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Impact of eastern and central Pacific El Niño on lower tropospheric ozone in China

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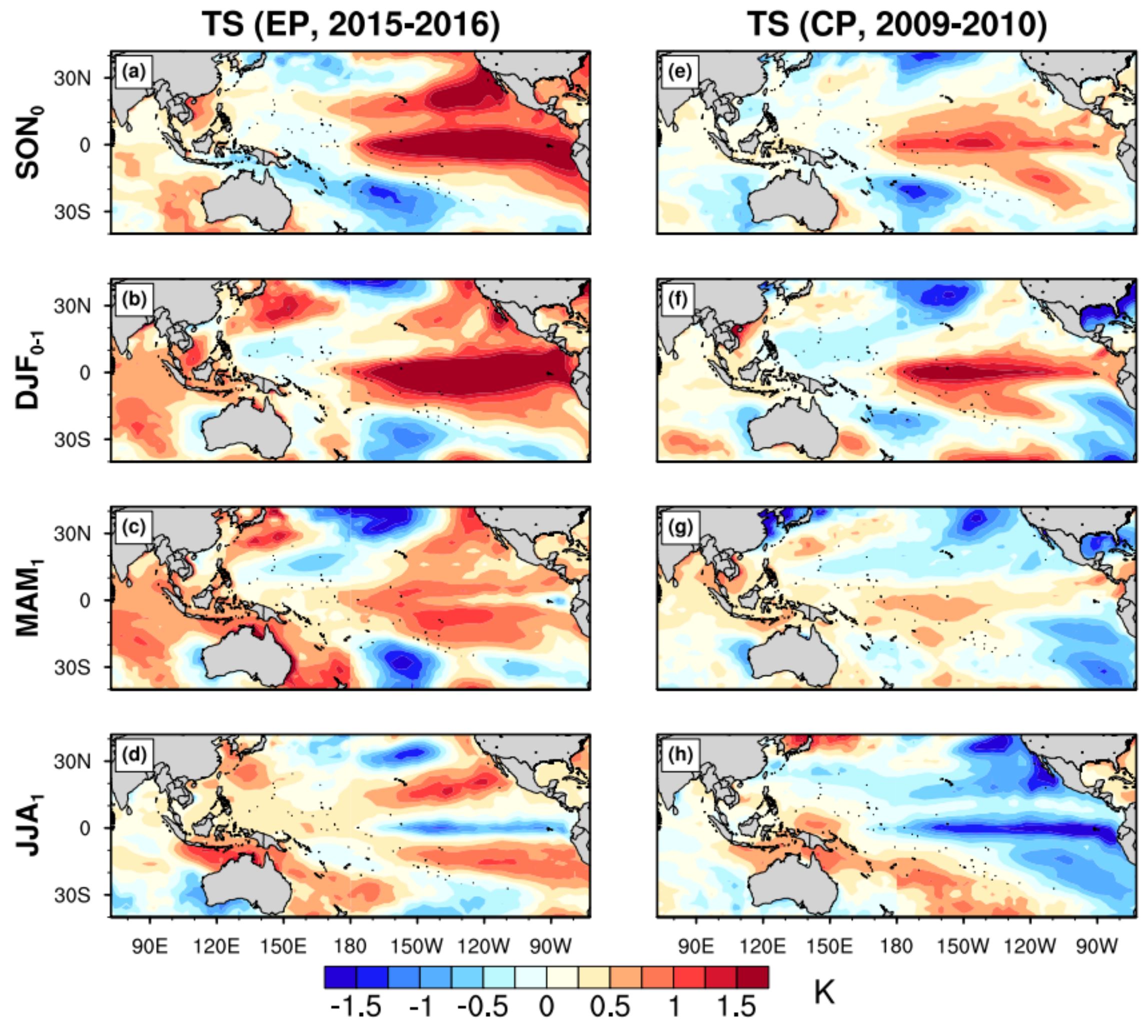

Figure S1. The sea surface temperature (SST) anomalies for four seasons in EP (2015-2016) and CP (2009-2010) El Niño years.

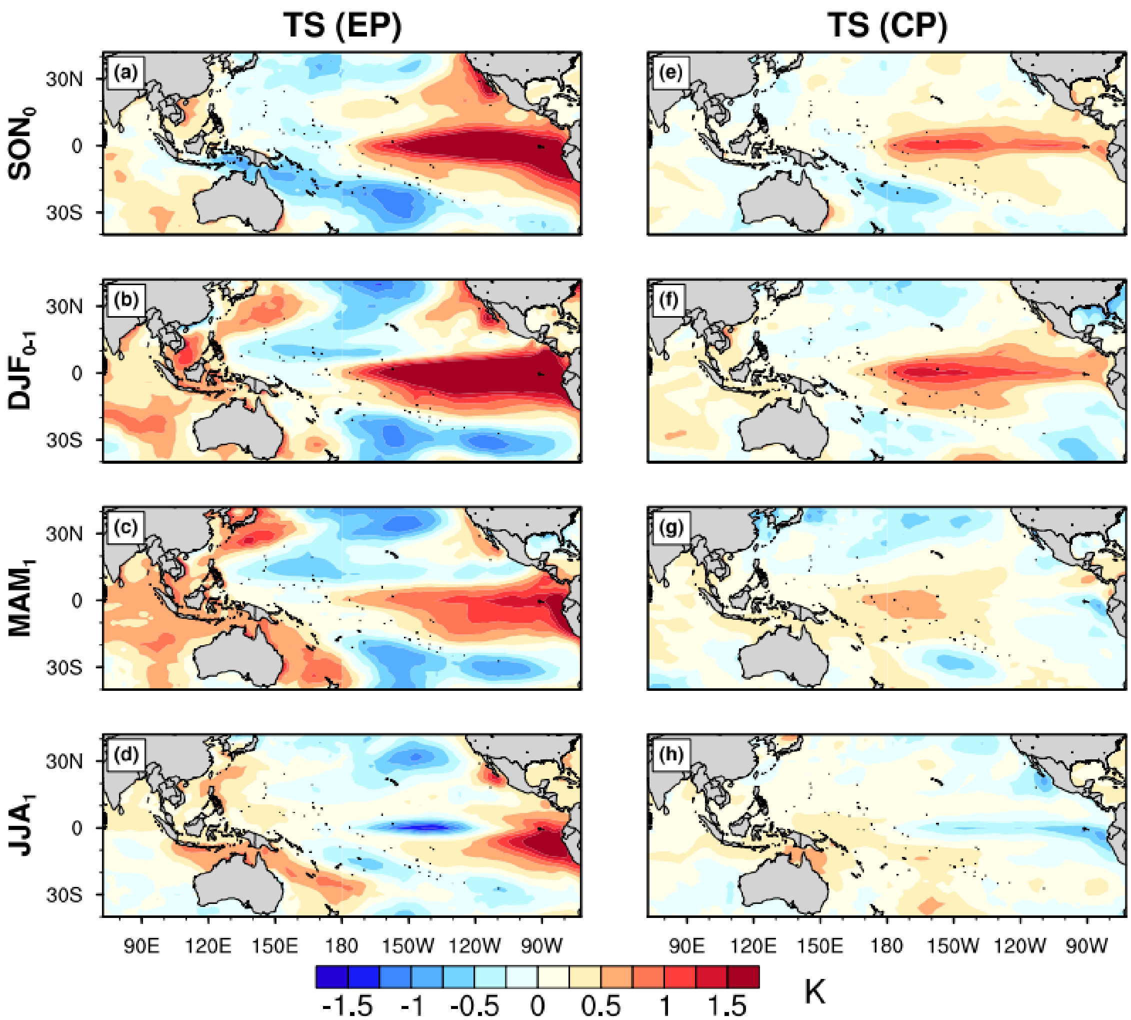

Figure S2. The composite sea surface temperature (SST) anomalies for four seasons in EP and CP El Niño years.

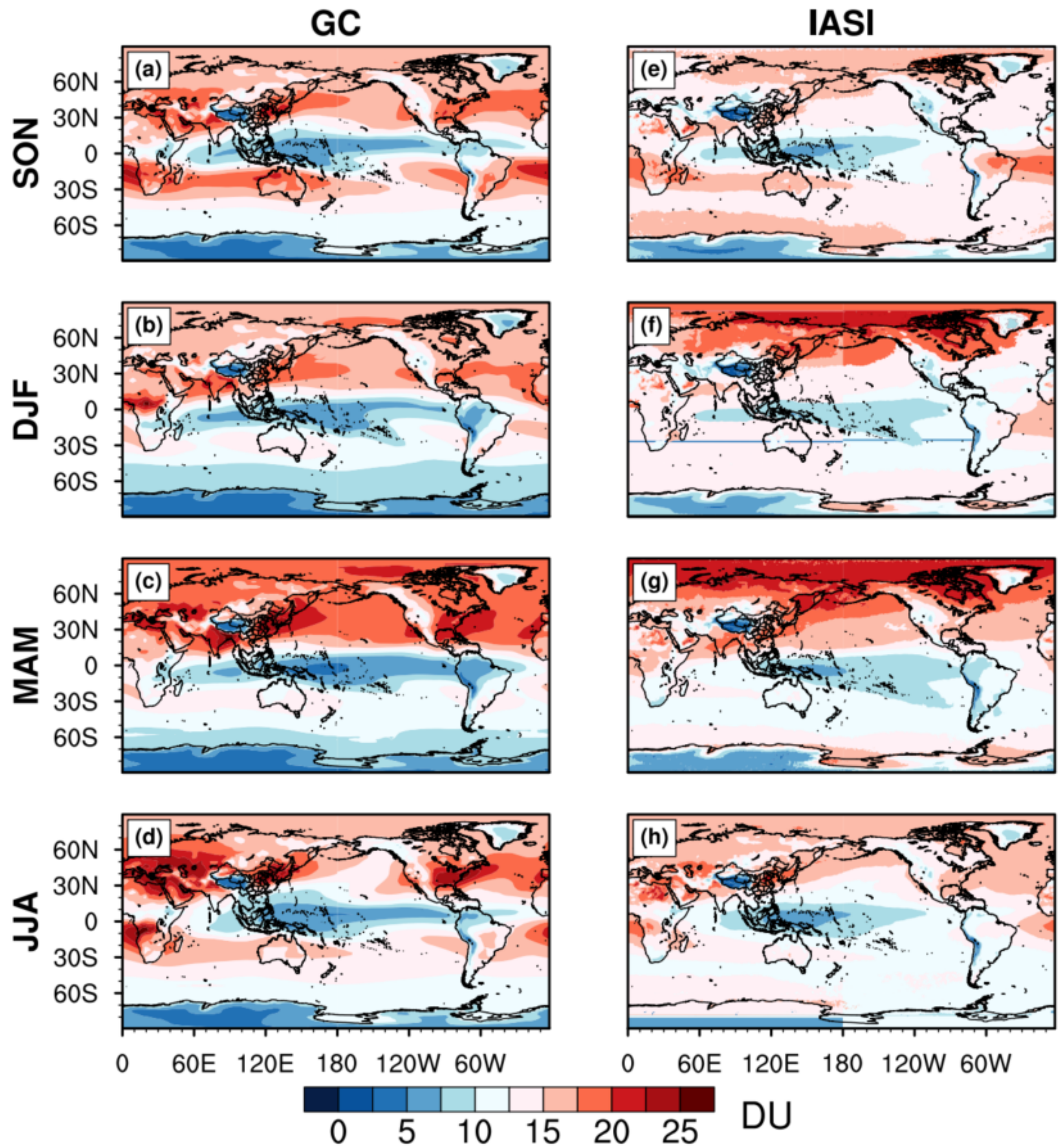

Figure S3. The simulated (GC) and satellite-observed (IASI) seasonal mean tropospheric column ozone concentration (0-6 km, unit: DU) for four seasons from September 2007 to August 2017.

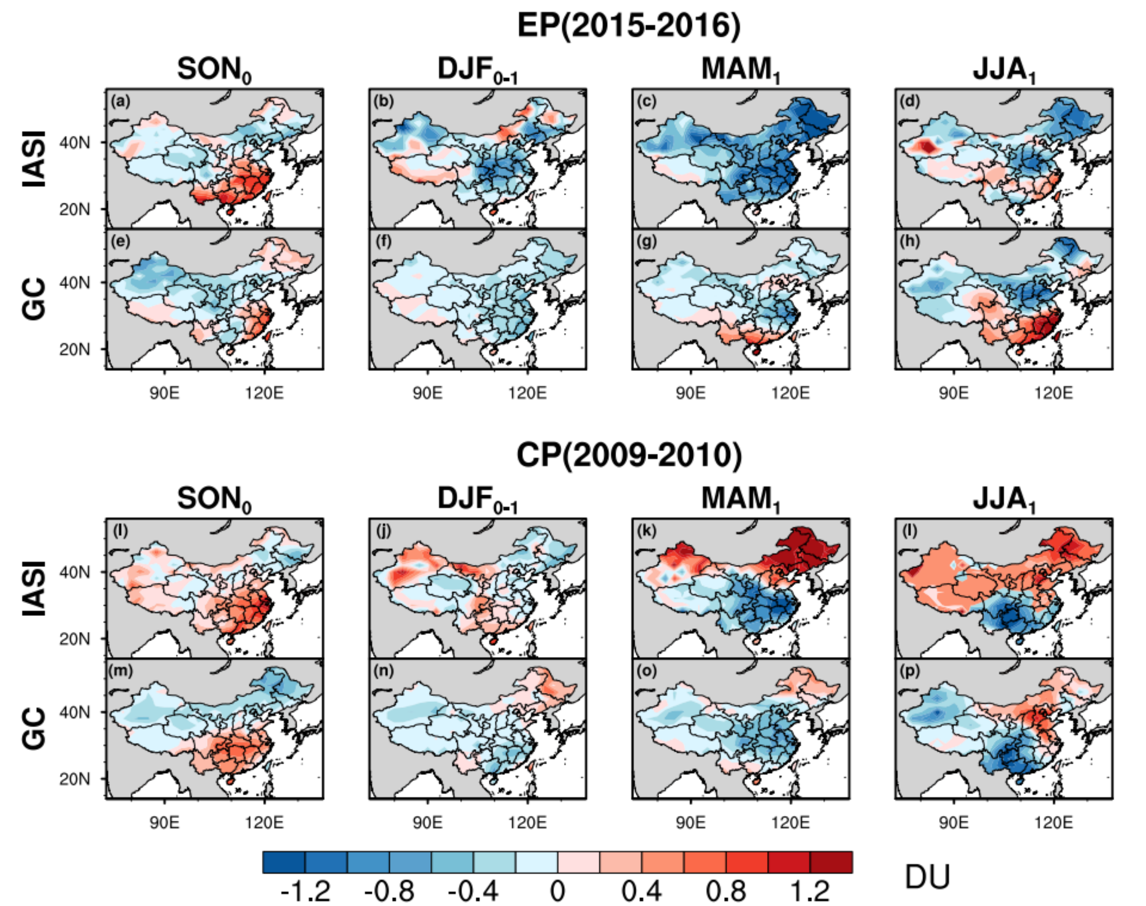

Figure S4. The satellite-observed (IASI) and simulated (GC) tropospheric column ozone (0-6 km, unit: DU) anomalies for four seasons in EP (2015-2016) and CP (2009-2010) El Niño years.

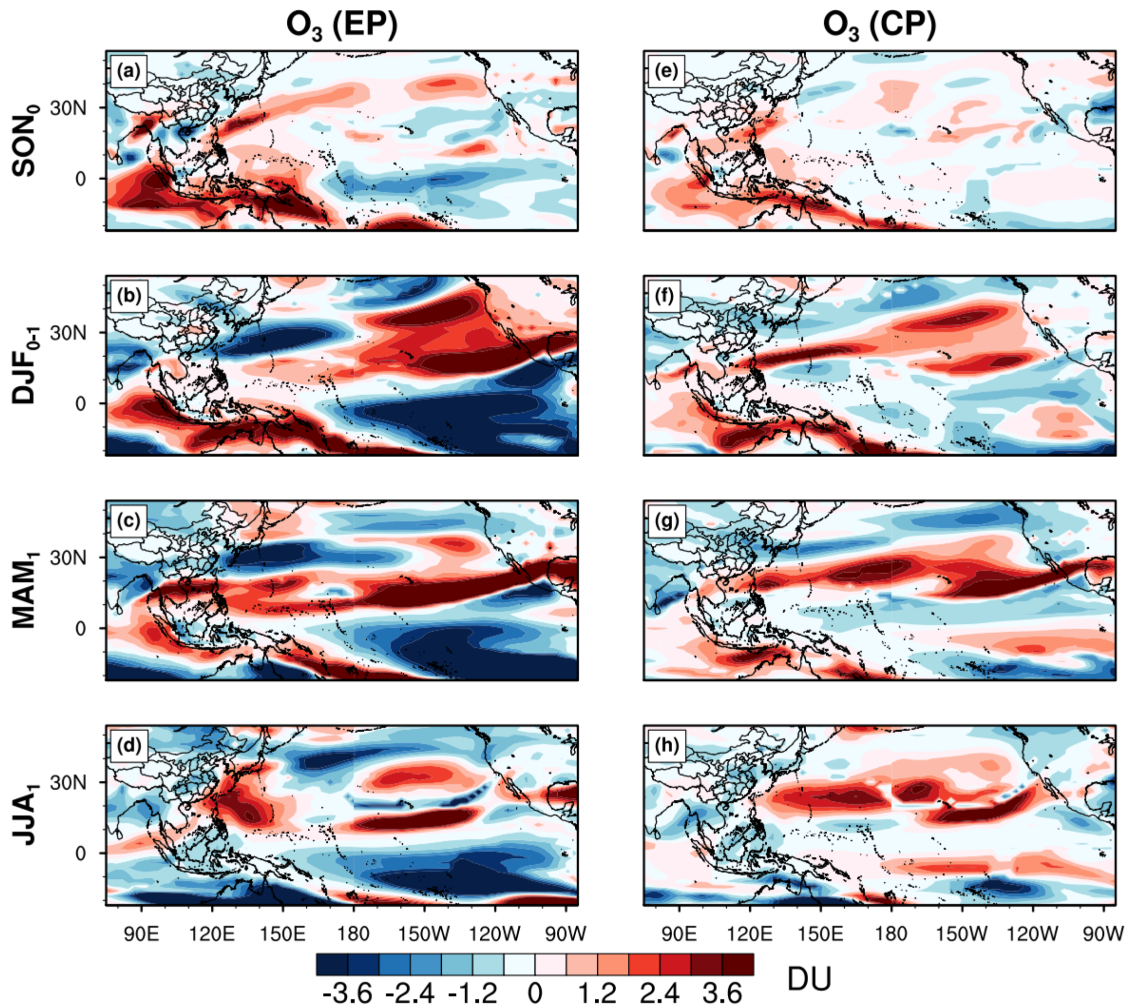

Figure S5. The simulated tropospheric column ozone (0-6 km, unit: DU) anomalies driven by the composite meteorological fields for four seasons in EP and CP El Niño years.

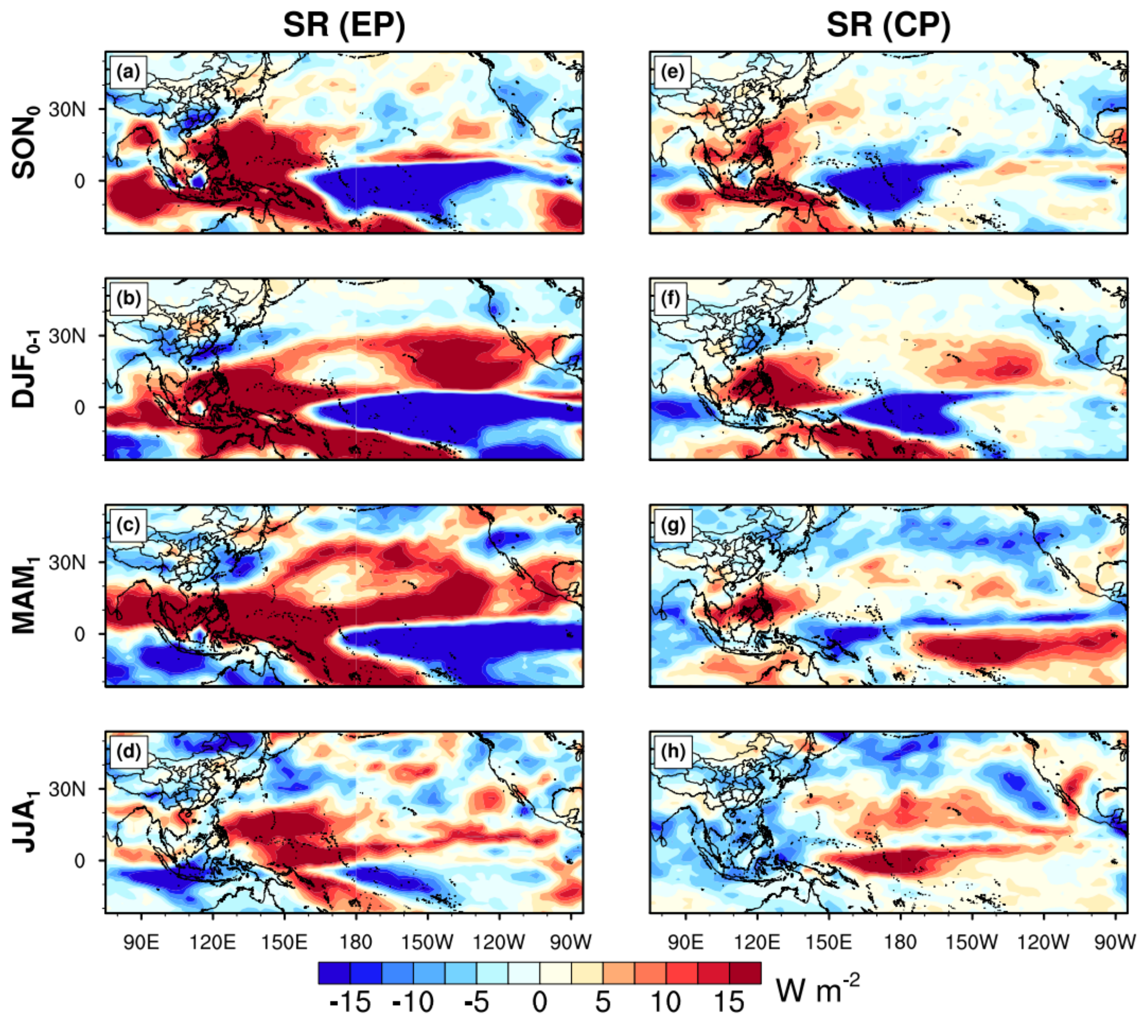

Figure S6. The composite solar radiation (SR) anomalies for four seasons in EP and CP El Niño years.

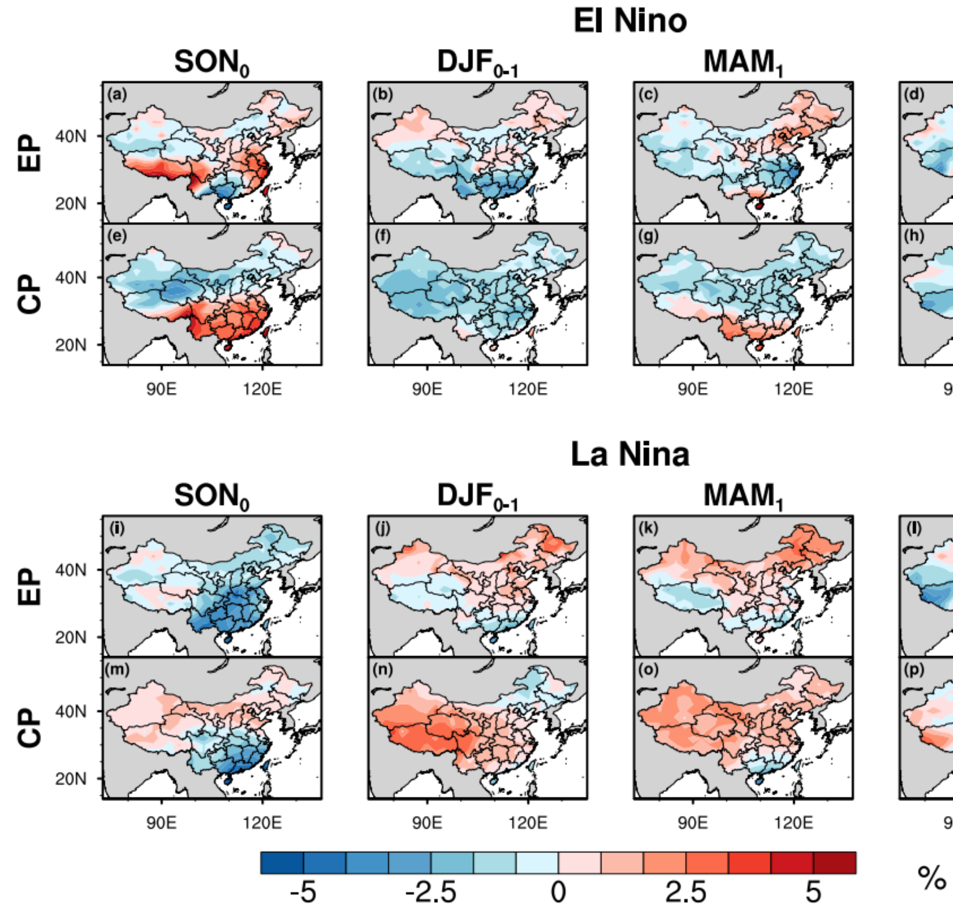

Figure S7. The percentage changes (unit: %) of composite simulated (GC) tropospheric column ozone (0-6 km, unit: DU) anomalies for four seasons in EP and CP El Niño and La Niña years from 1980-2017 historical simulation. The selected EP and CP La Niña years are shown in Table S1.

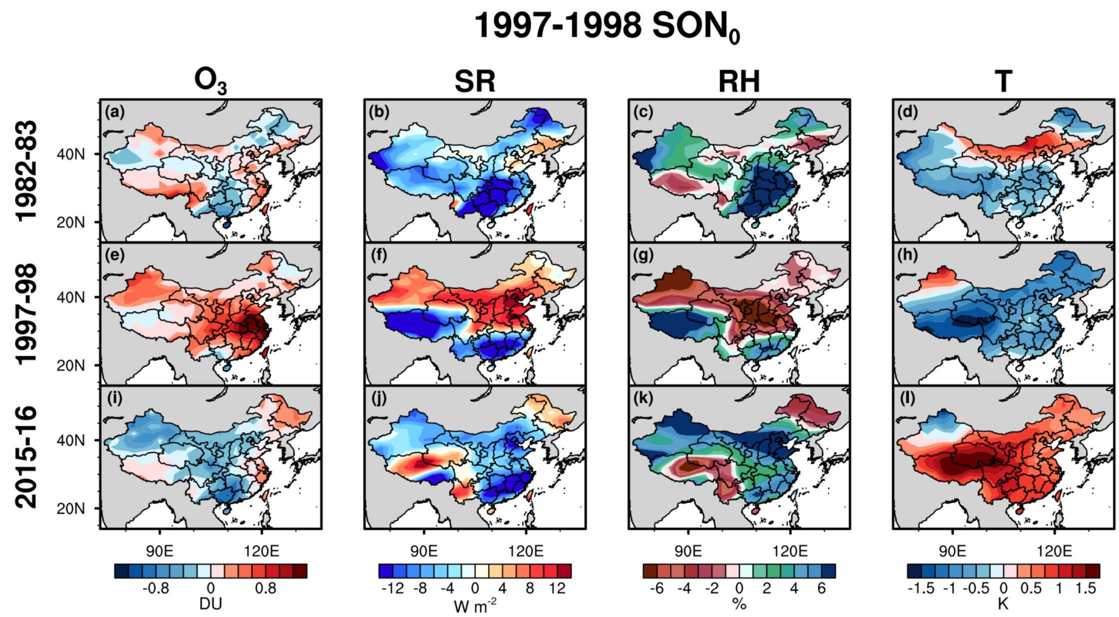

Figure S8. The anomalies of simulated (GC) tropospheric column ozone O3), solar radiation (SR), relative humidity (RH), and temperature (T) during autumn (SON_0) for 1982-1983, 1997-1998, 2015-2016 EP El Niño events.

Text1. In this work, we applied two approaches to check the ozone response to El Niño:

(1) Performing the composite analysis of simulation results from the historical run (Figure S7a-h);
(2) Driving the model with composite meteorological fields and then comparing the simulation result (Figure 2).

The ozone changing patterns from these two approaches agree well for MAM and JJA, mostly agree for DJF, but showed some differences in southern China for SON under EP conditions. The SON difference is caused by the 1997-1998 El Niño. This event induced a comparable meteorology change with respect to other events but a much larger positive ozone change, which is opposite to other events (Figure S8). This might be a signal of model volatility and uncertainty. Since our purpose is to investigate how ozone responds to El Niño-induced meteorological changes, we think that driving the model using composite meteorological fields is more appropriate for further analysis.

type	years
EP La Niña	1984-1985,1995-1996,2005-2006
CP La Niña	1988-1989, 1998-1999, 2000-2001, 2008-2009, 2011-2012

Table S1. The classification results of EP and CP El Niño from 1980 to 2017, adopted from Shi & Qian (2018).

References

Shi, J., & Qian, W. (2018). Asymmetry of two types of ENSO in the transition between the East Asian winter monsoon and the ensuing summer monsoon. *Climate Dynamics*, *51*(9–10), 3907–3926. https://doi.org/10.1007/s00382-018-4119-1