Supplemental materials for

The Warming Tibetan Plateau improves winter air quality in the Sichuan Basin, China

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Text S1 We use three statistical indices to evaluate O_3, CO and $PM_{2.5}$ mass concentrations simulated by the WRF-CHEM model against the measurements monitored by the Ministry of Environmental Protection, China. These three indices are the mean bias (MB), root mean square error (RMSE), and index of agreement (IOA), and the calculation formulas are as follows.

$$MB = \frac{1}{N}\sum_{i=1}^{N}(P_i - O_i) \quad (1)$$

$$RMSE = \left[\frac{1}{N}\sum_{i=1}^{N}(P_i - O_i)^2\right]^{\frac{1}{2}} \quad (2)$$

$$IOA = 1 - \frac{\sum_{i=1}^{N}(P_i - O_i)^2}{\sum_{i=1}^{N}(|P_i - \bar{O}| + |O_i - \bar{O}|)^2} \quad (3)$$

where P_i and O_i are the simulated and observed variables, respectively. N is the total sample number of the simulations, and $\bar{O}$ denotes the average of the observations. The IOA varies from 0 to 1, and the closer to 1 the IOA is, the better the model simulation is.

Table S1 Observational winter mean temperature at 10 weather stations over the Tibetan Plateau from 2013 to 2017.

Sites / Year	T (°C)										
	Wudaoliang	Lhasa	Nagqu	Qamdo	Qumarleb	Shiquanhe	Litang	Tuotuohe	Xainza	Zadoi	**Avg.**
2013	-13.84	1.55	-8.85	-0.03	-10.18	-10.61	-2.46	-13.63	-7.78	-7.90	-7.37
2014	-12.97	0.82	-10.17	-0.37	-10.08	-9.18	-2.26	-13.70	-8.53	-9.36	-7.58
2015	-14.72	2.15	-9.48	-0.35	-11.29	-7.91	-3.22	-13.65	-8.11	-7.67	-7.43
2016	-12.48	2.48	-7.33	0.66	-9.54	-7.03	-1.21	-11.72	-6.22	-6.23	-5.86
2017	-12.49	2.85	-6.91	1.56	-9.02	-6.94	-0.40	-11.33	-5.68	-5.25	-5.36
	ΔT(°C)										
T(2017) – T(2013)	1.35	1.30	1.94	1.59	1.16	3.67	2.06	2.30	2.10	2.65	**2.01**

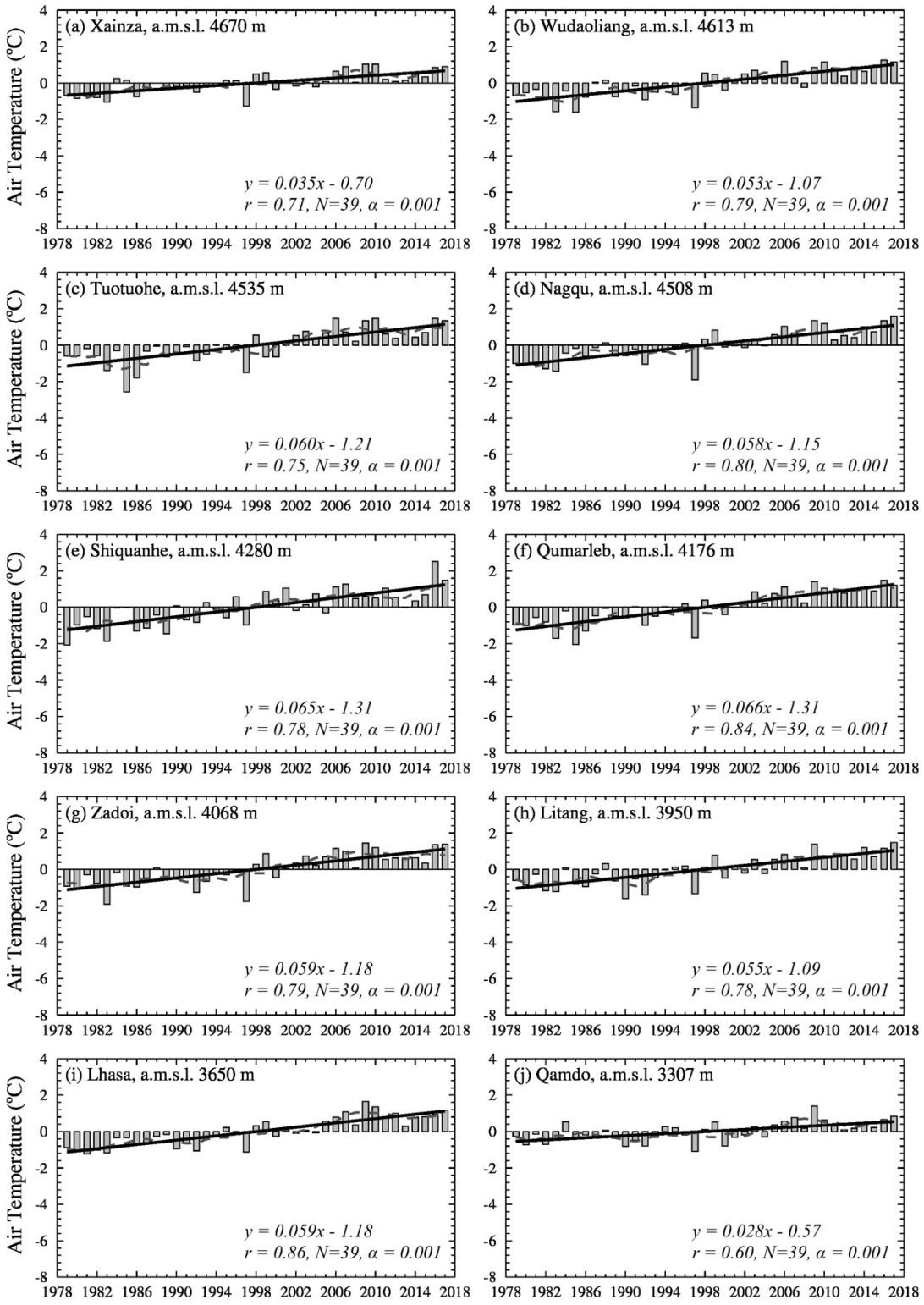

Figure S1 Trends of observational annual mean temperature anomaly at 10 weather stations over the Tibetan Plateau during the last four decades (1979-2017).

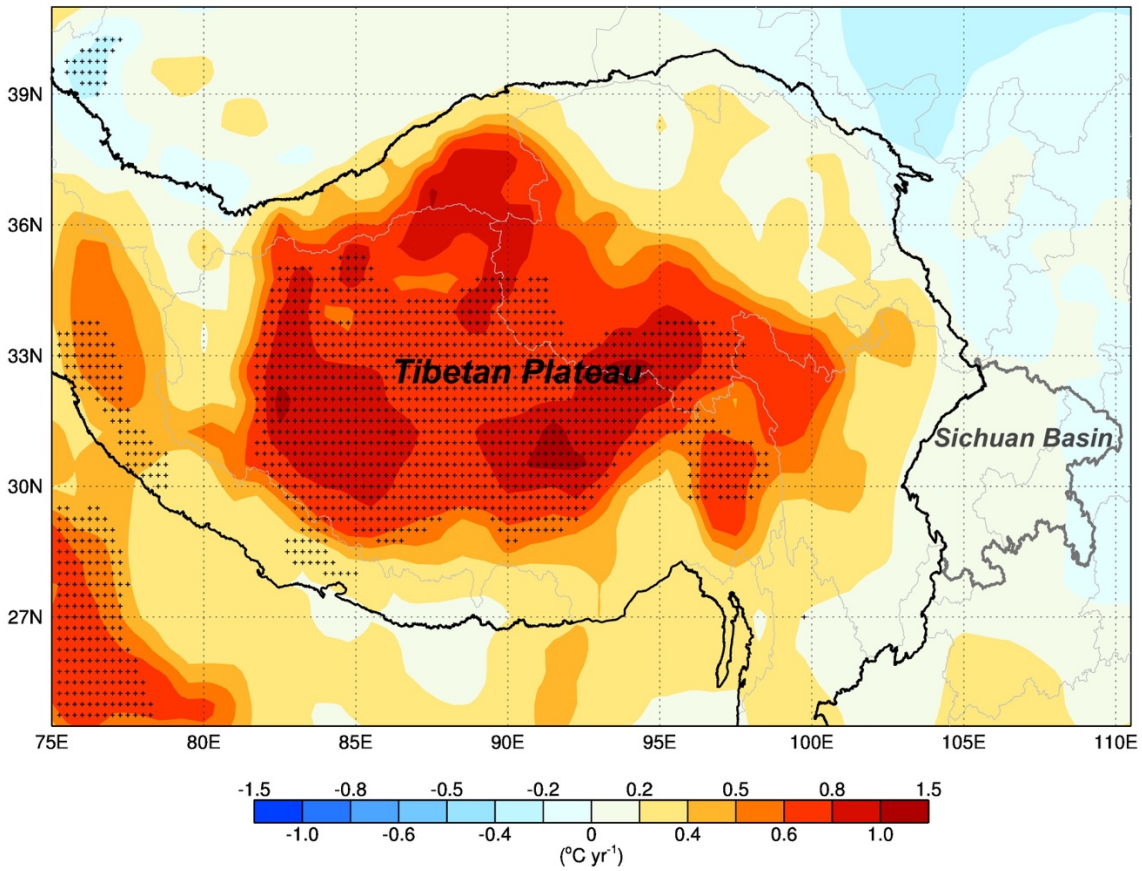

Figure S2 Trends of ERA-interim reanalysis winter mean temperature over the Tibetan Plateau from 2013 to 2017. The dotted regions show statistical significance with 95% confidence level (p-value < 0.05) from the Student's t test.

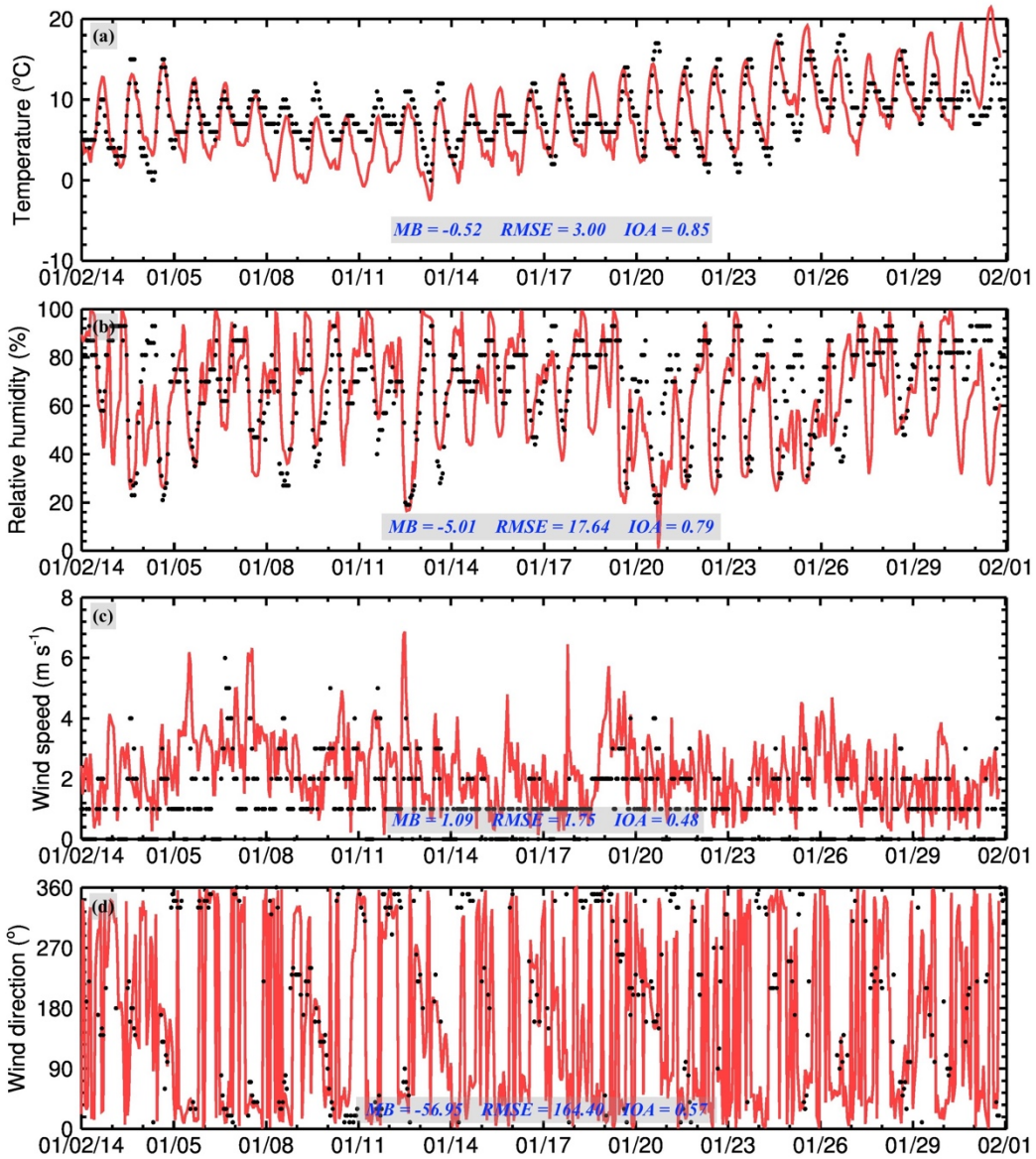

Figure S3 Simulated (red curves) and observed (black dots) hourly air temperature, relative humidity, and wind speed and direction at Chengdu in the Sichuan Basin in January 2014.

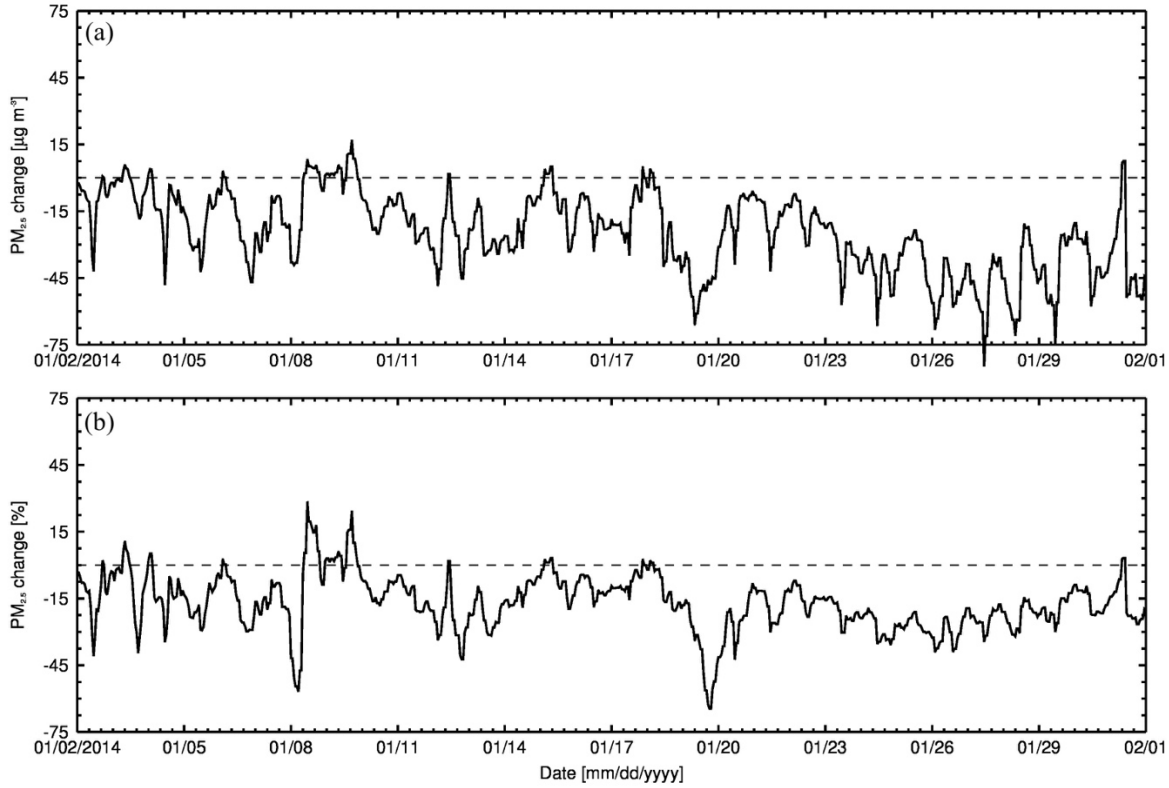

Figure S4 Changes in time series of $PM_{2.5}$ concentrations (a) and the percentage (b) over the Sichuan Basin after the Tibet is 2°C warmer. (Sensitivity simulation *minus* baseline simulation, the change in the following study is all calculated by the sensitivity simulation minus baseline simulation).

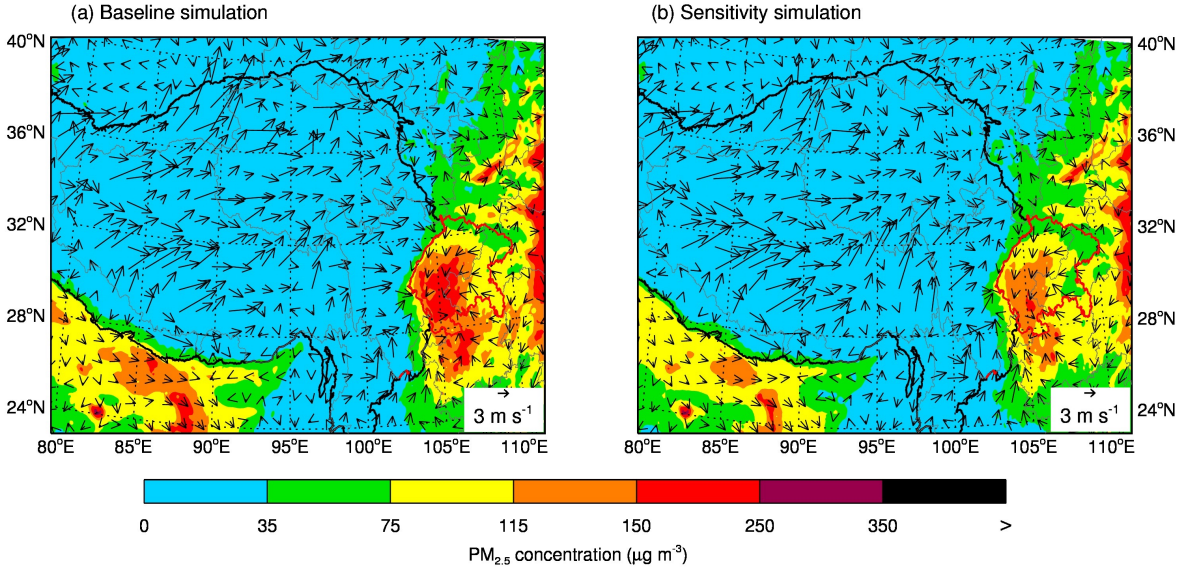

Figure S5 Comparison of spatial distributions of surface $PM_{2.5}$ concentration and winds between the (a) baseline simulation and (b) sensitivity simulation.