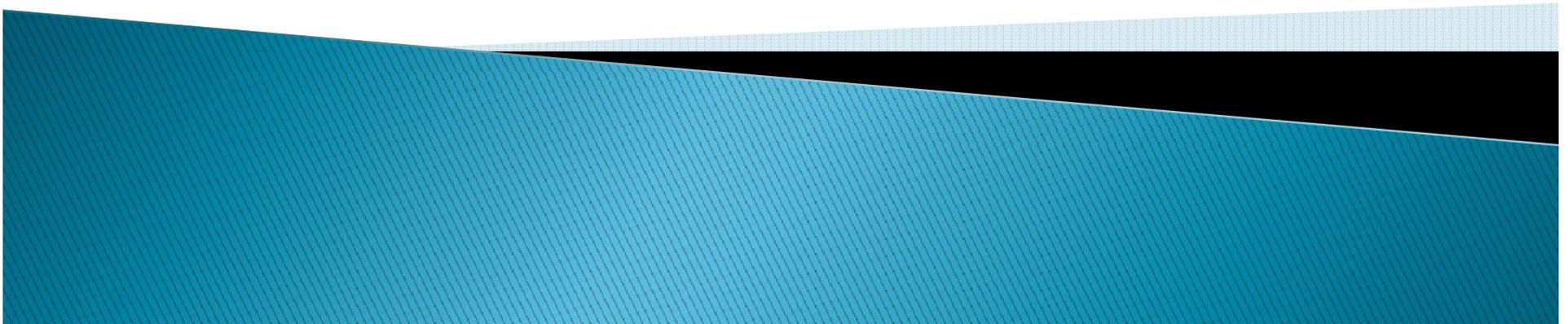


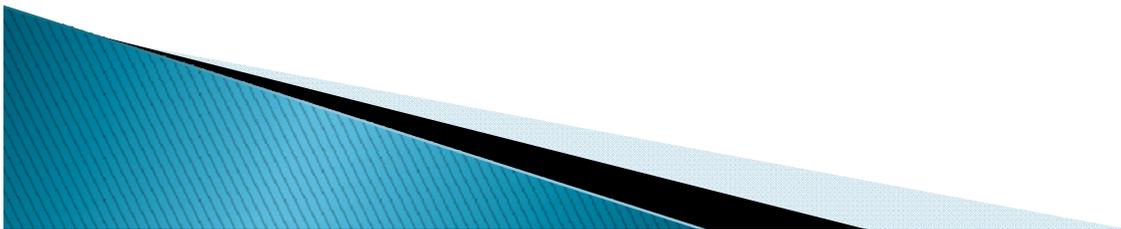
# Modeling for the 1-hr SO<sub>2</sub> Standard

S. F. Mueller  
Tennessee Valley Authority



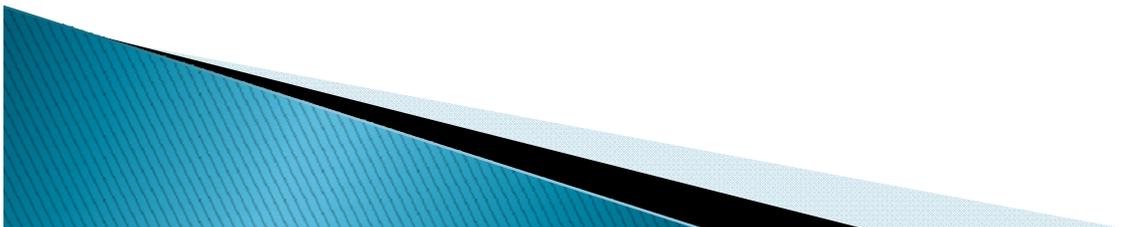
# Modeling Exercise

- ▶ Issue: Does temporal resolution of meteorological data influence modeling outcomes for 1-hr SO<sub>2</sub> levels?
- ▶ Analysis Objective: Compare performance of standard and sub-hourly versions of AERMOD against hourly observations for an SO<sub>2</sub> point source.



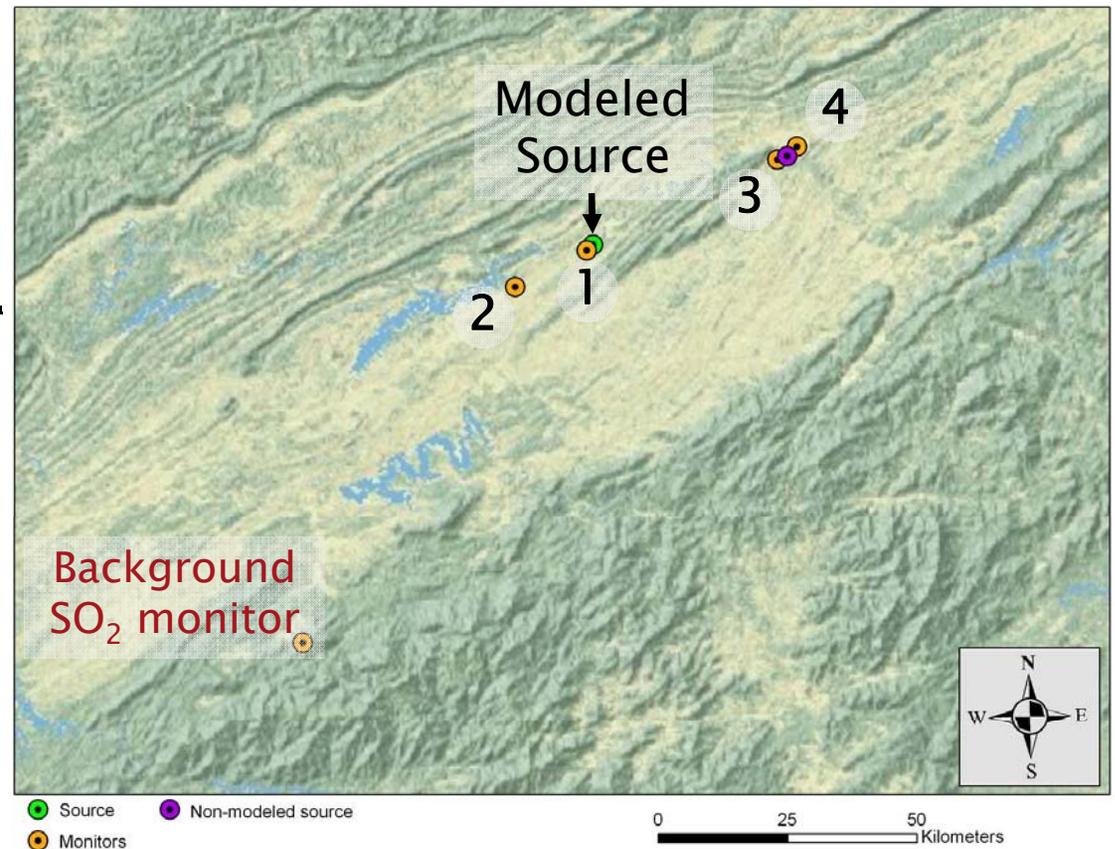
# Modeling Summary

- ▶ AERMOD (v. 11353) with EPRI/AECOM sub-hourly data processing and post-analysis options.
- ▶ Source: 800 MW coal-fired power station
- ▶ Variable hourly SO<sub>2</sub> emissions (CEMs data)
- ▶ Periods: 2000–2002, 2004
- ▶ Meteorological data:
  - National Weather Service (NWS) 1-min surface data
  - NWS upper-air data
- ▶ 50x50 km grid with 0.5 & 1 km receptor spacing
- ▶ No downwash calculations; no deposition

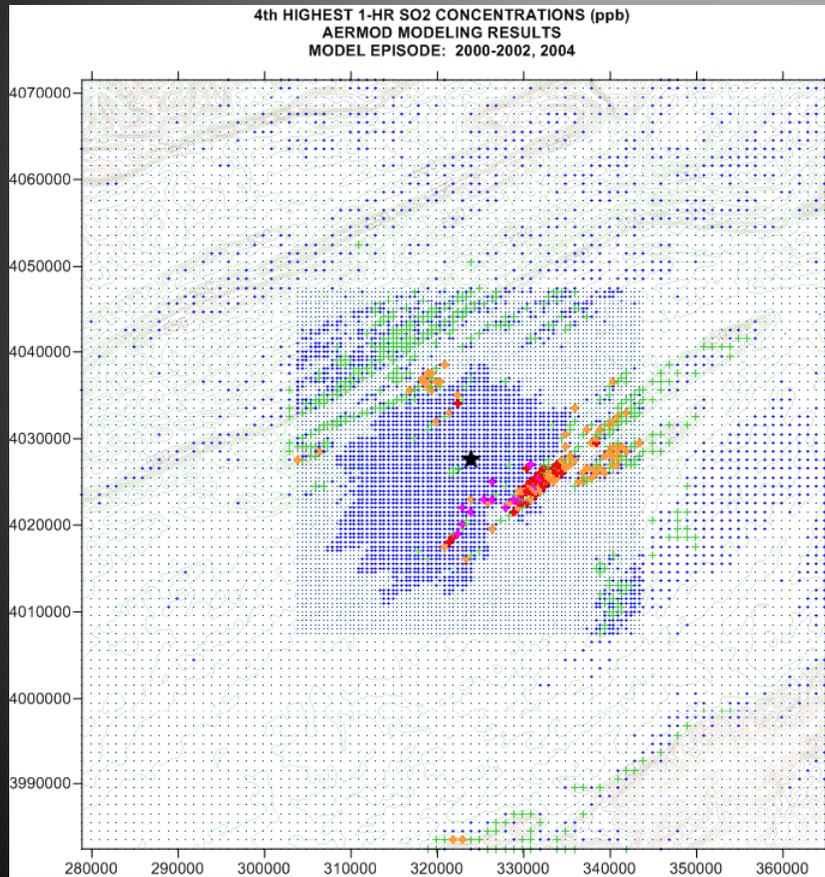


# SO<sub>2</sub> Observations

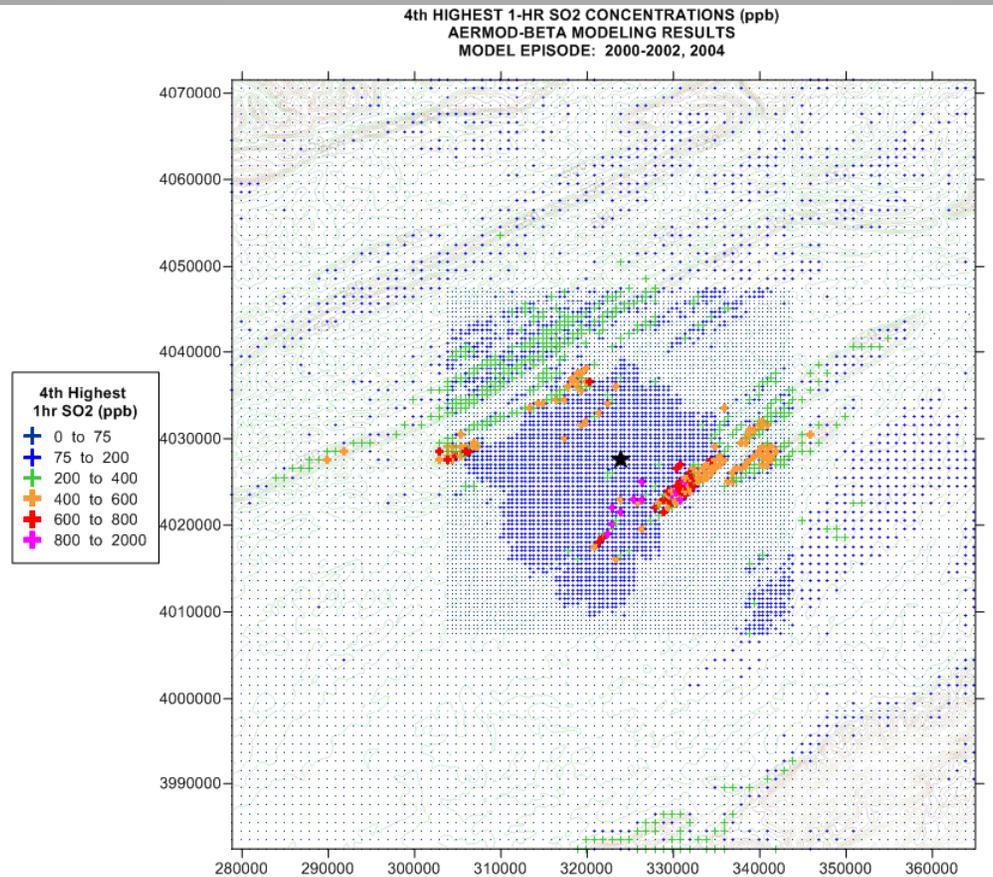
- ▶ Four low-elevation compliance/PSD monitors (numbered in figure) for comparison with model output.
- ▶ One mountain top monitor for daily background levels.



# 4-yr Ave. 99<sup>th</sup> Percentile of Daily Maximum 1-hr SO<sub>2</sub>



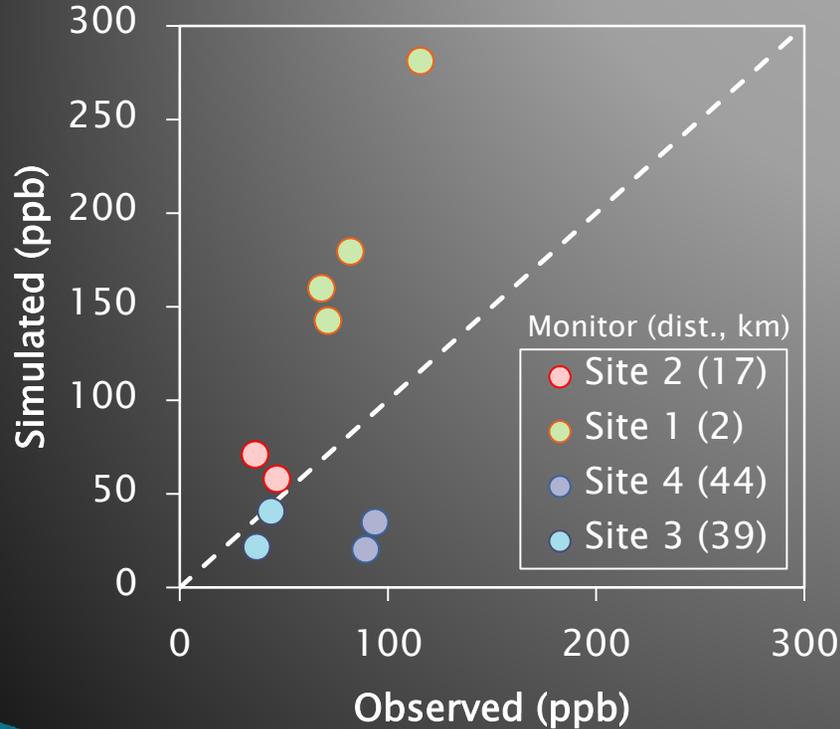
Standard Hourly Meteorology



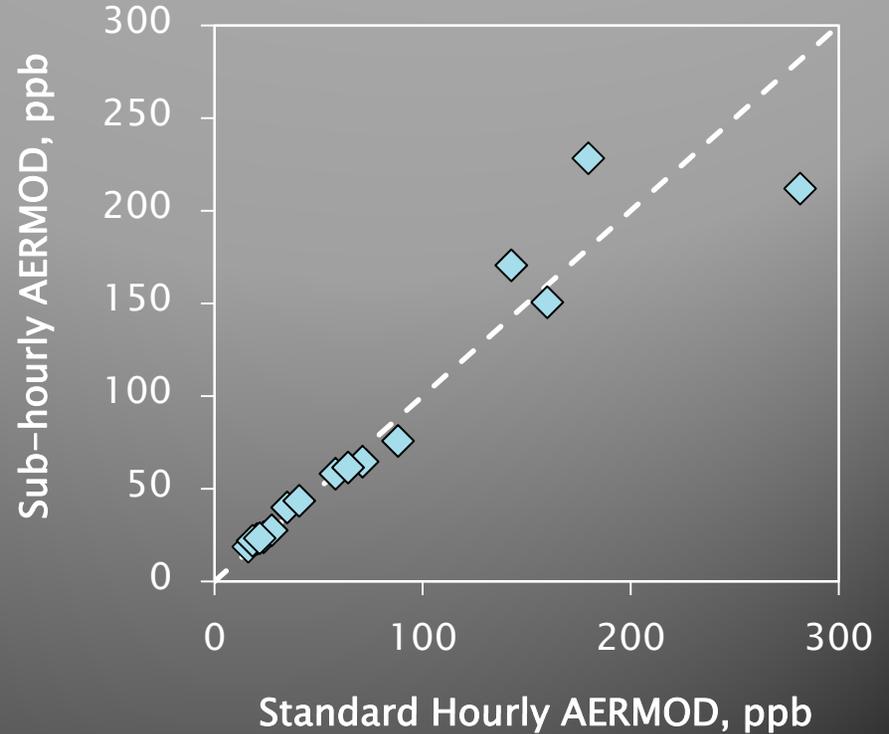
Sub-hourly Meteorology

# Simulated vs. Observed Annual 99<sup>th</sup> Percentile of Daily Max. 1-hr SO<sub>2</sub>

Standard AERMOD vs. Background-Adjusted Observations for Plant-Aligned Wind Directions

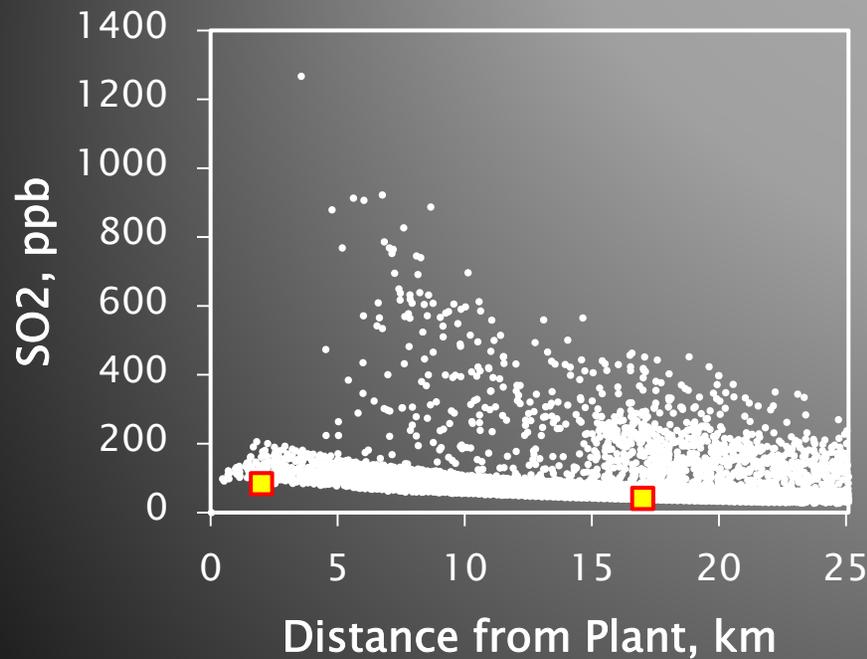


Sub-hourly & Hourly AERMOD Results Compared

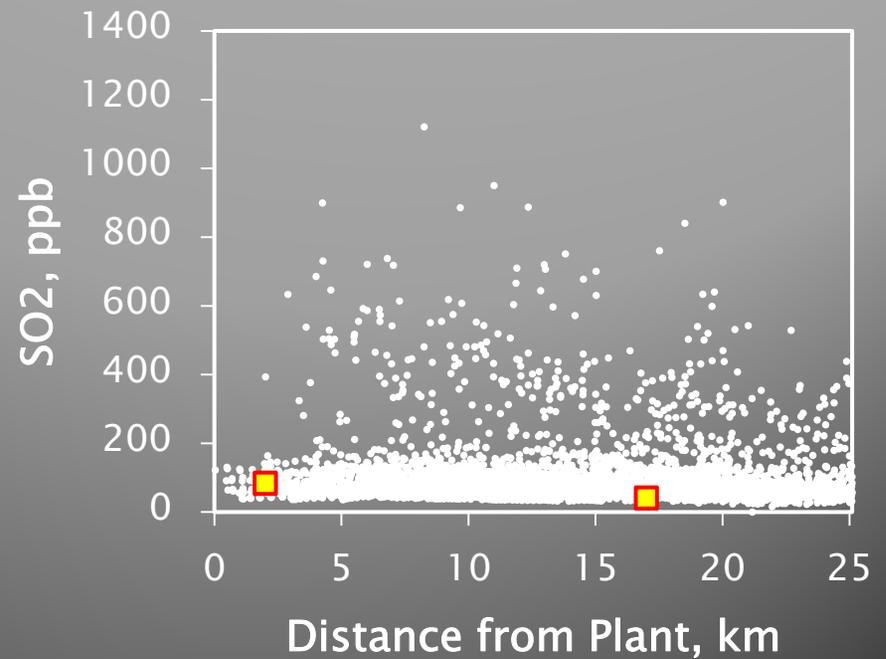


# 4-yr Average 99<sup>th</sup> Percentile SO<sub>2</sub> vs. Distance from Source

## Hourly Modeling



## Sub-hourly Modeling



■ = observed value

# Conclusions

- ❑ Time-scale of input meteorology does not always reduce simulated 99<sup>th</sup> percentile 1-hr values.
- ❑ AERMOD over-estimated max. daily 1-hr SO<sub>2</sub> by 80% on average when non-modeled source influences can be neglected. Is it time for a new modeling paradigm, i.e., non steady-state plumes?
- ❑ Increase in plume meander due to sub-hourly winds can be offset by an increase in hours modeled with very low wind speeds *increasing* the number of hours when the steady-state plume assumption is least valid.

