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Atmospheric
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Discussions

Interactive comment on "A new stratospheric and tropospheric NO_2 retrieval algorithm for nadir-viewing satellite instruments: applications to OMI" *by* E. J. Bucsela et al.

Anonymous Referee #1

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This excellent manuscript describes an important new algorithm for the separation of stratospheric and tropospheric NO2. The quality of this SP2 algorithm addresses several issues with the earlier SP1 algorithm. The reduction of algorithmic dependence on a priori information and on assumptions such as wave-2 is commendable. The manuscript is well written with a thorough introduction. I recommend publication after considering the questions and suggestions below.

How is the tropopause defined (thermal or dynamical) in the GMI CTM when separating the NO2 subcolumns of the stratosphere and troposphere as used in the air mass factor calculation? How would the alternative definition affect the results?

How are stratospheric aerosols treated in the stratospheric air mass factor calculation?

In Section 2.2 it appears that the monthly NO2 profiles change abruptly with changes in the calendar month. A 30-day running mean NO2 profile would eliminate those sharp transitions.

Would it be useful to refine the algorithm described in section 2.4? The algorithm masks regions where tropospheric contamination (based on modeled NO2 columns) exceeds a threshold, and then eliminates hot spots. How about (partially) replacing the modeled NO2 columns with an average of the OMI tropospheric NO2 product produced from recent observations? That could allow you to reduce the dependence on the modeled NO2 column (which has errors), and possibly to reduce the need for the subsequent hot spot detection.

Why is the hot spot detection done at 1 degree resolution? Wouldn't finer resolution be more effective?

The error formulation is well presented, but it was surprising to see little discussion of the errors in air mass factors developed at the end of section 3.1. It would be instructive to show the air mass factor uncertainty as a function of cloud fraction. Or at least consider including a table stating the expected errors for common choices of cloud fraction.

The error discussion says little about the a priori NO2 profile. What are the expected implications of unresolved horizontal variation in NO2 sub-columns in the GMI CTM at its coarse resolution of 2x2.5 degrees?

Specific: L9, p1373, the resolution should be stated for geographically gridded

P1375, is this interpolation done on the stratospheric vertical column? Interpolating the slant column would introduce errors due to spatial variation in geophysical fields (such as clouds) that affect the air mass factor.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 1361, 2013.