forecasts must include



Satellite view of Hurricane Ileana (August 2006)

quantitative information regarding uncertainty, i.e., probabilistic prediction; that verification must include probabilistic measures of skill; and that a multi-model ensemble strategy is the best current approach for adequately resolving forecast uncertainty.

The **first WCRP Seasonal Prediction Workshop** (Barcelona, Spain, 4-7 June 2007, hosted by the Catalan Meteorological Service) addressed the questions: what factors are limiting our ability to improve seasonal predictions and to use seasonal predictions for societal benefit? At the **Workshop on Systematic Errors in Climate Models** (San Francisco, USA, 12-16 February 2007), the modelling community discussed the importance of using and refining metrics that gauge the skill of forecasts.

The challenge of seamless prediction from days to decades, particularly in terms of bridging the gap between forecasting high impact weather events and seasonal variations, naturally brings together the activities of the communities of WCRP and the World Weather Research Programme's THORPEX. Both programmes have the obligation to help develop relevant scientific knowledge and a science infrastructure to provide society, in particular policymakers and decision makers more accurate, and from a socio-economic perspective more useful, prediction of high impact weather and climate extremes.

In 2007, a new cross-cutting initiative was endorsed to advance the science of decadal prediction. WCRP will assess decadal predictability using state-of-the-art coupled models. Evidence for the existence of decadal predictability has arisen from research on the El Niño phenomenon and other global-scale oscillation systems.

Responsible (Seasonal Prediction):

Dr B. Kirtman, Center for Ocean-Land-Atmosphere Studies, Maryland, USA

Dr T. Stockdale, European Centre for Medium-Range Weather Forecasts, UK

Responsible (Decadal Prediction):

Professor J. Marotzke, Max Planck Institute for Meteorology, Germany

Professor C. Vera, University of Buenos Aires, Argentina

Dr I. Wainer, Universidade de São Paulo, Brazil

Professor J. Shukla, George Mason University, USA

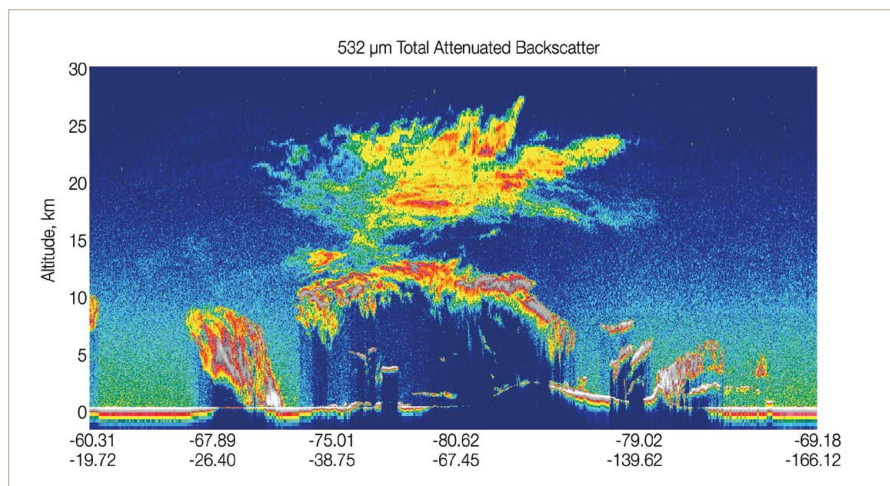
Seasonal Prediction:

http://wcrp.wmo.int/AP_SeasonalPrediction.html

http://wcrp.ipsl.jussieu.fr/SF_TFSP.html

Atmospheric Chemistry and Climate

A large part of human-induced climate forcing occurs through chemically active species. Changes in climate can lead to changes in the chemical composition of the atmosphere both through alterations in emissions and changes in the chemical processes. Studies of climate-chemistry interactions represent one of the most important foci of global change research. Provision of high-quality, policy relevant information on the current state of the climate and its possible future states (for example, for the next Scientific Assessment of Ozone Depletion prepared jointly by the WMO and UNEP and for a potential IPCC Fifth Assessment), as well as options for mitigation and adaptation, are all strongly dependent on progress in the area of Atmospheric Chemistry and Climate (AC&C) research.



CloudSat and CALIPSO data provide the first view of the full vertical structure of clouds (here of Hurricane Ileana on 23 August 2006) and aerosols over the globe.

AC&C is a cross-cutting initiative of the WCRP together with the International Geosphere-Biosphere Programme. The projects on Stratospheric Processes and their Role in Climate (WCRP) and International Global Atmospheric Chemistry (IGAC) of IGBP are leading the implementation of AC&C. Currently, the major focus of AC&C is to improve process representation in the chemistry-climate models, which are essential tools for understanding and calculating the present, hindcasting the past (essential for confidence) and forecasting future conditions and, therefore, for making policy decisions.

The initial **scoping meeting for AC&C**, Boulder, USA, 7-9 August 2006, laid the groundwork for the basic structure and goals of the initiative. An **open workshop** (Geneva, 22-23 January 2007) engaged a broader set of the WCRP-IGBP community to establish three

working programmes that study the impacts of climate on atmospheric chemistry; the impact of atmospheric chemistry on climate; and the impact of climate on air quality.

Responsible:

Professor V. Ramaswamy, NOAA Geophysical Fluid Dynamics Laboratory, USA

Professor L.A. Ogallo, IGAD Climate Prediction and Applications Centre, Kenya

Professor J. Marotzke, Max Planck Institute for Meteorology, Germany

Professor P. Cornejo R. de Grunauer, Marine Science and Engineering, ESPOL, Ecuador

Professor P.J. Rasch, National Center for Atmospheric Research, USA

Professor A.R. Ravishankara, NOAA Earth System Research Laboratory, USA

Dr S. Doherty, NOAA Pacific Marine Environmental Laboratory, USA

AC&C

<http://www.atmosph.physics.utoronto.ca/SPARC/initiativesNEW2005Climate.html>

<http://www.igac.noaa.gov/ACandC.php>

Surface Fluxes and SOLAS

In 2006-2007, the WCRP co-sponsored Surface Ocean-Lower Atmosphere Study (SOLAS), on the basis of two expert meetings, published a synthesis of over a dozen open ocean iron enrichment experiments (*Science* 315: 612-617). According to a Position Statement of the SOLAS Scientific Steering Committee “current scientific evidence indicates that [the strategy of using large-scale iron fertilization to reduce atmospheric CO₂ levels] will not significantly increase carbon transfer into the deep ocean or lower atmospheric CO₂”; in contrast, ocean fertilization “may have negative impacts” including effects on climate and air quality, changes in biodiversity and decreased productivity in other oceanic regions (<http://www.uea.ac.uk/env/solas/org/SSCmins/SOLASSSCPosition%20statem.pdf>).

SOLAS and the WCRP Working Group on Surface Fluxes (WGSF) continue to jointly develop improved parameterizations of air-sea fluxes of gases and

particles (aerosols) for accurate representation of fluxes in climate and numerical weather prediction models with the aim to uncover the potential predictability associated with the ocean-atmosphere interaction. In March 2007, SOLAS held an **Open Science Meeting** in Xiamen, China. The Conference handbook and presentations of plenary speakers are available at <http://www.uea.ac.uk/env/solas/OSC2007.html>.

Recent science highlights of WGSF include the development of a new strategy for archiving surface flux products generated by numerical weather prediction centres at the US National Climate Data Center; and, in October 2006, the publication of a handbook on best practices of ship/buoy flux measurements, edited by Drs C. Fairall and F. Bradley.

Responsible:

Professor P. Liss (Chair, SOLAS), University of East Anglia, UK

Dr C. Fairall (Chair, WGSF), National Oceanic and Atmospheric Administration, USA

SOLAS

<http://www.solas-int.org>

WGSF

<http://www.etl.noaa.gov/et6/wgsf/>

NEWS FROM WCRP CORE PROJECTS



HERIBERTO HERRERA

GEWEX

The multiyear regional hydroclimate projects of GEWEX have made significant progress during 2006/2007. In particular over western Africa, a wide range of data sets were collected during pre-monsoon, monsoon and post-monsoon observation periods and field campaigns as part of the joint GEWEX/CLIVAR African Monsoon Multidisciplinary Analyses project. The data will be critical to understanding the role of sea-surface temperature and soil moisture in the development of monsoons and for assessing the role of easterly waves and Saharan dust storms in the development of tropical storms (and hurricanes) over the Atlantic Ocean.

Highlights from the GEWEX BALTic sea EXperiment (BALTEX) include the official adoption of the HELSinki COMmission (HELCOM) Thematic Assessment Report on Climate Change for the Baltic Sea Area. The projections for future climate change in the Baltic Sea region, with all their uncertainties, indicate that atmospheric temperatures will continue to rise during the course of the twenty-first century in every subregion of the Baltic Sea.



T. HOCK, UCAR

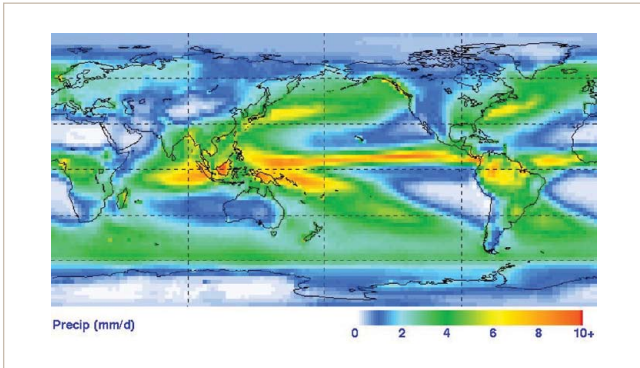
Balloon launch during AMMA campaign

The Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI), the follow-on project for the GEWEX Asian Monsoon Experiment, which successfully concluded in 2005, now has a Science Plan and new website (<http://mahasri.cr.chiba-u.ac.jp/>). The First MAHASRI/Asian Monsoon Year Workshop was held with over 60 participants in Tokyo, Japan, in January 2007.

The Coordinated Energy and water cycle Observations Project (CEOP) allows a global synthesis of the water cycle associating surface, satellite and model data with the ultimate aim to evaluate model skill and accelerate model development. CEOP is GEWEX's largest cross-cutting global scale project and has grown to include 35 reference sites, product generation by more than 10 numerical weather prediction centres and a large archive of satellite data with contributions from five major space agencies.

GEWEX process and modelling studies help address improvements in climate models and understanding of the effects of aerosols, land-use change and global water system changes on the climate. Recently, GEWEX consulted with its community and developed a roadmap for 2007 to 2012.

Research products made available to the scientific community during 2006/2007 include global precipitation maps produced by the GEWEX Global Precipitation Climatology Project that use multiple sources of observations including remote sensing techniques and in situ gauges. Water management for agriculture, electrical power and flood control, and drought and flood monitoring all require quantitative information on precipitation. The GPCP Assessment of Global Precipitation has now



Satellite-gauge combined precipitation product of the GEWEX Global Precipitation Climatology Project averaged for the 27 years 1979–2005, in mm per day

been completed and covers various time and space scales back to the year 1986 (<http://cics.umd.edu/~yin/GPCP//main.html> and <http://www.gewex.org/gpcp.html>). Other high-quality global data sets covering more than two decades of determinations of clouds, precipitation, aerosols (oceans only) and surface and top-of-atmosphere radiation are the International Satellite Cloud Climatology Project (ISCCP) Cloud and Radiation Data Set (http://www.gewex.org/ISCCP_data_products_4-2006.pdf) and the Global Land Data Assimilation System (GLDAS) data product on global time series of soil moisture, evapotranspiration, sensible heat flux and other surface water and energy cycle variables (http://www.gewex.org/GLDAS_data_product_4-2006.pdf).

Chair: Professor S. Sorooshian, University of California, Irvine, USA

Vice-Chair: Dr U. Schumann, DLR German Centre for Aerospace Research, Germany

Director, IPO: Dr Richard Lawford

GEWEX International Project Office

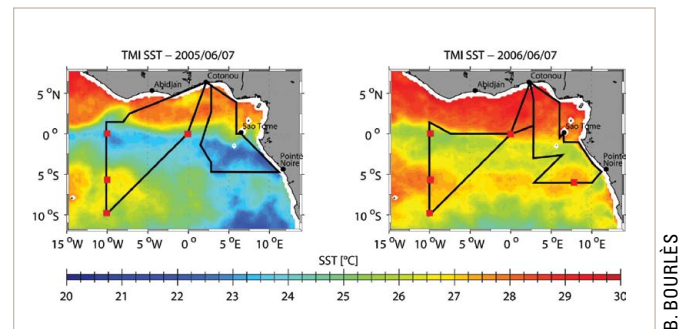
Maryland, USA

E-mail: gewex@gewex.org

Web: <http://www.gewex.org>

CLIVAR

The Climate Variability and Predictability (CLIVAR) panel active in Africa, Variability of the African Climate System, held a very successful, multi-sponsored training workshop at the Tanzania Meteorological Agency in Dar es Salaam, United Republic of Tanzania, from 10 to 13 July 2006, on the **Predictability and Prediction of Southern and Eastern African Climate Variability and Impacts of the Neighbouring Oceans** (see WCRP Informal Report No. 19/2006 at http://eprints.soton.ac.uk/47558/01/109_VACS_Wshop.pdf).



Oceanographic observations during AMMA field campaigns show a warmer sea-surface temperature (SST) in June 2006 compared with June 2005.

The CLIVAR Pacific Panel ran a workshop on **Multidecadal to Centennial Global Climate Variability** in Hawaii, USA, November 2006. One of the outcomes was the emerging

awareness that the North Atlantic significantly influences the Pacific climate system on long time scales. It does so via the atmosphere, global ocean wave adjustment and changes in the Bering Strait throughflow, which cools the North Pacific and impacts the equatorial eastern Pacific in spring, and at the same time intensifies the El Niño Southern Oscillation substantially. See report with issues for the future at www.clivar.ucar.edu/organization/atlantic/meetings/Hawaiiworkshop_sutton.pdf.

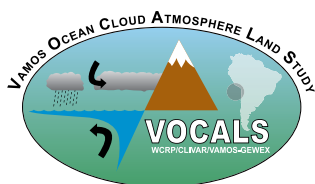
The Tropical Atlantic Climate Experiment (TACE), developed through CLIVAR's Atlantic Panel and with funding support in several countries, is well under way. TACE will advance understanding of coupled ocean-atmosphere processes, seek to improve sea-surface temperature based climate prediction for the eastern tropical Atlantic region and provide coordinated observational, modelling and synthesis studies of the region in the 2006–2011 time frame. A key component of TACE is the extension of the observational network in the region as a contribution to the Global Climate Observing System.

The CLIVAR Variability of the American Monsoon System panel and partners (such as the US National Science Foundation and NOAA) are currently developing the VAMOS Ocean Cloud Atmosphere Land Study (VOCALS) to achieve a better understanding of ocean-cloud-atmosphere-land coupling processes in the southeast Pacific. The main research foci for VOCALS are to improve

regional and global climate models; to study aerosol effects on cloud and drizzle formation; and to improve the accuracy of weather predictions and ocean processes in coastal areas dominated by low and persistent cloud cover (see VOCALS website for details: <http://www.eol.ucar.edu/projects/vocals/>).

Other research products of CLIVAR during 2006/2007 include: three papers incorporating the outputs of the earlier Expert Team on Climate Change Detection and Indices (ETCCDI) capacity building workshops, which all had substantial influence on the IPCC Fourth Assessment Report. A selection of papers from the First International CLIVAR Science Conference, held in Baltimore, USA, in June 2004, was published as a special issue of the *Journal of Climate* (Volume 19, Issue 20) in October 2006; another special issue of this journal containing papers from the CLIVAR Atlantic Panel's Workshop on Atlantic Climate Predictability held in Reading, UK, in April 2004, was published in December 2006 (Volume 19, Issue 23). Various modelling and data assimilation activities have leveraged off the outputs from the CLIVAR/VAMOS North American Monsoon Experiment (NAME) 2004 field experiment, including a special issue of the *Journal of Climate* published in 2007 (Volume 20, Issue 19).

Co-Chairs: Dr J. Hurrell, National Center for Atmospheric Research, USA, and Dr T. Palmer, European Centre for Medium-Range Weather Forecasts, UK
Director, IPO: Dr Howard Cattle



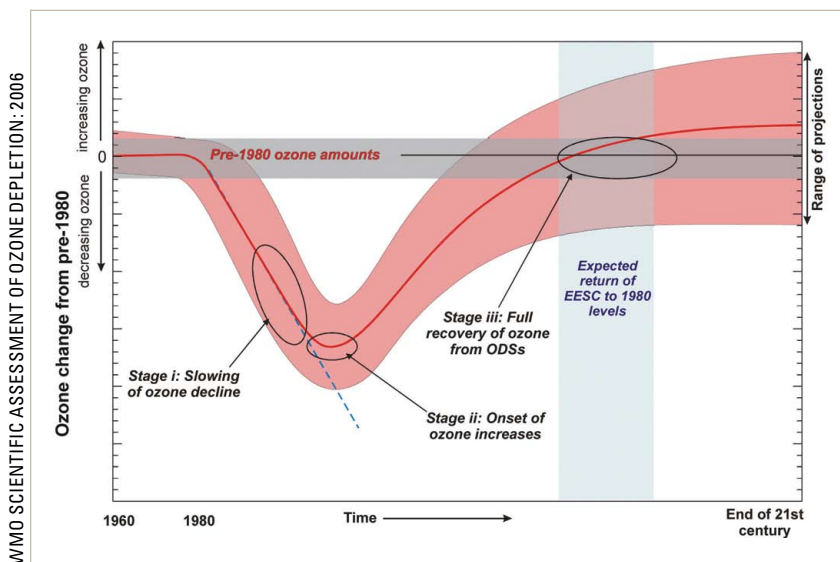
CLIVAR International Project Office
Southampton, United Kingdom
E-mail: icpo@soc.soton.ac.uk
Web: <http://www.clivar.org>

SPARC

One of the scientific highlights for the WCRP project on Stratospheric Processes And their Role in Climate in 2006-2007 was the completion and distribution of the comprehensive Assessment of Stratospheric Aerosol Properties (ASAP) Report, which describes the stratospheric aerosol's morphology in detail during volcanically quiescent and volcanically perturbed periods (<http://www.atmosph.physics.utoronto.ca/SPARC/ASAP%20V3c1.pdf>). The assessment report on Polar Stratospheric Clouds (PSCs) is being prepared and a third report on Chemistry-Climate Modelling is in the planning stages. SPARC assessment reports are peer-reviewed and fully acknowledged by the science community, and have served as bases for the international WMO/UNEP Reports such as the Scientific Assessment of Ozone Depletion: 2006. Scientists within the SPARC

community served as members of the Assessment Steering Committee, lead and contributing authors, and reviewers. The SPARC Chemistry-Climate Model Validation (CCMVal, <http://www.pa.op.dlr.de/CCMVal/>) project organized the key element of the assessment process: the Chemistry Climate Model simulations. These simulations were of critical importance in assessing the evolution of ozone, temperature and trace species in the stratosphere in the recent past and in making projections of ozone recovery in the twenty-first century.

New directions within the SPARC project include strong foci on stratosphere-troposphere dynamical coupling and its role in dynamical variability and predictability from days to decades; and the role of large-scale transport, convection and chemistry on water vapour and chemical composition in the lower



Schematic diagram of the temporal evolution of observed and expected global ozone amounts

stratosphere-upper troposphere region. Global models typically represent the stratosphere poorly. However, there is strong evidence that the stratospheric state exerts a significant influence on the tropospheric circulation. The new project on dynamical variability will set up a model intercomparison to explore the dynamical coupling between the two atmospheric layers. Understanding of processes that control the amount of water vapour and trace gases and the intrusion of stratospheric ozone into the troposphere may be increased using cloud resolving models to discriminate between different mechanisms using high-resolution observations and modelling.

Co-Chairs: Professor T. Peter, Institute for Atmospheric and Climate Science, ETH Zürich, Switzerland, and Professor T. Shepherd, University of Toronto, Canada
 Director, IPO: Dr Norman McFarlane

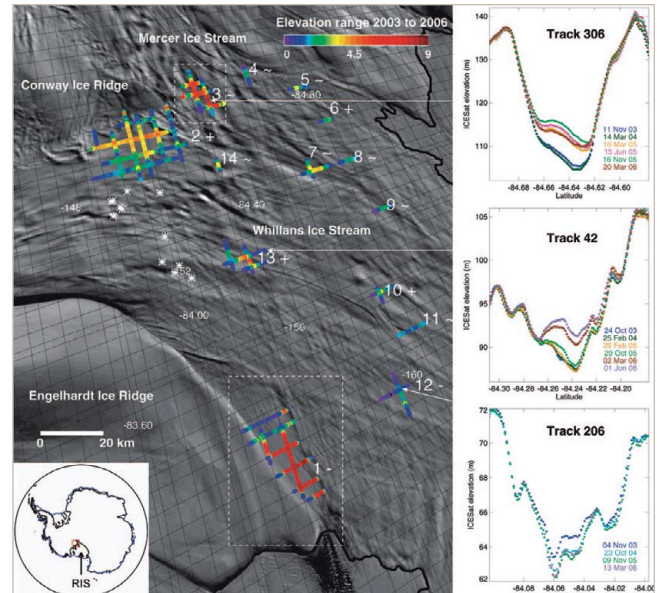
SPARC International Project Office
 Toronto, Ontario, Canada

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Web: <http://www.atmosph.physics.utoronto.ca/SPARC/>

CLiC

“Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level” says the *Summary for Policymakers* of the 2007 IPCC Working Group I Fourth Assessment Report. WCRP/CLiC activities have significantly raised the visibility of the cryosphere-climate discipline during the past years. A special IPCC chapter was devoted to Observations: Changes in Snow, Ice and Frozen Ground, with many



Locations of elevation change events identified through ICESat repeat track analysis on lower Mercer Ice Stream and Whillans Ice Stream, Ross Ice Shelf, Antarctica (2003 to 2006).

CLiC scientists contributing with research results and as authors and/or reviewers. The conclusions in the report highlighted past, present and future changes in the cryosphere, including declining Arctic sea ice, melting ice sheets and glaciers, rising sea level, decreasing spring snow cover, decreasing area of frozen ground and the shortening of the ice-cover season for lakes and rivers.

In responding to the difficulty highlighted by the IPCC of reproducing the observed variability of the cryosphere over the last two decades, CLiC initiated the Ice Sheet Model Intercomparison Project (ISMIP), which has led

to the development and discussion of ice sheet models and the development of protocols for their intercomparison. Understanding and predicting the contribution of the cryosphere to sea-level rise requires improved observations and models of ice sheets, ice shelves and glaciers. The CliC co-sponsored Antarctic Sea Ice Processes and Climate Panel (ASPeCt) has produced the first ever climatology of sea-ice thickness for the Antarctic sea-ice zone, an unique database that merges the results of many field experiments, satellite data and analyses by the National Ice Center (NIC). In the context of the International Polar Year 2007-2008, CliC is contributing to a coordinated plan to develop a Sustained Arctic Observing Network and a Pan-Antarctic Observing System in cooperation with research and operational entities. CliC has also been very active in designing the IPY data management policy. CliC is a co-sponsor of the IGOS Cryosphere theme which addresses how well user requirements are being met by the existing mix of observations, including those of global observing systems, and how they could be improved in the future through better integration and optimization of remote sensing and in situ systems (http://cryos.ssec.wisc.edu/docs/cryos_theme_report.pdf). The

implementation of the Cryospheric Observing System (CryOS) will be a future focus within CliC.

New directions within the CliC project aim at increasing the linkages to the Earth System Science Partnership. The role of the cryosphere in Earth system science will remain a high priority topic of research over the next decade. Permafrost and its response to a changing climate, and the potential release of methane and its influence on the global carbon cycle, will feed directly into the ESSP Global Carbon Project.

Chair: Dr B. Goodison, Meteorological Service of Canada, Canada

Vice-Chairs: Dr A. Worby, University of Tasmania, Australia, and Professor K. Steffen, CIRES, University of Colorado, USA

Director, IPO: Dr Victoria Lytle

CliC International Project Office

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WCRP RESOURCES



TANYA MCCONNELL

WCRP Joint Scientific Committee and Secretariat



WCRP Joint Scientific Committee

Front row, from left to right: **Dr K.A. Anaman** (Institute of Economic Affairs, Ghana), **Professor L.A. Ogallo** (IGAD Climate Prediction and Applications Centre, Kenya), **Professor A. Henderson-Sellers** (Director, WCRP), **Professor V. Ramaswamy** (Vice-Chair, JSC, NOAA Geophysical Fluid Dynamics Laboratory, USA), **Dr J. Church** (Chair, JSC, Antarctic CRC and CSIRO Marine and Atmospheric Research, Australia), **Dr D.J. Griggs** (Hadley Centre, Met Office, UK), **Professor C. Vera** (University of Buenos Aires, Argentina), **Dr S. Gulev** (P.P. Shirshov Institute of Oceanology, Russian Federation)

Back row, from left to right: **Professor G. Wu** (Chinese Academy of Sciences, China), **Professor T. Yasunari** (Nagoya University, Japan), **Professor H. Le Treut** (IPSL Université de Paris, France), **Dr V. Ryabinin** (Joint Planning Staff), **Professor J. Shukla** (George Mason University, USA), **Professor J. Marotzke** (Max Planck Institute for Meteorology, Germany), **Professor A. Busalacchi** (ESSIC, University of Maryland, USA), **Dr I. Wainer** (Universidade de São Paulo, Brazil), **Dr G. Flato** (Environment Canada, Canada), **Professor P. Cornejo R. de Grunauer** (Marine Science and Engineering, ESPOL, Ecuador)

Absent: **Professor J. Slingo** (University of Reading, UK), **Professor R. Ardakanian** (Sharif University of Technology, Islamic Republic of Iran)

WCRP Joint Planning Staff (JPS)

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WCRP Web Downloads

E-zine

- The WCRP e-zine (electronic newsletter), published quarterly, available at http://wcrp.wmo.int/Newsletter_index.html. To subscribe, send an email with your electronic contact details to wcrp@wmo.int.

Brochures/Posters

- Climate Research Network Partners (2007). Download flyer from http://wcrp.wmo.int/pdf/WCRP_network-Poster.pdf [pdf, 1 MB].
- Climate Information for Adaptation and Development Needs (2007). Joint WMO publication (WMO-No. 1025) edited by WCRP and WCP. Download from http://wcrp.wmo.int/pdf/WMO1025_CIADN_LowRes_E.pdf [pdf, 1 MB].
- WCRP posters prepared for the Fifteenth World Meteorological Congress (May 2007). WCRP overview; Highlights 2003–2007; Major Activities; Cross-cutting activities; Anthropogenic Climate Change; French Contribution to WCRP and to Research on Climate and Climate Change. Posters available for download at http://wcrp.wmo.int/PG_Posters.html.

CDs/DVDs

- WCRP (2007). Africa Climate Research Networking. A WCRP Presentation from a WCP/START/WCRP Workshop for Young Scientists in Zanzibar, United Republic of Tanzania, 28 March 2007. The DVD is also part of the back-cover DVD included with this Annual Report.
- CliC (2006). First CliC International Science Conference, Beijing, China, 11-15 April 2005. Send request for a copy to clic@npolar.no.

More WCRP Newsletters

- GEWEX News for download at http://www.gewex.org/gewex_nwsltr.html
- CLIVAR Exchanges for download at <http://www.clivar.org/publications/exchanges/exchanges.php>
- SPARC Newsletter for download at <http://www.atmos.physics.utoronto.ca/SPARC/Newsletters.html>
- CliC Ice and Climate News for download at http://clic.npolar.no/disc/disc_newsletters.php?choice=CliC

- WGSF Flux News for download at <http://www.sail.msk.ru/newsletter.php>
- SOLAS Bulletin for download at <http://www.uea.ac.uk/env/solas/latest.html>.

Finances

The WCRP sponsors contribute annually to the Joint Climate Research Fund (JCRF), which is managed by the WCRP Joint Planning Staff (secretariat) with oversight from the WCRP Joint Scientific Committee.

Income and expenditure for the JCRF in 2006 are summarized in the table below.

		Swiss francs
2006	Carry forward from 2005	547,029
Income	WMO	2,008,446
	ICSU	340,500
	IOC	165,000
	interest income	19,650
Total income		2,533,596
Total funds available		3,080,625
Expenditure	Salaries and associated costs	1,831,462
	Operating expenses, including staff travel, publications, contractual support and miscellaneous office expenses	266,624
	Meeting support	782,265
Total expenditure		2,880,351
	Carry forward to 2007*	200,274

* As of 1 January 2007, the amount available as carryover was actually negative due to an erroneous salary charge to the JCRF. This amount was credited to the JCRF in March 2007; the adjusted salary costs for 2006 are shown here.

The four WCRP international project offices (CLiC, CLIVAR, GEWEX and SPARC in Norway, UK, USA and Canada, respectively), plus staff support in France and Germany, are funded by national contributions, which amounted to approximately 2.1 million Swiss francs in 2006 and constitute an important resource for the WCRP in terms of personnel, employing approximately 23 people (some part-time) who all contribute to supporting the WCRP.

Acknowledgements

Funding for the activities of the WCRP in 2006 was provided to the JCRF by the following organizations:

- World Meteorological Organization



- Intergovernmental Oceanographic Commission of UNESCO



- International Council for Science (through 2 union and 20 national contributions in 2006).



The International Group of Funding Agencies for global change research (IGFA) helps promote dialogue with national funding agencies.

The Institut Pierre Simon Laplace (IPSL) and CNRS fully support the WCRP Strategic Support Unit in Paris and a staff member of the JPS. The Alfred Wegener Institute for Polar and Marine Research in Bremerhaven supports a staff member of the JPS.

The GEWEX international project office is supported by the US National Aeronautics and Space Administration (NASA) and some staff travel is supported by the US National Oceanic and Atmospheric Administration (NOAA).

The CLIVAR project office is supported by the Natural Environment Research Council, UK, and NASA, NOAA and the US National Science Foundation through US CLIVAR.

The SPARC international project office is supported by contributions from the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS), the Canadian Space Agency, Environment Canada and the University of Toronto.

The CliC project office is supported by the Norwegian Polar Institute and the Research Council of Norway.

WCRP expresses its gratitude to all of the above organizations.



Left: Dr Thomas Rosswall (Executive Director, ICSU) and Dr Ann Henderson-Sellers (Director, WCRP)

Right: Dr Guy Brasseur and Dr Paul Crutzen discussing WCRP.

ACRONYMS

ACC	Anthropogenic Climate Change
AC&C	Atmospheric Chemistry and Climate
AMIP	Atmospheric Model Intercomparison Project
AMMA	African Monsoon Multidisciplinary Analyses
AOPC	Atmospheric Observation Panel for Climate
AR4	IPCC Fourth Assessment Report
AREP	Atmospheric Research and Environment Programme
ARGO	A global array of ocean profiling floats
ASAP	Assessment of Stratospheric Aerosol Properties
ASPeCt	Antarctic Sea Ice Processes and Climate panel
BALTEX	BALtic sea EXperiment
CALIPSO	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation
CCMVal	Chemistry-Climate Model Validation
CEOP	Coordinated Energy and water cycle Observation Project
CEOS	Committee on Earth Observation Satellites
CFCAS	Canadian Foundation for Climate and Atmospheric Sciences
CIRES	Cooperative Institute for Research in Environmental Sciences
CliC	Climate and Cryosphere project
CLIPS	Climate Information and Prediction Services
CLIVAR	CLimate VARiability and predictability project
CMIP	Coupled Model Intercomparison Project
CMIP3	Coupled Model Intercomparison Project 3
CNRS	Centre National de la Recherche Scientifique
CRC	Cooperative Research Centre
CryOS	Cryospheric Observing System
CSIRO	Commonwealth Scientific and Industrial Research Organisation
C4MIP	Coupled Carbon Cycle Climate Model Intercomparison Project
DEMETER	Development of a European Multimodel Ensemble system for seasonal to inTERannual prediction
DIVERSITAS	International programme of biodiversity science
EESC	Effective Equivalent Stratospheric Chlorine
ESPOL	Escuela Superior Politécnica del Litoral
ESSIC	Earth System Science Interdisciplinary Center
ESSP	Earth System Science Partnership
ETCCDI	Expert Team on Climate Change Detection and Indices
FAR	IPCC First Assessment Report

GAME	GEWEX Asian Monsoon EXperiment
GCOS	Global Climate Observing System
GE	General Electric
GEC-HH	Global Environmental Change and Human Health
GEF	Global Environment Fund
GEO	Group on Earth Observations
GEOS	Global Earth Observation System of Systems
GEWEX	Global Energy and Water cycle Experiment
GLDAS	Global Land Data Assimilation System
GODAE	Global Ocean Data Assimilation EXperiment
GOOS	Global Ocean Observing System
GPCP	Global Precipitation Climatology Project
GSOP	Global Synthesis and Observations Panel
HELCOM	HELSinki COMmission
IAMAS	International Association of Meteorology and Atmospheric Sciences
ICESat	Ice, Cloud, and Land Elevation Satellite
ICSU	International Council for Science
IGAC	International Global Atmospheric Chemistry
IGAD	Intergovernmental Authority on Development
IGBP	International Geosphere-Biosphere Programme
IGFA	International Group of Funding Agencies for Global Change Research
IGOS	Integrated Global Observing System
IGOS-Cryo	Cryospheric Theme of IGOS
IHDP	International Human Dimensions Programme
IMO	International Meteorological Organization
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
IPO	International Project Office
IPSL	Institut Pierre Simon Laplace
IPY	International Polar Year 2007-2008
IRI	International Research Institute for Climate and Society
ISCCP	International Satellite Cloud Climatology Project
ISMIP	Ice Sheet Model Intercomparison Project
IUGG	International Union of Geodesy and Geophysics
JCRF	Joint Climate Research Fund
JPS	Joint Planning Staff (of the WCRP)
JSC	Joint Scientific Committee (of the WCRP)
MAHASRI	Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative
MAIRS	Monsoon Asia Integrated Regional Study
NAME	North American Monsoon Experiment
NASA	National Aeronautics and Space Administration
NCDC	National Climate Data Center

NIC	National Ice Center
NMHS	National Meteorological and Hydrological Services
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
ODS	Ozone Depleting Substance
OOPC	Ocean Observation Panel for Climate
OSC	Open Science Conference
PCMDI	Program for Climate Model Diagnosis and Intercomparison
PSC	Polar Stratospheric Clouds
SALLJEX	South American Low Level Jet EXperiment
SAR	IPCC Second Assessment Report
SBSTA	Subsidiary Body on Scientific and Technological Advice (of the UNFCCC)
SCAR	Scientific Committee on Antarctic Research
SOLAS	Surface Ocean-Lower Atmosphere Study
SPARC	Stratospheric Processes And their Role in Climate
SST	Sea-Surface Temperature
START	SysTem for Analysis, Research and Training
TACE	Tropical Atlantic Climate Experiment
TAR	IPCC Third Assessment Report
THORPEX	THE Observing system Research and Predictability EXperiment
TMA	Tanzania Meteorological Agency
TMI	TRMM (Tropical Rainfall Monitoring Mission) Microwave Imager
UCT	University of Cape Town
UKMO	United Kingdom Met Office
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VACS	Variability of the African Climate System
VAMOS	Variability of the American MONsoon System
VOCALS	VAMOS Ocean Cloud Atmosphere Land Study
WB	World Bank
WCP	World Climate Programme
WCRM	World Climate Research Modelling
WCRP	World Climate Research Programme
WGCM	Working Group on Coupled Modelling
WGNE	Working Group on Numerical Experimentation
WGSF	Working Group on Surface Fluxes
WMO	World Meteorological Organization
WMP	WCRP Modelling Panel
WOAP	WCRP Observation and Assimilation Panel
WOCE	World Ocean Circulation Experiment
WWW	World Weather Watch

WCRP DVD: PROVIDING THE SCIENCE FOR CLIMATE CHANGE SOLUTIONS

VIDEO 1

Climate Change Research Achievements and Challenges, 10 min., 28 min., PowerPoint

A WCRP Side Event at the twenty-fourth session of the Subsidiary Body for Scientific and Technological Advice of the UNFCCC

Bonn,
Germany,
19 May 2006

- Welcome: B. Nyenzi, Director, World Climate Programme, WMO
- Potentially Dangerous Sea-level Rise: A Research Needs Example: J. Church, Chair, Joint Scientific Committee, WCRP
- How Sure Are We About Climate Change Projections?: J.F.B. Mitchell, Chief Scientist, UK Met Office
- What Forces Climate Change and How Well Do We Know It?: V. Ramaswamy, US NOAA Geophysical Fluid Dynamics Laboratory, Princeton University
- What Climate Extremes Are Awaiting Us?: A. Busalacchi, Director, Earth System Science Interdisciplinary Center, University of Maryland
- Key Climate Change Research Gaps: J. Church, Chair, Joint Scientific Committee, WCRP

Moderator: A. Henderson-Sellers, Director, WCRP

VIDEO 2

Africa Climate Research Networking, 12 min.

A WCRP Presentation from a Workshop for Young Scientists

Zanzibar,
United Republic of Tanzania,
28 March 2007

WCP/START/WCRP, in conjunction with the twenty-eighth session of the WCRP Joint Scientific Committee, organized a workshop in Zanzibar focused on African climate research needs and attended by more than 30 national participants including young scientists. The agenda and a selection of the presentations are available at http://wcrp.wmo.int/PG_Presentations.html.

- Welcome: J. Church, Chair, JSC, WCRP; and M. Mhita, Director General, Tanzania Meteorological Agency (TMA)
- IPCC AR4 WG I Findings for Africa: B. Hewitson, UCT, South Africa
- CLIVAR-VACS: Current Status and Challenges for the Future: C. Reason, UCT, South Africa
- AMMA: Current Status and Challenges for the Future: A. Gaye, University of Dakar, Senegal. Presented by S. Sorooshian
- WMO CLIPS: Current Status on Application of

- Climate Information and Products in Africa: B. Nyenzi, WMO/WCP
- Past Global Changes in Africa: M. Umer, Addis Ababa University, Ethiopia
 - Advancing African Climate Predictions: A Proposal for Near- and Longer-term Strategy, F. Semazzi, North Carolina State University, USA
 - Climate Change-related Vulnerability; Resilience and Adaptation in Tanzania: J. Adosi, TMA, United Republic of Tanzania
 - Invited Lecture: Mainstreaming Climate Information in National Development Plans and Strategies: Hon. Minister M. Mwandosya, United Republic of Tanzania
 - Panellists: S. Muhongo (South Africa), L. Ogallo (Kenya), K. Anaman (Ghana), M. Mhita (United Republic of Tanzania)

Producer of the DVD:

G. Reboux, gilles.reboux@wanadoo.fr,
www.HumanWorldAVbank.net

Building the Climate Research Partnership

The great success of the WCRP is directly related to the proactive involvement of leading climate scientists and effective partnering with organizations from around the world. The primary means of partnering with this Programme are as follows:

Partners: contribute to WCRP initiatives as sponsors, which can involve prioritization of user needs and provision of resources. Joining our partnership provides an excellent opportunity for individuals and organizations to demonstrate a strong commitment to climate and climate change research. The WCRP welcomes the opportunity to partner with private industries, non-governmental and intergovernmental organizations, foundations and associations.

National Academies, Agencies and Climate Committees:

the WCRP encourages the involvement of National Agencies (such as National Meteorological and Hydrological Services) and National Academies including by the establishment of National Climate Committees as a mean of building a truly international network to support integrated climate research. Such organizations and groups play an important role in linking national and international programmes, as well as interacting with policymakers and other stakeholders in their home countries.

Scientists: the WCRP invites and encourages individual scientists to make the WCRP global secretariat aware

of their ongoing research and to suggest ways to integrate local and international initiatives. The WCRP Joint Scientific Committee, as well as the core projects and cross-cutting activities, welcomes proposals for new collaborative activities (research projects, workshops, syntheses, etc.) that support the implementation of the WCRP Strategic Framework. Such proposals should be high-priority issues where significant progress can be expected over a short period of time and should result in a synthesis or integration of research activities from across the breadth of the WCRP.

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ICSU

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