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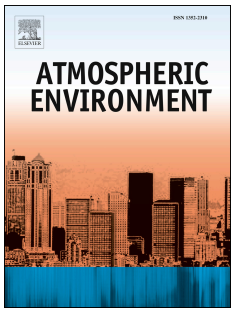

Impact of temporal upscaling and chemical transport model horizontal resolution on reducing ozone exposure misclassification

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Title: Impact of Temporal Upscaling and Chemical Transport Model Horizontal Resolution on Reducing Ozone Exposure Misclassification

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Keywords: Bayesian Maximum Entropy; ozone; data fusion; Chemical Transport Model

Highlights:

- A BME framework that integrates ozone observations and CTM model predictions
- Compared the impact of multiple temporal upscaling methods
- Finer CTM horizontal resolution can improve BME estimates
- BME estimates improved estimation accuracy and spatial variability

Abstract:

We have developed a Bayesian Maximum Entropy (BME) framework that integrates observations from a surface monitoring network and predictions from a Chemical Transport Model (CTM) to create improved exposure estimates that can be resolved into any spatial and temporal resolution. The flexibility of the framework allows for input of data in any choice of time scales and CTM predictions of any spatial resolution with varying associated degrees of estimation error and cost in terms of implementation and computation. This study quantifies the impact on exposure estimation error due to these choices by first comparing estimations errors when BME relied on ozone concentration data either as an hourly average, the daily maximum 8-hour average (DM8A), or the daily 24-hour average (D24A). Our analysis found that the use of DM8A and D24A data, although less computationally intensive, reduced estimation error more when compared to the use of hourly data. This was primarily due to the poorer CTM model performance in the hourly average predicted ozone. Our second analysis compared spatial variability and estimation errors when BME relied on CTM predictions with a grid cell resolution of 12x12km^2 versus a coarser resolution of 36x36km^2. Our analysis found that integrating the finer grid resolution CTM predictions not only reduced estimation error, but also increased the spatial variability in daily ozone estimates by 5 times. This improvement was due to