Supplement to “Stratospheric ozone trends and attribution over 1984-2020 using ordinary and regularised multivariate regression models”

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Figure S1: (a-c) Monthly ozone anomalies (blue dots) and the OLS (red line) and Ridge fitting (green dot-dashed line) from ML-TOMCAT data during 1984-2020 at the pressure levels of 1 hPa (left column), 10 hPa (middle column) and 46.4 hPa (right column) for the 1°N latitude. (d-f) Cross-validated MSE values as well as (g-i) Ridge regression trace of the coefficients that change with alpha ($\alpha$) are also shown. The vertical red dashed line indicates the optimal tuning value ($\alpha_0$) for Ridge regression where the minimal MSE exists.
Figure S2: Same as Figure S1 but for simulation A_RAI during 1984-2018.

Figure S3: Same as Figure S1 but for simulation B_ERAS during 1984-2020.
Figure S4: Profiles of seasonal ozone trends (blue for MAM, green for JJA, magenta for SON, and red for DJF) during post-1998 time periods from (a-c) SWOOSH, (d-f) ML-TOMCAT, simulation (g-i) A_ERA and (j-l) B_ERA averaged over three latitude bands (60-35 °S, 20 °S-20 °N, 35-60 °N) based on the Ridge regression method. Error bars are 2-σ uncertainties.
Figure S5: OLS-Ridge Differences of seasonal ozone trends (blue for MAM, green for JJA, magenta for SON, red for DJF) between OLS and Ridge regression methods averaged over three latitude bands (60°-35°S, 20°S-20°N, 35°-60°N) from (a-c) SWOOSH, (d-f) ML-TOMCAT, simulation (g-i) A_ERAI and (j-l) B_ERA5 during post-1998 time periods.
Figure S6: Pressure-season variation of 30 hPa QBO in ozone (%) from (a-c) SWOOSH, (d-f) ML-TOMCAT, (g-i) A_ERAI and (j-l) B_ERA5 data for three selected latitudinal bands (60-35° S, 20° S-20° N, 35-60° N) based on the OLS regression method.
Figure S7: Same as Figure S6 but for 50 hPa QBO in ozone (%).
Figure S8: Pressure-latitude cross sections of the natural ozone variations (%) associated with (a-d) ENSO, (e-h) AO and (i-l) AAO derived from SWOOSH, ML-TOMCAT, and TOMCAT simulations (A_ERAI and B_ERA5) based on the OLS regression method. The stippling indicates regions that are significant at the 95 % level.