

Interactive comment on “Improved aerosol correction for OMI tropospheric NO₂ retrieval over East Asia: constraint from CALIOP aerosol vertical profile” by Mengyao Liu et al.

Anonymous Referee #2

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The paper “Improved aerosol correction for OMI tropospheric NO₂ retrieval over East Asia: constraint from CALIOP aerosol vertical profile” by Liu et al. describes an improved OMI tropospheric NO₂ retrieval for East China using CALIOP aerosol vertical profile information. This study updates the POMINO retrieval algorithm described in Lin et al., 2014 and 2015. Comparisons have been made between the NO₂ satellite data and ground-based MAX-DOAS measurements at three sites in East-China.

The topic of the manuscript is within the scope of AMT and it is of interest to the scientific community. It can be recommended for publication, if the authors make an effort to address the comments listed below, and improve the manuscript accordingly.

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Specific comments:

Section 2.2

P9-10 The improved POMINO NO₂ algorithm for China builds on the Dutch OMI NO₂ v2 algorithm from 2011. The DOMINO v2 algorithm is now about 7 years old, and the authors shortly discuss some recent improvements in the satellite retrieval (e.g. improvements in the slant column retrieval). Please include the recently released “Dutch/European” OMI NO₂ product provided in the framework of the QA4ECV project (v1.1) in this discussion as well (e.g. including the latest developments in the STS and the trop. AMF algorithms).

P11 The authors mention that the climatological adjustments in the aerosol information is based on the assumption that systematic model limitations are month-dependent and persist over the years and days. On the other hand, the daily variations in the aerosol extinction profile are coming from the model only (Eq. 3). How good are the daily variations in the aerosol parameters modeled by GEOS-Chem?

P11 From Eq. (2) and (3), I would expect a “jump” in the aerosol extinction profile from the last day of the month to the first day of the next month (because of the change in R). Is this ‘jump’ also noticeable in the trop. AMF and VCD?

P12 How large is the effect of neglecting polarization in the RTM (LIDORT) on the trop. AMF calculation?

Section 3.1

Fig.3 For some specific areas there seem to be large differences between the two CALIOP ALH datasets, e.g. for Shandong in summer. Is this only caused by the differences in resolution/sampling/regridding, or are there other factors?

Section 4

A difficult/confusing concept of the POMINO NO₂ algorithm is that for the trop. AMF,

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(thin) clouds are treated as reflecting boundaries in the RTM calculations (using effective cloud parameters retrieved from the O₂-O₂ band), while Mie parameters are used in the RTM for the layers with aerosols. It is clear that the aerosols are included in the POMINO O₂-O₂ cloud retrieval, but the different treatment of scattering by clouds and aerosols in the trop. AMF calculation could be addressed in more detail.

Section 6

The evaluating of the improved OMI NO₂ product with MAX-DOAS data is an important part of this study. However, the number of measurements/points in Fig. 10 seems low (e.g. compared to other satellite validation studies using the BIRA-IASB MAXDOAS data at these sites). Can the number of points be increased, e.g. by increasing the time period, relaxing the cloud screening, collocation criteria etc? Then the statistics can be improved and also time series could be added.

In addition to the comparisons in Fig. 10, the MAXDOAS retrieved NO₂ profiles could also be exploited with the Averaging Kernel (AK) of the OMI NO₂ columns. Comparisons of the satellite NO₂ columns with these “smoothed” MAXDOAS NO₂ columns could provide useful additional information (e.g. to isolate the impact of the satellite a priori NO₂ profile).

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