A novel air quality analysis and prediction system for São Paulo, Brazil to support decision-making

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The extensive economic development and urbanization in southeastern Brazil (SEB) in recent decades have notably degraded the air quality with adverse impacts on human health. Since the Metropolitan Area of São Paulo (MASP) accommodates the majority of the economic growth in SEB, it overwhelmingly suffers from the air pollution. Consequently, there is a strong demand for developing ever-better assessment mechanisms to monitor the air quality and to assist the decision makers to mitigate the air pollution in MASP.

Here we present the results of an air quality modeling system designed for SEB with focuses on MASP. The Weather Research and Forecast model with Chemistry (WRF-Chem) is used considering the anthropogenic, biomass-burning and biogenic emissions within a 1000×1500 km domain with resolution of 10 km. FINN and MEGAN are used for the biomass-burning and biogenic emissions, respectively. For the anthropogenic emissions we use a local bottom-up inventory for the transport sector and the HTAPv2 global inventory for all other sectors. The bottom-up inventory accounts for the traffic patterns, vehicle types and their emission factors in the area and thus could be used to evaluate the effect of changes in these parameters on air quality in MASP.

The model outputs are compered to the satellite and ground-based observations for O_3 and NO_x. The results show that using the bottom-up or top-down inventories individually can result in a huge deviation between the predictions and observations. On the other hand, combining the inventories significantly enhances the forecast accuracy. It also provides a powerful tool to quantify the effects of traffic and vehicle emission policies on air quality in MASP.