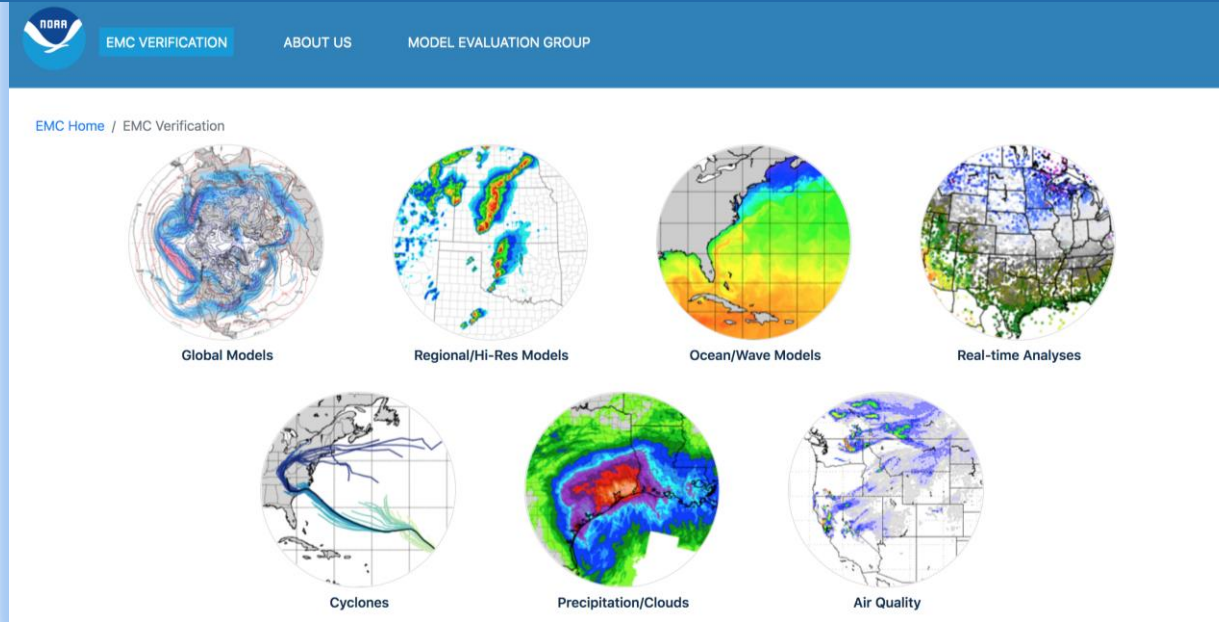




# A New Webpage for Visualizing Verification Statistics from the National Centers for Environmental Prediction Production Suite



Alicia M. Bentley<sup>1</sup>, Mallory P. Row<sup>1,2</sup>, Logan C. Dawson<sup>1</sup>, and Jason J. Levit<sup>1</sup>

<sup>1</sup>NOAA/NWS/NCEP/EMC | <sup>2</sup>I.M. Systems Group, Inc.



# Previous EMC Verification Webpages

- EMC has provided verification webpages to the public for decades
- Verification webpages have not been centralized—often maintained by individual EMC employees as part of their personal webpages



# Previous EMC Verification Webpages

- EMC has provided verification webpages to the public for decades
- Verification webpages have not been centralized—often maintained by individual EMC employees as part of their personal webpages
- Without being centralized, verification webpages have been difficult to find and could easily be neglected or forgotten after personnel changes
- Verification webpages that were maintained tend to appear outdated, often retaining the look that they originally had in the 1990s/2000s



# New EMC Verification Webpages

Redesigned and reorganized by the NCEP/EMC

**Verification, Post-Processing, and Product Generation  
(VPPPG) Branch *Established: May 2017***

- VPPPG consolidates NCEP/EMC verification and evaluation functions to efficiently and consistently ***support all modeling groups***



# New EMC Verification Webpages

Redesigned and reorganized by the NCEP/EMC  
**Verification, Post-Processing, and Product Generation  
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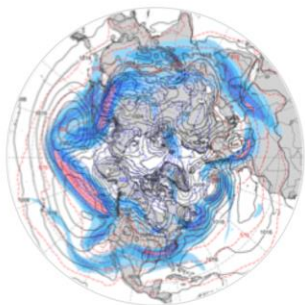
- VPPPG consolidates NCEP/EMC verification and evaluation functions to efficiently and consistently ***support all modeling groups***

## Goals of New EMC Verification Webpages:

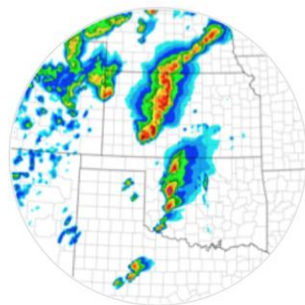
- Centralize webpages so they are all accessible from one location
- Make webpages easier to use and more aesthetically pleasing
- Transition the generation of verification images to VPPPG branch
- Utilize MET and METplus capabilities developed at NCAR/DTC



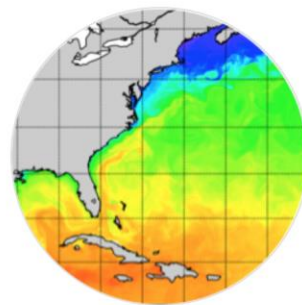
[EMC Home](#) / EMC Verification



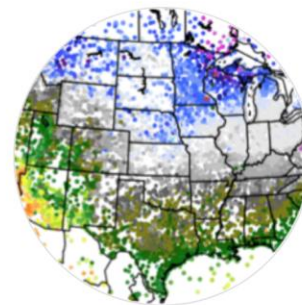
Global Models



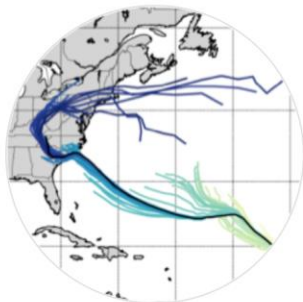
Regional/Hi-Res Models



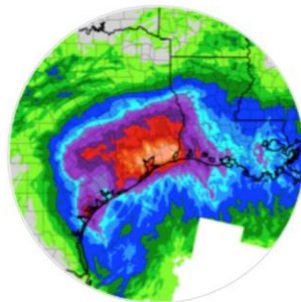
Ocean/Wave Models



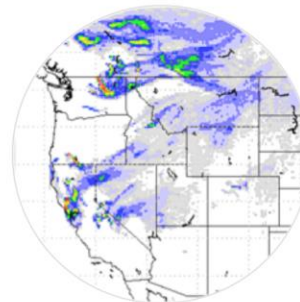
Real-time Analyses



Cyclones



Precipitation/Clouds



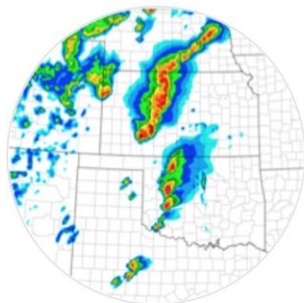
Air Quality



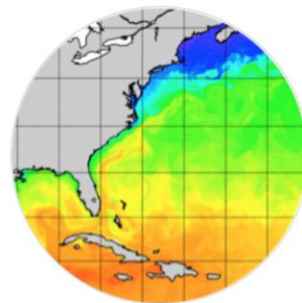
[EMC Home](#) / EMC Verification



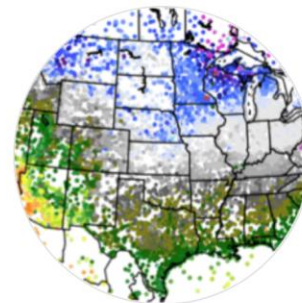
Global Models



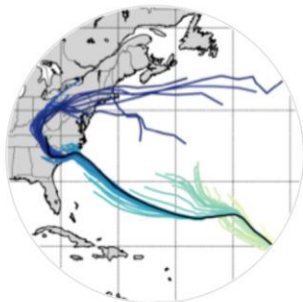
Regional/Hi-Res Models



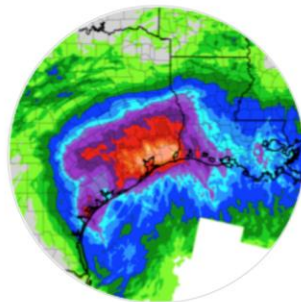
Ocean/Wave Models



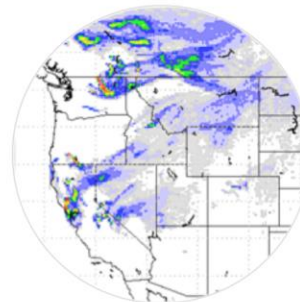
Real-time Analyses



Cyclones



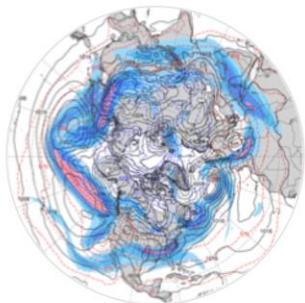
Precipitation/Clouds



Air Quality



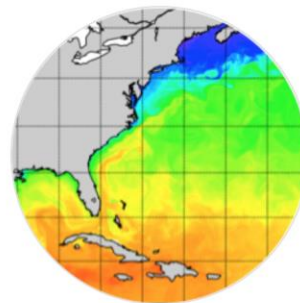
[EMC Home](#) / EMC Verification



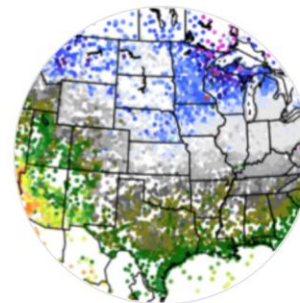
Global Models



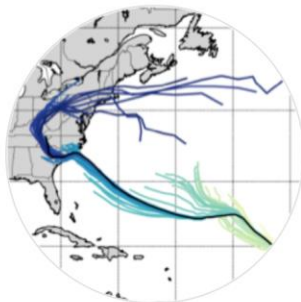
Regional/Hi-Res Models



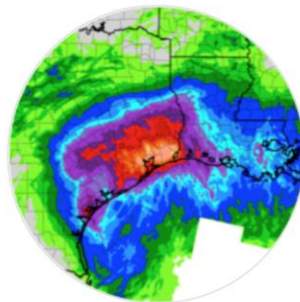
Ocean/Wave Models



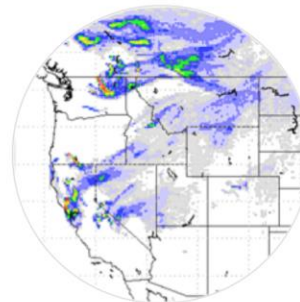
Real-time Analyses



Cyclones



Precipitation/Clouds

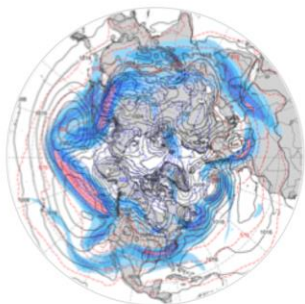


Air Quality

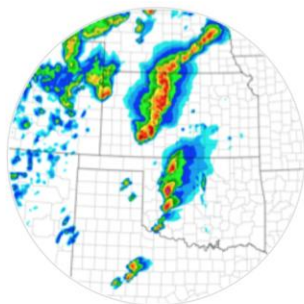




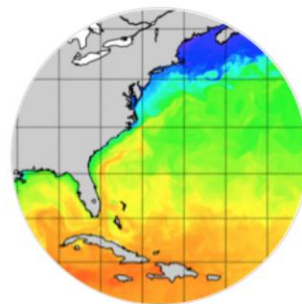
[EMC Home](#) / EMC Verification



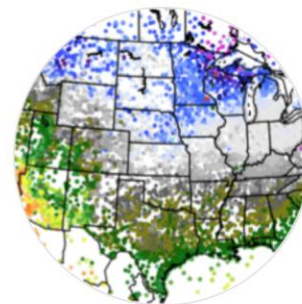
Global Models



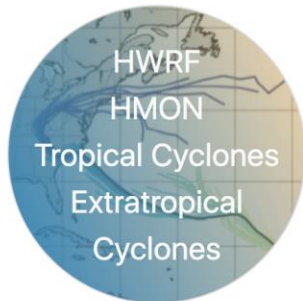
Regional/Hi-Res Models



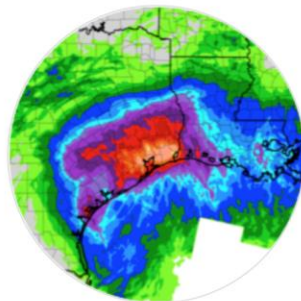
Ocean/Wave Models



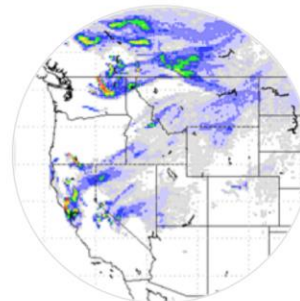
Real-time Analyses



Cyclones



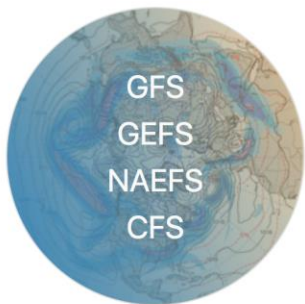
Precipitation/Clouds



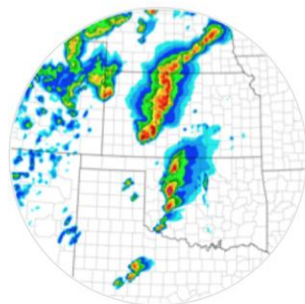
Air Quality



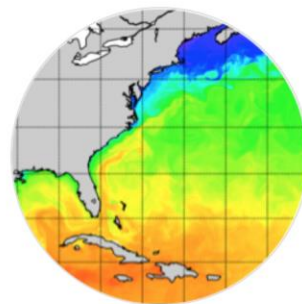
[EMC Home](#) / EMC Verification



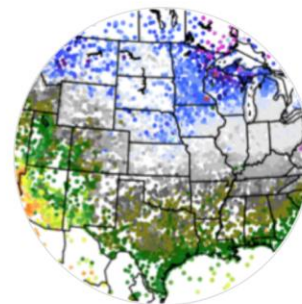
Global Models



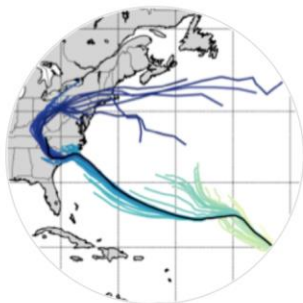
Regional/Hi-Res Models



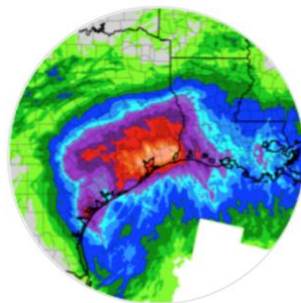
Ocean/Wave Models



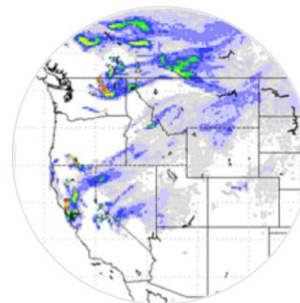
Real-time Analyses



Cyclones



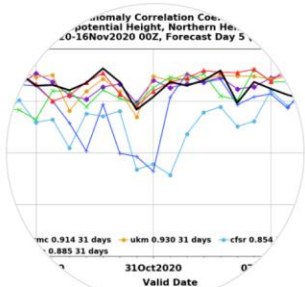
Precipitation/Clouds



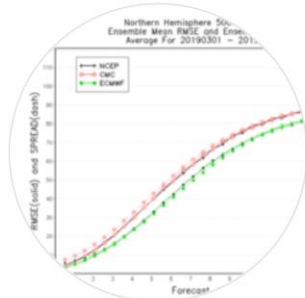
Air Quality



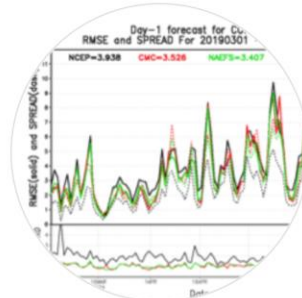
# Global Models



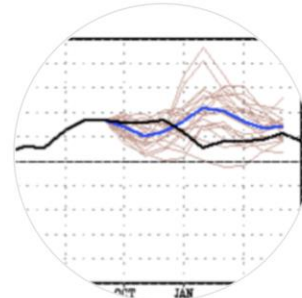
GFS Verification



GEFS Verification



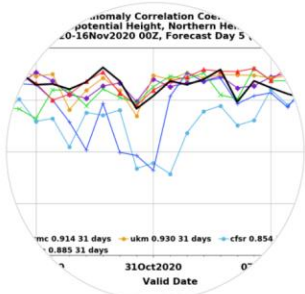
NAEFS Verification



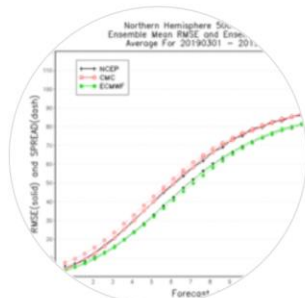
CFS Verification



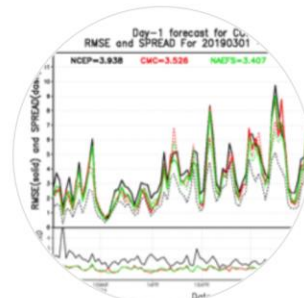
# Global Models



GFS Verification



GEFS Verification



NAEFS Verification



GLOBAL MODELS

REGIONAL/HI-RES MODELS

OCEAN/WAVE MODELS

REAL-TIME ANALYSES

CYCLONES

PRECIPITATION/CLOUDS

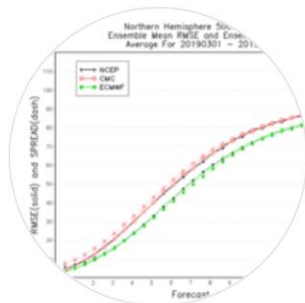
AIR QUALITY



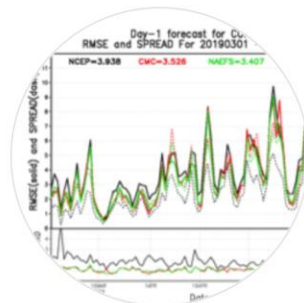
# Global Models



GFS Verification



GEFS Verification



NAEFS Verification



GLOBAL MODELS

REGIONAL/HI-RES MODELS

OCEAN/WAVE MODELS

REAL-TIME ANALYSES

CYCLONES

PRECIPITATION/CLOUDS

AIR QUALITY



## Operational GFS Verification

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## NCEP/EMC GFS v15.3.3 Operational Verification



The National Centers for Environmental Prediction (NCEP)'s Global Forecast System (GFS) is the cornerstone of NCEP's operational production suite of numerical guidance. NCEP's global forecasts provide deterministic and probabilistic guidance out to 16 days. The GFS provides initial and/or boundary conditions for NCEP's other models for regional, ocean, and wave prediction systems. The Environmental Modeling Center (EMC) is responsible for the enhancements, transitions-to-operations, and maintenance of the GFS. The global data assimilation and forecasts are made four times daily at 0000, 0600, 1200 and 1800 UTC by NCEP Central Operations (NCO).

The current operational version of the GFS is version 15.3.3 as of 2020 October 22. Verification for the operational GFS and other operational global models can be found by navigating the links to the left.

Information about the ongoing GFS version 16 evaluation can be found [here](#) and verification statistics can be found [here](#).

Verification is done using [EMC\\_verif-global](#), which uses [METplus](#).



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ANOMALY  
CORRELATION

BIAS

RMSE

MURPHY'S MSE SKILL  
SCORE

RATIO OF STANDARD  
DEVIATION

RMSE FROM MEAN  
DIFFERENCE

RMSE FROM PATTERN  
VARIATION

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## Operational GFS Verification

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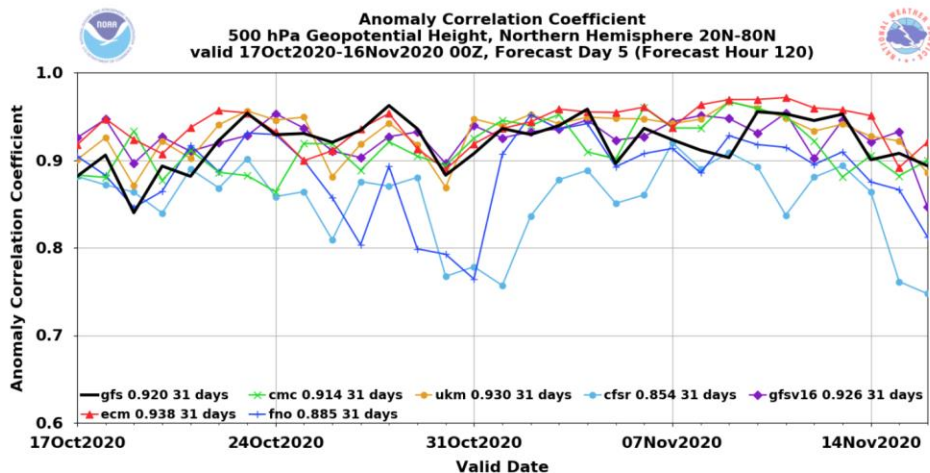


## Operational GFS Verification

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# Grid-to-Grid: Anomaly Correlation

Valid: 0000 UTC Forecast Lead: Day 5 Region: N. Hemisphere Variable: Geopotential Height Level: 500 hPa

Left/Right arrow keys = Change forecast lead | Up/Down arrow keys = Change level  
For information on grid-to-grid verification, [click here](#)

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### Anomaly Correlation Coefficient 500 hPa Geopotential Height, Northern Hemisphere 20N-80N

#### Grid-to-Grid Verification Information

- Regular and anomalous partial sums are computed for each model (see [here](#)). Each model's forecasts are verified using its own analysis as truth. All data are regrided using bilinear interpolation, if needed, to the G002 (2.5x2.5 degree) grid. A 30-year (1959-1988) climatology of the NCEP/NCAR reanalysis is used for computing anomalous partial sums.
- Verification statistics are computed from the regular and anomalous partial sums. The equations used to calculate the verification statistics can be found [here](#). Statistical significance is calculated using a student-t test.
- The wave breakdown for heights is done using Fourier Decomposition.
- The verification regions used are: **Global**, **N. Hemisphere**: 20N-80N, **S. Hemisphere**: 20S-80S, **Tropics**: 20S-20N, **PNA**: 180E-320E, 20N-75N, **60N-90N**, **60S-90S**, **N. Pacific Ocean**, **S. Pacific Ocean**, **N. Atlantic Ocean**, **S. Atlantic Ocean**.



## Operational GFS Verification

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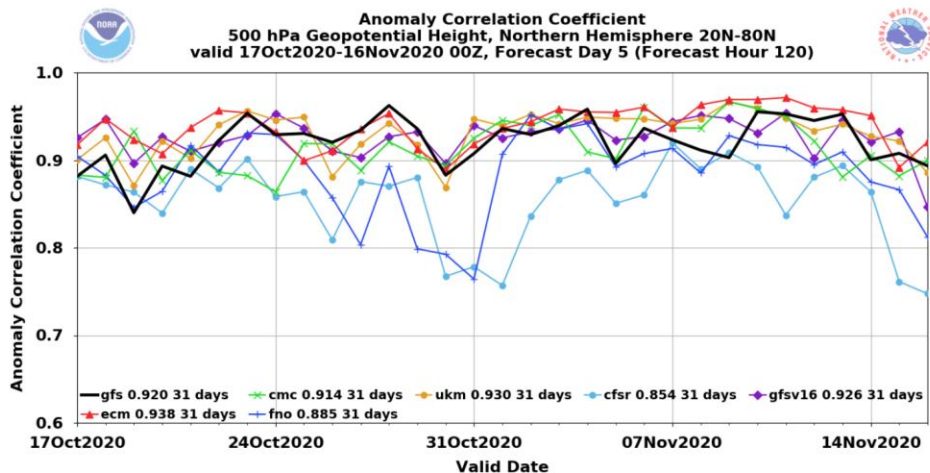


## Operational GFS Verification

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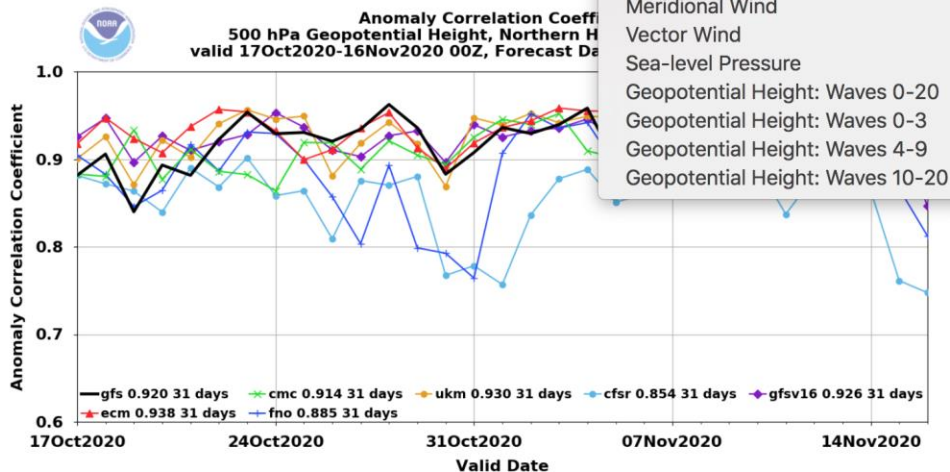
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# Grid-to-Grid: Anomaly Correlation

Valid: 0000 UTC Forecast Lead: Day 5 Region: N. Hemisphere Variable: **Geopotential Height** Level: 500 hPa

Left/Right arrow keys = Change forecast lead | Up/Down  
For information on grid-to-grid verification



Geopotential Height

Temperature

Zonal Wind

Meridional Wind

Vector Wind

Sea-level Pressure

Geopotential Height: Waves 0-20

Geopotential Height: Waves 0-3

Geopotential Height: Waves 4-9

Geopotential Height: Waves 10-20

## Grid-to-Grid: Anomaly Correlation

Valid: 0000 UTC Forecast Lead: Day 5 Region: N. Hemisphere Variable: Geopotential Height Level: 500 hPa

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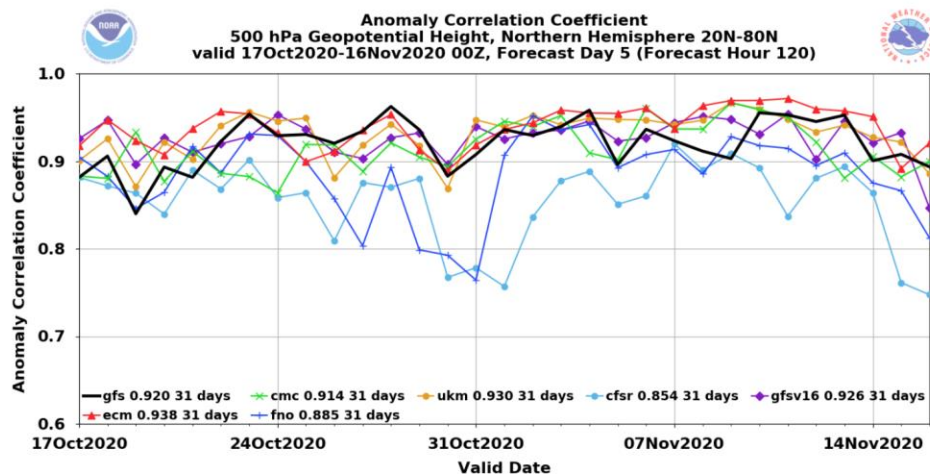
### Operational GFS Verification

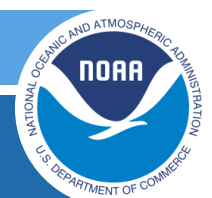
HOME

GRID-TO-GRID »

GRID-TO-OBS »

S1 SCORES

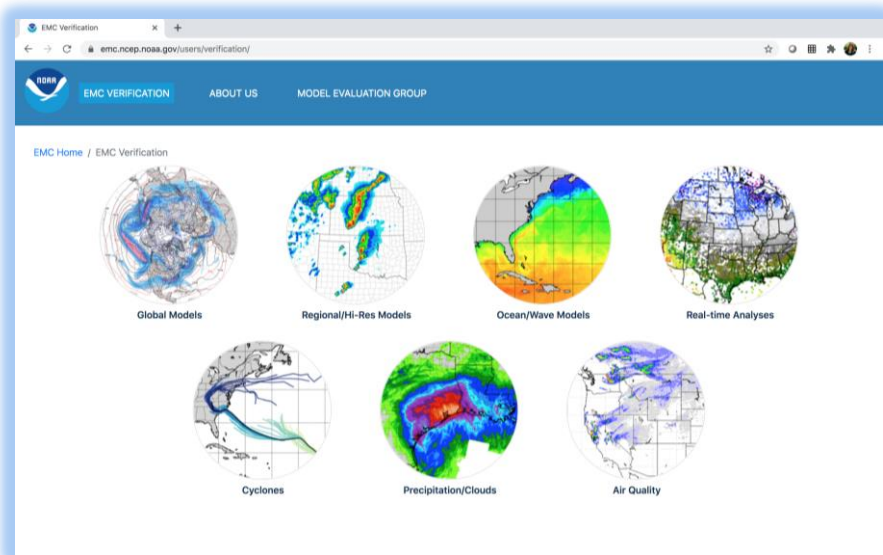
CREATE GRAPHICS  
WITH METVIEWER AND  
METEXPRESSVSDB LONG TERM  
STATSASSIMILATION  
MONITORING« RETURN TO  
GLOBAL MODELS



# Summary

New EMC Verification Webpage (now live):

<https://www.emc.ncep.noaa.gov/users/verification/>



One-stop shop for all  
EMC verification webpages  
Compatible with all devices  
Updated EMC verification  
graphics coming soon...

[Alicia.Bentley@noaa.gov](mailto:Alicia.Bentley@noaa.gov)