Climate Prediction Program for the Americas (CPPA)

(formerly GAPP)

Reporting Period: October 2005 – September 2006
Starting Date: 2003
End Date: unknown
URL: http://www.climate.noaa.gov/cpo_pa/cppa/
Program Manager: Jin Huang (NOAA Climate Program Office)
Associate Program Manager: Annarita Mariotti (NOAA Climate Program Office)

Overview:

Objective(s): The Climate Prediction Program for the Americas (CPPA) is a competitive research program under NOAA Climate Program to improve operational intraseasonal to interannual climate and the hydrological applications. The CPPA program is an integrated program from the former GEWEX Americas Prediction Project (GAPP) and CLIVAR Pan American Climate Studies (PACS). CPPA has four scientific objectives: (1) to quantify the sources and limits of predictability of climate variations on intra-seasonal to interannual time scaleto quantify the sources and limits of predictability of climate variations on intra-seasonal to interannual time scale; (2) to improve predictive understanding and model simulations of ocean, atmosphere and land-surface processes, including the ability to quantify uncertainty; (3) to advance NOAA's operational climate forecasts, monitoring, and analysis systems by transferring research to operation; and (4) to develop climate-based hydrologic forecasting capabilities for decision support and water resource applications.

Status:

- CPPA Science Panel was formed in Feb. 2006 to develop a CPPA Science and Implementation Plan, to develop a structure that coordinates CPPA research activities, and to synthesize research outcomes, and to coordinate with relevant national and international programs, such as, GEWEX and CLIVAR.

- In FY2006, CPPA supported about 60 projects including continuations and new awards. CPPA supports various GEWEX cross-cutting studies, such as, precipitation, diurnal cycle, WEBS, extremes and transferability.

- The GAPP Core Project that aims at transferring GAPP research into NOAA operations has been reviewed by an external group and has been renewed for the next 5 years (2006-2010) under CPPA.

- CPPA continued to support CEOP by managing 41 CEOP reference site data, providing data (in-situ, remote sensing, and model output) in the GAPP region, data analysis, demonstrating the utility of satellite data in research and climate prediction and evaluating the performance of global and regional models across climate regimes and time scales.

- CPPA/GAPP participated in various GEWEX and related activities including WEBS, NLDAS, Regional Climate Modelling (RCM), CEOP, GLASS, GABLS, PILPS, and HEPEX.

- CPPA supported the NOAA Climate Test Bed (CTB) (which is aimed at transferring research into operation) by supporting several operational-related research projects and providing guidance to the land-arena of CTB.

- CPPA supported collaboration with the NWS Office of Hydrology and the NWS River Forecast Centers with a focus on seasonal forecasting of streamflow, snow pack and soil moisture, and with the NWS's Advanced Hydrologic Prediction Service (AHPS) initiative.

- Dr. Annarita Mariotti was hired as a CPPA associate program manager. She works part time at NOAA Climate Program Office and University of Maryland as a research scientist.

New directions:

- CPPA's long term goal is to improve operational intra-seasonal to interannual hydroclimatic predictions for the Americas with quantified uncertainties sufficient for making informed decisions. To achieve this goal, CPPA will focus on five research areas: 1) climate predictability at intra-seasonal to interannual time scales. The climate predictability studies will focus on the following climate phenomena: ENSO and cold season prediction, the monsoon system, western hemisphere warm pool and warm season prediction, drought and extreme events; 2) atmosphere-ocean interactions: the process studies are to improve the understanding of role of ocean memory on climate predictability and to address model biases and model improvement. The two focus areas for the air-sea interaction process studies are SE Pacific and cold season prediction, and Western hemisphere warm pool and warm season prediction; 3) land-atmosphere interactions: the process studies are to improve the understanding of role of land memory on climate predictability and to improve understanding and modeling soil moisture, snow/ice/frozen soil, vegetation/land cover, and topography; and 4) operational climate prediction, monitoring and analysis: The strategies include the GAPP Core Project, CPPA Synthesis Teams, and support to Climate Test Bed; (5) climate-based hydrologic forecasting and water resource applications: the goal is to reduce uncertainties in streamflow forecasts from uncertainties in climate forecasts, uncertainties in initial conditions, and uncertainties in hydrologic models. CPPA plans to build on linkages with water users by working with other human dimension programs such as, NOAA Regional Integrated Sciences and Assessments (RISA) program.

- CPPA is sponsored by NOAA Climate Program. Within NOAA Climate Program, CPPA and several other programs operate under the NOAA Climate Predictions and Projections Program (P&P). CPPA needs to meet NOAA mission requirement in scientific and budget planning.

- CPPA will strengthen the integration between CLIVAR and GEWEX within the program: The North American Monsoon Experiment is a successful case for CPPA to take advantage of CLIVAR expertise in large scale and ocean studies and GEWEX expertise in land-surface process and regional studies. CPPA plans to support research in various cross-cutting themes such as, precipitation, diurnal cycle, drought and extremes, which are interested by both CLIVAR and GEWEX communities.

Future: Next year foreseen activities*:*

- CPPA Science and Implementation Plan will be completed early 2007. CPPA will ask GEWEX, US CLIVAR, and NOAA Climate Predictions and Projections Program to provide comments. The CPPA Plan is a living document that will be updated periodically.

- CPPA plans to initiate some synthesis teams to integrate individually funded research projects and to foster research-to-operation transition.

- Contribute to NIDIS (National Integrated Drought Information System): engage the US DM community to improve quantitative, verifiable land surface monitoring for decision support; add basin-scale hydrology to near-term climate prediction; support the US CLIVAR WG effort on long term drought; leverage the GAPP Core Project and Climate Test Bed to enhance transition to operational drought prediction; promote research to integrate & enhance the NOAA operational seasonal outlook and drought outlook products to support the prediction component of NIDIS.

Key results

Predictability of climate phenomena:

- NAME (North American Monsoon Experiment): NAME 2004 was a major field campaign during the Summer of 2004. NAME 2004 data, field catalog and some value-added data are fully available at http://www.joss.ucar.edu/name/catalog/.
- Several projects have been funded to develop drought monitoring and prediction products. Those products take advantage of long-term research results from GCIP, GAPP and CPPA, including real time and retroactive National Land Data Assimilation System (NLDAS), North American Regional Reanalysis (NARR), US precipitation data, CPC soil moisture product, West-wide and East-wide seasonal hydrologic prediction systems.

Air-Sea Interactions

- Eastern Pacific Investigation of Climate (EPIC): EPIC is a 2-month intensive process study in 2001, embedded in 4 years of enhanced monitoring, built on the ENSO observing system. CPPA is currently funding a nascent effort to bring the EPIC ITCZ data into a compact integrated dataset easy to compare with numerical models, and a comparison with a cloud-resolving model forced from ERA40. EPIC improved understanding of maintenance and variability of N-S structure of the E Pacific atmosphere/upper ocean. Leading US coupled models still have significant biases in the E Pacific, but the IPRC iROAM mesoscale model has shown remarkable skill in simulating the E Pacific ITCZ/cold tongue/Sc complex. iROAM components have been tested against many EPIC, TAO and satellite observations.
- Western Hemisphere warm pool: CPPA funded PIs found that during boreal summer, the Atlantic warm pool (AWP) affects the overturning circulation and precipitation in the Western Hemisphere tropics & subtropics. They completed document the WP heat budget, how large AWPs are formed, and the interannual impact of AWP variability on rainfall and tropical storms. It has been found that in late summers with large WPs, it rains more over the Caribbean and tends to rain less over the Midwest. The moisture transport from the Intra American Sea (IAS) into the continental US is reduced with large warm pools (warm IAS).

Land-Atmosphere Interactions

- Improved NOAA/NCEP operational Noah Land Surface Model (LSM): Seasonal LAI and root fraction have been implemented to Noah LSM. The new version of Noah LSM has yielded better surface fluxes, particularly both the high latent heat bias during the spring and the low latent heat bias during the summer have been reduced. The warm bias of the surface skin temperature has been reduced. The new version of Noah LSM produces better surface water budget, i.e. surface runoff. It also solved the early snowpack depletion bias.
- 25-year global Global LDAS-Noah execution is completed and provides superior land states for NCEP Climate Forecast System (CFS)-Noah tests.
- Analysis of the North American Regional Reanalysis (NARR): Evaluation of NARR over Complex Terrain found spurious grid-scale precipitation in the NARR grids. These events are not likely to affect precipitation averages over months or seasons, but can affect studies of extreme precipitation amounts. Water budget study found unbalanced water budget over the Great Plains in NARR. It is found that state-of-the-art GCMs vigorously recycle precipitation via evaporation, erroneously. NARR is used to study soil moisture memory and land-atmosphere interactions: the regions with strong soil moisture memory are consistent with those indicated by R. Koster's predictability study.

Hydrologic Applications:

- West-wide and East-wide Seasonal Hydrologic Prediction Systems: The Systems currently produce experimental streamflow forecasts with monthly updates for the five major river basins of the western U.S. and for the Ohio River basin for lead times of one to twelve months. The forecasts are based on the Variable Infiltration Capacity (VIC) macroscale hydrology model forced with gridded observations up to the time of forecast,

and downscaled and bias corrected ensemble forcing from climate models and other sources during the forecast period.

- Collaborative activities with the NWS Office and Hydrologic Development and the NWS River Forecast Centers (RFCs) to improve seasonal hydrologic forecasting techniques: These activities are needed to develop prototype software components that enable new procedures to be developed and tested in an RFC environment. RFC Pilot Project is initiated in CNRFC to evaluate new procedures for possible future use by other RFCs.

Issues and Recommendations:

The CPPA program started in 2003 by integrating GAPP and CLIVAR/PACS. GAPP has been operated under CPPA since then. In other words, NOAA contributes to GEWEX through the CPPA program. Since GAPP will officially end in 2007 and GAPP is part of CPPA, we should consider replacing GAPP by CPPA as the CSE in U.S.

Contributions to WCRP strategic framework

- With the merger from CLIVAR/PACS and GEWEX/GAPP, CPPA supports various research projects in the WCRP cross-cutting themes. The activities include improving seasonal climate predictions, predicting monsoon rains, precipitation, diurnal cycle, drought and extremes.
- CPPA supports a Climate Process Team for NAME that brings together expertise from both observations and modelling communities to evaluate and improve models.

Contributions to society and to WCRP/GEWEX visibility

- The CPPA program is a primary program in NOAA to support GEWEX research objectives.
- CPPA develops climate-based hydrologic forecasting capabilities for decision support and water resource applications.
- CPPA spends tremendous efforts to transfer research into operational NWS climate and hydrologic prediction including development and improvement of NCEP operational climate prediction model and NWS/River Forecast Center forecasts.

Summary

List of key publications:

In 2006, CPPA PIs published 56 journal articles in areas of air-sea interaction, land-predictability and prediction, monsoon studies, and hydrologic applications. The following is a few examples.

Higgins, R. W. and the NAME SWG, 2006: The NAME 2004 Field campaign and Modeling Strategy. Bull. Amer. Met. Soc: Vol. 87, No. 1, pp. 79–94.

Y. Fan, H. M. Van den Dool, D. Lohmann and K. Mitchell. 2006: 1948–98 U.S. Hydrological Reanalysis by the Noah Land Data Assimilation System. Journal of Climate: Vol. 19, No. 7, pp. 1214–1237.

David J. Raymond, Christopher S. Bretherton and John Molinari. 2006: Dynamics of the Intertropical Convergence Zone of the East Pacific. Journal of the Atmospheric Sciences: Vol. 63, No. 2, pp. 582–597.

Fedor Mesinger, Geoff DiMego, Eugenia Kalnay, Kenneth Mitchell, Perry C. Shafran, Wesley Ebisuzaki, Dušan Jovi, Jack Woollen, Eric Rogers, Ernesto H. Berbery, Michael B. Ek, Yun Fan, Robert Grumbine, Wayne Higgins, Hong Li, Ying Lin, Geoff Manikin, David Parrish and Wei Shi. 2006: North American Regional Reanalysis. Bulletin of the American Meteorological Society: Vol. 87, No. 3, pp. 343–360.

List of meetings, workshops

- CPPA PIs meeting was held in Aug.14-16 in Tucson, AZ. This was the first meeting to bring GAPP PIs and CLIVAR/PACS PIs together to discuss issues to improve intraseasonal to interannual climate predictability and predictions.
- CPPA and Climate Test Bed jointly organized the second NOAA Climate Program Office and NWS Dialogue Meeting to improve research to operation transition.

Planned meetings, workshops

- "North American Drought" special session co-convened by CPPA in 2006 Fall AGU in Dec. 2006, San Francisco.
- "Climate Variability over the Americas: Links with Oceans and Land" special session co-convened by CPPA in 2006 Fall AGU in Dec. 2006, San Francisco.
- CPPA plans to hold 2007 CPPA PIs meeting with the US Water Cycle Workshop.

List of members and their term dates

Members of CPPA Science Panel (the Panel was formed in Feb. 2006)

Ruby Leung (Chair, DOE/Pacific Northwest National Laboratory)
Hugo Berbery (University of Maryland)
Martyn Clark (University of Colorado)
David Enfield (NOAA/AOML)
Chris Fairall (NOAA/ETL)
Dave Gutzler (University of New Mexico)
Wayne Higgins (NOAA/NCEP/CPC)
Paul Houser (IGES/Center for Research on Environment and Water)
Dick Johnson (Colorado State University)
John Roads (Scripps Institution of Oceanography)
Siegfried Schubert (NASA/GSFC)
Eric Wood (Princeton University)
Shang-Ping Xie (University of Hawaii at Manoa)