Lessons learned from OMI observations of point source SO2 pollution.

The Ozone Monitoring Instrument (OMI) on NASA Aura satellite makes global daily measurements of the total column of sulfur dioxide (SO2), a short-lived trace gas produced by fossil fuel combustion, smelting, and volcanoes. Although anthropogenic SO2 signals may not be detectable in a single OMI pixel, it is possible to see the source and determine its exact location by averaging a large number of individual measurements. We describe new techniques for spatial and temporal averaging that have been applied to the OMI SO2 data to determine the spatial distributions or "fingerprints" of SO2 burdens from top 100 pollution sources in North America. The technique requires averaging of several years of OMI daily measurements to observe SO2 pollution from typical anthropogenic sources. We found that the largest point sources of SO2 in the US produce elevated SO2 values over a relatively small area - within 20-30 km radius. Therefore, one needs higher than OMI spatial resolution to monitor typical SO_2 sources. TROPOMI instrument on the ESA Sentinel 5 precursor mission will have improved ground resolution (~7km at nadir), but is limited to once a day measurement. A pointable geostationary UVB spectrometer with variable spatial resolution and flexible sampling frequency could potentially achieve the goal of daily monitoring of SO2 point sources and resolve downwind plumes. This concept of taking the measurements at high frequency to enhance weak signals needs to be demonstrated with a GEOCAPE precursor mission before 2020, which will help formulating GEOCAPE measurement requirements.

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