

Climate Test Bed (CTB) Overview

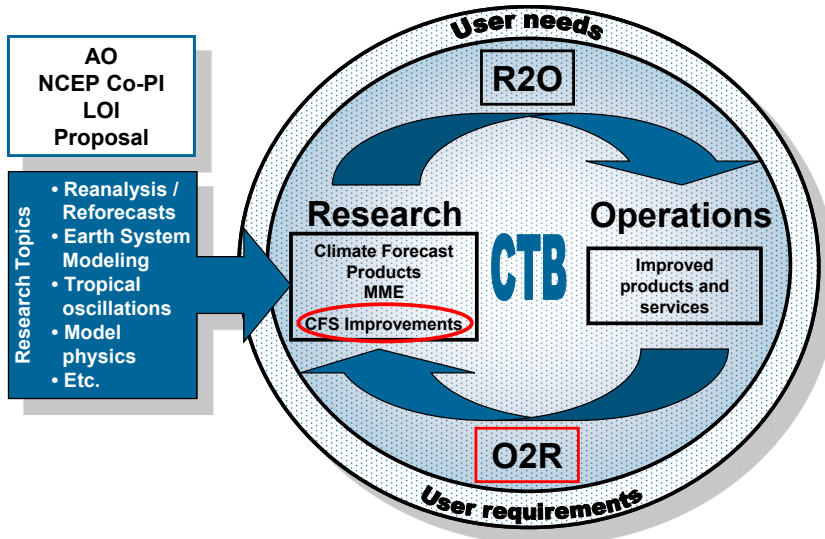
Jin Huang

October 6, 2011
Fort Worth, TX

Purpose of the CTB Pls Meeting and CTB/SAB Meeting

1. Review CTB progress since 2008
2. Seek recommendations on
 - Issues on ongoing and near-term activities
 - Future CTB direction, priorities and strategies

NCEP Climate Test Bed



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*
- A grants program sponsored by CPO/MAPP Program
- CTB emphasizes three science priorities
 - 1) *CFS evaluations and improvements*
 - 2) *Multi-model ensembles*
 - 3) *Climate forecast tools and products*
- Bi-weekly CTB management meeting (CTB, CPO, CPC, and EMC)
- CTB Monthly Seminar Series

CTB Science Advisory Board (SAB)

To provide independent scientific advice, broad direction, and endorsement of ongoing and planned activities

- T. Barnston (IRI)
- T. Busalacchi (ESSIC, U. of Maryland) - **Chair**
- J. Kinter (COLA)
- M. Harrison (UKMO)
- E. Harrison (PMEL)
- D. Lettenmaier (U of Washington)
- K. Redmond (DRI)
- T. Rosati (GFDL)
- M. Suarez (GMAO)
- J. Tribbia (NCAR)

CTB Activity (1): Multi-Model Ensembles

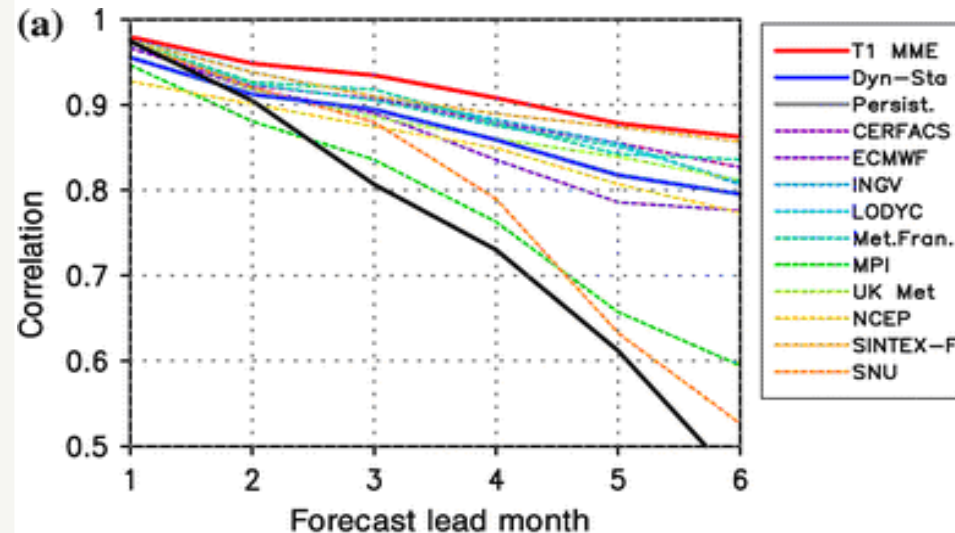
Goal

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

CTB Funded Activities:

- Consolidation techniques (FY08)
- Recalibrating and Combining (FY08)
- MME Prediction with CFS and CCSM (FY08)
- Subseasonal Ensemble Forecast Techniques (FY09)
- MME Forecast of MJO (FY10)
- Incorporating Scale and Predictability Information in MME Prediction (FY10)

ENSO Prediction



MME mean outperforms individual models

National Multi-Model Ensemble (NMME)

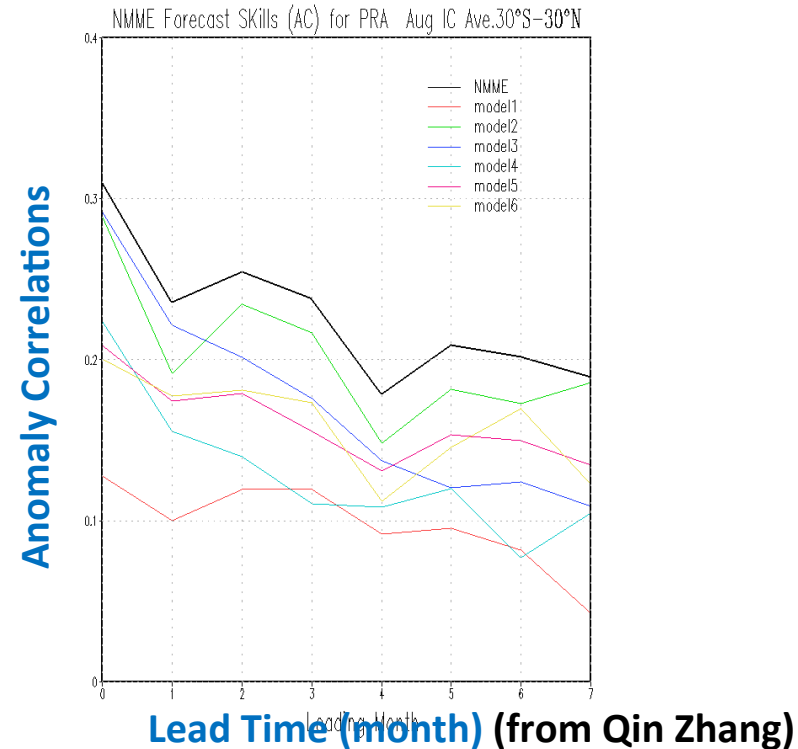
that leverages the best US climate models for improved operational predictions on intraseasonal-to-interannual time scales

- **Phase-I (FY11): NMME of Opportunity**
 - Ad hoc system based on existing hindcasts
 - Started to issue experimental real time NMME forecasts in August, 2011
- **Phase-II (FY12-13): Purposeful NMME**
 - A designed and improved system
- **Phase-III (> FY13): Operational NMME**

- **CPO funded** Phase-I project and issued a FY12 call for proposals for a Phase-II NMME project

- **Participating models in Phase-I:**

- NCEP CFSv1; CFSv2
- GFDL CM2.1
- NCAR CCSM3.0
- NASA GEOS5
- IRI-ECHEM



NMME precipitation forecast Skills compared to individual models:

- August initial condition
- Based on 28 year hindcast
- 30S-30N averaged
- Black lines show the NMME skill

CTB Activity (2):

Improving Climate Forecast Tools/Products

Goal

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

CTB Funded Activities

- **Drought**
 - New tool for drought prediction (FY08)
 - Drought monitoring and prediction products using NLDAS and CPPA results (FY10)
 - Drought Early Warning Index using satellite data (FY09)
 - **Participating MAPP Drought Task Force**
- **Forecast Tools, Assessment and Improvement**
 - Precipitation Prediction System over the Pacific Islands (FY08)
 - Probabilistic Forecasts of Extreme Events and Weather Hazards (FY08)
 - Seasonal Prediction for Ecosystems and Carbon Cycle (FY10)
 - Enabling the Transition of CPC Products to GIS Format (FY08)



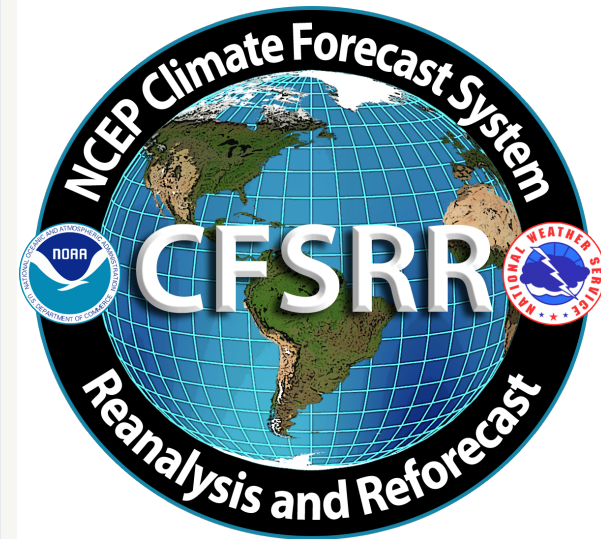
CTB Activity (3): CFS Evaluation and Improvements

Goal

- To accelerate evaluation of and improvements to the operational Climate Forecast System (CFS) and to enhance its use as a skillful tool in providing NCEP's climate predictions and applications

CTB Funded Activities

- NCEP Climate Process Team (FY10) – Bretherton, Teixeira, Pan, et al.
- CFS Stratosphere Improvement (FY09) – Perlwitz, Long, Alpert & Iredell
- Hybrid Data Assimilation and coupled O-A Data Assimilation for Reanalysis (FY09) – Ide, Kalnay, Miyoshi & Wang
- Generation and Evaluation of Long-Term Forecasts with NCEP CFS (FY08) – Cane, Wang, Xue



Planning for the Next Generation of CFS (CFSv3)

- **Purpose of the CFSv3 planning meeting in August, 2011**
 - To bring NCEP and the external community together to develop a strategy for CFSv3
 - 48 participants from national and int'l modeling centers, universities, COLA, NCEP and other NOAA centers/labs
- **Key questions discussed in the meeting**
 - What are NOAA's requirements for CFS and the need for a new version (CFSv3)?
 - Should CFSv3 be a community model?
 - What should be the CFSv3 development strategy?
- **Next Steps**
 - **CFS Science Workshop** focused on CFSv2 evaluations in **Spring, 2012**
 - Develop a **White Paper on CFSv3 Development Strategy**

CFSv3 Development Strategy

based on recommendations in the CFSv3 Planning Meeting

- **Plan for sustainability**
 - **Bold, far-reaching vision** (model for 2018 – 2025!): regional-scale information, extremes, *environmental* prediction
 - **External advice** from research community, other model development shops, and private sector
 - **Opportunities (grants) for collaboration** of external researchers and NCEP operations
 - Accelerated, continuous and articulated **testing** phase
- **Transparent development pathway**: evaluation metrics, decision points, policies that promote openness while reasonably protecting intellectual property
- Consider **science-based alternatives** to current strategy
 - E.g., on-the-fly reanalysis/reforecast cycle
 - E.g., full decoupling of reanalysis and model development
- Conduct **full evaluation of CFSv2** to justify and guide CFSv3 development: skill, consistency, reliability, value of products

Entraining Research: R20

- **Visiting scientists program**
 - Recruiting next generation NCEP model development team
- **Annual workshops**
 - Evaluation of current operational model
 - Presentation of alternative components, parameterizations and initialization/ensemble strategies
- **Climate Process Teams**
 - E.g. entrain moderated community of people interested in fast time-scale processes
 - Other environmental processes (hydrology, land ice, carbon/nitrogen cycle, etc.)
- **Interagency funding** (NSF, NASA, DOE)

Supporting Research: O2R

- Requires **improved CFS code**
 - Documentation
 - Accessibility
 - Readability
- Requires **easy to access and easy to use data archives**
- Requires interactions and collaborations with the **external science community**
- Exploit **best practices** from CCSM/CESM, UK Met Office, ECMWF
- **Seamless prediction**: tighter, bi-directional integration of CFS and GFS development pathways
- Lessons learned and/or **leveraging JCSDA and DTC**

Summary

- **CTB is aimed at transitioning science advances to improved NOAA climate operations.**
- **CTB is jointly sponsored by NCEP and Climate Program Office (CPO)**
 - The CTB grants program sponsored by CPO/MAPP Program
 - NCEP provides personnel and computer
- **CTB current science priorities**
 - 1) CFS evaluations and improvements*
 - 2) Multi-model ensembles*
 - 3) Climate forecast tools and products*
- **CTB Monthly Seminar Series**
 - **Acknowledgement to Jiayu, Zhou and Song Yang**
 - **CTB PIs are encouraged to give a CTB seminar when you come to DC area**