Introduction

The Total Column sensor is part of the Ozone Mapping and Profiler Suite (OMPS) that is flying onboard the Suomi-NPP satellite. It provides total column ozone retrievals that are designed to meet the original 50 km x 50 km FOV at nadir requirement of the JPSS program. However, since the FOVs for OMPS are created by combining individual pixel elements of the sensor's imaging CCD (in the cross-track direction) and by setting the total exposure time (in the along-track direction), the OMPS FOVs can be made smaller by commanding the sensor to combine fewer pixel elements and by reducing the total exposure time.

OMPS Data at Maximum Resolution

Early in the mission, a few days of data were taken at the highest possible resolution (unbinned pixels, shortest exposure time), providing a nadir FOV of 2.5 km cross-track x 10 km along-track. The effective reflectivity was calculated using these measurements to validate the geolocation determination of the OMPS TC sensor.

The effective reflectivity was then combined with the determination of aerosol index to demonstrate the detail that can be achieved by the OMPS sensor at its maximum resolution.

Aerosol Studies

The long-range transport of dust and pollutants is often associated with mid-latitude cyclones; these cyclones result in a mixed scene of dust, pollutants, and clouds. Greater spatial resolution is necessary for detailed studies of the transport mechanisms associated with these types of events. Furthermore, one of the largest uncertainties in determining optical depth is the presence of undetected clouds at the “sub pixel” level. The use of smaller FOVs reduces the uncertainty associated with clouds, and it also further helps delineate whether aerosol appears over clouds or clear scenes.

On 29 April 2012, a dust cloud from China’s Taklamaken Desert was detected using OMPS aerosol index data as the cloud was being transported out over the Pacific Ocean. On this day, OMPS was commanded to take data at high resolution.

Volcanic Hazard Applications

High-resolution OMPS SO₂ data are needed for improved volcanic monitoring in localized pre-eruptive mode and hazard mitigation for drifting volcanic ash clouds. The Ozone Monitoring Instrument is currently providing such high-resolution data; an example is presented below.

By changing the CCD binning factor and reducing the total exposure time along the orbital track, the OMPS resolution in the nadir direction can be increased to 15 km x 15 km at nadir. The above image shows such FOVs superimposed on Washington, DC.

Measurements from OMPS have periodically been taken at higher resolution during the first year of its mission. The following examples will use data from those measurements, as well as measurements from the higher-resolution Ozone Monitoring Instrument (OMI) onboard the Aura spacecraft, to demonstrate the higher resolution capabilities of the sensor and how those capabilities can benefit not only the operational and research needs of NOAA and NASA, but those of the USGS, EPA, and NRL as well.

Future OMPS nadir sensors

The successful demonstration of higher resolution data taken by the 5-NPP OMPS total column sensor has prompted NOAA to replace the previous FOV requirement for OMPS nadir sensors that will fly on the JPSS satellites with the following one:

- “The OMPS TC shall provide measurements sampled over the cross-track field of view at an interval and shape sufficient to achieve a spatial resolution on the ground of 10 km at nadir.”

The revised requirement will ensure that measurements made by future OMPS systems will provide enhanced products for use both operationally and for research by the USGS, EPA, and NRL as well as NOAA and NASA.