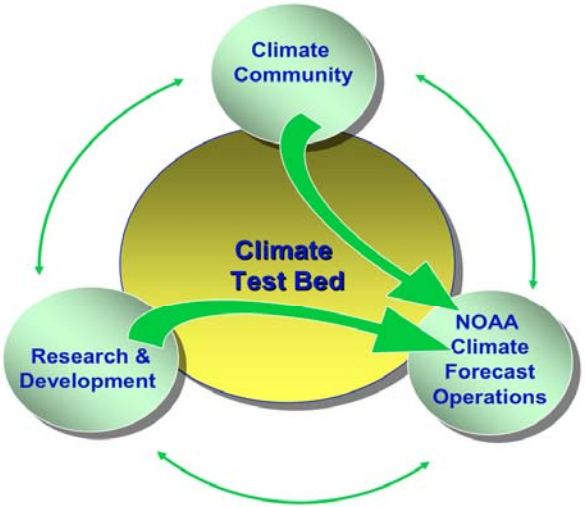
NCEP Climate Test Bed (CTB) Overviw

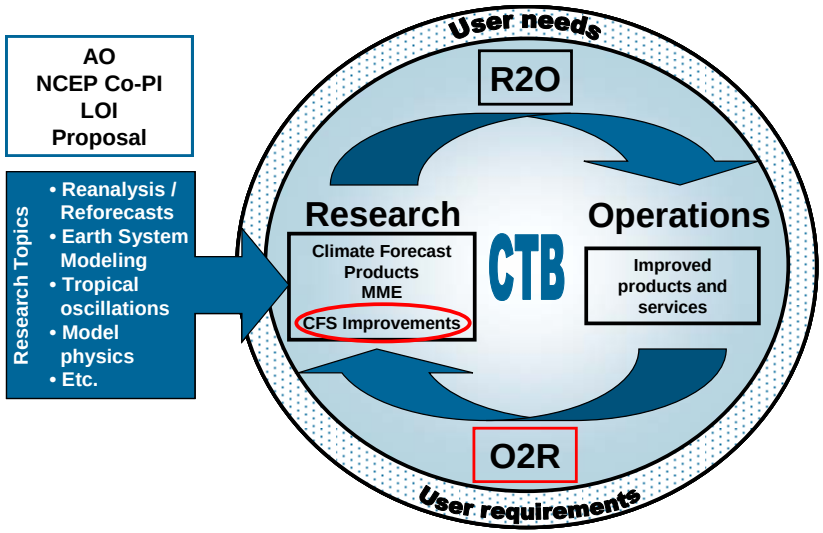
Mike Halpert for
Jin Huang
April 2, 2013



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

http://www.cpc.ncep.noaa.gov/products/ctb/

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.

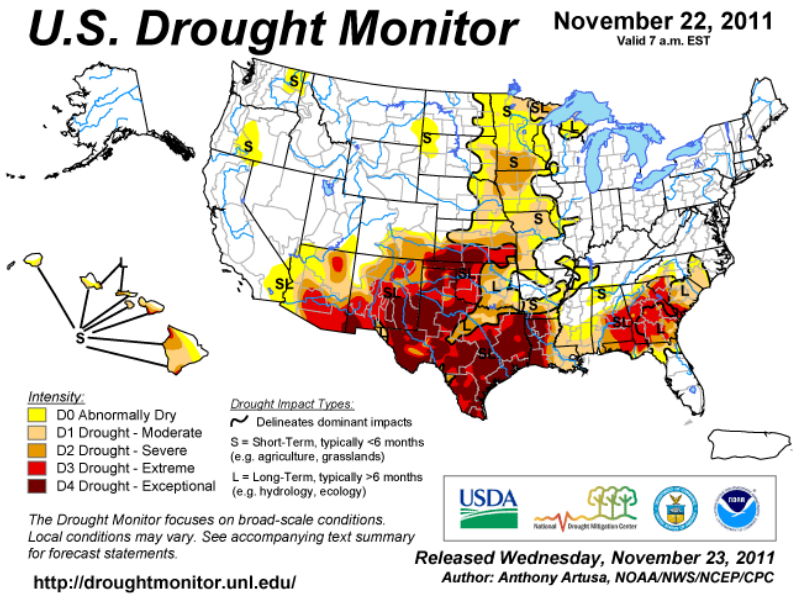
- Joint NCEP-CPO facility @ NCEP
- CTB Science Advisor Board (SAB)
- Established in 2005
- Serves as conduit between the operational, academic and research communities

- CTB embraces *the R2O and O2R paradigms*
- *Grants projects sponsored by Climate Program Office*
- CTB emphasizes three science activities
  - *CFS improvements*
  - *Multi-model ensembles*
  - *Climate forecast products*
- CTB supports both CPC and EMC

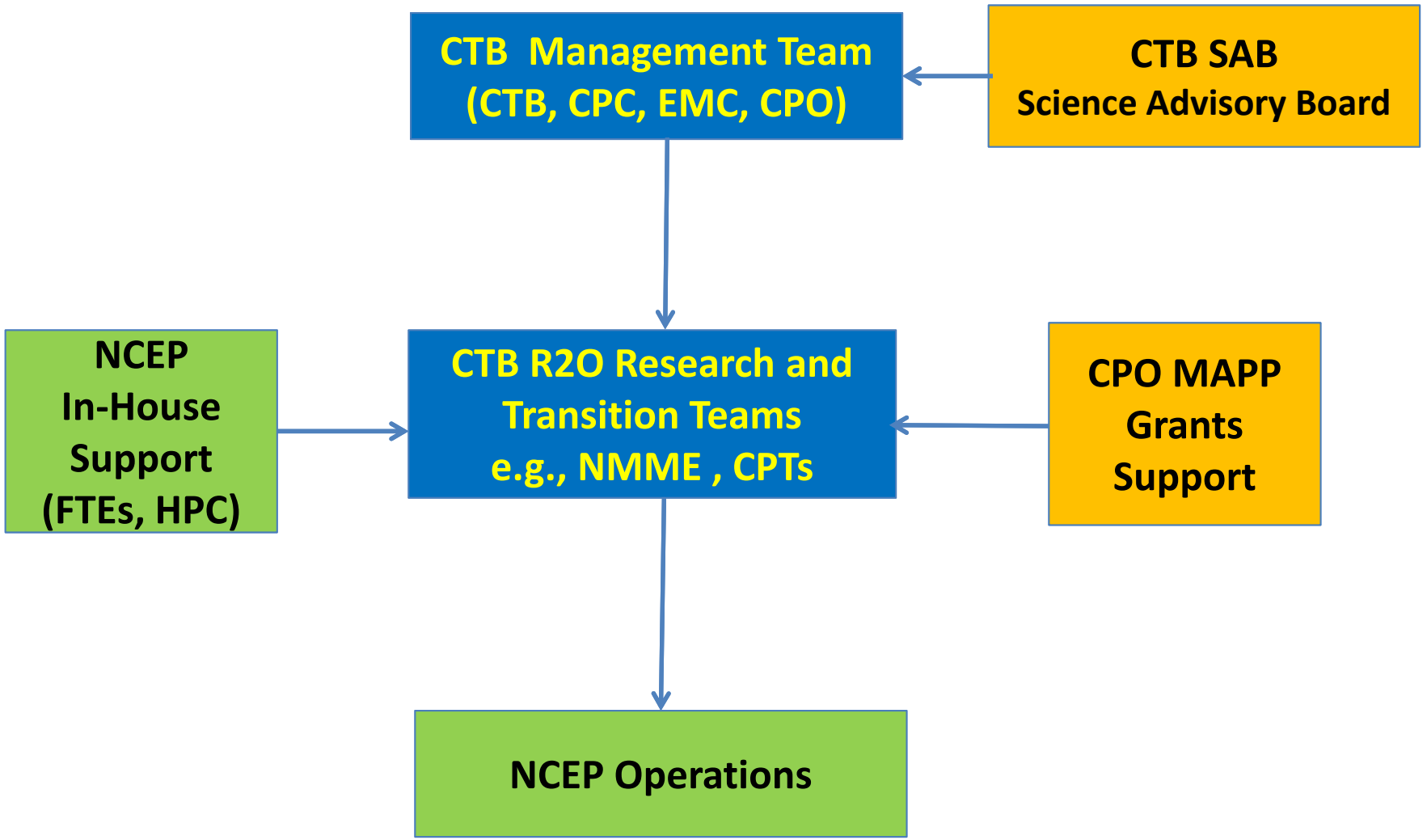
Climate Prediction Center (CPC) Mission

CPC delivers climate prediction, monitoring, and diagnosis products for timescales from weeks to years to the Nation and the global community for the protection of life and property and the enhancement of the economy.

- **Current use of TRMM for CPC operational climate monitoring**
  - Inputs to an integrated high-resolution global precipitation analysis (CMORPH)
  - Real-time climate monitoring (e.g. MJO)
  - Climate model verification and diagnostics
  - **Global hydrological cycle**
- **Climate requirements for GPM:**
  - **Drought monitoring** (precipitation, soil moisture, snow) and **water resources managements**
  - **Climate model evaluations**: e.g., NCEP Climate Forecast System (CFS)
  - **Long-term trend**, especially in extreme events



How Does CTB Function?



CTB Priority (1):
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 Early Warning Index using satellite data (FY09)
  - Drought monitoring and prediction products using NLDAS and CPPA results (FY10)
  - 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)
  - Enabling the Transition of CPC Products to GIS Format (FY08)
  - Seasonal Prediction for Ecosystems and Carbon Cycle (FY10)

CTB Priority (2):
CFS Evaluation and Improvements

- **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**

Past Supported CTB Projects:

Data Assimilation Methodology

- 150-yr Coupled ocean data assimilation (Cane, FY08)
- Hybrid data assimilation for reanalysis (Ide, FY09)

Model Physics Improvement

- Stratosphere (Perlwitz, FY09)
- CPT (Bretherton, FY10)

Empirical and Stochastic Parameterizations

- Stochastic perturbation (Delsole, FY06)
- Neural Network (NN) Emulation of model radiation (Fox-Rabinovitz, FY06)

FY13 Funding Opportunity:

- **MAPP Priority #2: Climate Process and Modeling Teams**
- **CTB proposals need to meet extra requirements for funding under MAPP-CTB Execution Agreement**

CTB Recent Efforts to Engage the Community in Development of next version CFS

Team efforts of NCEP, CPO, and the external community:

- **CFSv3 Planning Meeting in August, 2011**
- **CFSv2 Evaluation Workshop in April 30-May1, 2012**
  - Document improvement from CFSv1 to CFSv2
  - Identify model biases and deficiencies in CFSv2
  - Identify research directions for the development of CFSv3
- **CFS Strategy document**
- **Special CFSv2 Collection in Climate Dynamics**

CTB Priority (3):

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)**: Established collaborations and NMME protocol
- **Phase-II (FY12-13)**: A more "purposeful" MME Experiment with improved models and an optimal experimental design to address key research questions

- **Real-time forecasts used by NCEP/CPC operational forecasters**
- **Data (Hindcast and Forecasts) Readily Available to the Community**
- **NMME data for ISI climate predictability and prediction research**

NMME Partners

- University of Miami
- COLA
- NCAR
- IRI
- U of Colorado – CIRES
- NASA – GMAO
- NOAA/NCEP (CPC & EMC)
- NOAA/GFDL
- Princeton University

The NMME project is sponsored by NOAA/MAPP, DOE, NASA, and NSF

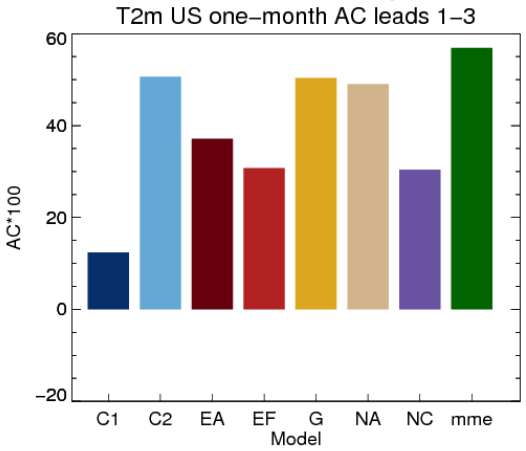
Realtime Verification over CONUS

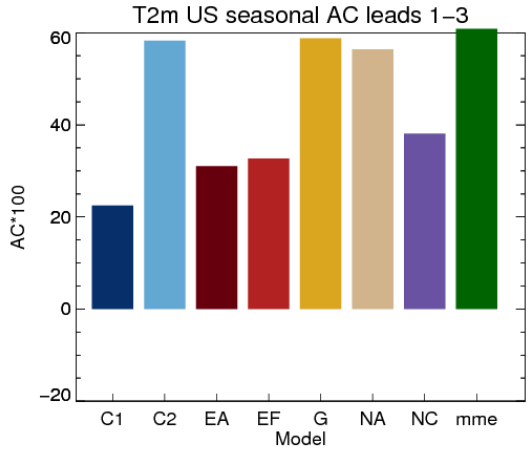
(AC, 1 month lead, August 2011-July 2012 IC)

Monthly

Seasonal

T2m





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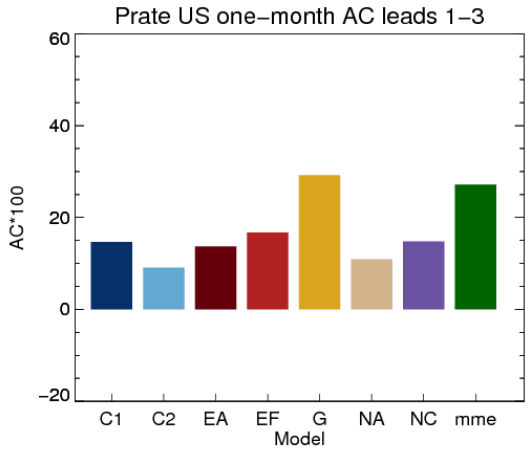

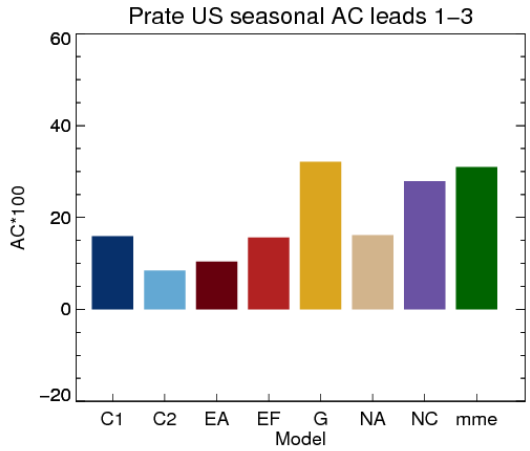

NMME is among the reliable best.

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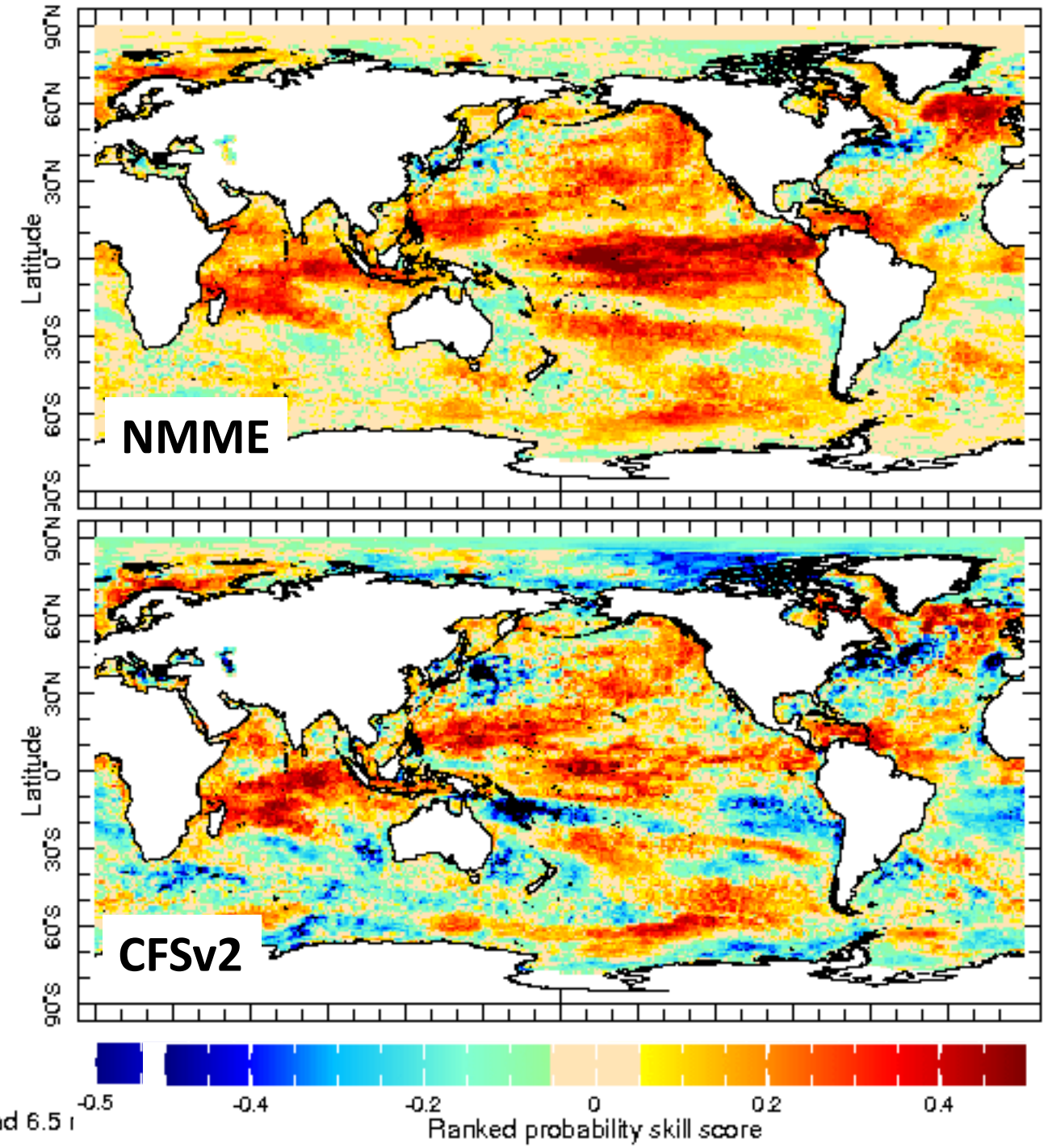
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE

July 1 start DJF SST forecast RPSS

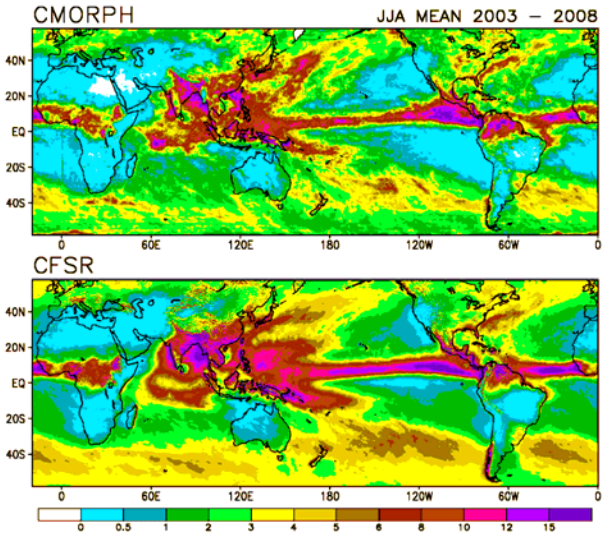


CCS CENTER FOR COMPUTATIONAL SCIENCE UNIVERSITY OF MIAMI

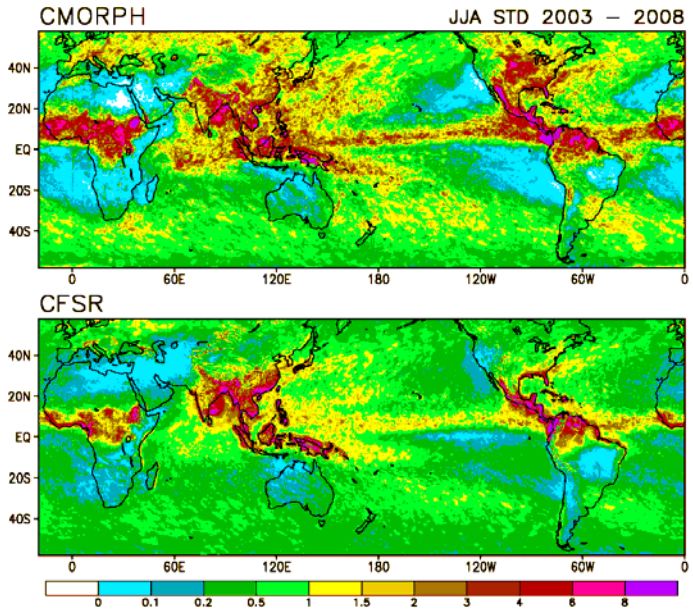
GPM Applications in Climate Monitoring and Model Verifications

- CMORPH satellite precipitation estimates reprocessed and bias corrected for a 15-year period from 1998 to the present
- The high time-space resolution enabled the verifications of NCEP model generated precipitation fields on a wide spectrum of scales

Mean Precipitation

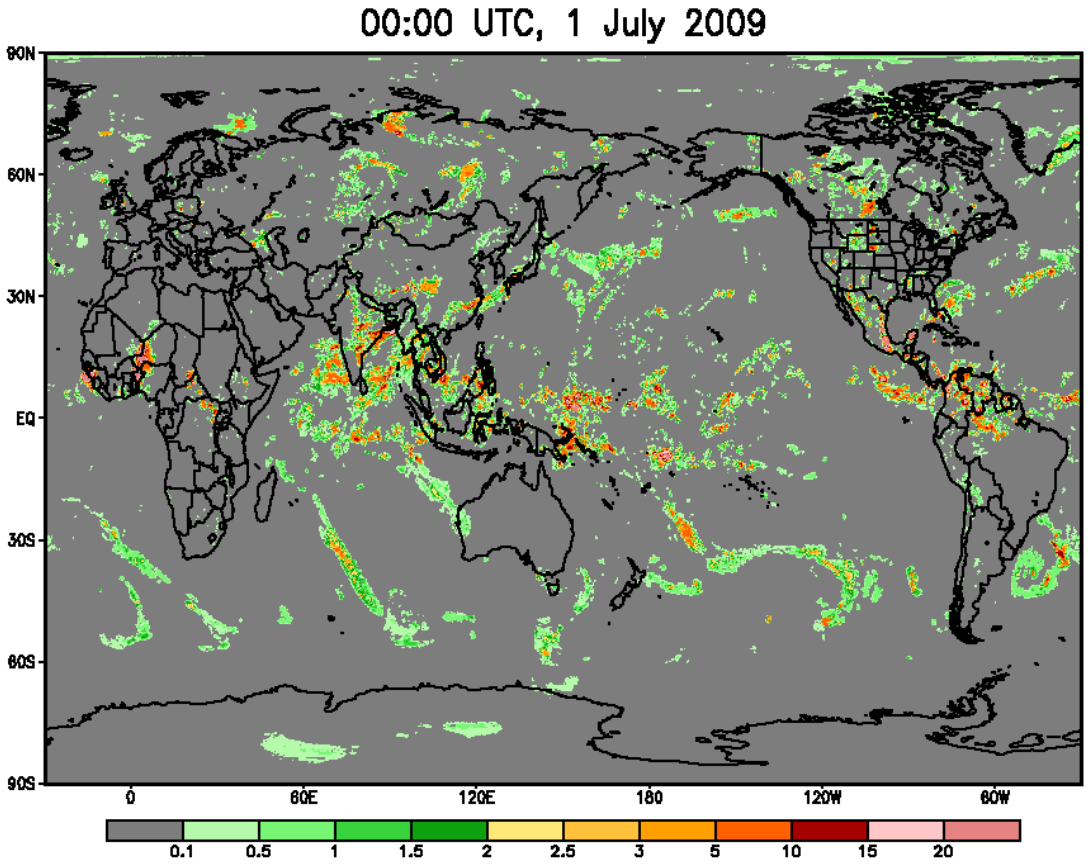


Diurnal Amplitude



- CFSR reproduced the large-scale patterns of total precipitation (top) and the diurnal amplitude (left)
- CFSR over-estimated precipitation over most of the globe compared to the bias corrected CMORPH (top)
- At the meantime, the magnitude of the diurnal cycle is under-estimated in the CFSR (left)

NOAA GPM Products Related Expected to Further Improve Climate Monitoring



- Test version of pole-to-pole CMORPH being developed at CPC

Summery

Potential Roles/Interests of CTB as a Testing Platform in Transferring GPM to NOAA Operations

- To accelerate the transition of mature satellite **climate monitoring** tools and products to NOAA operational institutes in a timely manner
- To expand GPM applications to **climate model diagnosis and evaluations, and applications**
- To collaborate with other NOAA testbeds (e.g., HMT) on GPM applications
- To interact with the satellite science community for better collaborations to ensure productions of climate quality products

Mechanisms:

- **Grants projects**: However, The CTB current funding is from CPO/MAPP program, focused on modeling and predictions. Improving operational climate monitoring is beyond the MAPP's mission
- **Joint Transition Teams** consisting of internal NCEP scientists and external PIs.