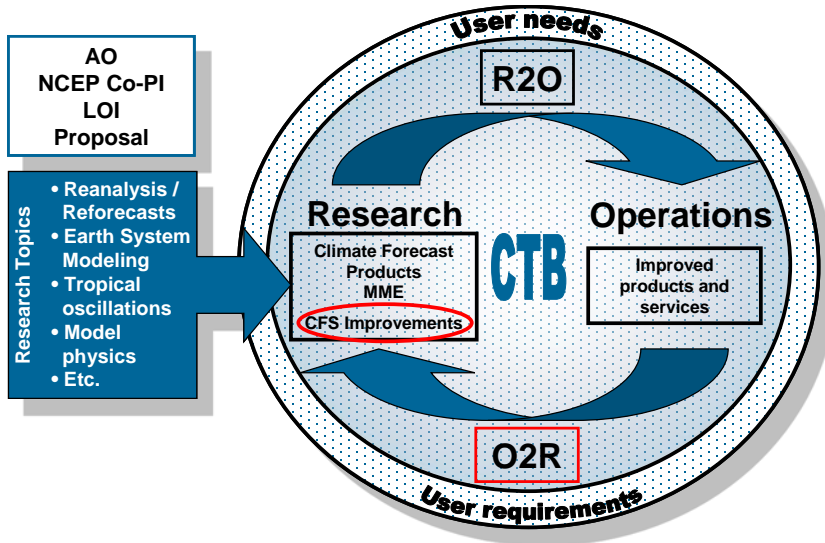


NOAA Climate Test Bed

Jin Huang
CTB Director



Mission

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

- Joint NCEP-CPO facility @ NCEP
- CTB Science Advisor Board (SAB)
- Established in 2005
- Serves as conduit between the operational, academic and research communities

- CTB embraces *the R2O and O2R paradigms*
- **CTB emphasizes high profile science activities**
 - *Climate model improvements*
 - *Multi-model ensembles*
 - *Climate forecast tools & products*
- Competitive Grants Program
- CTB Seminar Series

Climate Test Bed

Currently Funded Projects

- **FY09**

- CFS Stratosphere Improvement, Perlwitz, Long, Alpert & Iredell
- Multi-model Ensemble Reanalysis System (MERS) Using the 4D Kalman Filter, Ide, Kalnay, Miyoshi & Wang
- A GOES Thermal-based Drought Early Warning Index For NIDIS, Anderson, Mo, Svoboda, Wardlow, Zhan, Mecikalski, Kustas & Brown

- **FY10**

- Incorporating Scale and Predictability Information in Multi-model Ensemble Climate Predictions, DelSole, Tippett & van den Dool
- Multi-Model Ensemble Forecast of MJO, Wang & Waliser,
- Enhancing operational drought monitoring and prediction products through synthesis of N-LDAS and CPPA research results, Wood & Lettenmaier
- Improved Extended Range Prediction through a Bayesian Approach Exploiting the Enhanced Predictability Offered by the Madden-Julian Oscillation. Xie, Johnson, L'Heureux, Collins & Gottschalk
- Seasonal Prediction for Ecosystems and Carbon Cycle Using NCEP/CFS and a Dynamic Vegetation Mode, Zeng, Kalnay & Kumar
- CPT for Improving the Representation of the Stratocumulus to Cumulus Transition in Climate Models, Bretherton, Mechoso, Park & Teixeira

Climate Test Bed

Past Funded Projects

- **FY06**

1. Using Initial tendency errors to reduce systematic errors, identify model errors, and construct stochastic parameterizations (DelSol) (**Transition: FY08**)
2. Development of neural network emulations of model physics components for improving the computational performance of the NCEP seasonal climate forecasts (Fox-Rabinovitz) (**FY08**)
3. The Ocean Component of the NCEP ENSO CFS (McPhaden/Xue/Behringer) (**FY08**)

- **FY07**

4. System-wide advancement of user-centric climate forecast products (Hartmann/O'Lenic) (**FY09**)

- **FY08**

5. Probabilistic forecasts of extreme events and weather hazards over the United States (Jones/Gottschalck) (**FY09**)
6. Enabling the Transition of CPC Products to GIS Format (Doty/Silva/Halpert) (**FY09**)
7. Generation and Evaluation of Long-Term Retrospective Forecasts with NCEP Climate Forecast System: Predictability of ENSO and Drought (Cane/Wang/Xue) (**FY10**)
8. Multi-Model Ensemble Climate Prediction with CCSM and CFS (Kirtman/van den Dool) (**FY10**)
9. Development of an Extended and Long-range Precipitation Prediction System over the Pacific Islands (Annamalai/Kumar) (**FY10**)
10. New Tools for North American Drought Prediction (Lyon/Kumar) (**FY10**)

Multi-Model Ensembles

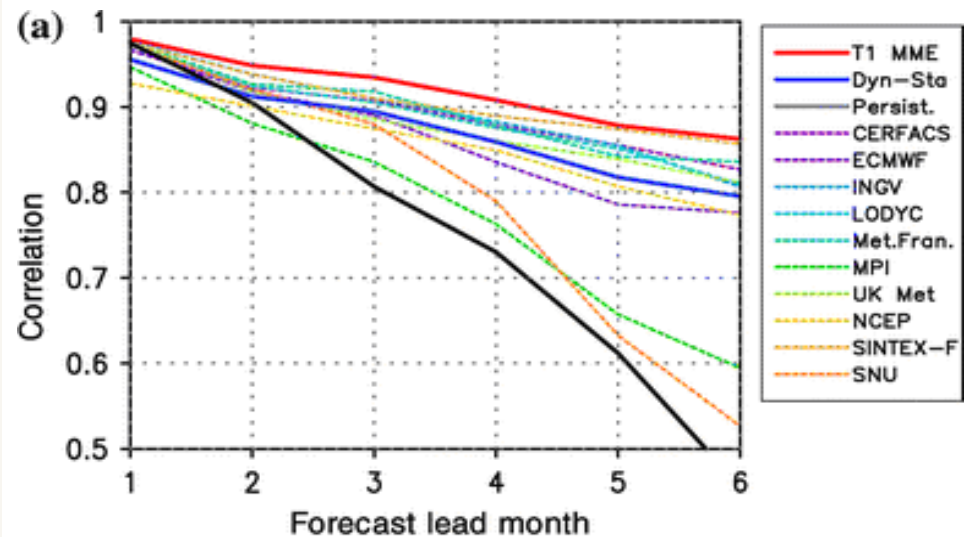
Goal

A multi model ensemble prediction system that leverages the best national and international models for improved predictions on intraseasonal-to-interannual time scales

CTB Activities

- Consolidation techniques
- Verification
- MME Prediction System
 - MME Forecast of MJO (FY10)
 - MME Prediction with CFS and CCSM
 - **National MME Prediction System in planning** (NCEP, GFDL, NASA, NCAR) in collaboration with COLA, IRI, ESRL

ENSO Prediction



■ MME mean outperforms individual models

CFS Improvements

Goal

To accelerate evaluation of and improvements to the operational Climate Forecast System (CFS) to enhance its use as a skillful tool in providing NCEP's climate predictions for users to address today's problems and plan for tomorrow

- CFS V1 implemented in 2004
 - Atmosphere & ocean DA
 - Real time coupled 9-month forecasts
 - 25 years of hindcasts
- CFS V2 (2011)
 - CFS Reanalysis & Reforecast (CFSRR) project (completed)
 - Coupled O-A-L-Sea Ice data assimilation 1979-2010
 - Coupled reforecasts initialized from coupled reanalysis, 1981-2010
- CFS V3 (in planning)
 - Will engage the external community in planning process

CTB Activities

- **NCEP Climate Process Team (FY10)**
 - to improve CFS cloud representation
 - consists of scientists from NCEP NCAR, NASA, DOE and universities.
- CFS Stratosphere Improvement (FY09)
- Hybrid Data Assimilation and coupled O-A Data Assimilation for Reanalysis (FY09)

- Focus areas for CFS Improvements
 - Dynamics
 - Physics
 - Coupled Data Assimilation (Ocean Atmosphere Land Cryosphere)

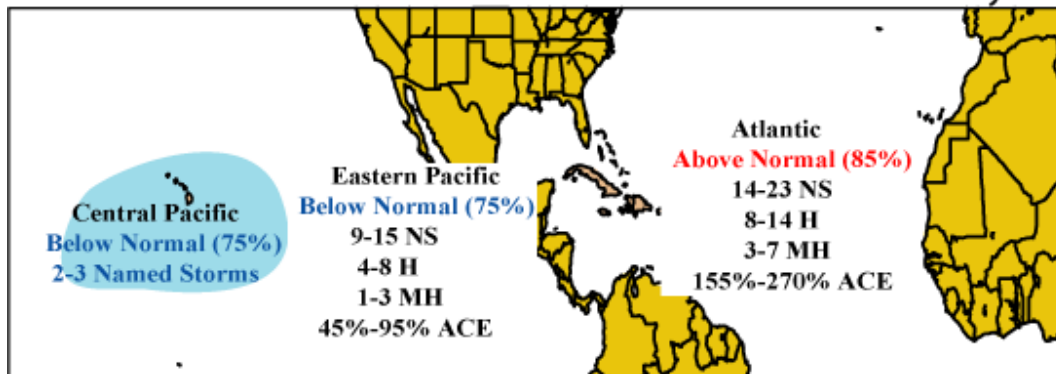
Advancement of Climate Forecast System (CFSv2) Planned for Q2FY11

Attribute	Operational (Since 2004)	Jan 2011
Analysis Resolution	200 km	38 km
Atmosphere model	<p>1995: 200 km/28 levels Humidity based clouds</p>	<p>100 km/64 levels Variable CO2 AER SW & LW radiation Prognostic clouds & liquid water Retuned mountain blocking Convective gravity wave drag</p>
Ocean model	<p>MOM-3: 60N-65S 1/3 x 1 deg. Assim depth 750 m</p>	<p>MOM-4 fully global 1/4 x 1/2 deg. Assim depth 4737 m</p>
Land surface model (LSM) and assimilation	<p>2-level LSM No separate land data assim</p>	<p>4 level Noah model GLDAS driven by obs precip</p>
Sea ice	Climatology	Daily analysis and Prognostic sea ice
Coupling	Daily	30 minutes
Data assimilation	<p>Retrieved soundings, 1995 analysis, uncoupled background</p>	<p>Radiances assimilated, 2008 GSI, coupled background</p>
Reforecasts	15/month seasonal output	<p>25/month (seasonal) 124/month (week 3-6)</p>

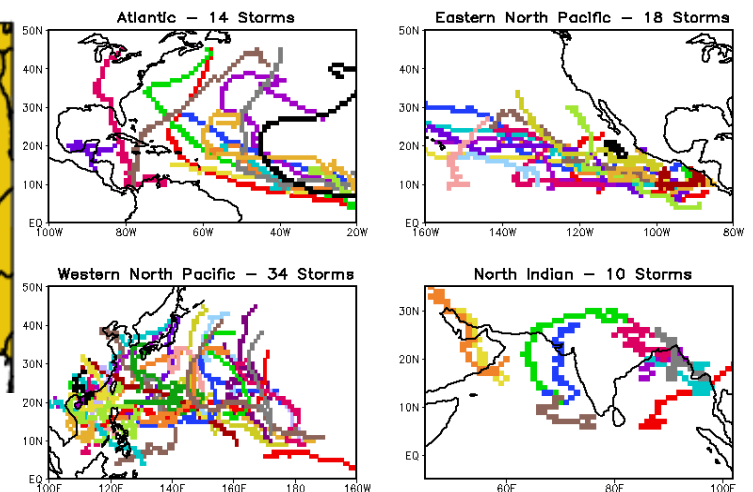
Application of T382 CFSv2 for Dynamic Hurricane Seasonal Prediction

- CFS is used operationally (April+) to produce an ensemble of high resolution runs in support of NOAA's Atlantic and Eastern Pacific Hurricane Seasonal Outlooks.
- CFS is able to reliably capture the net seasonal frequency and intensity of tropical cyclone activity in these basins.

NOAA's 2010 Hurricane Season Outlooks Issued in May



Northern Hemisphere Tropical Cyclone Storm Tracks for 1981



Climate Forecast Tools/Products

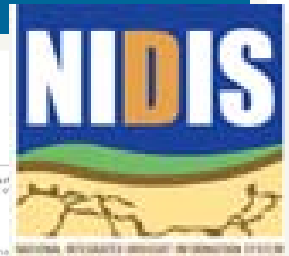
Goal

To provide reliable climate forecast tools/products that are responsive to the needs of users and incorporate state-of-the-art science and research.

- Relationships with partners
- Delivery of useful products
- Continuous flow of user requirements
- Strong research component

CTB Activities

- Forecast Evaluation Tool
- Development of an Extended and Long-range Precipitation Prediction System over the Pacific Islands
- Experimental Drought monitoring and prediction System
- CTB Regional Connection Development is underway



Historical Analysis and Analogs

The following graph shows recent conditions compared to a 30-year climatology. It also uses examples from the past to select specific years from the past to be highlighted, so you can see how some conditions may be more likely than others.

1. Make selection(s) from menu(s) below.
2. Click on an area on the map.
3. If you would like to see a probability plot for a specific time period, select the period on the graph.

4. Which Climate Variable are you interested in?

Precipitation 1 Month 3 Month (Seasonal)

Temperature 1 Month 3 Month (Seasonal)

How many months of the recent past do you want to see?

12 24

How many months into the future do you want to see?

12 24

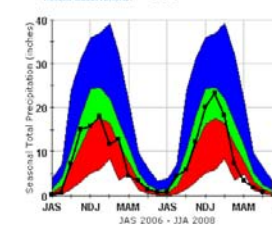
2. Choose (Click) target area on the map.



Historic Conditions

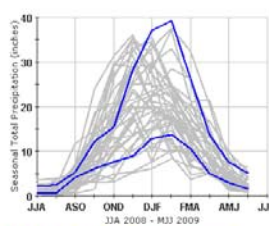
Precipitation / Northern California Coast (89)
This plot shows 3 month (seasonal) **Precipitation** for the last **24 Months** compared to the historic tercile categories from 1971-2000.

Tercile Categories: Wet (Blue) Neutral (Green) Dry (Red)
Recent Observations: 8-8-8



Analogs: Examples of Possible Futures

Precipitation / Northern California Coast (89)
Possibilities for the future **12 Months** are shown in this subplot, using each 3 month (seasonal) period from the past 40 years, 1961-2000.



3. Analog Selector

Select/deselect a year by clicking on it.

Select All Clear All

1961 1971 1981 1991
1962 1972 1982 1992
1963 1973 1983 1993
1964 1974 1984 1994
1965 1975 1985 1995
1966 1976 1986 1996
1967 1977 1987 1997
1968 1978 1988 1998
1969 1979 1989 1999
1970 1980 1990 2000

Patterns
El Niño Only
La Niña Only
Neither El Niño nor La Niña
High Pacific Decadal Oscillations
Mid Pacific Decadal Oscillations
Low Pacific Decadal Oscillations

4. Probability of Exceedance Graph

To view graphs:
Use the slider below to select the season from the chart above. Select a season by moving shaded area and clicking on it.

J J A S O N D J J F M A M J J

CTB Seminar Series

Co-hosted by NCEP, NASA, COLA, ESSIC, IRI, ESRL

#	Date	Location	Speaker	Title
1	29-Oct	NCEP	Steve Lord/Hua-Lu Pan, NCEP/EMC	CFS - Under the Hood and CFS – Where It's Going
2	12-Nov	NCEP	V. Ramaswamy, GFDL	Climate Modeling at GFDL: The Scientific Challenges
3	17-Nov	ESSIC	Ed O'Lenic, NCEP/CPC	An Interactive, Community-Based Web Tool for Evaluating the Skill of CPC Forecasts
4	24-Nov	NCEP	Zhaohua Wu, COLA	Annual cycle and predictability of interannual variability
5	3-Dec	COLA	Eugenia Kalnay, U. of MD	New ideas on Ensemble Kalman Filter
6	10-Dec	NCEP/209	Kathy Pegion, COLA	Subseasonal Variability of Tropical Cyclone Activity
7	21-Jan	COLA	Jae Schemm, NCEP/CPC	Hurricane season prediction experiment with CFS
8	28-Jan	NCEP	J. Shukla, COLA	Seamless weather and climate prediction
9	4-Feb	NCEP	Emilia Jin, COLA/GMU	TBD
10	11-Feb	COLA	Soo-Hyun Yoo, NCEP/CPC	The relationships between Indo-Pacific SSTs and Asian summer Monsoons in the NCEP CFS
11	25-Feb	NCEP	Renguang Wu, COLA	The relationship of U.S. droughts with SST and soil moisture: Distinguishing the time scale of droughts (with J. Kinter)
12	9-Mar	ESSIC	Viviane Silva, NCEP/CPC	Validation of Reanalysis Daily Precipitation over the Americas
13	25-Mar	NCEP	J. Kinter, COLA	Soil moisture effects on predictions with CCSM
14	8-Apr	COLA	Jim Carton, U. of MD	Ocean reanalyses: prospects for climate studies
15	22-Apr	NCEP	E. Schneider, COLA	Amazon deforestation in CFS
16	29-Apr	NCEP	Rong-Hua Zhang, ESSIC	Effects of freshwater flux (FWF) forcing on interannual climate variability in the tropical Pacific
17	6-May	NCEP	Jiangfeng Wei, COLA	TBD
18	11-May	ESSIC	Huug van den Dool, NCEP/CPC	Methods of Multi-Model Consolidation, with Emphasis on the Recommended Cross Validation Approach
19	27-May	NCEP	Vladimir Krasnopolsky, NCEP and ESSIC	Development of neural network emulations of model radiation for improving the computational performance of the NCEP seasonal climate forecasts
20	3-Jun	NCEP	Li Zhang, COLA	TBD
21	10-Jun	COLA	Kingtse Mo, NCEP/CPC	Monitoring many faces of drought over the United States
22	24-Jun	NCEP	Sumant Nigam, U. of MD	TBD

Speakers from CLIVAR and VAMOS community are welcome

Summary

- Climate Test Bed (CTB) is aimed at accelerating transition of research to operations.
- CTB Research-to-Operation Priorities:
 - *Climate model improvement*
 - *Multi-model ensembles*
 - *Climate forecast tools & products*
- CTB serves as a testing platform to transfer research from science community to NOAA operations
 - *Competitive Grants*
 - *CTB Monthly Seminars*
- CTB PIs meeting will be Oct.3-6, 2011 in Fort Worth, TX

website: <http://www.cpc.ncep.noaa.gov/products/ctb/>