NGGPS Annual Meeting

Verification and Validation Team Plans

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NGGPS Verification and Validation Team Objectives

- Verification and validation team objectives:
  - A comprehensive and flexible verification package for evaluation of progress in the development and operational readiness of NGGPS and of future NGGPS operational performance
  - Enable stakeholder validation of NGGPS performance

Team Members

- Proposed Team Members
  - Lead: Ivanka Stajner (NWS/STI)
  - Glenn White (NWS/EMC)
  - Geoffrey Manikin (NWS/EMC)
  - Fanglin Yang (NWS/NCEP)
  - Bonnie Strong (OAR/ESRL/GSD)
  - Stephen Weygandt (OAR/ESRL/GSD)
  - Others TBD

State of the Current Verification System

- The current GFS verification system evaluates several metrics

- NCEP's Global NWP Model Verification package includes:
  - Computation of model forecast statistics for global NWP model simulations
  - Comparison of statistics among different model simulations
  - The data is saved in VSDB format

- Examples of statistics include:
  - Anomaly Correlation (AC)
  - Root Mean Square Error (RMSE) for Geo-Potential Height (HGT), Temperature (T) and Vector Wind (Wind)

Current Status

Main Verification Web Page http://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/, including 1) verification statistics of AC, RMSE, Bias etc for major international NWP models and GFS implementation parallels in the past 31 days, 2) real-time weather forecast maps of GFS, ECMWF and GFS implementation parallels, 3) links to other verifications.

Grid-to-Obs Verification http://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/g2o/ and http://www.emc.ncep.noaa.gov/gmb/ssaha/
Including 1) verifications of surface 2-m T, RH, Td, 10-m winds, SLP and total clouds against ground observations over the CONUS and its sub-regions and, 2) verifications of atmospheric T, Q, RH and Winds against rawinsonde and aircraft observations over the globe and its sub-regions.

Precipitation Verification
http://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/www/rain2/rain.html
Including precipitation forecast maps verified against CCPA over the CONUS and CPC gauge observations over the globe, and precipitation Equitable Threat Scores for major international models

Current Status cont.

Objected-Oriented (MODE) Verification
http://www.emc.ncep.noaa.gov/gc_wmb/tdorian/
Including MODE verifications of precipitation over CONUS and jet streams over the globe.

Historical Performance http://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/longterm/
Including annual review of GFS forecast skills and historical performances of major international NWP models.

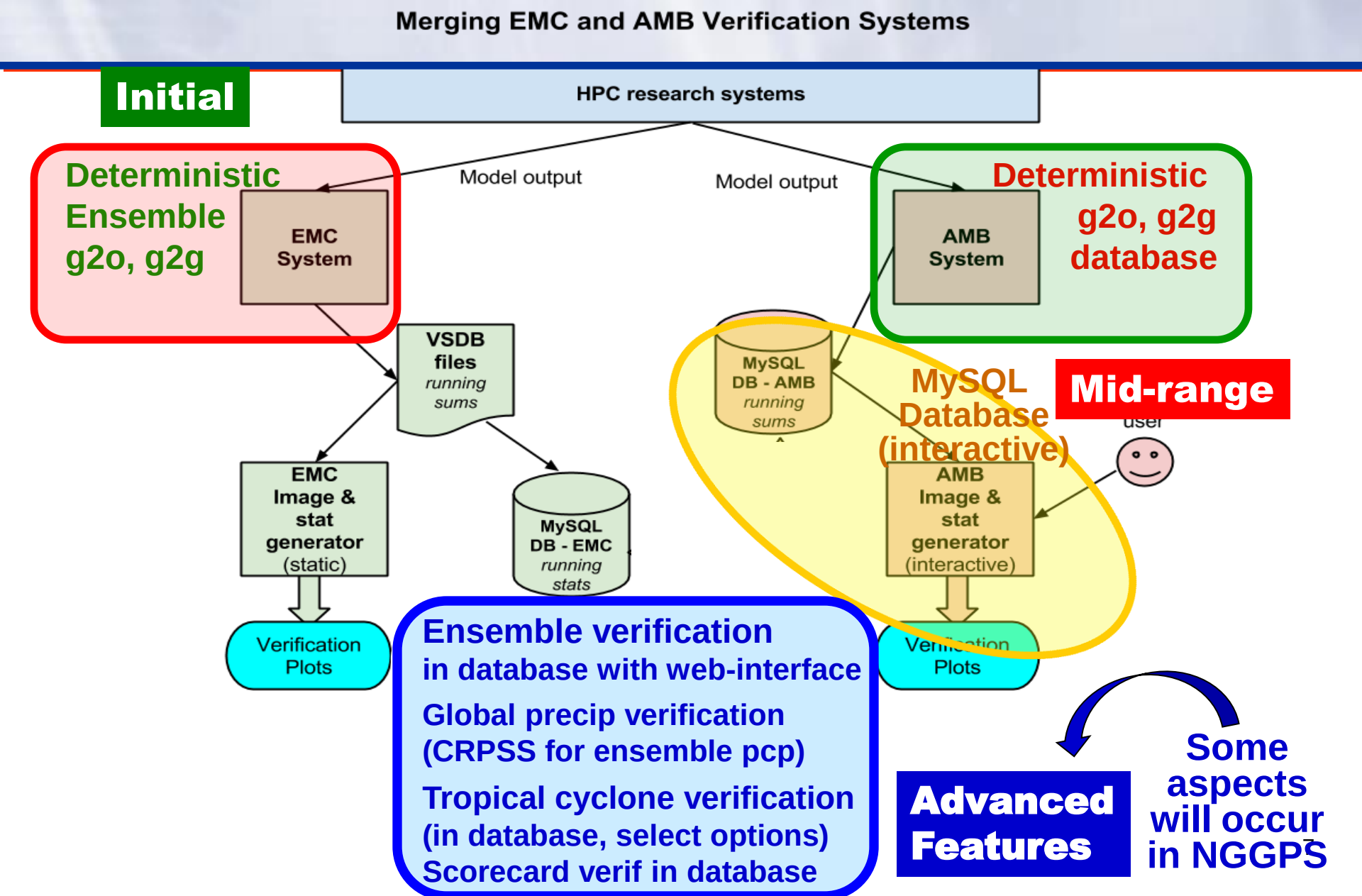
Ensemble Forecast Verification
http://www.emc.ncep.noaa.gov/gmb/STATS_vsdb/ensm/, and
http://www.emc.ncep.noaa.gov/GEFS/verif.php
including GEFS, NAEFS and other international global ensemble forecasts.

Data Assimilation Monitoring http://www.emc.ncep.noaa.gov/gmb/gdas/

GFS Experimental Parallels Verification:
http://www.emc.ncep.noaa.gov/gmb/wd20rt/vsdb/ and
http://www.emc.ncep.noaa.gov/gmb/wx24fy/vsdb/

Others : http://www.emc.ncep.noaa.gov/GFS/perf.php contains a list of all verifications related to GFS and GEFS. http://www.emc.ncep.noaa.gov/gmb/STATS/MAPS.html presents daily weather forecast maps.

Merging HIWPP Verification Systems



HIWPP Verification Development

1. **Initial System – EMC verification package (VSDB output)**
   -- run within HIWPP (basic stats, reference) **Initial**

2. **Mid-range System -- MySQL database system** **Mid-range**
   -- Incorporates EMC and AMB verification
   global: upper-air, AC (work toward surface / precip)
   conversion package from VSDB → database in place
   -- Basic verification system with interactive database)

3. **Advanced System -- Fully merged system with additional capabilities** (ensemble verification, global surface, global gridded and station-based precipitation) **Advanced**

HIWPP Verification metrics / attributes

Variable	Levels	Area	Scores	Forecast Range (Hours)
Height	500 hPa	NH, SH	ACC, RMSE, Spread, CRPS	0 to 384
Height	1000 hPa	NH, SH	CRPS	0 to 384
Temperature	850 hPa	NH, SH	CRPS	0 to 384
Pressure	Surface	NH, Tropics	Track Error	0 to 120
Winds	850, 200 hPa	NH,Tropics	CRPS, RMSE	0 to 384
Precipitation		GLOBAL	ETS, CRPS, Bias	0 to 384
Temperature	2 meter	NH	RMSE, bias, CRPS	0 to 384
Winds	10 meter	NH	RMSE, bias, CRPS	0 to 384
Tropical cyclone track and intensity verification				

NGGPS verification priorities

- Identify gaps, additional metrics (e.g. standard, sensible weather, ensemble verification)
- Prioritize metrics to be added to the existing verification package
- Leverage/coordinate with HIWPP verification effort
- Consider a more flexible database approach

Examples of GFS verification gaps

- GDAS *analysis-minus-first guess* increments
- Forecast consistency from cycle to cycle
- Monitoring of extreme cold temperatures near the surface
- Hurricane track and intensity verification to day 7 (currently to day 5) and significance
- Sensible weather over the globe (currently for CONUS and Alaska)
- Quantitative Precipitation Forecast over the globe
- Cloud verification against satellite products

Development of verification priorities

- Requesting a prioritized list of verification gaps from all NGGPS area teams
  - Consider gaps in verification of forecast skill, process representation, coupling of system components, increased model resolution

Validation priorities

- Does NGGPS meet user needs?
- Are phenomena or thresholds of most interest to stakeholders predicted well?
- Coordinate with UMAC evaluation of NCEP production suite and collection of stakeholder input.

Summary

- A comprehensive and flexible verification package for evaluation of progress in the development and operational readiness of NGGPS and of future NGGPS operational performance
- Enable stakeholder validation of NGGPS performance
- Requesting prioritized verification gaps from NGGPS area teams
- Leveraging/coordination with HIWPP verification effort
- Coordinate validation with UMAC evaluation of NCEP production suite and collection of stakeholder input

Questions?

NGGPS Website:

http://www.nws.noaa.gov/ost/nggps

Future of Verification and Validation System

- Examples of some skill metrics/capabilities to consider/add:
  - What other verification fields are desired?
  - What other types of error measures?
  - Preset vs. on-the-fly skill score assessments (or both)?
  - Database and web interface aspects?
  - Precipitation and reflectivity verification (also novel fields like solar irradiance, etc.)?
  - Ensemble, tropical cycle and scorecard verification?