1.040 Investigating Combustion and Emission Trends in Megacities through Synthesis of Combustion Signatures Using Multiple Datasets.

Early Career Scientist

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Abstract:

Combustion and its associated emissions are important consequences of urbanization. However, accurate monitoring and quantitative assessment of these consequences, especially in rapidly developing regions, are hindered by the lack of information regarding combustion activities and efficiencies. There is a unique opportunity to augment our observational capability by using multiple datasets from ground, aircraft, and satellite products as well as emission databases and chemical transport models (CTM) and associated reanalysis. In particular, joint analysis of CO, CO_2 and NO_X which are co-emitted provide a unique perspective to study anthropogenic combustion given the availability of satellite retrievals for these combustion products. Here, we analyze these three species, including their associated ratios and trends using satellite observations (Measurement of Pollution In The Troposphere, Ozone Monitoring Instrument, Tropospheric Emission Spectrometer and Greenhouse gases Observing Satellite, Orbiting Carbon Observatory), available reanalyses, and emissions from EDGAR and RCPs in all major cities in US and applying similar methodology to all megacities around the globe. We also compare results from various data sources (ground and aircraft measurements) for verification of our trend analysis. Temporal evolution within one city and comparison between cities provide knowledge on how the city and its natural/artificial environment interact. Our initial results show that: 1) There are obvious differences in trends between satellite-based and emission-based data. 2) Distinct patterns are found in bulk characteristics in regions with clear fire or fossil fuel combustion. 3) Generally, CO/NOx decreases with time and this ratio is lower in developed countries than developing countries with the exception of rapidly urbanizing regions in China where both CO and NOx are significantly high. We will couple our results with socio-economic indicators of urbanization such as population, GDP, economic structure and development patterns, to provide an integrated perspective to city evolution and interaction between urbanization, anthropogenic activity, and our environment.