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*Supplement of*

## **Developing a novel hybrid model for the estimation of surface 8 h ozone (O<sub>3</sub>) across the remote Tibetan Plateau during 2005–2018**

**Rui Li et al.**

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## Text S1

We employed three statistical indicators of the coefficient of determination ( $R^2$ ), the rootmean-square error (RMSE), and the mean prediction error (MPE) to evaluate the model performance.

These indicators are calculated as follows:

$$R^2 = \frac{\sum_{i=1}^n (pre - \bar{pre})(obs - \bar{obs})}{\sqrt{\sum_{i=1}^n (pre - \bar{pre})^2} \sqrt{\sum_{i=1}^n (obs - \bar{obs})^2}} \quad (1)$$

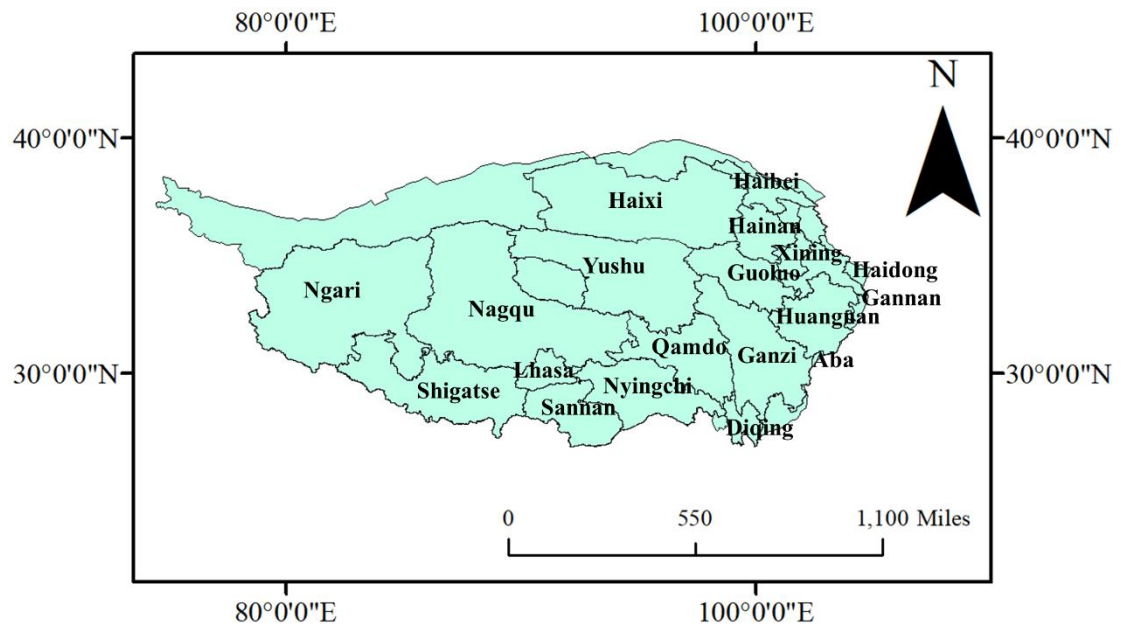
$$RMSE = \sqrt{\frac{\sum_{i=1}^n (pre - obs)^2}{n}} \quad (2)$$

$$MPE = \frac{\sum_{i=1}^n |pre - obs|}{n} \quad (3)$$

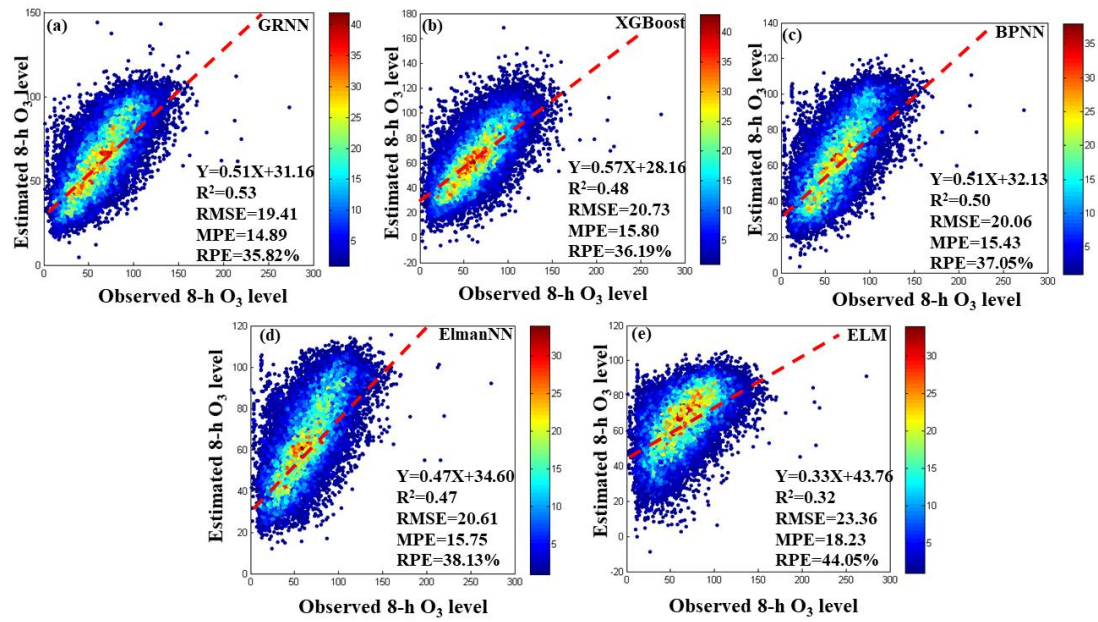
$$RPE = \frac{\sum_{i=1}^n |pre - obs|}{obs} \quad (4)$$

where  $pre$  represents the predictive value,  $obs$  is the observation value, and  $n$  is the total number of data records.

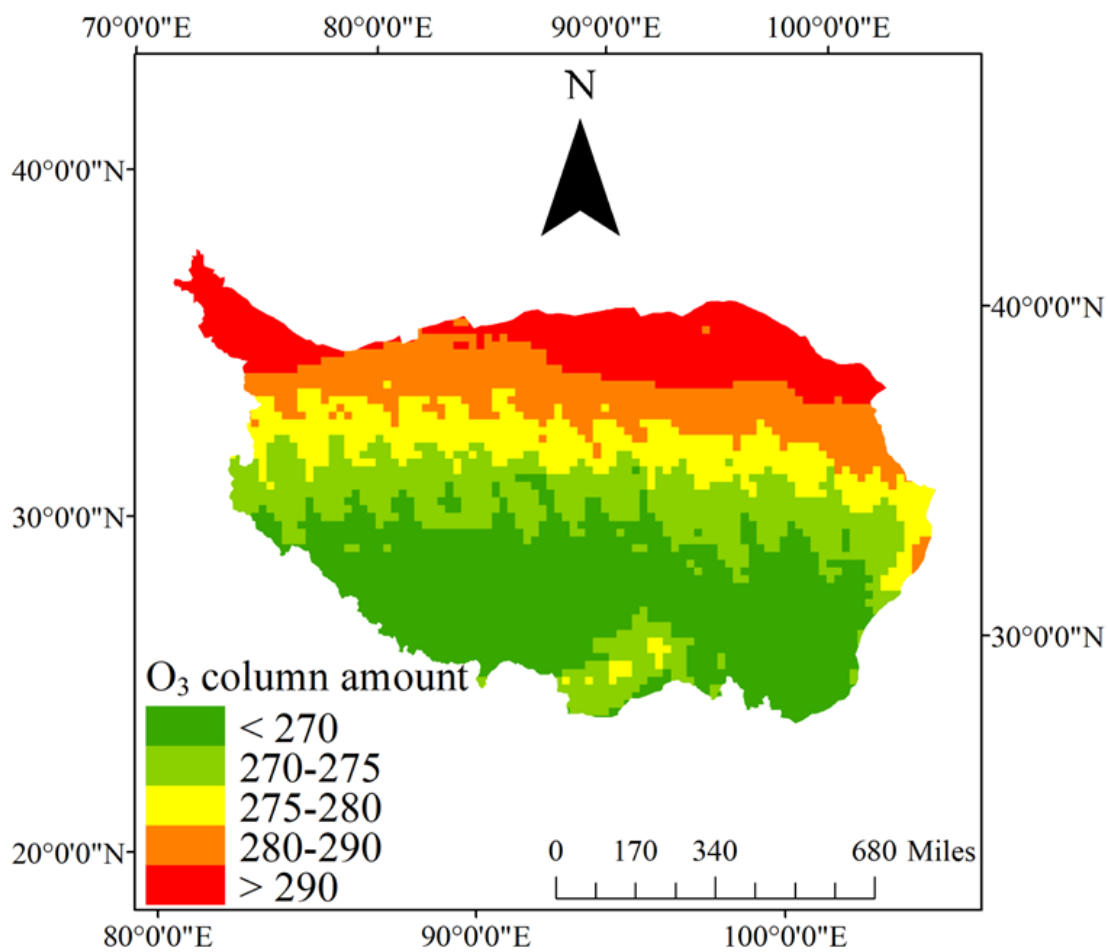
**Fig. S1** The names and geographical locations of prefecture-level cities in Tibetan Plateau



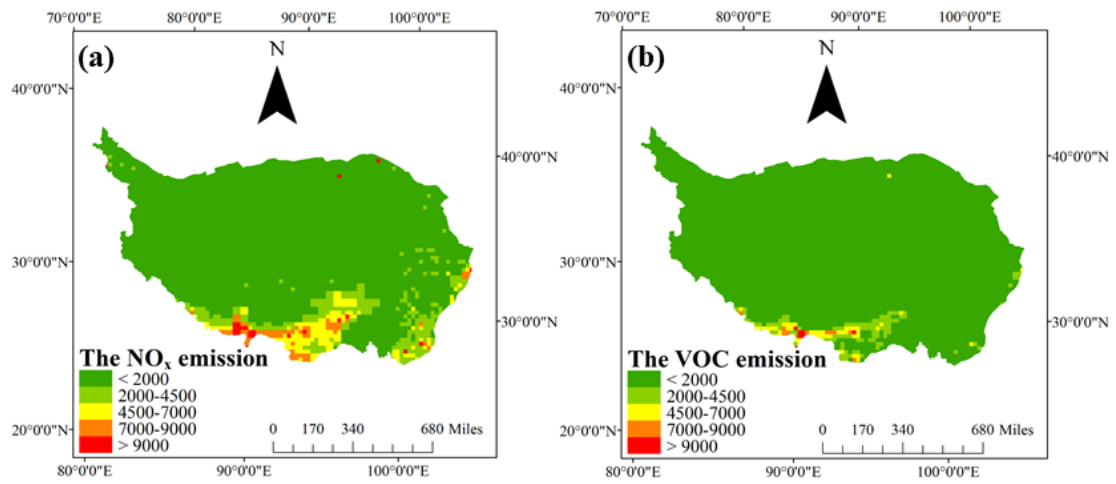
**Fig. S2** The predictive performances of GRNN (a), XGBoost (b), BPNN (c), ElmanNN (d), and ELM (e) for the 8-h O<sub>3</sub> estimation across Tibetan Plateau. The red dotted line denotes the fitting linear regression line through the data points.



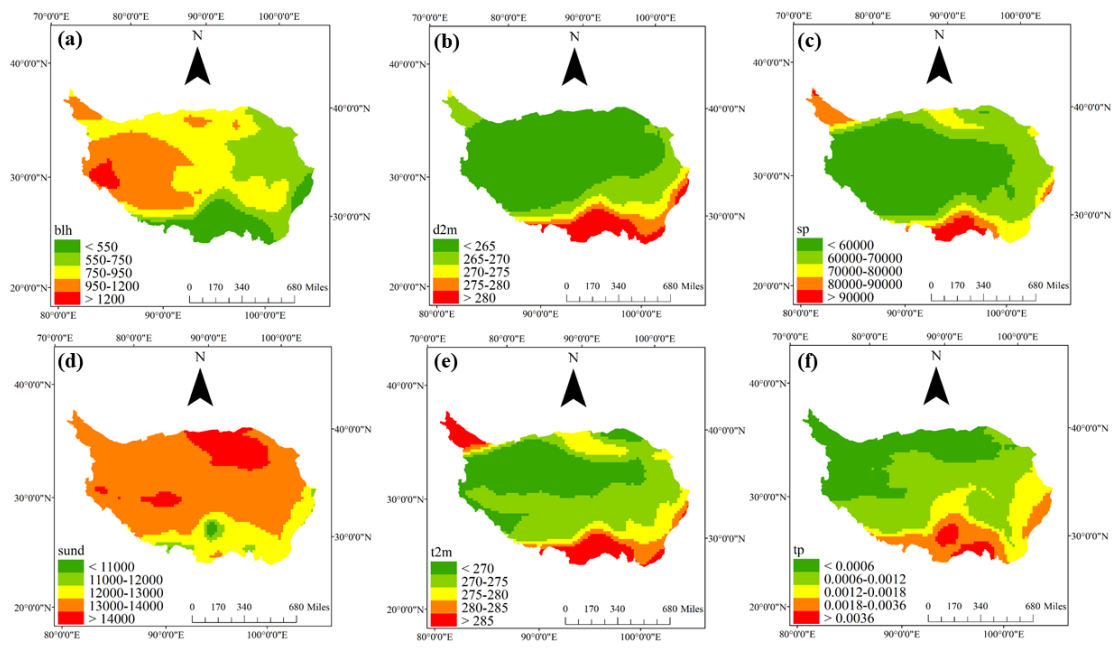
**Fig. S3** The annually mean O<sub>3</sub> column amount (Unit: DU) in Tibetan Plateau during 2005-2018.



**Fig. S4** The mean VOC and NO<sub>x</sub> emissions (Unit: Mg) in Tibetan Plateau during 2005-2018.

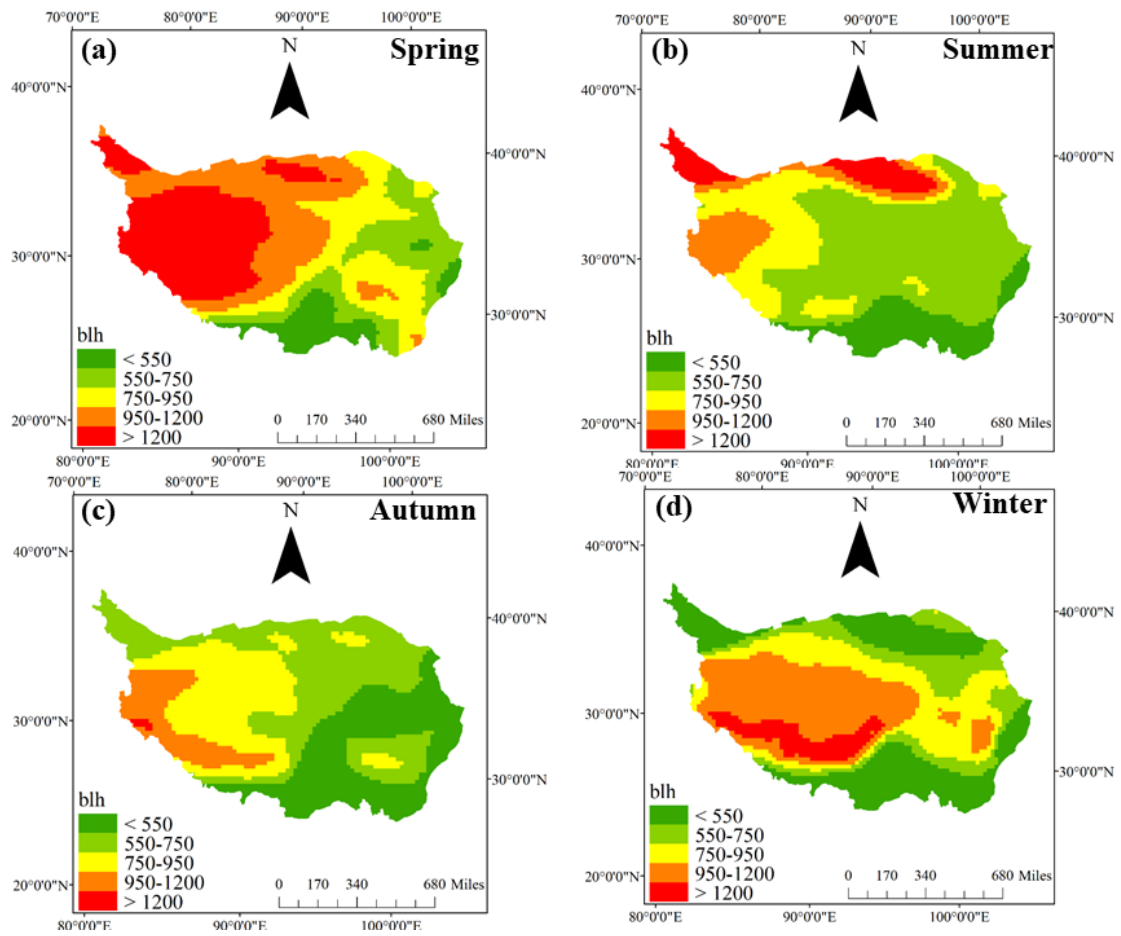


**Fig. S5** The annually mean values for key meteorological factors during 2005-2018.

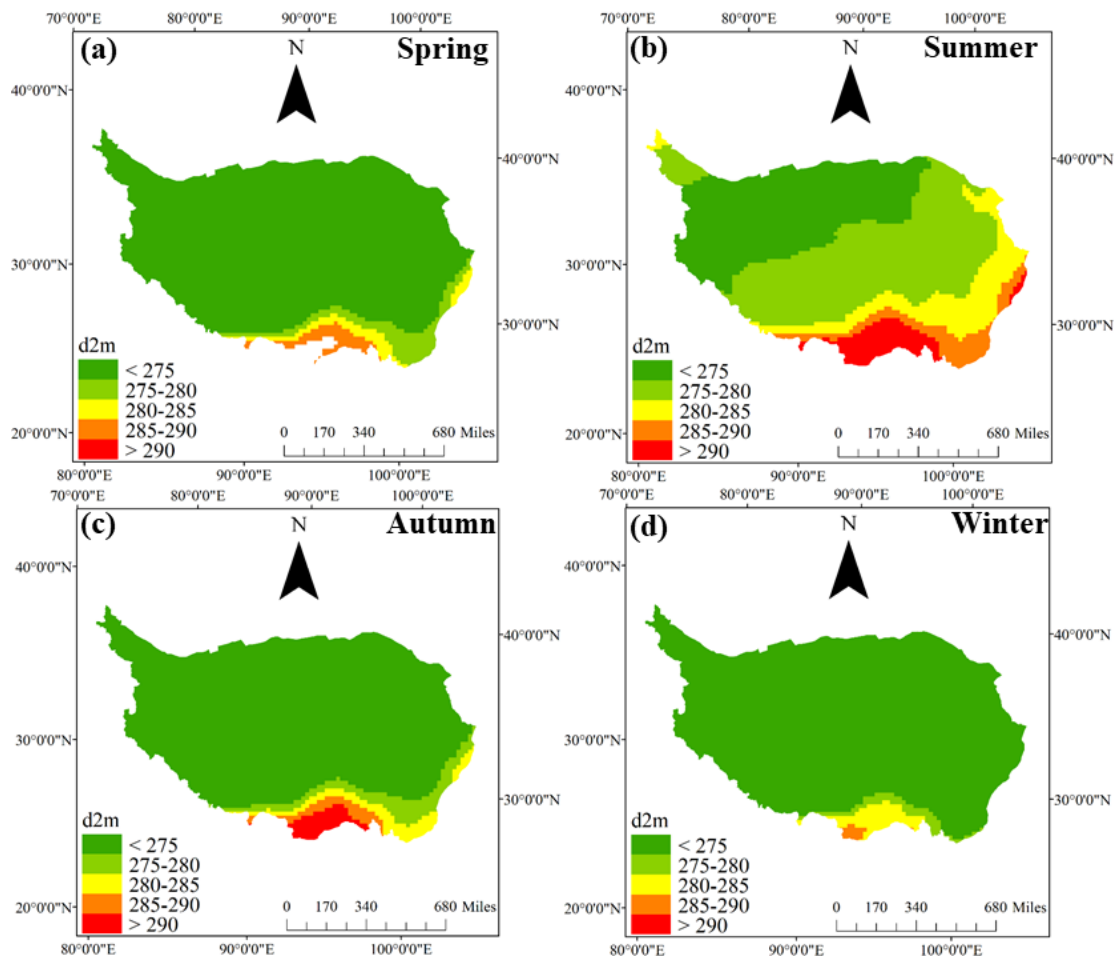




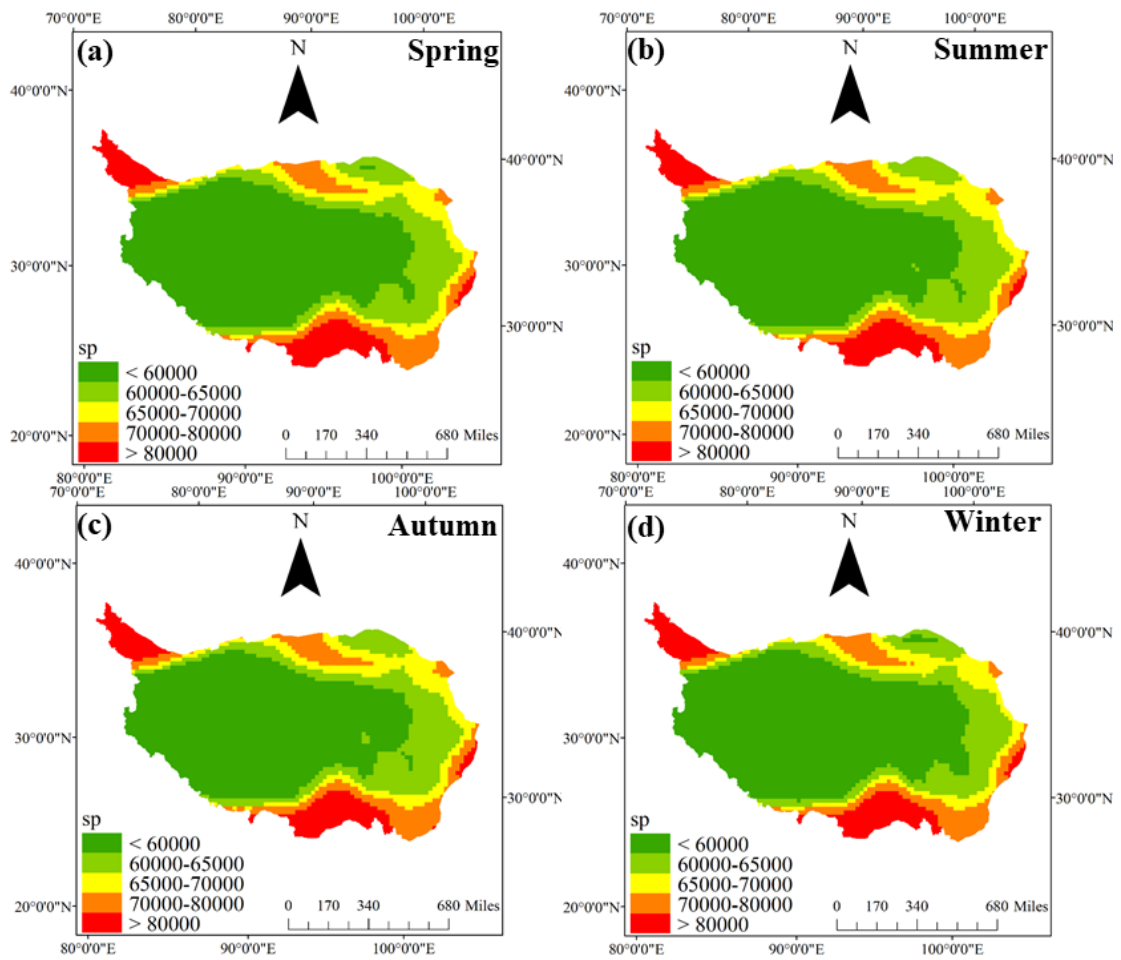
**Fig. S6** The mean values for blh in four seasons during 2005-2018.



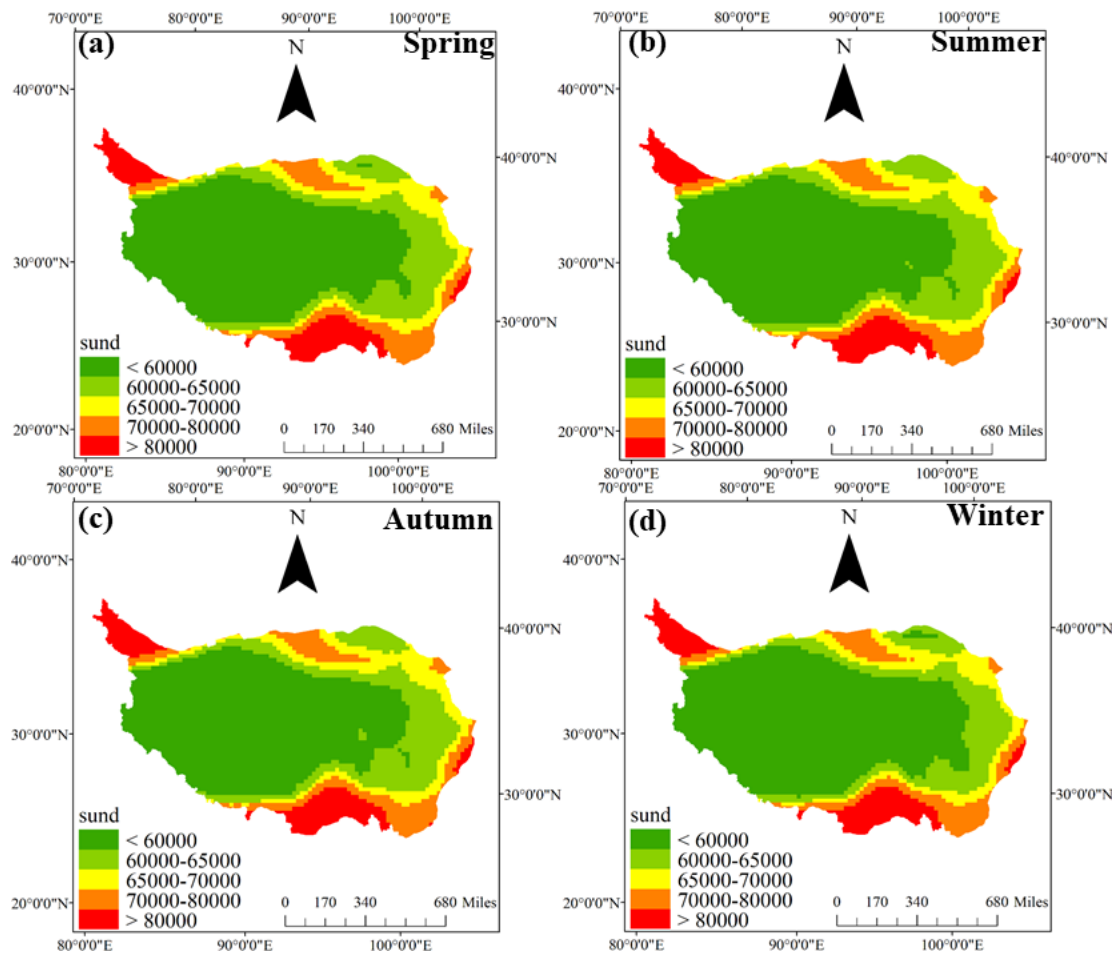
**Fig. S7** The mean values for d2m in four seasons during 2005-2018.



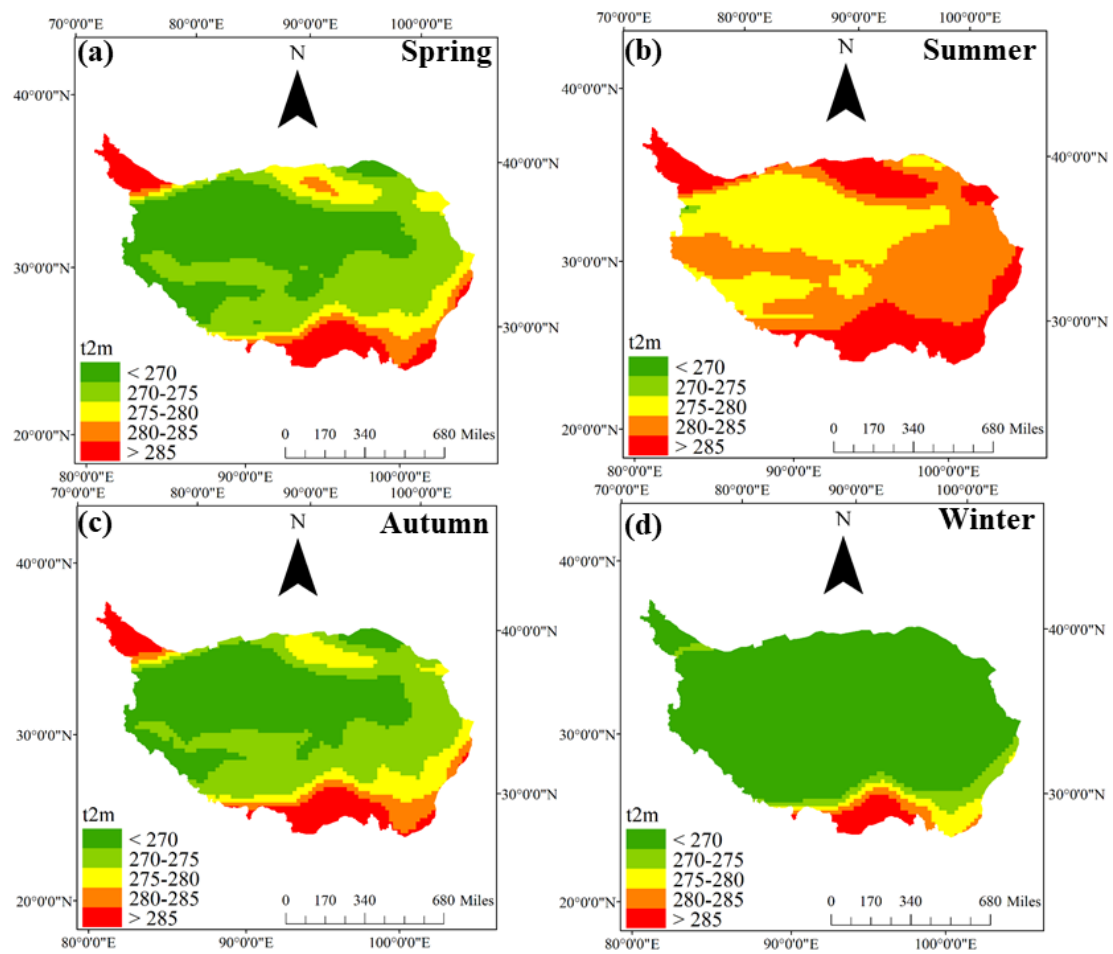
**Fig. S8** The mean values for sp in four seasons during 2005-2018.



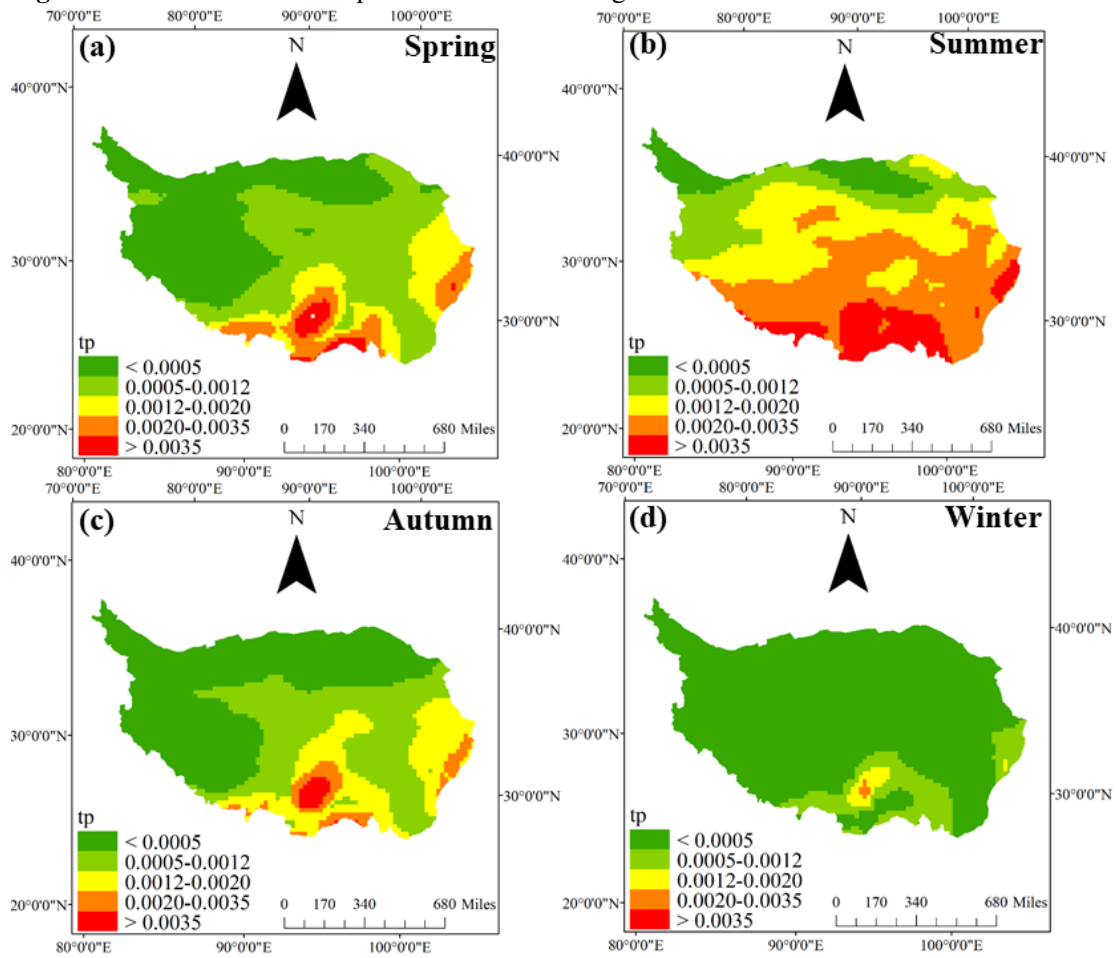
**Fig. S9** The mean values for sund in four seasons during 2005-2018.



**Fig. S10** The mean values for t2m in four seasons during 2005-2018.



**Fig. S11** The mean values for tp in four seasons during 2005-2018.



**Table S1** The temporal variation of 8-h O<sub>3</sub> concentrations and nonattainment days over Tibetan Plateau.

Year	Annual mean 8-h O <sub>3</sub> level ( $\mu\text{g}/\text{m}^3$ )	maximum nonattainment days
2005	$64.74 \pm 8.30$	92
2006	$64.75 \pm 8.20$	103
2007	$65.17 \pm 8.23$	80
2008	$64.57 \pm 8.32$	93
2009	$65.15 \pm 8.26$	85
2010	$65.44 \pm 8.44$	79
2011	$64.47 \pm 8.44$	70
2012	$64.97 \pm 8.41$	73
2013	$64.96 \pm 8.48$	70
2014	$65.68 \pm 8.53$	89
2015	$66.45 \pm 8.67$	95
2016	$64.61 \pm 8.48$	75
2017	$65.27 \pm 8.65$	89
2018	$65.87 \pm 8.52$	77

**Table S2** The NO<sub>x</sub> and VOC emissions (Unit: Mg) in four seasons over Tibetan Plateau

	Spring	Summer	Autumn	Winter
NO <sub>x</sub>	92.74±5.52	90.69±5.21	91.64±5.34	95.24±5.65
VOC	207.21±6.44	206.15±6.46	207.16±6.46	219.99±6.55