Supplementary Materials for

"Large and increasing stratospheric contribution to tropospheric ozone over East Asia"

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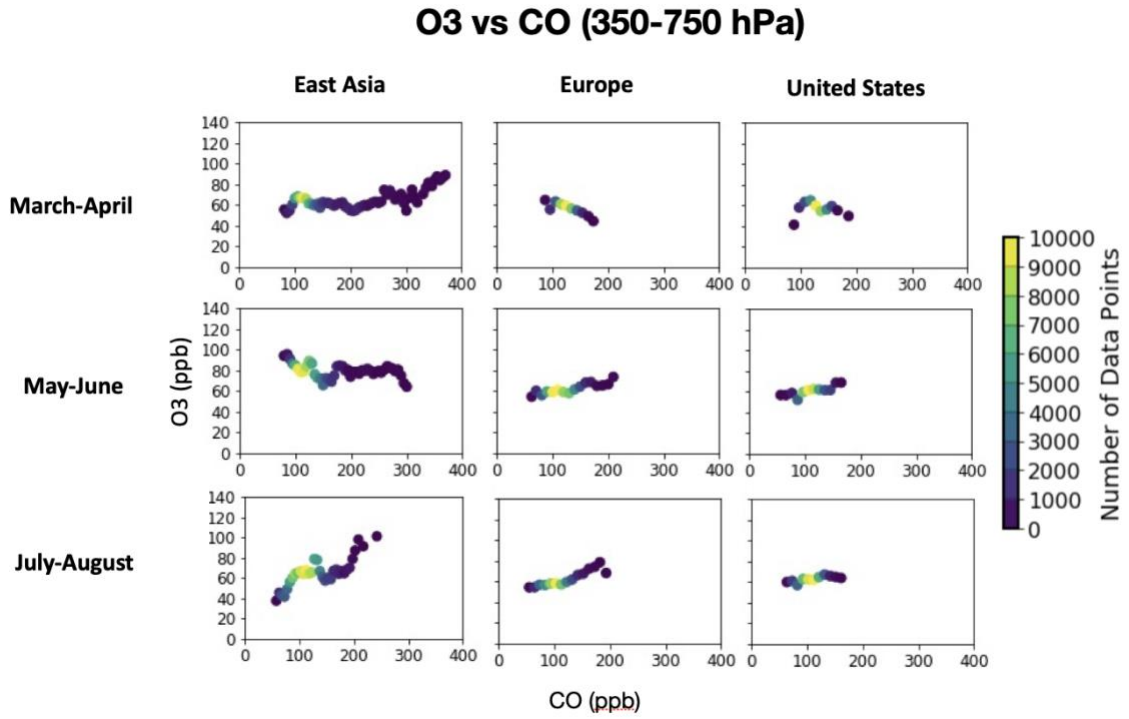

Figure S1 IAGOS ozone versus CO concentrations in the free troposphere (750-350 hPa) over East Asia (30.0-45.0 ° N, 109.0-145.0 ° E), Europe (35.0-54.0 ° N, -11.0-30.0 ° E), and the United States (28.0-49.0 ° N, -124.6.0- -66.8 ° E) for March-August 2015-2019. Ozone and CO column mixing ratios are computed from individual vertical profiles averaged over 25 hPa pressure levels. Ozone column mixing ratios are then averaged over bins of 5 ppb CO. Only bins with 50 or more observations are included.

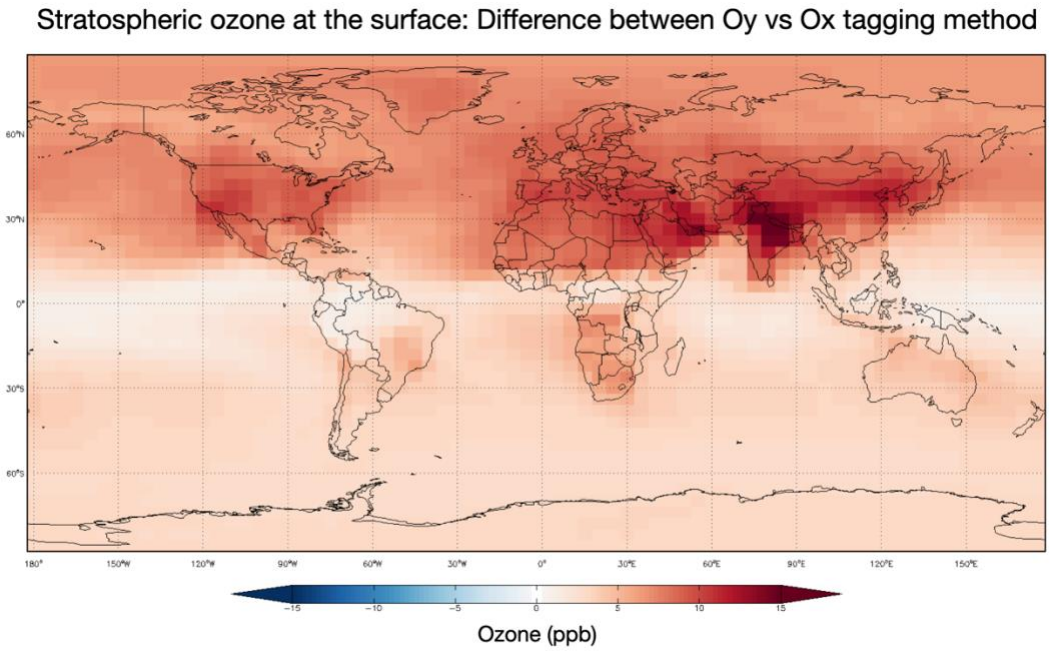

Figure S2 Stratospheric contribution to surface ozone for May 2016 using the expanded odd oxygen family to include hydrogen oxide radicals produced from ozone photolysis as in Bates and Jacob (2020).

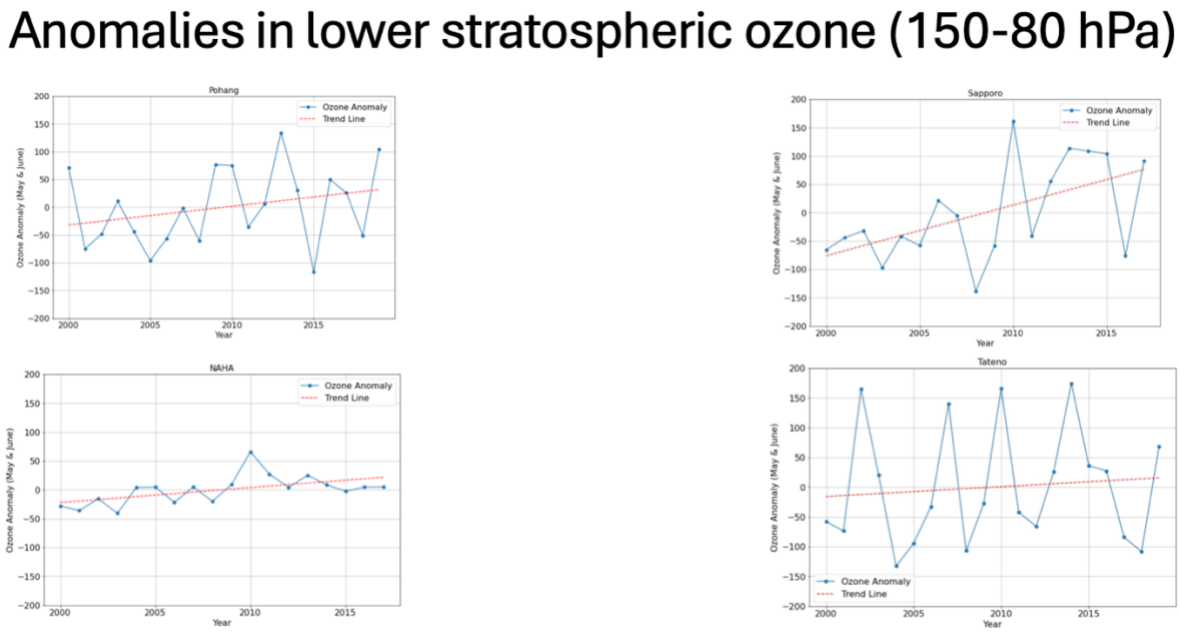

Figure S3 Anomalies in lower stratospheric (150-80 hPa) ozone relative to the 2000-2019 May-June mean from four ozonesonde stations in East Asia. Data is obtained from the World Ozone an Ultraviolet Radiation Data Centre (https: //woudc.org/data/explore.php?lang=en).

References

[1] Bates, K. H. and Jacob, D. J.: An Expanded Definition of the Odd Oxygen Family for Tropospheric Ozone Budgets: Implications for Ozone Lifetime and Stratospheric Influence, Geophysical Research Letters, 47, e2019GL084486, https://doi.org/10.1029/2019GL084486, 2020.