The paper analyzes the complex effects of aerosols on cloud and NO2 retrievals from OMI, by doing sensitivity tests with assumed aerosol and atmospheric properties. It can be published after some revisions and clarifications.

The sensitivity tests follow the DOMINO procedure, especially the use of a LUT. And the authors point out the significant limitation in the LUT that undermines the analysis of the actual effects of aerosols on cloud and NO2 retrievals. While analyzing the behavior of DOMINO (with its LUT) is interesting, a general reader can benefit from additional sensitivity studies with no use of the LUT. In this way, a more general question can be answered on how aerosols affect cloud and NO2 retrievals (rather than how DOMINO is limited by its aerosol treatment with its particular LUT). Also, since this LUT limitation is important, it appears appropriate to indicate such limitation in the abstract.

A few recent studies that addressed the effects of aerosols on cloud and NO2 retrievals (Lin et al., 2014 for China; Castellanos et al., 2015 for South America; Lin et al., 2015 for China) have been discussed in the present paper (in the end of Sect. 4). It is appropriate to discuss these prior studies in the introduction section, particularly that these works have addressed the effects of aerosols on cloud and NO2 retrievals. The current writing of introduction is vague and could be read mistakenly as if the present paper is the first study on this topic.

As the authors (and previous studies) point out, the relative height of aerosols versus NO2 is very important when determining whether an implicit aerosol treatment leads to underestimated or overestimated NO2 VCDs. The work of Vlemmix et al. (2015) is often referred to in the present paper to argue that aerosols are above NO2 in summer in East China. Vlemmix et al. (2015) only analyzed MAX-DOAS measurements in Beijing with limitations in observations (MAX-DOAS measurements have difficulties in determining vertical profiles) and location (vertical profiles in Beijing may not fully represent East China). Also, the assumption of aerosol altitude in the present study (i.e., aerosols are evenly mixed within a particular pressure range) differs from the actual vertical profile. Therefore, rather than giving a strong statement regarding NO2 retrieval bias that has to assume aerosols to be above NO2, it appears more appropriate to focus on how the relative height would affect the NO2 retrieval.

Abstract

Please discuss the limitation of this study due to use of LUT.

Line 6-7: POMINO already accounts for explicit aerosols.
Line 12: please define ‘cloud-free’
Line 16: please remove ‘linear’. Obviously the relation is not simply linear
Line 19-21: the reduced cloud pressure is primarily because aerosols are set at higher altitudes than NO2, rather than due to its ‘absorbing effects’

Line 21-24: ‘actual’ here is not clear – you are not doing an actual retrieval. Also, please change ‘high aerosol pollution … and elevated particles’ to ‘high aerosol pollution … at elevated altitudes’

P8388, Line 9: change ‘(±25%)’ to ‘±25%’

P8388, Line25 – P8389, Line 19: please update this paragraph to better reflect the existing relevant works on the effects of aerosols on cloud and NO2 retrievals (Lin et al., 2014; Castellanos et al., 2015; Lin et al., 2015). The current writing of introduction is vague and could be read mistakenly as if the present paper is the first study on this topic.

P8390, Line 11: A middle step is to remove stratospheric SCD to derive tropospheric SCD.

Eq. 3 – there is a temperature correction for a(p)

Sect 2.3 – discussion here does not consider the cloud retrieval yet. Please specify this, for better readability.

Eq.4 – how will the use of this simplified phase function and g affect the analysis?

P8394, Line 8 – what is the wavelength for AOD and SSA?

P8397, Line 9 – is this OMI cloud fraction?

P8397, Line 19-21: any statistical significance? Also, please clarify that here the spatial variability in AOD and NO2 is included, such that the apparent correlation between AOD and NO2 may be affected by other spatial factors like albedo, elevation, etc.

P8398, Line 6: ‘loud’ should be ‘Cloud’

P8401, Line 10: AOT at which wavelength?

P8402, Line 10-11: how do you know it is due to absorption rather than scattering (since the assumed aerosols are above NO2)

Sect. 3.3.2 – since the analysis is significantly affected by the use of coarse-resolution LUT. Is it possible to do some additional tests with no use of the LUT?

P8403, last paragraph and P8405, last paragraph – see my major comments.

P8408, Line 8: should be NO2 AMF

P8409, Line 5-8 – In POMINO, model AOD is constrained by monthly MODIS/Aqua AOD data, and it is also validated by ground-based AOD measurements.

Figure 3 caption – please check the month

Figure 5 caption – should be ‘0.95 and 0.9’