Supplement of Atmos. Chem. Phys., 23, 12651–12669, 2023
https://doi.org/10.5194/acp-23-12651-2023-supplement

Atmospheric Chemistry and Physics
Open Access

Supplement of

What controls ozone sensitivity in the upper tropical troposphere?

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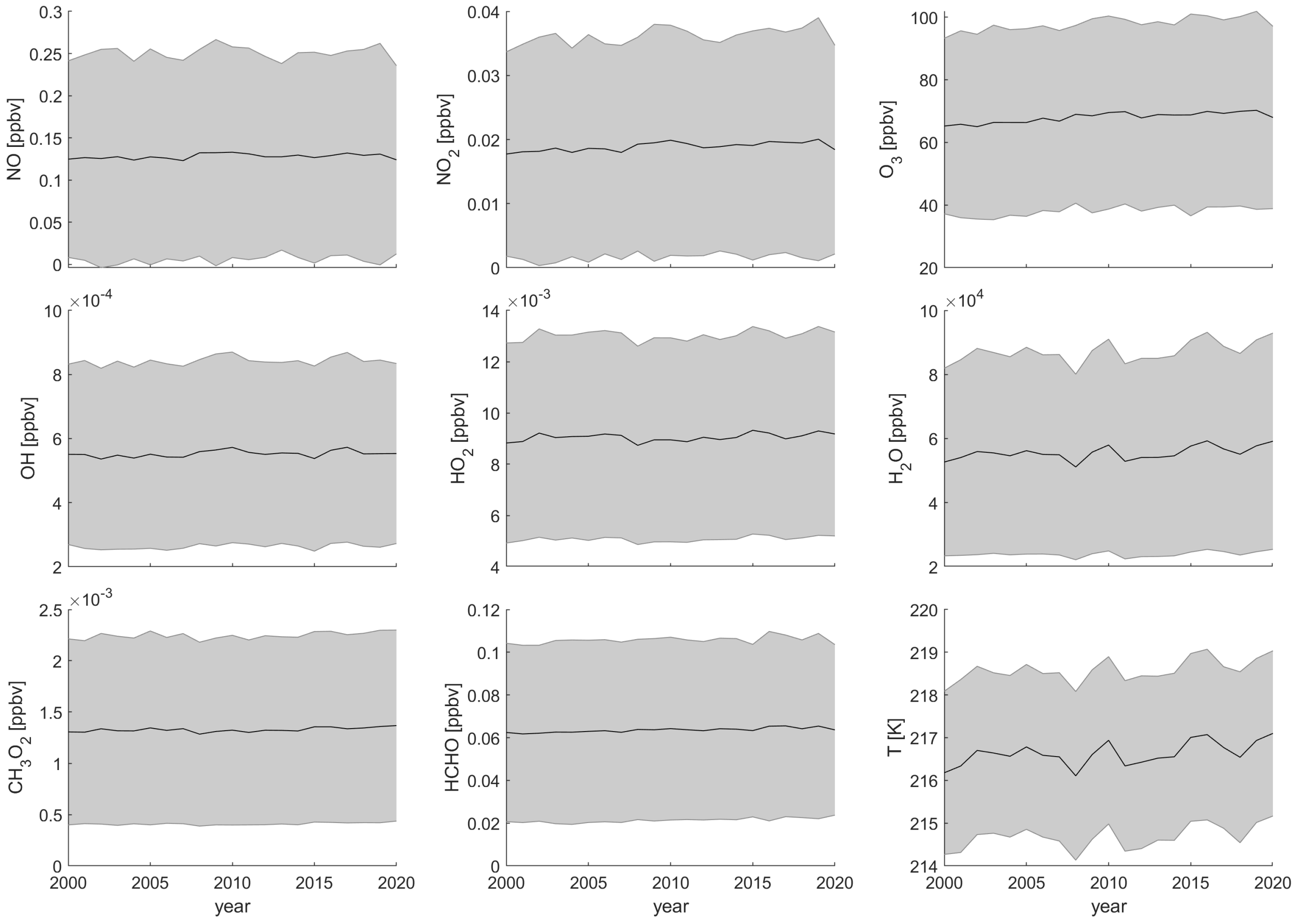

Figure S1. Development of modeled trace gas mixing ratios in the upper tropical troposphere at 200 hPa from 2000 to 2019. Black lines represent the average of daily mixing ratios at local noon for each year and the grey shades show the variability, calculated as the 1 σ standard deviation of the averaging.

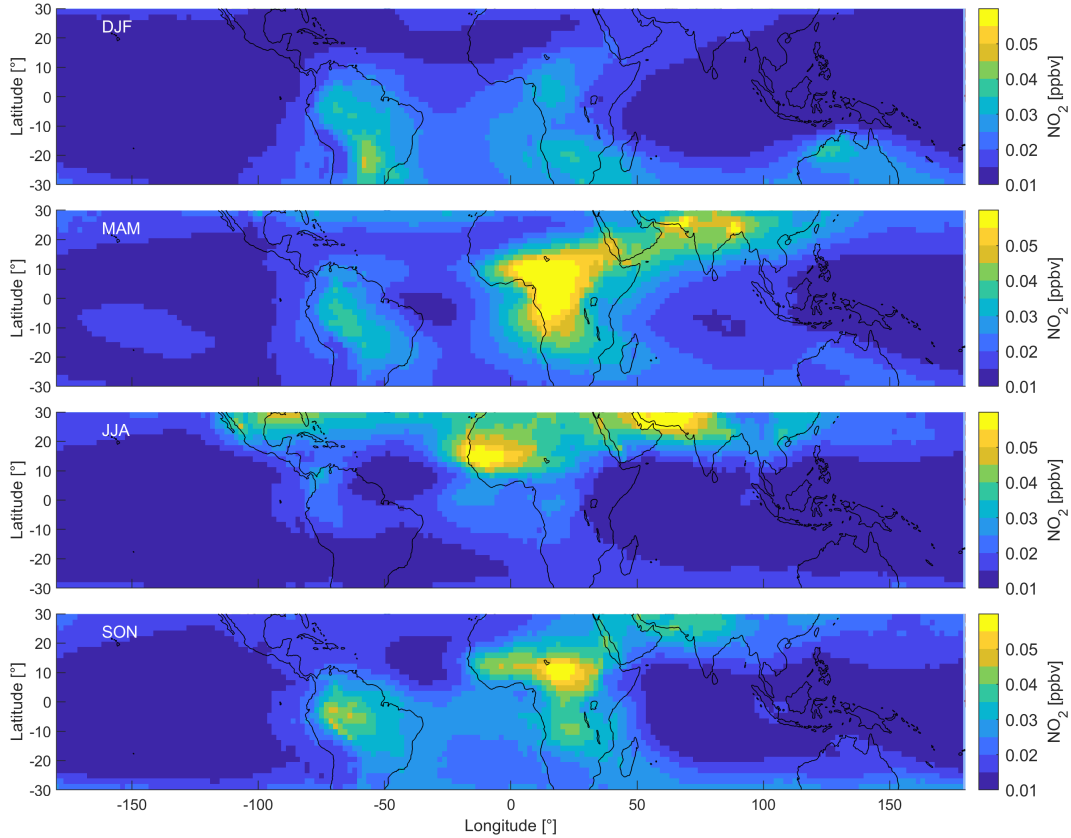

Figure S2. Distribution of NO_2 in the tropical UT between 30 ° S and 30 ° N for all periods.

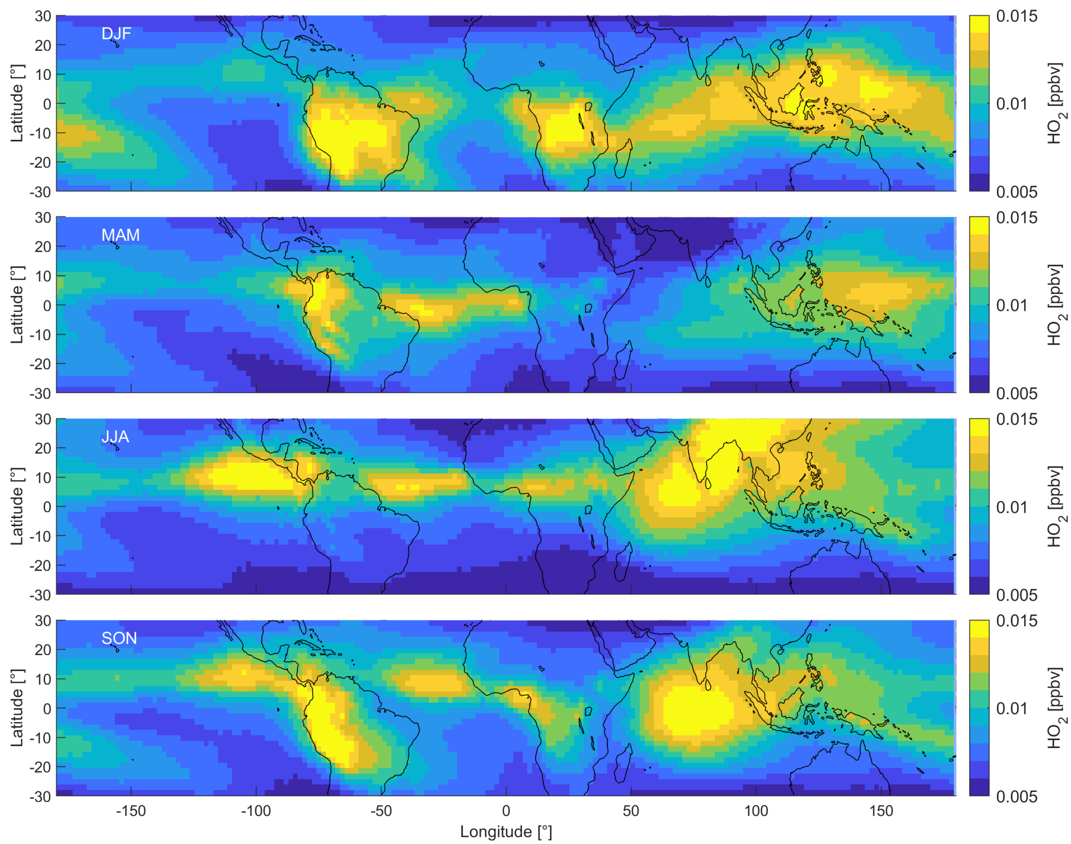

Figure S3. Distribution of HO_2 in the tropical UT between 30 ° S and 30 ° N for all periods.

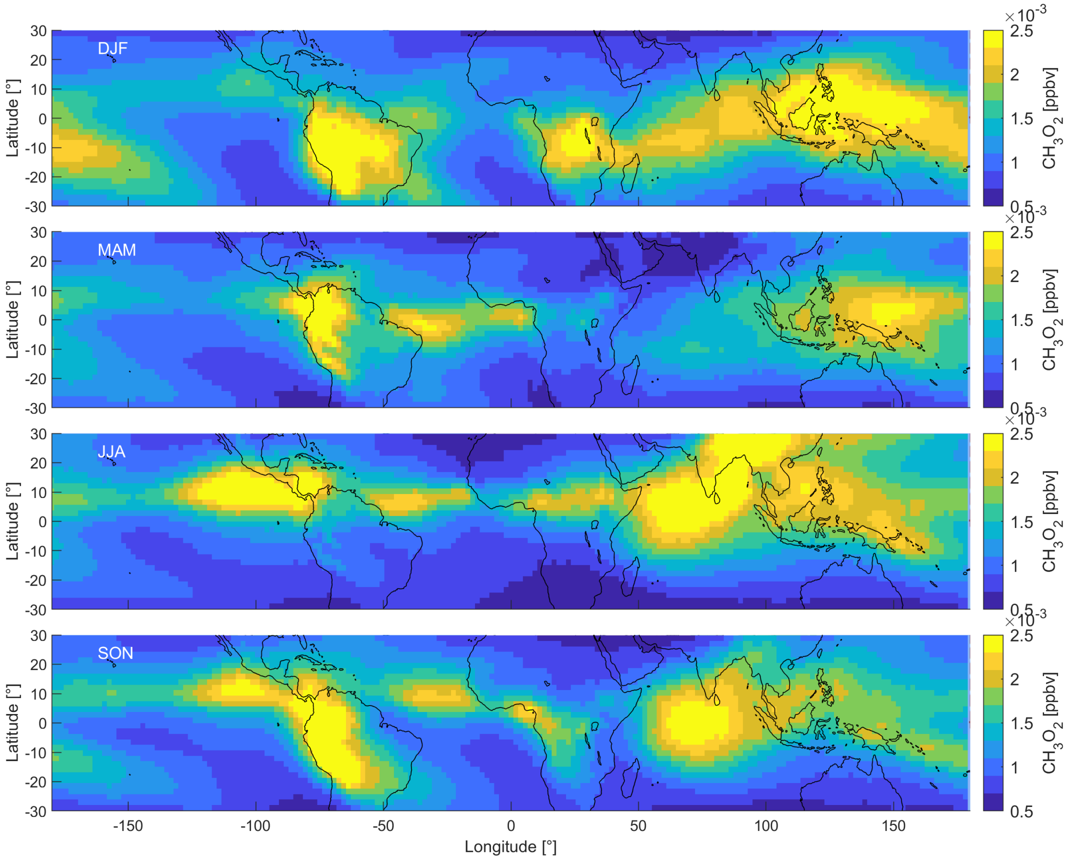

Figure S4. Distribution of CH_3O_2 in the tropical UT between 30° S and 30° N for all periods.

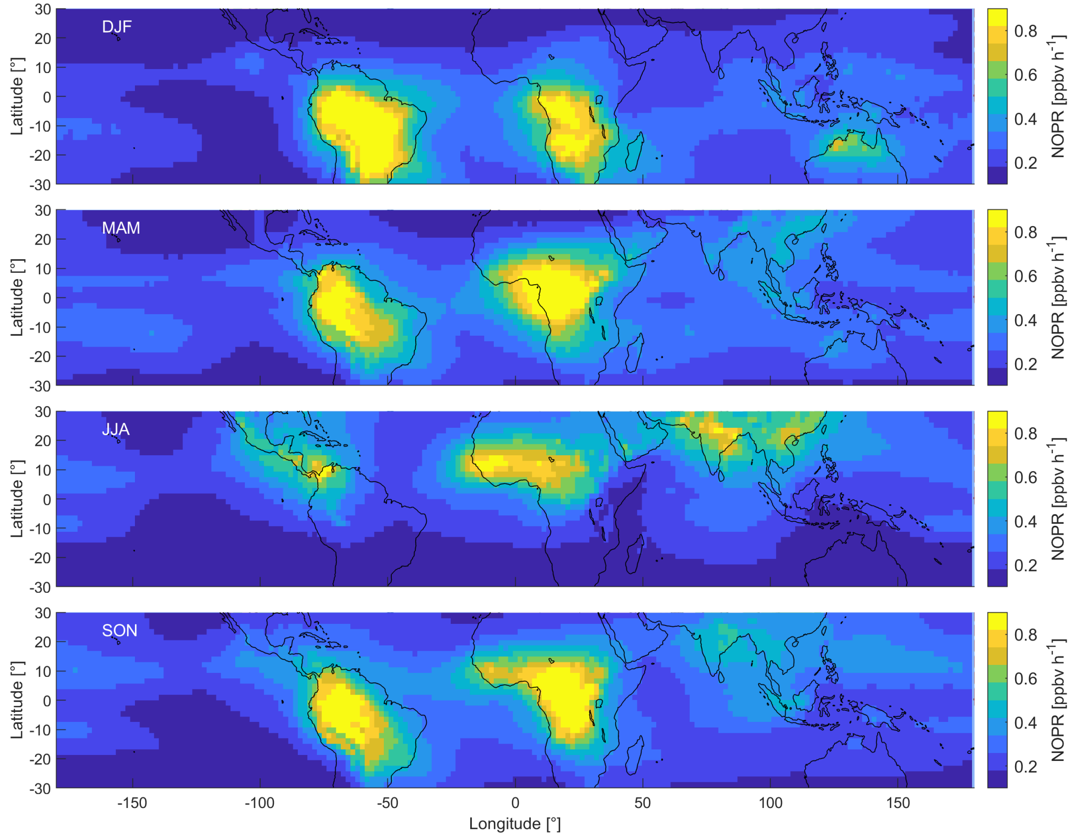

Figure S5. Distribution of NOPR in the tropical UT between 30 ° S and 30 ° N for all periods.

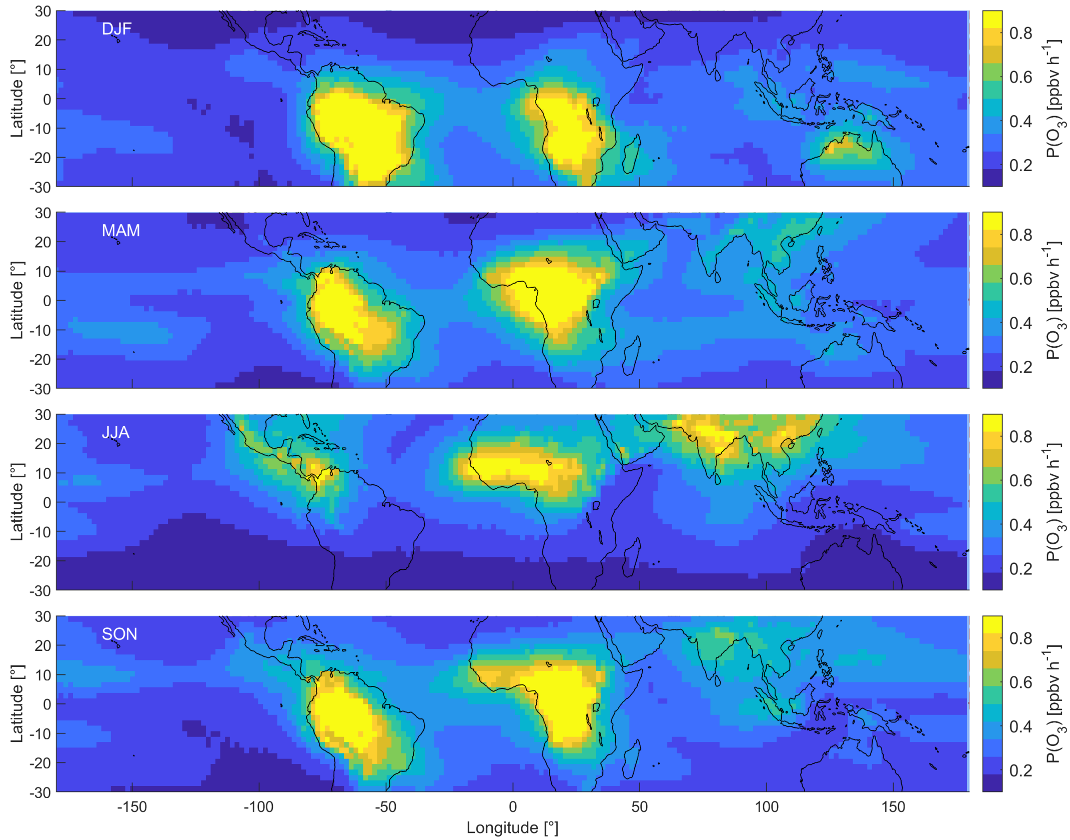

Figure S6. Distribution of $P(O_3)$ in the tropical UT between 30 ° S and 30 ° N for all periods.

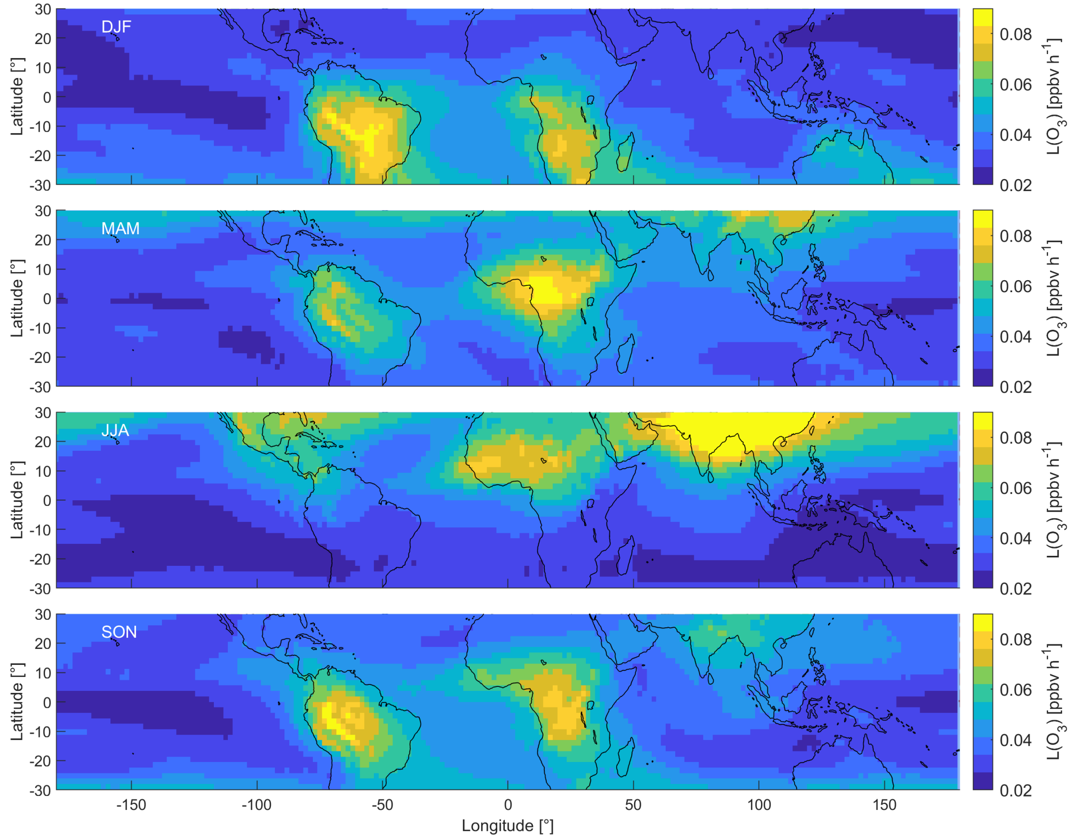

Figure S7. Distribution of L(O_3) in the tropical UT between 30 ° S and 30 ° N for all periods.

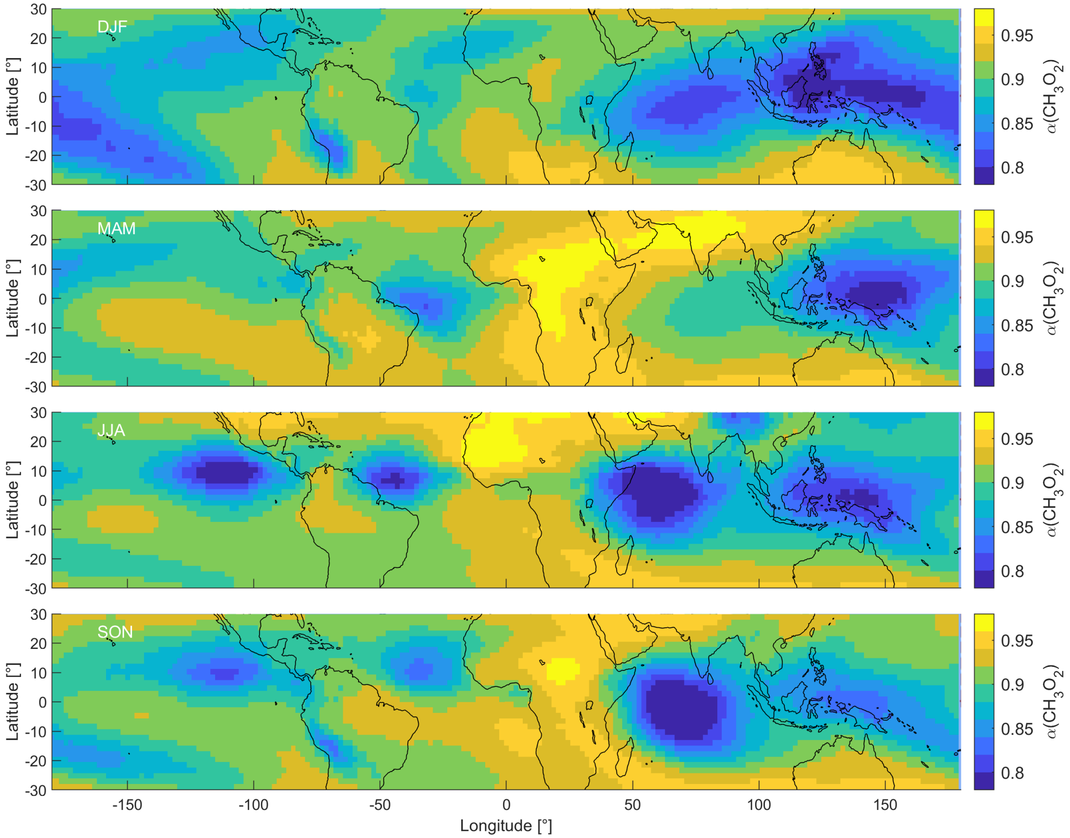

Figure S8. Distribution of $\alpha(CH_3O_2)$ in the tropical UT between 30° S and 30° N for all periods.

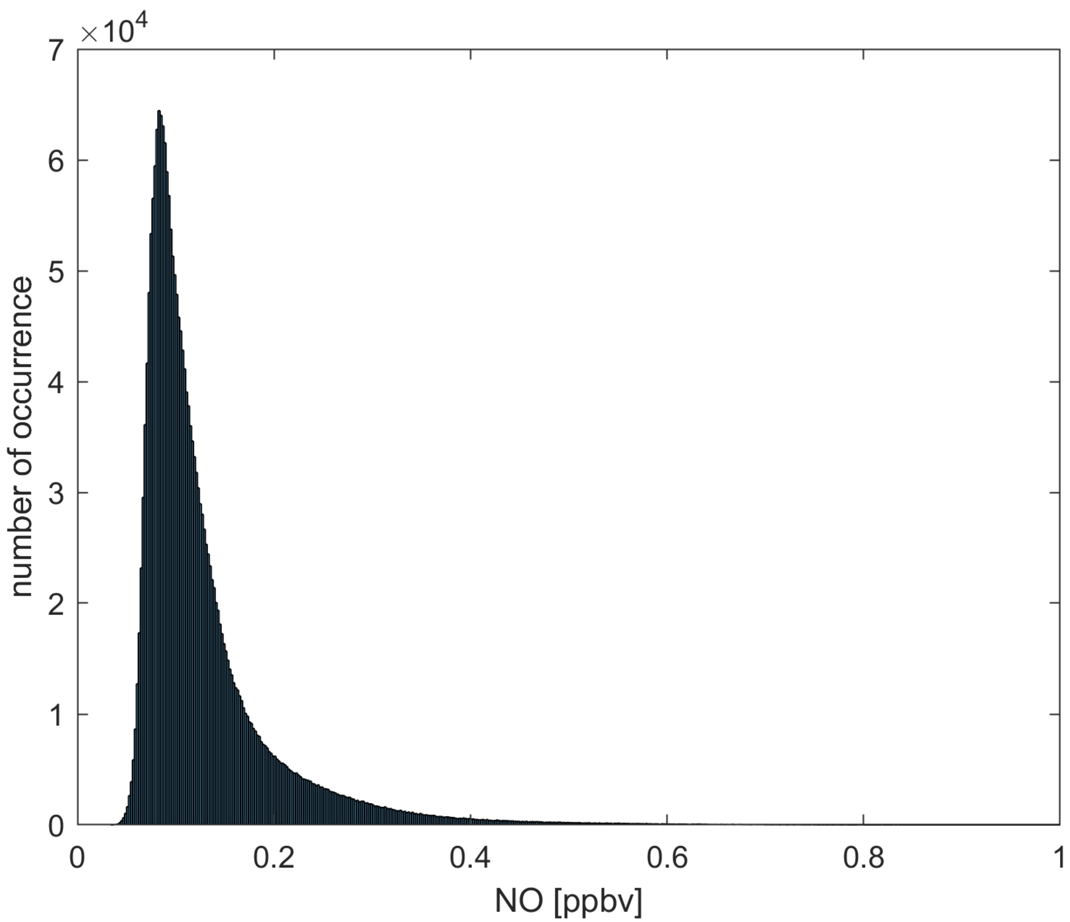

Figure S9. Frequency distribution of NO mixing ratios. 99.6 % of the data points show ≤ 0.5 ppbv NO.

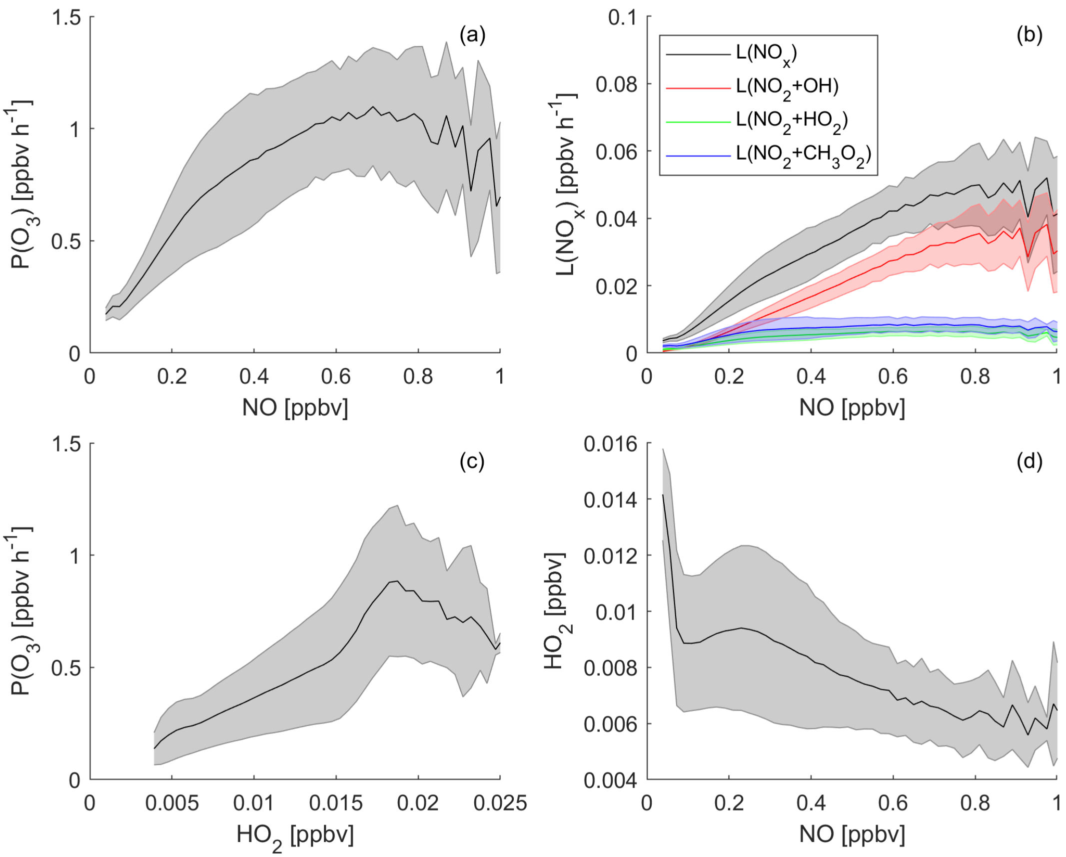

Figure S10. (a) $P(O_3)$ binned to NO mixing ratios up to 1 ppbv NO, (b) NO_x loss binned to NO mixing ratios and subdivided into loss via OH, HO_2 and CH_3O_2, (c) $P(O_3)$ binned to HO_2 mixing ratios and (d) HO_2 binned to NO mixing ratios. Lines show averages of all data points and grey shades present the 1 σ standard deviation.

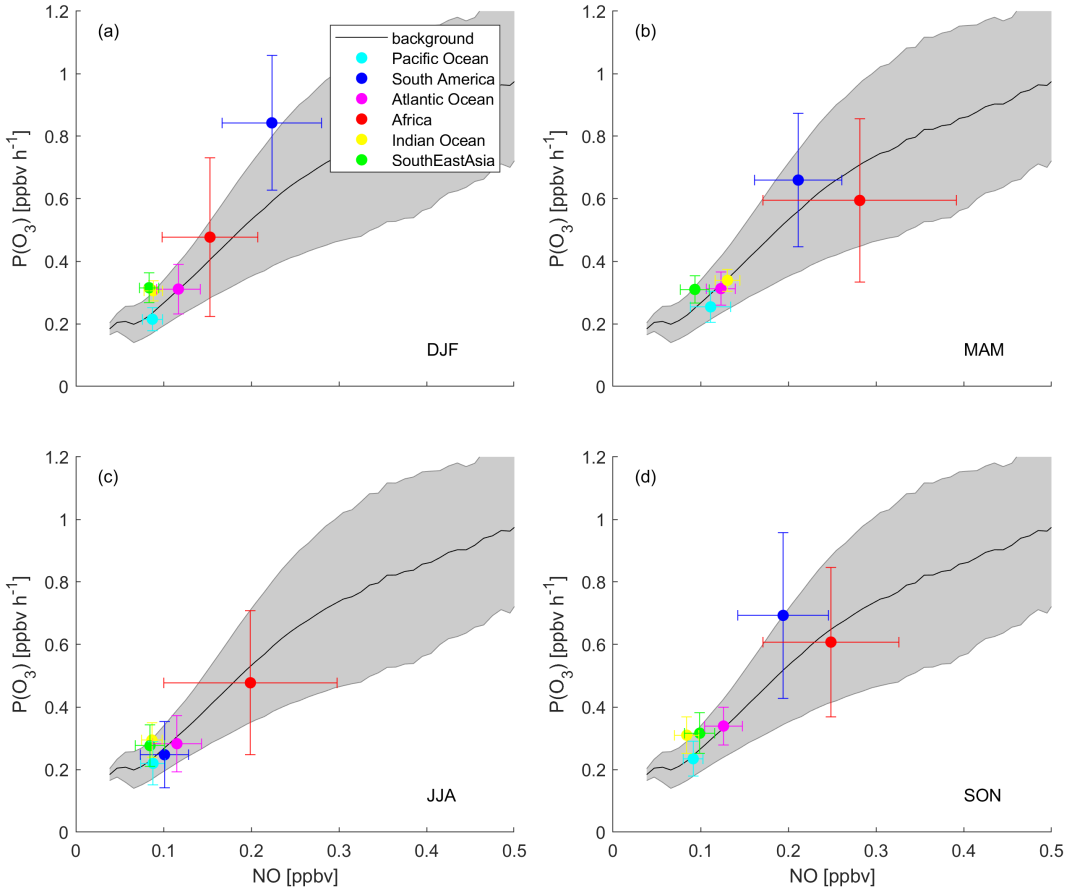

Figure S11. $P(O_3)$ binned to NO mixing ratios, distinguishing the four periods. Black lines show averages of all data points, and grey shades present the 1 σ standard deviation. Colored data points show the averages for the indicated areas with the 1 σ standard deviation.

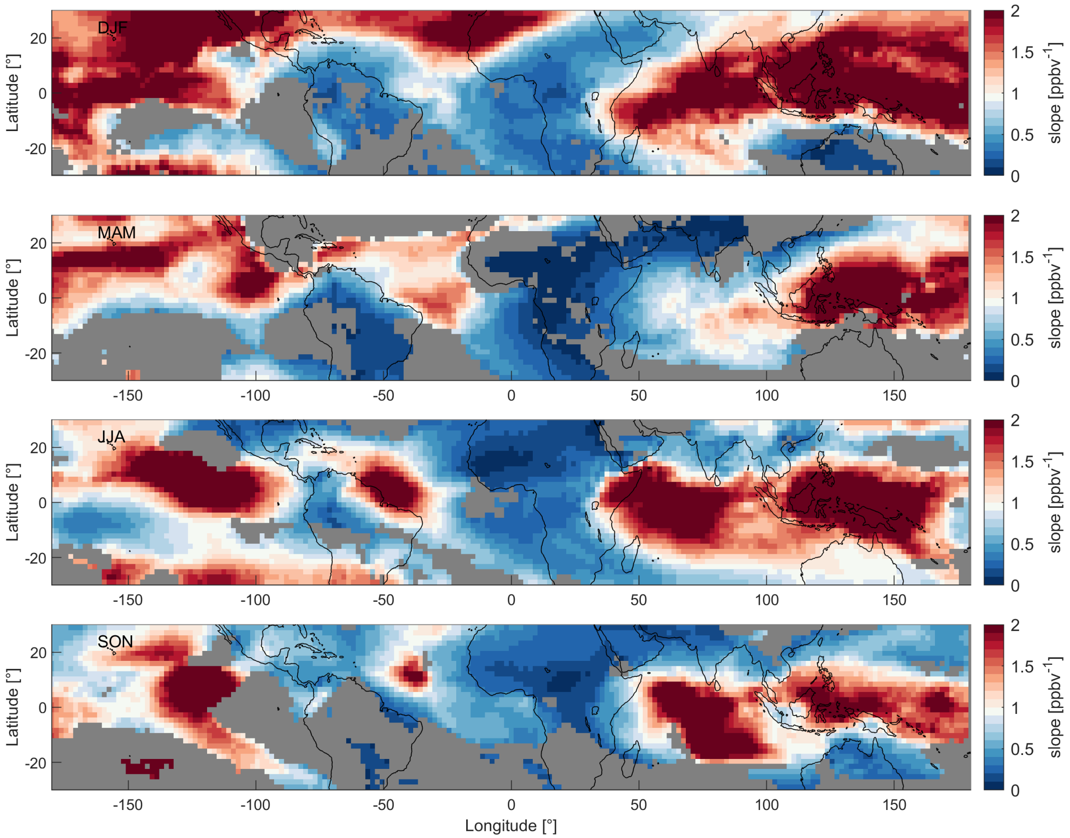

Figure S12. Map of the tropical UT between 30 ° S and 30 ° N for each period colored by the slopes of NO vs $\alpha(CH_3O_2)$ of the data in model grid regions. Red colors indicate NO_x and blue colors VOC sensitive regimes. For grey areas the R^2 of the fit is below 30 %.

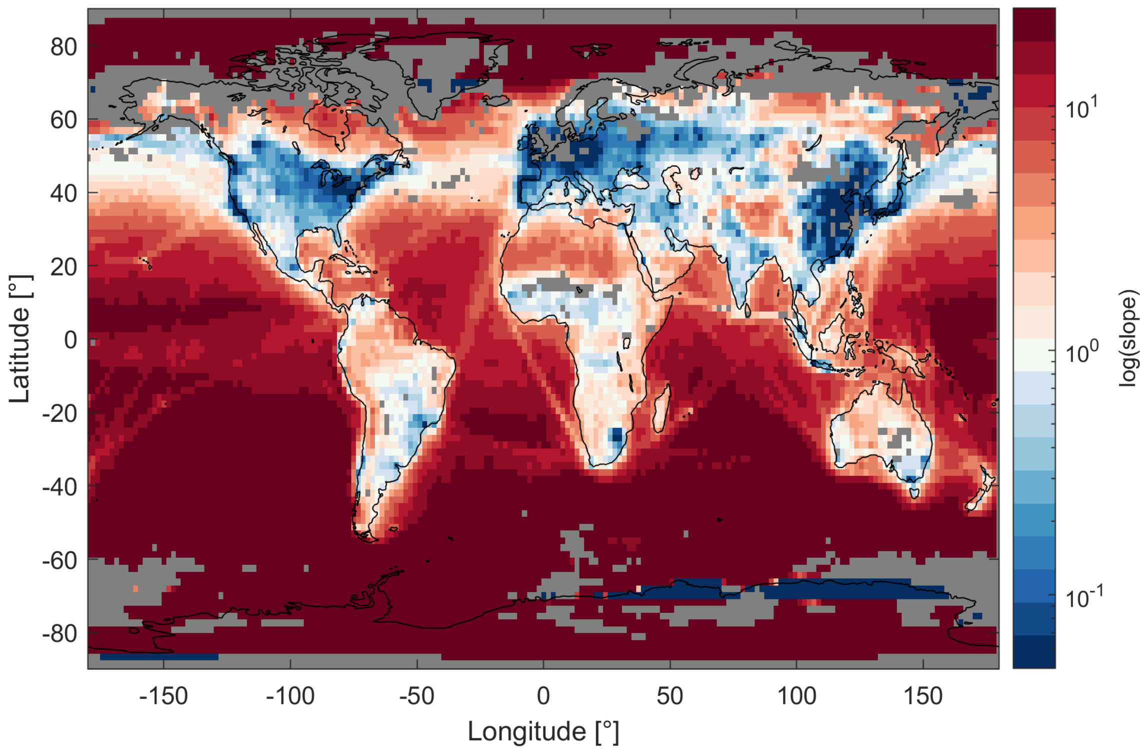

Figure S13. Determination of the dominant chemical regime at the surface for all latitudes, using the slope of NO vs $\alpha(CH_3O_2)$ as indicator – showing the annual average. Red colors indicate NO_x and blue colors VOC sensitive regimes. For grey areas the R^2 of the fit is below 30 %.

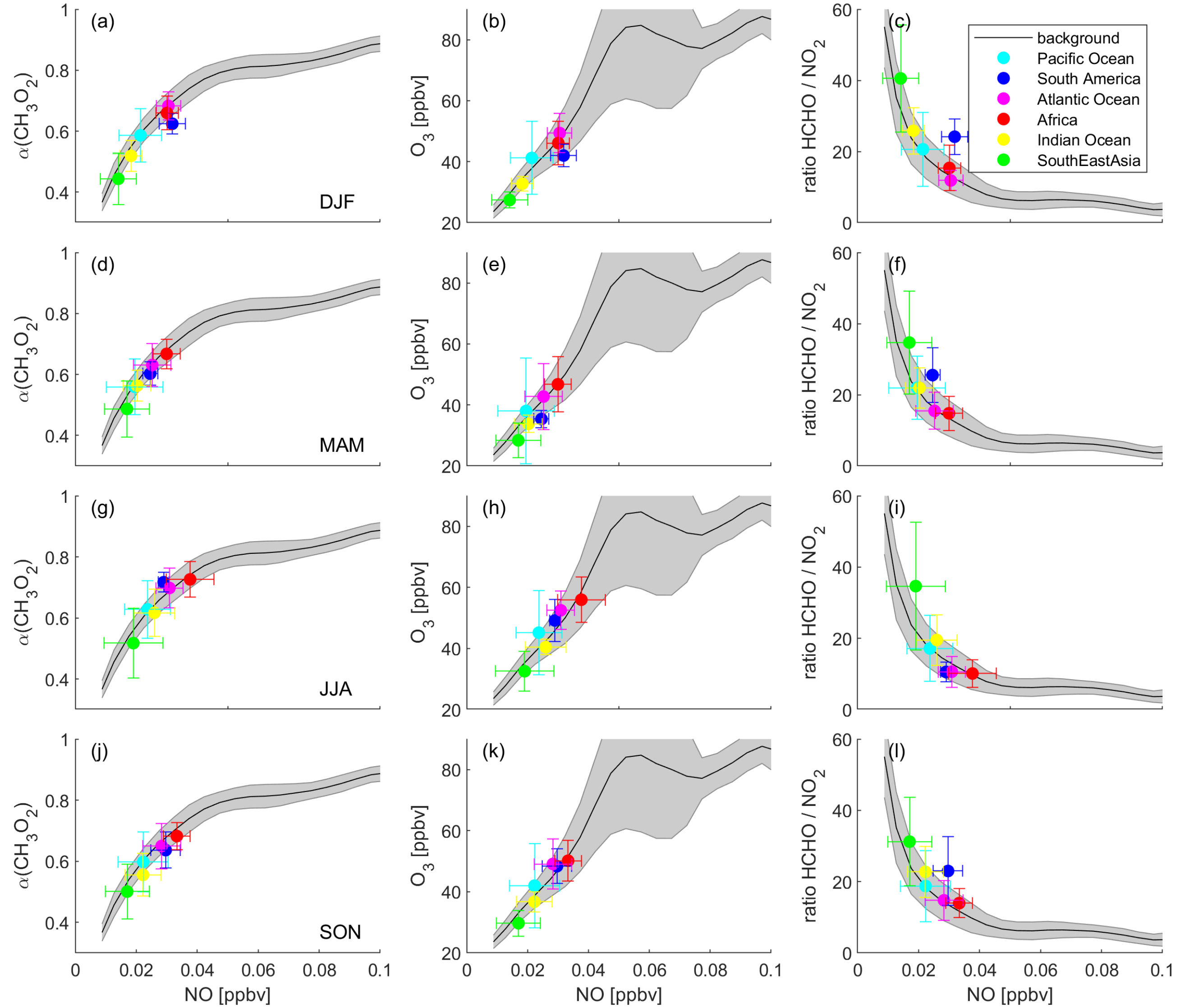

Figure S14. Determination of the dominant chemical regime in the tropical UT in the no lightning scenario via $\alpha(CH_3O_2)$, O_3 and the $HCHO/NO_2$ ratio binned to NO mixing ratios for the four periods. Black lines show averages of all data points, and grey shades present the $1\,\sigma$ standard deviation. Colored data points show the averages for the indicated areas with the $1\,\sigma$ error.

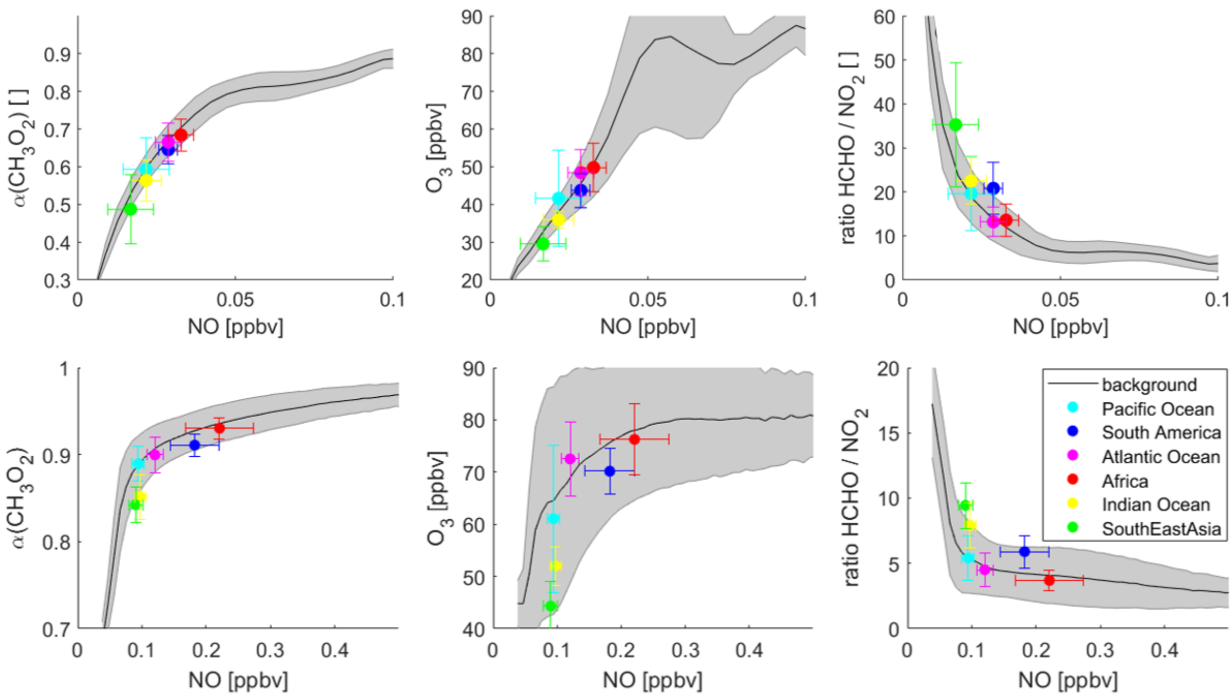

Figure S15. Comparison of the plots shown in Figure 6 ($\alpha(CH_3O_2)$, O_3 and the $HCHO/NO_2$ ratio binned to NO mixing ratios) for the modeling scenario with (bottom row) and without lightning (top row). The baseline scenario is here shown as a yearly average. Black lines show averages of all data points, and grey shades present the 1 σ standard deviation. Colored data points show the averages for the indicated areas with the 1 σ error.

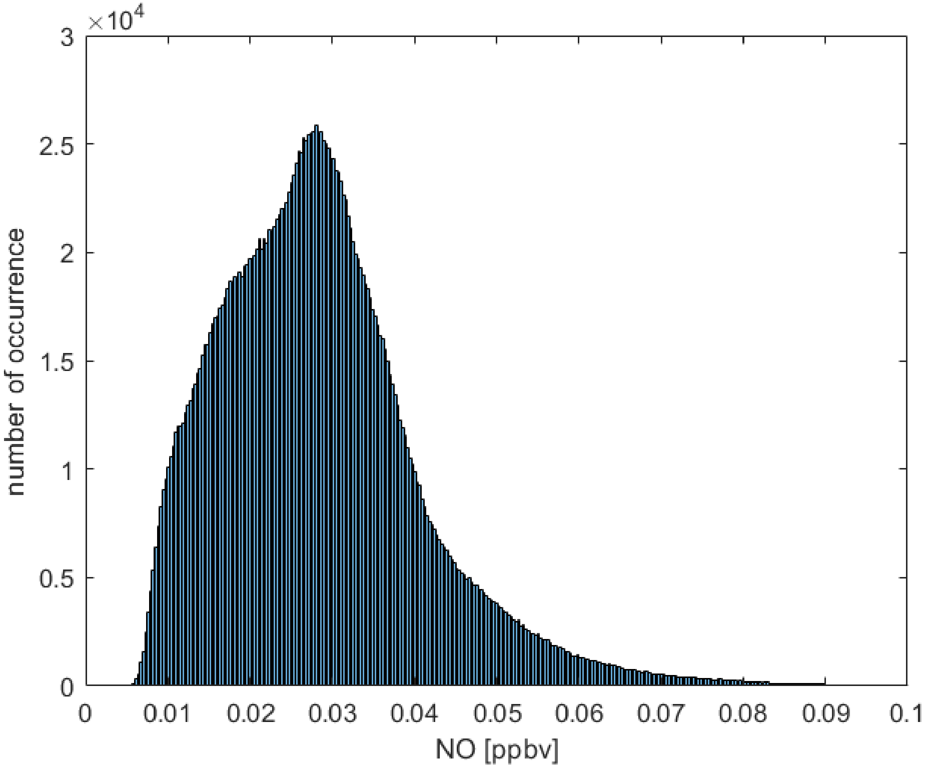

Figure S16. Frequency distribution of NO mixing ratios in the no lightning scenario.

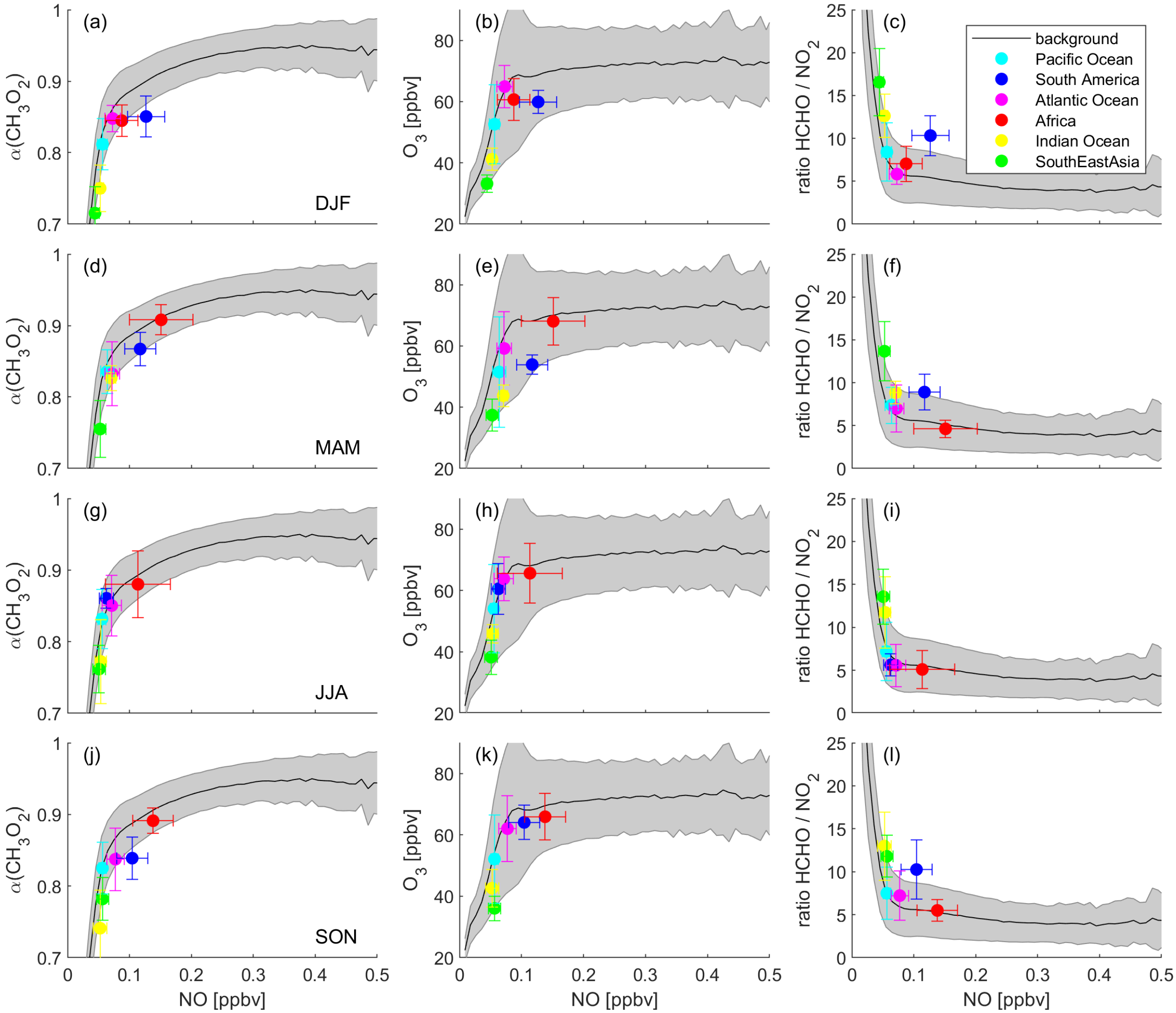

Figure S17. Determination of the dominant chemical regime in the tropical UT in the scenario with halved lightning via $\alpha(CH_3O_2)$, O_3 and the $HCHO/NO_2$ ratio binned to NO mixing ratios for the four periods. Black lines show averages of all data points, and grey shades present the 1 σ standard deviation. Colored data points show the averages for the indicated areas with the 1 σ standard deviation.

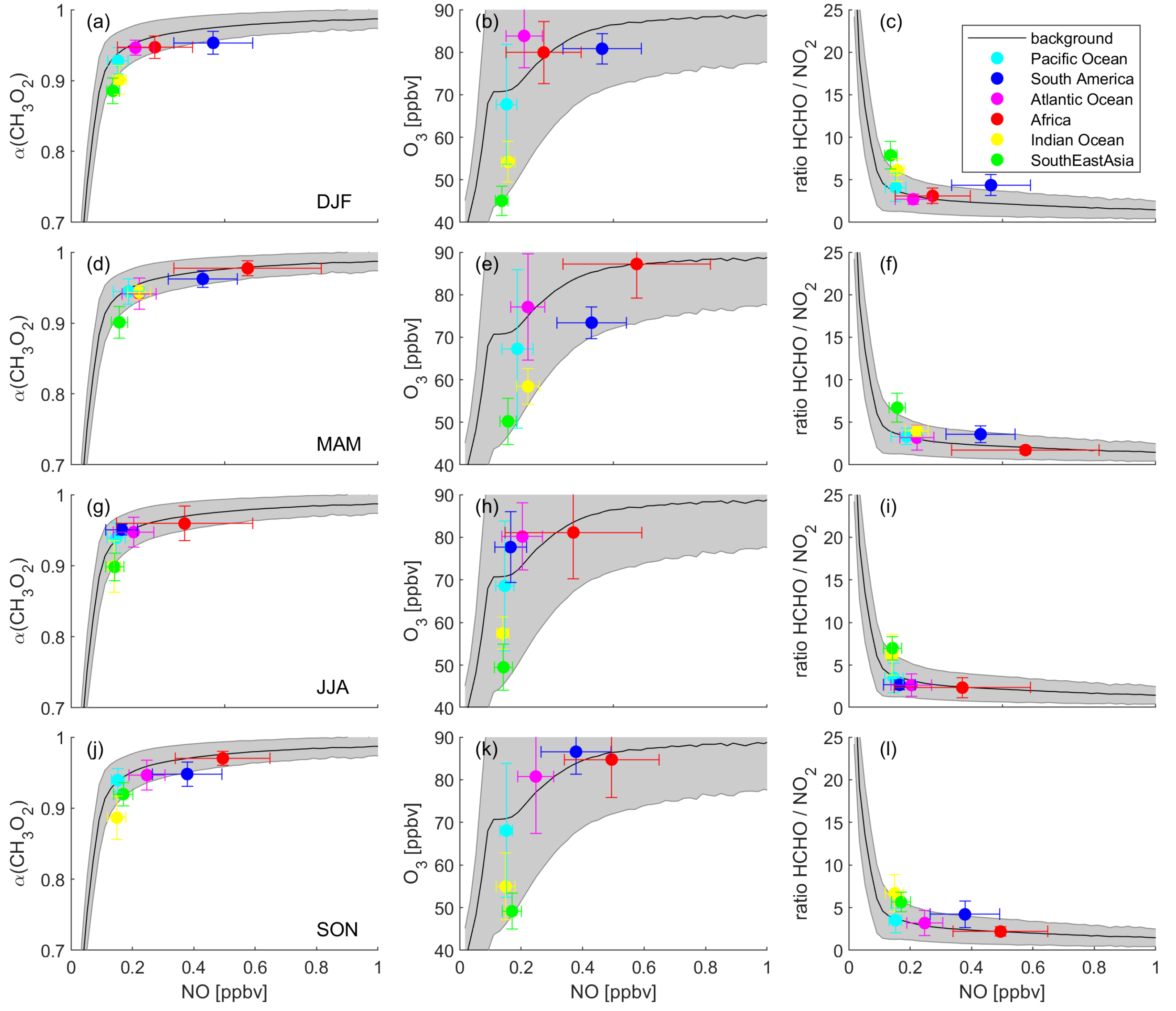

Figure S18. Determination of the dominant chemical regime in the tropical UT in the scenario with doubled lightning via $\alpha(CH_3O_2)$, O_3 and the $HCHO/NO_2$ ratio binned to NO mixing ratios for the four periods. Black lines show averages of all data points, and grey shades present the 1 σ standard deviation. Colored data points show the averages for the indicated areas with the 1 σ standard deviation.