Developmental Testbed Center: Facilitating R2O for Numerical Weather Prediction

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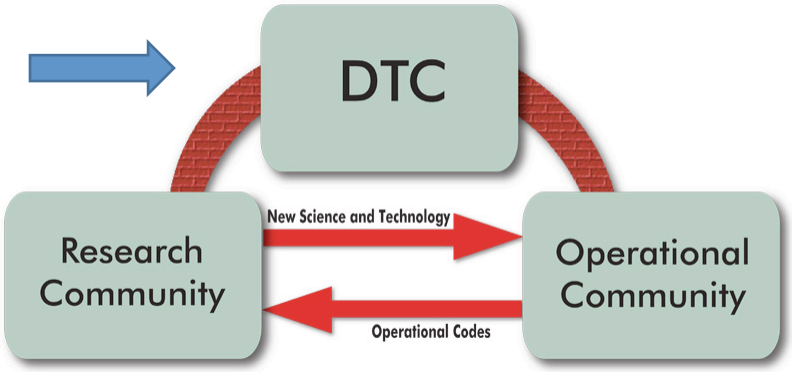
Developmental Testbed Center

1. National Center for Atmospheric Research
2. NOAA Earth System Research Laboratory

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

Distributed facility:
NCAR & ESRL



Software Systems

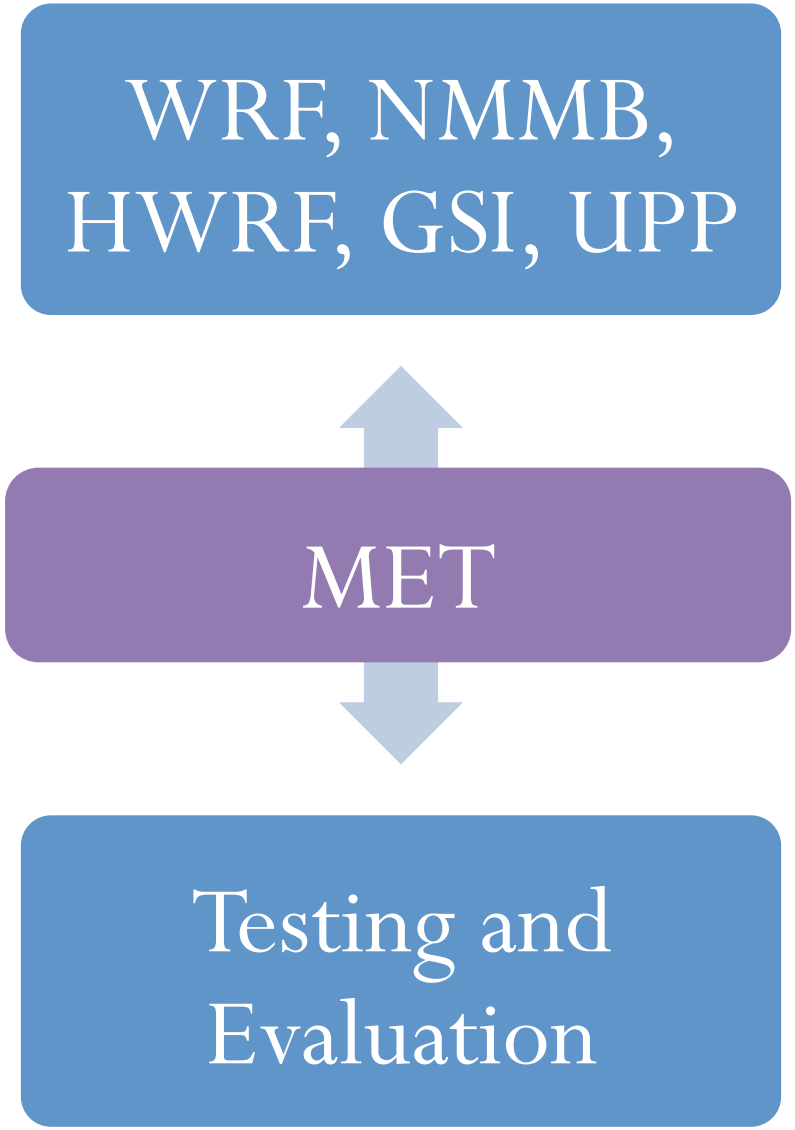
- Include capabilities of operational system
- Distributed development
- Code management plans

Verification Tools

Current foci:
mesoscale modeling, hurricanes, data assimilation & ensembles

Testing and Evaluation

- Diagnostics of current operational systems
- Performance of new innovations



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Global Model Test Bed (GMTB)

- New effort in support of NOAA's R2O initiative
  - Objective: Design, develop, and implement a Next-Generation Global Prediction System (NGGPS) with the goal of providing enhanced forecasting capability from a few hours to 30 days
- Focus areas for GMTB during the 1st year
  - Code management, testing, and support of a Common Community Physics Package (CCPP)
  - Code management and user support for the Interoperable Physics Driver
  - Integration, testing and improvement of a sea ice model for NGGPS
  - Community events
    - Sea Ice Model Workshop
    - NGGPS Physics PI Workshop
- All areas will be a joint effort between NCAR and GSD nodes

Examples of how DTC is engaging the research community

In the context of

- T&E feedback loop, including new/modified capabilities and diagnostic tools
- Providing assistance to community developers
- Providing framework for research community T&E
- Workshops

DTC's role in HWRF development: connecting the pieces

2013

- DTC tests HWRF w/ RRTMG/Thompson – mixed results w/ degradations in the eastern North Pacific
- EMC tests RRTMG – poor results for bundled tests

2014

- Fo… stics &
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Related papers – Tuesday 1:30 – 3:15 pm

- Paper 3.1 Fovell and Bu
- Paper 3.2 Holt et al.

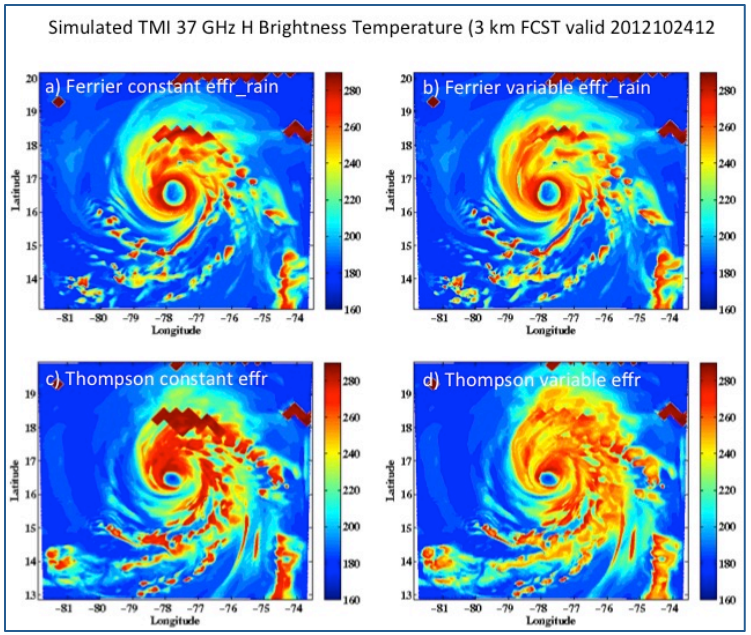
2015

- RRTMG, eddy mixing and subgrid-scale cloudiness schemes delivered to EMC and included in 2015 operational HWRF

Assisting community with software system contributions

- J. Otkin's team at U. Wisconsin CIMSS (HFIP grant) added innovations to UPP – the NCEP Unified Post Processor, used by all NCEP models
- DTC's role
  - Connect U. Wisconsin team with UPP and CRTM developers at NCEP for planning
  - Assist U. Wisconsin team with incorporating developments into HWRF code repository

- Added sensors for synthetic satellite images
  - GOES-13 and GOES-15 imagers, channels 2-5
  - (MSG) SEVIRI imager , channels 5-11
  - (F13-15) SSMI, channels 1,2,4,5,6,7
  - (F16-F20) SSMIS, channels 9,12,13,15,16,17,18
- Improved computation of hydrometeor effective radii
- User configuration files simplified



Mesoscale Model Evaluation Testbed (MMET)

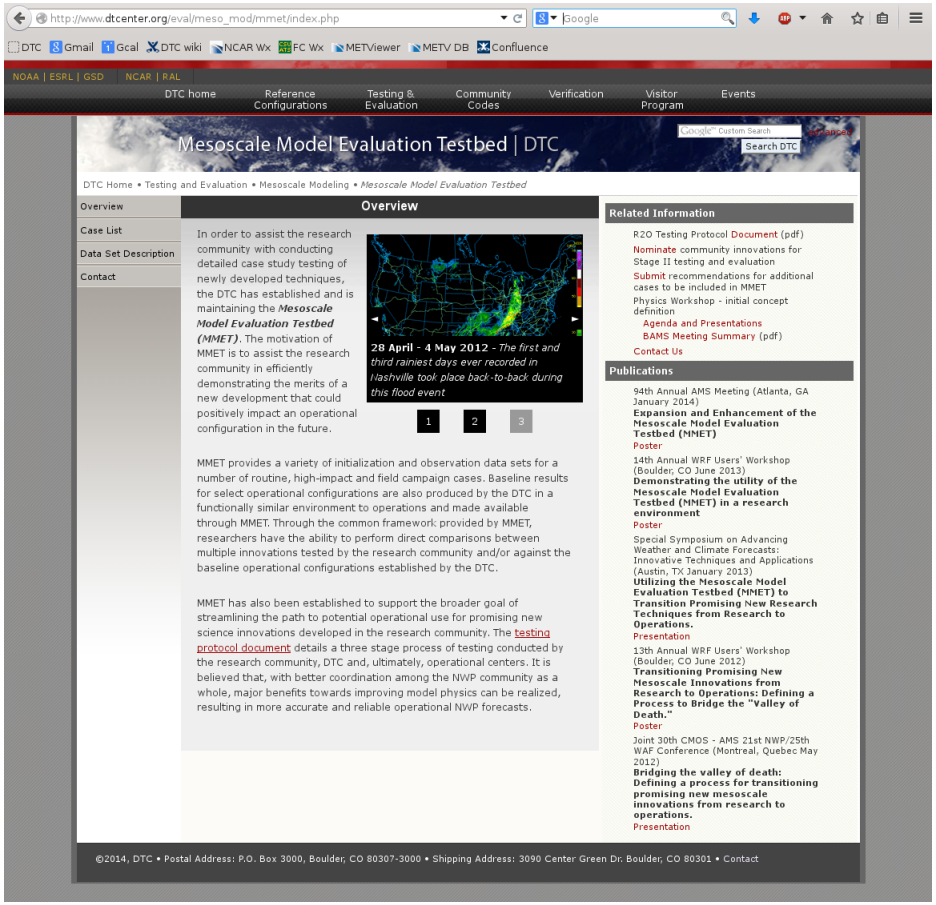
Why: Assist the research community in efficiently demonstrating the merits of a new development

- Provide a common framework for testing; allow for direct comparisons

What: Mechanism to efficiently *assist* research community *with initial stage of testing*

- Provide model input and observational datasets to utilize for testing
- Establish and publicize baseline results for select operational models

Where: Hosted by the DTC; served through **R**epository for **A**rchiving, **M**anaging and **A**ccessing **D**iverse **DA**ta (RAMADDA)



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

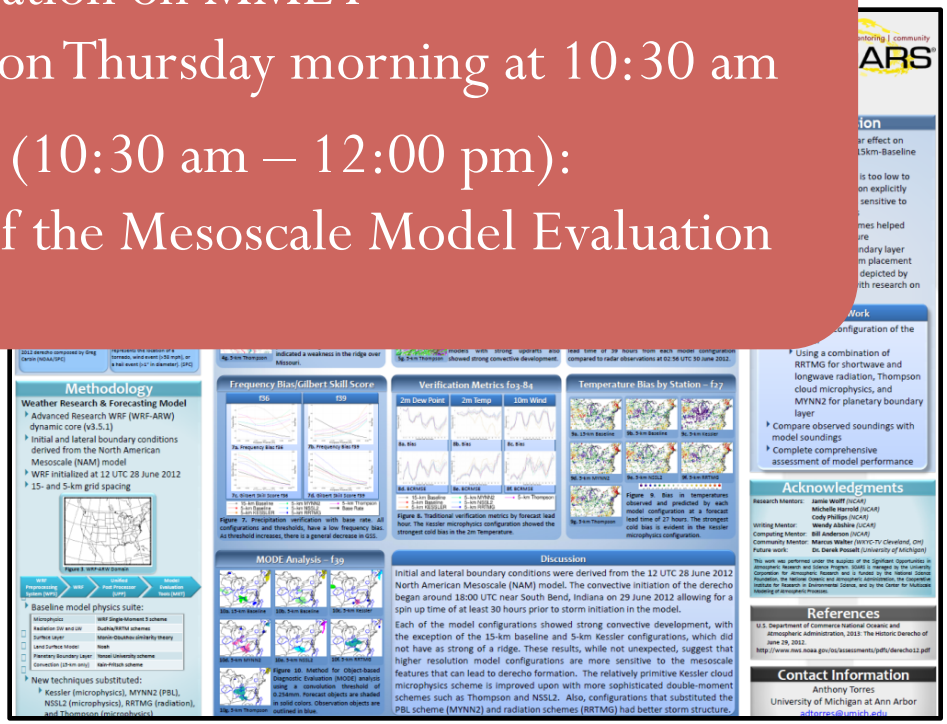
Date(s)	Meteorological Scenario
20090228	Mid-Atlantic *snow storm* -NAM high QPF shifted too far north
20090311	*High dew point NAM* predictions - upper Midwest and in areas of snow
20091007	*HIRESW* runs *underperformed* compared to coarser NAM model
20091217	"*Snowpocalypse '09*"
20100428-0504	Historic Tennessee *flooding* associated w/ an atmospheric river
20110404	Record breaking *severe* report day
20110518-26	Extended *severe weather* outbreak
20111128	*Cutoff low* over SW US
20120203-05	*Snow storm* over Colorado, Nebraska, etc.
20120628	*Derecho* event
20130729	*Mesoscale convective system* (MCS) over SE Kansas
20130908-14	Historic Colorado *flooding*
20140105	*Arctic air outbreak* impacting much of the United States east of the Rockies
20110214-17	*Atmospheric river* impacting the West Coast

MMET – Community Use
User Cases – Anthony Torres

- SOARS Protégé in Summer 2014 from University of Michigan
- Used MMET to investigate 29 Jun '12
- [illegible]
  (microphysics) and **Thompson w/ MYNN2** (microphysics/radiation)
- Performed traditional and spatial verification using the Model Evaluation Tools (MET)

More information on MMET –

- Paper 6a.7 Hertneky et al. on Thursday morning at 10:30 am
- Friday instructional session (10:30 am – 12:00 pm): Demonstrating the utility of the Mesoscale Model Evaluation Testbed (MMET)



Workshop on Parameterization of Moist Processes for Next-Generation NWP Models

Goal: Inform & advise the future directions of moist process parameterization development, w/ emphasis on NWP applications for scales & resolutions ranging from synoptic-scale to convective permitting scale

Organizing committee: Jamie Wolff (DTC), Yu-Tai Hou (EMC), Jim Doyle (NRL), Robert Pincus (CIRES)

27-29 January 2015 @ NCWCP, College Park, MD

80+ scientists from leading centers around the world

In-depth discussions on state-of-the-science and current operational status at NCEP for microphysics, sub-grid scale clouds and turbulence, and deep convection

DTC Visitor Program

- Supports visitors to work w/ the DTC to test new 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
- Also welcome proposals employing MMET cases to investigate avenues for addressing known weaknesses of operational systems
- Currently accepting proposals – funding is available!

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

Other DTC-related presentations

- Mesoscale Modeling
  - 3.6 Harrold et al. – Assessment of ACM2 PBL scheme & Pleim-Xiu surface schemes within the WRF system
  - P34 Wolff et al. – Establishing a functionally similar operational environment for the hourly-updating NAM forecast system: Current status & future plans
- Data Assimilation
  - 4a.6 Newman et al. – Indirect impact of ozone assimilation using the GSI DA system for regional applications
  - P9 Zhou et al. – Regional applications of the GSI-hybrid DA for high-resolution tropical storm forecasts: Tackling the intensity spin-down issue in 2014 HWRF
- Hurricanes
  - 6a.1 Biswas et al. - Evaluation of QPF by the HWRF model
- Ensembles
  - P36 Jankov et al. – Mode uncertainty in NARRE: Multi-physics vs. stochastic approach
- Verification
  - P57 Jensen et al. – Recent advancements of verification capability for R2O T&E within the DTC
- Infrastructure
  - P59 Carson et al. – NITE: An infrastructure to facilitate development of NCEP numerical models