NOAA Testbeds & Proving Grounds Workshop
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Developmental Testbed Center: Facilitating R2O for Numerical Weather Prediction

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Developmental Testbed Center

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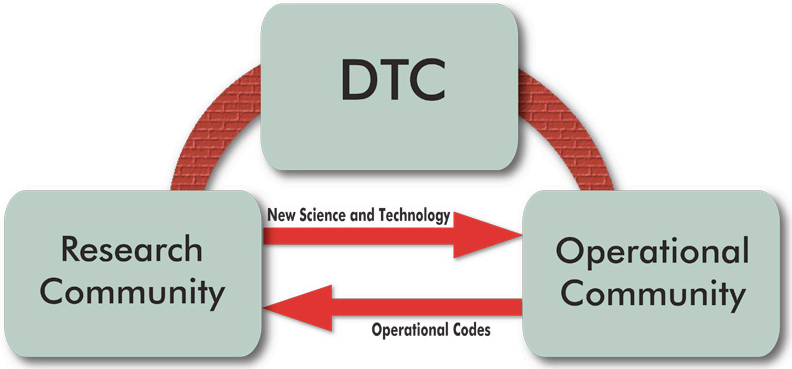
What is the DTC?

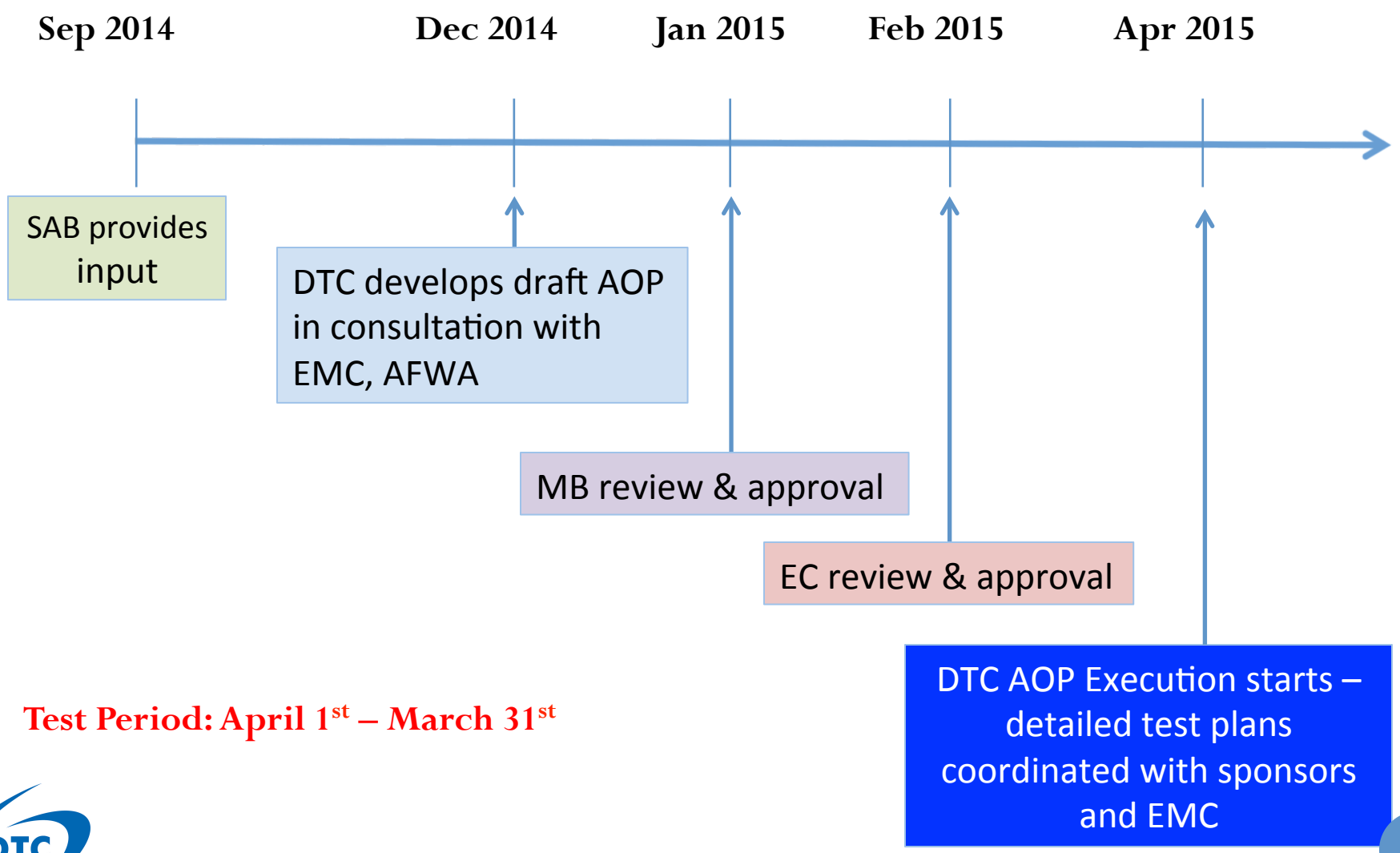
- **Purpose**: Facilitate the interaction and transition of NWP technology between research & operations
  - **O2R**: Support operational NWP systems to the community
  - **R2O**:
    - Partner with developers to get innovations into centralized code
    - Perform diagnostics on and test and evaluate promising NWP innovations for possible operational implementation
  - **Interaction between R & O**: Workshops, visitor program, newsletter



While the DTC has been focusing exclusively on limited-area applications, future activities will include global NWP systems

DTC is jointly sponsored by NOAA, Air Force, NSF, and NCAR

How does the DTC decide what to test?



Test Period: April 1st – March 31st

How does the DTC decide what to test?

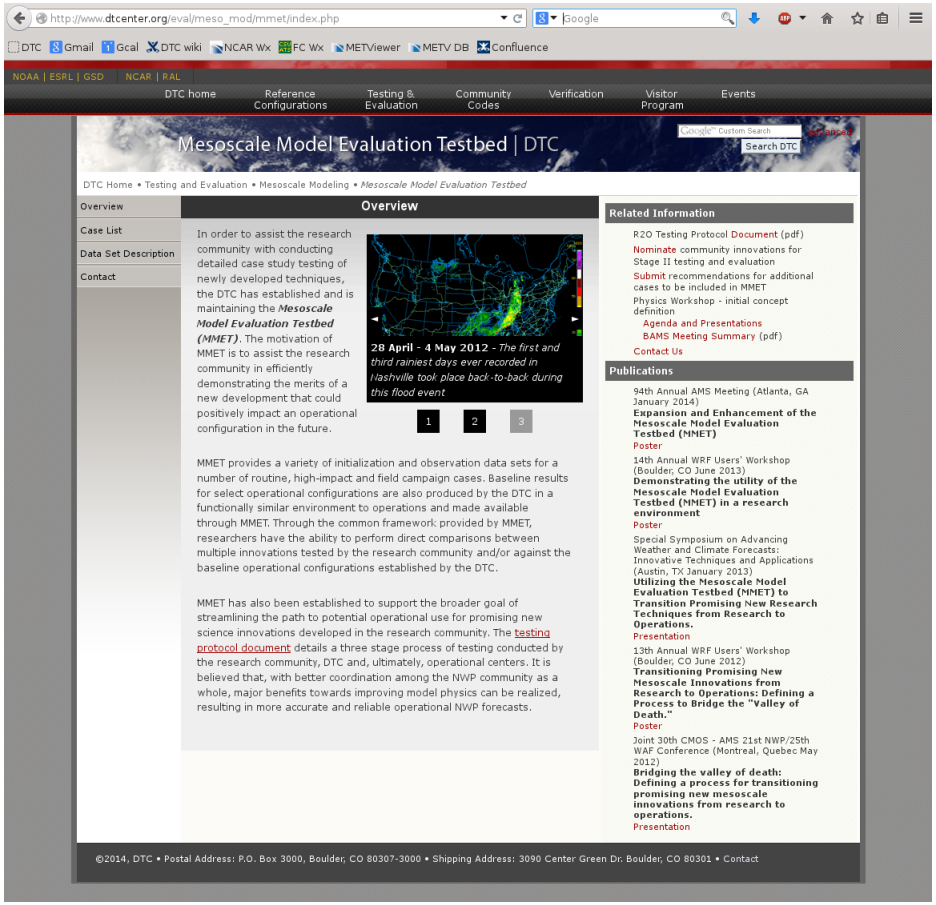
Mesoscale Model Evaluation Testbed

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

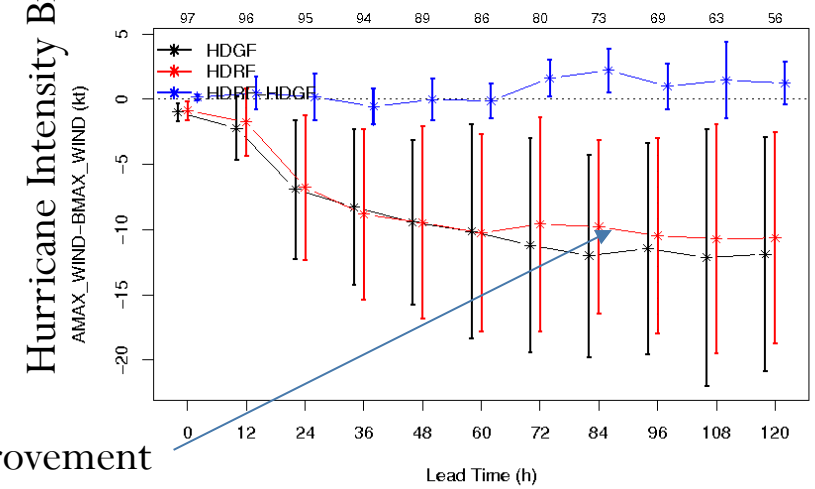


http://www.dtcenter.org/eval/meso_mod/mmet/index.php

Also see Jensen et al. poster tomorrow on DTC verification methods and software

Examples of tests - AOP 2014

HWRF radiation/clouds



Improvement

Improved EP intensity bias by using
(1) a "partial cloudiness" (in grid cell) parameterization
(2) an alternate radiation

Transitioned to EMC (testing & impl.)

See Bernardet et al. talk tomorrow

NMMB microphysics

(1) Connected Thompson microphysics to NMMB

(2) Compared performance against control with Ferrier microphysics

See Wolff et al. talk tomorrow

Pre-NARRE physics

Conducted test to choose physics configurations for the experimental EMC/GSD/DTC regional ensemble with ARW and NMMB members. Now running in realtime

See Jankov et al. talk tomorrow

Codes Supported by DTC

Software	Type	Developers	Repository	DTC's role
WRF NMM phasing out in 2015	mesoscale model	NCAR, GSD	NCAR	Assist w/ rep maintenance & community contributions Community support for NMME
UPP	post-processor	EMC	EMC Community	Maintain community repository (sync & portability) Community support
NMMB New in 2015	mesoscale model	EMC	EMC DTC	Portability & friendly user releases Assist w/ community contributions Documentation
GSI	data assimilation	EMC, NASA, GSD, NCAR, NESDIS	EMC Community	Chair GSI Review Committee Maintain community repository (sync & portability) Assist w/ community contributions Community support
EnKF New in 2015	ensemble – GSI-hybrid	EMC, GSD	EMC	Working w/ dev to build code mgmt framework Documentation
HWRF	tropical cyclone	EMC, HRD, URI, GFDL	Community (10 components)	Chair HWRF Developers Committee Transition ops capability to component repositories Repository maintenance Support for system run scripts Community support
MET	verification	NCAR	NCAR	Maintain repository and advance capability Community support

Accomplishments during last AOP

GSI

- New multiple-platform compilation tool using Autotools – unify community and operational compilation tools

NMMB

- Capability to run w/ Thompson microphysics and RUC LSM
- Consistent coupling between Thompson microphysics scheme and the Rapid Radiative Transfer Model (RRTM) radiation scheme

UPP (J. Otkin – CIMMS – U. Wisconsin)

- New and improved synthetic satellite image capabilities

HWRF

- Atmosphere
  - Enhanced physics interoperability
    - Radiation – RRTMG
    - Microphysics - Thompson and WSM6
    - Consistent coupling between Thompson microphysics & RRTMG radiation schemes (also available for ARW)
  - Physics enhancements/innovations
    - Improvements to GFS PBL eddy mixing (visitor: R. Fovell – UCLA)
    - Subgrid-scale cloudiness scheme (also available for ARW)
- Ocean (visitor: Yablonsky – URI)
  - Capability to run coupled HWRF in all global basins
  - Extensive diagnostics and graphics
  - Flexible MPIPOM-TC initialization

DTC co-sponsored events in AOP 2014

- Annual WRF Users Workshop (June 2014)
- Parameterization of Moist Processes for Next Generation Weather Prediction Models Workshop (co-sponsored with NGGPS & HIWPP; January 2015)
- Workshop on Numerical Prediction of Tropical Cyclones (Taiwan, May 2014)
- 6th NCEP Ensemble User Workshop (March 2014)
- MPAS Workshop at Offutt Air Force Base (September 2014)

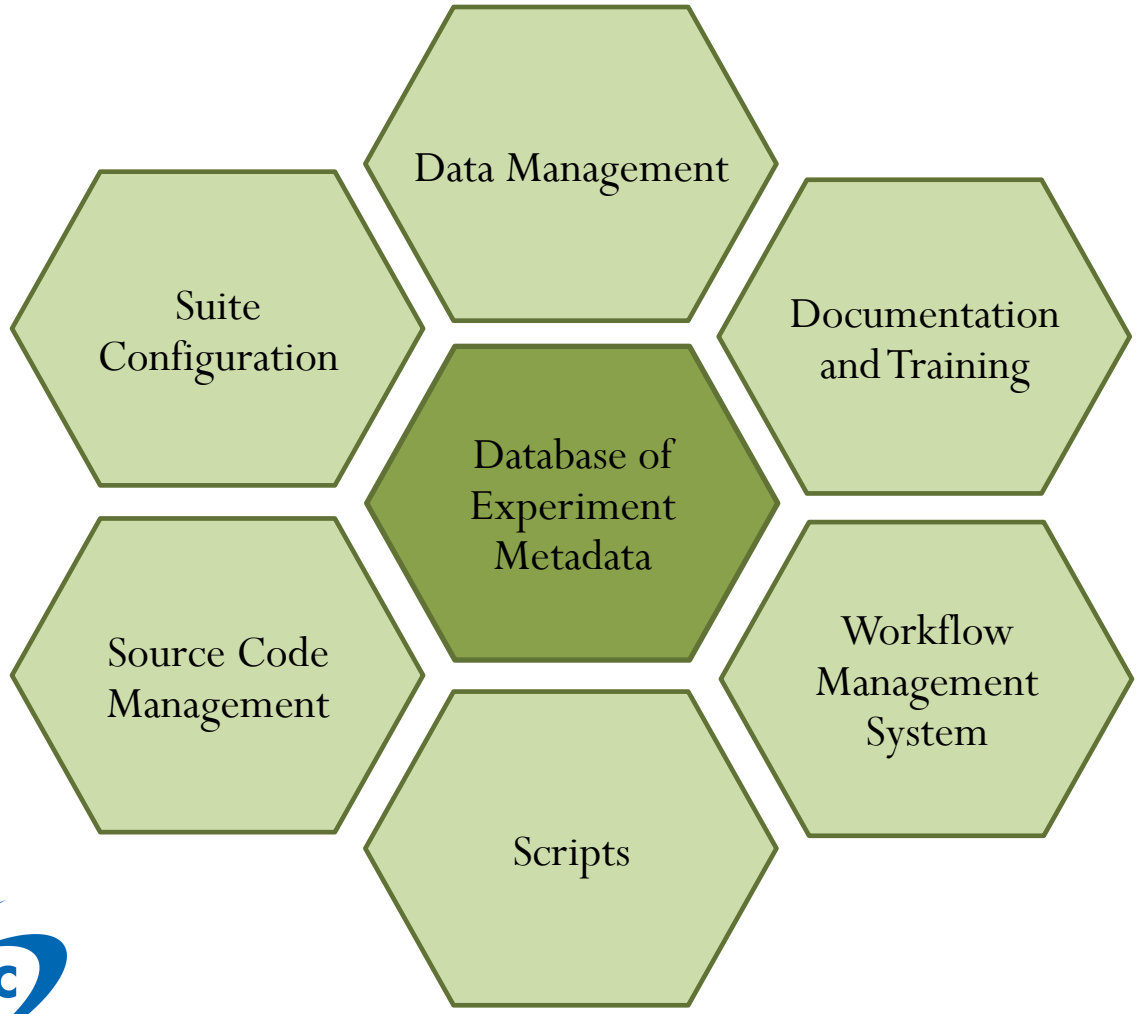
Currently accepting proposals - PI 2 month support, or grad student 1 year + travel

DTC Visitor Program – AOP 2014		
T. Galarneau	NCAR	Diagnosing tropical cyclone motion forecast errors for HWRF (2013)
R. Fovell & Peggy Bu	UCLA	Improving HWRF track and intensity forecasts via model physics evaluation and tuning (2013)
M. Mittermaier	UKMET	Incorporating observations uncertainty to a spatial probabilistic verification framework for km-scale models (2013)
Shaowu Bao	Coastal Carolina University	Evaluation of Two HWRF Microphysics/Radiation Configurations with Remote-sensing Data
István Geresdi	University of Péc	Towards Improving Representation of Convection and MCC Longevity in High-Resolution WRF and NEMS-NMMB model forecasts
Hongli Wang	Colorado State University (CIRA)	Estimation of Initial and Forecast Error Variances for the NCEP's Operational Short-Range Ensemble Forecast (SREF) System
Richard Yablonsky	University of Rhode	Developing and Supporting Global HWRF Ocean Coupling with Advanced Ocean Physics and Initialization Options and New Diagnostic Tools for Comprehensive Model Evaluation
Thomas Galarneau	NCAR	Diagnosing Tropical Cyclone Motion Forecast Errors in the 2014 HWRF Retrospective Test (H214)
Paul Roebber	University of Wisconsin - Milwaukee	Demonstration Project: Development of a Large Member Ensemble Forecast System for Heavy Rainfall using Evolutionary Programming

http://www.dtcenter.org/visitors

See Carson & Bernardet poster tomorrow

NWP Information Technology Environment



DTC has prepared a design for NITE - an infrastructure to facilitate NOAA and non-NOAA scientists in conducting experiments with NCEP operational models

Investment in NCEP infrastructure to support scientists was a recommendation of the DTC Science Advisory Board and the UCACN

What are DTC AOP 2015 Plans?

- **Visitor Program**
- **WRF Users Workshop (15-19 June 2015)**
- **MMET** (add new, tough events/case studies)
- **Community and/or developer/infrastructure support for NWP codes**
  - NEMS-NMMB, WRF, HWRF, UPP, GSI, EnKF, NARRE, MET
- **MET:** Evaluation & Testing; Reaching out and connecting with NCEP
- **NITE**
  - NWS will lead development, DTC will be a partner
- **Regional ensemble-based (and hybrid) DA T&E**
  - Currently NCEP regional models use GFS ensemble for DA
  - DTC will develop and test regional ensemble for DA
- **HWRF physics improvement**
  - Diagnostics and development to improve connection cloud-radiation, crucial for a good representation of environment and storm processes
- **NARRE stochastic physics**
  - Work toward next-generation NCEP regional ensemble by comparing multi-physics vs stochastic physics for selecting members

What are the Future Opportunities?

Global DTC?

Next-Generation Global Prediction System (NGGPS):

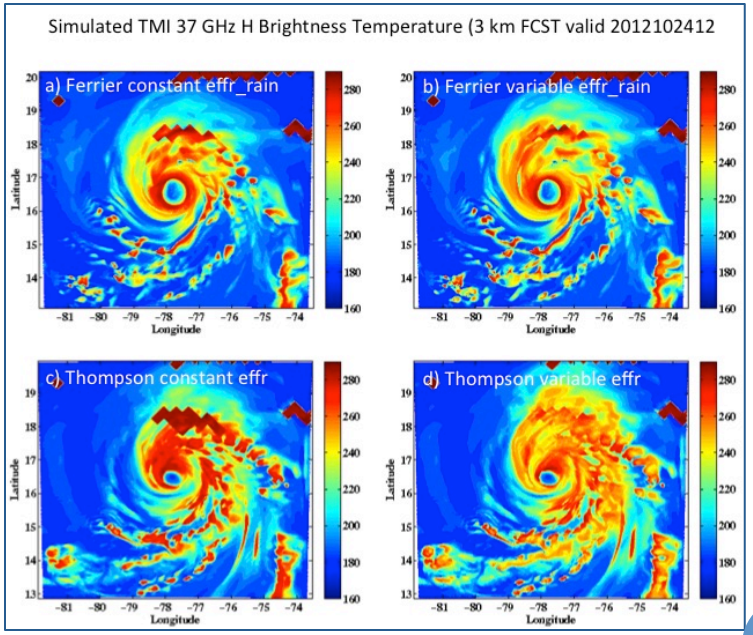
- Goal: A non-hydrostatic, very-high resolution (convection permitting) global model, equipped with advanced data assimilation and physical parameterization.
- Project Plan: selection of dynamic core in ~ 18 months, and a full model in five years.
- The development and operation of NGGPS will lead to significant changes in the entire NCEP modeling suite:
  - The function and roles of current regional forecast systems will need to change
  - Provides a basis for "unified modeling framework", as recommended by UCACN
- Potential DTC contributions
  - Connection with community to harness contributions
  - Infrastructure to facilitate distributed development
  - Testing and evaluation of innovations

Backup Slides

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
- On schedule for transition to EMC trunk and use in NCEP operations in 2015
- 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



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

Courtesy of Tom Galarneau

Diagnosing TC Motion Errors in H213

Purpose: Apply TC motion error diagnostic equation from Galarneau and Davis (2013; *MWR*) to short-range (24-h) H213 forecasts

Equation: TC motion error = environment wind error + storm radius error + vertical depth error

Results:

- Environment wind errors are dominant contributor to motion errors on average
- Westward-moving TCs are too slow due to subtropical ridge that does not extend far enough west
- Northwestward-moving TCs are sensitive to vorticity asymmetries near the TC vortex on western flank of subtropical ridge
- Northeastward-moving TCs are slow due to weaker and more zonal midlatitude steering flow/ waveguide

Climatology of H213 TC motion errors for NE-moving TCs