

## **1.016 Significant Recent Changes in Anthropogenic SO<sub>2</sub> Emissions: Insights from Spaceborne Observations and Large Scale Implications.**

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Abstract:

Sulfur dioxide (SO<sub>2</sub>) and its secondary sulfate aerosol product in the atmosphere have profound impacts on air quality, ecosystems, and the climate. SO<sub>2</sub> is predominantly emitted from anthropogenic sources such as coal-fired power plants and smelters, but also has sizable sources from volcanic activities. While the overall level of global anthropogenic SO<sub>2</sub> emissions has seen relatively gradual changes over the past few decades, there have been significant regional trends due to changes in energy consumption as well as pollution control measures. These regional emission trends likely have substantial effects on the environment in both source and downwind areas. Accurate, up-to-date emission inventories are critical for assessing and mitigating these effects, but are often challenging to obtain due to the lack of necessary information. Here, we present our efforts and recent progresses in deriving SO<sub>2</sub> emission information from satellite measurements. In particular, we focus on advances in space-based SO<sub>2</sub> observations enabled by high-quality measurements from the Dutch/Finish Ozone Monitoring Instrument (OMI) aboard the NASA Aura spacecraft. We show that new remote sensing techniques, combined with innovative data analysis methods, have helped to quantify and track SO<sub>2</sub> emissions from ~500 sources around the world on an annual basis: <https://so2.gsfc.nasa.gov/measures.html>. This new top-down emission inventory reveals significant reduction in SO<sub>2</sub> emissions from China in recent years due to more strict pollution control measures, as well as steady increase in emissions from India due to continued growth of coal consumption. We also investigate SO<sub>2</sub> pollution transport events observed over the North Pacific during the same period. We present evidence that SO<sub>2</sub> emission reduction in northern China since the early 2010s has led to decrease in the export of SO<sub>2</sub> pollution from East Asia. Finally, we discuss the large-scale implications of these recent changes in SO<sub>2</sub> pollution observed from space.