



World Climate Research Programme: Scientific Foundation for Decision Making

Introduction

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

Advancing Climate Science

About 20 modeling groups from around the world are currently running the CMIP5 experiments that represent the most ambitious multi-model inter-comparison and analysis project ever attempted. The WCRP Working Group on Coupled Models (WGCM), in consultation with the IGBP Analysis Integration and Modeling of the Earth System (AIMES) and a number of other elements of WCRP and the climate research community, is coordinating three major categories of experiments and analysis based on model simulations. They are; 1) Decadal Hindcasts and predictions simulations; 2) "long-term" simulations; and 3) "Atmosphere-only" (prescribed SST) simulations for especially computationally-demanding models. More details on the Climate Model Intercomparison Project (CMIP5) can be found at: <http://cmip-pcmdi.llnl.gov/cmip5/>. Some model data are already available for analysis through PCMDI web page, with more results steadily becoming available soon. The multi-model datasets will mature through the course of 2011 as more model data become available. Ultimately, these results will be available through the peer reviewed publications for use in the 5th IPCC Assessment Report (AR5).

CMIP5 also includes a series of experiments on short-term climate prediction (2005-2030) and provides international coordination of research on understanding the mechanisms associated with regions/modes of climate variability and change, and our ability to predict them. It is well established that, based on knowledge of the initial conditions, important aspects of regional climate are predictable up to a year ahead. Predictability at this time scale is primarily, though not solely, associated with the El Niño Southern Oscillation (ENSO), and is currently addressed by seasonal forecasting. On multi-year timescales other factors are also important, including low frequency variations in ocean circulation and changes in external (or boundary) forcing from anthropogenic (e.g. greenhouse gases and aerosols) and natural sources (e.g. solar variability and volcanic eruptions). CMIP5 has organized a set of experiments that include climate predictions up to 2035. The experiments are organized in a core set and an additional tier 1 set. The core experiments will allow assessment of the forecast quality (i.e. in a hind-cast mode) on time-scales when the initial climate state is most likely to exert some influence. The tier 1 near-term experiments also include predictions with 1) additional initial states after the year 2000 when ocean data is of better quality, 2) volcanic eruptions removed from the hindcasts, 3) a hypothetical volcanic eruption imposed in one of the predictions of future climate, 4) different initialization methodologies, and 5) the option of performing high-resolution time-slice experiments with specified SST for certain decades in the future.

Another major ongoing effort within WCRP is the Climate-system Historical Forecast Project (CHFP, <http://www.clivar.org/organization/wgsip/chfp/chfp.php>). This project is a multi-model, multi-institutional experimental framework for the assessment of state-of-the-science seasonal forecast systems, and to evaluate the potential for untapped predictability due to interactions between the components of the climate system that are currently not fully accounted for in seasonal forecasts. A workshop was held in October 2010 on Seasonal to Multi-decadal Predictability of Polar Climate that focuses on mechanisms for climate predictability in Polar Regions from a phenomenological and process-oriented perspective (<http://www.atmosp.physics.utoronto.ca/SPARC/PolarWorkshop/main.html>). WCRP also co-sponsored with the World Weather Watch Research Programme (WWRP), a workshop on Sub-seasonal to Seasonal Prediction that took place in December 2010 in Exeter UK. The outcomes of the workshop included the identification of high-priority research topics and the establishment of an international research project to facilitate progress on characterising uncertainties and enhancing quality of seasonal climate prediction.

The WCRP SPARC project, through its Chemistry Climate Model (CCM), Validation (CCMVal) activity, made a major contribution to the 2010 Ozone Assessment through the coordination and analysis of CCM simulations performed in support of the Assessment. A detailed process-oriented evaluation of CCMs using performance metrics, as well as an objective and robust statistical analysis method, were developed as part of the peer-reviewed SPARC CCMVal Report (http://www.atmosp.physics.utoronto.ca/SPARC/ccmval_final/index.php). The CCMVal model results not only confirmed our understanding of past ozone depletion, but quantified the two-way interaction between ozone depletion and climate change. For the first time, meaningful statistical measures of uncertainty could be placed on the model projections used in the Ozone Assessment.

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

Providing Climate Information for Decision Makers

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

The provision of climate information at regional to local scales is an important requirement to support informed decision making in response to potential climate change. Such information is needed to assess the impacts of climate change on human and natural systems, enabling the development of suitable adaptation and risk management strategies at the regional to local level.

The WCRP Task Force on Regional Climate Downscaling has launched the CORDEX project (http://wcrp.ipsl.jussieu.fr/SF_RCMTerms.html) in order to provide quality-controlled data sets, model simulations and regional climate-based information for the recent historical past and for the rest of 21st century in form of climate projections. CORDEX domains cover the majority of populated land regions on the globe with a major focus on Africa. The project is well underway and is becoming a reference for the community of practice in regional climate downscaling and analysis. The group organized the first International CORDEX Conference in Trieste in March 2011 that reviewed the status and main issues of the CORDEX initiative over the various CORDEX domains. Special sessions were devoted to the Africa domain and to the assessment of the first multi-model CORDEX simulations over this region, followed by a special training session for the African scientists towards developing research and analysis capacity in this region.

Research on “Climate Extremes” is one of the WCRP cross-cutting activities and it is focused on the design of an intercomparison framework through which both observations and climate model representations of extremes and projections of climate can be assessed, and by which changes in climate extremes can be better evaluated

and communicated to the decision makers. The overall aim of this activity is to accelerate progress on the prediction/projection of climate extremes with a focus on developing capabilities and products which facilitate practical applications for stakeholders in regions/sectors around the world. A workshop on Metrics and Methodologies for Estimation of Extreme Climate Events, jointly sponsored by WCRP and UNESCO, has been organized in September 2010 at UNESCO Headquarters, Paris, France (<http://www.extremeworkshop.org/>). The workshop considered stakeholder requirements for improved information on climate extremes, reviewed progress in meeting these requirements, identified gaps, and facilitated an active dialogue amongst researchers from different disciplines, climate data producers and stakeholders to develop a strategy for future research. Drought has been identified as an important focus of the WCRP extremes activity and a major international workshop was organized in March 2011 in Barcelona, Spain (<http://drought.wcrp-climate.org/workshop/>). The key recommendations that resulted from this workshop include the development of a drought catalogue to provide a summary of our current understanding of the causes of drought world-wide, the definition of case studies and coordinated analysis of the mechanisms, research priorities to improve drought predictability and prediction skill, and the development of an experimental drought early warning system (DEWS) that takes advantage of our current capabilities in drought prediction and monitoring.

Training Next Generation of Climate Scientists

WCRP has been partnering with WMO, GCOS and ICPAC to execute a World Bank-sponsored project on climate risk reduction for the Greater Horn of Africa countries (http://www.wcrp-climate.org/CB_projects_GFDRR.shtml). A series of three coordinated workshops brought together climate practitioners and users to assess available climate data and information for water resources and agriculture, and to identify best practices and gaps that need to be filled. The overall objectives of the workshop programme were to help ensure that attention is given by countries in the GHA region to observation and data needs, to demonstrate the use and value of regional models, to provide advice on model limitations, and to improve capabilities across the GHA for using data records and model projections for adaptation planning.

WCRP has launched a grants programme to enable and support the active participation of about 200 individuals among students, early career scientists and scientists from developing countries to attend the WCRP Open Science Conference. More than 400 applications are received and they are being reviewed by an expert Panel to select the final recipients of these grants. WCRP has reached a formal agreement with major international scientific and technical programmes (e.g. American and European Geophysical Unions, American Meteorological Society) to award more than 100 complimentary membership and access to their annual meetings to the best papers and posters to be presented by these scientists at the WCRP Open Science Conference.

WCRP also constituted a policy to invite and support participation of early career scientists and graduate students in everyone of its co-sponsored scientific and technical meetings, workshops and conferences. In 2010, WCRP supported 150 such candidates representing 27 countries, mostly from the developing regions/nations.

WCRP in partnership with START is developing a regional research capacity development for Asia and Africa in conjunction with the CORDEX to ensure long-term availability of experts who are able to translate scientific knowledge of climate variability and change for use by decision makers in food and agriculture, water resources management, urban and peri-urban agriculture and development, etc.

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