Recent and Upcoming Upgrades to Operational Post Processing Systems at NOAA Environmental Modeling Center

NATIONAL WEATHER SERVICE

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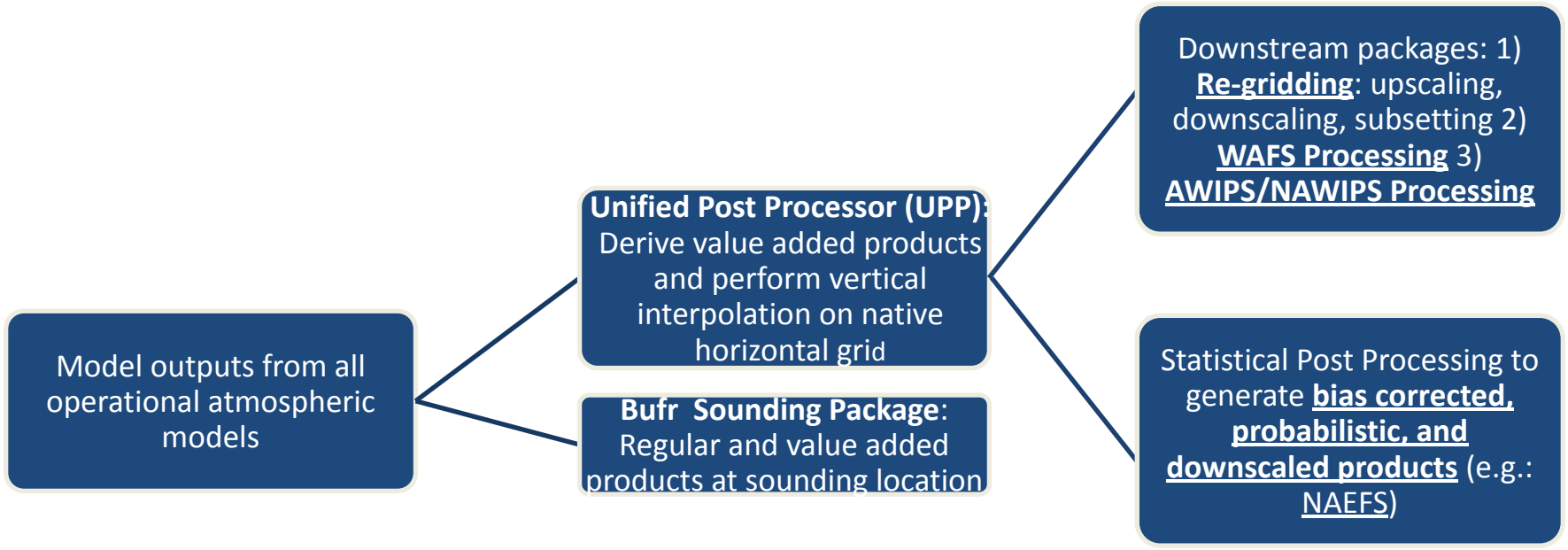
NOAA Atmospheric Post Processing Flow Chart



Introduction to EMC's Post Processing Systems

- EMC's Post Processing Systems comprise several components to produce gridded and point products for NOAA's customers.
- Unified Post Processor (UPP) interfaces directly with all UFS based applications while maintaining backward compatibility with NOAA's legacy models. See Poster #535 for details.
- Downstream packages perform re-gridding and AWIPS/NAWIPS processing to make tailored products for each application.
- Sounding packages generate forecast at sounding locations.
- Ensemble Post Processing packages produce bias-corrected and probabilistic products.
- Ocean/Ice/Wave Post processing packages generate marine products.

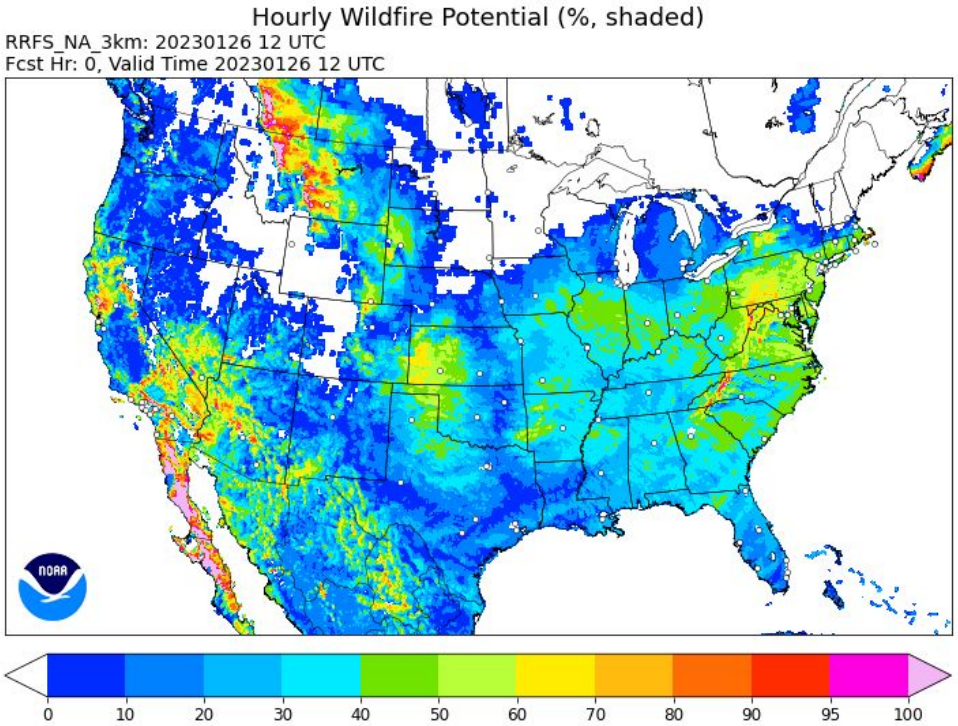
Post Processing Applications: Value Added Product Examples

- Aviation: Turbulence, in-flight icing, wind shear, ceiling, and visibility.
- Wind Energy: Wind prediction at various tower heights.
- Hurricane forecasting: Simulated satellite and radar reflectivity.
- Transportation: Precipitation types, snow accumulation, wind gust, marine fog and freezing spray.
- Fire Weather: Wildfire potential, transport wind, and ventilation rate.
- Severe Weather: several types of CAPE/CIN, lifted index, and helicity.

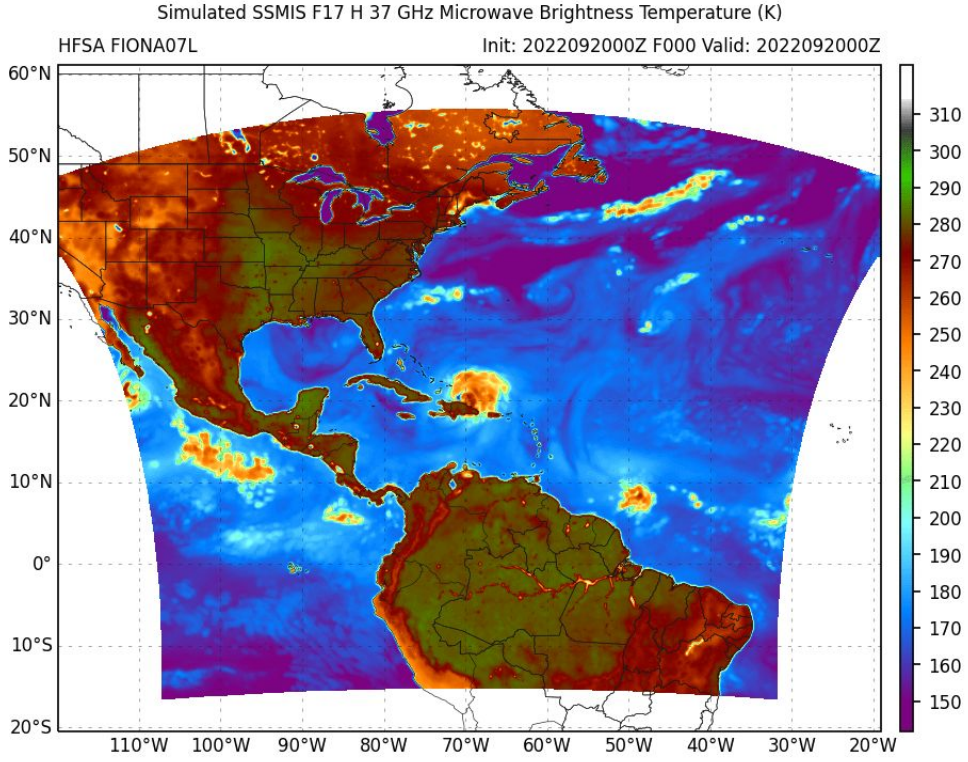
Recent Operational Post Processing Upgrades

- Updated post processing components during each model upgrade (e.g.; HAFS v1, AQM v7, GFS v16, and GEFS v12):
  - Update algorithms for existing products,
  - Add new products based on forecasters' request,
  - Improve efficiency to compensate for resolution increases.
- Completed UPP re-engineering project to clean up, modernize, and modularize UPP.
- Improved bias corrected products by upgrading North America Ensemble Forecast System (NAEFS) to use all 31 GEFS v12 members.
- Increased temporal and spatial resolutions of global aviation products.

RRFS v1 Wildfire Potential Derived From UPP



HAFS v1 Simulated Microwave Products for Hurricane Fiona Derived From UPP



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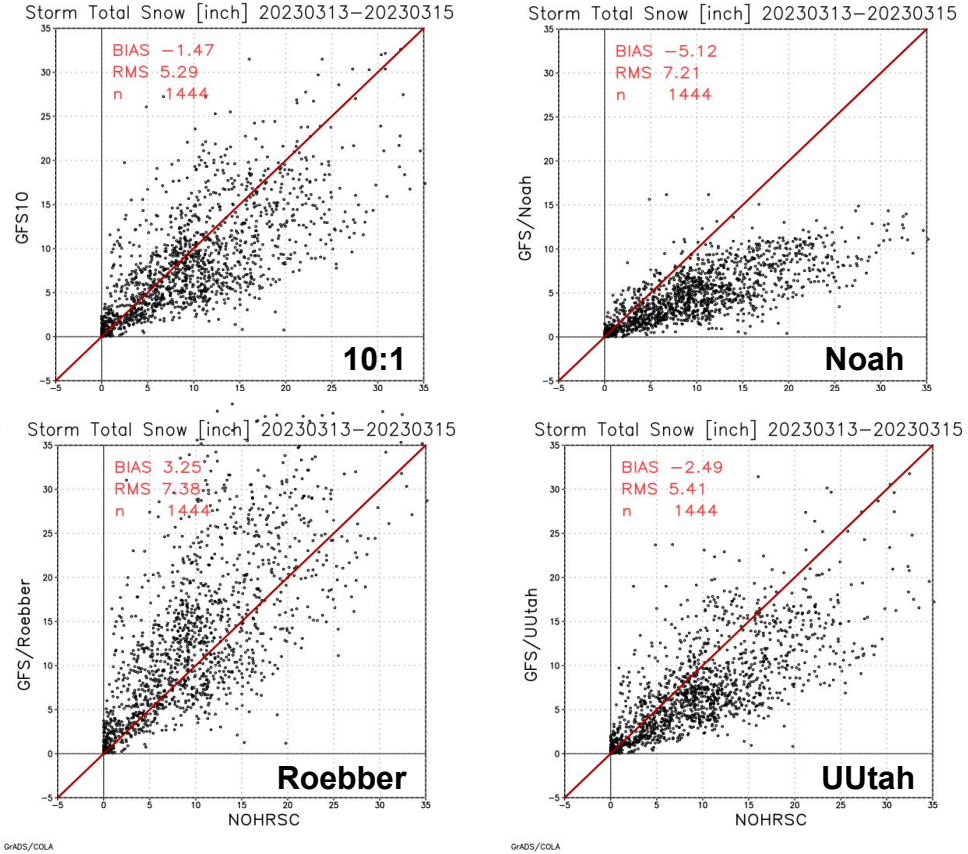
Transition Post Processing Research Advancements to NCEP Operations (R2O)

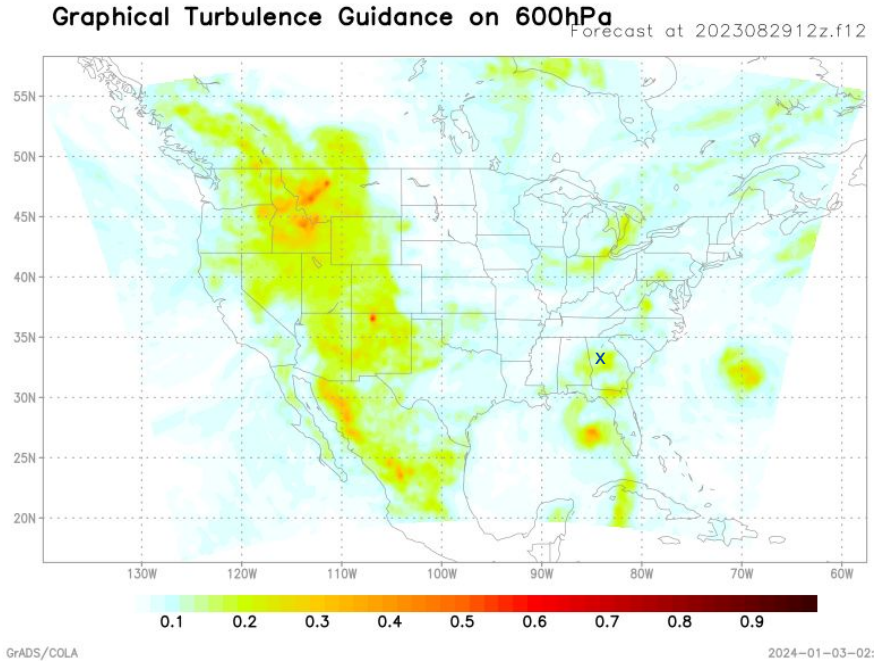
- Improve domestic and international aviation safety by transitioning and implementing NCAR's aviation algorithms to operations:
  - 2015: Implemented NCAR's Forecast Icing Potential (FIP) algorithm;
  - 2017: Implemented NCAR's Graphical Turbulence Guidance (GTG) algorithm
- Improve snow forecast by transitioning AI based Snow Liquid Ratio (SLR) algorithms from Universities of Utah and Wisconsin to UPP:
  - Currently evaluating performance of these algorithms as compared to that of model LSM for operational GFS v16 and RRFS v1

Comparison of Snow Estimation (Y axis) Using Different SLR Algorithms with NOHRSC snow Obs (X axis) for the 20230313 Nor'easter case

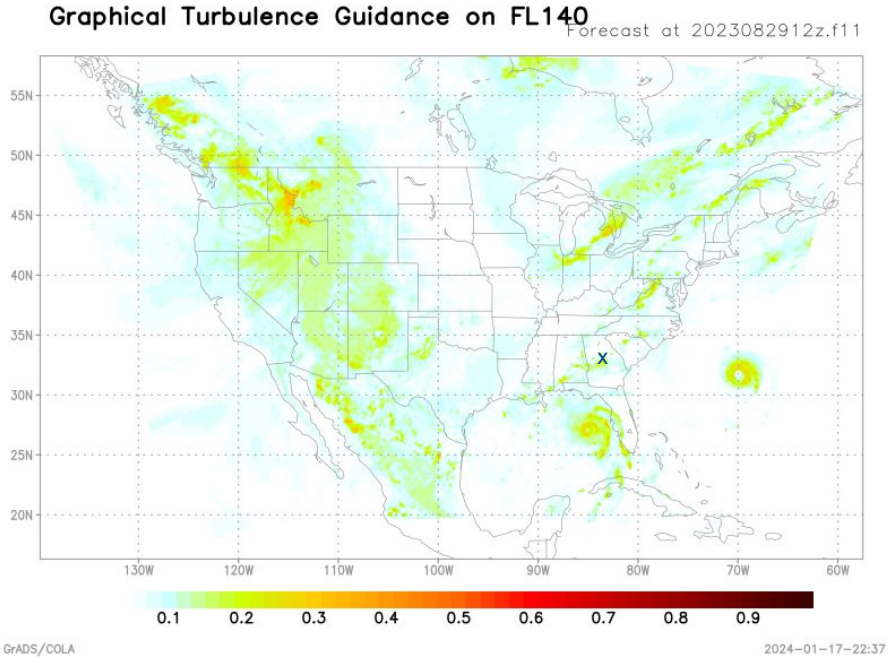


- UUtah and 10:1 ratio SLRs had the lowest RMS and Bias
- Noah LSM underestimated while Roebber overestimated for this case

GFS/RRFS Based GTG Predicted Aug. 29 2023 Delta Airline Turbulence Event (Marked by X) near Atlanta GA



Operational GFS GTG 12 h forecast from 2023082912 cycle



Parallel **untuned** RRFS GTG 11 h forecast from 2023082912 cycle

Future Plan: Upcoming Operational Post Processing Upgrades

- Prepare for RRFS v1, GFS v17, and GEFS v13 implementations:
  - Maintain domestic flight safety by transitioning to updated NCAR's aviation algorithms tuned to RRFS v1 resolution and Physics:
    - NCAR's GTG v4 with convectively-induced turbulence and Machine Learning has been transitioned to UPP;
    - NCAR's In-Flight Icing (IFI) v2 also transitioned to UPP;
  - Unify winter weather variables among all applications;
  - Retire legacy products;
  - Create new ocean, wave, and ice products.
- Upgrade global aviation products:
  - 2027 United Nation milestone: Produce probabilistic global aviation products.