This study utilizes VIIRS DNB day-night band data to investigate the spatial derivative of upward atmospheric layer attenuation and artificial light at night (ALAN) over the United States, the Middle East, and the Indian subcontinent in 2017. It explores the feasibility of developing a gridded nighttime aerosol optical thickness (AOT) dataset. Additionally, the study evaluates the potential of using the NASA standard Black Marble nighttime lights product suite (VNP46) to estimate the spatial derivative of surface artificial light emissions, and discusses the sensitivity of nighttime aerosol retrieval to observational conditions as well as the application of different methods for estimating the spatial derivative of surface artificial light emissions. The research validates the retrieved AOD by comparing it with ground-based AOD data from AERONET sites and satellite-based AOD products, such as MODIS AOD and MISR AOD. There are certain aspects/details that require further clarification from the authors, and I have listed them in my comments below :

We thank the reviewer for the constructive comments.

1. The selection of aerosol types has a certain impact on the inversion accuracy. In this context, aerosol plumes in the Indian subcontinent primarily consist of a mixture of polluted haze, smoke, and pollutant aerosols (Line 224). How is this mixed aerosol type (aerosol composition) defined?

Response: Great question. Since there is only 1 channel (Day-Night-Band) available at nighttime, it is not possible to determine aerosol types from VIIRS DNB observations alone. Therefore, we simply preassigned aerosol type for each region. We assigned pollutant aerosol to the Indian subcontinent, knowing there might be uncertainties in the aerosol typing assignment over the region. Indeed, it is a region with a mixture of pollutant haze, smoke and pollutant aerosols. The aerosol type assignment will affect diffuse radiance correction and the uncertainties in this misidentification of aerosol types is further discussed in section 4.3.2.

2. The lunar AERONET AOT data at 440, 675, 870, 1020, and 1640 nm (Line 152). Why was the 700 nm value not obtained by fitting the 675 nm and 870 nm bands for the analysis in Figures 4-7?

Response: We chose to use AERONET data from 675 nm to inter-compare with VIIRS DNB retrievals from 700nm for two reasons. First, only marginal changes are expected from AOTs from 675 and 700 nm spectral channels, due to the small spectral gap between the two channels. Second, uncertainty exists in interpolating 700 nm AERONET data using AERONET data from 675 and 870 nm. Given the above two reasons, we used AERONET data from the 675 nm instead.

We added the following discussions in the text:

"Note that we chose to use AERONET data from 675 nm to inter-compare with VIIRS DNB retrievals from 700nm for two reasons. First, only marginal changes are expected from AOTs

from 675 and 700 nm spectral channels, due to the small spectral gap between the two channels. Second, uncertainty exists in interpolating 700 nm AERONET data using AERONET data from 675 and 870 nm.”.”

3. Please discuss the influence of lunar radiation on the AOD nighttime inversion results in Section 4.5.

Response: We discussed this topic in detail in one of our other papers, targeting to understanding nighttime AOT retrievals using a nighttime 3-D radiative transfer model [Zhang et al., 2023]. We added the following discussions in the text to address the comment.

“This finding is not a surprise as we have also explored the topic using a nighttime 3-D radiative transfer model [Zhang et al., 2023]. Zhang et al. [2023] suggests that incoming lunar flux introduces only marginal impacts on nighttime AOT retrieving using the artificial light based method.”

4. The 6S model requires satellite surface reflectance data as input, but the method for calculating the surface reflectance from VIIRS DNB remote sensing imagery is not explained.

Response: We used the 6S model to estimate the ratio of direct versus diffused downward moon flux/radiation due to the atmospheric layer. Since only the atmospheric layer is involved in the process, the change in surface properties does not affect the ratio. Details of the approach are captured in our earlier papers [e.g. Johnson et al., 2013].

We added the following discussion in the text:

“Details of using the 6S model for estimating *k* terms are included in a s previous paper (see Johnson et al., 2013).”

Johnson, R. S., Zhang, J., Hyer, E. J., Miller, S. D., and Reid, J. S.: Preliminary investigations toward nighttime aerosol optical depth retrievals from the VIIRS Day/Night Band, Atmos. Meas. Tech., 6, 1245–1255, https://doi.org/10.5194/amt-6-1245-2013, 2013.