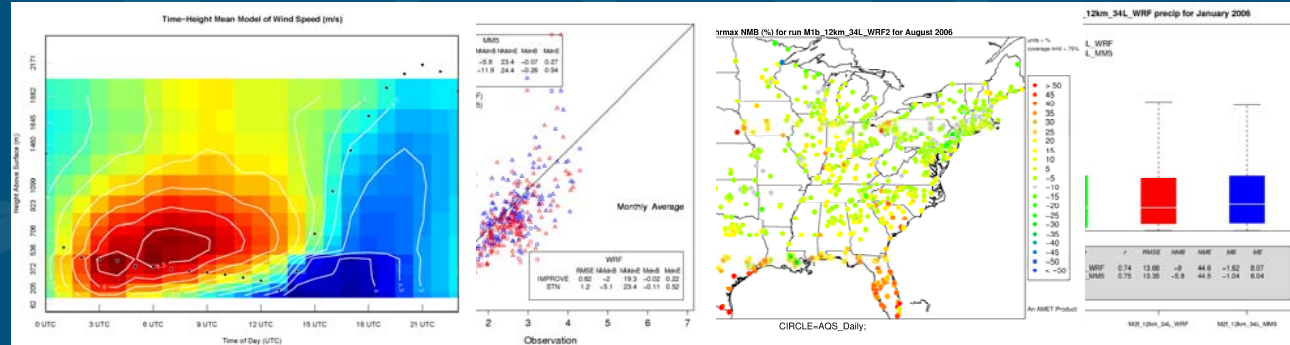


The Atmospheric Model Evaluation Tool

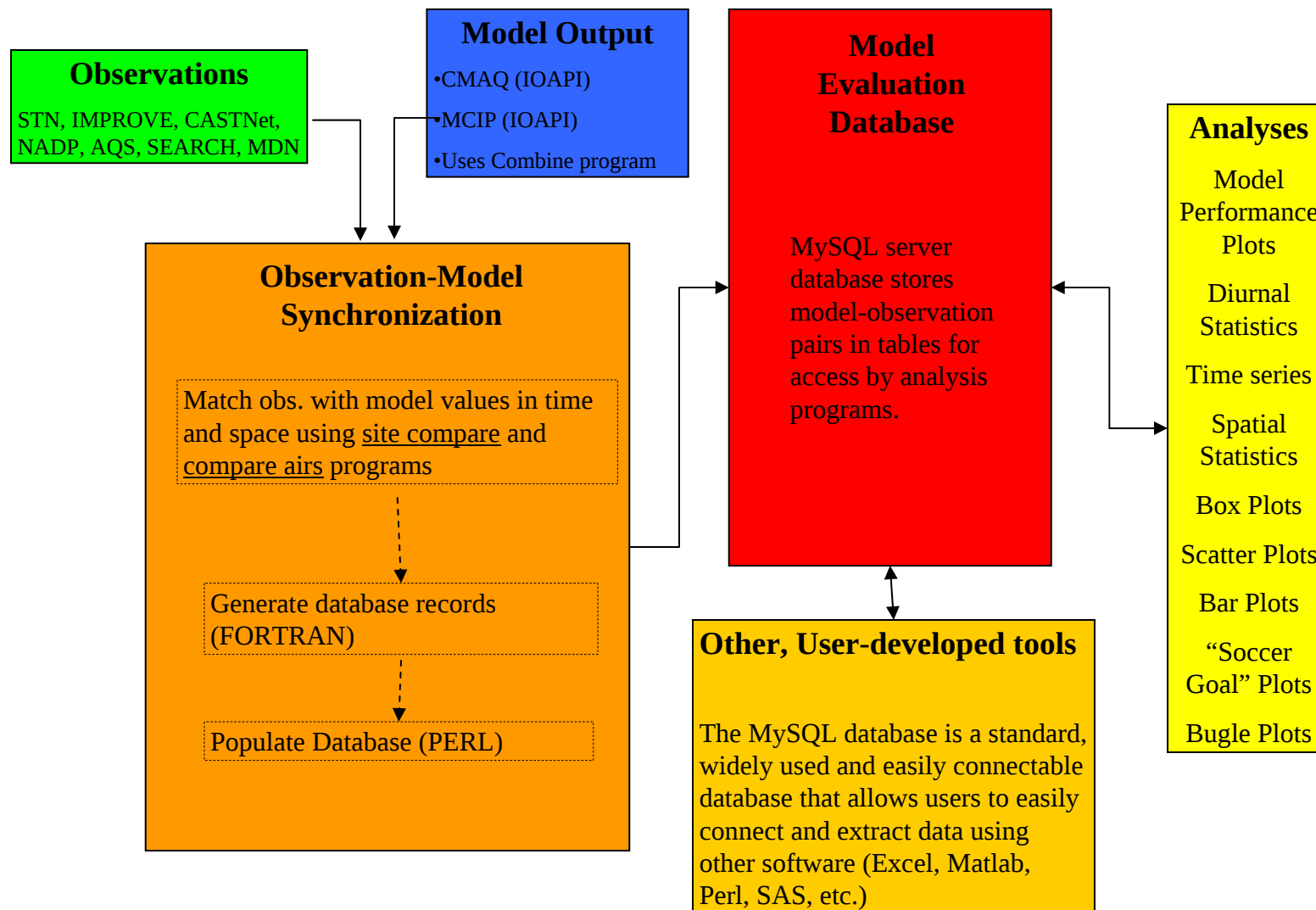
K. Wyat Appel and Robert C. Gilliam
9th Modeling Conference, RTP, NC
October 10, 2008



What is AMET?

- Atmospheric Model Evaluation Tool
- Two modules
 - Meteorology (Rob Gilliam)
 - Air Quality (Wyat Appel)
- Combination of several open source software packages
 - MySQL
 - R
 - Perl
- AMET specifically designed to compare observations against meteorological (e.g. MM5, WRF) and air quality model (e.g. CMAQ, CAMx) predictions
 - Does not export all gridded data to database

AMET-AQ Evaluation Flow Chart



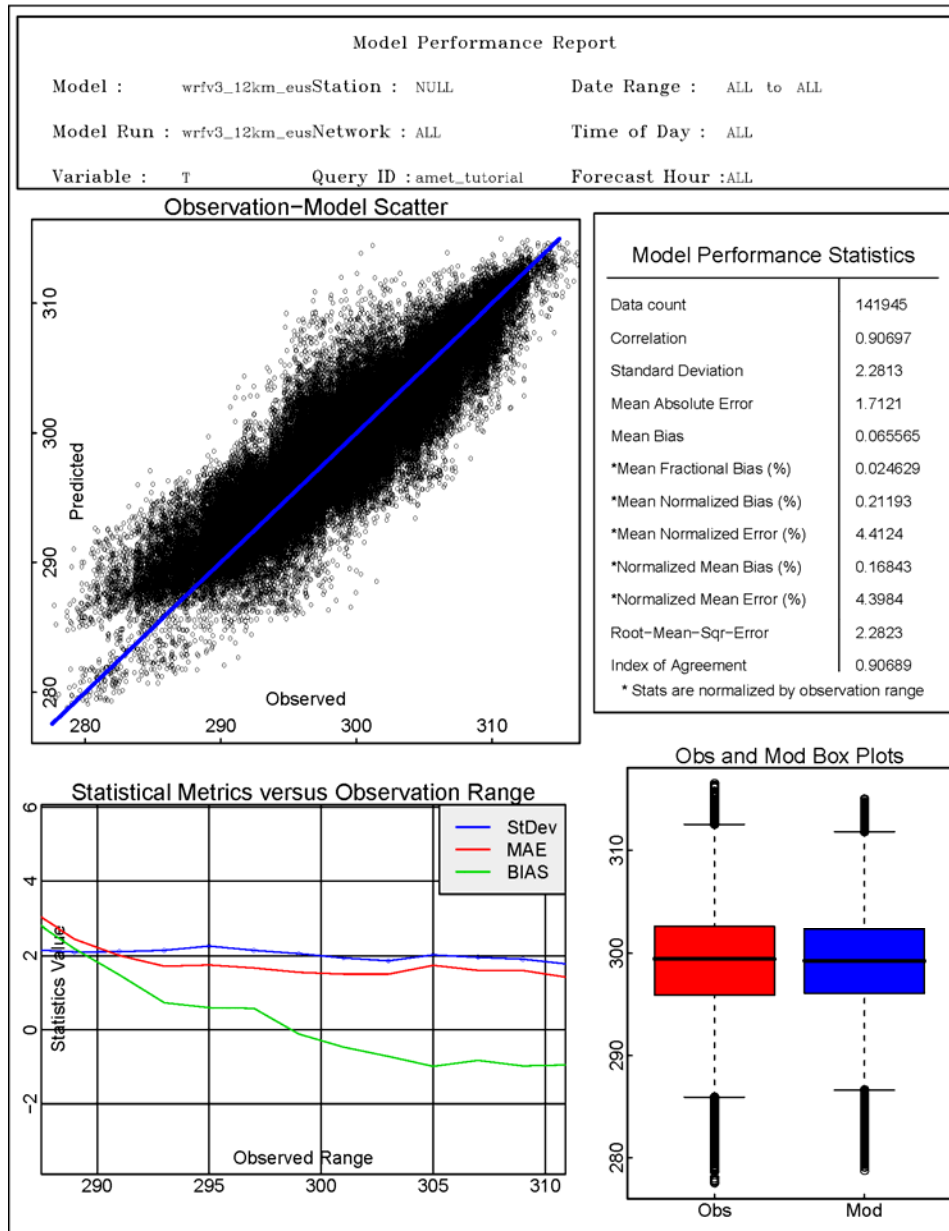
Advantages of the AMET System

- Somewhat automated/interactive system
- Data stored in relational database
 - Data from multiple simulations stored in a single location
 - Allows data queries based on many factors
 - Time period, geographic location, time of day, etc.
- Pre-generated analysis scripts
 - Same analysis for multiple simulations
 - Common analyses between different groups
- Open Source
 - Easy to create new scripts (if you know R)

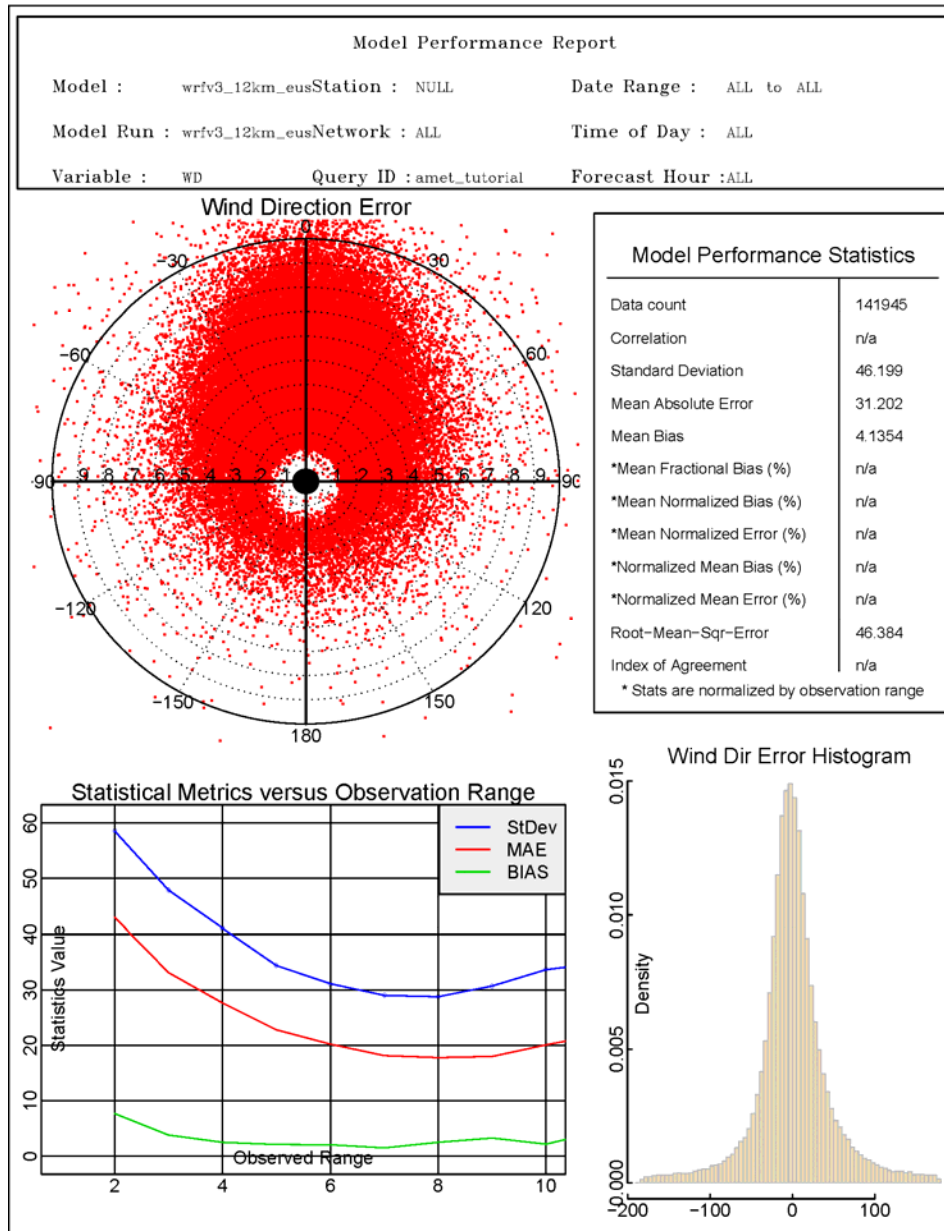
Available AMET-MET Analyses

- Model Performance Summary
 - includes various plots (scatter, box, etc.) along with various statistics
- Timeseries
- Spatial Plots
 - various statistical values (e.g. NMB, NME, etc.)
- Bar Plots
 - error, bias, etc.
- Rawindsonde
- Wind Profiler
- Aircraft Profiler

Model Performance Summary



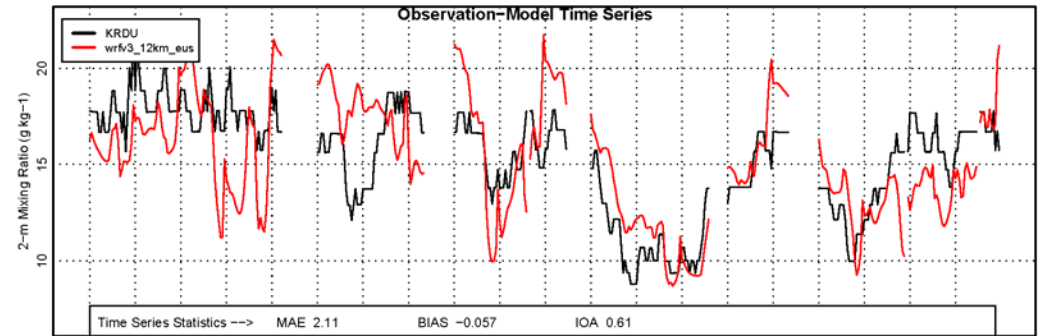
Temperature



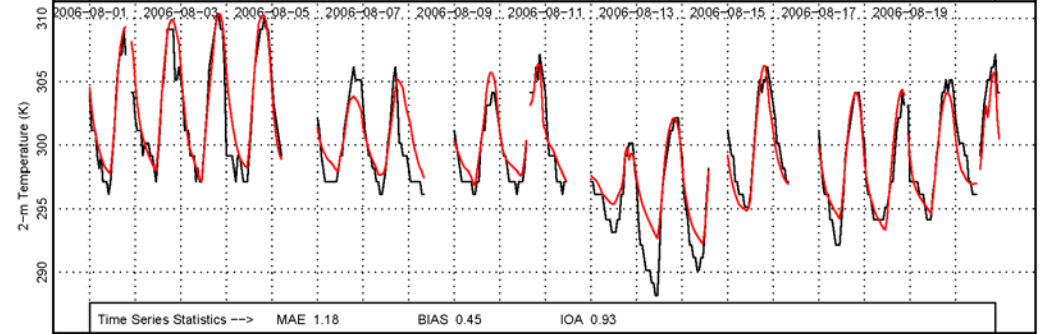
Wind Direction

Time Series

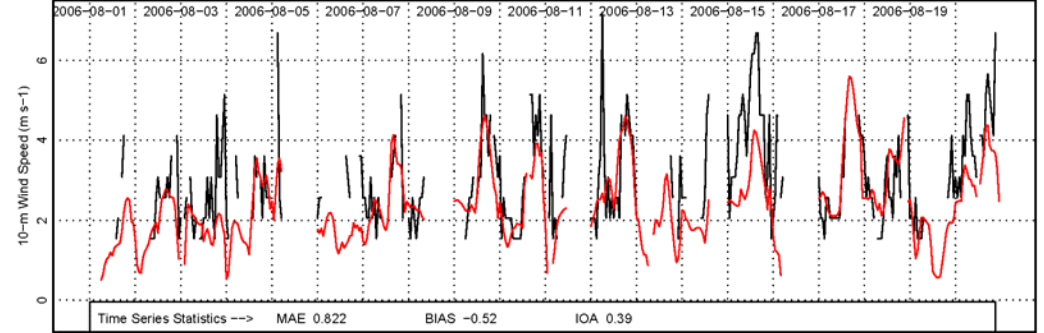
2-m Mixing Ratio →



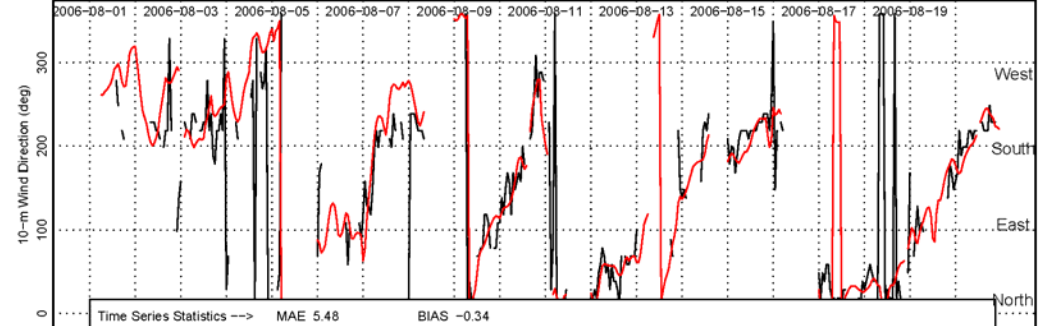
2-m Temperature →



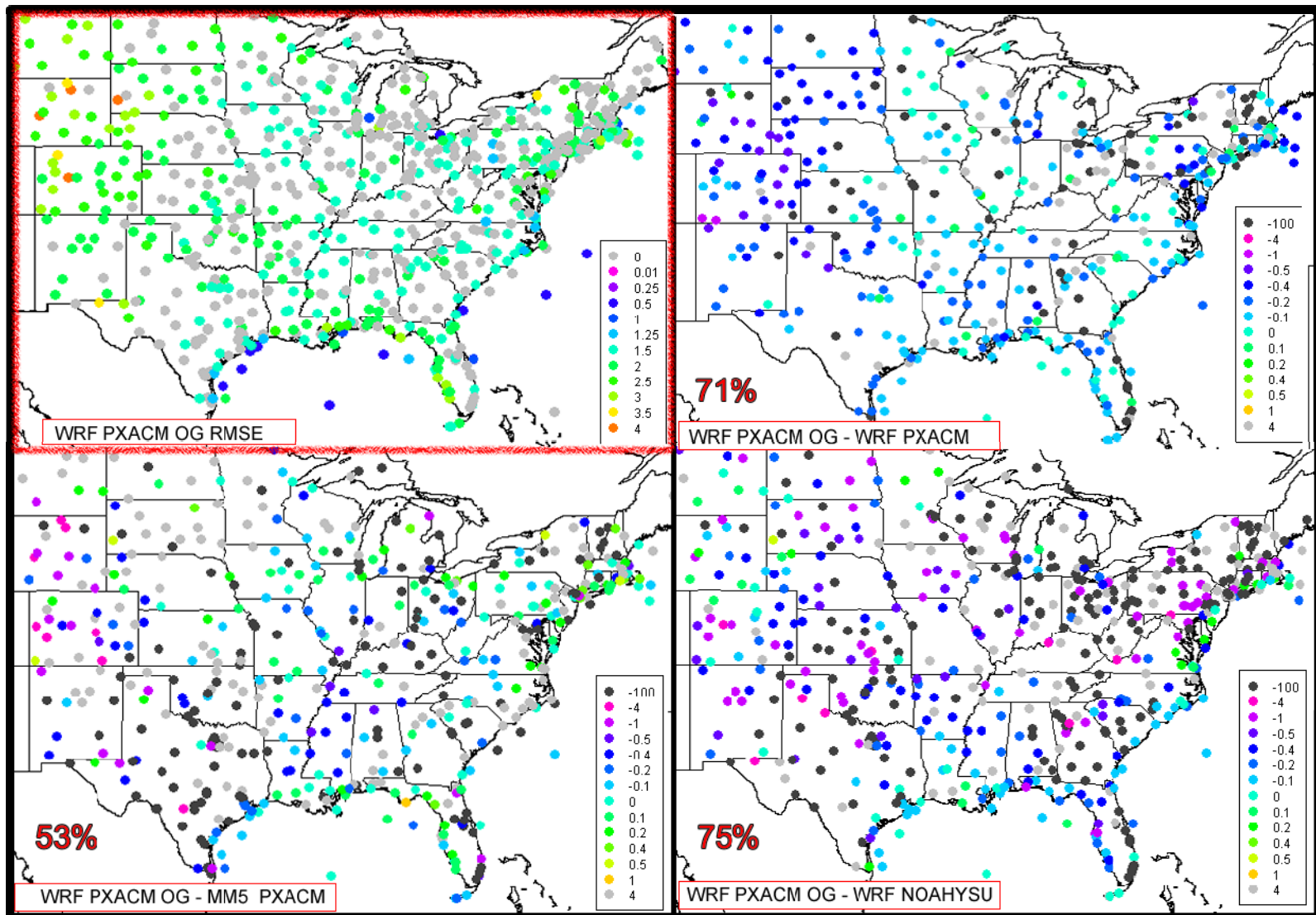
2-m Wind Speed →



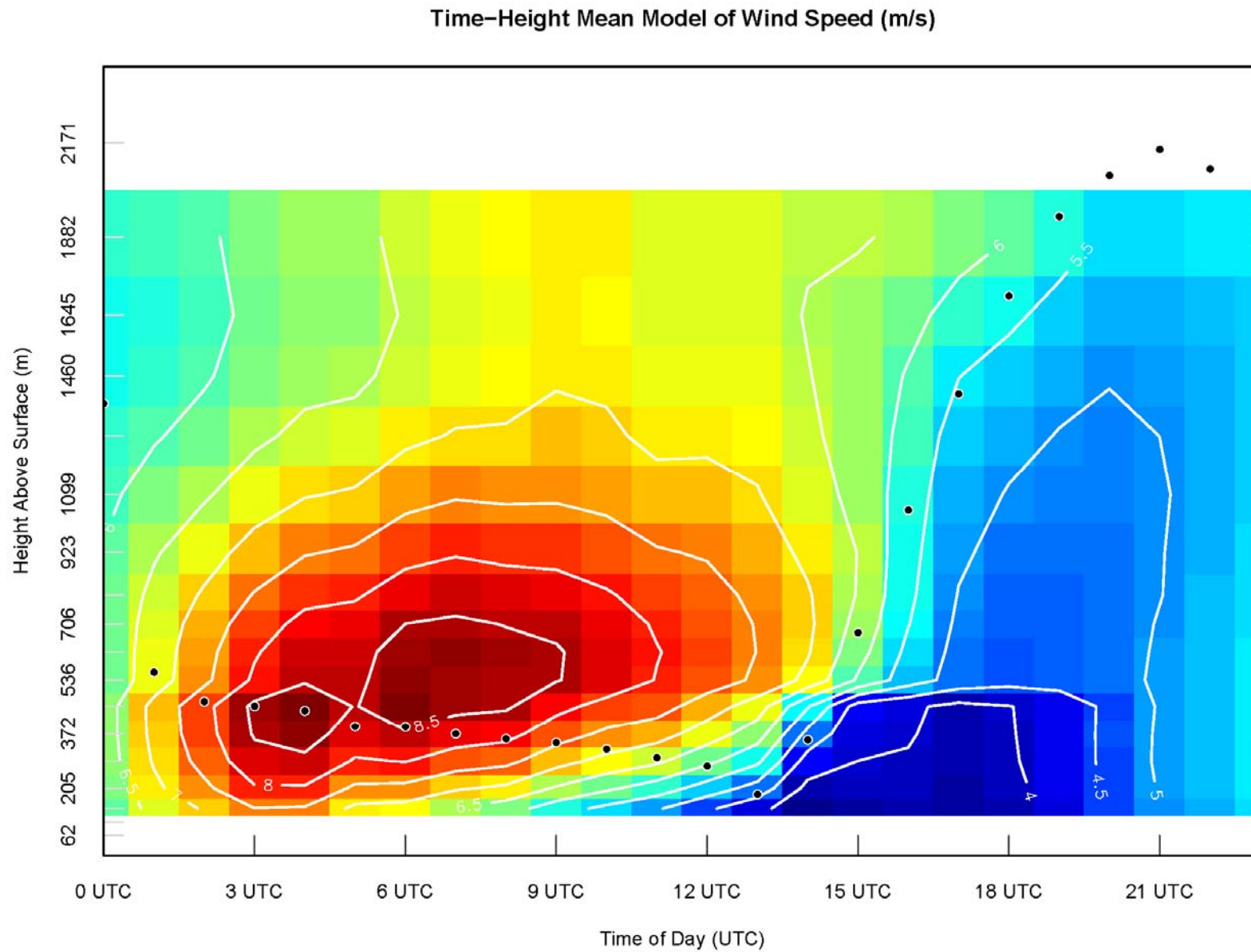
2-m Wind Dir. →



Spatial Statistics

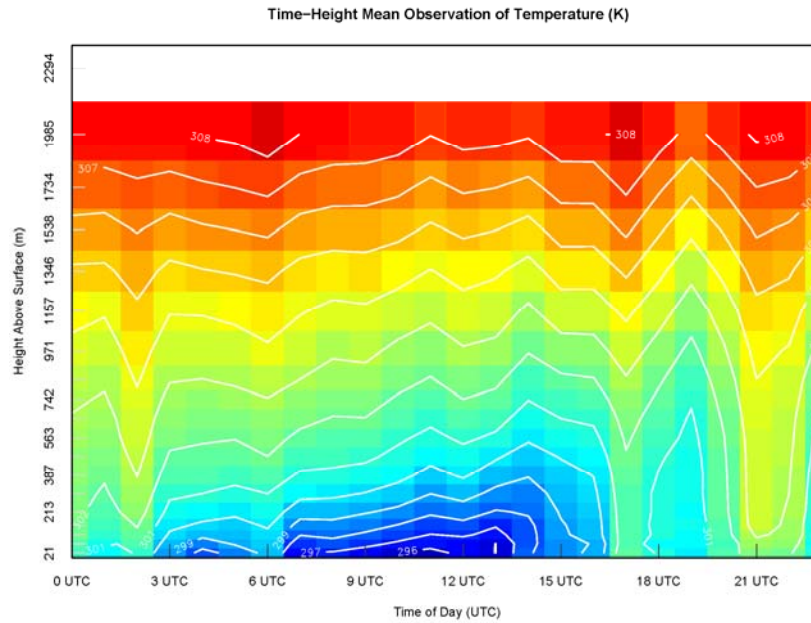


Wind Profiler – Model Comparisons

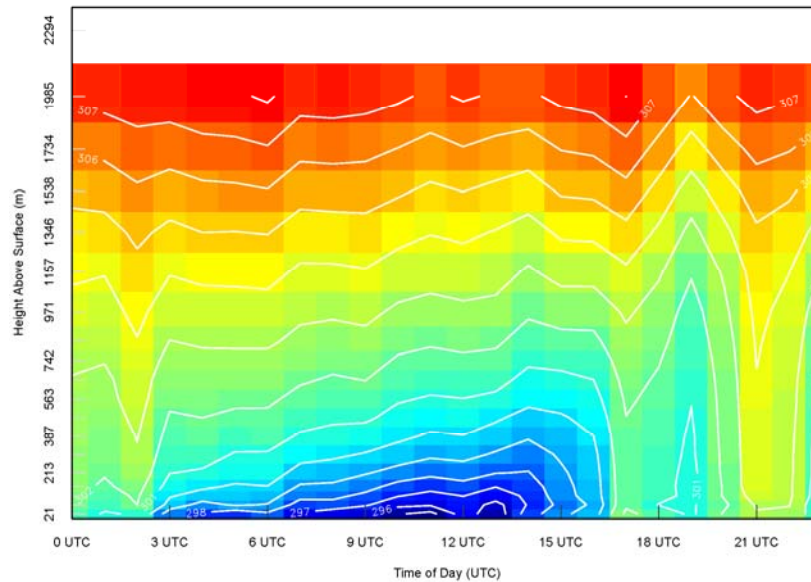


Aircraft Profile Comparisons (Potential Temp)

Aircraft
Mean

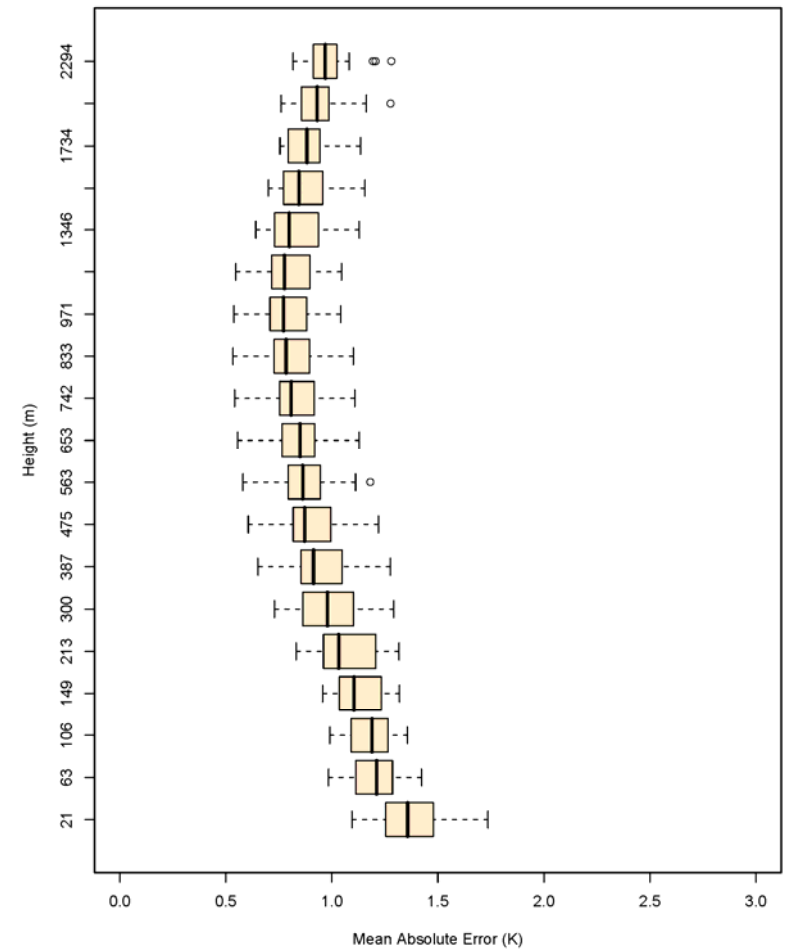


WRF
Mean



Mean Absolute Error Distribution by level

Distribution by Height of Mean Absolute Error for Temperature

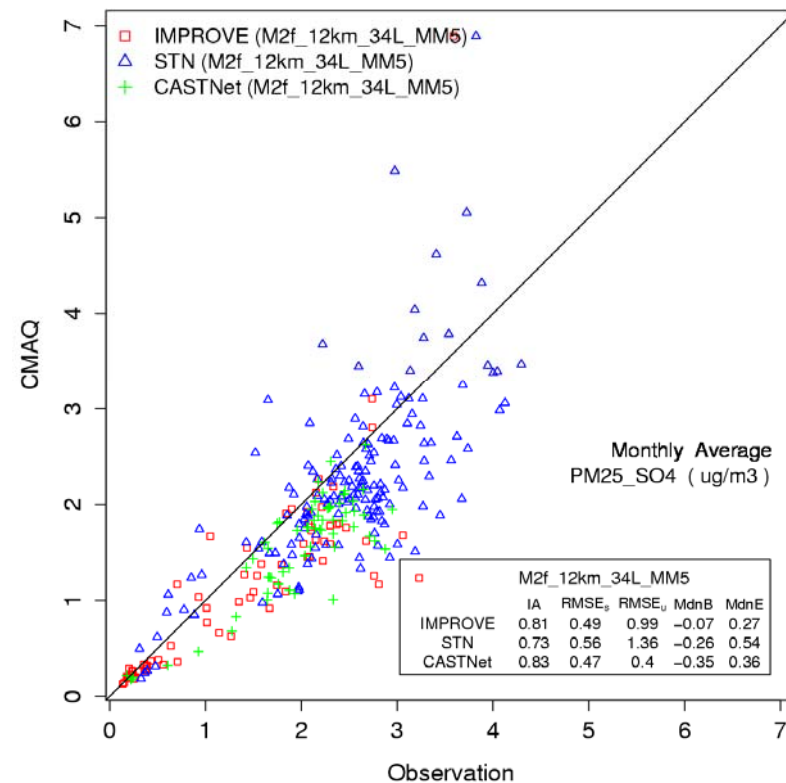


Available AMET-AQ Analyses

- Scatter Plots
 - model to observation
 - model to model (at observation points)
- Summary Statistics (as csv text file)
- Spatial Plots
 - various statistical values (e.g. NMB, NME, etc.)
 - concentrations (predicted, observed, and difference)
- Box Plots
- Stacked Bar Plot
- Bugle Plot
- Soccer Goal Plot

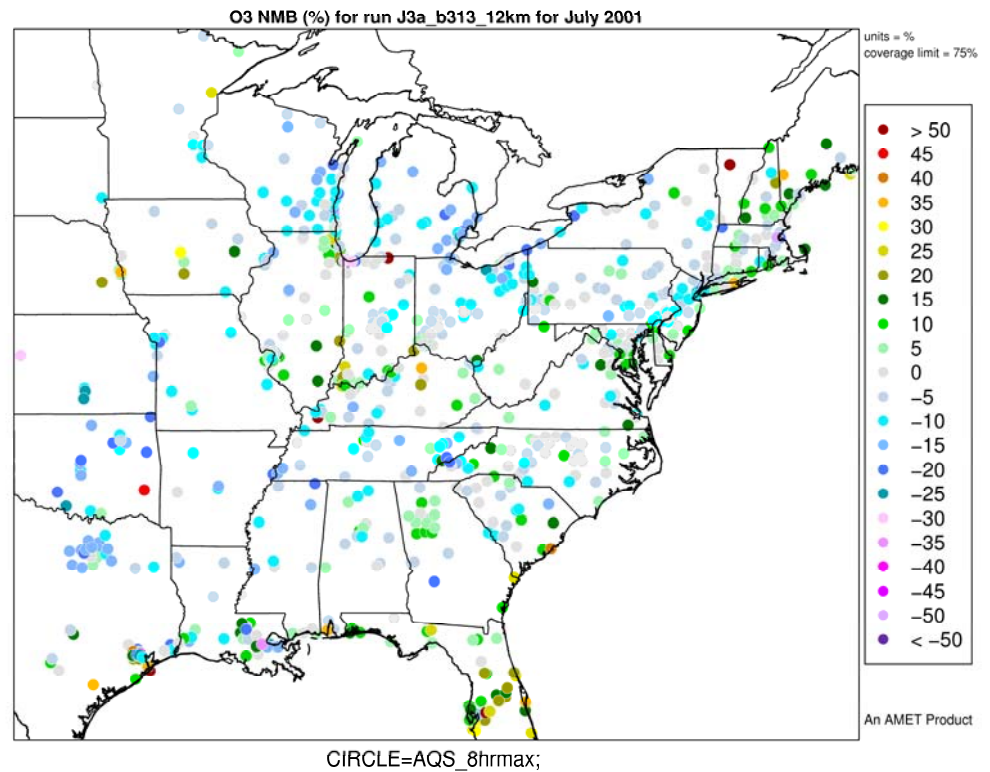
Scatter plots

- Model vs. Obs
- Model vs. Model
- Multiple Networks
 - select statistics
- Single Network
 - additional statistics
- Ozone Specific
- Temporal Averaging
 - monthly, seasonal, annual



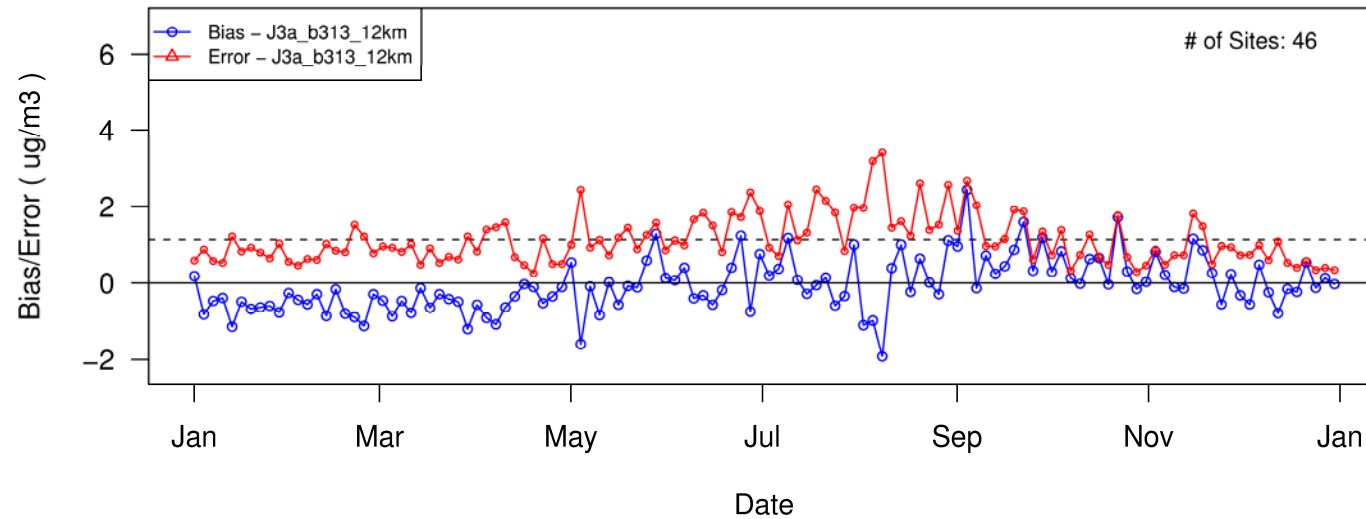
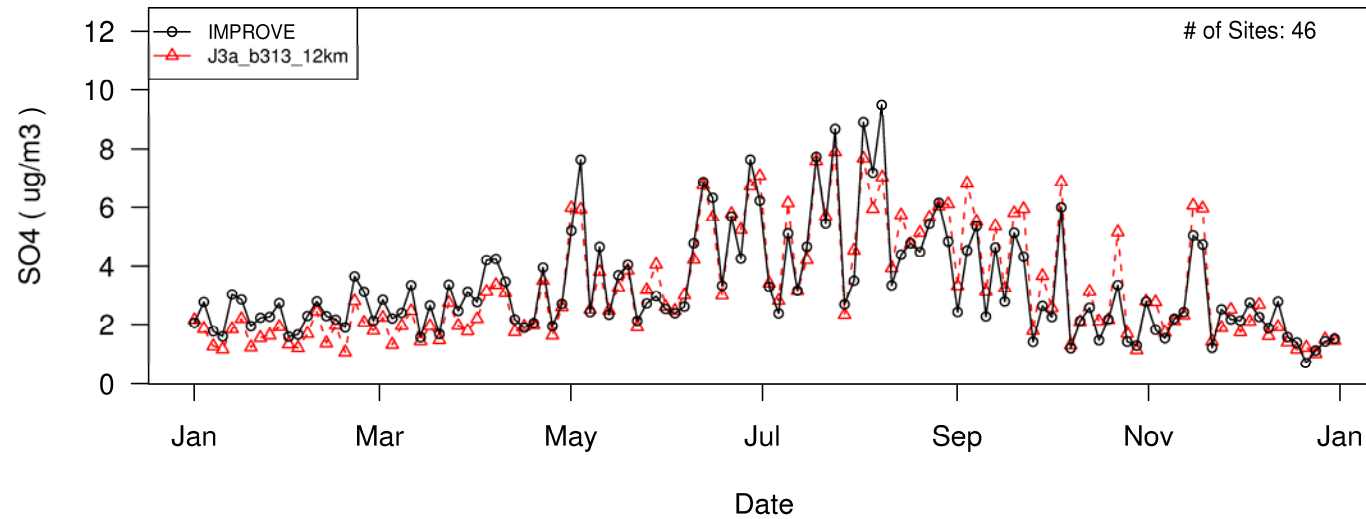
Spatial Plots

- Statistics
 - NMB, NME, Correlation, etc.
- Concentrations
 - model, observation, difference
- Sub-regions



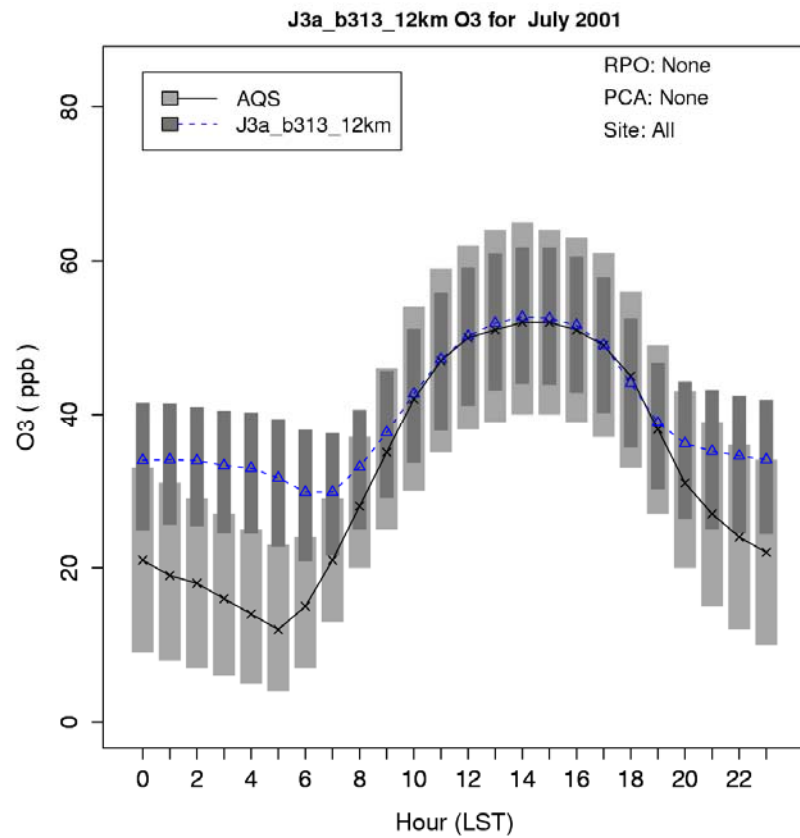
Time Series Plots

J3a_b313_12km SO4 for IMPROVE Site: All

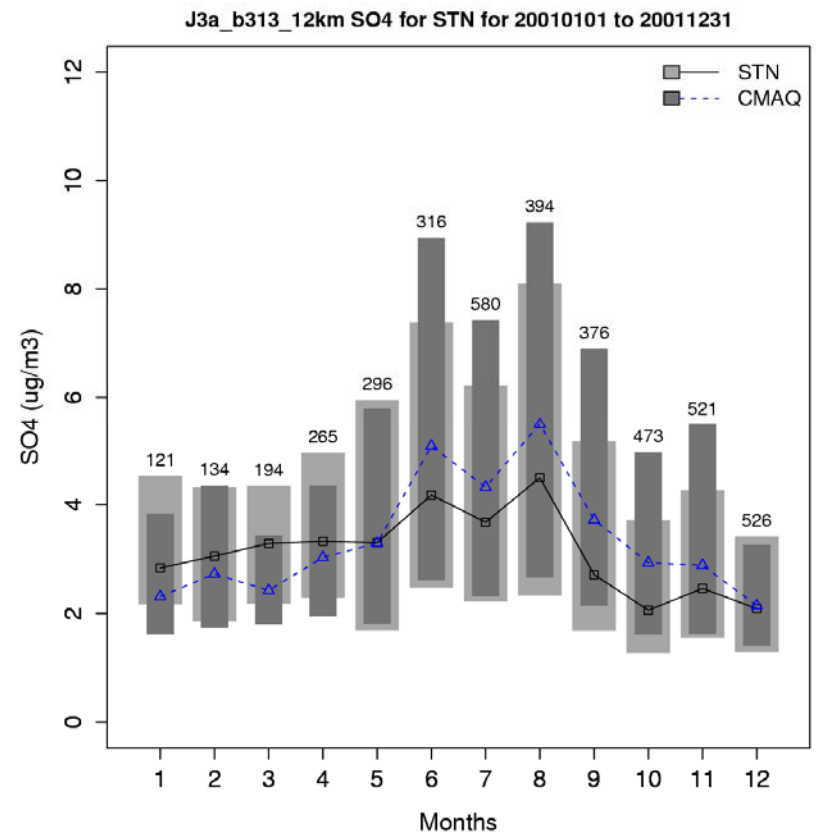


Box Plots

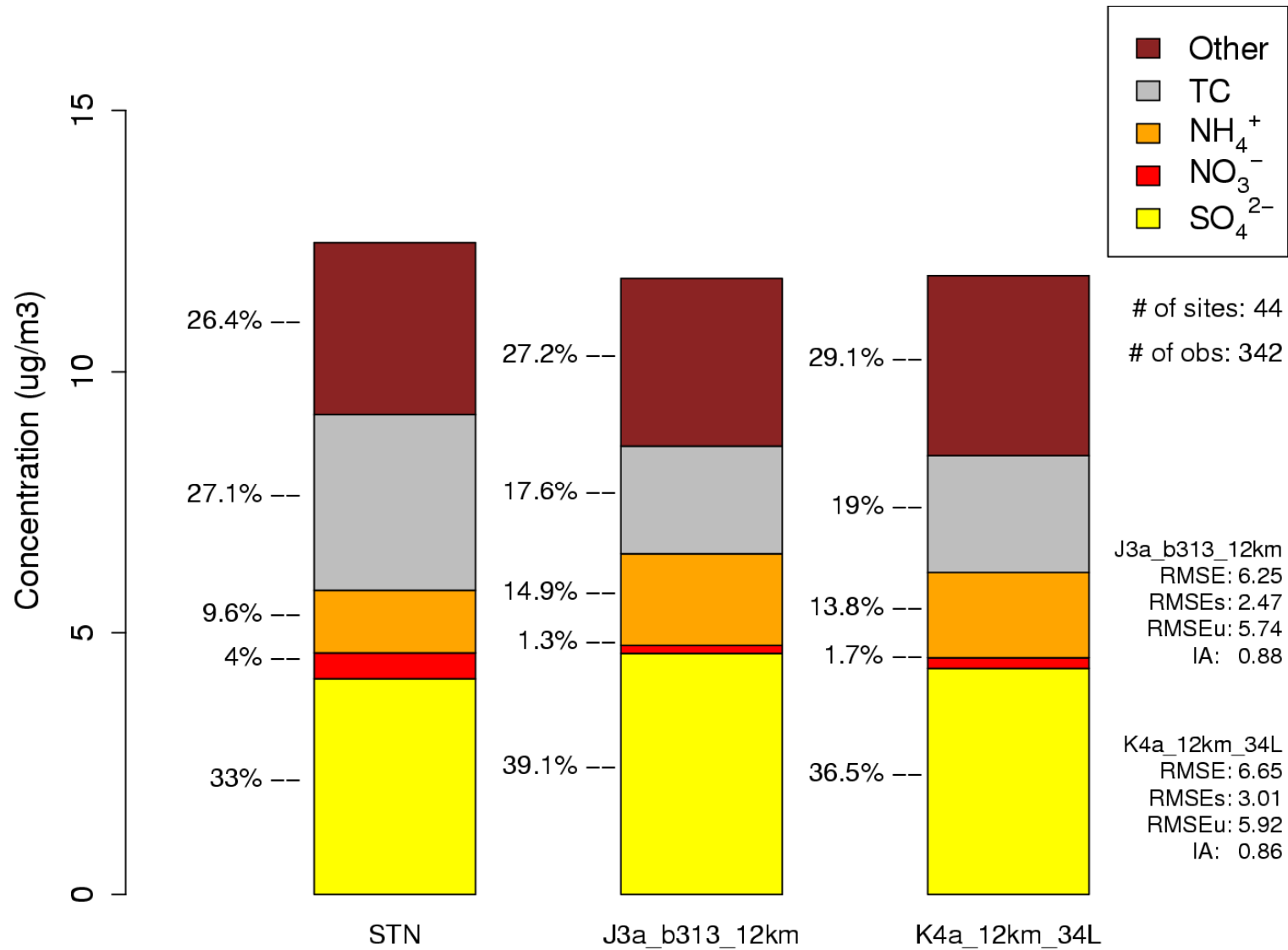
Diurnal Box Plot



Monthly Box Plot

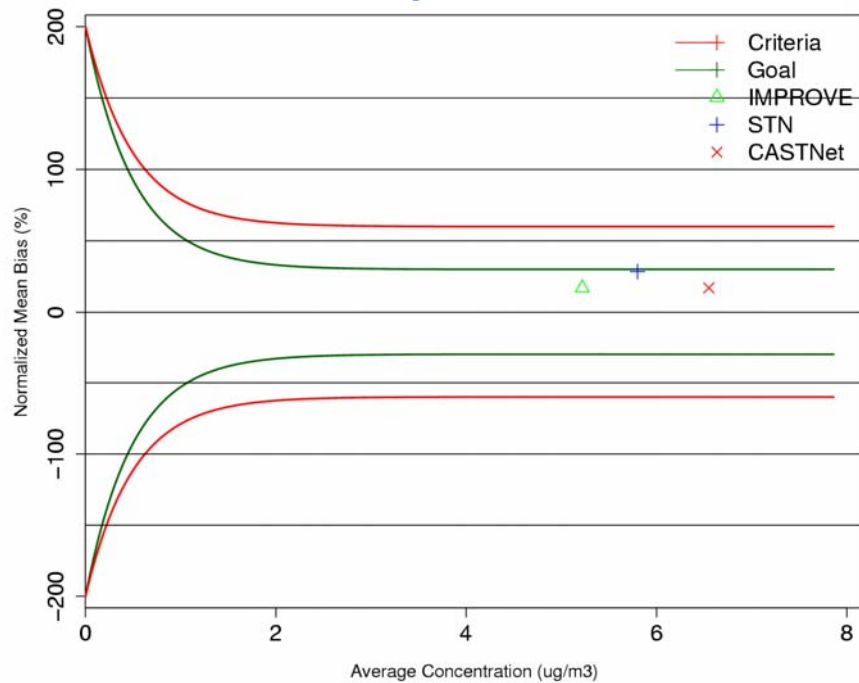


Stacked Bar Plots

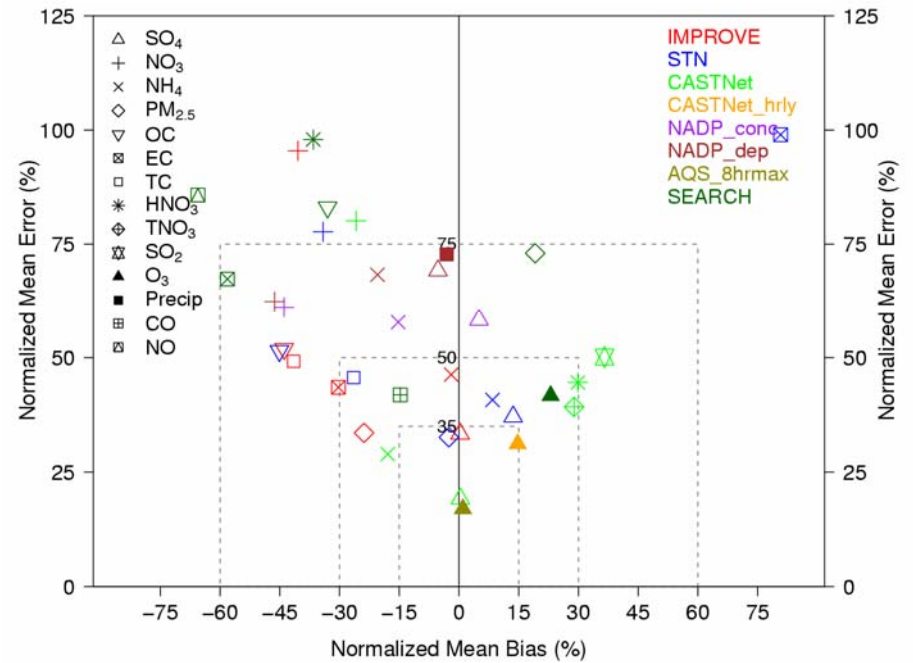


Other Plots

“Bugle” Plot



“Soccer Goal” Plot



Extending AMET beyond CMAQ

- Design of AMET can be extended beyond CMAQ
- Any paired prediction / observation dataset could potentially be used
- Analysis scripts can be used without the rest of AMET

Public Availability of AMET

- AMET is available for download on the CMAS website
 - Both Met and AQ versions available
 - Script based version
 - Extensive users guide included
- Contains most of the functionality shown here
- Met and AQ versions can be installed together or individually
- Includes tutorial data and example output plots
- Bugzilla available for AMET

Future Improvements to AMET

- Java interface
 - Currently under development
 - Runs AMET locally and accesses remote database
 - Interactive tabs
 - User friendly
 - Portable (to a degree)
- Additional analysis scripts
 - Developed internally
 - Developed externally (user community)
- More query options