Supplemental Material

Figure S1. Top row: Eastern US domain used in this study with state abbreviations. The NOx SIP Call states are shown in grey and the Ohio River is shown in blue. Bottow row: Location of AQS and CASTNET monitors falling with the 21 NO$_x$ SIP Call states, including DC, used in this study.
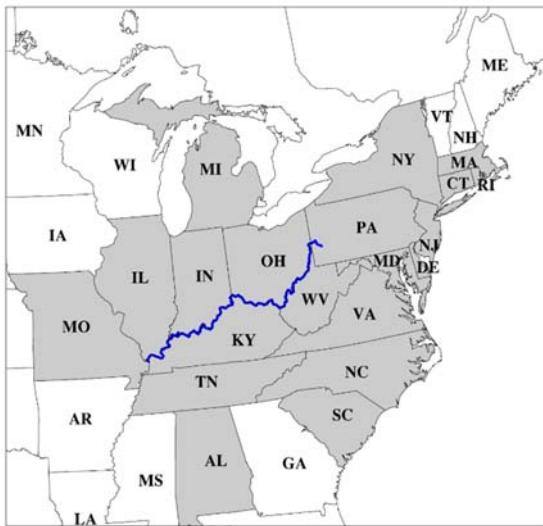

Monitor locations for Figures 1 and 6

◇ CASTNET (n=42)
● Rural AQS (n=192)
● Suburban AQS (n=189)
● Urban AQS (n=63)

Monitor locations for Figures 3 and 7

◇ CASTNET (n=7)
● AQS CBSA (n=53)
✱ Urban AQS for NO2 (n=45)
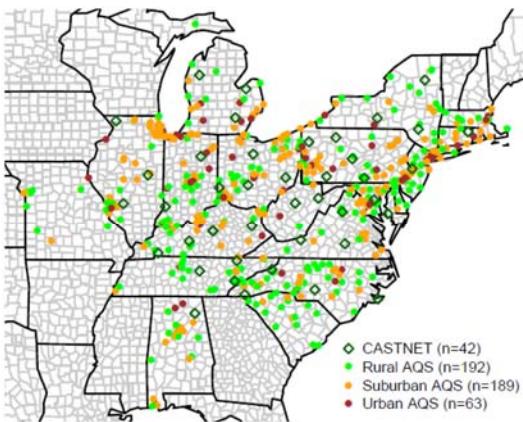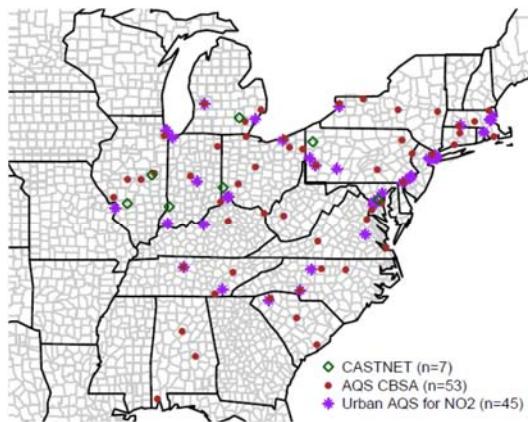
Figure S2. Daily total NO$_x$ (tons) CEMS data from the Herbert A. Wagner (HAW) Generating Station in Anne Arundel County, MD. 2005 NO$_x$ emissions were generally lower than 2002 emissions at this unit but the temporal fluctuations were different due to differences in electricity demand which was heavily influenced by year-specific meteorology. For example, the periods of zero NO$_x$ emissions during 2002 corresponds to a series of days when max temperatures at the nearby BWI Airport were 5-10 degrees Celsius lower than the average max temperature for the summer.

Daily Total NOx (Tons)
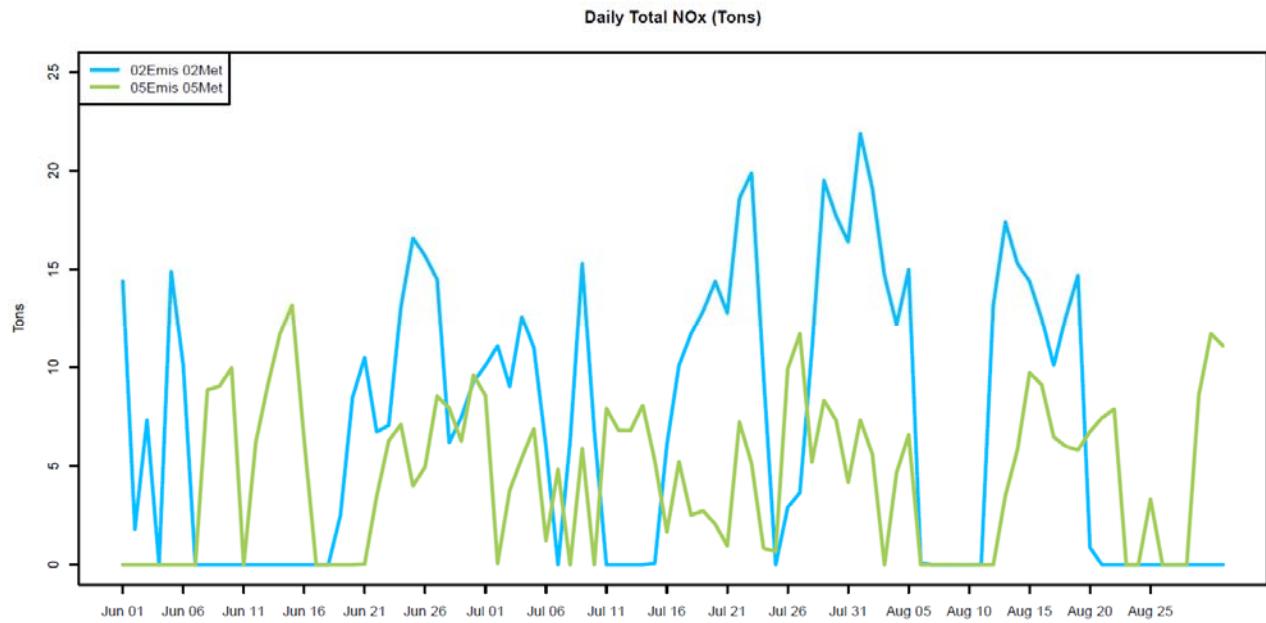
S3. Creation of hourly emissions for point sources without CEMS data (ptipm)

Pseudo-CEMS data were created for point sources that only have annual total emissions available in the NEI. For Sim02e02m, state-specific month-to-annual ratios were created by calculating three-year averages of 2001-2003 CEMS data for each month and dividing these monthly averages by the three year annual average for the state. The annual total ptipm emissions for each unit were then allocated to month totals using these state-specific monthly ratios. To allocate the monthly emissions to each day, state-specific day-to-month ratios were calculated using daily 2005 CEMS data divided by the monthly average for 2005. These state-specific day-to-month factors were then multiplied by the monthly total emissions for a given unit to calculate the total emissions on each day for that unit. The resulting daily emissions were input into the SMOKE processing system and hourly-to-daily allocation was performed using diurnal profiles. An analogous calculation was made to estimate hourly 2005 emissions for the Sim05e05m simulation based on 2004-2006 CEMS data. This is the standard method used in regulatory applications for creating simulations based on future emissions levels under current, base line meteorological conditions. Emissions inputs for Sim02e05m used 2002 ptipm unit annual total emissions scaled with 2001-2003 annual-to-month ratios to preserve the NO_x SIP call seasonal distribution and 2005 day-to-month ratios to preserve the meteorological patterns of the meteorological year. Emissions inputs for Sim05e02m used 2005 ptipm unit annual total emissions scaled with 2004-2006 annual-to-month ratios and 2002 day-to-month ratios.

Figure S4. Observed and modeled 2005 – 2002 change in mean MDA8 ozone (ppb) attributed to changes in meteorology at 53 AQS and 7 CASTNET locations. Note that the met-adjusted observations (top plot) are based on the mean over May through September of each year and the modeled values (bottom) are based on June through September averages.

Observed 2005 – 2002 Summer Mean MDA8 Attributed to Meteorology

Modeled 2005 – 2002 Summer Mean MDA8 Attributed to Meteorology