

# ***Interactive comment on “Explicit and consistent aerosol correction for visible wavelength satellite cloud and nitrogen dioxide retrievals based on optical properties from a global aerosol analysis” by Alexander Vasilkov et al.***

**Anonymous Referee #1**

Received and published: 24 March 2020

In this paper, the authors discuss the impacts of explicit aerosol corrections in OMI NO<sub>2</sub> retrieval. They explicitly account for aerosol for the clear-sky part of a pixel by taking aerosol optical properties from the GEOS-5 global aerosol assimilation system. A case study over Shenyang, Northeastern China, is used as a specific case with high aerosol loadings to evaluate this method. This study is a part of the update in NASA NO<sub>2</sub> product, which should be more comprehensive. I strongly encourage the authors to expand their discussion and provide more robust and convincing arguments in support of their approach. I recommend publication of this manuscript only after major revision

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addressing the following comments.

General comments:

1, The explicit aerosol corrections are only applied to the clear-sky part of a pixel, which causes inconsistency between the cloud and NO<sub>2</sub> retrieval. The studies of Lin et al., (2014) and Liu et al., (2019) have already shown the impacts of aerosols on cloud retrievals. Jethva et al., (2016) also showed absorbing aerosols were observed over clouds in spring and winter in Eastern China. So at least, the authors should discuss the impacts of explicit aerosol treatments on cloudy-sky retrievals.

2, The authors have listed plenty of comparisons in the introduction to illustrate the difference between satellite retrievals and other measurements. However, only one case study without any comparisons with ground- or aircraft-based data are discussed in the paper. The reviewer is doubt about the applicability of this method. The authors should collect some measurements and make further comparisons since it seems that the method can be applied to anywhere globally. At least, more cases should be collected to reach comprehensive/valid analysis.

Specific comments: 1, Line 3: “over norththeast Asia” should be “over northeastern Asia”. Based on the context, the authors only discussed a specific case over northeastern China.

2, Line 17: “top down” should be “top-down”. “assimilation” should be “assimilations”

3, Line 26: “optical properties” would be more accurate than “scattering properties”

4, Line 27: Please cite (Castellanos et al., 2014; Liu et al., 2019)

5, Line 31: What do you mean by “detailed”?

6, Line 33: I do not think the definition of the Jacobians (AK) is the same as AMF.

7, Line 47: “southeast Asia” should be “Eastern China”

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8, Line 48: “using data from the GEOS-Chem model with further adjustment through MODIS monthly AOD dataset.”

9, Line 51: Not exactly. Lin et al., (2014, 2015) and Liu et al., (2019) claimed that they used parallel RTM to ensure the efficiency of the calculation.

10, Line 175-180: See the general comment 1. Please add some specific case to help valid the argument here. “part of pixel only” should be “part of a pixel only”

11, Line 244: What causes such an enhancement? It happens in this specific case or it related to the way that GEOS-5 uses to separate the troposphere and stratosphere?

12, Based on my understanding, the procedure for deriving GLER does not include aerosol optical properties, either. GLER is an important concept in this paper. Please add the definition or give a brief introduction to it.

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