Atmospheric Chemistry and Physics

Supporting Information for

Arctic spring and summertime aerosol optical depth climatological, inter-annual trend and extreme event statistics derived from model reanalyses, remote sensing retrievals and ground observations, with implications for the impact of regional biomass burning processes

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Discussion of Table 1 in terms of difference between FMF vs. SMF and arithmetic vs geometric statistics:

The CM AODs of Table 1 tend to be substantially higher than the values reported in Aboel-Fetouh et al. (2020) for common sites of Barrow, Resolute Bay, Thule and Hornsund (MAM and JJA arithmetic averages of 0.031 and 0.016 vs ~ geometric means of 0.02 and 0.002 respectively). Part of the reason for this is the difference between their SMF approach and our FMF approach (as per the next paragraph, our FMFs transform to larger SMFs) and the fact that they used geometric means as opposed to our arithmetic means. If we employ the average FMF to SMF (SDA to Aboel-Fetouh et al. change in FMF) we obtain a CM AOD decrease (averaged over the 4 common sites) of 0.012 and 0.015 for the MAM and JJA periods. If we employ the arithmetic to geometric statistics transformations given in Hesaraki et al. (2017) we obtain a mean reduction in our CM AOD of 0.012 and 0.008 for MAM and JJA respectively (again averaged over the four common sites). These substantial reductions in CM AOD would produce CM AOD values that were ~ those in Aboel-Fetouh et al. (2020). The associated changes in FM AOD would be significantly less important in a relative sense. The reanalysis results of Table 1 would, of course, be subject to the same types of FMF to SMF and arithmetic to geometric transformations as the data.

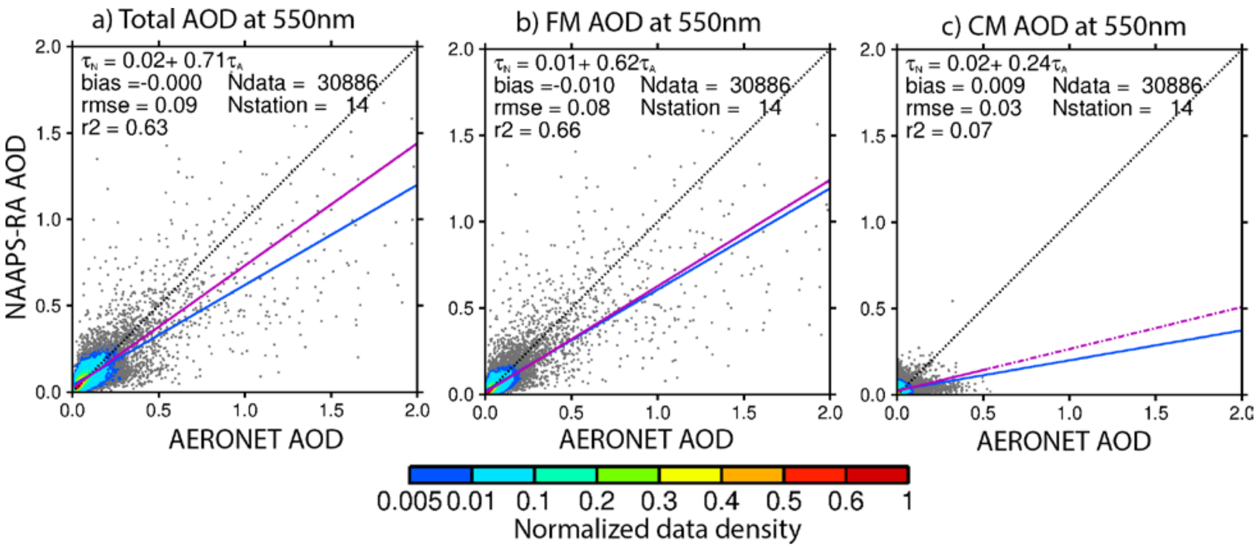

Figure S1. Pairwise comparison of the NAAPS-RA 6-hrly AOD and AERONET AOD with respect to total (left), fine (middle) and coarse (right) modes at 550 nm for sites north of 60N for 2003–2019. The normalized data density is shown in color. The solid magenta line represents a Theil–Sen linear regression and the corresponding equation is shown, where τ_N is the NAAPS-RA AOD and τ_A is the AERONET AOD. The solid blue line is a least-squares linear regression and the corresponding equation is not shown. Also shown are the bias, root mean square error (rmse), coefficient of determination (r^2), total number of stations (Nstation) and total number of 6-hrly AERONET data (Ndata).

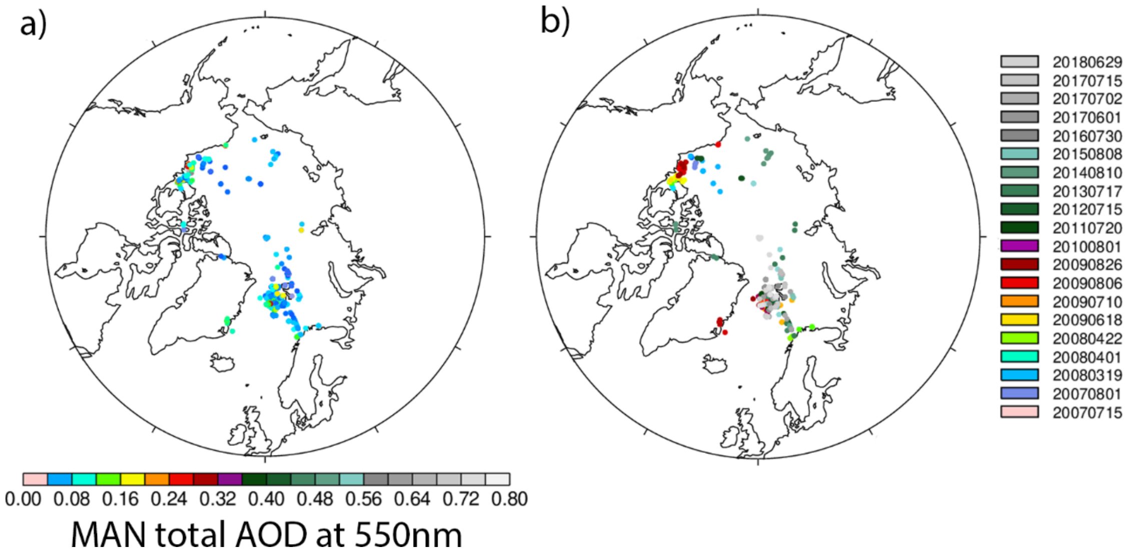

Figure S2. MAN a) total AOD at 550nm for measurements made north of 70N and between 2003-2019, and b) measurement date in the format of year-month-date. 6-hrly AOD data is used.

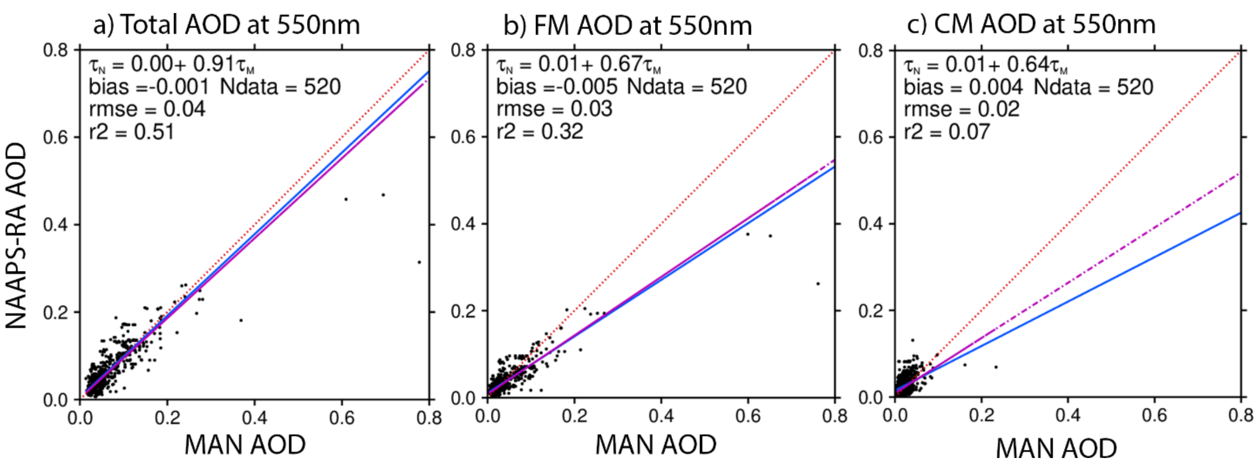

Figure S3. Pairwise comparison of the NAAPS-RA 6-hrly AOD and MAN AOD with respect to total (left), fine (middle) and coarse (right) modes at 550 nm for north of 70N for 2003–2019. The solid magenta line represents a Theil–Sen linear regression and the corresponding equation is shown, where τ_N is the NAAPS-RA AOD and τ_M is the MAN AOD. The solid blue line is a least-squares linear regression and the corresponding equation is not shown. Also shown are the bias, root mean square error (rmse), coefficient of determination (r^2), total number of 6-hrly MAN data (Ndata).