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Interactive comment on "Effect of surface BRDF of various land cover types on the geostationary observations of tropospheric NO$_2$" _by_ K. Noguchi et al.

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We would like to thank the referee #1 for providing helpful comments for the original manuscript. We took into account these comments for the revised manuscript. We describe our responses to the referee's comments below.

1. The authors' conclude that the next step is to validate satellite measurements of BRDF and confirm that the use of a full BRDF improves the accuracy of NO2 column measurements by comparison with in-situ measurements. Some comments on the recommended strategy for accurate retrievals in advance of that research would be

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useful.

Reply: Since the range of local time (i.e., SZA and a relative azimuth angle) of the MODIS BRDF products is limited, it would be better to obtain the information of BRDF for various local times. Then, the validation of NO2 column densities by ground and/or airborne measurements would be needed for typical SZAs and relative azimuth angles. We added this description in the third paragraph of Concluding remarks as follows:

"For example, the range of local time (i.e., the combination of SZA and relative azimuth angle) of the MODIS BRDF products is limited, and it would be better to obtain the information of BRDF for various local times, combined with the validation of NO2 column densities by ground and/or airborne measurements."

2. The text directs the reader to compare the difference in AMFs in Fig. 10 with those of Fig. 7 to understand the effect of aerosols on the impact of BRDF vs. BRF. Since Figs. 7 and 10 may not be typeset near each other in the final paper, including AOD = 0.2 and AOD = 1.0 in the same figure might make the point clearer, especially since the difference appears to be one of magnitude, not shape. As both forest types, crops, and urban AMFs have very similar shapes in each subfigure, perhaps it would be more informative to the reader to choose one of these as a representative case, and plot both the AOD = 0.2 and AOD = 1.0 AMF differences on the same axes.

Reply: Figure 10 in the original manuscript is important, because it indicates that the differences among surface types decrease with the increase of AOD, which cannot be represented by the new figure which the referee suggested. However, the original manuscript is not good for explaining this point. Therefore, we leave Figure 10 as it is and add an new figure (as Figure 11) which the referee suggested to include the results for the two AOD values (0.2 and 1.0) for one surface type. We also add the following sentences for explanation in Section 3.4:

"For better comparison, Figure 11 shows only the results for the Urban type at different AOD values (0.2 and 1.0)."

"In other words, the values of AMF for all land cover types tend to converge in Figure 10."

3. On p. 3445 (lines 20-25), it is not clear from this sentence what Lin. et. al. compared. (What is "no consideration" of BRDF – does that mean LER was used?) Is the decrease in NO2 observed a further deviation from an accurate measurement, or is this not known?

Reply: The original sentence was not appropriate. We change the description in the third paragraph of Introduction as follows.

". . . and the authors showed that without consideration of the BRDF in the NO2 retrievals (OMI-based LER product was used for the surface albedo), a decrease of the tropospheric NO2 vertical column densities by 7% on average resulted with a variability of up to -45% for individual grid pixels compared to the retrievals with BRDF."

4. On pp. 3446 (line 26)-3447 (line 3), fiso is mentioned twice when describing what the different coefficients correspond to. I suspect this is a typo.

Reply: This was a typo. We corrected the "fiso" to "fgeo" (in the second paragraph of Section 2.1).

5. The first two paragraphs of the Results section clearly describe the application of different land cover thresholds to determine the appropriate value. A minor suggestion: the sentence "For a sensitivity study, we changed the threshold to be 90 %, 95 % and 100 %..." could be rephrased to make this application clearer sooner: e.g. "As a sensitivity study, the values of fiso, fvol, and fgeo were compared for different values of the land cover threshold (90%, 95%, and 100%). Different values were used for crop land cover type (60%...), owing to. . ."

Reply: According to the comment, we correct the sentence to the suggested one.

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