

# **HIWPP Test Program**

## **February 9, 2016**

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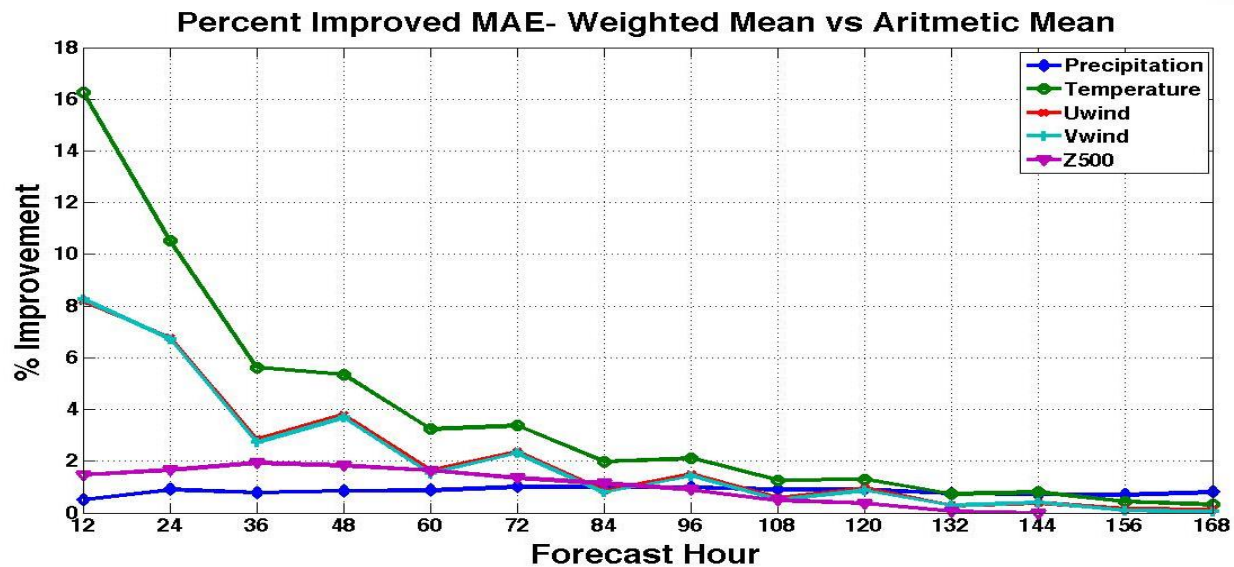
# Tasks

- 1. Ensemble Statistical Post-Processing**
2. Visualization & Extraction via NEIS
- 3. Verification**
- 4. Real-time IT Operations**

# Statistical Post-Processing

- Initial objective: combine a few high-resolution deterministic weather models to obtain a more skillful forecast
- At each grid point, produces model weighting that is inversely proportional to the MAE at that point in 30 days of training data

- 2m temp
- 10m winds
- Z500
- 6-hr precip



- Standard deviation of the weighted forecast error in the training period at each grid point (T2m, U/V10m, Z500).
- For precipitation, the probability of exceeding 1mm, 5mm and 10mm of precipitation .

# Statistical Post-Processing

## Additional research areas

- Evaluation of field alignment method, which allows quantification and removal of displacement and amplitude errors
- Extension of post-processing code to ensembles of 20 or more members, permitting evaluation of GEFS and FIM ensemble research
- Evaluating the feasibility and benefit of methods developed to improve precipitation forecasts at a regional scale in the Sandy Supplemental Blender project, applied at a global scale within HIWPP

# Verification - objectives

Metrics available for evaluation of HIWPP hydrostatic models

- Retrospectives
- Real-time

Unified platform to view both:

- EMC's VSDB verification images
- GSD interactive web-based images


Enhancements including some of:

- Advanced precipitation verification
- Ensemble verification
- Multi-parameter score-cards

# HIWPP Verification Available

- Running on dedicated hardware
- Publicly accessible

U.S. Department of Commerce | National Oceanic & Atmospheric Administration | NOAA Research



**HIWPP**  
HIGH IMPACT WEATHER PREDICTION PROJECT  
*FUNDED BY HURRICANE SANDY DISASTER RELIEF SUPPLEMENTAL APPROPRIATIONS*

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## HIWPP VERIFICATION

### VSDB FILE-BASED VERIFICATION

00Z cycles - [http://hiwpp.noaa.gov/verify/HiWPP\\_realtime\\_00/](http://hiwpp.noaa.gov/verify/HiWPP_realtime_00/)  
12Z cycles - [http://hiwpp.noaa.gov/verify/HiWPP\\_realtime\\_12/](http://hiwpp.noaa.gov/verify/HiWPP_realtime_12/)


These sites display verification statistics for HIWPP Global NWP model forecasts. Statistics are currently computed for GFS and FIM on the G2 grid (2.5x2.5 degree) over five regions, Global, Northern Hemisphere, Southern Hemisphere, Tropical, and Pacific North America. The 30-year NCEP/NCAR reanalysis is used for computing pattern and anomaly correlations.

### INTERACTIVE UPPER-AIR VERIFICATION

Time Series- <http://hiwpp.noaa.gov/verify/upper-air/time-series/Welcome.cgi>  
Vertical Profile - <http://hiwpp.noaa.gov/verify/upper-air/profile/Welcome.cgi>

These sites display verification statistics for HIWPP Global NWP model forecasts. Statistics are currently computed for GFS and FIM over several regions. Data are stored in 10 mb. increments in the vertical and displayed in 50 mb. increments. Time series and vertical profiles of the statistical comparisons can be viewed.

For more detailed information on the Global models in use, please see the [model descriptions page](#).



# Verification: EMC and GSD

[High Impact Weather Prediction Project](#)  
[Earth Modeling Branch Verification Page](#)  
[National Centers for Environmental Prediction](#)

## HIWPP Global Model Experimental Forecast Performance Statistics



**HIWPP**

HIGH IMPACT WEATHER PREDICTION PROJECT

FUNDED BY HURRICANE SANDY DISASTER RELIEF SUPPLEMENTAL APPROPRIATIONS

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### HIWPP VERIFICATION

#### UPPER AIR TIME SERIES

- To **zoom** any plot, **click and drag across** the region of interest.
- To change how a curve appears, double-click (or right-click) on the curve's legend.
- To change an axis, right-click on the axis.
- **Plot matching** matches all curves against each other; only times for which all requested models produced forecasts are included in the plots, and in any averages requested. Each curve after the first is compared against the first curve, and difference curves are generated.
- **Plot Pairwise** matches each pair of curves against the other in the pair; for each pair only times for which both requested models produced forecasts are included in the plots, and in any averages requested. Within each pair the curves are compared, and a difference curve is generated.
- **Plot Unmatched** plots all available data for each curve requested. Difference curves are not generated.

[Change history](#) | [RESIDUALS](#) | [SOUNDINGS](#) | [Profiles](#)

model:	FIM9	var:	temperature	cvr:	All		
region:	7 (Global)	stat:	rms	valid:	All Times		
bottom:	1000	top:	100	avg:	None		
proj:	0						
model:	GFS	var:	temperature	cvr:	All		
region:	7 (Global)	stat:	rms	valid:	All Times		
bottom:	1000	top:	100	avg:	None		
proj:	0						
Dates:	2016	Jan	9	through	2016	Feb	8

- The site displays verification statistics for the following regions:
  - **G2**: North America, 180E-320E, 20N-75N
  - **N60**: 60N-90N
  - **S60**: 60S-90S
  - **NSA**: N. South America
- Pattern correlations for all NW models against the NCEP/NCAR reanalysis.
- Please see [this presentation](#) for more details.



# Verification – MATS web interface

- Installing GSD's interactive web application uses Java Applets:
  - Have been labeled a major security risk
  - No longer supported by Chrome and some other applications

## MATS

Model

Assessment

Tool

Suite

- Uses HTML5 in place of Java Applets

The screenshot displays the MATS web interface configuration panel. At the top, there are radio buttons for 'Plot Type' (selected), 'Time Series', and 'Profile'. Below this is a date range selector showing '6/14/2015' to '7/14/2015'. Further down, there are radio buttons for 'show matching diff', 'pairwise diffs', and 'no diffs'. A list of data series is shown, including 'FIM9: FIM9:global, 1000-100mb temperature RMS 0h BOTH None' and 'GFS: GFS:global, 1000-100mb temperature RMS 0h BOTH None', each with 'Remove' and 'Edit' buttons. Action buttons include 'Plot Unmatched', 'Plot Matched', 'Save Settings', and 'Remove All'. A green bar contains 'Add Curve', 'Restore Settings', and 'Reset to Defaults'. Below are dropdown menus for 'label', 'model' (GFS), 'region' (global), 'statistic' (RMS), 'variable' (temperature), 'cloud coverage' (All), 'valid time' (BOTH), 'average' (None), 'forecast length' (0), 'top' (100), and 'bottom' (1000).

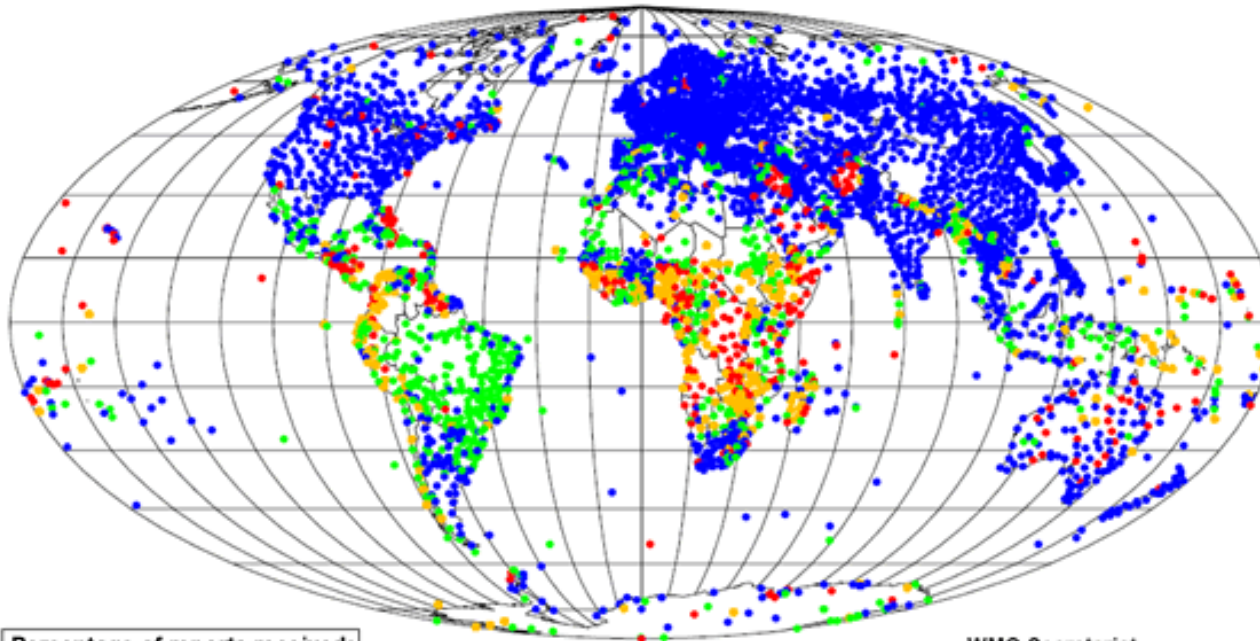


# Verification – adding SYNOP observations

b

Annual Global Monitoring 1-15/10/2008

SYNOP reports made at 00, 06, 12 and 18 UTC at RBSN stations



Percentage of reports received:

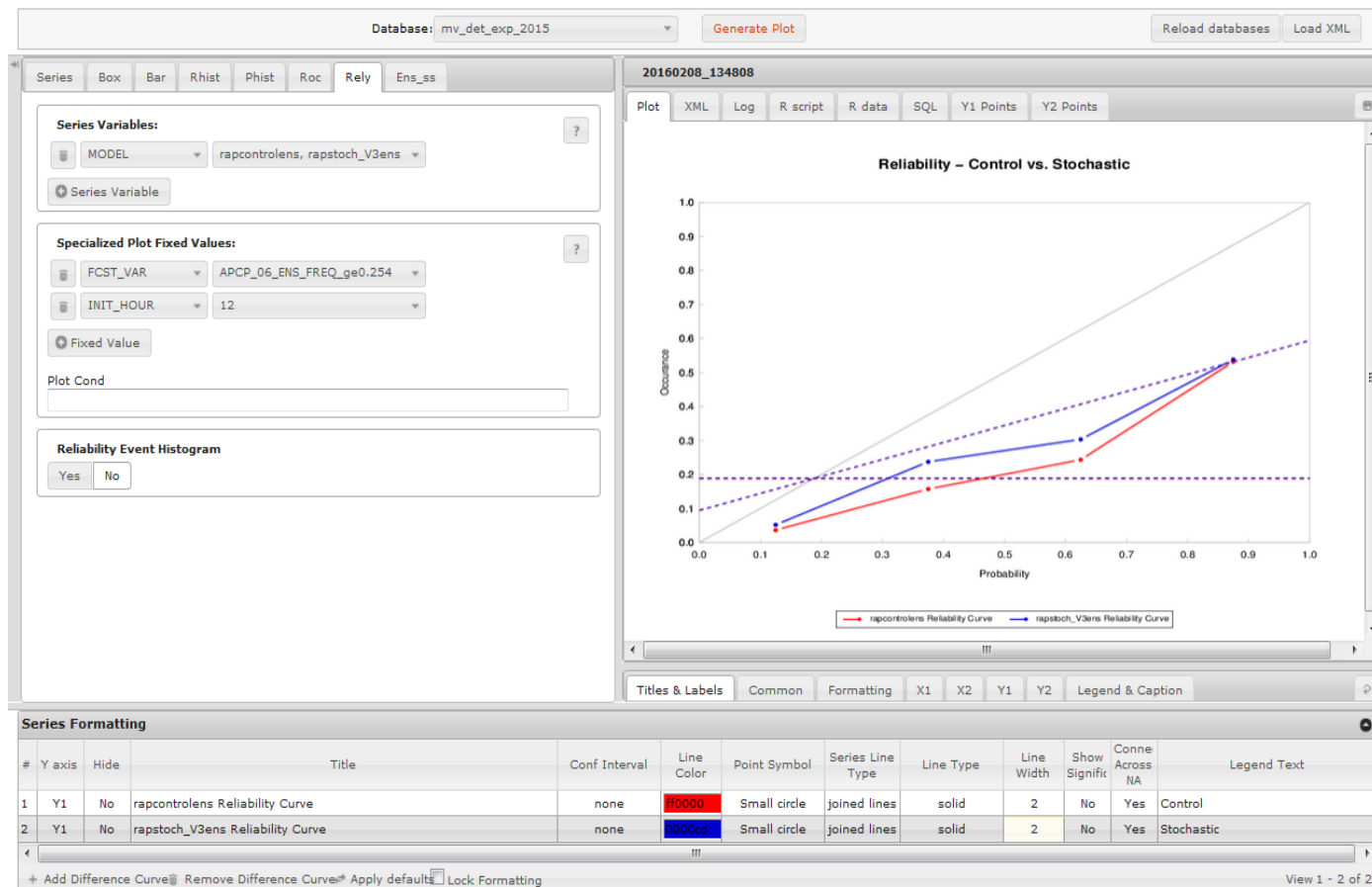
- 90 to 100% (2912 stations)
- 45 to 90% (697 stations)
- Less than 45% (325 stations)
- Silent stations (350 stations)

WMO Secretariat

The designation employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the WMO Secretariat concerning the legal status of any country, territory, city or area

# Verification - Ensembles

- Using VSDB package provided by Yuejian Zhu.
- To view output, we have a HIWPP installation of DTC's METViewer software.



# Verification - future

- HIWPP has stimulated significant interactions and sharing of code between:
  - NCEP/EMC
  - DTC
  - ESRL/GSD
- Each has significant strengths, but also areas that need important development.
- For model development and transition into operations, would be very helpful to share a common set of metrics.
- Led to a vision of Unified Verification system, which has been proposed through NGGPS V&V team.

# Real Time IT Operations

- Purchase of hardware
  - Including ~170 TB storage
- Managing transfer of data to collect model output in one place
- Open Data Initiative

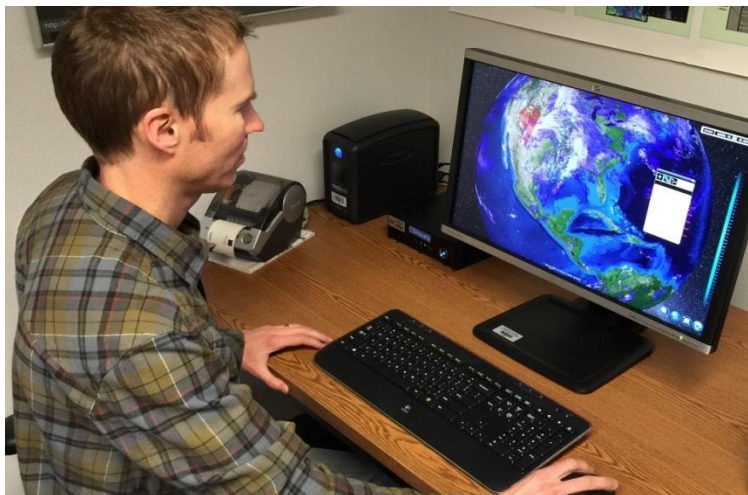
# Outcomes

- Improved transfer performance and resilience between major HPC locations
  - Installed and tuned **GridFTP** from **Globus**

<http://toolkit.globus.org/toolkit/docs/latest-stable/gridftp/>

- Large storage pool available for model data
- Distribution mechanism via THREDDS for sharing model data to public or collaborators
- Upgrades and improvements to serving data through web applications

# Open Data Initiative Users



<b>Total Registered Users</b>	<b>56</b>
Commercial users	18
NOAA users	13
Academic users	12
Other gov't agencies, CIs	13

Count	gbytes	Org name
5,644	1,119	Minnesota education cooperative
5,528	804	Meteociel
10,615	577	Weatherbell
30,295	74	Weather Company
<b>52,082</b>	<b>2,577</b>	<b>Total</b>

**Usage 9/10/15  
- 10/10/15**

# What Did We Learn?

## Users:

- Early access to research model data was very highly welcomed by private enterprise
- Reliability was not a concern
- Most active users were companies with a web-based product that included weather information

## Engagement with modelers:

- Users did not engage with modelers or provide any feedback about the models through the forum
- Some engagement did occur directly with some researchers

## Support required:

- User support was not a significant issue for real-time data
- High-resolution visualization was difficult to support for bandwidth available to many users

# Unexpected outcomes

## **Benefit for research collaboration:**

- Infrastructure for public access was very useful for sharing dycore test output for researchers

## **Issues with volume of data:**

- Issues with quantity of data produced by high resolution non-hydrostatic models had not been fully anticipated
- This is likely to be a significant issue in many aspects of model research in the near future



# What Next?

- HIWPP project is in its final year and Open Data Initiative will conclude on Feb 8, 2016
- **But** – access to real-time research model data will carry on under NOAA's Big Data Partnership
- Infrastructure will continue to be used to support NOAA research collaboration
- FIM and NAVGEM data are expected to remain available as long as:
  - 1) the model runs in real-time at NOAA/ESRL/GSD, and
  - 2) resources are available to support it