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Observing the distributions and chemistry of major air pollutants (O_3 and $PM_{2.5}$) from space

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Ambient exposure to fine particulate matter ($PM_{2.5}$) and ground-level ozone (O_3) is identified as a leading risk factor for global disease burden. A limitation to advancing our understanding of the cause and impacts of air pollution is the lack of observations with the spatial and temporal resolution needed to observe variability in emission, chemistry and population exposure. Satellite remote sensing fills a spatial gap in ground-based networks. I will first introduce how remotely sensed aerosol optical depth (AOD) products have been used to infer distributions of $PM_{2.5}$. We use multiple satellite-based $PM_{2.5}$ products to assess the $PM_{2.5}$-related health benefits of emission reduction over New York State from 2002 to 2012. I will discuss different sources of uncertainties of satellite-derived $PM_{2.5}$, and use multi-platform ground, airborne and radiosonde measurements to quantify different sources of uncertainties of the satellite-derived $PM_{2.5}$. The second part will focus on ground-level O_3. Urban O_3 formation can be limited by NO_x, VOCs, or both, complicating the design of effective O_3 abatement plans. We use satellite observations of NO_2 and HCHO to infer the O_3 chemical regime. Two-decade multi-satellite HCHO/NO_2 captures the timing and locations of the transition from VOC-limited to NO_x-limited O_3 production regime in major U.S. cities, which aligns with the observed long-term changes in urban-rural gradient of O_3 and the reversal of O_3 weekend effect. Our findings suggest promise for applying space-based observations to interpret the distribution and chemistry of $PM_{2.5}$ and O_3, particularly with the new-generation satellite instruments that offer finer spatial and temporal resolution.

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Virtual refreshment 3:15 p.m.

Live webcast: meet.google.com/rsf-bvgr-bmb

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