Verification of Air Quality Predictions Using METplus

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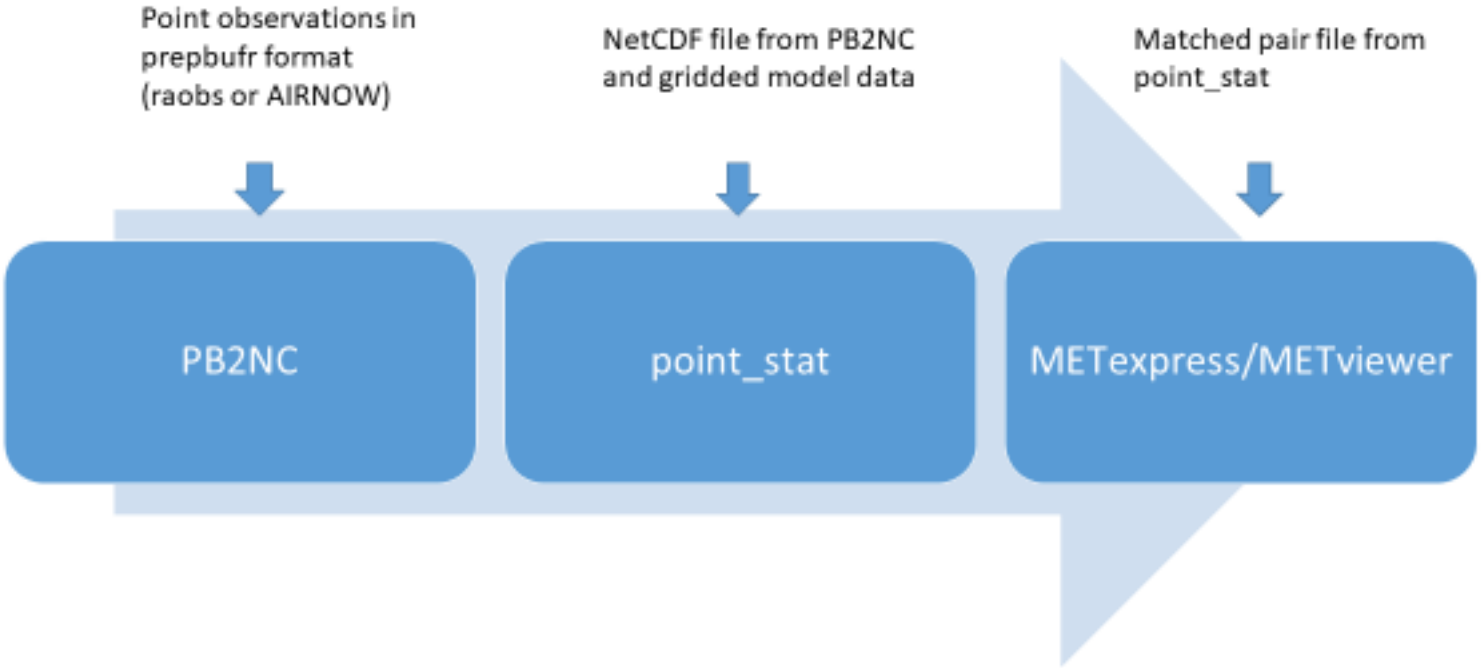
Introduction

- Verification and validation important in both air quality models and the meteorology that drives the AQ models
- Development Testbed Center (DTC) of the National Center for Atmospheric Research (NCAR) developed unified verification system for meteorological community
- MET – Model Evaluation Tools; METplus – python wrappers that run MET
- Adapted from old EMC system called VSDB – Verification Statistics Database
- Adapted for use for ozone and PM2.5 - has been rigorously tested
- Ready for near real-time use

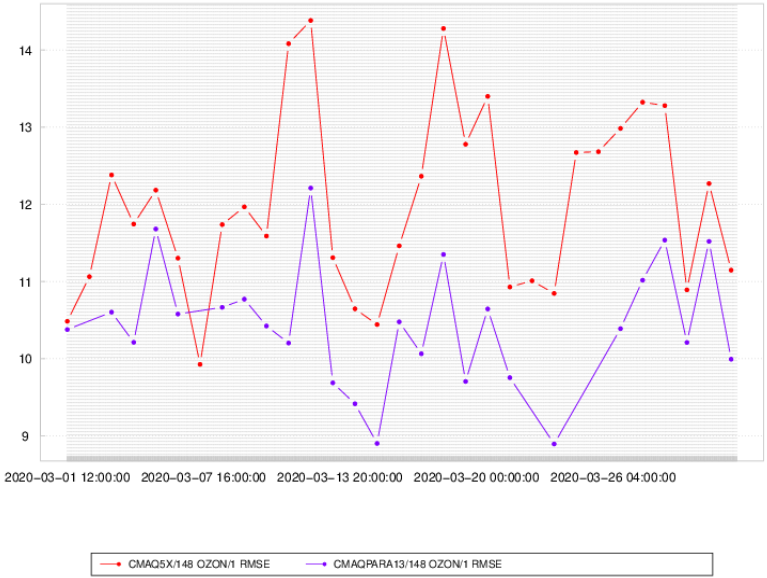
Flow of Verification



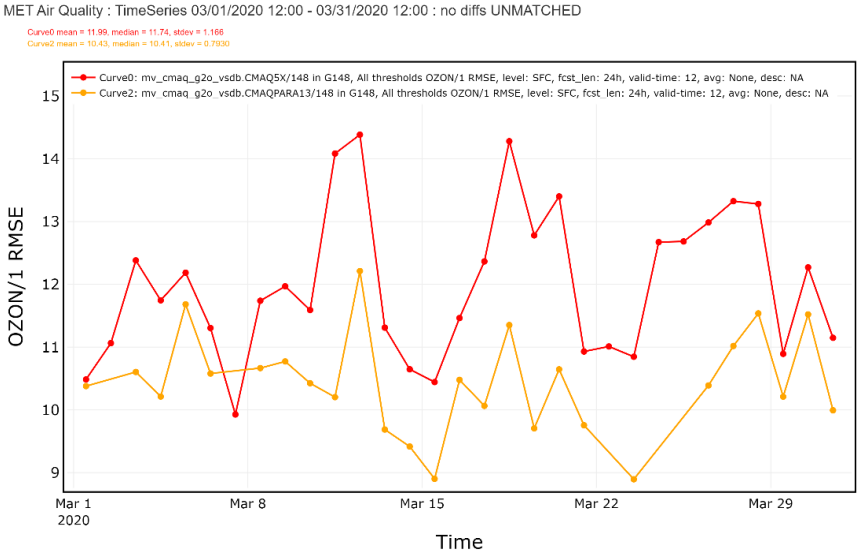
Variables verified and metrics

- Air quality variables from CMAQ (Community Multi-scale Air Quality model)
  - Surface-based ozone, surface 2.5-micron particulate matter (PM25) and Aerosol Optical Depth (AOD)
    - Hourly, daily maximum (ozone), daily maximum and daily average (ozone and PM25)
- Metrics/plots
  - Time series (by date and also by time of day) – RMS and Mean Error
  - Diurnal plots (follows a forecast)
  - Critical Success Index (CSI) and Frequency Bias from contingency table counts
  - Performance diagrams (METviewer only)

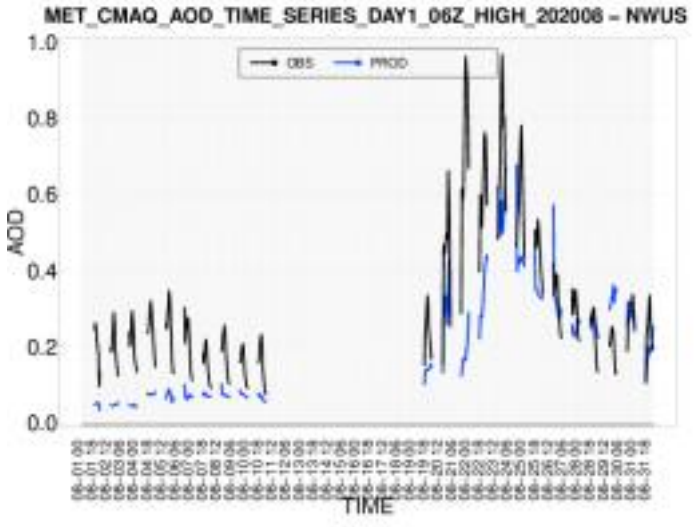
METviewer

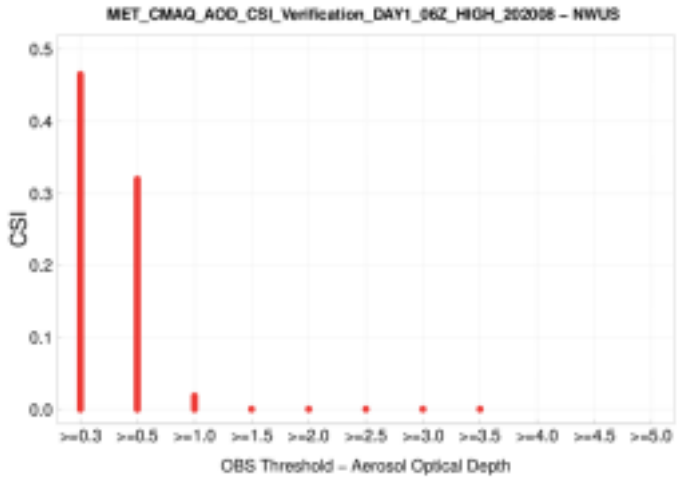


METexpress



Regional AOD Verification from CMAQ

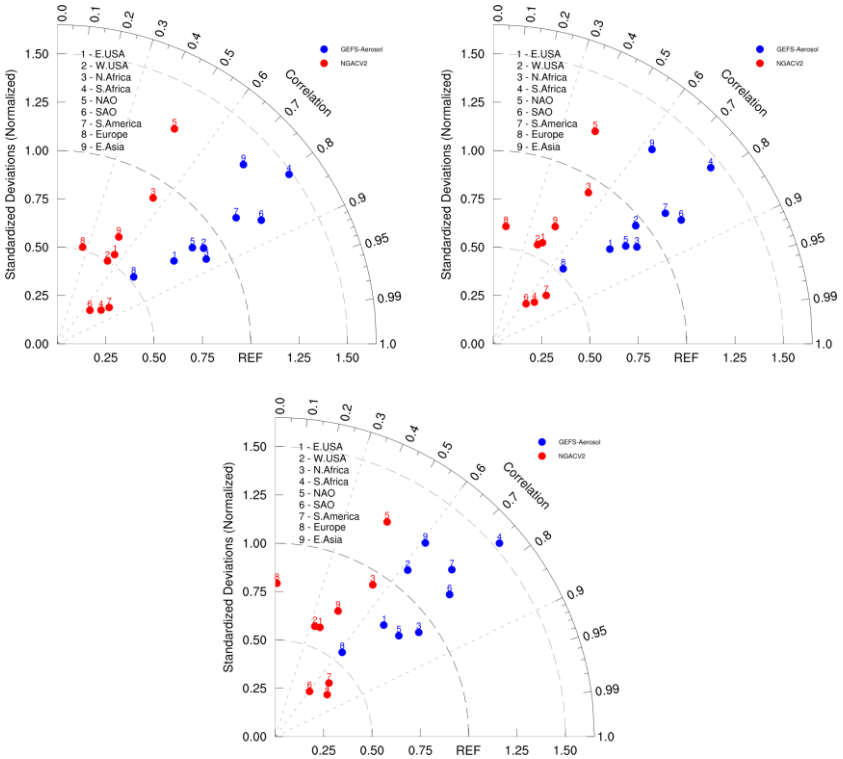




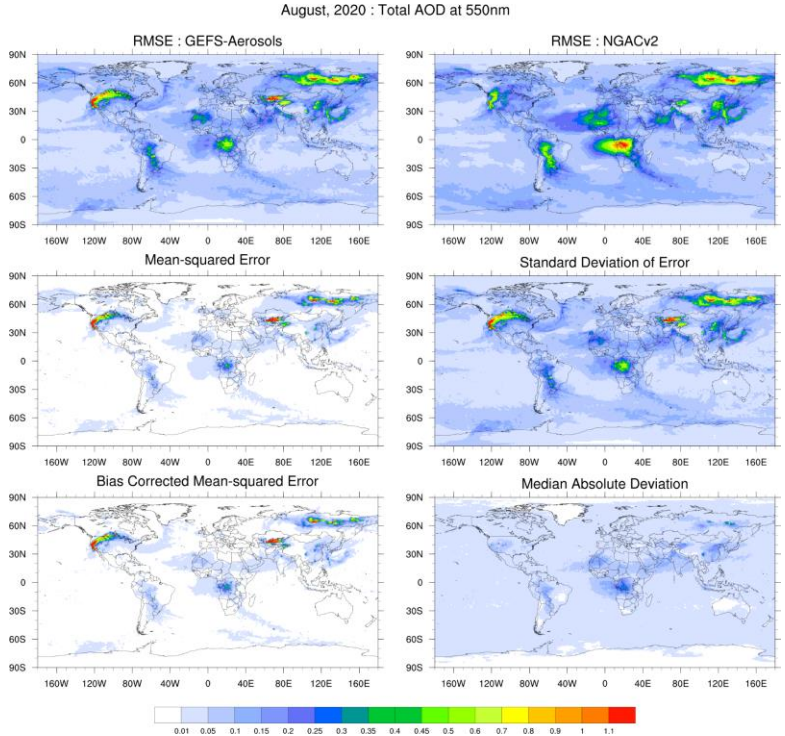
Observed GOES-16 pixel AOD vs CMAQ hourly AOD
Point data gridded, then grid_stat is used to compare vs gridded AOD
Verification metrics: RMSE, mean error, CSI

GEFS-Aerosol vs MERRA2 satellite

Taylor Diagrams

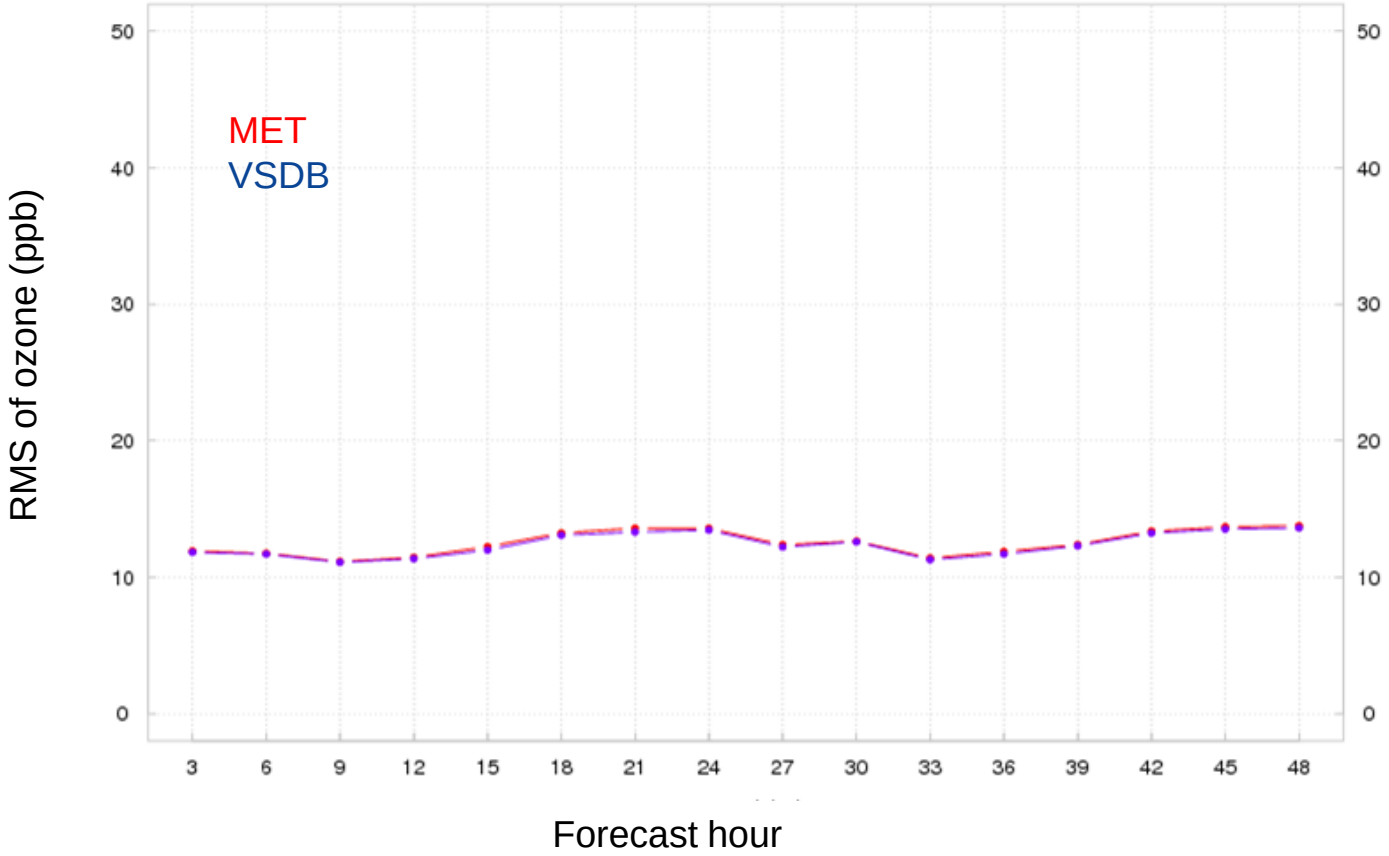


Horizontal error maps using Series-Analysis

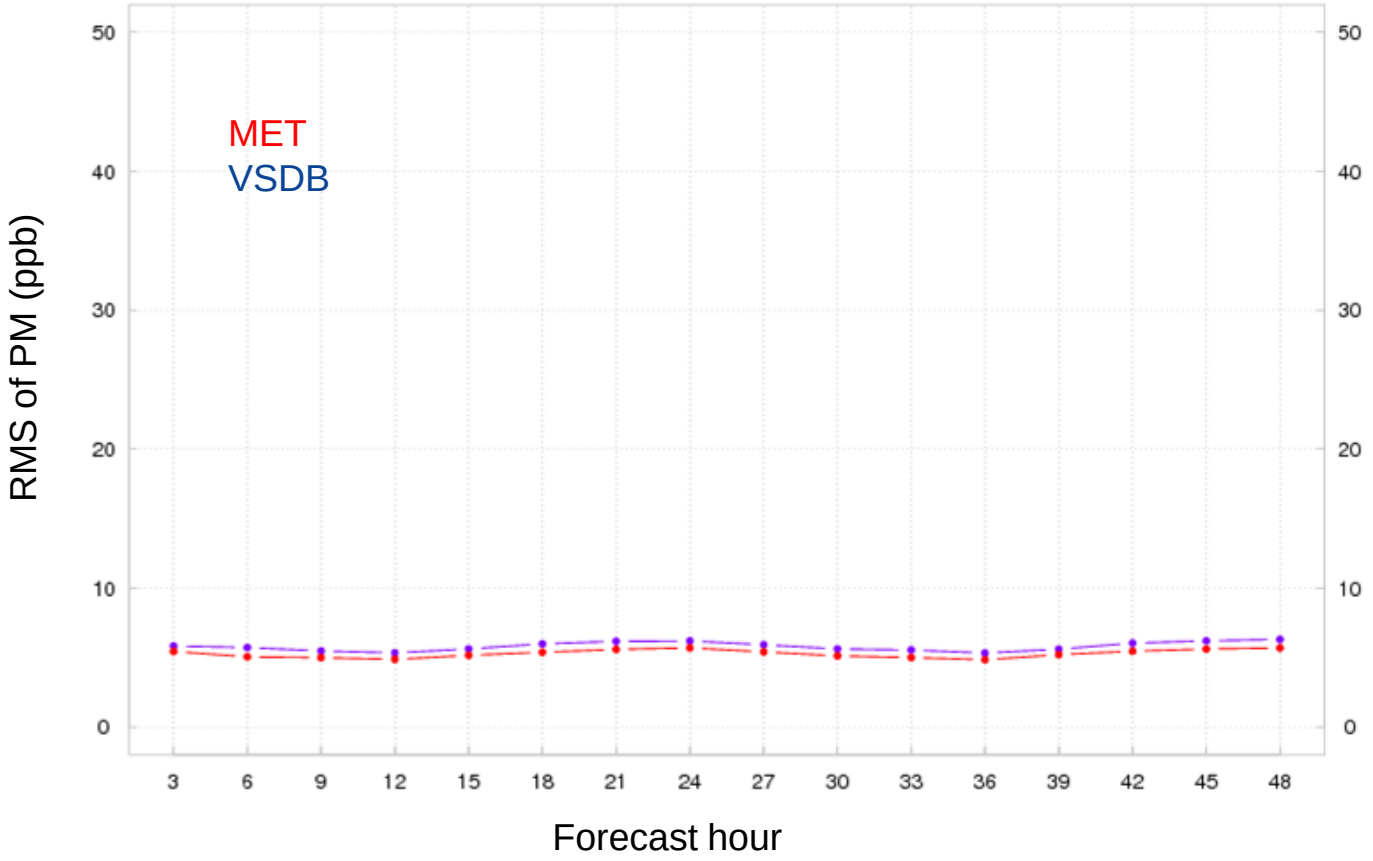


Extra Slides

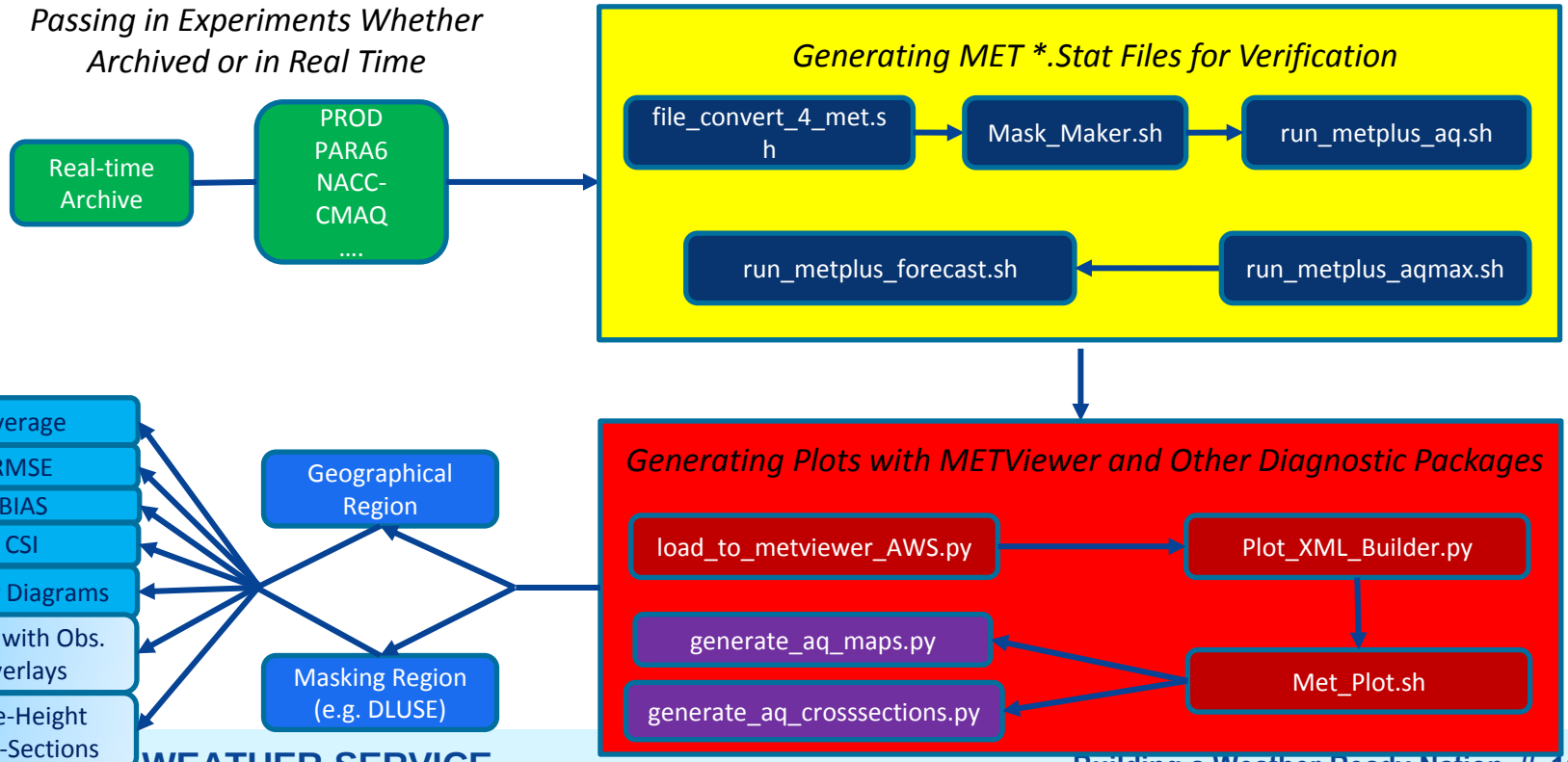
Ozone verification VSDB vs MET



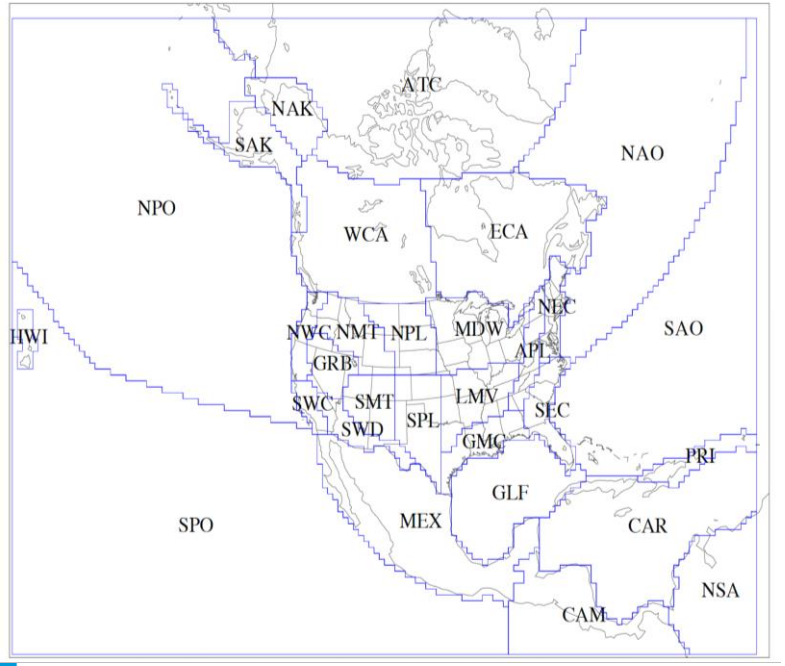
PM25 verification VSDB vs MET

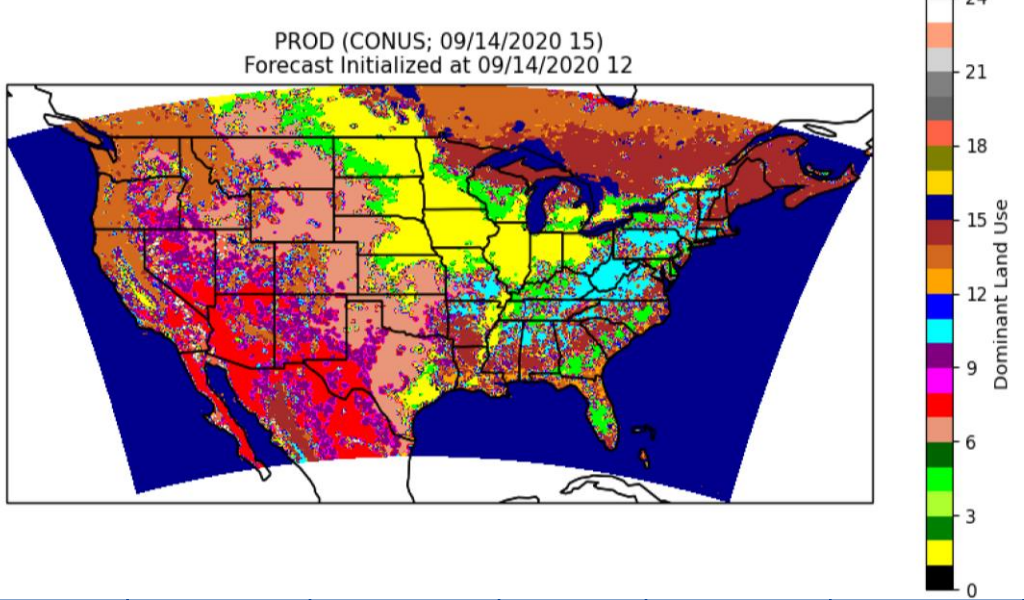


Overview of Current Capabilities: Generating Results Once Daily



Regions and Masking Options





1. Urban	2. Dryland Crop	3. Irrigated Crop	4. Mixed Dry/Irr. Crop	5. Crop/Grassland	6. Crop/Woodland
7. Grassland	8. Shrubland	9. Mixed Shrub/Grass	10. Savanna	11. Deciduous Broadleaf	12. Deciduous Needleleaf
13. Evergreen Broadleaf	14. Evergreen Needleleaf	15. Mixed Forest	16. Water	17. Herbaceous Wetland	18. Wooden Wetland
19. Barren	20. Herbaceous Tundra	21. Wooded Tundra	22. Mixed Tundra	23. Bare Ground Tundra	24. Snow

Note: not all DLUSE types have matched pairs; will consolidate similar land types rather than process them individually