Source Contributions to Secondary Organic Aerosol in China: Comparison of MEIC and REAS2

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A source-oriented version of the Community Multiscale Air Quality Model (CMAQ) was developed to simulate the formation of secondary organic aerosol (SOA) and determine the contributions of different anthropogenic and biogenic sources to the predicted SOA in China in the entire year of 2013. The SOA module in the source-oriented CMAQ model is based on a vanilla version of the SOA module, which tracks the formation and equilibrium partitioning of semi-volatile products from precursors of long chain alkanes, aromatic compounds, monoterpenes and sesquiterpenes and from reactive surface uptake of glyoxal, methylglyoxal, isoprene epoxydiols (IEPOX) and methacrylic acid epoxide (MAE). The source-oriented version tracks precursors and their oxidation products from different sources simultaneously to determine their contributions to SOA. To explore the uncertainty in SOA concentration and source contributions due to different inventories, two popular emission inventories, the Multi-resolution Emission Inventory for China (MEIC) developed by the Tsinghua University and the Regional Emission inventory in Asia version 2 (REAS2) developed by the National Institute for Environmental Studies in Japan. While the total monthly emissions of precursor species in China from the two inventories are close to each other, leading to similar levels of SOA, emission rates from different source sectors are quite different. For example, for the aromatic compounds, REAS2 suggests that solvent utilization and transportation sectors are the two most important sources but MEIC shows majority of the emissions are from industry sources. These differences in emissions lead to different estimations of source contributions to SOA, particularly in the winter when biogenic contributions are much smaller in most part of China. Summer time SOA is mostly due to biogenic emissions of isoprene, thus the difference in anthropogenic contributions are limited to a small extend. The results from this analysis suggests that significant uncertainties still exist in current emission estimations for China.

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