**Supplementary of**

# Surface ozone over High-Mountain Asia controlled by stratospheric intrusion

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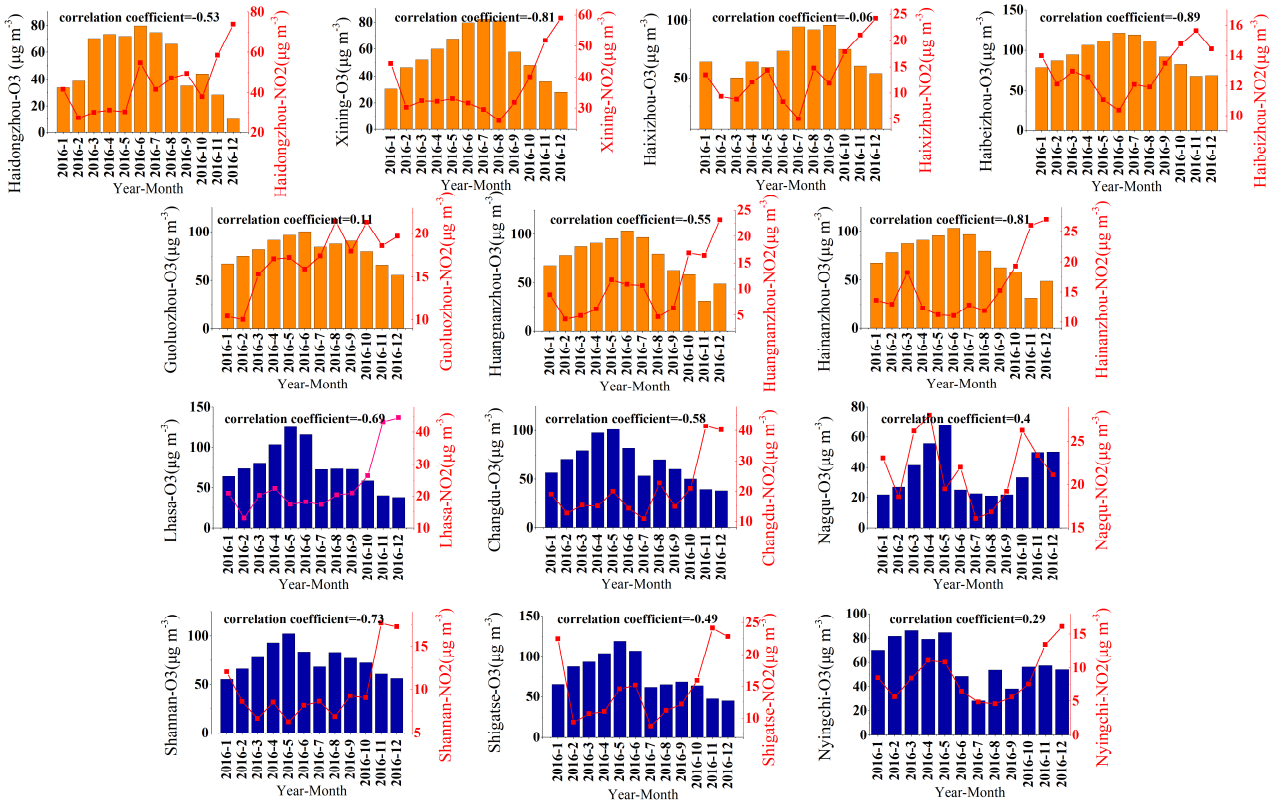


**Figure S1. Monthly mean concentrations of $O_3$ and $NO_2$ at thirteen sites in High-Mountain Asia. The correlation coefficient between $O_3$ and $NO_2$ concentrations at each site is also shown in the figure. Sites with ozone peaked in May colored in blue, in June and July colored in orange.**

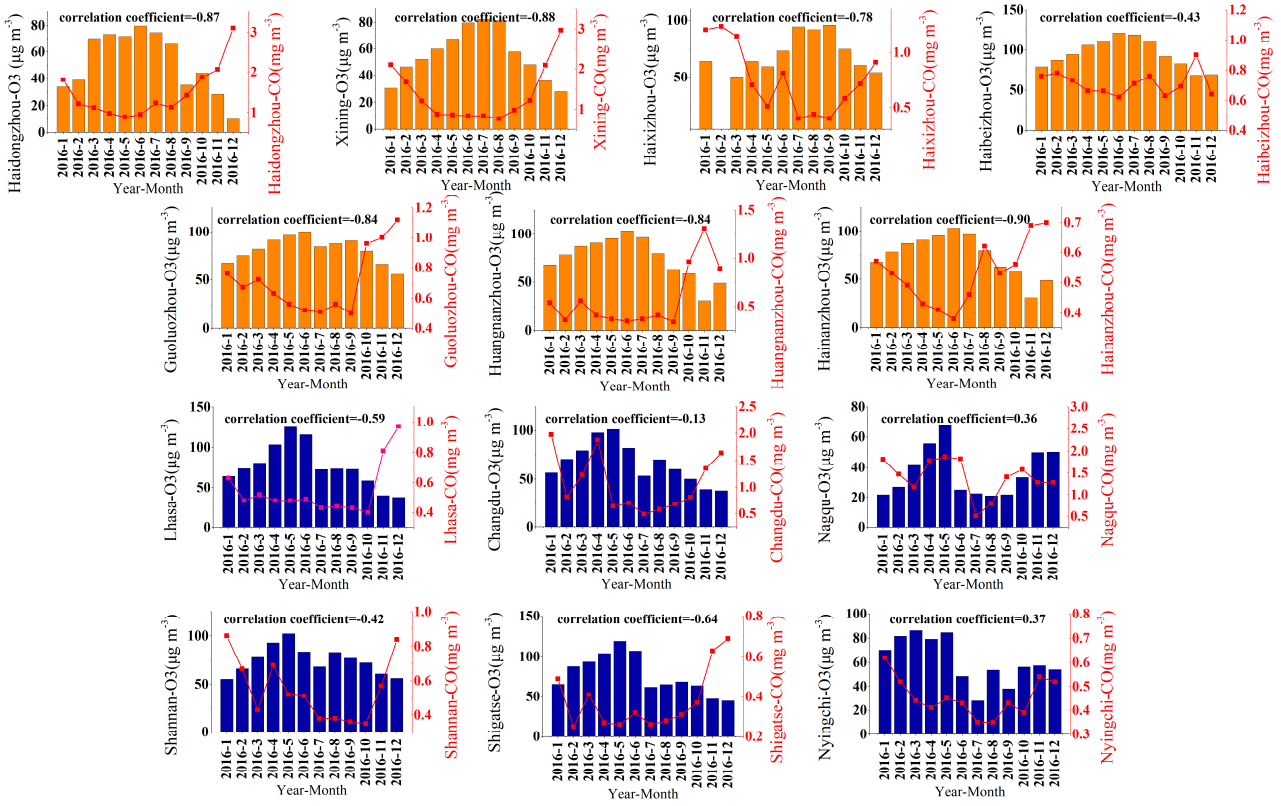


**Figure S2. Monthly mean concentrations of $O_3$ and CO at thirteen sites in High-Mountain Asia. The correlation coefficient between O3 and CO concentrations at each site is also shown in the figure. Sites with ozone peaked in May colored in blue, in June and July colored in orange.**

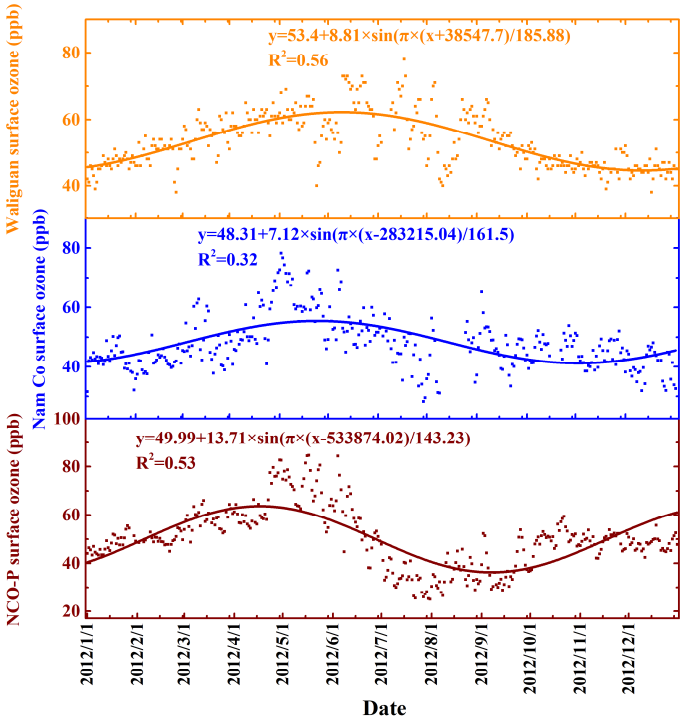


**Figure S3. Annual variation of surface ozone at three background sites in High-Mountain Asia (Waliguan: Xu et al. (2020); Nam Co: Yin et al. (2017); NCO-P: The Institute of Atmospheric Sciences and Climate, https://www.isac.cnr.it/en) in 2012 and their sinusoidal curve fits.**

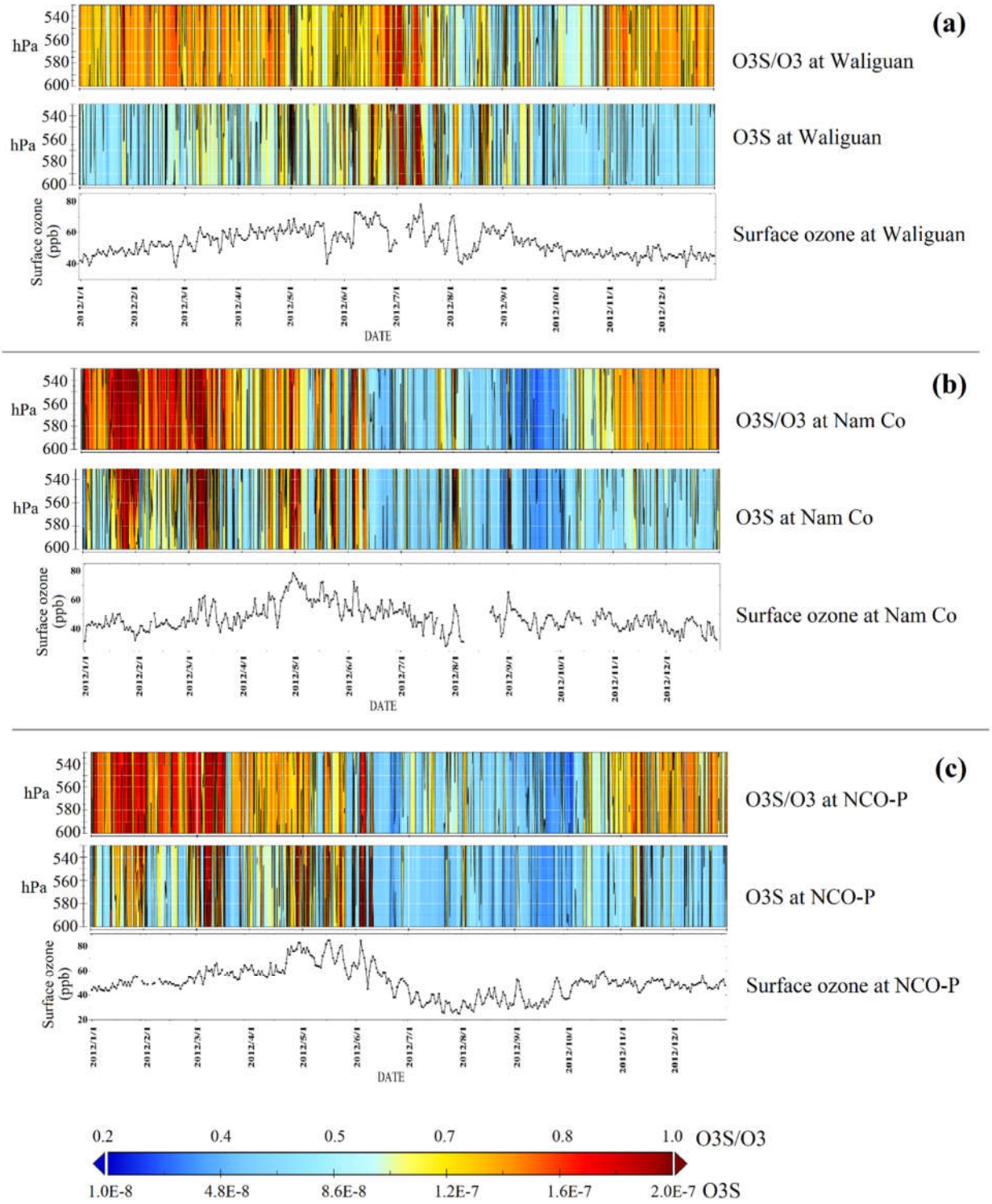


**Figure S4. Contour plots of daily mean O3S and O3S/O3 between 530 hPa and 600 hPa along with daily mean concentration of surface ozone at Waliguan, Nam Co, and NCO-P in High-Mountain Asia in 2012**

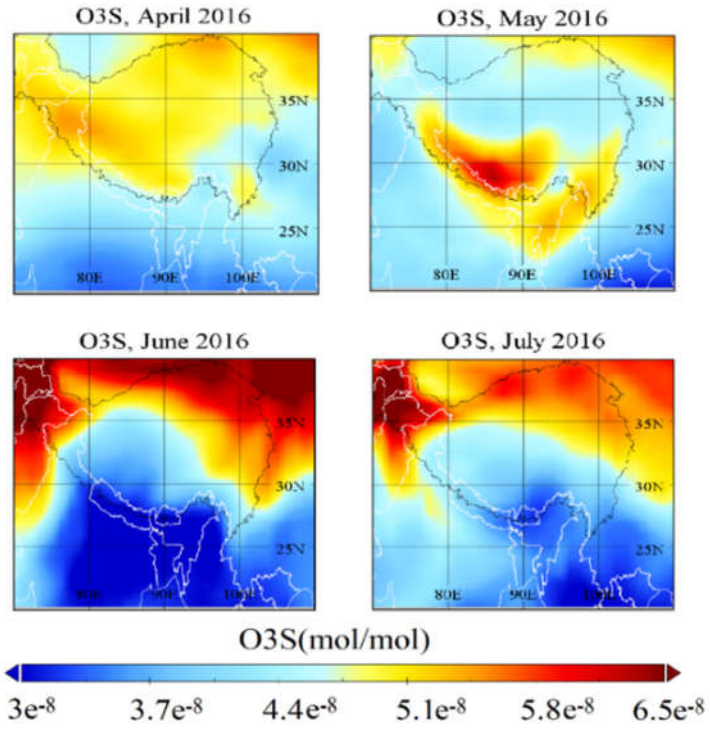


**Figure S5. The monthly mean $O_{3S}$ at 543.75 hPa in April, May, June and July in 2016 simulated with the Community Atmosphere Model with Chemistry (CAM-chem).**

**Table S1. Longitude and latitude of the sites in High-Mountain Asia in this study**

| | City | Latitude(N°) | Longitude (E°) | Type |
|---|---|---|---|---|
| 1 | Haixizhou | 37.3753 | 97.3731 | Urban |
| 2 | Haibeizhou | 36.9639 | 100.9048 | Urban |
| 3 | Xining | 36.63855 | 101.7828 | Urban |
| 4 | Haidongzhou | 36.5067 | 102.0306 | Urban |
| 5 | Hainanzhou | 36.2866 | 100.6188 | Urban |
| 6 | Waliguan | 36.283 | 100.9 | Remote |
| 7 | Huangnanzhou | 35.5102 | 102.0199 | Urban |
| 8 | Guoluozhou | 34.4714 | 100.2561 | Urban |
| 9 | Nagqu | 31.48215 | 92.05815 | Urban |
| 10 | Changdu | 31.1266 | 97.18065 | Urban |
| 11 | Nam Co | 30.77 | 90.99 | Remote |
| 12 | Lhasa | 29.652 | 91.097 | Urban |
| 13 | Nyingchi | 29.6504 | 94.36485 | Urban |
| 14 | Shigatse | 29.25415 | 88.89035 | Urban |
| 15 | Shannan | 29.24615 | 91.7657 | Urban |
| 16 | NCO-P | 27.95 | 86.82 | Remote |

**Table 2. Monthly mean (±standard deviation) O3S/O3 at NCO-P, Nam Co, and Waliguan in southern, central and northern Tibetan Plateau, respectively in 2012**

| Month | NCO-P | Nam Co | Waliguan |
|---|---|---|---|
| January | 0.856±0.105 | 0.849±0.113 | 0.713±0.057 |
| February | 0.796±0.088 | 0.819±0.073 | 0.748±0.062 |
| March | 0.776±0.147 | 0.801±0.110 | 0.711±0.069 |
| April | 0.733±0.062 | 0.689±0.088 | 0.717±0.072 |
| May | 0.625±0.142 | 0.627±0.129 | 0.660±0.069 |
| June | 0.493±0.161 | 0.545±0.153 | 0.718±0.082 |
| July | 0.526±0.089 | 0.508±0.093 | 0.754±0.100 |
| August | 0.475±0.087 | 0.487±0.101 | 0.579±0.072 |
| September | 0.381±0.067 | 0.349±0.084 | 0.571±0.108 |
| October | 0.542±0.133 | 0.563±0.099 | 0.601±0.078 |
| November | 0.717±0.099 | 0.729±0.061 | 0.716±0.066 |
| December | 0.708±0.089 | 0.747±0.049 | 0.736±0.050 |
| Mean (2012) | 0.635±0.181 | 0.643±0.179 | 0.685±0.098 |