Supplementary material for the following ACP submission

Causes of growing middle-upper tropospheric ozone over the Northwest Pacific region

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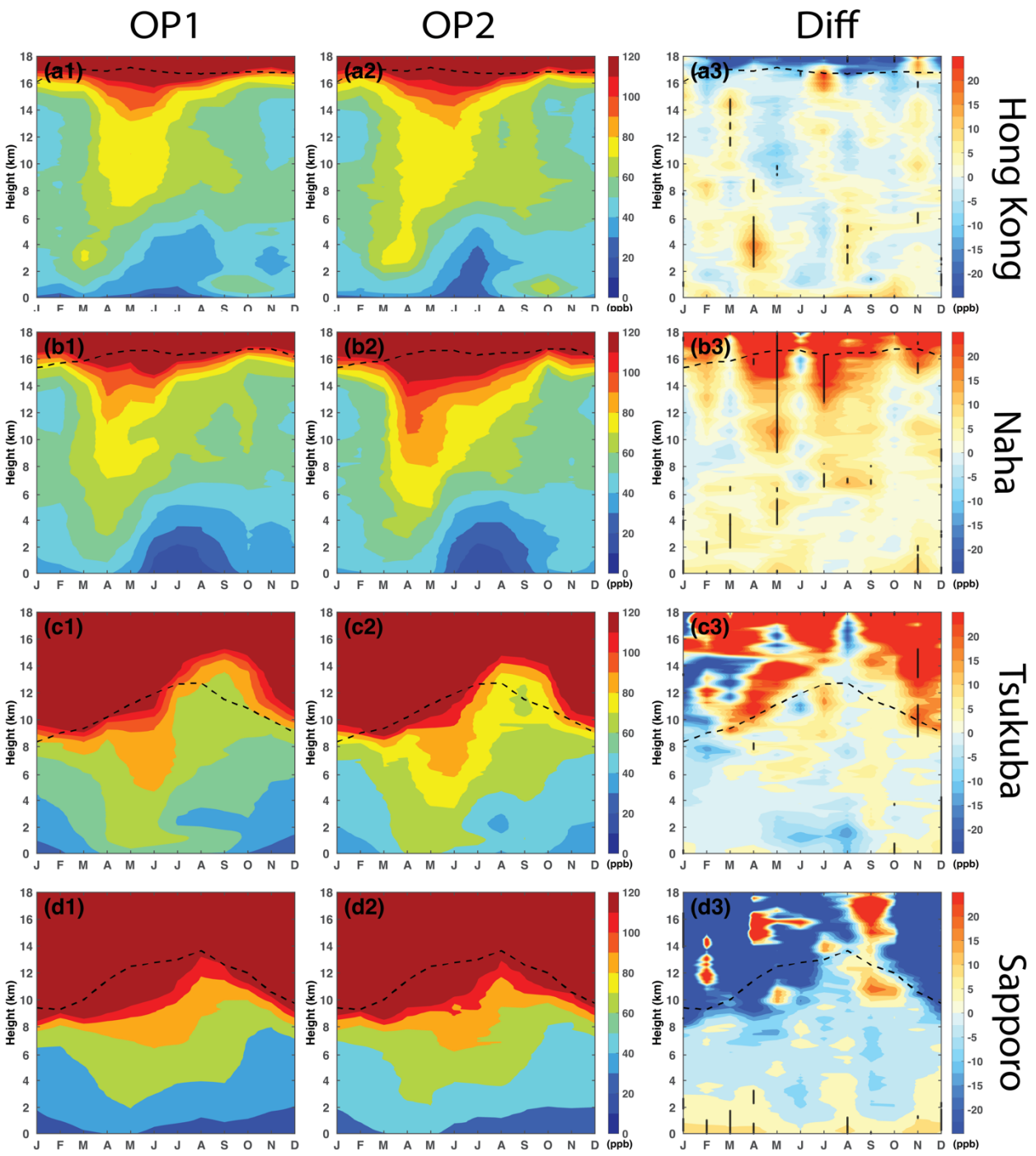

Figure S1. Monthly evolution of the vertical distribution of mean O_3 in the first overlapping period (OP1: 2000-2008), the last overlapping period (OP2: 2009-2017), and the difference between OP2 and OP1 of O_3 at four observation sites (a1-a3) Hong Kong, (b1-b3) Naha, (c1-c3) Tsukuba and (d1-d3) Sapporo. Black dash lines indicate tropopause height. Dots in the i-l represent the layer with statistically significant changes according to a paired two-sided t-test ($p < 0.05$).

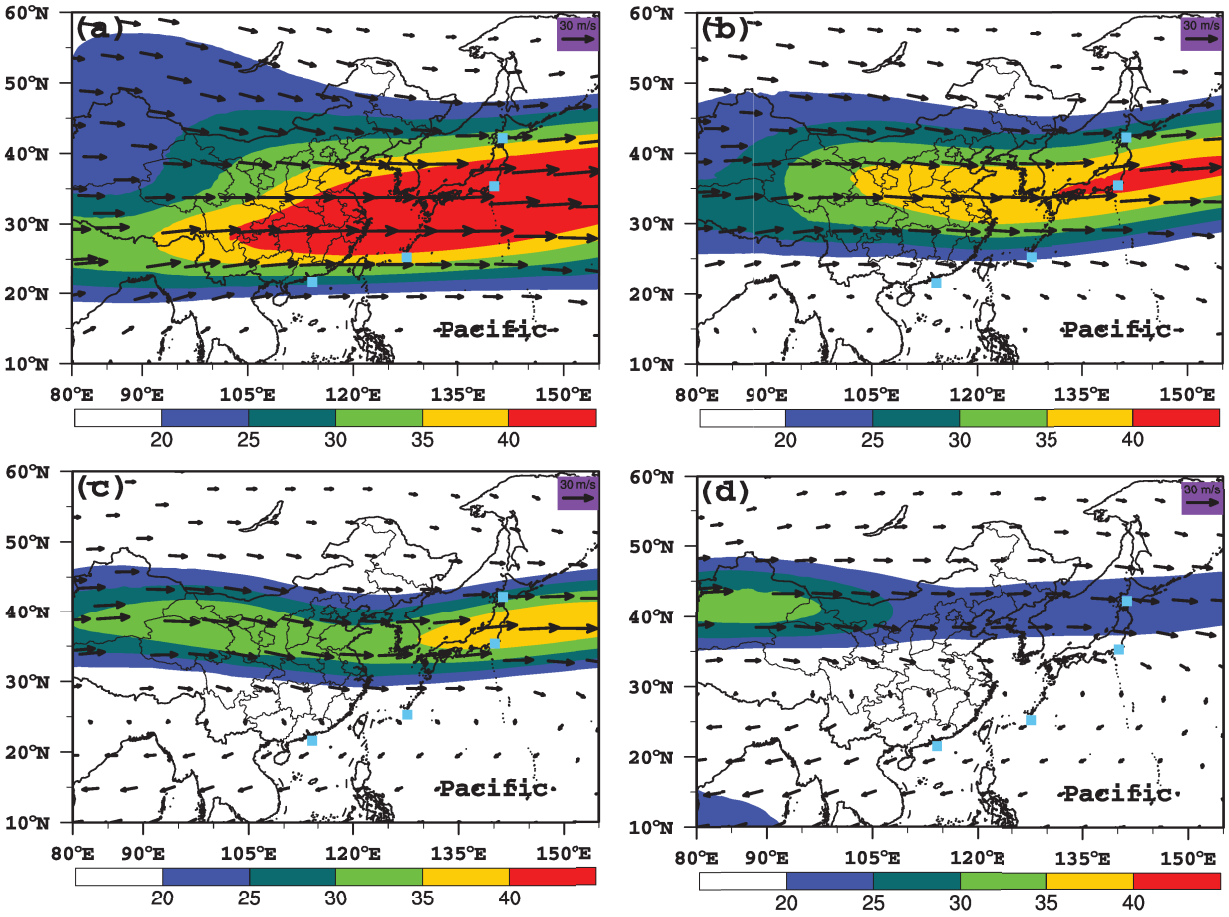

Figure S2. The wind field (vector) and wind speed (color shades) retrieved from ERA5 (the fifth generation ECMWF reanalysis) at 200hPa in (a) April, (b) May, (c) June, and (d) July averaged over 1990-2020. Four O_3-sounding sites are indicated in the blue squares.

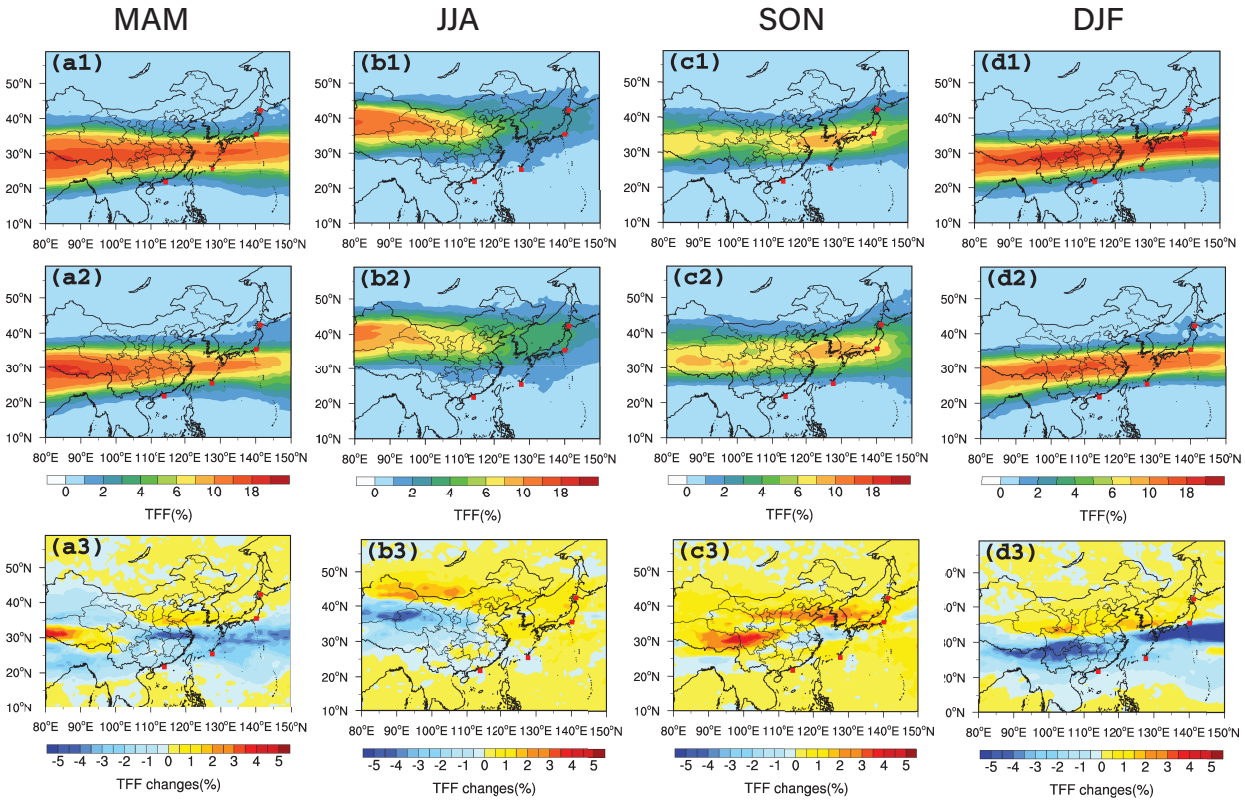

Figure S3. Distribution of tropopause folding frequency, a product provided by ETH Zurich, during the 1990s (a1-d1), 2010s (a2-d2) and its changes (a3-d3) at (a) spring, (b) summer, (c) autumn and (d) winter.