



Overview of NOAA Climate Test Bed (CTB)

Jin Huang
and
Annarita Mariotti, Dave DeWitt, Hendrik Tolman

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Outline

- Mission, scope, organizational structure, science priorities
- Recent achievements
- Currently funded projects
- Near term activities (FY16 priorities)
- Long-term directions (3-5 years)
- Opportunities and challenges
- CTB R2O Process (to be presented on Day 2)

CTB Goals

Mission: Advancing operational climate monitoring, models, and prediction capabilities at subseasonal to seasonal and interannual timescales.

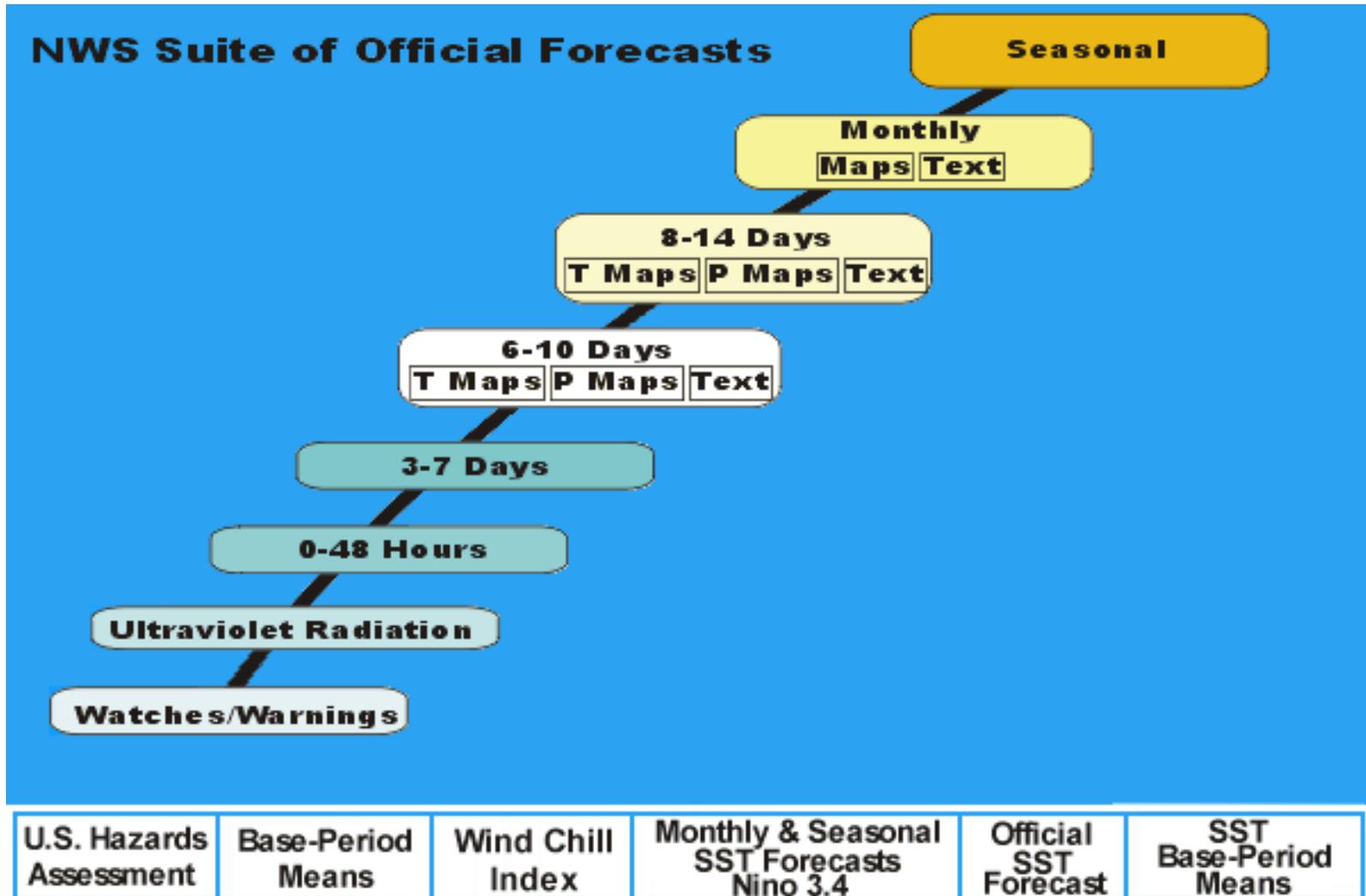
- Accelerate **research-to-operations (R2O)** transition to improve NCEP operational climate prediction
- Provide **operations-to-research (O2R)** support to the climate research community with access to operational models, forecast tools and datasets

Climate Test Bed Priorities:

1. Multi-model ensembles
2. Climate Forecast System (CFS) improvements
3. Climate forecast tools and products
4. Climate monitoring tools and products (*new*)

New website: <http://www.nws.noaa.gov/ost/CTB>

CTB Driving Forces: NWS Operational Products

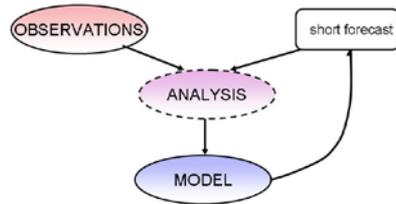


CTB is aimed at improving the NWS products suite from weeks to seasons (S2S)

CTB Driving Forces: Science Readiness from OAR and external research community

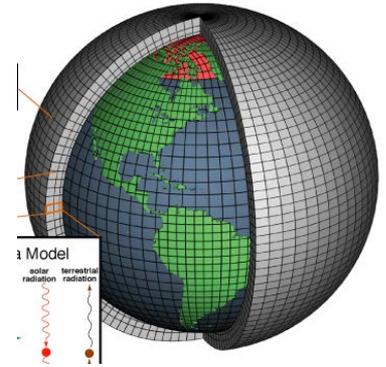
Improving the “Building Blocks” for S2S Prediction

Upgrade Data Assimilation Systems



Identify and correct model errors; account for uncertainties

Improvements in models, observational networks, and data assimilation systems lead to improved understanding and more realistic prediction over time.



Enhance Observational Networks



Understanding key sources of predictability at S2S timescales

- ENSO
- Sea ice
- Land surface
- MJO
- Stratosphere
- Atmospheric dynamical processes
- Long-term trends,

CTB Resources and Management

joint effort of NWS/NCEP and OAR/CPO

- **Resources for R2O Demonstration Projects:**
 - Primarily supported by CPO/MAPP Program via competitive projects; other supports are from NGGPS and Sandy Supplemental Fund
 - NCEP provides additional in-kind support of employees as co-Is or collaborators
 - NCEP's O2R Support to facilitate the R2O projects; CPO and NCEP jointly provide HPC
- **CTB Management Team (CTB, MAPP, CPC, EMC)**
- Mechanisms to facilitate NCEP-Research community interactions and collaborations (CTB Seminar Series, workshops)

Implemented NMME Seasonal Forecast System

NMME (North American Multi-Model Ensemble): To improve intraseasonal to interannual predictions based on ensemble of models augmenting CFS predictions

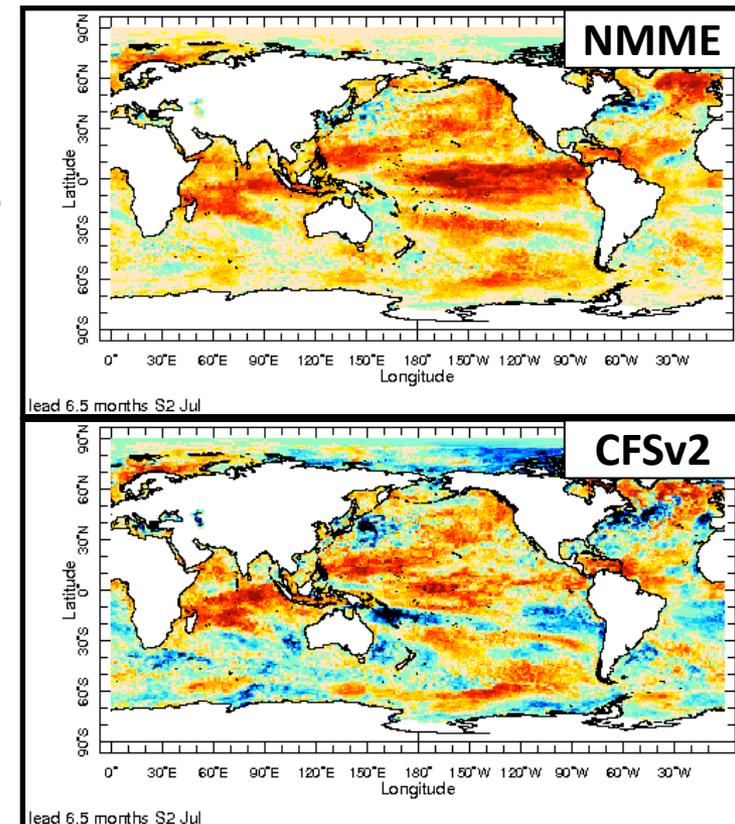
What was tested: A prediction system based on major climate models in U.S. and Canada for NCEP operational seasonal forecasts

How it was tested: Tests based on 30-year hindcasts and real-time forecasts since Aug 2011

What was demonstrated: Improved forecast reliability and forecast skill

Impact: (1) Improved numerical guidance for CPC operational seasonal forecasts; (2) the most comprehensive seasonal prediction dataset publically available for research and applications

MAPP-CTB Project initiated in FY11, with contributions from DOE, NASA, NSF



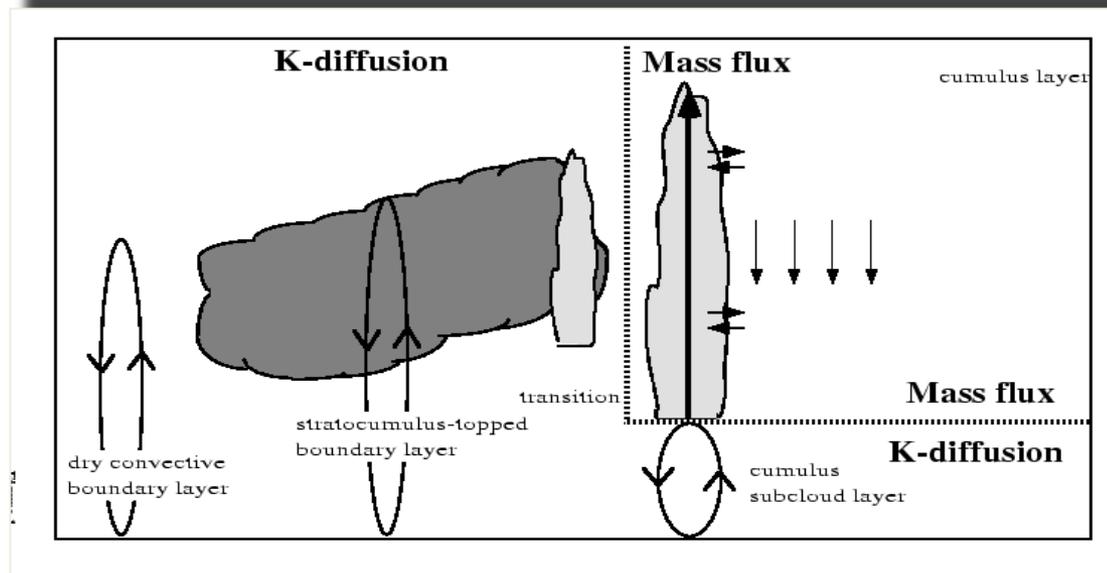
Ranked probability skill scores of 6.5-month sea surface temperature forecasts

Contributed to Operational NCEP GFS/CFS

- “Hybrid EDMF” (Eddy-Diffusivity Mass-Flux) scheme became operational in GFS in 2014, which improved representation of dry convective updrafts in strongly unstable boundary layers.
- The next step is to implement a candidate EDMF parameterization for GFS and CFSv3 that includes a full representation of moist processes.

$$\overline{w' \phi'} \cong -K \frac{\partial \bar{\phi}}{\partial z}$$

$$\overline{w' \phi'} \cong M (\phi_u - \bar{\phi})$$



2010 CTB funded Climate Process Team (CPT):

UW: C. Bretherton

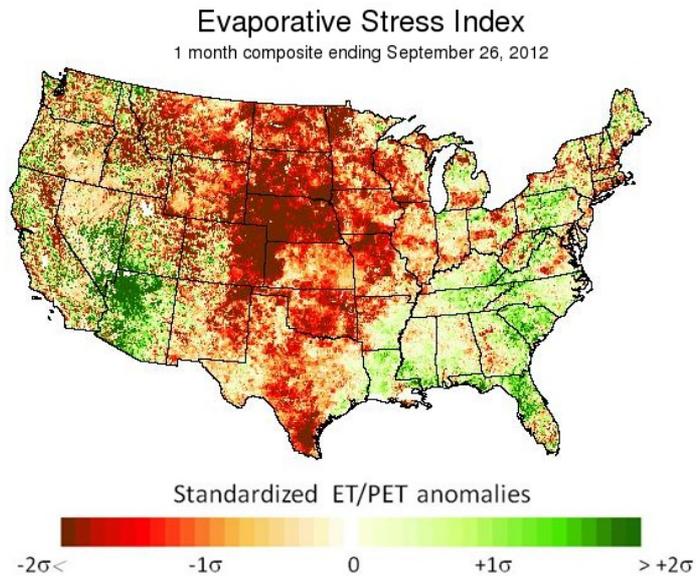
NCEP: J. Han, R. Sun

GFDL: C. Golaz, M. Zhao

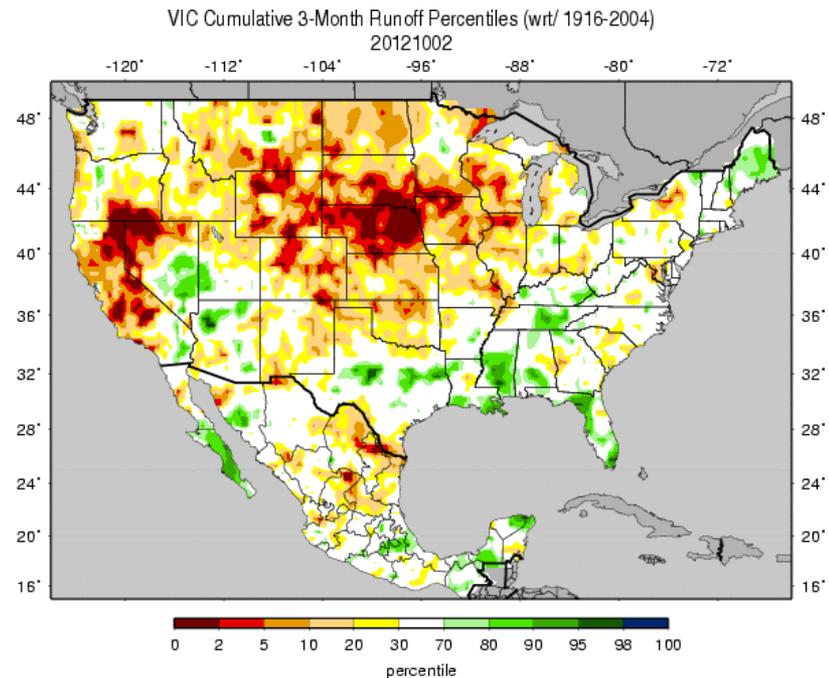
JPL: J. Teixeira, M. Witek

Improved Drought Monitoring and Outlooks contributing to NIDIS

Satellite-based drought monitoring index ([Anderson, FY10](#))

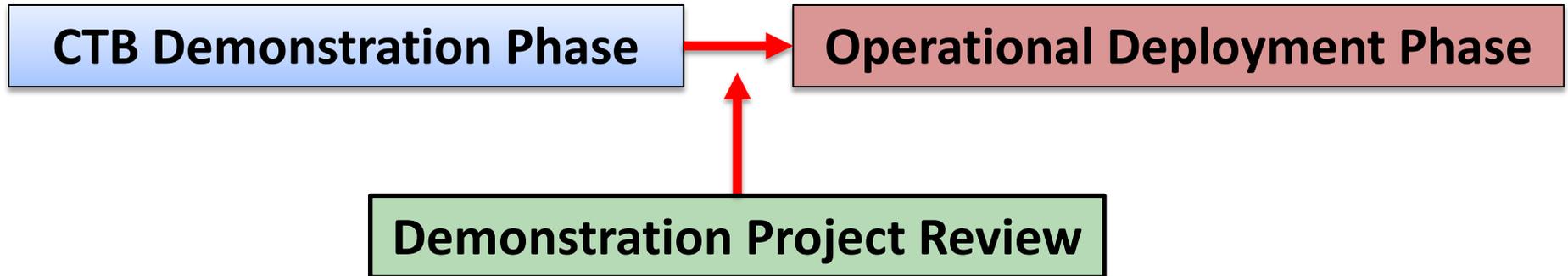


Enhancing operational drought monitoring and prediction products ([Lettenmaier, Wood and Mo, FY10](#))



Improved CTB R2O Process

NCEP and CPO close collaboration and partnership
(to be presented tomorrow by Mariotti and Huang)



- Established an efficient planning and transition process
- NWS plays a major role in setting R2O priorities and reviewing relevance of proposed projects
- Refined requirements for MAPP-CTB proposals
- Transition plans and milestones to track the progress of the funded demonstration projects
- Quarterly R2Omanagement meeting to discuss execution and plans

Engaging the research community

- **Organized CFSv2 Evaluation Workshop and CFSv3 Planning workshop**
- **Organized NMME sub-seasonal workshop**
- **Leading MAPP Climate Model Development Task Force**
- **Led the development of Drought Research-to-Capability Synthesis Report as part of MAPP Drought Task Force**
- **Organized CTB Seminar Series**

On-going MAPP-CTB Projects:

Forecasts methods and 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

1. Week-3 and Week-4 Forecast Tools

PI: [Johnson](#), CPC Co-Pis: L'Heureux and Baxter

2. Extended Range Severe Weather Forecast Tools PI:

[Tippett](#), CPC Co-PI: Gottschalck, SPC Co-PI: Carbin

3. NMME Prediction Post-processing Protocol

PI: [Del Sole](#), CPC Co-PI: Kumar

4. Probabilistic NMME Products

PI: [Barnston](#), CPC Co-PIs: van Den Dool and Becker

On-going MAPP-CTB Projects: Modeling

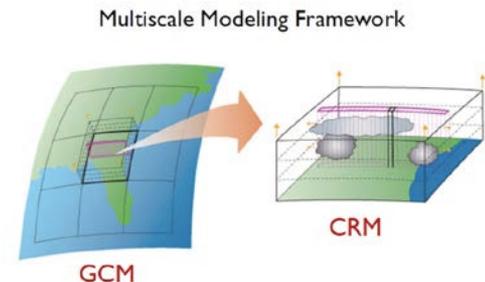
Goal: To accelerate evaluation of and improvements to the operational Climate Forecast System (CFS) and to enhance its use as a skillful tool in providing NCEP's climate predictions and applications

5 modeling projects to test new parameterizations and schemes for use in CFS:

1. **Cloud-CPT 1** PI: [Krueger](#), EMC Co-PI: Moorthi
2. **Cloud-CPT 2** PI: [Bretherton](#), EMC Co-PIs: Jongil Han and Rui-Yu Sun
3. **Lake Module** PI: [Jin J](#), EMC Co-PIs: Ek and Wu
4. **Land Module** PI: [Chen](#), EMC Co-PIs: Ek, Yang and Meng
5. **Aerosol Module** PI: [Lu](#), EMC Co-PI: Hou YT, Co-I Moorthi



Images courtesy of S. Krueger



Near-term CTB Activities (starting FY16)

(Priorities based on CTB Management Team discussions – specific projects to be selected based on peer review process via CPO/MAPP FY16 AO)

- 1) Test the performance of **modeling components**, schemes or mythologies
 - **data assimilation** for Earth system components
 - **sea ice**
- 2) Test experimental **prediction methodologies** (e.g., hybrid statistical/dynamical methodologies, post-processing techniques, and verification techniques) and products
- 3) Conduct the **NMME sub-seasonal forecast experiment** to test a multi-model system for sub-seasonal climate prediction

CTB Long-Term Priorities

driven by

NWS operational requirements, science readiness, and programmatic opportunities

- **Improve NCEP Climate Model System**
 - In coordination with NGGPS
- **Sustain and improve NMME**
 - Improved products for sub-seasonal to seasonal forecast products
 - Continue to serve as a research-operation interaction platform
- **Improve forecast tools and products**
 - Weeks 3-4 forecasts
 - Improve forecasts in Arctic regions
 - Improve drought monitoring and outlook products
 - Develop/improve products for regional and/or sectoral applications
- **Improve monitoring tools and products**
 - Develop new climate reanalysis
 - Test the utilization and assimilation of new data
 - Test new data assimilation methodologies

Opportunities and Challenges

- **Need enhanced resources for CTB R2O demonstration projects and operational deployment:**
 - Currently CPO/MAPP program supports CTB projects, but the resources are limited
 - To respond to NWS broader service needs, CTB needs support from other CPO programs and relevant NWS programs
- Effective CTB R2O research requires strong and dedicated **O2R infrastructure support** to the external collaborators, e.g., model documentation, model code/scripts, data during the development phase (not after a model is frozen)
- The NCEP plans to develop a unified modeling suite, weather to climate. The opportunity is for the MAPP program and the NWS **NGGPS** program to continue to coordinate to support CTB modeling activities.
 - Can CFS development fully leverage NGGPS infrastructure?

Summary

- CTB is aimed at accelerating transitioning science advances to improved NOAA climate operations.
- CTB is jointly supported by CPO/MAPP program and NCEP resources and effectively co-managed
- CTB recent accomplishments
 - Development, planning, and implementation of NMME.
 - Improving NCEP GFS/CFS; Engaging the community in CFSv3 planning
 - An improved CTB's R2O transition process.
- Challenges/requirements for more effective R2O
 - Enhanced grants funding for R2O demonstration projects
 - NCEP O2R infrastructure support for CFS to ensure impactful transition. It is possible this can leverage NGGPS infrastructure that is being established.