1.020 Monitoring sulfur dioxide from space: How we can interpret satellite data.

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Abstract:

Satellite measurements of vertical column densities (VCD: the total number of molecules or total mass per unit area) of sulfur dioxide (SO2), a criteria air contaminant, were analyzed to link them with reported SO_2 emissions.

Fitting Ozone Monitoring Instrument (OMI) SO_2 VCD data by a linear combination of functions, where each function represents the plume from an individual source, makes it possible to estimate emission from these sources or groups of sources. If the location of all sources is known, it is expected that the fitting results and the actual OMI data will agree within the noise level as was found to be the case for the eastern U.S. and Canada. The approach was also used in reverse; that is, VCDs were reconstructed from reported emissions. Such “reconstructed” VCDs demonstrated a good agreement with the fitting results and the actual OMI data. This suggests a simple way of interpreting satellite SO_2 VCD data: they should agree with VCD estimates based on available emission inventories. Moreover, the differences between satellite SO_2 VCD data and VCD estimates based on available emission inventories can be used to find sources missing from these inventories.

The method was also applied to Europe demonstrated the agreement between satellite data and reported emissions and showing that the countries where no decreasing trends are observed are non-EU member states surrounded by EU countries with decreasing emissions. Applications for anthropogenic and volcanic sources in other regions such as Middle East, Central America, India, Africa, and China are also discussed.

While this study is focused on SO_2, the methods can be applied to other species with relatively short lifetimes measured from space, particularly to NO_2 and NH_3.