NEXT-GENERATION AURA/OMI NO₂ AND SO₂ PRODUCTS

Nickolay Krotkov ¹, Kai Yang ², Eric Bucsela ³, Lok Lamsal ⁴, Edward Celarier ⁴, William Swartz ⁵, Simon Carn ⁶, Pawan Bhartia ¹, James Gleason ¹, Ken Pickering ¹, Russ Dickerson ²

(1) NASA Goddard Space Flight Center, Code 613.3, Greenbelt, MD
(2) Department of Atmospheric and Oceanic sciences, University of Maryland, College Park, MD
(3) SRI International, Menlo Park, CA
(4) Universities Space Research Association, Columbia, MD
(5) The Johns Hopkins University Applied Physics Laboratory, Laurel, MD
(6) Michigan Technological University, Houghton, MI

ABSTRACT

The measurement of both SO₂ and NO₂ gases are recognized as an essential component of atmospheric composition missions. We describe current capabilities and limitations of the operational Aura/OMI NO₂ and SO₂ data that have been used by a large number of researchers. Analyses of the data and validation studies have brought to light a number of areas in which these products can be expanded and improved. Major improvements for new NASA standard (SP) NO₂ product include more accurate tropospheric and stratospheric column amounts, along with much improved error estimates and diagnostics. Our approach uses a monthly NO₂ climatology based on the NASA Global Modeling Initiative (GMI) chemistry-transport model and takes advantage of OMI data from cloudy scenes to find clean areas where the contribution from the trop NO₂ column is relatively small. We then use a new filtering, interpolation and smoothing techniques for separating the stratospheric and tropospheric components of NO₂, minimizing the influence of a priori information. The new algorithm greatly improves the structure of stratospheric features relative to the original SP.

For the next-generation OMI SO₂ product we plan to implement operationally the offline iterative spectral fitting (ISF) algorithm and re-process the OMI Level-2 SO₂ dataset using a priori SO₂ and aerosol profiles, clouds, and surface reflectivity appropriate for observation conditions. This will improve the ability to detect and quantify weak tropospheric SO₂ loadings. The new algorithm is validated using aircraft in-situ data during field campaigns in China (2005 and 2008) and in Maryland (Frostburg, 2010 and DISCOVER-AQ in July 2011). The height of the SO₂ plumes will also be estimated for high SO₂ loading cases (e.g., volcanic eruptions). The same SO₂ algorithm will be applied to the data from OMPS sensor to be launched on NPP satellite later this year. The next-generation NO₂ and SO₂ products will provide critical information (e.g., averaging kernels) for evaluation of chemistry-transport models, for data assimilation, and to impose top-down constraints on the SO₂ and NO₂ emission sources.