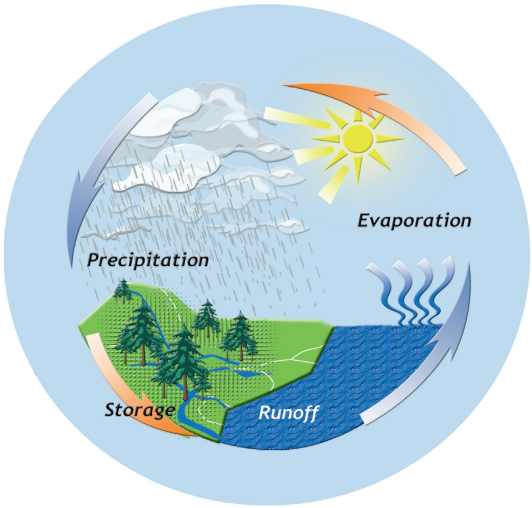
WCRP NEWS
World Climate Research Programme

Global Energy and Water Cycle Experiment
GEWEX
WCRP

The Global Energy and Water Cycle Experiment (GEWEX), one of four core projects of the World Climate Research Programme (WCRP), addresses observations, understanding and modelling of the hydrological cycle and energy fluxes in the atmosphere, at land surface and in the upper oceans.

Within the World Meteorological Organization, GEWEX has strong ties with the hydrology and water resources and the atmospheric research programms as well as links with the World Climate Programme, World Weather Research Programme and the Disaster Risk Reduction Programme. GEWEX contributes to improving services in support of adaptation and mitigation to global change effects, disaster risk reduction, climate change assessment, pollution abatement, water resources, and energy and health management.



GEWEX projects are designed to tie together all aspects of the global energy and water cycle. GEWEX components involve scientists from over 50 countries on six continents and produces global data sets of all the relevant parameters and also has nine focused hydrometeorological studies that cover most climate regimes.

GEWEX facilitates the transfer of knowledge from countries with well developed hydrometeorological prediction systems and observational capabilities to countries that do not have these capabilities, and assists in building national capacity through the training of skilled personnel. GEWEX seeks to broaden its base of national participation and support from member nations. More: www.gewex.org.

Examples of GEWEX accomplishments:

- The African Monsoon Multidisciplinary Analysis Project which involves the capabilities of meteorological services in West Africa yields unique data sets that support the development of climate models.
- GEWEX has developed high-resolution next generation hydrologic land surface and regional climate models by improving parameterizations and applying them for experimental predictions.
- GEWEX has developed global data sets on clouds, radiation and other parameters that are invaluable in understanding and predicting global processes.
- Modelling studies have identified key land-surface processes & conditions that contribute most significantly to the predictability of precipitation.
- GEWEX is developing land data assimilation systems that will resolve land surface features at resolutions as small as 1 km.
- GEWEX results contribute to the hydrometeorological services in decision-making in virtually every social and economic sector.

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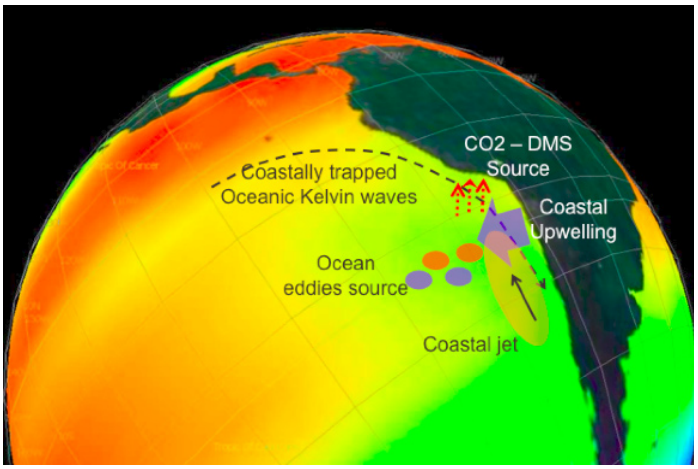
Climate Variability and Predictability (CLIVAR) is the main focus in WCRP for studies of climate variability. Its mission is to observe, simulate and predict the Earth's climate system, with a focus on ocean-atmosphere interactions enabling better understanding of climate variability, predictability and change to the benefit of society and the environment in which we live. CLIVAR seeks to encourage analysis of observations of climate variations and change on seasonal to centennial and longer time scales. It collaborates closely with the WCRP/GEWEX project on the monsoon systems of the world. It also encourages and helps to coordinate observational studies of climate processes, particularly for the ocean but also over monsoon land areas, encouraging their feed into climate models.
CLIVAR is providing management of and scientific input to the WCRP Joint Scientific Committee cross-cutting topics on seasonal and decadal prediction and (with GEWEX) on monsoons and climate extremes. It also contributes to those on anthropogenic climate change, sea level rise and atmospheric chemistry and climate.



Study area of the CLIVAR/VAMOS Ocean Cloud Atmosphere Land Study (VOCALS), which focuses on a better understanding of ocean-cloud-atmosphere-land coupling processes in the southeast Pacific.

CLIVAR encourages the broadest possible participation in its activities. Within the World Climate Programme, it links particularly to the Commission for Climatology and the World Climate Applications and Services Programme and more widely to the activities of the Global Climate Observing System, THORPEX and the IPCC. For more information visit the CLIVAR web page at www.clivar.org.

Examples of CLIVAR accomplishments:

- Development of improved understanding & prediction of climate variability/change.
- Coordination of climate model scenario experiments for IPCC. Key inputs on changes in climate extremes to IPCC AR4.
- Model intercomparison activities aimed at improving seasonal predictions and ocean model performance.
- Coordination of field studies to help improve parameterization schemes for atmosphere and ocean climate models and their interactions.
- Synthesis of ocean data & information.
- Advocacy for real time data and high quality delayed mode observational data for operations and research.
- Development of an electronic African Climate Atlas, a tool for research on African climate.
- Organizing & sponsoring training workshops on seasonal prediction in Africa, climate impacts on ocean ecosystems, climate data and extremes and ENSO.

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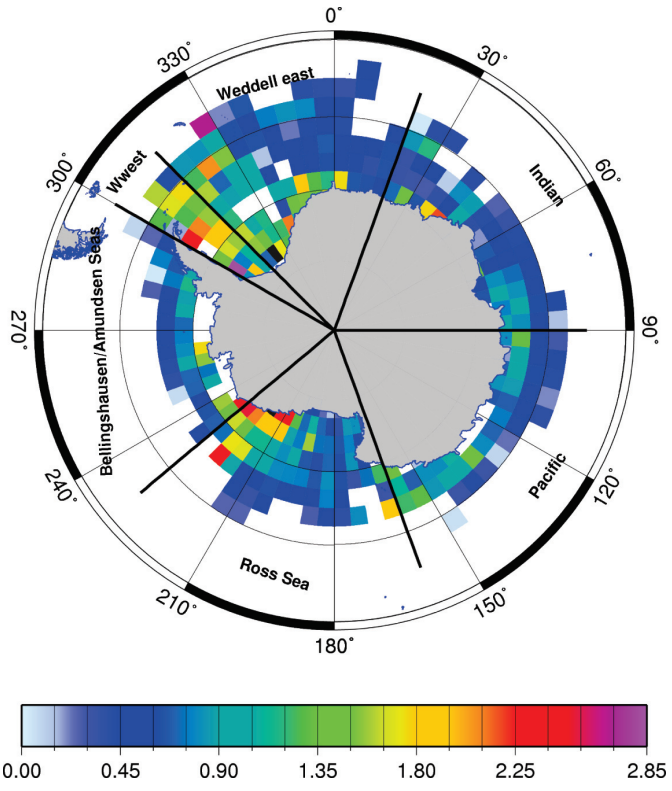
The Climate and Cryosphere (CliC) Project was established by WCRP in March 2000. The Scientific Committee on Antarctic Research (SCAR) became its co-sponsor in 2004.
CliC's mission is to understand and represent in models the role of the cryosphere in Earth's climate system and to assess and quantify the impacts that climate variability and change have on components of the cryosphere and its overall stability, and the consequences of these impacts for the climate system. To achieve its mission, CliC encourages and coordinates national and international activities related to cryosphere and climate, organizes conferences, workshops, scientific experiments, and model intercomparison studies.



Circumpolar annual mean sea ice thickness compiled from ASPeCt ship observations for the period 1980 - 2005. Source: Worby et al. (2008) JGR Vol. 113.

The word "cryo" stands for ice cold in ancient Greek, but the cryosphere has become a "hottest" topic of science. CliC targets a quantum change in our ability to observe, understand, model and predict it.
To learn more, please visit http://clic.npolar.no.

Examples of CliC accomplishments:

- CliC prepared an IGOS Theme on Cryosphere (IGOS-Cryo) in partnership with SCAR and published a report reflecting broad consensus on the planned development of cryospheric observations for years to come. In May 2007, the 15th WMO Congress approved Canada's proposal to create a Global Cryospheric Watch, which was based on the IGOC-Cryo recommendations.
- CliC generated strong input from the climate research community to the scientific programme of IPY 2007-2008. This included a concept of polar satellite snapshot aimed at obtaining unprecedented coverage of both polar regions.
- CliC was one of the key scientific programmes that drew the attention of the world's scientific community to the cryosphere. For the first time, a chapter on Snow, Ice and Frozen Ground was prepared in the IPCC Assessment Report 4 (2007). Contribution of melted water to recent sea-level change is now known with considerably increased accuracy.
- Through the 2nd International Conference on Arctic Research Planning CliC engaged the Arctic climate and weather modelling communities in developing a 10-year plan to improve projections of Arctic change.

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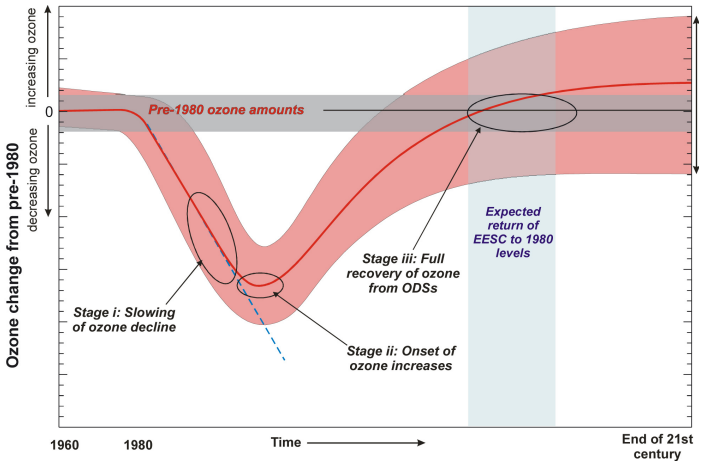
The WCRP core project Stratospheric Processes and their Role in Climate (SPARC) addresses key questions in climate research in the context of three main themes: (a) climate-chemistry interactions; (b) detection, attribution, and prediction of stratospheric change; (c) stratosphere-troposphere dynamical coupling. SPARC co-leads, with the IGBP's International Global Atmospheric Chemistry Project (IGAC), the WCRP-IGBP joint research activity on Atmospheric Chemistry and Climate, which has a leading role in the preparation of the WMO/UNEP Scientific Assessments of Ozone Depletion. Through its modelling and data assimilation activities SPARC is contributing directly to the knowledge base which supports the development of next generation weather analysis systems and weather and climate prediction models. In addition, SPARC, through its research activities in stratosphere-troposphere dynamical coupling, contributes to the understanding that is required as underpinning for the development of next-generation weather, climate and Earth system prediction models.



SPARC provided significant direct input into the last three WMO/UNEP Assessments of Ozone Depletion (1998, 2002 and 2006).

SPARC research and subsequent reports and publications have been widely used and cited. They served as key sources of knowledge for major assessments such as the IPCC AR4. Components of the WCRP/SPARC research programme such as the studying the coupling of stratosphere and troposphere are important not only for predicting climate change but also for improving numerical weather prediction.

More: www.atmosp.physics.utoronto.ca/SPARC.

Examples of SPARC accomplishments:

- SPARC's Chemistry-Climate Model Validation (CCMVal) organizes model simulations and analyses that were a central element of the WMO/UNEP Scientific Assessments of Ozone Depletion.
- SPARC-related scientists served on the WMO/UNEP Assessment Steering Committee, as lead and contributing authors, and reviewers.
- SPARC comprehensive peer-reviewed reports include:
  - Trends in the Vertical Distribution of Ozone,
  - Upper Tropospheric and Stratospheric Water Vapour,
  - Intercomparison of Middle Atmosphere Climatologies,
  - Stratospheric Aerosol Properties.
- SPARC reports in preparation include: Chemistry-Climate Model Validation and an updated Assessment of Upper Tropospheric and Stratospheric Water Vapour.

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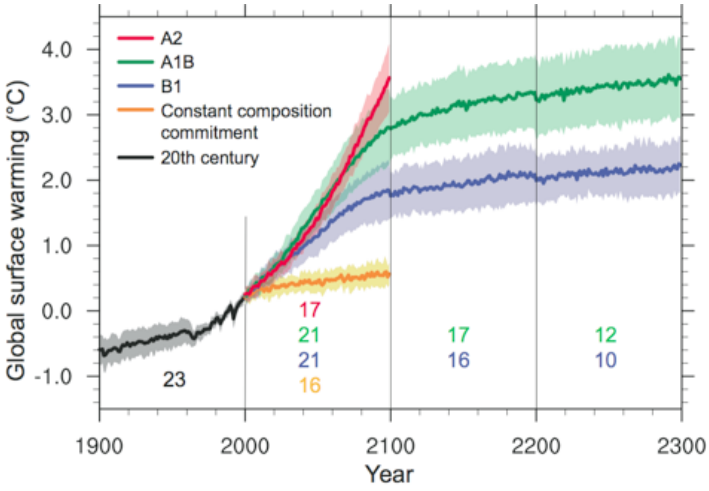
Modelling

The development and evaluation of global climate models is an important unifying component of WCRP, building on scientific and technical advances in the more discipline-oriented activities. These models are the fundamental tool for understanding and predicting natural climate variations and providing reliable predictions of natural and anthropogenic climate change. Models also provide an essential means of exploiting and synthesising in a synergistic manner all relevant atmospheric, oceanographic, cryospheric and land-surface data collected in WCRP and other programmes. The Working Group on Numerical Experimentation (WGNE), jointly sponsored by the WCRP and the WMO Commission for Atmospheric Sciences (CAS), leads the development of atmospheric models for both climate studies and numerical weather prediction. Numerical experimentation groups of WCRP projects meet in the WCRP Modelling Panel.



IPCC AR4 used model data derived from the CMIP3 multi-model dataset archive at PCMDI.

Example of Modelling accomplishments:
The latest Coupled Model Intercomparison Project (CMIP) was initiated in 2004. In 2005, WCRP facilitated the collection, archive and access to all the global climate model simulations undertaken for the IPCC Fourth Assessment Report (AR4). This third phase of CMIP (CMIP3) involved an unprecedented set of 20th and 21st century coordinated climate change experiments from 16 groups in 11 countries with 23 global coupled climate models. About 31 terabytes of model data were collected at the Program for Climate Model Diagonosis and Intercomparison (PCMDI). The model data are openly available, and have been accessed by over 1200 scientists who have produced over 200 peer-reviewed papers.

In addition, the Working Group on Coupled Modelling (WGCM) leads the development of coupled ocean/atmosphere/land models used for climate studies on longer time-scales. WGCM is also WCRP's link to the Earth system modelling in IGBP's Analysis, Integration and Modeling of the Earth System (AIMES) and to IPCC. Activities in this area concentrate on the identification of errors in model climate simulations and exploring the means for their reduction by organizing coordinated model experiments under standard conditions.
Under the auspices of the WCRP, the Atmospheric Model Intercomparison Project (AMIP) has facilitated controlled simulations of the ten-year period 1979-1988 by thirty different atmospheric models under specified conditions. The comparison of the results with observations has shown the capability of many models to represent adequately mean seasonal states and large-scale interannual variability.

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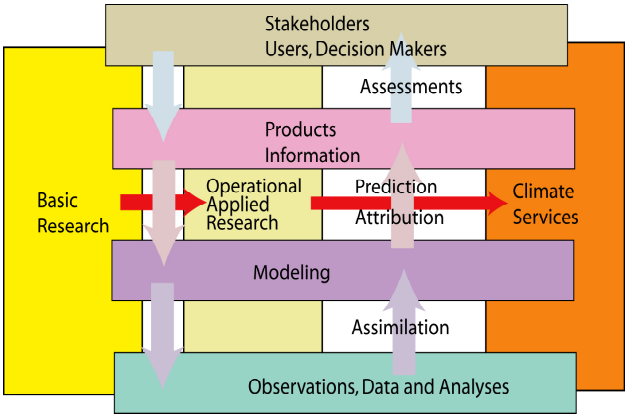
Observations & Analysis

The WCRP Observation and Assimilation Panel (WOAP), co-sponsored by the Global Climate Observing System (GCOS), is the expert panel for all aspects of global observations, their analysis and assimilation and development of climate products. Members of WOAP are representatives from all WCRP and GCOS activities including the WCRP projects CLIVAR, SPARC, GEWEX, CliC, and joint working groups such as the Atmospheric Observation Panel for Climate (AOPC), the Ocean Observation Panel for Climate (OOPC), the Terrestrial Observation Panel for Climate (TOPC), and WCRP modelling groups. WOAP identifies requirements of climate researchers for in situ and space-based observation networks and systems for use in analysis, diagnosis, modelling and prediction. Research on improving analysis and assimilation of observations to initialize models for prediction is also a key objective of WOAP. Other tasks of WOAP are to support the community in the collection and reanalysis of climate observations, and to explore mechanisms for the management, stewardship and access of data (WCRP's Data Management). WOAP exploits observations and re-analyses in its input to the Intergovernmental Panel on Climate Change (IPCC) assessment reports and other wide-ranging policy fora. In addition, WOAP interacts and represents WCRP on observational issues with the Global Earth Observing System of Systems.



A view of how a climate information system may be structured to result in climate services. Source: Trenberth 2008, WMO Bulletin.

WOAP activities:

- Identifies climate observational requirements;
- Promotes optimizing observations;
- Provides a forum and focal point for WCRP observational issues;
- Promotes and coordinates analysis, reprocessing, reanalysis and assimilation;
- Promotes and coordinates information and data management activities.

More at: http://wcrp.wmo.int/AP_WOAP.html.

Examples of WOAP accomplishments:

WCRP places very high priority on obtaining and using the highest possible quality observations and derived products, with continuity over time to ensure their use in climate change assessments and climate research. This includes promoting reprocessing of observations, especially those from space-based platforms, as well as reanalysis of the observations into global gridded physically consistent fields. WCRP has led re-analysis efforts since they started for the atmosphere in 1988, and WOAP now provides ongoing leadership in promoting reanalysis and expanding it to embrace ocean re-analysis and even whole Earth system re-analysis. A series of three WCRP reanalysis conferences has been held, with the first in 1997 at NOAA, USA; the second in 1999 in Reading, UK; and the Third WCRP International Conference on Reanalysis held in January/February 2008 in Tokyo, Japan.

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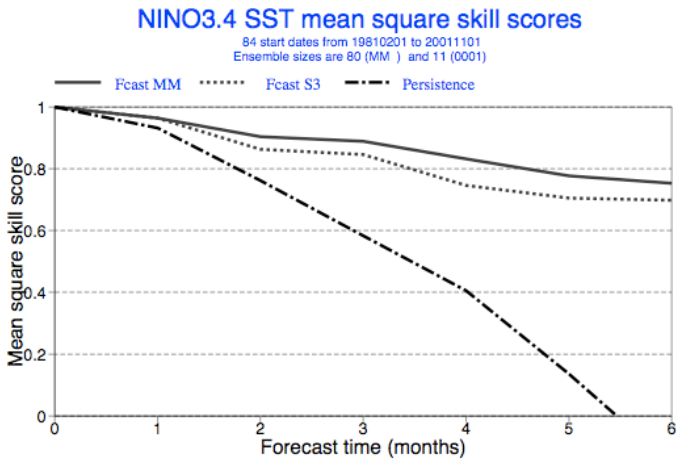
Seasonal Prediction

One of the overarching objectives of the World Climate Research Programme (WCRP) is to facilitate analysis and prediction of Earth system variability and change for use in an increasing range of practical applications of direct relevance, benefit and value to society. In 2005, the WCRP commissioned the Task Force on Seasonal Prediction (TFSP) to assess current seasonal prediction capability and skill. The CLIVAR Working Group on Seasonal to Interannual Prediction (WGSIP) now continues the TFSP mandate.



One of the successes of seasonal prediction is the ability of today's forecast systems to predict El Niño variability. Errors are still larger than expected, but a multi-model average (solid line) has improved prediction skill compared to individual models (dotted line), and provides a good indication of expected El Niño SST evolution over the ensuing six months. Source: ECMWF.

The maximum predictability of the climate system has yet to be achieved by current state-of-the-science seasonal forecasting systems, with challenges not just in terms of predicting land surface temperature and rainfall, but also in the use of seasonal prediction information for practical societal applications. The effective communication of forecast skill, including uncertainty, is crucial to evaluate progress in quality and to attain forecast value through its application.
The seasonal prediction is still in the early stages.

Examples of WOAP accomplishments:

- The First WCRP Seasonal Prediction Workshop,organized by TFSP on June 4-7 2007 in Barcelona, Spain, brought together climate researchers, forecast providers and application experts to discuss the current status of seasonal forecasting and their applications by users. The consensus statements, recommendations and best practices from the Workshop are presented in a WCRP Seasonal Prediction Position Paper (WCRP Informal Report No.3/2008).
- The TFSP launched the WCRP Climate-system Historical Forecast Project (CHFP), a multi-model, multi-institutional experimental framework for the assessment of state-of-the-art 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.

Common physical processes and models explicitly link predictive timescales so that seasonal forecast methodologies are a vital test-bed to assess the reliability of climate simulations and multi-decadal predictions, particularly at the regional scale. Read more: www.clivar.org/organization/wgsip/wgsip.php.

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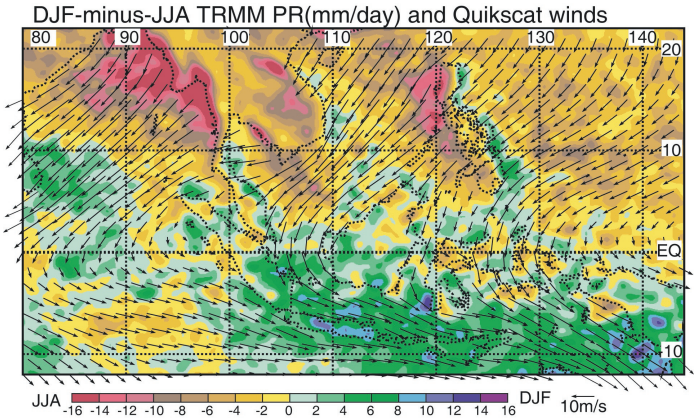
Monsoons

Monsoons are a central component of the Earth's climate system: large enough to influence the global climate system yet small enough to have distinct regional characteristics and be influenced by the global circulation of the atmosphere and the oceans. Accurate regional monsoon predictions and forecasts on various timescales are of crucial importance to enable decision makers, including National Hydrological and Meteorological Services to effectively administer their programms dealing with all aspects related to weather, climate and water.



Difference on TRMM Precipitation Rader data and QuikSCAT winds between boreal winter and boreal summer (DJF minus JJA) above Indonesia and Malaysia. Warm colours are the boreal summer monsoon regime and cool colours are the boreal winter monsoon regime. Source: C.-P. Chang.

WCRP, through the efforts of it's core projects CLIVAR and GEWEX, is playing a major role in coordinating monsoon studies. CLIVAR's Asian-Australian Monsoon and Indian Ocean Panels (AAMP and IOP) have focused on the prediction of the Indian and Australian monsoons whilst the GEWEX Asian Monsoon Experiment (GAME) and the SCSMEX (South China Sea Monsoon Experiment) focused on the eastern Asian monsoon. These and the other regional monsoon experiments including, under CLIVAR's Variability of the American Monsoon System (VAMOS) Panel, the North American Monsoon Experiment (NAME), the Monsoon Experiment in South America (MESA) and a focus on the La Plata Basin (LPB), all have distinctly regional approaches to monsoon issues as has the African Monsoon Multidisciplinary Analysis (AMMA).

Major steps:

- WCRP, through the concept of an International Monsoon Study (IMS), focusses on key uncertainties in monsoon prediction and in particular, the multi-scale interactions essential for the dynamics & prediction of diurnal to intra-seasonal variability and the seasonal march of the monsoons.
- A major IMS activity has been the development of a science plan for the Asian Monsoon Years (AMY) 2007-2012, with the goal to improve Asian monsoon prediction for societal benefits through coordinating efforts to improve our understanding of monsoon variability.
- A realistic representation of tropical convection and its multi-scale organization in global atmospheric models continues to limit the success of Numerical Weather Prediction (NWP) forecasts and global predictions, and in particular those of monsoons. To address this issue WCRP and WWRP/THORPEX are sponsoring a year of coordinated observing, modelling and forecasting of organized tropical convection and its influences on prediction (YOTC).

In Asia, GEWEX has recently launched the Monsoon Asian Hydro-Atmosphere Scientific Research and prediction Initiative (MAHASRI). Read more: www.clivar.org and www.gewex.org.

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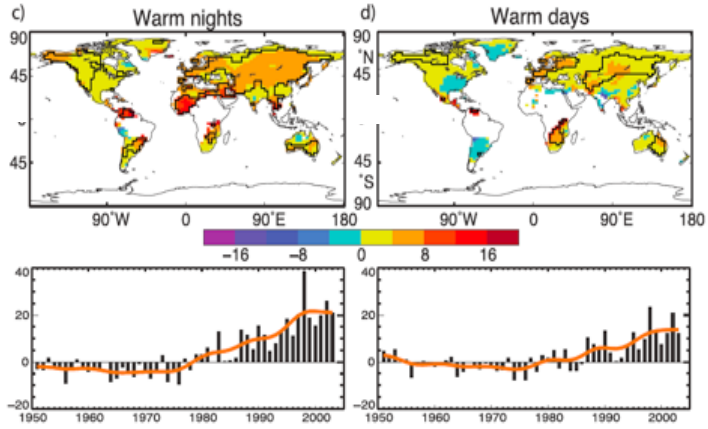
Extremes & Risks

Climate Extremes and Risks form one of the World Climate Research Programme cross-cutting activities. The topic is of great interest to policy decisions on climate change and managing risks and impacts of natural disasters and their economic impacts on regions and nations. This is also one of the 9 major thrusts of the Nairobi Work Programme to which WCRP efforts in this area contribute.



Observed trends (days per decade) for 1951-2003 in the frequency of extreme temperatures, based on 1961 to 1990 values, as maps for the 90th percentile: warm nights (left) and warm days (right). Black lines enclose regions where trends are significant at the 5% level. Source: IPCC AR4 SPM, adapted from Alexander et al. 2006.

The joint WMO Commission for Climatology/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) aims are, to

- Develop new indices of extremes, including those for the ocean (with JCOMM);
- Hold capacity-building workshops, to build a global indices database on extremes. 2007 workshops were held in the Congo and Vietnam with support from WMO;
- Provide key input on extremes into the IPCC assessment process;
- Initiate development of a WMO guidance-document on the analysis of extremes in a changing climate.

Major steps:

- A focus on extremes under the GEWEX Coordinated Energy and Water Cycle Observations Project (CEOP) with the key objective to better understand the occurrence, evolution and role of extremes within the Earth's climate system.
- Developing a global product, based on satellite observations, of heavy rainfall at 24 and 48 hour accumulation periods through a joint GEWEX/UNESCO project.
- Focus on model representation of extremes in climate predictions on seasonal, decadal and climate change timescales.
- Evaluate model products to address issues such as the roles of the ocean on drought through US CLIVAR activities on drought and its Drought in Coupled Models project.
- Monitor and understand cryospheric extremes under the WCRP Climate and Cryosphere (CliC) project.
- Study extreme stratospheric conditions under the WCRP Stratospheric Processes and Climate (SPARC) project.

The Joint Scientific Committee (JSC) for WCRP is currently establishing a Task Force on Climate Extremes to help focus these activities and develop user-oriented deliverables including links to the WMO Climate Watch. WCRP/CLIVAR and GEWEX jointly manage the effort.

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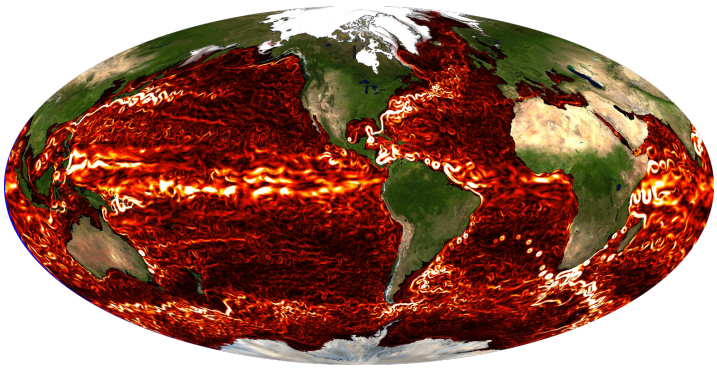
Ocean & Climate

The oceans play an important role in climate variability and change. They influence climate oscillations on seasonal to decadal time scales. By redistributing heat and freshwater, the ocean circulation influences the climate at regional, basin and global scales. The oceans, by absorbing heat and serving as a carbon dioxide storage, mitigate some adverse impacts of climate warming. In collaboration with other organizations, CLIVAR provides the focus within WCRP for understanding the role of the ocean in climate, with contributions from CliC on cryospheric aspects and GEWEX and SOLAS in terms of surface fluxes and the global hydrological cycle.



Simulated near-surface (15m) ocean-current speed and sea-ice cover from an unconstrained eddy-permitting integration carried out by the Estimating the Circulation and Climate of the Ocean - Phase II (ECCO2) project. Units are m/s with the color scale ranging from black (0 m/s) through reds to white (>5 m/s). Simulated sea ice is shown as an opaque, white cover. Land masses and ice shelves are overlain with NASA satellite imagery. The ECCO2 project (http://ecco2.org/) is funded by the NASA Modeling, Analysis, and Prediction (MAP) programme.

A better understanding of the role of the oceans in climate will improve both our capabilities to predict climate variability and change and also help adequate formulation of mitigation and adaptation measures thus providing benefits to society on a variety of climate change risks, such as sea level rise, changes in the nature of extreme weather events, abrupt climate change and ocean acidification. More at: http://wcrp.ipsl.jussieu.fr/SF_OceanClimate.html.

Examples of accomplishments:

- Collaborative intercomparison and assessment of existing global ocean synthesis products aimed at determining the quality of such products and their potential for ocean initialization for climate prediction.
- Ongoing implementation of an integrated Indian Ocean Observing System in collaboration with Indian Ocean GOOS.
- Facilitation of a Tropical Atlantic Climate Experiment (2006-11) to improve climate prediction for the Tropical Atlantic region.
- Support and coordination of programmes to monitor the Meridional Overturning Circulation (MOC) in the Atlantic.
- Input to design the post-IPY Arctic and Southern Ocean Observing Systems, in collaboration with several partners.
- Coordination of key international climate process studies in the Pacific.
- Development of the tropical moored buoy arrays to provide key observations for seasonal predictions.
- Work with IOC to provide guidelines for the future global deep ocean hydrography and carbon network.

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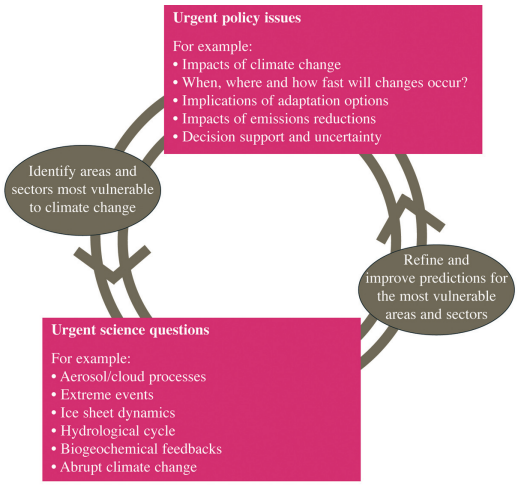
Anthropogenic Climate Change

WCRP, together with the partners of the Earth System Science Partnership (IHDP, Diversitas, IGBP), contributes to the scientific understanding, synthesis and assessments that are required by UNFCCC SBSTA and the IPCC. This contribution is based on the scientific knowledge generated by all WCRP projects. For example, the WCRP/WGCM (Working Group on Coupled Modelling) played a major role in the IPCC AR4 process by coordinating the model developments and intercomparisons required for developing future climate scenarios, together with IGBP/AIMES. Observational studies, as organized in GCOS also constitute a major aspect of the necessary scientific developments to support these activities.
The Joint Scientific Committee meeting for WCRP has established a dedicated Anthropogenic Climate Change (ACC) cross-cutting action to (1) a more prominent role by the WCRP in the IPCC assessments and the SBSTA discussions and decisions; (2) a more effective identification of the scientific priorities related to ACC issues, with a corresponding strategy and capability to address them within WCRP. The 'Learning from IPCC AR4' Workshop was noted as an essential part of this identification process; (3) a better definition of the interface with the other ESSP partners based on these ACC priorities.



Using vulnerability of regions and sectors to climate change is a possible framework to link urgent science questions with societal concerns.

Activities planned for 2009:

One of the high priority tasks for WCRP/ACC in 2009 is to develop a plan to focus on regional studies and modelling activities. A workshop will be held in Toulouse, France, to complement the Modelling Summit for Climate Prediction (Reading, UK, May 2008), but with a focus on a regional approach to climate model development and applications.
More at: http://wcrp.ipsl.jussieu.fr/SF_ACC.html.

Major activities completed in 2007/08:

- The GCOS-WCRP-IGBP workshop 'Learning from the IPCC AR4' (Sydney, Australia, October 2007) determined "urgent science questions" which are part of a larger strategy to address ACC policy issues, and constitute issues requiring action from WCRP and IGBP, and possibly the other ESSP programmes. The figure (left) summarizes areas in which an increased research is required.
- WCRP participated in a number of activities focused on the UNFCCC SBSTA and the Nairobi Work Programme, in particular the dissemination of scientific results to policy makers and the private sector (meetings in Bonn, and at the COP in Bali). A joint WCRP-ICTP workshop was held in Trieste, in November 2007, to support capacity building in developing and least developed countries.
- WCRP was also involved in the meetings to define the scenarios for the IPCC AR5.

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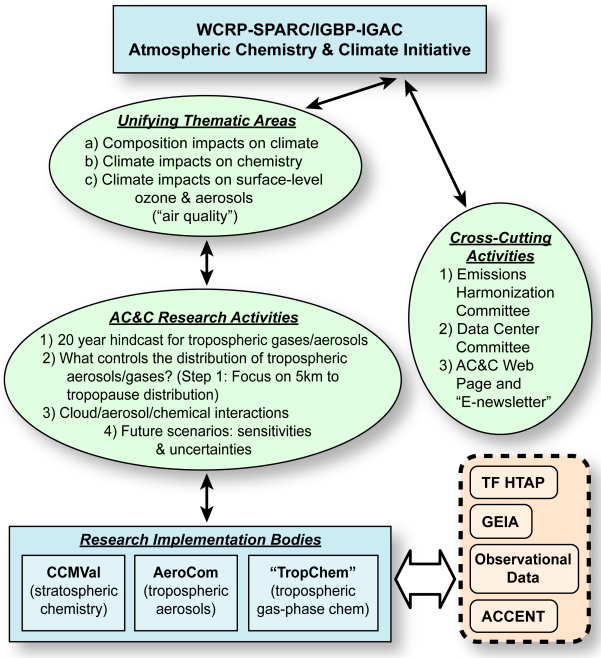
Chemistry & Climate

Understanding what controls the atmospheric distribution of chemically active species, their role in climate change, how their distribution might change with climate, and the coupling between climate and air quality are all critical to effective climate change projections and to mitigation and adaptation planning. However, this also represents one of the most difficult aspects of global change research due to the complex interaction between natural and anthropogenic emissions and the fact that dynamic, thermodynamic, and chemical processes all control the distribution of these species and are, in turn, influenced by them. Recognizing this, in 2006 WCRP and the International Geosphere-Biosphere Programme (IGBP) started a new initiative on Atmospheric Chemistry and Climate (AC&C), with the WCRP/SPARC and IGBP/IGAC projects tasked to take the lead in its implementation.



Organizational framework for AC&C activities.

Major steps:

- The first phase of the AC&C initiative focusses on improving process representation in chemistry-climate models and regional/global air quality models, ultimately as a contribution to future IPCC Assessments and the WMO/UNEP Assessments on Ozone Depletion.
- AC&C includes both new activities and improved coordination and collaboration with existing activities, e.g.: CCMVal, AeroCom, the European ACCENT project Model Inter-comParison (ACCENT-MIP) and the Task Force on Hemispheric Transport of Air Pollution. The IGBP/AIMES Global Emission Inventory Activity (GEIA) and other emissions activities will also be associated with AC&C. Observational data sets will be critical for testing and improving process representation in the models, so observational communities will also be engaged.

In its first phase, AC&C is comprised of the following four activities: (1) Multi-decadal hindcast simulations; (2) Simulations of factors controlling the distribution of aerosols/gases in the troposphere; (3) Simulations of cloud, aerosol, chemical interactions; (4) Future scenarios: Sensitivities and uncertainties. AC&C will ultimately lead to better understanding and representation of the distribution (past and future) of short-lived chemical species in climate models, which will result in improvements in forecasting the climate and air quality impacts. This will have direct benefits for future IPCC and WMO assessments.

More at: http://www.igac.noaa.gov/ACandC.php.

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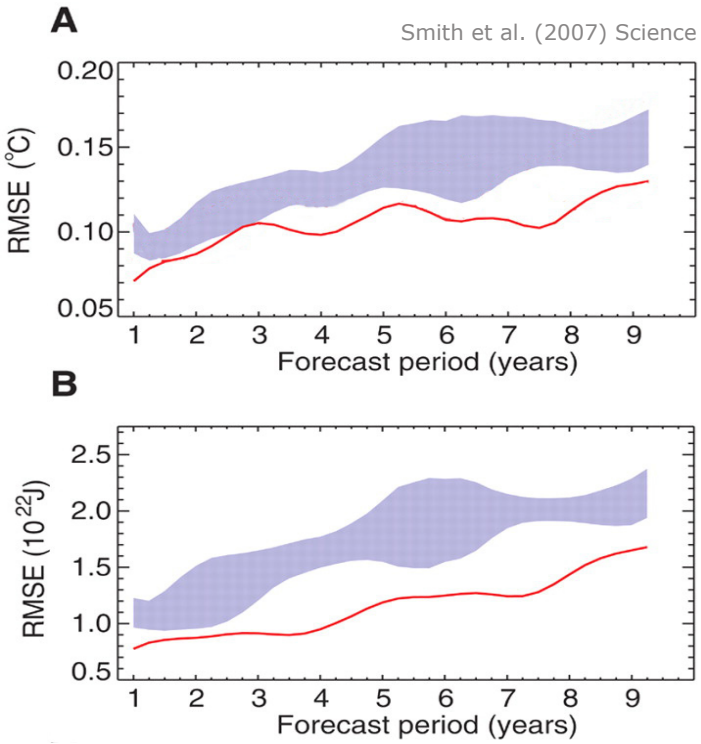
Decadal Prediction

Planning for building dams, roads, hospitals and other major infrastructure and energy investments is done on decadal timescales. Hence, climate predictions ten or twenty years in advance would be of great value in making these plans compatible with climate change and in calculating the risks associated with climate change. WCRP is launching a major effort to investigate the potential for climate predictions and help make these predictions operational. In addition to decadal changes associated with climate change, there is decadal-variability in most climate records. Perhaps the most striking in recent decades is the decadal timescale drought in the Sahel (Africa). Multidecadal changes in the Atlantic sector are linked with decadal hurricane variability.

Decadal climate is a "meeting ground" for the weather and climate modelling communities because the decadal prediction problem must take into account accurate initial conditions and future concentrations of greenhouse gases (GHGs).



Impact of initial conditions on hindcast skill (measured as root mean square error (RMSE) of model ensembles). (A): RMSE of globally averaged annual mean surface temperature anomalies (relative to 1979-2001). The solid red curve, representing the Decadal Climate Prediction System (DePreSys) is compared with hindcasts set identical to DePreSys but with no assimilation of ocean or atmosphere observed state. (B): as (A), but for ocean heat content in the upper 113m (relative to 1941-1996).

Planned activities:

Building on these developments WCRP has initiated an activity to advance the science of decadal prediction. This is based on internationally-coordinated multi-model experimentation to gauge the overall level of predictability arising from having both different initial conditions and different greenhouse gas forcings. A detailed proposal is being developed on numerical experimentation to assess the expected skill of decadal predictions. It is anticipated that the programme of experimentation initiated by this activity will contribute to any IPCC fifth assessment report.

Aims:

- to provide model integrations to allow estimation of the evolution of expected climate for the period 2005-2035, relative to the climate of recent decades;
- to encourage the use of higher resolution climate models, with the hope of better resolving synoptic processes associated with extremes, and assessing the benefits of higher resolution in general.

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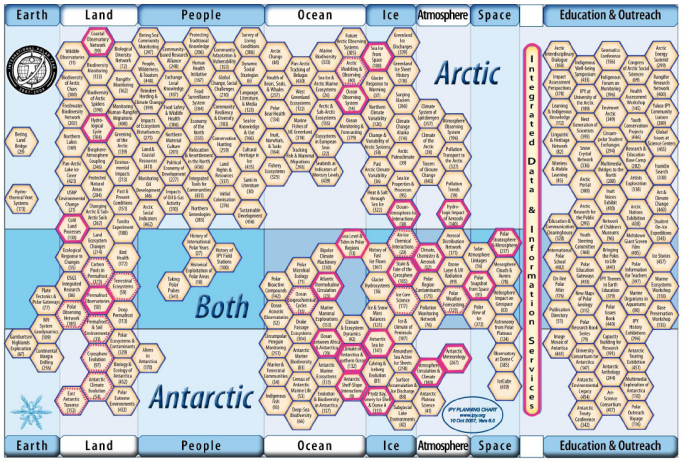
Polar Regions

The World Meteorological Organization (WMO) and the International Council for Science (ICSU) lead the International Polar Year (IPY) 2007-2008, which is envisioned as an intensive burst of internationally coordinated, interdisciplinary, scientific research and observations focused on the Earth's polar regions. Active participation of WCRP projects in IPY will help to build capacity for WCRP polar research in several areas. The WCRP core project on Climate and Cryosphere (CliC) coordinates WCRP involvement in IPY. The main goals of WCRP in IPY are to address existing gaps in the knowledge of polar processes, develop understanding of the role of polar regions in Earth's climate system and an ability to better predict global climate. Many of the IPY leaders and participants are members of WCRP projects and groups.



Climate change research ranges prominently on the IPY agenda. More than 20 research projects are directly affiliated with WCRP (marked in pink colour) and many more contribute to the attainment of WCRP IPY goals.

IPY is a very large undertaking. Approximately 60,000 researchers from 50 countries participate in it. Overall funding of all IPY activities in 2008 is reported to be of the order of $1.2 Billion (with approximately US$800 Million in continuous funding and US$400 Million in targeted additional funding).

More at: www.ipy.org and http://wcrp.wmo.int/Special_IPY.html.

WCRP contributions to IPY scientific achievements:

- Establish a basis for a sustained Arctic Ocean Observing System and Sustained Arctic Observing Networks.
- Establish an Arctic hydrological cycle observing system that will enable advances in polar hydrology.
- Promote sustained survey of the Southern Ocean forming the foundation of the Southern Ocean Observing System.
- Coordinate for the first time a satellite snapshot of the polar regions by major space agencies, especially with the Synthetic Aperture Radars.
- Initiate a world-wide coordinated permafrost monitoring system.
- Obtain a record-long ice-core based climate history reconstruction (Chinese contribution).
- Coordinate an interoperable data and information exchange and archive.
- Reconstruct snapshots of the polar cryosphere and polar atmosphere, including stratosphere and mesosphere, as a benchmark for an integrated 'atmosphere-cryosphere' study of the polar regions.