3.039 Wintertime NOx Chemistry in Power Plant Plumes.

Early Career Scientist

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Abstract:

Nitrogen oxides (NO\textsubscript{x} = NO + NO\textsubscript{2}) play a key role in atmospheric chemistry and coal-fired power plants are a major source of NO\textsubscript{x} to the atmosphere, making up approximately 30% of emissions in the US (epa.gov). NO\textsubscript{x} emissions can vary seasonally, as well as plant-to-plant, with important impacts on the evolution of the plume chemistry. In particular, due to inefficient plume dispersion, nighttime NO\textsubscript{x} emissions from power plants are held in concentrated plumes, where various reaction and mixing rates can have a strong influence on plume chemistry. During the day, NO\textsubscript{x} catalyzes ozone (O\textsubscript{3}) production, while at night it can react to form nitric acid (HNO\textsubscript{3}) and nitryl chloride (ClNO\textsubscript{2}) and remove O\textsubscript{3} from the atmosphere. These processes are well studied in the summer, but winter measurements are more limited.

We will show results from the aircraft-based WINTER campaign over the northeastern United States, where several nighttime intercepts of power plant plumes were made. The intercepts show variable rates of N\textsubscript{2}O\textsubscript{5} conversion to HNO\textsubscript{3} and CINO\textsubscript{2}, which, in turn, alters the rate of removal of NO\textsubscript{x} from the atmosphere. Additionally, if the N\textsubscript{2}O\textsubscript{5} conversion is high, then the partitioning between CINO\textsubscript{2} and HNO\textsubscript{3} formation plays a
significant role in NO$_X$ removal. Finally, the rate of plume mixing and the background O$_3$ level also contribute to the rate of NO$_X$ removal. Through modeling of plume chemistry and dispersion, we will show the relative importance of each of these influences on wintertime power plant plume chemistry and transport and how they influence removal of NO$_X$ from the atmosphere.