Advancing Climate Prediction:
The Climate Test Bed

- Jointly established in 2004 by NCEP and NOAA Climate Program Office
- Serves as conduit between the operational, academic and research communities

Mission
- To accelerate the transition of scientific advances from the climate research community to improved NOAA climate forecast products and services

R2O and O2R
- Focus Areas
  - CFS Improvements
  - MME
  - Climate Forecast Products
- Competitive Grants Program
- CTB Seminar Series
- CPC-RISA-Partners Program
- Distinguished Visiting Scientist Program (FY09)
CTB Structure

Present
• Oversight Board
• Science Advisory Board
• Announcement of Opportunity (AO)
• NCEP Co-PI identified in advance
• LOI
• Proposals
• Links to NIDIS

Future (new charter under development)
Steering Committee (SC)
• Science teams to work with PIs
• Visiting scientists and post-docs
• AO/LOI with CTB, SC involvement
• Proposals evaluated with criteria from CTB, SC
• NCEP Co-PI tbd
• Project relevance to society in general
Climate Test Bed
Currently Funded Projects

• 10 ongoing projects
  – 1 transitioned in FY08
  – 1 in the “funnel” FY08 (not funded for FY09)
  – 1 identified as unsuitable for transition FY08
  – 3 for transition in FY09
  – 4 for transition in FY10

• 3 new projects funded for FY09

1. Objective: Apply numerical weather prediction models to current climate model experiments to identify errors, identify model errors, and construct stochastic parameterizations (DelSol) (Transition: FY08)
2. Objective: Investigate aerosol, cloud microphysics components for improving the computational performance of the NCEP seasonal climate forecasts (Jamieson) (FY08)
3. Objective: Component of the NCEP ENSO CFS (McPhaden/Xue/Behringer) (FY08)
4. Objective: Study the atmospheric implications of oceanic tracer correlations (Marinari/Schiller) (FY08)
5. Objective: Probabilistic forecasts of extreme events and weather hazards over the United States (Cohen/Anderson/Harley) (FY09)
6. Objective: Enabling the Transition of CPC Products to GIS Format (Doty/Silva/Halpert) (FY09)
7. Objective: Transition of Climate System Models and Atmospheric Forecasts with NCEP Climate Forecast System: Predictability of ENSO and Drought (Cane/Wang/Valdes) (FY10)
8. Objective: Evaluate model uncertainties and enable improved climate predictions (Kiladis/Kumar/En Dool) (FY10)
9. Objective: Development of an Extended and Long-range Precipitation Prediction System over the Pacific Islands (Annamalai/Kumar) (FY10)
CTB Focus Areas

• Climate Forecast System (CFS) Improvements
  – Dynamics
  – Physics
  – Coupled Ocean Atmosphere Land Cryosphere
• Multi Model Ensemble Prediction System
  – International
  – National
• Climate Forecast Products
  – Forecast evaluation tool (FET)
  – NIDIS Pilot Project
  – Improving NWS Products and Services in Partnership with the External Community
• Push for O2R
  – CPC to stage subset of reanalysis data for community
  – March 2010: Conversion of CPC operational monitoring products from CDAS-based to CFS-Reanalysis based
  – Establish Model Test Facility
## CTB Seminar Series
### For 2008-2009

## Schedule of Speakers

<table>
<thead>
<tr>
<th>#</th>
<th>Date</th>
<th>Location</th>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>1</td>
<td>23-Oct</td>
<td>NCEP</td>
<td>Steve Lord/Has-Lu Pan, NCEP/EMC</td>
<td>CFS - Under the Hood and CFS - Where It's Going</td>
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<td>2</td>
<td>12-Nov</td>
<td>NCEP</td>
<td>V. Ramaswamy, GFDL</td>
<td>Climate Modeling at GFDL: The Scientific Challenges</td>
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<tr>
<td>3</td>
<td>19-Nov</td>
<td>ESSIC</td>
<td>Ed O’Lamic, NCEP/CPC</td>
<td>An Interactive, Community-Based Web Tool for Evaluating the Skill of CPC Forecasts</td>
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<td>4</td>
<td>24-Nov</td>
<td>NCEP</td>
<td>Zhanyun Wu, COLA</td>
<td>Annual cycle and predictability of interannual variability</td>
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<td>6</td>
<td>2-Dec</td>
<td>COLA</td>
<td>Eugenia Kelley, U. of MD</td>
<td>New ideas on Ensemble Kalman Filter</td>
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<td>6</td>
<td>4-Dec</td>
<td>ESSIC/CI</td>
<td>Kathi Pepin, COLA</td>
<td>Subseasonal Variability of Tropical Cyclone Activity</td>
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<td>6</td>
<td>4-Feb</td>
<td>NCEP</td>
<td>Eniace Jin, COLA/U</td>
<td>From MRI to CFS: Assessing GCM performance in model and initialization</td>
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<td>10</td>
<td>18-Mar</td>
<td>NCEP</td>
<td>J. Shukla, GMUI/SFS</td>
<td>Seamless Weather and Climate Prediction</td>
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<td>11</td>
<td>11-Mar</td>
<td>COLA</td>
<td>Seo-Hyung Yoo, NCEP/CPC</td>
<td>The relationships between Indo-Pacific SST and Atm. Monsoons in the NCEP CFS</td>
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<td>12</td>
<td>24-Feb</td>
<td>NCEP</td>
<td>Ruth Westerveld, NCEP/EMC</td>
<td>Signatures of droughts with SST and soil moisture: The role of the time scale of droughts (with examples)</td>
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<td>14</td>
<td>8-Mar</td>
<td>ESSIC</td>
<td>Viviane Silva, NCEP/CPC</td>
<td>On the importance of atmospheric and oceanic initial conditions in forecasting the MJO with the NCEP CFS</td>
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<td>16</td>
<td>16-Mar</td>
<td>NCEP</td>
<td>Augustin Valdes, NCEP/CPC</td>
<td>Monitoring many faces of drought over the United States</td>
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<td>17</td>
<td>28-Feb</td>
<td>NCEP</td>
<td>Jian Li, NCEP/EMC</td>
<td>Investigating land-atmosphere interaction with multi-forcing and multi-model coupling methods</td>
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<td>18</td>
<td>15-Mar</td>
<td>NCEP</td>
<td>Harry van den Boven, NCEP/CPC</td>
<td>Methods of Multi-Model Consolidation, with Emphasis on the Recommended Cross Validation Approach</td>
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<td>19</td>
<td>7-May</td>
<td>NCEP</td>
<td>Vladimir Krasnopolsky, NCEP and ESSIC</td>
<td>Development of neural network simulations of model radiation for improving the computational performance of the NCEP seasonal climate forecasts</td>
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<td>20</td>
<td>3-Jun</td>
<td>NCEP</td>
<td>Alexander (Sandy) MacDonald</td>
<td>TBD</td>
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<tr>
<td>22</td>
<td>19-Jun</td>
<td>COLA</td>
<td>Jim Carson, U. of MD</td>
<td>Ocean reanalyses: prospects for climate studies</td>
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<td>23</td>
<td>26-Jun</td>
<td>NCEP</td>
<td>Suman Narasim, U. of MD</td>
<td>TBD</td>
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[Schedule and past presentations available at www.cpc.ncep.noaa.gov/products/ctb](http://www.cpc.ncep.noaa.gov/products/ctb)
High-Resolution Global Precipitation Analyses
Based on Multiple Satellite Observations and In situ Measurements

Pingping Xie
NOAA’s Climate Prediction Center

2009.04.28.
Objective:

- To create an analysis system of high-resolution precipitation over the globe using all estimates available from GPM and other satellites as well as other sources of information
CMORPH

- **CPC Morphing technique**
  - Create hi-resolution precipitation estimates by combined use of MW-based precip estimates from polar orbiting satellites and IR data from geostationary satellites
  - Compute the advection vectors of cloud/precipitation systems using consecutive IR images from geostationary satellites;
  - Define precipitation estimates through propagating the instantaneous MW-based precipitation estimates from individual polar orbiting satellites

- **Features**
  - 8kmx8km resolution / Quasi-global coverage (60°S-60°N);
  - 30-min interval / from December 2002 / Real-time

- **Performance**
  - Best performance among similar products in most situations
  - Bias and random error
  - Relatively short records (from Dec.2002)
Example of CMORPH Estimates

Example CMORPH Precipitation for Aug. 18, 2003

Daily Precipitation for: 18 Aug 2003 (00Z–00Z)
Data on .25 x .25 deg grid; UNITS are mm/day

CMORPH Precipitation Estimates
Strategy

- Improving CMORPH satellite-based high-resolution precipitation estimates through adopting Kalman Filter technique
- Removing the Bias in the CMORPH satellite estimates through combination with gauge analysis
Improving CMORPH [1]

Methodology

- **Taking inputs from more satellites**
  - Microwave estimates from all available satellites
  - IR-based precipitation estimates to fill gaps of MW observations

- **Combining satellite estimates through Kalman Filter**
  - Weights inversely proportional to the error variance of each satellite estimates
  - Error variance of each satellite estimates as a function of advection time from its observed time
Improving CMORPH [2]

Results over CONUS

Correlation

- CMORPH
- IRFREQ
- Kalman Base
Improving CMORPH [3]
Sample Kalman Filter CMORPH for July 10, 2007
Combining with Gauge [1]

Removing Bias Through PDF Matching

- Construct PDF for CMORPH and gauge-observed daily precipitation using co-located data pairs
- Correct the bias in the CMORPH through matching the PDF of CMORPH against that of the gauge data
- Cross-Validation results over China

<table>
<thead>
<tr>
<th></th>
<th>Bias (%)</th>
<th>Corr.</th>
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<tbody>
<tr>
<td>Original</td>
<td>-9.7%</td>
<td>0.706</td>
</tr>
<tr>
<td>Adjusted</td>
<td>-0.0%</td>
<td>0.785</td>
</tr>
</tbody>
</table>
Combining with Gauge [2]

*Blending Bias-Corrected CMORPH with Gauge*

- Combine the bias-corrected CMORPH with CPC Unified gauge analysis through the OI to further improve the quality of precipitation analysis.

- Bias-corrected CMORPH as first guess, gauge data as observations to correct the first guess over regions with coverage.
Combining With gauge [3]

Merged Analysis for August 1 – 10, 2007
Final Goal

- **CMORPH satellite** high-resolution satellite precipitation estimates improved and constructed for a period from 1998 to the present

- **High-Resolution (0.25°lat/lon) satellite-gauge merged analysis** of precipitation created over the globe by combining with CPC Unified Gauge Analysis
Summary

• Improving CMORPH through including observations from more satellites and applying Kalman Filter technique

• Reducing error in CMORPH through combining information from gauge observations
  • PDF matching to remove bias
  • OI blending to reduce random error

• Work underway to implement the techniques over global domain and to construct high-resolution precipitation analysis
Backup Slides
ECT of Available PMW Satellites

Equator–Crossing Times (Local)
1987–2007, Ascending Passes (F08 Descending)

Thickest lines denote GPCP calibrator.

Image by Eric Nelkin (SSAI), 30 August 2007, NASA/Goddard Space Flight Center, Greenbelt, MD.
CPC Unified Daily Gauge Analysis
for July 1, 2003