Response:

We thank Dr. Barkley for his comments and the references. The issues of AMF trends and statistical significance were discussed in the manuscript. The authors' responses are in **bold**.

One point I would like to raise is whether or not the observed trends you find are (1) actually 'real' - or in other words not caused by trends in the cloud fraction, cloud-top pressure, the AMFs or number of samples, and (2) statistically significant. Both aspects are important when comparing to real data. You might be getting better agreement to the trends in the in-situ data - but is that because the OMI NO2 is improved with your corrections or because a trend, in say the AMFs, has been introduced?

The surface albedo update is aimed at reducing false signals in AMF. As stated in Section 3, we constructed the uncertainties of the trends with a confidence level of 95%, thus the derived trends are statistically significant. OMI-based trends are compared with spatially and temporally coincident EPA in situ trends. By selecting coincident in situ and OMI data, the effects of varying samples are already accounted for. Improving surface albedo data using MODIS products reduces the discrepancies between OMI-based and EPA in situ NO_2 trends in the Midwest and the Northeast. There are good physical reasons for the improvements, i.e. the variation in snow albedo. In essence, slant column trends can potentially be affected by the factors you mentioned. Properly processed vertical columns minimize their effects and thereby allow for comparison with in situ observations.

Section 2.3.1 Ocean trend. Is the trend statistically significant? In my paper we looked at OMI NO2 over the Pacific (60 N–60 S, 90–170 W) - we couldn't find a statistically significant trend - but hey we maybe gridded the data in a different way!

We calculated the ocean trend using the Slant Column Densities (SCDs) at the northern latitudes similar as the continental United States, which is the region of interest in our analysis. We used SCDs instead of Vertical Column Densities (VCDs) since the sampling stripes directly affect SCDs. Please note that the ocean trend is indeed small with a magnitude of $10^{13}\ molecues\ cm^{-2}\ yr^{-1}$. The different selections of regions (Northern Pacific vs Pacific), NO_2 products (SCDs vs VCDs), any difference in trend analysis methodology (such as accounting for seasonal variations in the trend analysis in the Mann-Kendall method we used) can all contribute to the discrepancies between observed ocean trends.

Section 2.3.3 The lightning filter. I like this approach but aren't you introducing a sampling trend by losing these observations? I assume this is done per OMI observation in which case you changing the footprint resolution too.

The lightning filter will decrease the data availability from 2%-27% as stated in Section 2.3.3. In places of significant lightning trends, this may introduce a sampling bias. However, the EPA data are also filtered out such that only coincident data were used in the comparison. Given the large effects of lightning NOx on OMI observations, we suggest that the lighting filter is essential for satellite-based trend analysis.