

## Supplement

**Table S1.** Correlation values for the JJA mean TCO and climate factors over the TP during 1979-2017

Corr.	TCO	EESC	Solar	QBO30	QBO10	ENSO	Aerosol	AO	GH150	ST
TCO	1	<b>-0.442</b> ***	<b>0.466</b> ***	<b>-0.070</b>	<b>0.458</b> ***	<b>0.161</b>	<b>0.266</b>	<b>0.036</b>	<b>0.169</b>	<b>0.035</b>
EESC		1	-0.231	0.022	0.007	0.061	-0.248	0.036	-0.153	-0.091
Solar			1	-0.103	-0.117	-0.092	0.132	0.199	0.235	0.076
QBO30				1	0.057	-0.147	-0.073	-0.215	-0.130	-0.150
QBO10					1	0.159	0.030	0.073	0.004	-0.038
ENSO						1	0.189	-0.257	-0.361 ***	-0.249
Aerosol							1	0.122	-0.332 ***	-0.224
AO								1	0.254	0.270
GH150									1	0.819 ***
ST										1

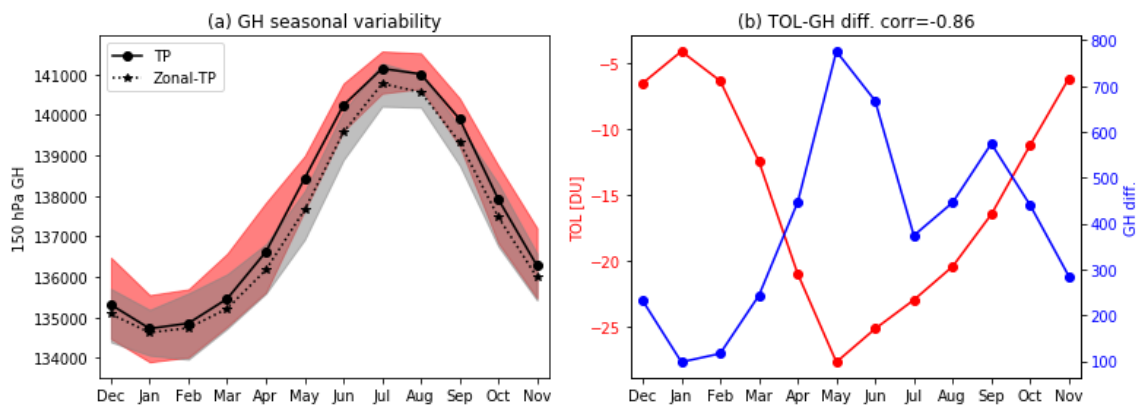
\*\*\* 99% confidence level; \*\* 95% confidence level; \* 90% confidence level

**Table S2.** EESC-based regression coefficients with standard deviations

	DJF ( $R^2=0.780$ )		JJA ( $R^2=0.585$ )	
	Coef.	std err.	Coef.	std err.
EESC	-2.01	0.97	-1.32	0.49
Solar	3.70	0.94	1.39	0.49
QBO30	-2.27	0.96	-0.10	0.44
QBO10	-4.85	0.91	2.20	0.48
GH150	-5.31	0.92	0.17	0.52

**Table S3.** Correlation coefficient between ozone values in a given month and the subsequent months (1 lag=1 month, bold numbers are statistically significant within  $2\sigma$ )

	1	2	3	4	5	6	7	8	9	10	11
<b>N</b>	<b>0.45</b>	0.27	<b>0.35</b>	<b>0.35</b>	<b>0.37</b>	<b>0.49</b>	0.23	<b>0.35</b>	<b>0.34</b>	<b>0.31</b>	0.03
<b>D</b>	<b>0.65</b>	<b>0.49</b>	<b>0.59</b>	<b>0.48</b>	<b>0.47</b>	0.17	<b>0.38</b>	<b>0.48</b>	<b>0.35</b>	0.11	-0.20
<b>J</b>	<b>0.77</b>	<b>0.72</b>	<b>0.61</b>	<b>0.41</b>	0.17	0.12	<b>0.32</b>	0.22	0.12	-0.23	-0.31
<b>F</b>	<b>0.71</b>	<b>0.64</b>	<b>0.45</b>	0.26	0.18	<b>0.33</b>	0.25	0.14	-0.18	-0.07	-0.02
<b>M</b>	<b>0.80</b>	<b>0.66</b>	<b>0.33</b>	0.29	<b>0.46</b>	<b>0.32</b>	0.23	-0.26	-0.26	<b>-0.32</b>	-0.25
<b>A</b>	<b>0.66</b>	<b>0.43</b>	<b>0.39</b>	<b>0.50</b>	<b>0.40</b>	0.29	-0.09	-0.21	-0.21	-0.12	-0.16
<b>M</b>	<b>0.60</b>	<b>0.59</b>	<b>0.63</b>	<b>0.50</b>	<b>0.37</b>	-0.09	-0.17	-0.26	-0.06	-0.14	-0.08
<b>J</b>	<b>0.59</b>	<b>0.57</b>	<b>0.53</b>	0.17	-0.15	-0.15	-0.25	-0.02	-0.12	0.04	0.16
<b>J</b>	<b>0.87</b>	<b>0.74</b>	<b>0.45</b>	0.19	0.06	0.03	0.17	0.07	0.18	<b>0.36</b>	<b>0.41</b>
<b>A</b>	<b>0.83</b>	<b>0.52</b>	0.11	-0.01	0.02	0.16	0.07	0.13	0.30	0.26	<b>0.32</b>
<b>S</b>	<b>0.48</b>	0.21	0.07	0.03	<b>0.32</b>	0.09	0.19	0.17	0.18	0.18	0.17
<b>O</b>	<b>0.45</b>	0.24	0.08	0.22	0.06	0.13	<b>0.38</b>	0.15	0.27	0.26	0.22



**Figure S1.** (a) Seasonal variations in geopotential height (GH) at 150 hPa during 1979-2017 over the TP (solid circles, 27.5-37.5°N, 75.5-105.5°E) and the zonal-TP region (asterisks, 27.5-37.5°N). The red and grey shaded areas show the maximum-minimum GH ranges for the TP and the zonal-TP region. (b) The total ozone low (TOL) values (red circles) and 150 hPa GH differences (blue circles) between the TP and zonal-TP region with a significant correlation of -0.86.