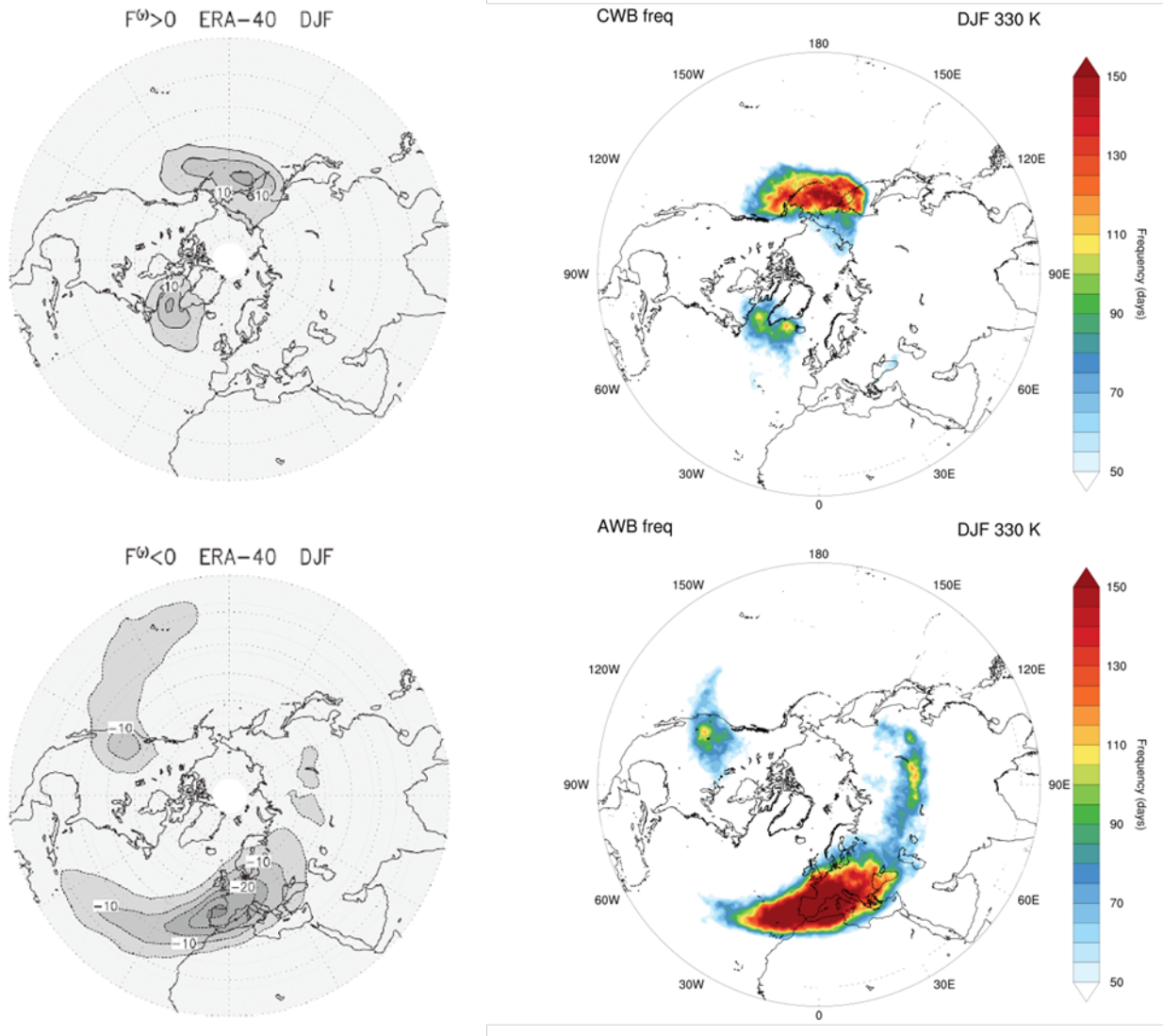
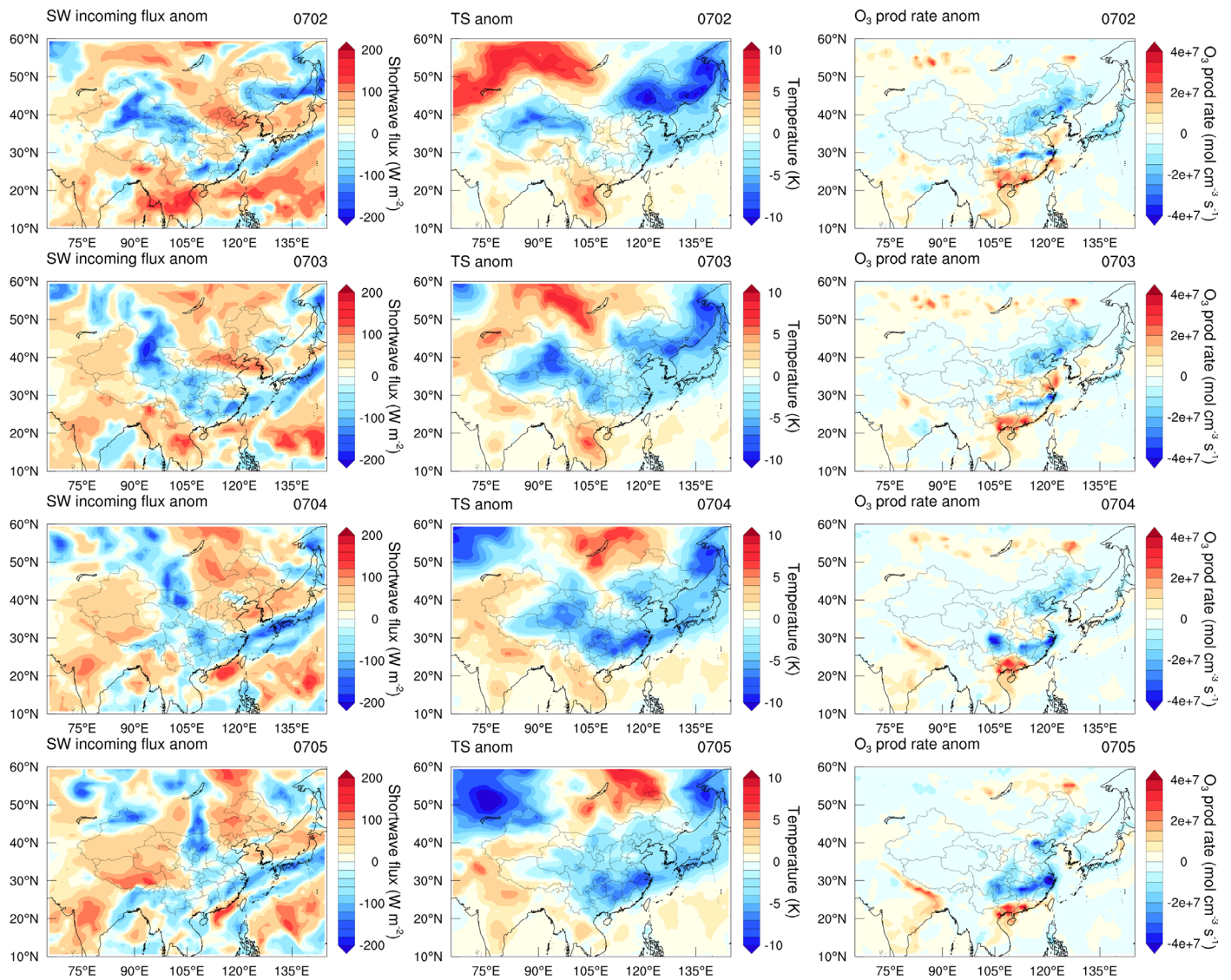


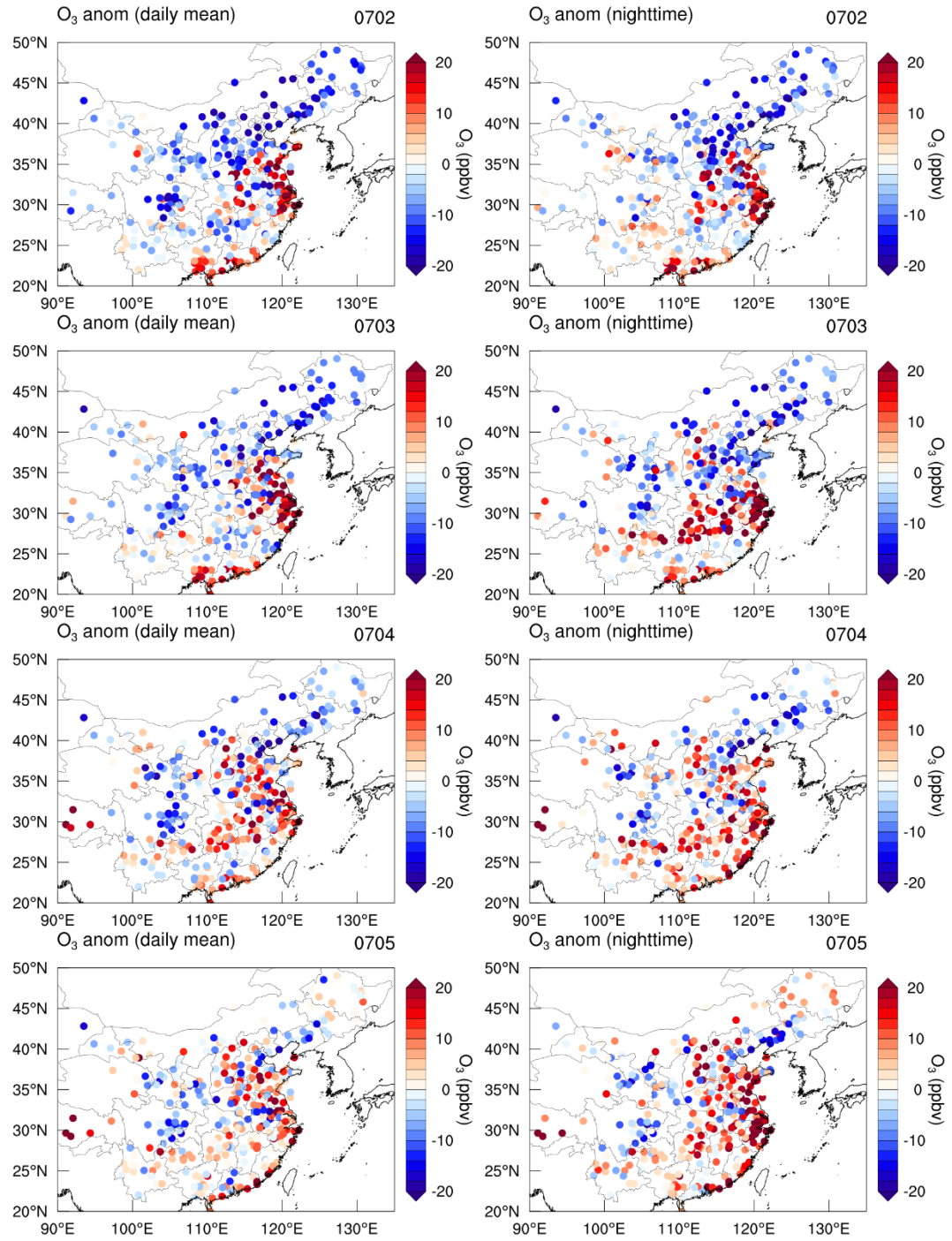
**Figure S1.** Horizontal distribution of  $O_3$  from AIRS (left) and  $O_3S$  simulated by CAM-chem (right) on 300 hPa on 2<sup>nd</sup> Jul, 2015.



**Figure S2.** Left Long-term means of meridional fluxes  $F_y$  at 330 K in DJF, with (upper panel) positive and (lower panel) negative values, each restricted to areas of negative meridional PV gradient ( $PV_y < 0$ ), which can reveal the areas that CWB and AWB occur and the frequency (Gabriel and Peters, 2008). Right CWB (upper panel) and AWB (lower panel) frequency at 330 K in DJF 1980-2020 calculated in our work.

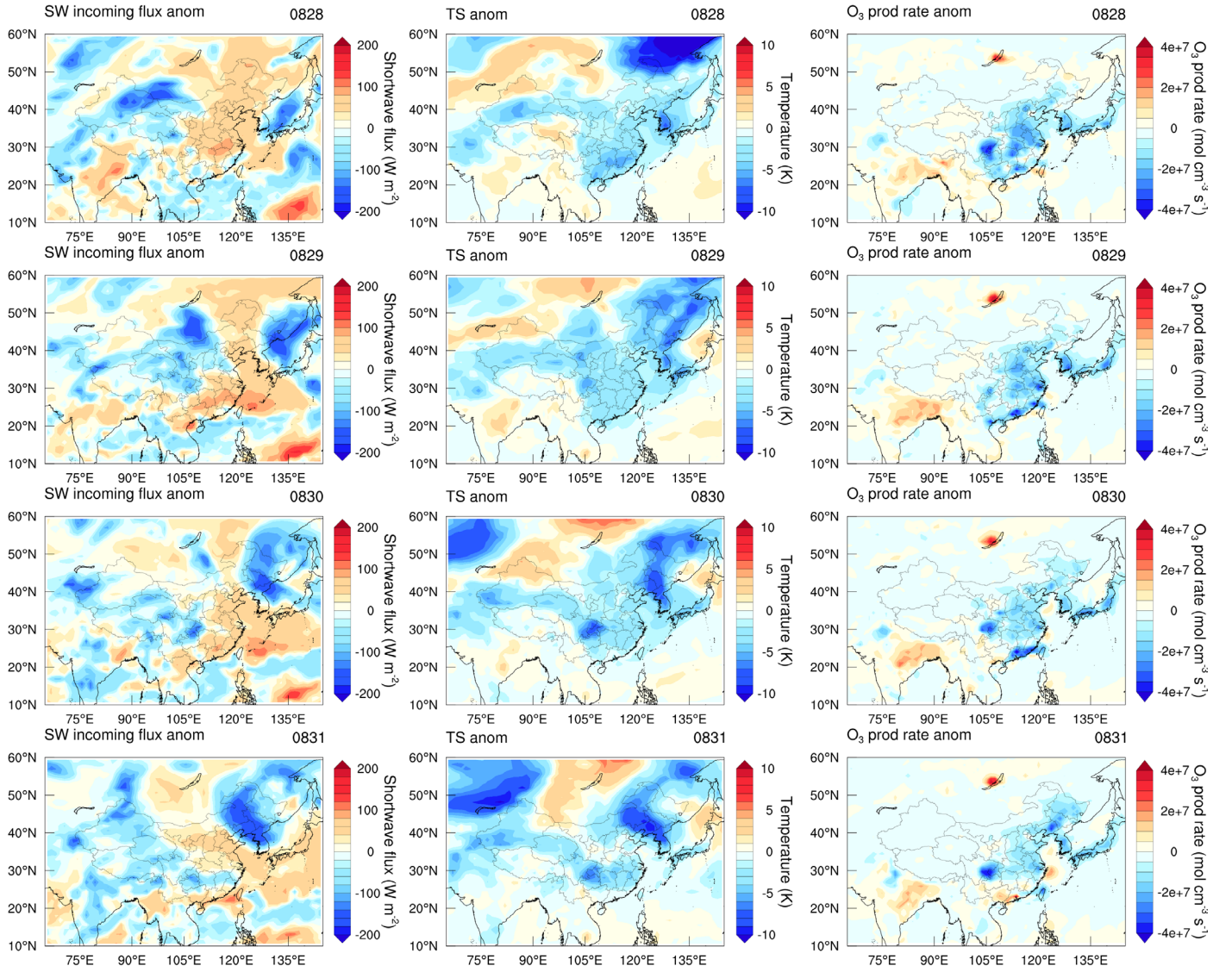


**Figure S3.** Time evolution of surface incoming shortwave radiation flux (left panels), surface temperature anomalies (middle panels) and surface O<sub>3</sub> production rate anomalies (right panels) for Case 1 from Jul 2<sup>nd</sup> to 5<sup>th</sup>, 2015.

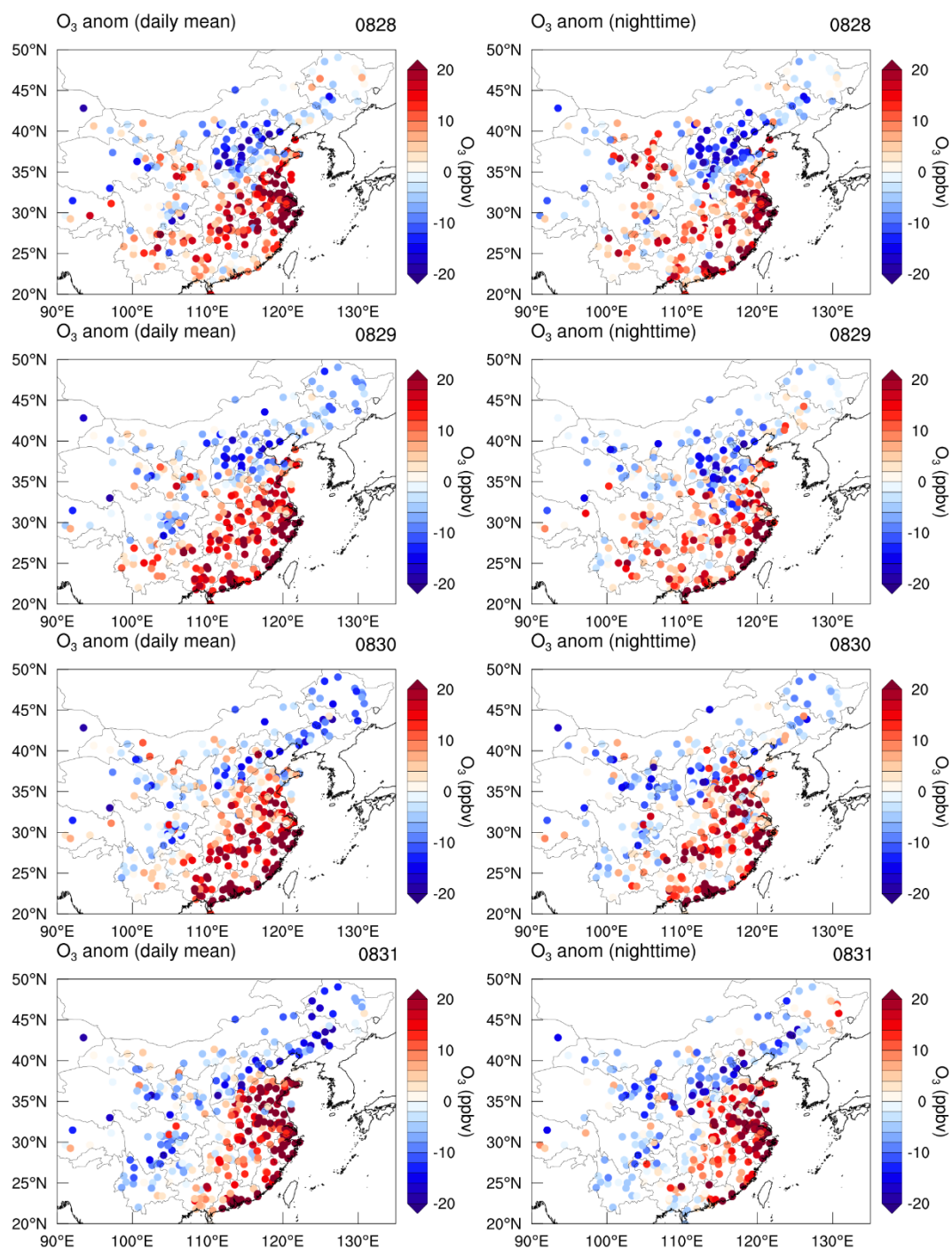


**Figure S4.** Time evolution of surface ozone anomalies for Case 1 from Jul 2<sup>nd</sup> to 5<sup>th</sup>, 2015. **Left** Daily mean ozone anomalies. **Right** Nighttime (20:00-07:00 local time) ozone anomalies.





**Figure S5.** Time evolution of surface incoming shortwave radiation flux (left panels), surface temperature anomalies (middle panels) and surface  $O_3$  production rate anomalies (right panels) for Case 2 from Aug 28<sup>th</sup> – 31<sup>th</sup>, 2016.



**Figure S6.** Time evolution of surface ozone anomalies for Case 2 from Aug 28<sup>th</sup> – 31<sup>th</sup>, 2016. **Left** Daily mean ozone anomalies. **Right** Nighttime (20:00-07:00 local time) ozone anomalies.