Developmental Testbed Center: Engaging the community in operationally relevant research and development

Louisa Nance[1+2], Bill Kuo[1+2], Ligia Bernardet[1+3+4], Tracey Dorian[5+6], Corey Guastini[5+6], Michelle Harrold[1+2], Isidora Jankov[1+3+7], Tara Jensen[1+2], Geoffrey Manikin[5], Kathryn Newman[1+2], Hui Shao[1+2], Glenn White[5] and Jamie Wolff[1+2]

[1]Developmental Testbed Center

[2]National Center for Atmospheric Research

[3]NOAA Earth System Research Laboratory / Global Systems Division

[4]University of Colorado/Cooperative Institute for Research in Environmental Sciences

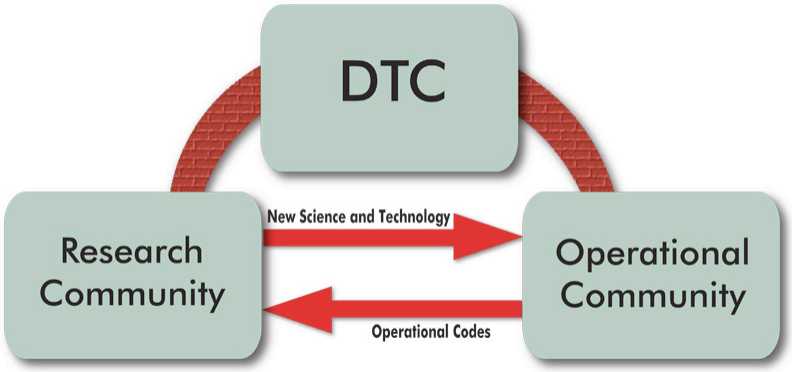
[5]NOAA National Centers for Environmental Prediction / Environmental Modeling Center

[6]I.M. Systems Group, Inc.

[7]Colorado State University/Cooperative Institute for Research in the Atmosphere

What is the DTC?

- **Purpose**: Facilitate the interaction & transition of NWP technology between research & operations
  - **O2R**: Support operational NWP systems to the community
  - **R2O**: Perform T&E on promising NWP innovations for possible operational implementation
  - **Interaction between R & O**: Workshops, Visitor Program, Newsletter
- Jointly sponsored by NOAA, Air Force, NSF, & NCAR



Model Evaluation Group (MEG)

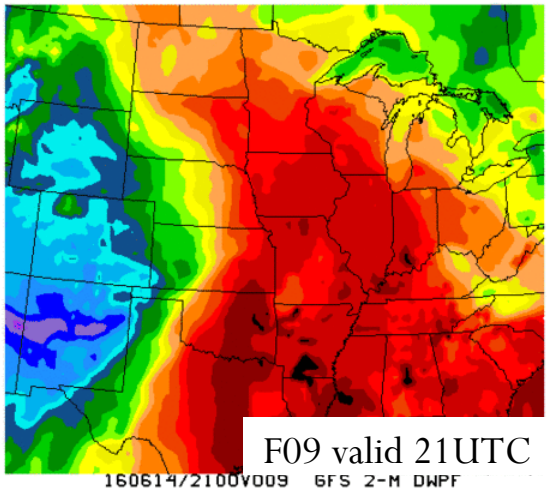
- Tasked with verifying and evaluating daily performance of EMC's forecast/analysis systems from a synoptic and mesoscale perspective
- Weekly webinar: MEG, model developers, NCEP service centers, NWS regional and field offices, DTC staff, academic community and private sector
- Forum for EMC to reach out to forecast and user community

Interested in participating? Contact
Glenn White (Glenn.White@noaa.gov) or Geoff Manikin (Geoffrey.Manikin@noaa.gov)

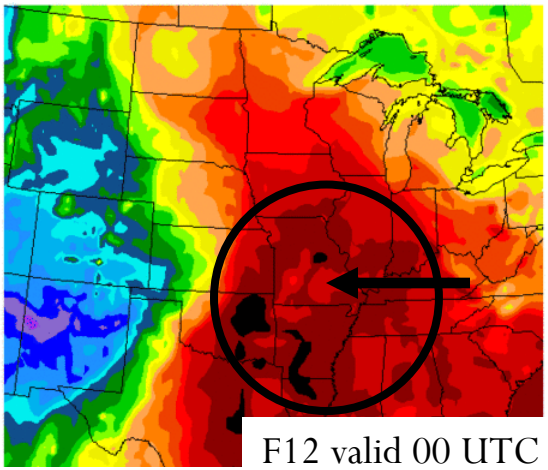
Issues MEG is currently evaluating

- Global Forecast System
  - 2-m T, particularly the early evening cool bias
  - High low-level T_d, maximized at 00 UTC
  - Light (convective) QPF in regimes supporting shallow (non-precipitating) convection
  - Difficulties generating and maintaining inversions
  - Difficulties forecasting MJO - tied to challenges in predicting ascent in the west equatorial Pacific
- NMMB
  - Generates spurious moist absolutely unstable layers
  - Ability to generate cold pools
  - Too much cloudiness
- ARW
  - Too little cloudiness
- All NCEP models
  - High T_d & instability this spring in the upper midwest where soil is wet
- Ensemble systems
  - SREF: Clustering by dynamic core in the SREF
  - GEFS: Insufficient spread

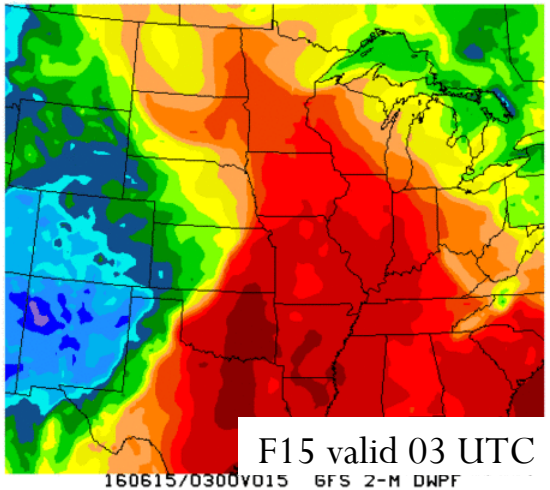
Spike in low-level T_d at 00 UTC



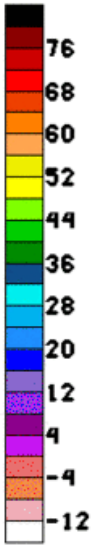
F09 valid 21UTC

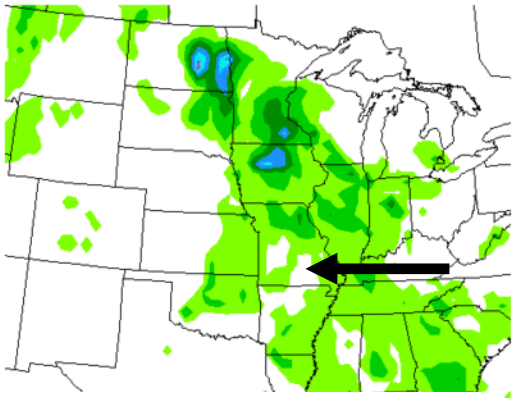


F12 valid 00 UTC

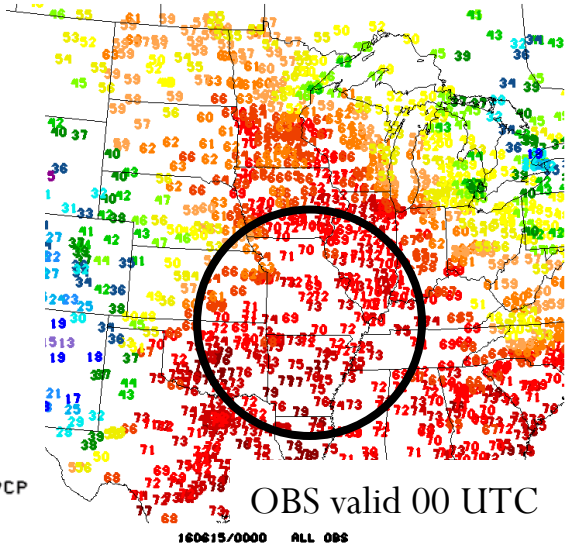


F15 valid 03 UTC

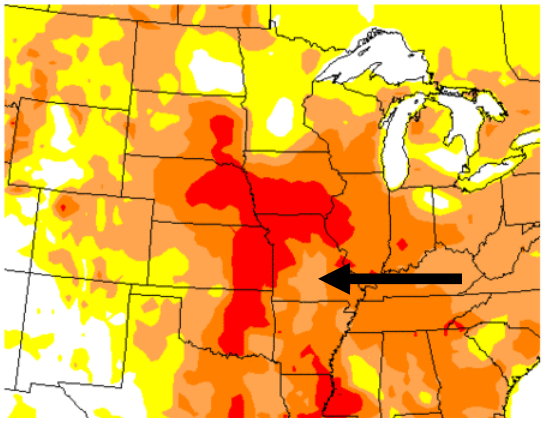




Total precip valid 21 UTC



OBS valid 00 UTC



Avg latent heat flux valid 00 UTC

Examples of DTC engaging the research community

In the context of

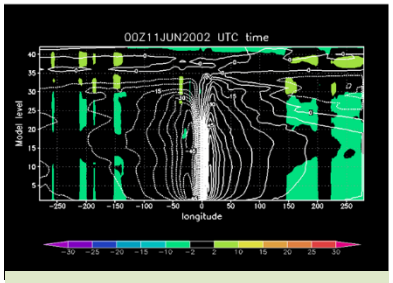
- T&E feedback loop, including new/modified capabilities and diagnostic tools
- Facilitating diagnostic evaluation of operational models and advancing capability of MET

DTC's role in HWRF development: connecting the pieces

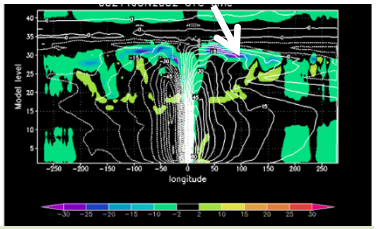
Forecast improvement

2015 HWRF implementation

Cloud top cooling due to radiation



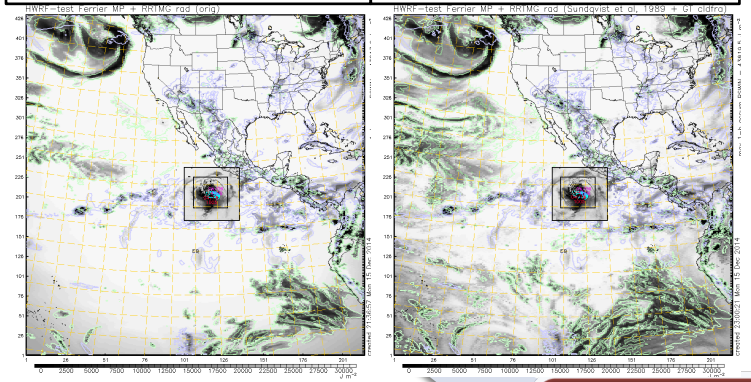
GFDL radiation



RRTMG radiation

EMC tested partial cloudiness together with other innovations

RRTMG old	RRTMG+partial cld



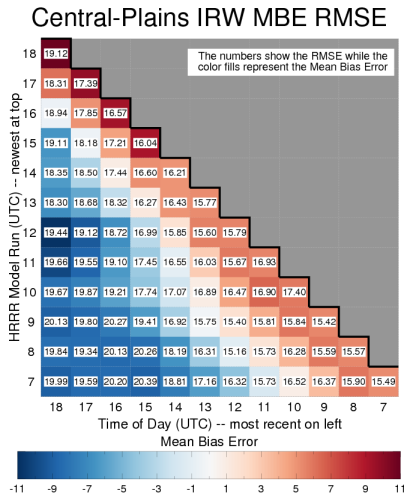
DTC/EMC tested RRTMG scheme

Forecast degradation

DTC visitors: Otkin, Griffin, Rozoff – U of Wisconsin

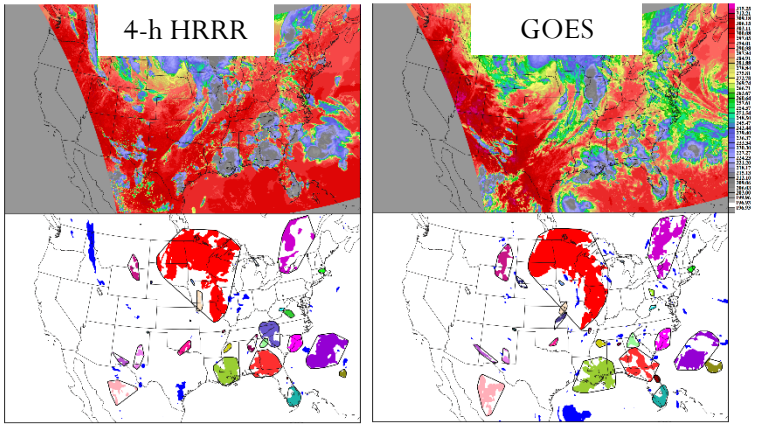
HRRR evaluation using observed & simulated GOES IR brightness temperature

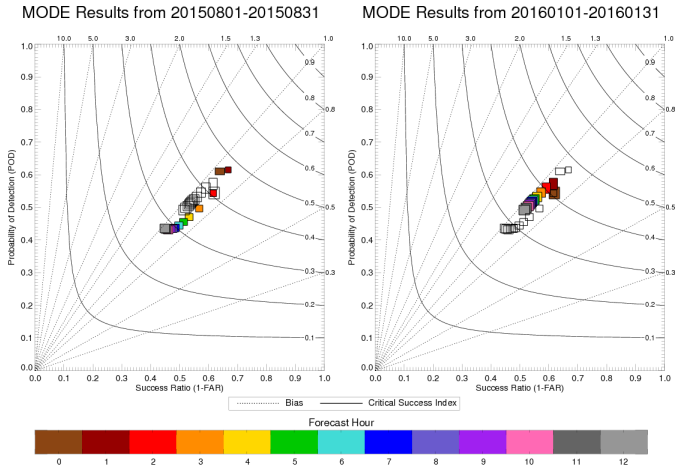
Standard grid-to-grid metrics



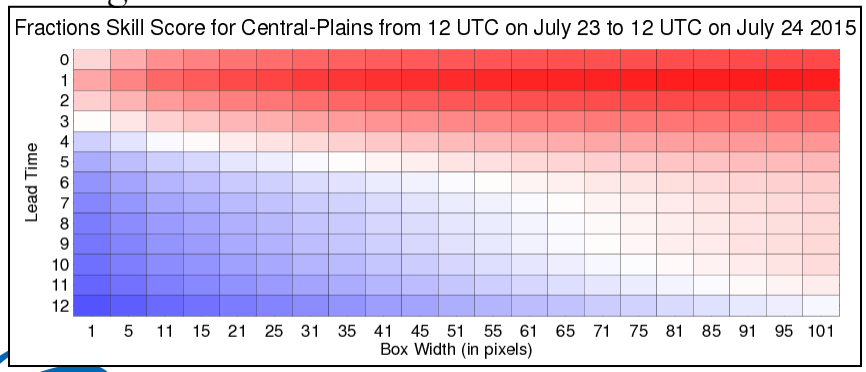
Spin-up issue:
Too few high (cold) clouds - quickly transitions to too many high clouds

Object-based - MODE





Neighborhood method – Fraction Skill Score



DTC Focus Areas

Data Assimilation

- Lead: Hui Shao
- Software: GSI & EnKF
- T&E: 4D hybrid EnVar for HRRR

Regional Ensembles

- Lead: Isidora Jankov
- Software: ARW, NMMB, UPP
- T&E: Stochastic physics within HRRR ensemble

Hurricanes

- Lead: Kathryn Newman
- Software: HWRF, GFDL vortex tracker
- T&E: HWRF physics advancement

Global Model Test Bed

- Lead: Ligia Bernardet
- Software: Physics (IPD/CCPP)
- T&E: Physics Testbed, GFS physics

Verification

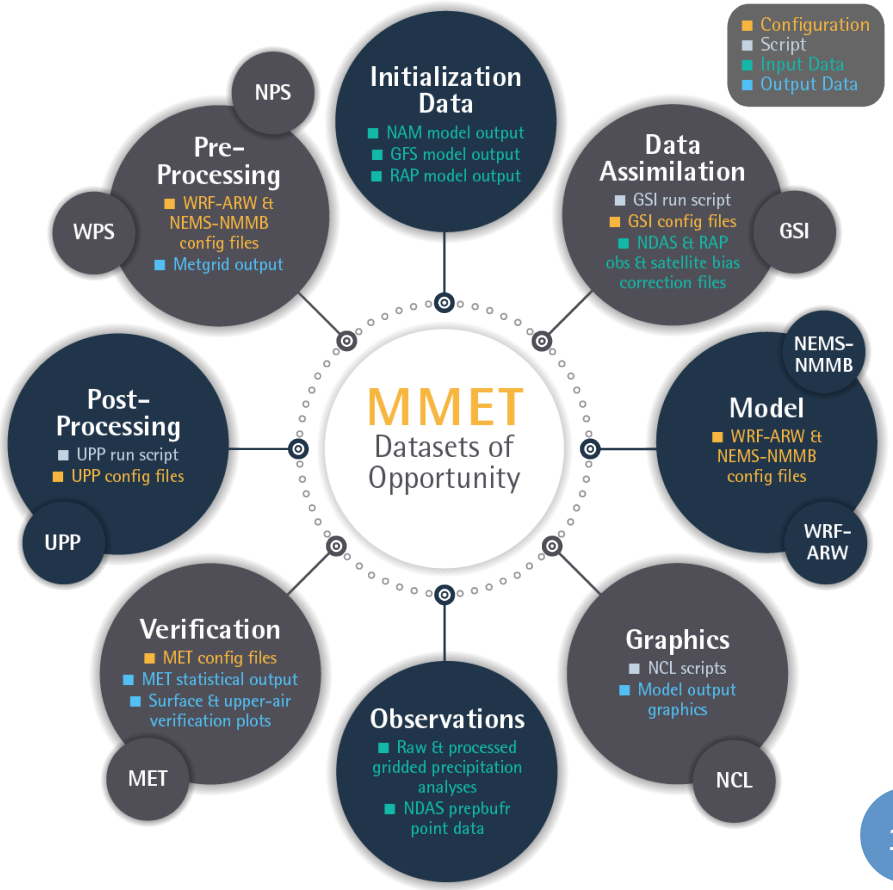
- Lead: Tara Jensen
- Software: MET, MET-TC, METViewer
- T&E: Verification expertise for other focus areas

Facilitating R2O using Mesoscale Model Evaluation Testbed (MMET)

Stage I: Proving ground for research community

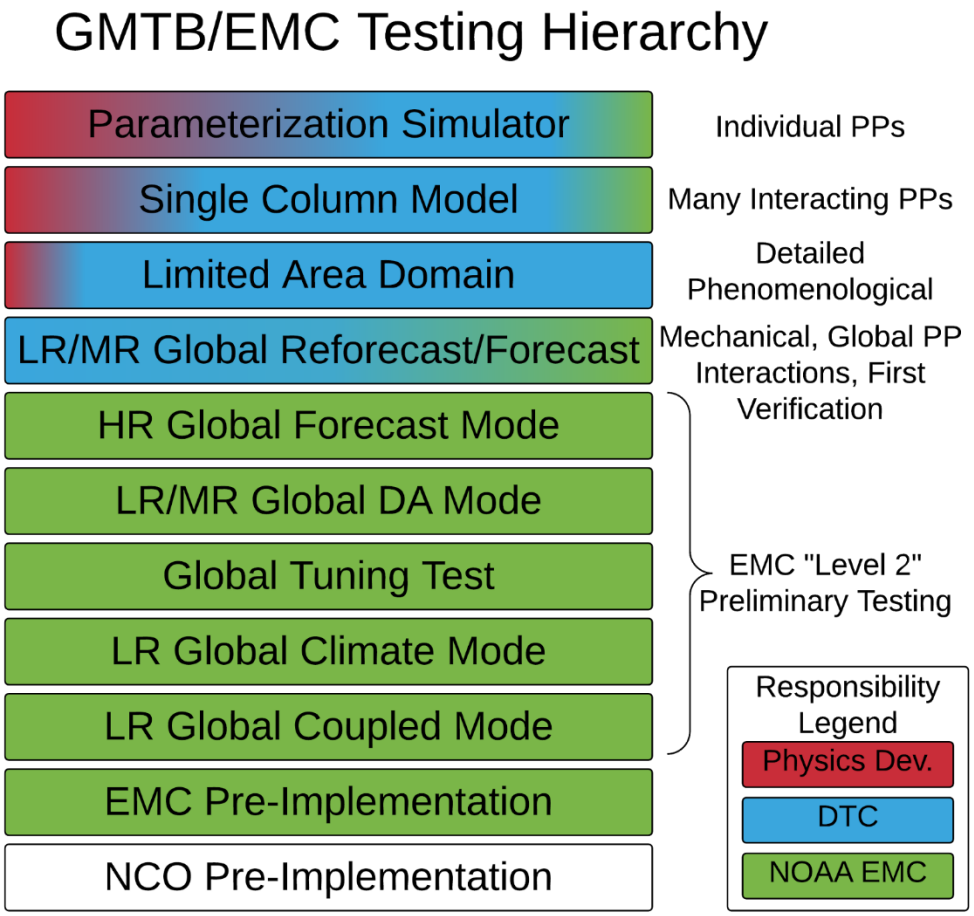
Stage II: Extensive T&E by the DTC or community

Stage III: Pre-implementation testing at Operational Center



http://www.dtcenter.org/eval/meso_mod/mmet/index.php

Hierarchical testing



LR/MR/HR=low/medium/high-resolution

GMTB is developing a test harness (initial tiers) the research community can use for conducting tests of physical parameterizations

Physical parameterizations that pass initial tests can be transferred to EMC for further testing

DTC Visitor Program

- Supports visitors to work w/ the DTC to test new data assimilation, forecasting & verification techniques, models & model components for NWP
  - PI project – up to 2 months salary & travel & per diem
  - Graduate student project - up to 1 year temporary living per diem stipend & travel expenses for student to work w/ DTC &/or one of its partners + travel & per diem for up to 2 2-week visits to the location of the student by project PI
- Looking for subject-matter-experts to collaborate with DTC on T&E activities
- Welcome projects that add new capabilities to supported software
- Currently accepting proposals – funding is available!

http://www.dtcenter.org/visitors/