

Interactive comment on “A new TROPOMI product for tropospheric NO₂ columns over East Asia with explicit aerosol corrections” by Mengyao Liu et al.

Anonymous Referee #2

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Major comments:

Liu et al. reported an improved tropospheric NO₂ retrieval over East Asia by accounting for the effect of aerosol and using a priori NO₂ profile from high-resolution chemical model. These results are generally showing better agreements compared to the ground-based MAX-DOAS measurements. As an alternative NO₂ data product over East Asia (compared to the operational product), the manuscript will benefit significantly from additional assessment on the NO₂ uncertainty which are of great importance to the user community. Also, The following major concerns should be well addressed before the final publication in the AMT journal.

1. The reviewer #1 has concerned on the inconsistent treatment of aerosol corrections between the NO₂ AMFs calculation and cloud pressure retrieval. In fact, there are

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many conflicting considerations due to the hybrid POMINO algorithm itself (i.e., using tropospheric NO₂ SCDs and cloud pressure from the operational product). For example, the surface BRDF parameters are used in the tropospheric NO₂ AMF calculations, while Lambertian Equivalent Reflectance (LER) are assumed during the retrieval of cloud pressure and tropospheric NO₂ SCDs. These conflicting considerations may introduce larger error sources on the NO₂ retrieval compared to other consistent independent retrieval algorithm. It should be investigated and discussed in the manuscript.

2. The manuscript lacks of necessary uncertainty estimation on tropospheric NO₂ retrieval, considering the existing conflicting considerations in the hybrid retrieval algorithm. Also, a reasonable error budget is beneficial to the potential users.

3. In Fig. 6, only limited MAX-DOAS observations on Summer 2018 (N=63) are used to validate satellite NO₂ retrieval. However, aerosol consideration can make larger difference to NO₂ retrieval especially in winter with severe haze pollution. It would be more convincing to include more data in temporal coverage.

Specific comments:

1. Page 4, Line 8-9: compared to the previous POMINO version in Liu et al., 2019, constraining aerosol profile with CALIPSO data is no longer used in this paper. Why? It would be better to explain these algorithm changes.

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