Blog Help Files: OMI NO_2 and SO_2

The Ozone Monitoring Instrument (OMI) flies on NASA's Aura polar-orbiting* satellite. OMI measures ultra-violet (UV) and visible solar radiation that is scattered off of the Earth's surface and atmosphere. OMI provides measurements of important air quality components, including nitrogen dioxide (NO_2) and sulfur dioxide (SO_2).

OMI measurements are useful for air quality analysis because they provide information about the location and transport of NO_2 and SO_2. There are several limitations of OMI, however. Clouds prohibit OMI measurements of NO_2 and SO_2, so no data are available on cloudy days, particularly during the rainy season. In addition, OMI NO_2 and SO_2 are vertical column measurements, so they represent the total concentration of NO_2 and SO_2 in the atmosphere between the Aura satellite and the Earth's surface. As a result, high values of NO_2 and SO_2 measured by OMI do not always correspond to high concentrations at the surface, because the pollutants can be located aloft in the atmosphere.

Figure 1 is an example of an OMI NO_2 image provided by the Royal Netherlands Meteorological Institute (KNMI) for North America on July 15, 2008. OMI NO_2 values are given in units of 10^{15} molecules/cm^2. The images are color coded, with reds and oranges corresponding to high NO_2 concentrations, and blues corresponding to low NO_2 concentrations. In Figure 1, NO_2 concentrations are high over New York City and Los Angeles due to urban sources, and over parts of the Midwest from agricultural sources. Grey areas in Figure 1 are areas of missing data that correspond to cloud cover. When working with the KNMI OMI NO_2 images for air quality analysis, be sure to use the "Tropospheric column" image, and not the "total column" image. The troposphere is the part of the atmosphere closest to the Earth's surface, and thus the area that is a focus for air quality analysis.

Figure 2 is an example of an OMI SO_2 image provided by the NOAA's Satellite and Information Service for Hawaii on September 15, 2009. OMI SO_2 values are given in Dobson Units (DU); 1 DU = 2.687×10^{16} molecules/cm^2. The images are color coded, with reds, oranges, and yellows corresponding to high SO_2 concentrations, and pale pinks and violets corresponding to low SO_2 concentrations. The primary application of OMI SO_2 measurements is monitoring of volcanic eruptions. As a result, OMI images are subsetted for areas of the Earth that have major volcanic activity. OMI SO_2 measurements are not accurate in the boundary layer of the troposphere, near the Earth's surface, so it is difficult to use OMI to monitor city-scale anthropogenic sources of SO_2. In Figure 2, SO_2 concentrations are high over the island of Hawaii due to emissions from the Kilauea volcano.

*For more information about polar-orbiting satellites in general and Aura in particular, see the **Satellite Basics Help File.**

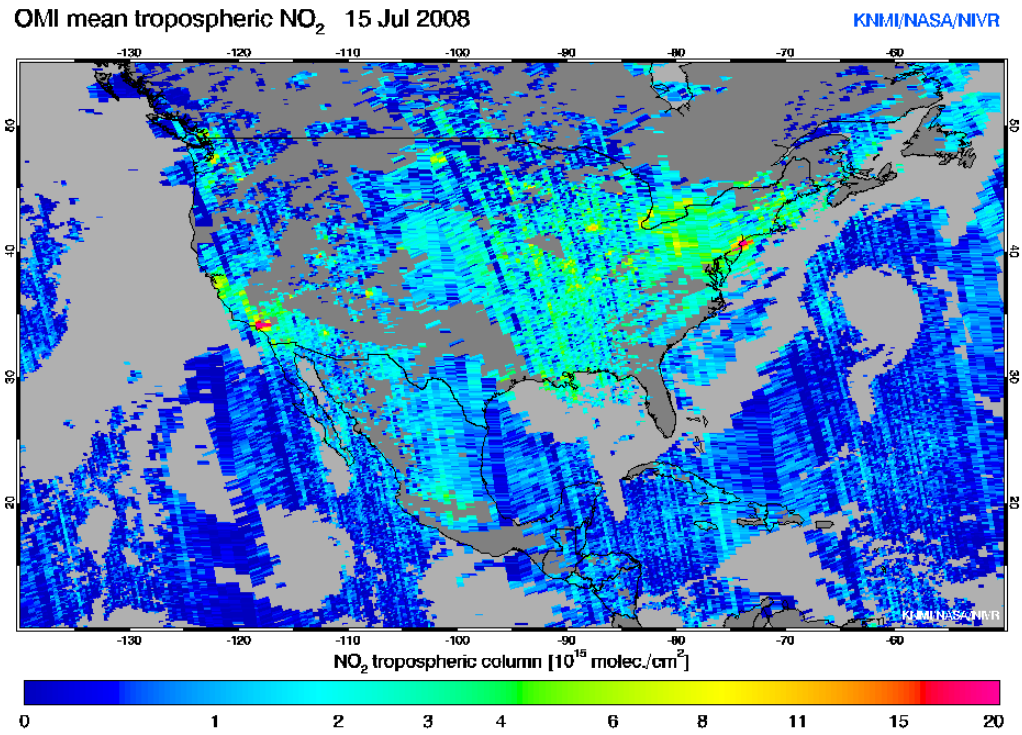

Figure 1. KNMI tropospheric column NO_2 image of North America on July 15, 2008.

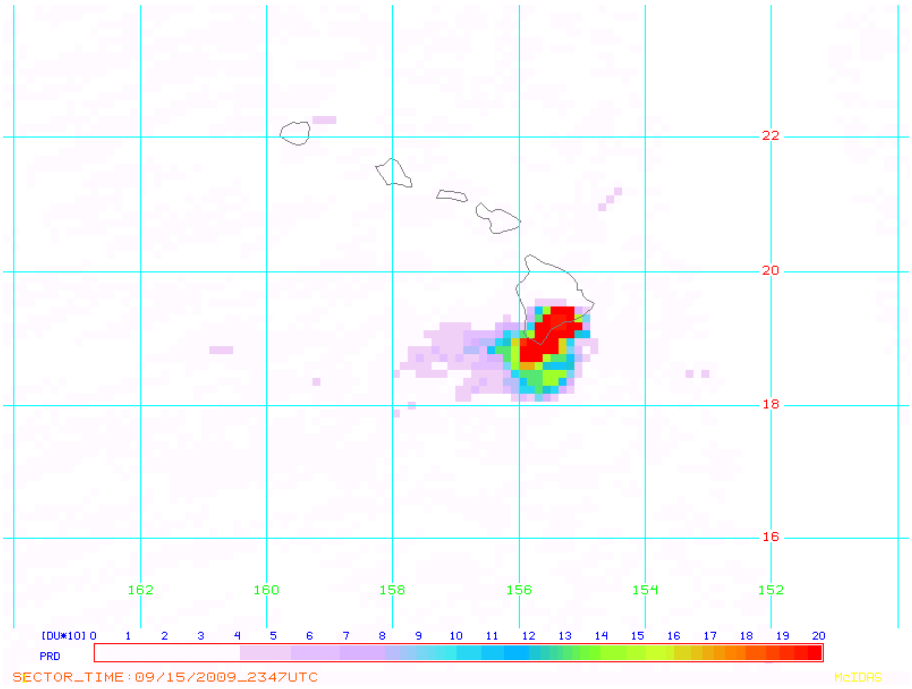

Figure 2. OMI SO_2 image of Hawaii on September 15, 2009.