**Fusing Observational Data and Chemical Transport Model Simulations to Create Spatiotemporally Resolved Ambient Air Pollution Fields for Health Analysis**

**OBJECTIVES**
Combine observational (OBS) and chemical transport model (CMAQ) simulations to create accurate and complete air pollution fields.
- Domain: Contiguous U.S., 12km resolution, 2005-2014
- Pollutants: 1h maxNO2, NOx, CO, SO2; 8h max O3; 24h PM10, PM2.5; EC, OC, NH4+, SO2⁻, NO3⁻
- Evaluate model through data withholding

**INTRODUCTION**
- Need spatially and temporally resolved air quality for acute health effects studies
- Monitoring networks provide accurate measurements but limited spatial information
- EPA and CDC have collaborated to provide air pollution concentration fields for 2005-2014 at a 12km resolution across the U.S.
- Data Fusion combines measurements with chemical transport model simulations to create spatiotemporally complete air pollution fields

**METHODS**

**Annual Average OBS-CMAQ Regression**
- Yearly average CMAQ and monitor concentrations
- Perform power regression

\[ \text{OBS} = \alpha \text{CMAQ}^\beta \]

**OBS/CMAQ Ratio Interpolation**
- Ratio of normalized observation to normalized CMAQ
- Inverse Distance Weight (IDW) ratio

**Fused Field Generation**
- Multiply IDW ratio field by CMAQ concentration in each cell

\[ C^* = \left( \frac{\text{OBS}}{\left(\alpha \text{CMAQ}^\beta\right)} \right)_{\text{IDW}} \times \alpha \text{CMAQ}^\beta \]

**RESULTS**

- Concentration fields at each step of process. The fused concentration maintains spatial pattern of initial CMAQ field with adjusted scale based on observational data of that day.
- The fused field reproduces monitor temporal variation better than the monitor spatial variation.
- Spatiotemporal $R^2$ values from 10% data withholding. The $R^2$ indicates how well the model can predict variation at removed location.

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**U.S. Ozone Monitoring Network for 2011**

Processes calculated in the CMAQ chemical transport model simulation.