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Foreign influences on tropospheric ozone over East Asia through global atmospheric transport

Han Han et al.

Correspondence to: Jane Liu (janejj.liu@utoronto.ca)

Table S1. Tropospheric ozone in and its components by source and associated terms defined in this paper. The components in italic are the focuses in this study.

Component By Source	**Tropospheric Ozone[1]**			
By in/out of East Asia	*Foreign ozone[2]*		*Native ozone[3]*	Stratospheric ozone[4]
By foreign region	*A foreign region's name + ozone[5]*		Native ozone	Stratospheric ozone
By precursor	*Anthropogenic ozone[6]*		Non-anthropogenic ozone + stratospheric ozone	
By both precursor and in/out of East Asia	*Foreign anthropogenic ozone[7]*	*Native anthropogenic ozone[8]*	Non-anthropogenic ozone + stratospheric ozone	
By both precursor and foreign region	*A foreign region's name +anthropogenic ozone[9]*	Native anthropogenic ozone	Non-anthropogenic ozone + stratospheric ozone	

[1]Troposphric ozone refers to ozone in the troposphere. It is the sum of the ozone components in each row in this table.

[2]Foreign ozone: ozone produced in the troposphere outside East Asia.

[3]Native ozone: ozone produced in the troposphere inside East Asia.

[4]Stratospheric ozone: ozone produced in the stratosphere and then transported to the troposphere.

[5]A foreign region's name + ozone: ozone produced in the troposphere over that foreign region. For example, European ozone.

[6]Anthropogenic ozone: ozone produced in the troposphere from its precursors that are emitted from anthropogenic sources.

[7]Foreign anthropogenic ozone: ozone produced in the troposphere from its precursors that are emitted from the anthropogenic sources outside East Asia.

[8]Native anthropogenic ozone: ozone produced in the troposphere from its precursors

that are emitted from the anthropogenic sources inside East Asia.

[9]A foreign region's name + anthropogenic ozone: ozone produced in the troposphere from its precursors that are emitted from the anthropogenic sources in that foreign region. For example, European anthropogenic ozone.

Table S2. Correlation coefficients between the interannual variations of ozone from various regions at the East Asian surface and each of the monsoon indices in winter and summer. The abbreviations are for regions of East Asia (EAS), North America (NAM), Europe (EUR), South Asia (SAS), and Southeast Asia (SEAS).

	Ozone Component	EAWM1	EAWM2	EAWM3
Winter	O_3 (EAS)	-0.84*	-0.68*	-0.72*
	O_3 (NAM)	0.77*	0.49*	0.39
	O_3 (EUR)	0.70*	0.47*	0.65*
	Ozone Component	EASM1	EASM2	EASM3
Summer	O_3	0.74*	0.69*	0.71*
	O_3 (EAS)	0.58*	0.50*	0.64*
	O_3 (SAS)	-0.64*	-0.41	-0.64*
	O_3 (SEAS)	-0.71*	-0.48*	-0.72*

*The correlation coefficient is statistically significant ($p<0.05$).

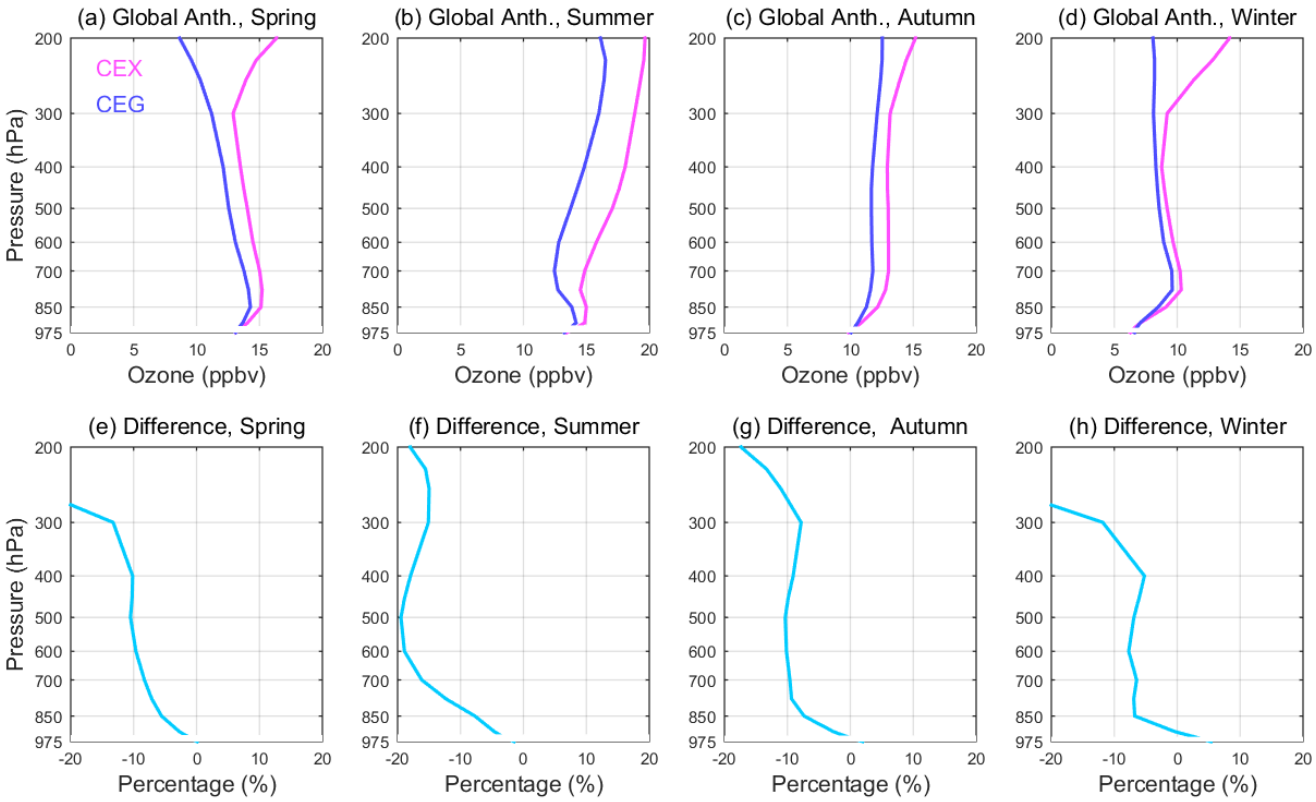

Figure S1. Comparison of ozone concentrations between $\sum_{i=1}^{8}(CTRL - EAnth\text{-}X_i)$ (CEX) and $CTRL - EAnth\text{-}GLO$ (CEG) in Equation (1) over East Asia in 2005.

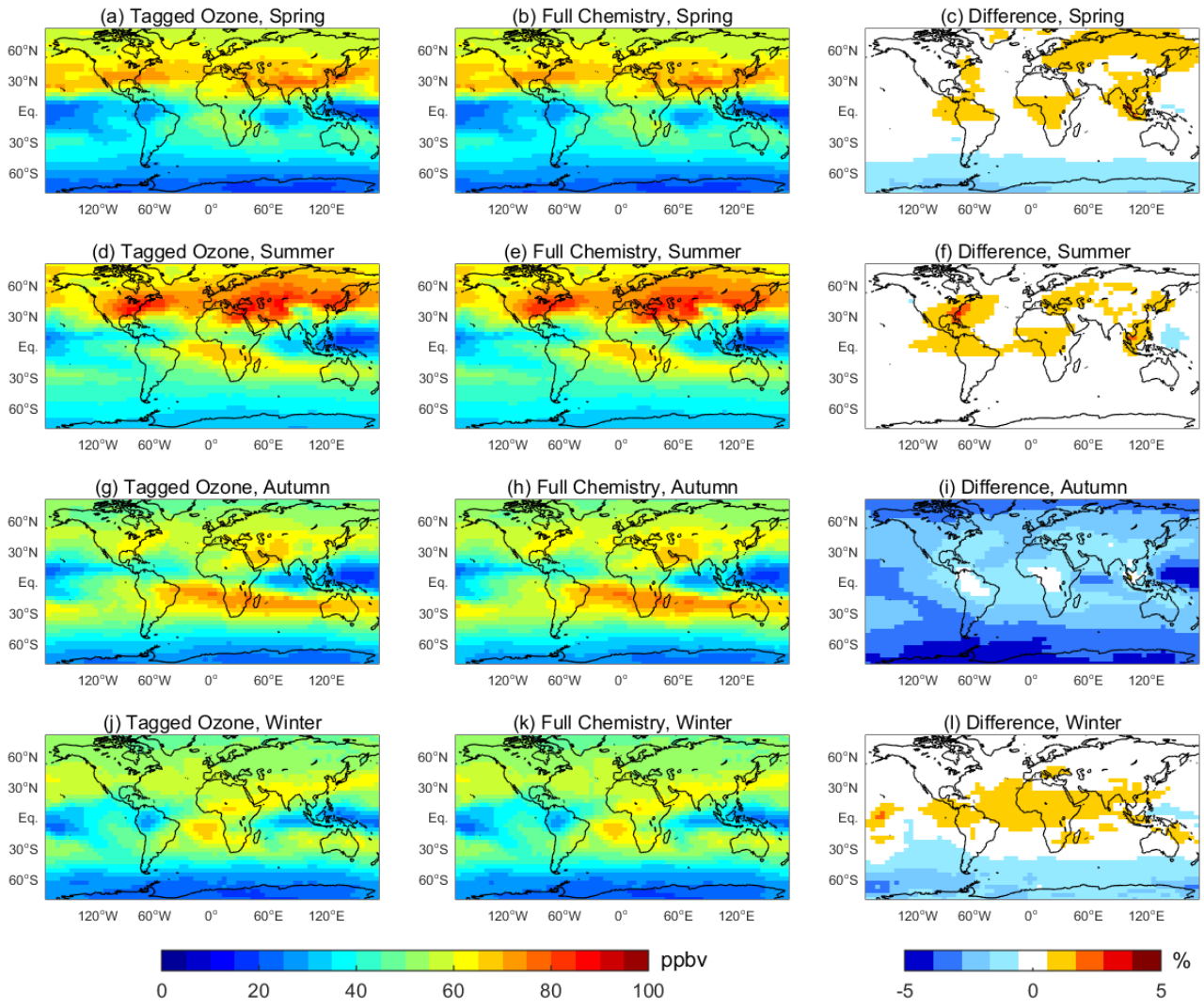

Figure S2. Comparison of ozone concentrations between the tagged ozone and the full chemistry simulations in the middle troposphere (500 hPa) in 2005 by season.

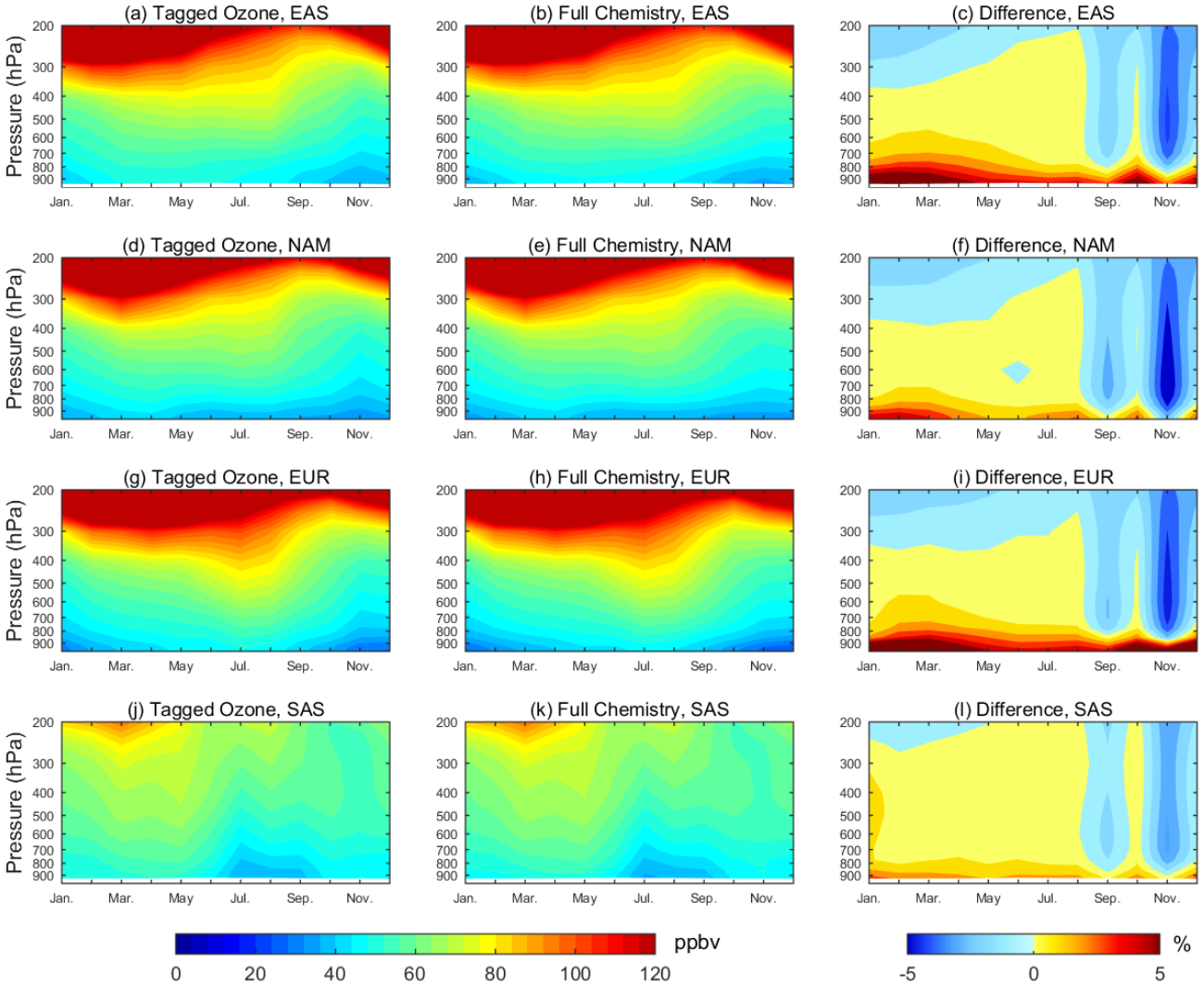

Figure S3. Comparison of ozone concentrations between the tagged ozone and the full chemistry simulations over East Asia (EAS), North America (NAM), Europe (EUR), and South Asia (SAS) in 2005.

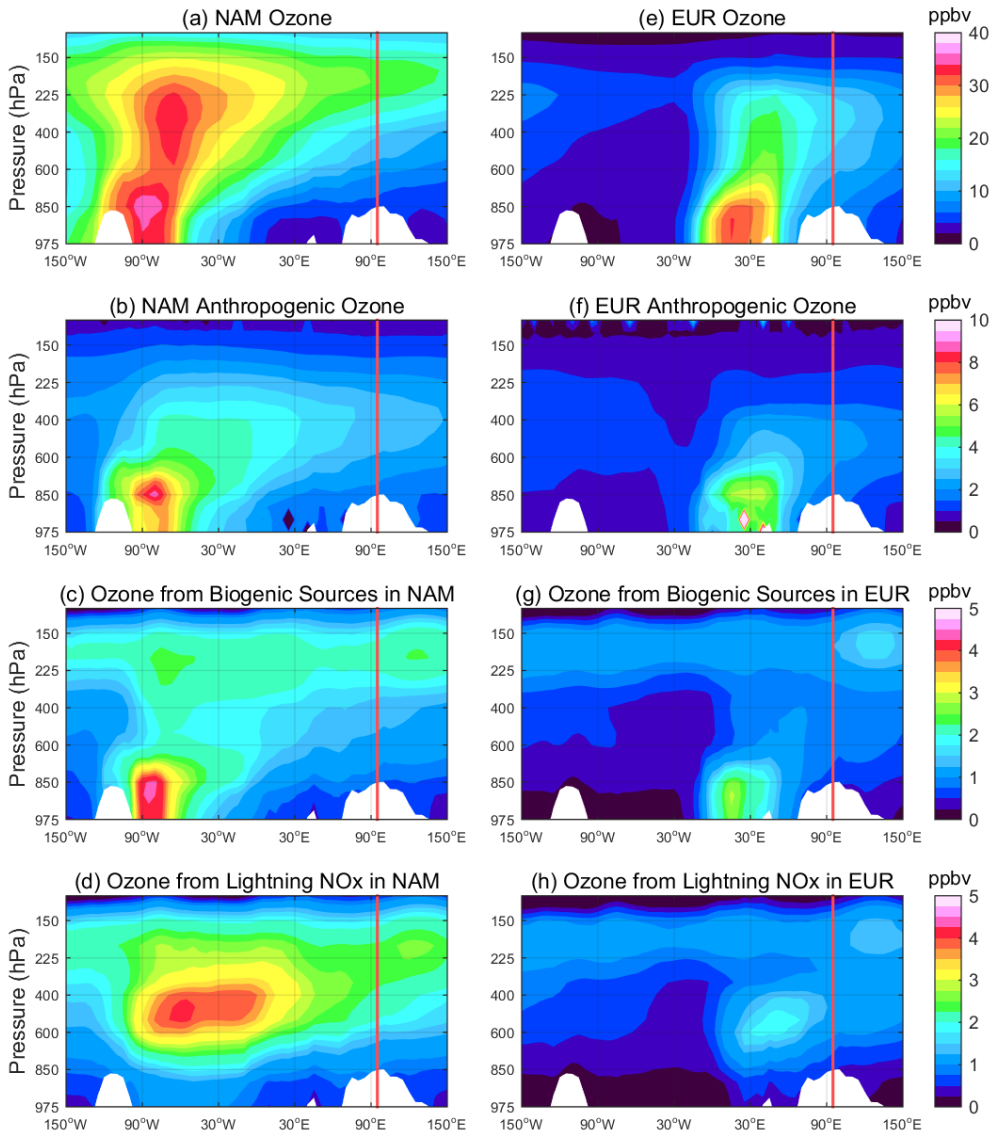

Figure S4. Longitude-pressure cross-sections of North American ozone (a), North American anthropogenic ozone (b), ozone produced from biogenic sources in North America (c), and ozone produced from lightning NO_x in North America (d). (e)-(f) the same as (a)-(d), but for Europe. The values are averaged between 35-60^{o}N in 2005. The white areas indicate topography. The red lines indicate the western border of East Asia.

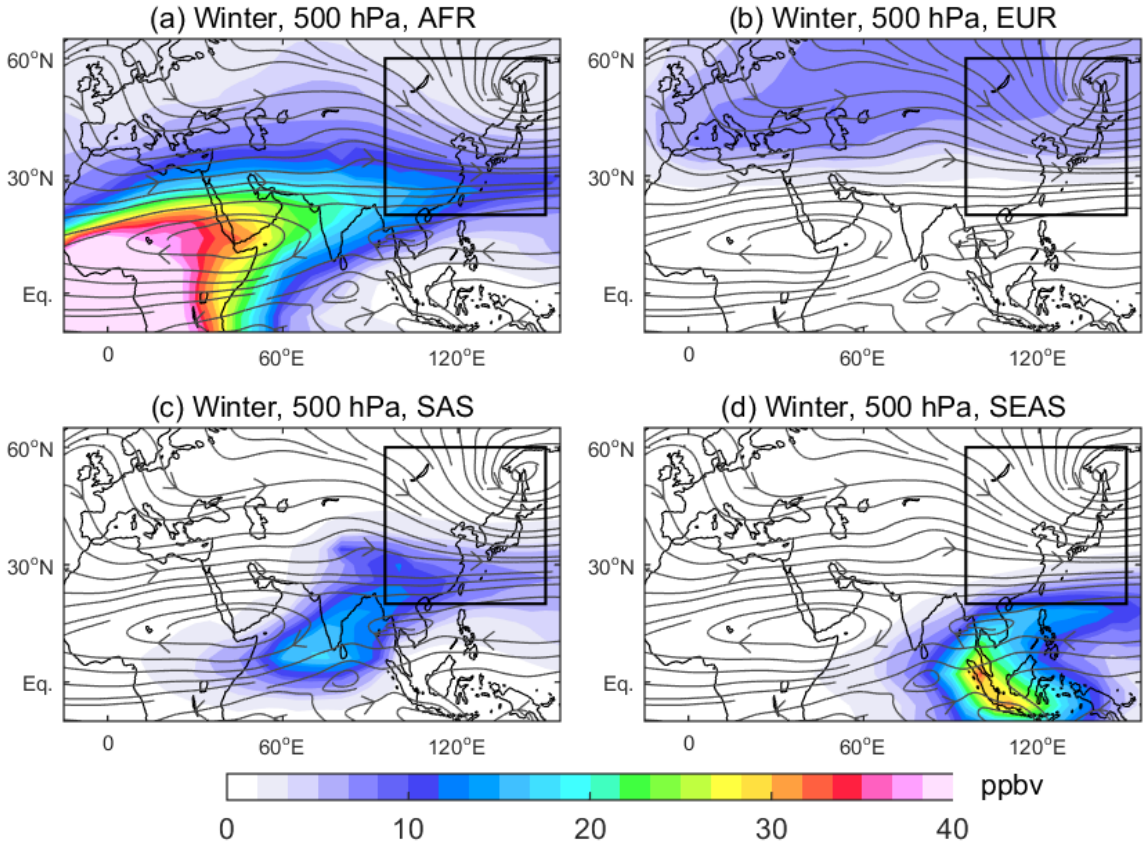

Figure S5. Horizontal distributions of ozone produced in Africa (AFR), Europe (EUR), South Asia (SAS), and Southeast Asia (SEAS) overlaid with streamlines at 500 hPa in the winter of 2005. The boxed area in each subplot indicates East Asia.

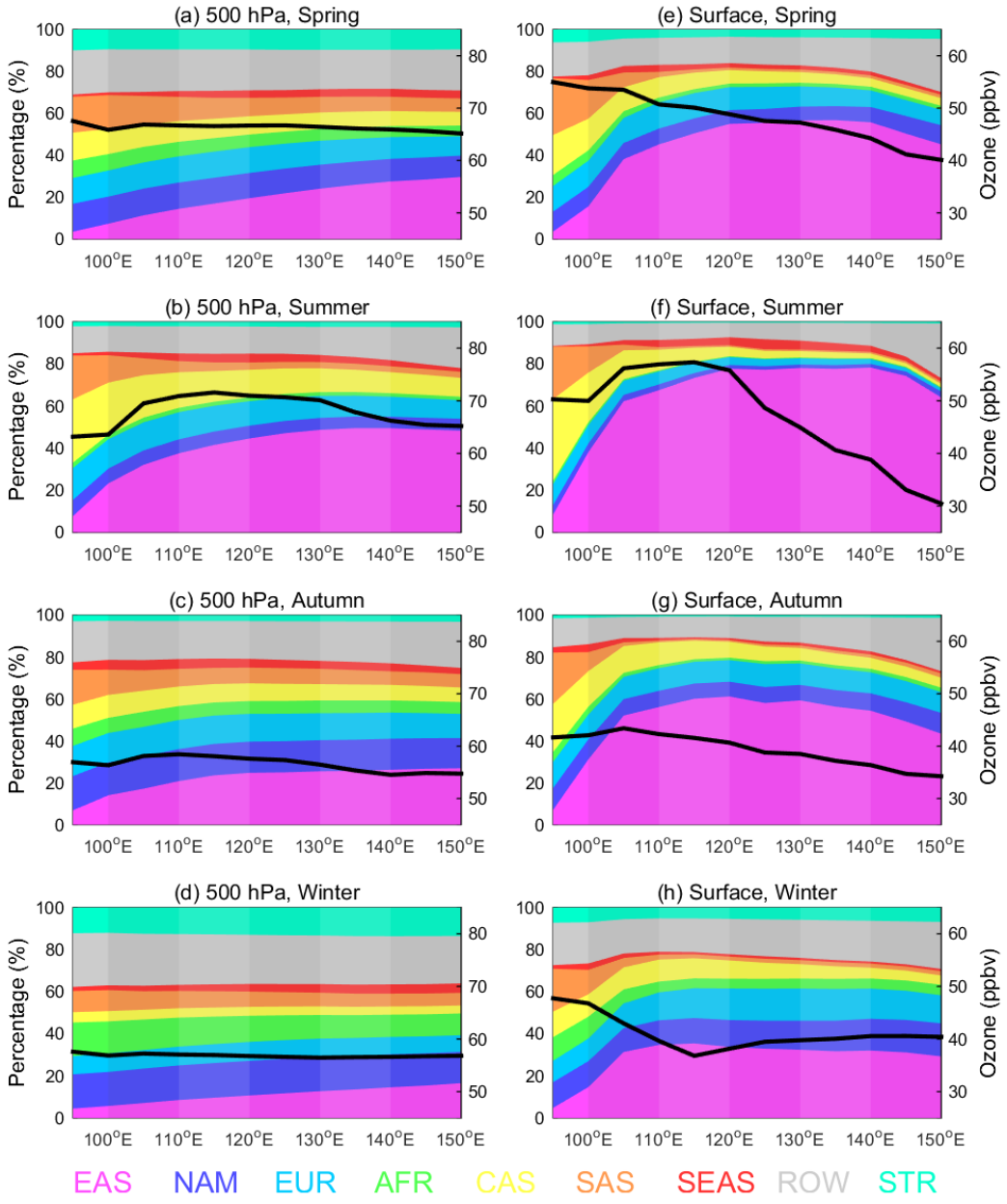

Figure S6. Longitudinal variations of the fractional contributions (in %, left y-axis) of native and foreign sources to ozone in East Asia at the surface (a-d) and in the middle troposphere (MT, 500 hPa) (e-h) in 2005. The black lines indicate ozone concentrations averaged over East Asia (in ppbv, right y-axis). The abbreviations are for East Asia (EAS), North America (NAM), Europe (EUR), Africa (AFR), central Asia (CAS), South Asia (SAS), Southeast Asia (SEAS), the rest of the world (ROW), and the stratosphere (STR).