

Bridging the Gap between Research and Operations using the Mesoscale Model Evaluation Testbed (MMET)

16th Annual WRF Users' Workshop
18 June, 2015

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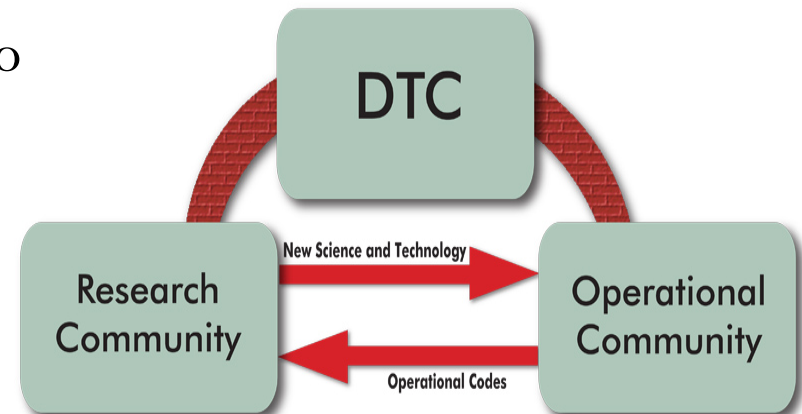
National Center for Atmospheric Research
Research Applications Laboratory and Developmental Testbed Center

DTC Mission

- The fundamental purpose of the DTC is to facilitate the interaction & transition of NWP technology between research & operations

DTC facilitates:

- **O2R** transition by making the operational NWP systems available to the research community & providing community user support
- **R2O** transition by performing testing & evaluation of new NWP innovations in a functionally similar operational environment over an extended period
- **MMET** was established by the DTC to provide a common framework for testing and evaluation to assist in streamlining the R2O process



Mesoscale Model Evaluation Testbed (MMET)

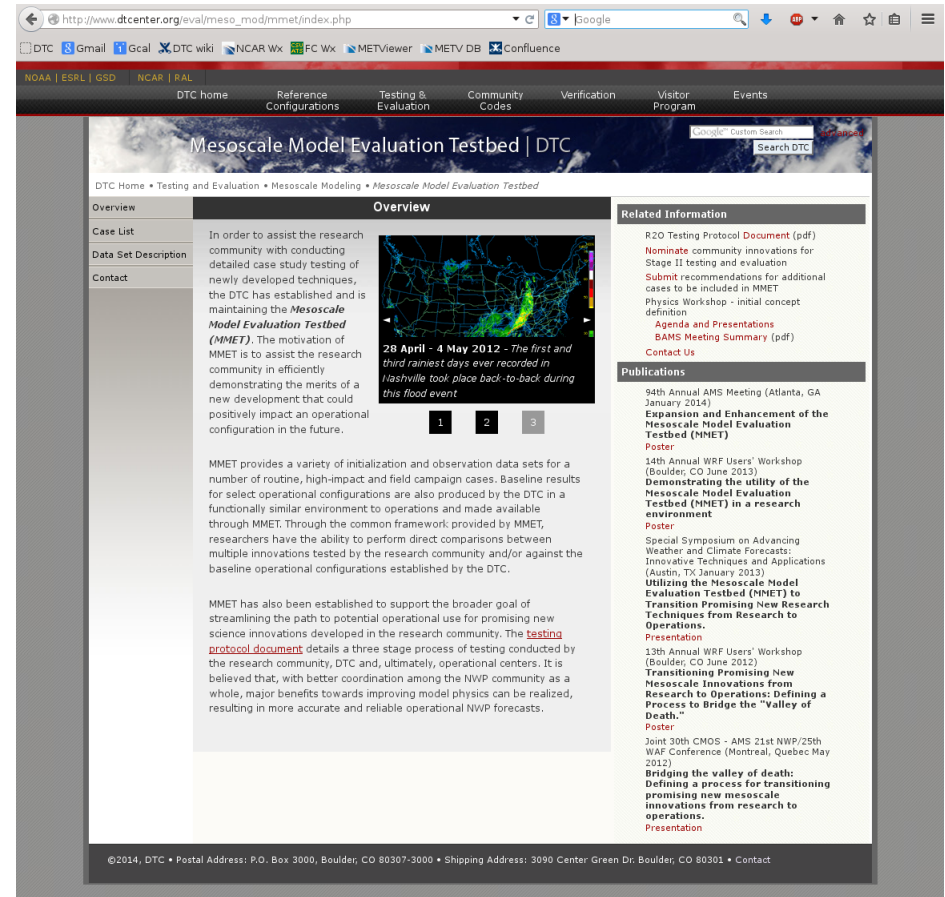
Why: Assist the research community in efficiently demonstrating the merits of a new development

- 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 Repository for Archiving, Managing and Accessing Diverse Data (RAMADDA)



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

MMET Case Inventory

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

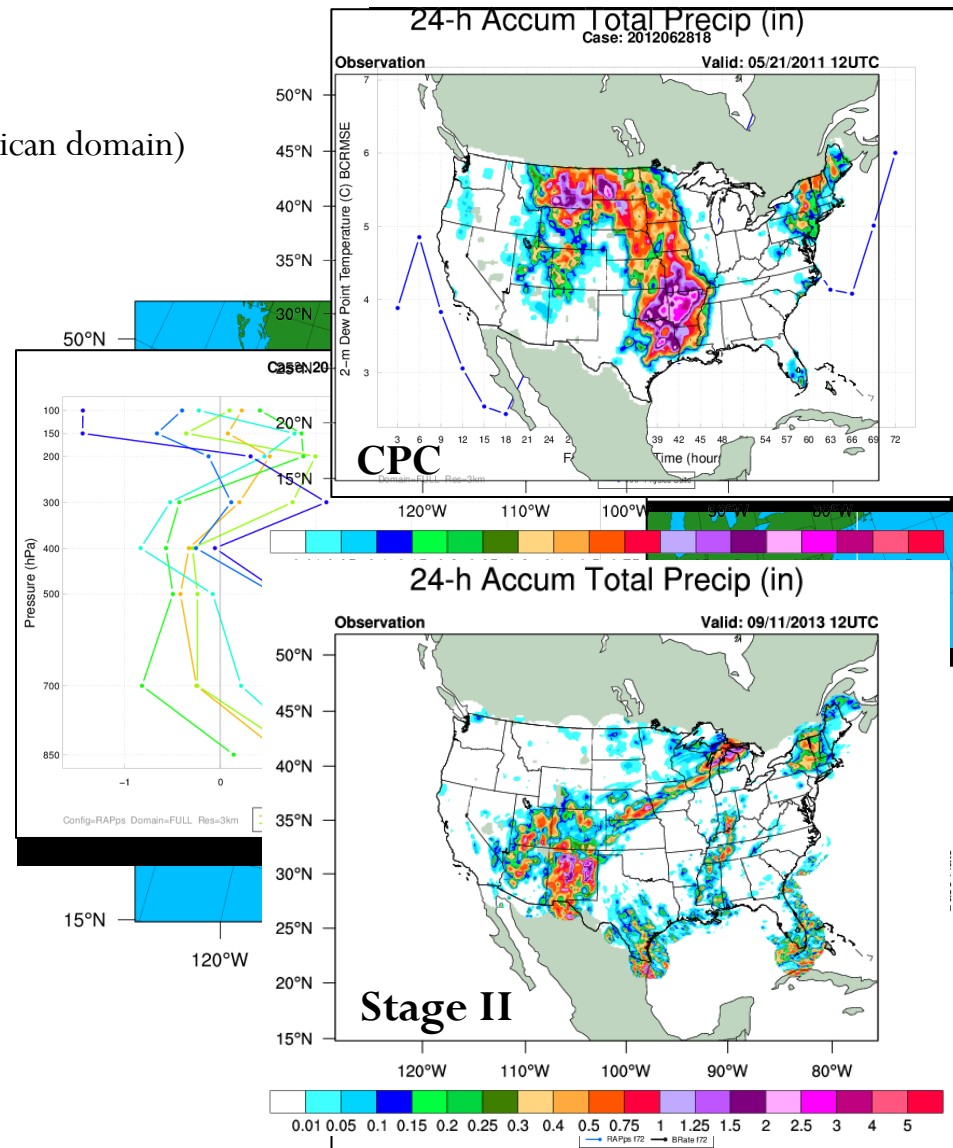
Operational Baselines

- Baseline results for select Operational Configurations (OC) using:
 - Weather Research and Forecasting - Advanced Research WRF (WRF-ARW)
 - Air Force OC
 - NOAA Environmental Modeling System – Nonhydrostatic Multiscale Model on the B-grid (NEMS-NMMB)
 - North American Mesoscale Forecast System (NAM) OC

Physics Suite	WRF-ARW Air Force OC	NEMS-NMMB NAM OC
Microphysics	WRF Single-Moment 5	Ferrier-Hires
Radiation (LW/SW)	RRTM/Dudhia	GFDL/GFDL
Surface Layer	Monin-Obukhov similarity theory	Mellor-Yamada-Janjic
LSM	Noah	Noah
PBL	Yonsei University	Mellor-Yamada-Janjic
Convection	Kain-Fritsch	Betts-Miller-Janjic

MMET Datasets of Opportunity

- Initialization datasets
 - NAM on NCEP grid 221 (32 km North American domain)
 - GFS on 0.5° grid
- Pre-processing datasets
 - WRF/NEMS namelists and metgrid output
- Model configurations
 - namelist/configuration files
- Post-processing scripts
 - Parameter files and run scripts
- Graphics of model output and scripts
 - NCL scripts and plots for various fields
- Verification datasets
 - Raw and processed NDAS and precip obs data
 - NCL scripts and plots for accumulated precip
- Verification output and scripts
 - MET configuration files and run scripts
 - MET gridStat and pointStat output
 - Verification plots



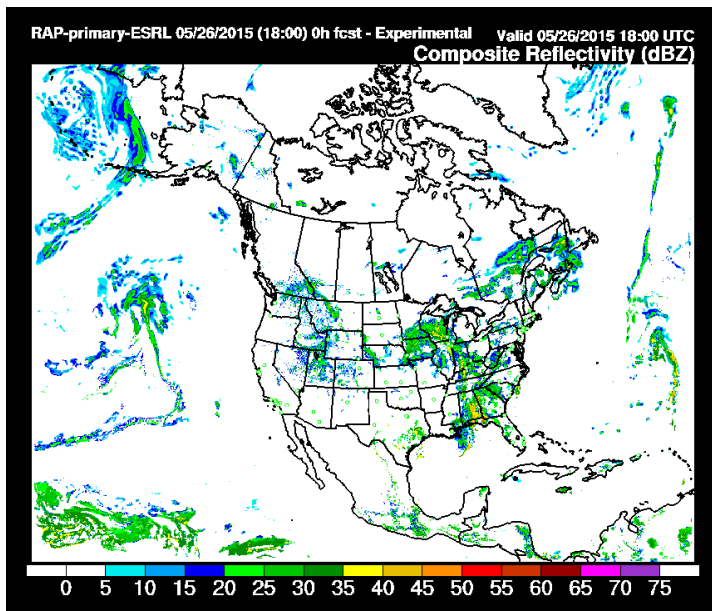
New MMET Features

- ❖ New WRF-ARW operational baseline utilizing RAP/HRRR physics configurations
- ❖ Addition of the RAP 13 km initialization dataset
- ❖ Implementation of the Gridpoint Statistical Interpolation (GSI) system
- ❖ Automated re-gridding capability within MET
- ❖ Addition of a hurricane case using the Hurricane WRF (HWRF)

New WRF-ARW baseline utilizing the RAP and HRRR OC

- ❖ RAP physics suite used for parent domain
- ❖ HRRR physics suite used for nests

Physics Suite	WRF-ARW RAP/HRRR OC
Microphysics	Thompson
Radiation (LW/SW)	RRTMG/RRTMG
Surface Layer	MYNN
LSM	RUC
PBL	MYNN 2.5
Convection	Grell-Freitas (RAP)

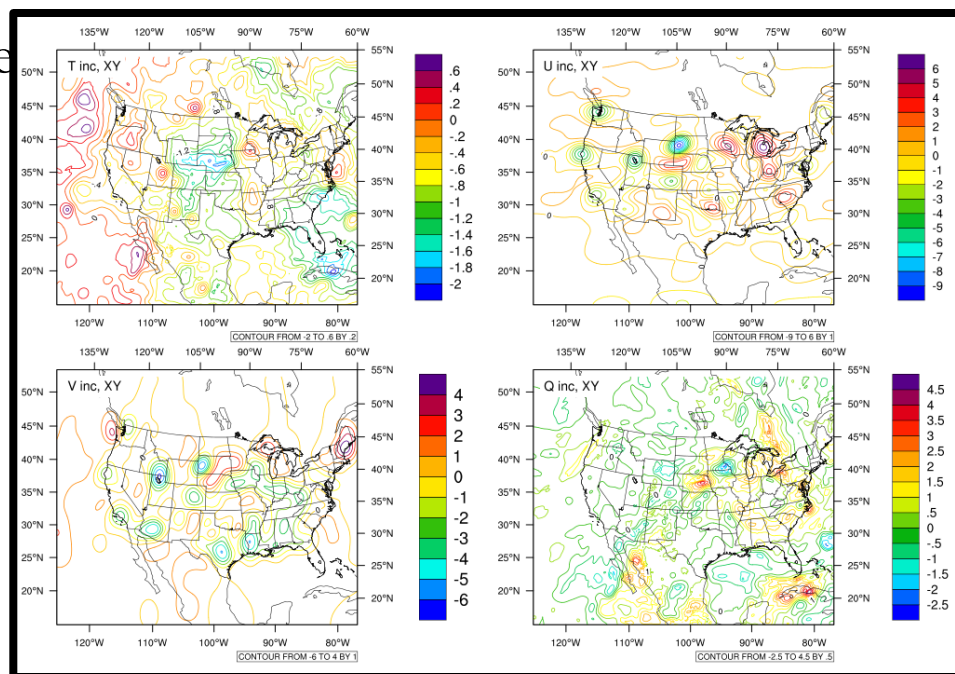


Addition of 13 km RAP initialization dataset

- ❖ Inclusion of RAP provides the user community with an additional option for initial and lateral boundary conditions from an operational model

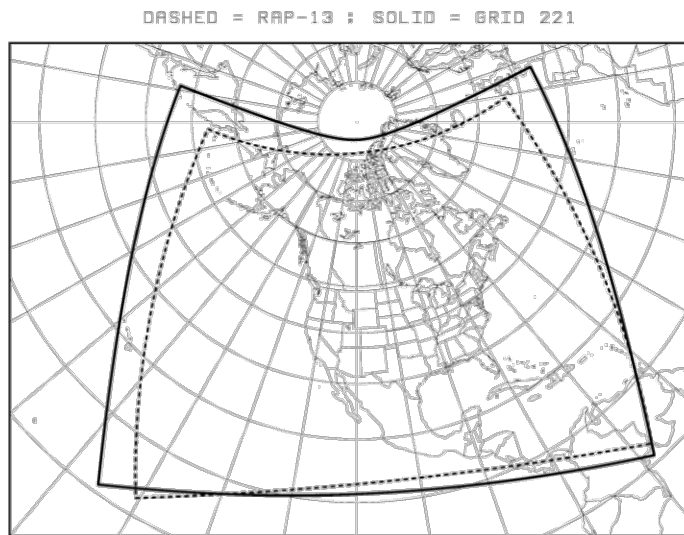
Gridpoint Statistical Interpolation (GSI) System

- Currently being implemented for use in WRF and NEMS MMET baseline configurations
 - Using the community version (currently v3.3)
 - Includes a 6-hr warm start spinup option with the assimilation of GDAS observation data which includes conventional and satellite radiance data
- All necessary files to run GSI are provided for each case
 - Script for running GSI and fixed files needed for the system to properly run
 - GDAS observation data



Re-gridding capability within MET

METv5.1 (coming soon) includes a basic capability for automated re-gridding



Interpolation options:

- Unweighted mean
- Distance-weighted mean
- Min, max, median
- Least squares
- Bilinear
- Budget

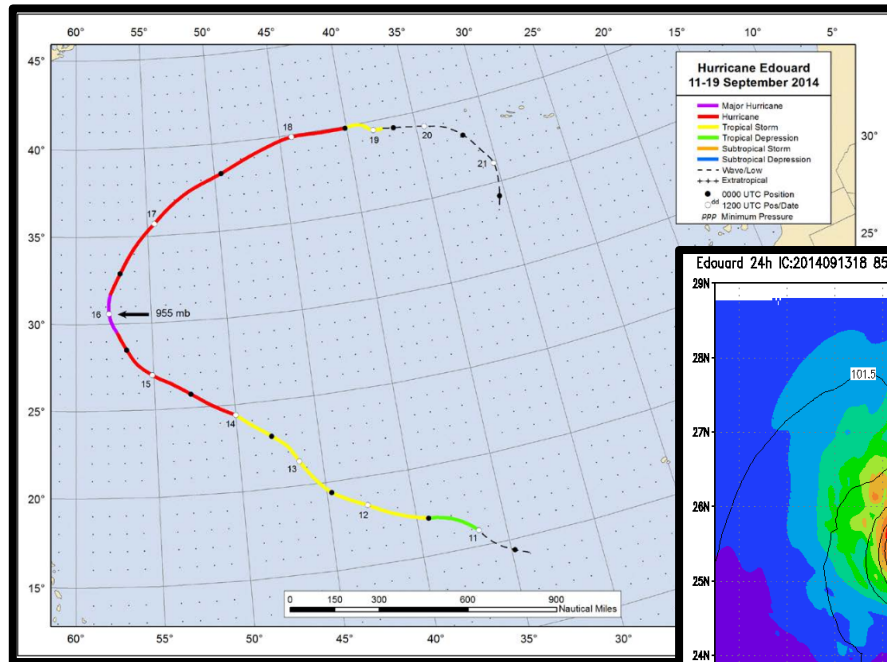
Re-gridding options:

- To forecast grid
- To observation grid
- To pre-defined grid (e.g. NCEP G221, user generated)
- To a grid specification (similar concept to UPP *copygb*)

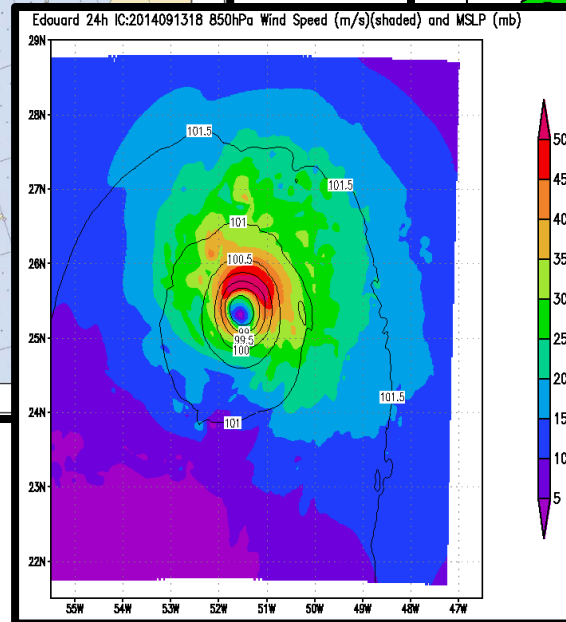
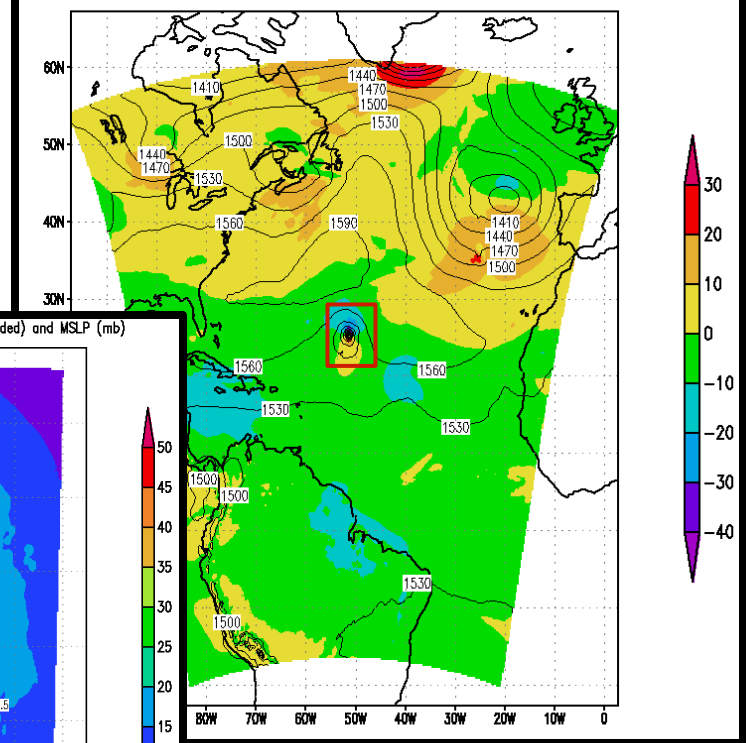
ALSO: Stand-alone tool available for re-gridding outside statistical tools

Upcoming Hurricane Case

Prime candidate: Hurricane Edouard
September 2014



Edouard 24h IC:2014091318 850hPa U (m/s)(shaded) and Geop ht (gpm)



Summary

- MMET serves as a common testing framework for testing and evaluation to assist in streamlining the R2O process
- Provide initialization/observation datasets as well as baseline results for 14 high-impact/routine weather cases
- New MMET capabilities include:
 - New baseline using the RAP/HRRR physics suites
 - Addition of 13-km RAP initialization data
 - Implementation of GSI
 - Re-gridding capability within MET
 - Addition of a hurricane case

Questions?

Thank You!

Contact information for MMET Team

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★ Instructional Session ★

*“Demonstrating the utility of the
Mesoscale Model Evaluation Testbed
(MMET)”*

*Friday, June 19th
10:30 AM – 12:00 PM*

