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Atmospheric Measurement Techniques Discussions

Interactive comment on "The importance of surface reflectance anisotropy for cloud and NO_2 retrievals from GOME-2 and OMI" *by* Alba Lorente et al.

Anonymous Referee #1

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This is an interesting and well-written paper that describes how surface reflectance anisotropy affects cloud and NO2 retrievals from satellite instruments. It is suitable for publication in AMT. I have a few suggestions below.

This is basically a theoretical sensitivity study focusing on surface reflectance. Some additional analysis of what to expect in a real retrieval (e.g., Zhou et al., 2010; Lin et al., 2015) and applications (which combine pixels with forward reflecting and pixels with backward reflecting) would be nice. I expect that adding forward and backward scenes together reduces the net effect of surface reflectance on both cloud and NO2.

Whether (and how) the effects on Ceff and Mcr act together or compensate each other

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to affect NO2 AMF is dependent on cloud pressure (CP). In this study, CP is assumed at 850 hPa, which for polluted situations means that most NO2 is below cloud, that Mcd is much smaller than Mcr, and thus that the effects through Ceff and Mcr are complementing each other. A higher CP could lead to Mcd larger than Mcr and thus compensating effects (on NO2 AMF) through Ceff and Mcr. Please comment.

Sects. 4 and 5 – Do you assume Henyey-Greenstein clouds in the forward model (Eq. 8) and then assume Lambertian clouds in the reverse model (i.e., in the cloud and NO2 retrievals)? What else are different between the forward and reverse models? Is cloud pressure the same between forward and reverse models? It is not clear how the difference between Ceff and Cgeo is derived. Also, where is the Cgeo from (e.g., in Fig. 8)?

P3, L20 – clarify "clear-sky" P12, L7 – could you comment on the large difference near the hot-spot region between LIDORT and DAK/SCIATRAN? Sect. 5.1 – why not use the retrieved Ceff_BRDF, rather than assuming Ceff_BRDF = 0.1 $\pm$ 0.05? Table 2 – please provide a complete set of ancillary parameters such Ps, T profile, etc.

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