

CPPA Update

(Climate Prediction Program for the Americas)

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CPPA Research Strategies and Activities

Mission: Improve operational intraseasonal to interannual hydroclimatic predictions for the Americas

- Predictability and Process Studies

- impacts of large scale modes (ENSO, monsoons) on regional climate
- intraseasonal variability
- Post-campaign process studies and impact analyses: NAME, VOCALS
- Roles of land surfaces in climate

- Modeling and Predictions

- Development of Land Data Assimilation System (LDAS)
- Improvement of Land models
- Evaluation and model improvement of NCEP Climate Forecast System
- Multi-regional model downscaling using multi-GCMs seasonal predictions

- Applications Development

- Drought monitor and prediction products
- Seasonal hydrological prediction in NWS/OHD and River Forecast Centers (RFCs)
- Applications of climate information for ecosystem prediction

- Transitioning Research to Operations

- CPPA Core Project (focus on land & hydrology)
- joint university-NCEP competitive projects on CFS improvement

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CPPA Contributions to GEWEX-II Objective 1

.... produce consistent research quality data sets.....

Process study observations:

- Support North American Monsoon Experiment (**NAME**) Field Experiment
- Support **VOCALS** Field Experiment
- Sonora Hydromet Network and Sonora 2008 NAM Mini-Field Campaign



- CPPA data management including data from field experiments

- Support data management for Global CEOP in-situ reference site data

- Provide data in CPPA region (in-situ, remote sensing, and global and regional land and coupled assimilation products) to CEOP, e.g. MOLTS data from NCEP/EMC

Eddy covariance tower site installation in the oak savanna at 1600-m elevation in the Sierra Los Locos Basin. The tower is collecting data at a rarely studied ecosystem at high elevation. [Courtesy of E. Vivoni.]

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CPPA Contributions to GEWEX-II Objective 2

.... Enhance the understanding.... ..

Quantify the roles of ocean and land surface in seasonal predictability

- monsoons
- drought and extremes
- MJO variability
- high elevation (e.g. snow & cold season processes)

Improve understanding and modeling of physical processes

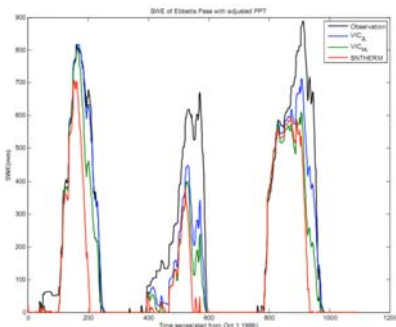
- land surface: soil moisture, snow, vegetation, topography
- atmosphere: cloud, convection

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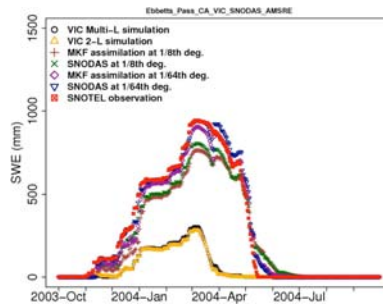
CPPA Snow process modeling

- Investigating the role of snow model complexity and meteorological forcing on SWE simulations

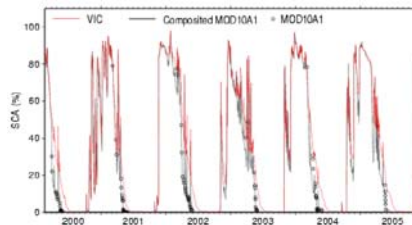
- Impact of data assimilation in snow cover/SWE



Comparison of SWE for various land models for the period from 1999 – 2005 at the Ebbetts Pass site in California with adjusted DMIP2 precipitation.



Impact of assimilating SNODAS data on SWE simulations (Courtesy of R. Leung)

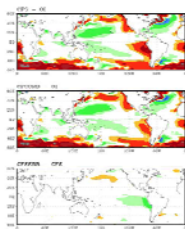


VIC simulated snow cover areal extent (percentage in the Feather River basin) without and with MODIS-based updating (Courtesy of D. Lettenmaier).

Simulating Cloud and Convection in Climate Models



Cumulus clouds over the Southeast Pacific during the VOCALS REX campaign (R. Wood)



Investigating the role of radiation and winds in CFS biases (P. Xie and W. Wang)

Ongoing activities

- Analyzing stratocumulus cloud and ITCZ convection in climate models using EPIC data (**Breatherton**)
- Diagnoses of tropical biases in CGCMs (**Mechoso and H. Pan**): one of VOCALS modeling projects
- Using VOCALS data to develop and evaluate stratiform cloud parameterizations (**L. Donner**)
- Simulating MJO / tropical convections in climate models

FY10 new priorities:

- Improve understanding and process modeling of cloud, planetary boundary layer and microphysics
- Supporting Climate Process Teams to improve NCEP and GFDL GCMs.

CPPA Contributions to GEWEX-II Objective 3

.... Improve the predictive capability

- Implement Global **Land Data Assimilation System** (LDAS) for operational NCEP Climate Prediction System (CFS)

- Developed and Implemented of the **land component** in NCEP next generations CFS

- Assessing impacts of different land initial conditions and land models on seasonal forecasts

- Land Data Assimilation System (LDAS)
- Noah Land Model

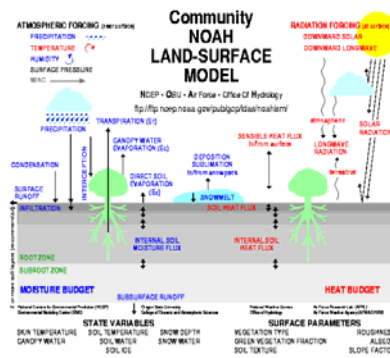


Figure 1. Schematic of the NCEP community Noah land-surface model of multi-layer soil, vegetation, and snowpack.

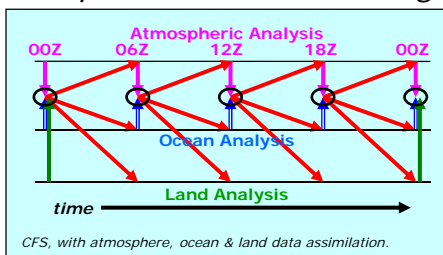
- Improving **hydrologic forecasting** in NWS/OHD and RFCs
- Participate GMPP initiated modeling activities, such as, **GLACE-2**, various model inter-comparison projects
- Model improvement effort in clouds and convection
 - Evaluating and reducing **tropical biases** in CFS
 - Improving cloud parameterizations

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CPPA NCEP Core Project: 2009

Coupled Climate Modeling

Uncoupled Land Modeling



CFS, with atmosphere, ocean & land data assimilation.

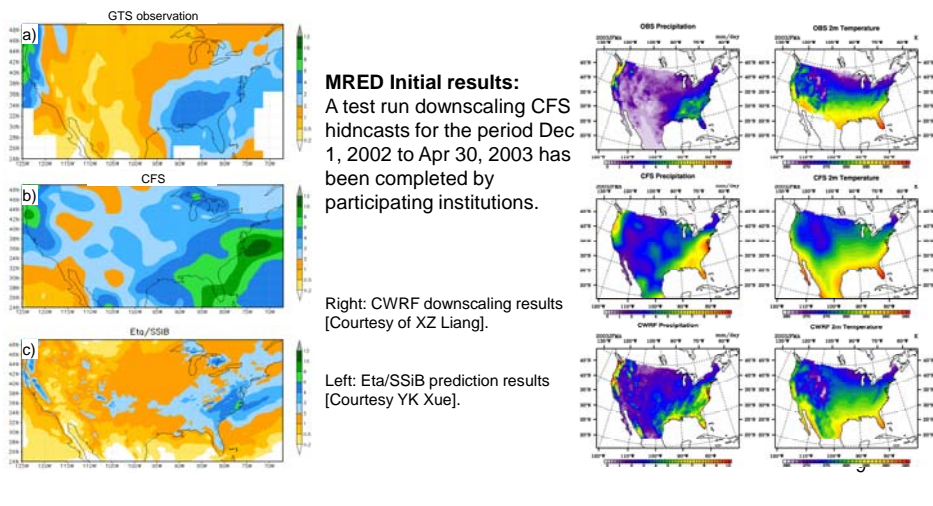


- Completed summer and winter seasonal forecasts (25 different years during 1979-2006) using the NCEP Climate Forecast System (CFS).
- Upgrading from previous generation *OSU* to advanced *Noah* land-model physics necessary in both Global Land Data Assimilation System (GLDAS) and in CFS for consistent & proper spin-up of land-state initial conditions.
- Modest gain in CFS precipitation skill during summertime over US for ENSO-neutral (vs ENSO-active) years.

- Completed 30-year (1979-2008) retrospective for North American Land Data Assimilation System (NLDAS) land models (Noah, VIC, Mosaic, & SAC).
- Quasi-realtime monitoring of model hydrological land-states (soil moisture, evaporation, runoff, streamflow, etc).
- Routine execution of Univ. Princeton CFS-forecast-based national (US) seasonal hydrological forecasts.
- Monitoring & seasonal forecasts used in drought support (National Integrated Drought Information System, NIDIS).

MRED: Multi-RCM Ensemble Downscaling of multi-GCM Seasonal Forecasts

Objective: Demonstrate the usefulness of multi RCM downscaling of global seasonal forecasts for hydrologic applications.

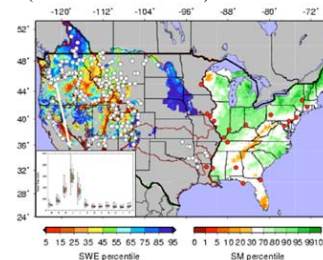


CPPA Contributions to GEWEX-II Objective 4

Undertake joint activities with operational hydro-meteorological services...

- Support **HEPEX** (Hydrological Ensemble Prediction Experiment)
- Quantify uncertainties in hydrologic forecasts (from climate forecasts, initial boundary condition, model, and predictability studies)
- Downscaling and hydrologic applications of seasonal forecasts
 - contribution to Hydrology Application Project (**HAP**)
- Continue collaborative activities among the international science community, CPPA researchers, the NWS Office and Hydrologic Development and the NWS River Forecast Centers to improve seasonal hydrologic forecasting techniques.

Experimental National Seasonal Hydrologic Prediction Systems (Lettenmaier and Wood)



Contributing to Drought Monitoring and Prediction Products (Mitchell, K. Mo, B. Cosgrove)

