Supporting Material

Use of a process analysis tool for diagnostic study on fine particulate matter predictions in the U.S.-Part I: Model evaluation

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Observational networks

Table S1 shows parameters and associated observational databases included in the model evaluation. As shown in Tables 1 and 2 and the Table S1, the six datasets do not always give similar data for model evaluation. For example, AIRS-AQS, CASTNET, and SEARCH contain max 1-hr and 8-hr O_3. SEARCH, CASTNET, IMRPOVE, and STN contain $PM_{2.5}$ or its components. NADP and ASOS contain weekly total and hourly precipitation data, respectively. In addition, there is no data overlapping of sites at different networks (e.g., no precipitation data overlapping at the NADP and ASOS sites). For all observational data available hourly, the hourly simulated results are directly compared with them. For observational data available at a larger time scale (e.g., weekly total for precipitation and wet deposition from NADP), the hourly values from the model simulation are first used to calculate the simulated weekly total and then compared with observations. The statistics are calculated based on the time scale of the observations (e.g., hourly, weekly average, or weekly total). Given different characteristics of network sites and methods used for measurements, the statistics for each measured variable at different networks are calculated separately.

Table S1. Parameters and associated observational databases included in the model evaluation

Network	Variables/Species	Total Sites Evaluated	Sampling Frequency
AIRS-AQS	O_3	1 058	hourly
ASOS	Precipitation	13	hourly total
	T2, RH2, WS10, WD10		hourly
CASTNET	O_3,	71	hourly
	SO_4^{2-}, NO_3^-, NH_4^+		weekly average
IMPROVE	$PM_{2.5}$, SO_4^{2-}, NO_3^-, NH_4^+, EC, OC	61	1 in 3 days, 24-h average
NADP	precipitation	136	weekly total
	wet deposition of SO_4^{2-}, NO_3^-, NH_4^+		weekly total
	T2, RH2, WS10, WD10		hourly
SEARCH	O_3, SO_2, NO, NO_2, CO, HNO_3	8	hourly
	$PM_{2.5}$, SO_4^{2-}, NO_3^-, NH_4^+, EC, OC		hourly and daily/24-h average
SOS99	T2, RH2, WS10, WD10	2	hourly
NARSTO SOS99NASH	PBLH	4	hourly
STN	$PM_{2.5}$	12	1 in 3 days, 24-h average
NARSTO SOS99NASH DOE G-1 Aircraft	vertical profiles of temperature, relative humidity, O_3, NO, NO_2, CO, SO_2	-	every 10 minutes during mid-afternoon (i.e., 1:00 to 2:00 pm, local time) on June 22, 1999
TOMS/SBUV	TOR	-	daily

Note:
AIRS-AQS: the Aerometric Information Retrieval System - Air Quality Subsystem (http://www.epa.gov/air/data/aqsdb.html).
ASOS: the Automated Surface Observing System (http://www.nws.noaa.gov/asos/index.html).
CASTNET: the Clean Air Status and Trends Network (http://www.epa.gov/CASTNET).
IMPROVE: the Interagency Monitoring of Protected Visual Environments (http://vista.cira.colostate.edu/improve).
NADP: the National Acid Deposition Program (http://nadp.sws.uiuc.edu).
SEARCH: the Southeastern Aerosol Research and Characterization (http://www.atmospheric-research.com/studies/SEARCH).
SOS99: the Southern Oxidants Studies (http://www.ncsu.edu/sos).
NARSTO SOS99NASH: North American Research Strategy for Tropospheric Ozone, 1999 SOS Nashville Study
    (http://eosweb.larc.nasa.gov/GUIDE/dataset_documents/narsto_sos99nash_surface_met_chem_data.html).
STN: the Speciation Trends Network (http://www.epa.gov/air/data/aqsdb.html), where PM components are not available for the episode
    in this study.
DOE G-1 aircraft: the U.S. Department of Energy (DOE) G-1 aircraft (http://gonzalo.er.anl.gov/ACP/G-1page.html). These data were
obtained from the NASA Langley Research Center Atmospheric Science Data Center
(http://eosweb.larc.nasa.gov/GUIDE/dataset_documents/narsto_sos99nash_g-1_air_chemistry_data.html).
TOR: tropospheric ozone residual (http://asd-www.larc.nasa.gov/TOR/data.html#ootor). The TOR data used in this study was provided by
    Drs. Jack Fishman and John K. Creilson from NASA Langley research center.
TOMS/SBUV: the Total Ozone Mapping Spectrometer/the Solar Backscattered Ultraviolet instruments.
T2: 2-m temperature; RH2: 2-m relative humidity; WS: 10-m wind speed; WD: 10-m wind direction; PBLH: planetary boundary layer height.

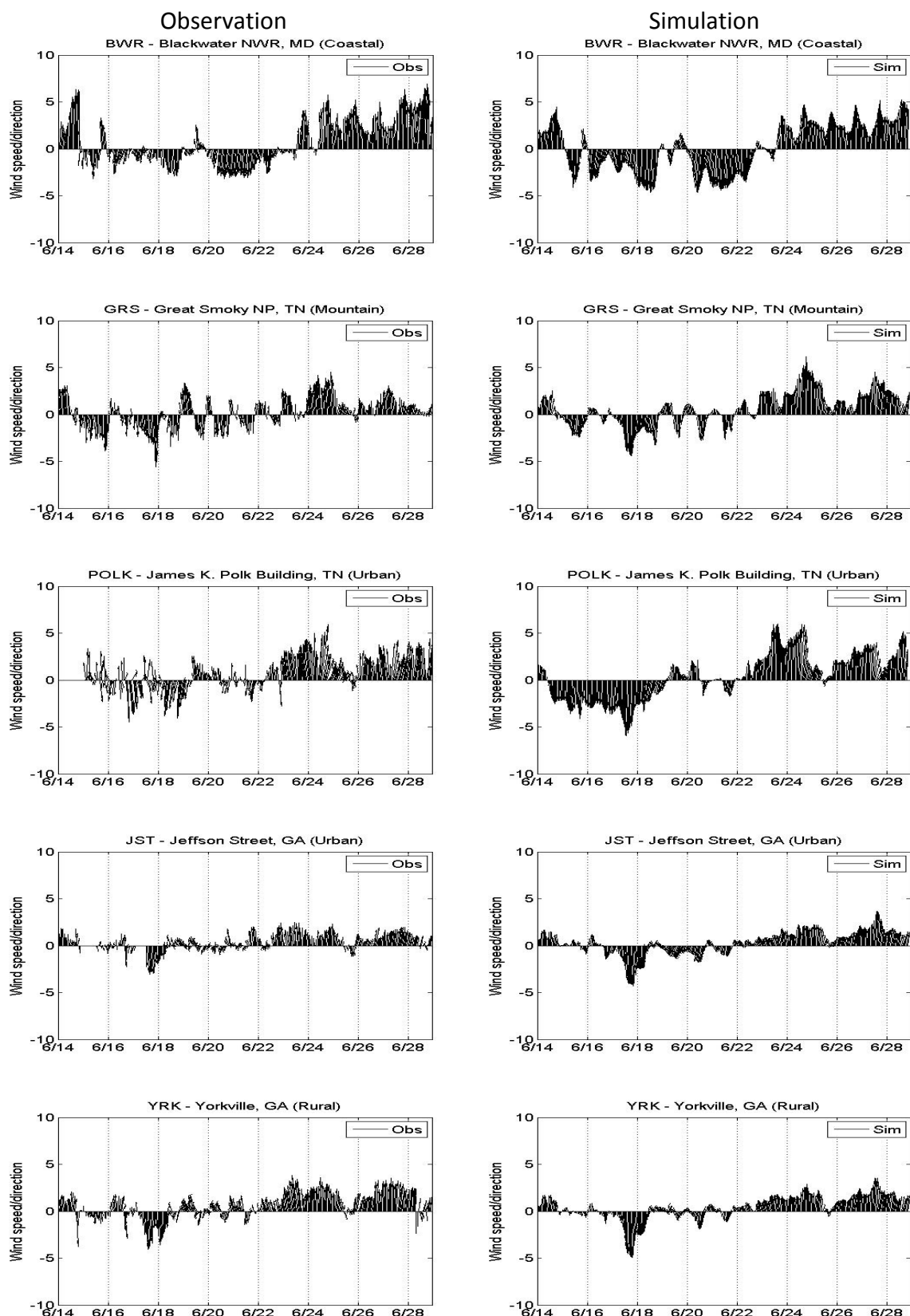## 1. Observed vs. simulated wind vectors

Figure S1. Simulated (by MM5) and observed temporal variations of 10-m wind speed/direction at coastal, mountain, urban (aloft and surface), and rural sites during June 14-28, 1999.
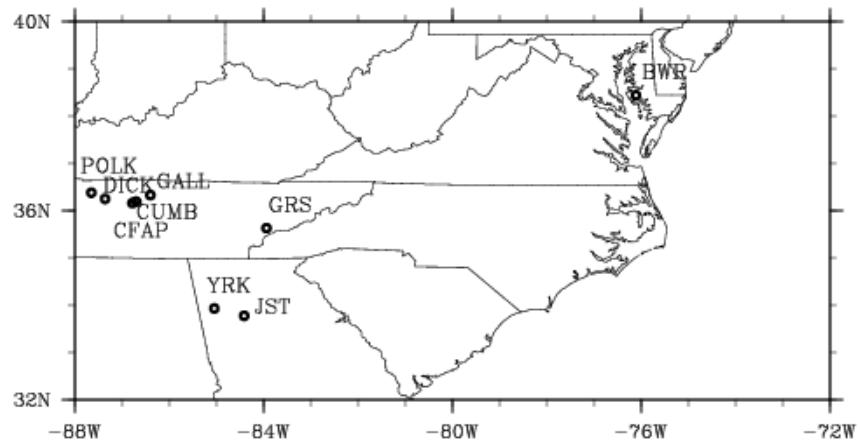
2. Locations of sites shown in Figures 1, 2, and S1.

Figure S2. The locations of the observational sites shown in Figures 1, 2, and S1 in this study.