3.013 Rapid Changes of Residential and Power Sector Energy Use in China: Emissions and Chemical Impacts .

Early Career Scientist

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Abstract:

Atmospheric pollutant emissions have serious consequences for ambient air quality, climate, and public health. Emissions, such as Particulate Matter (PM), Oxides of Nitrogen (NO_x), Carbon Monoxide (CO) and Sulfur Dioxide (SO_2), are rapidly changing in China. Residential energy usage is a large contributor to ambient $PM_{2.5}$, but plans are underway to mitigate these emissions through installation of improved cookstoves in rural China. Significant decreases in SO_2 and NO_x, largely a result of policies controlling thermal power plant emissions and mobile sources, have already been observed over (approximately) the last five years, as has been tracked by remote sensing observations. These rapid changes make it challenging to accurately simulate air quality in China using existing emission inventories. Further, assessment of specific pollution mitigation efforts, using chemical transport models, is limited by inaccurate emissions.

We conducted a series of sensitivity studies to investigate the impacts of rapidly changing emissions on air quality in China. We investigated several factors, such as the changes to NOx and SO_2 emissions based on the latest NASA Ozone Monitoring Instrument (OMI) data estimates, and the sensitivity of ambient pollutant concentrations to current and potential changes in residential emissions, distinguishing estimates of heating emissions from cooking. Annual simulations were completed for 2014 using the Weather Research and Forecasting model with Chemistry (WRF-Chem), a fully-coupled, “online” regional chemical transport model. Model output was evaluated against surface

air quality measurements across China, with the evaluation results used to assess the accuracy of available emission estimates. Finally, applying model output to available exposure—response relationships for $PM_{2.5}$ and cardiopulmonary health outcomes, we estimate potential health benefits from future emission mitigation scenarios associated with household energy interventions.