Supplementary Materials in the Manuscript

Contents:

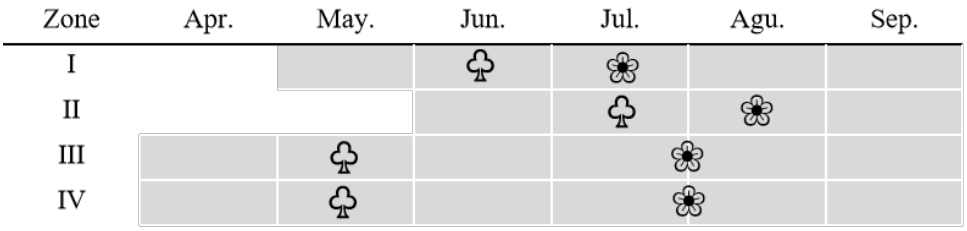

Figure S1. The typical growing cycles of maize in each agro-ecological zone. (♧ represents V3 stage, ❀ represents silking stage).

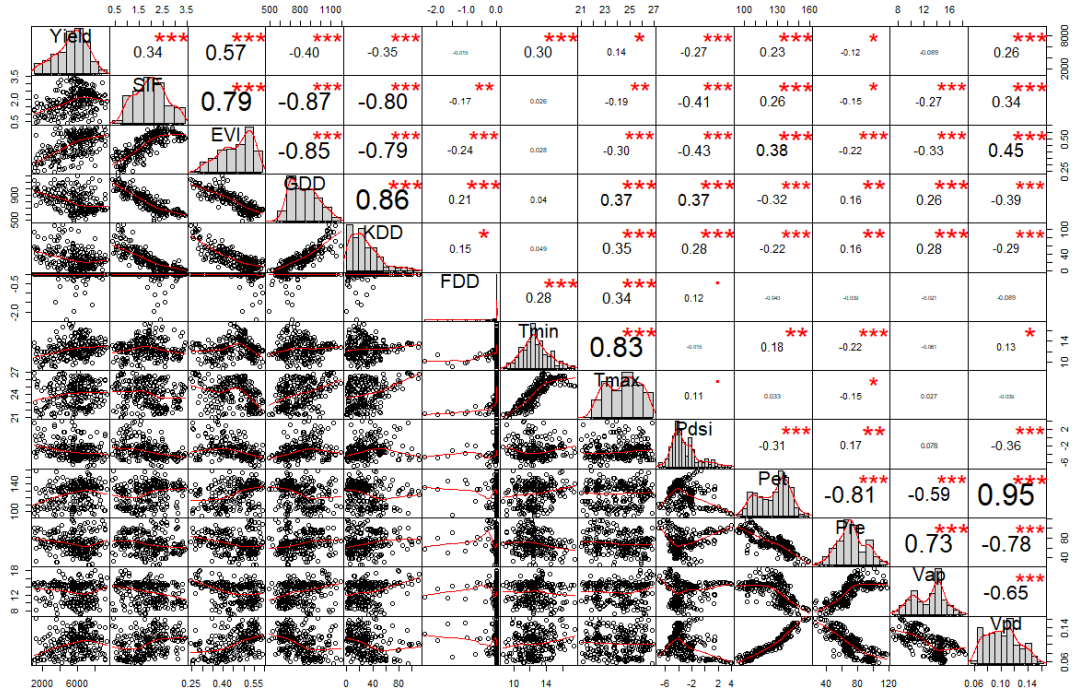

Figure S2. The correlations between transient variables (i.e., satellite data and climate variables) and yield in zone I. Each dot in the scatterplot represents a single county-year record. Single asterisk (*), double asterisks (**) and triple asterisks (***) denote statistical significance levels of p-value<0.05, p-value <0.01 and p-value <0.001, respectively; "NS" indicates significance levels above 0.05.

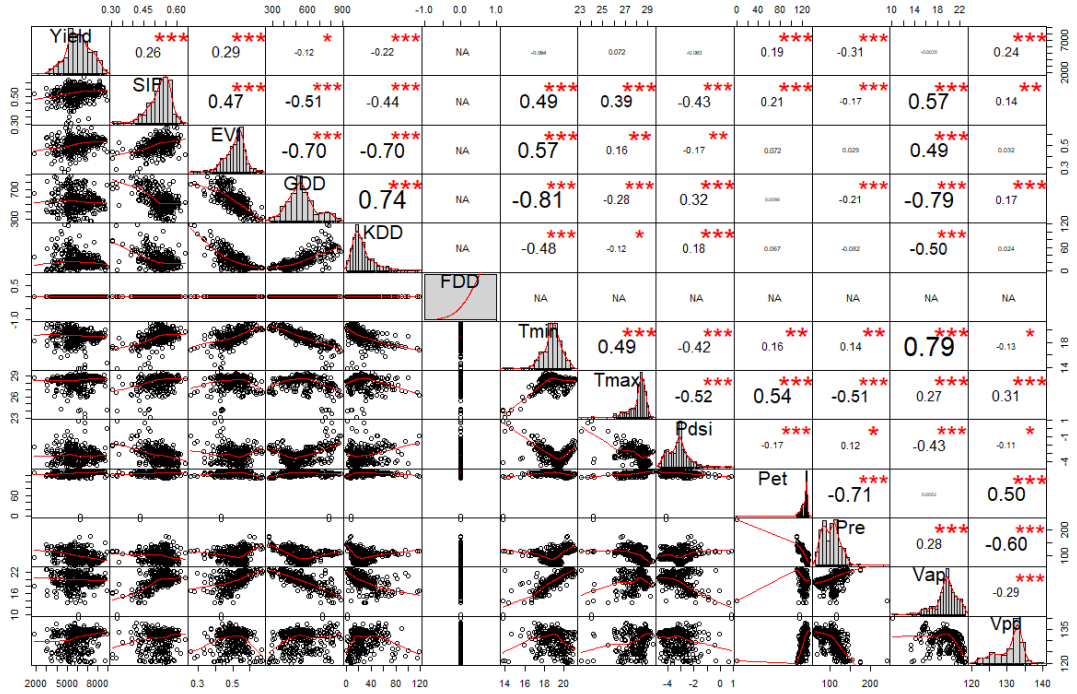

Figure S3. The correlations between transient variables (i.e., satellite data and climate variables) and yield in zone II.

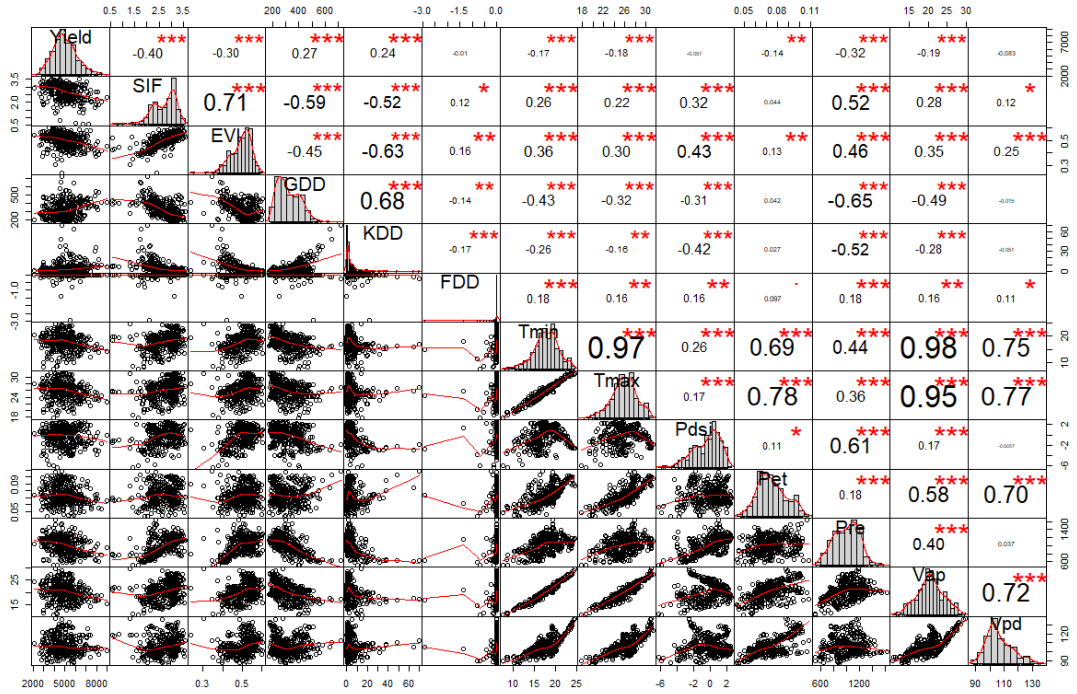

Figure S4. The correlations between transient variables (i.e., satellite data and climate variables) and yield in zone III.

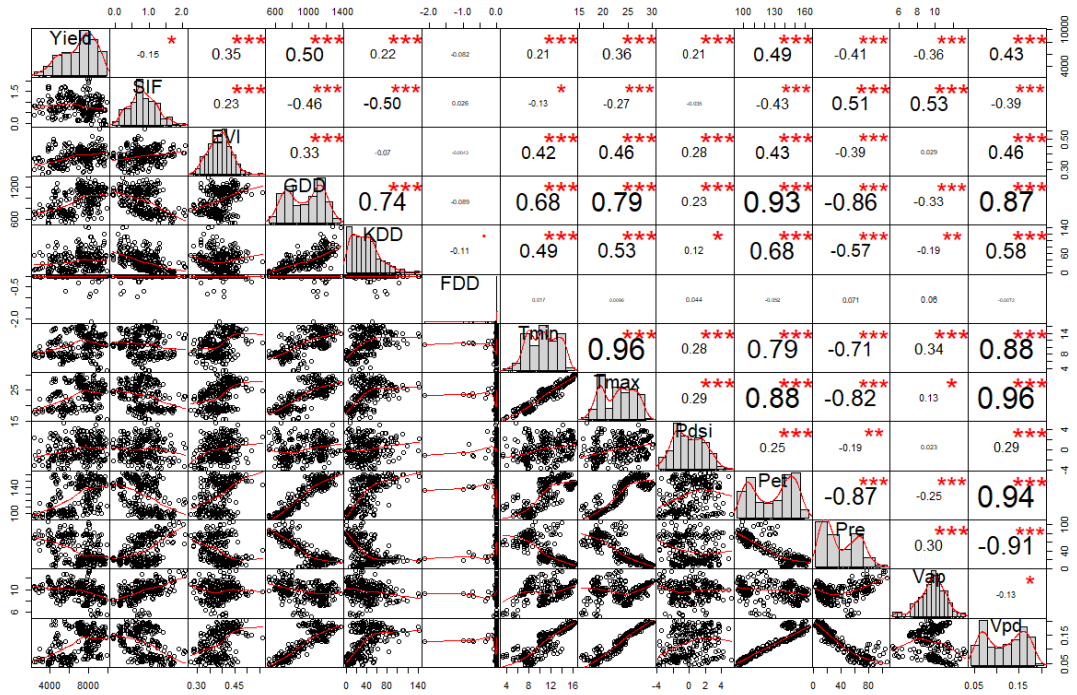

Figure S5. The correlations between transient variables (i.e., satellite data and climate variables) and yield in zone IV

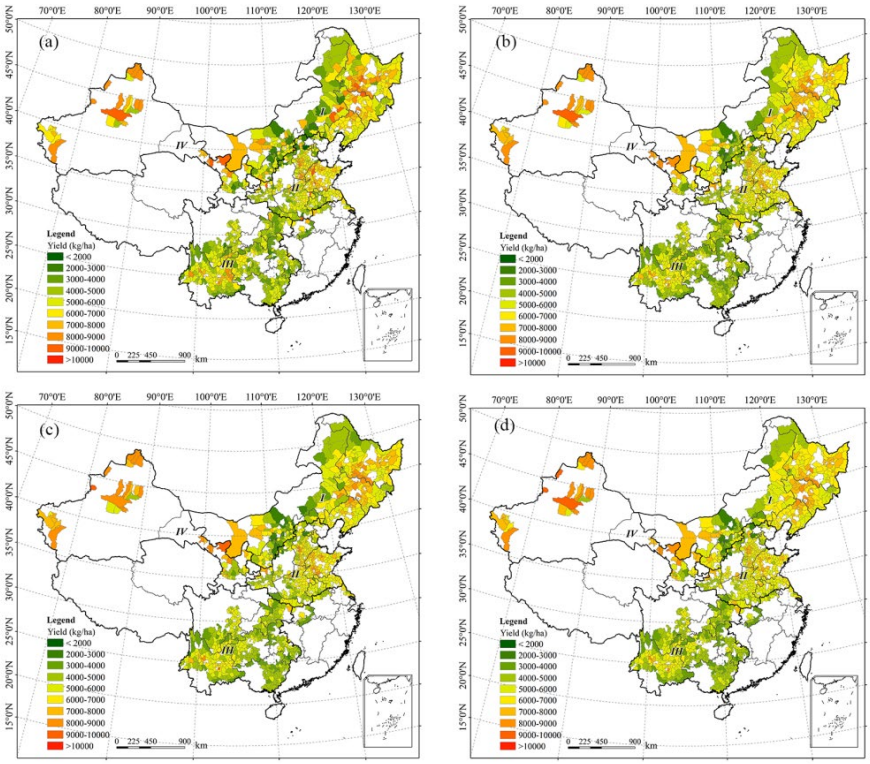

Figure S6. The spatial patterns of the recorded yield (**a**) and predicted yield using EVI for RF (**b**), XGBoost (**c**) and LSTM (**d**).

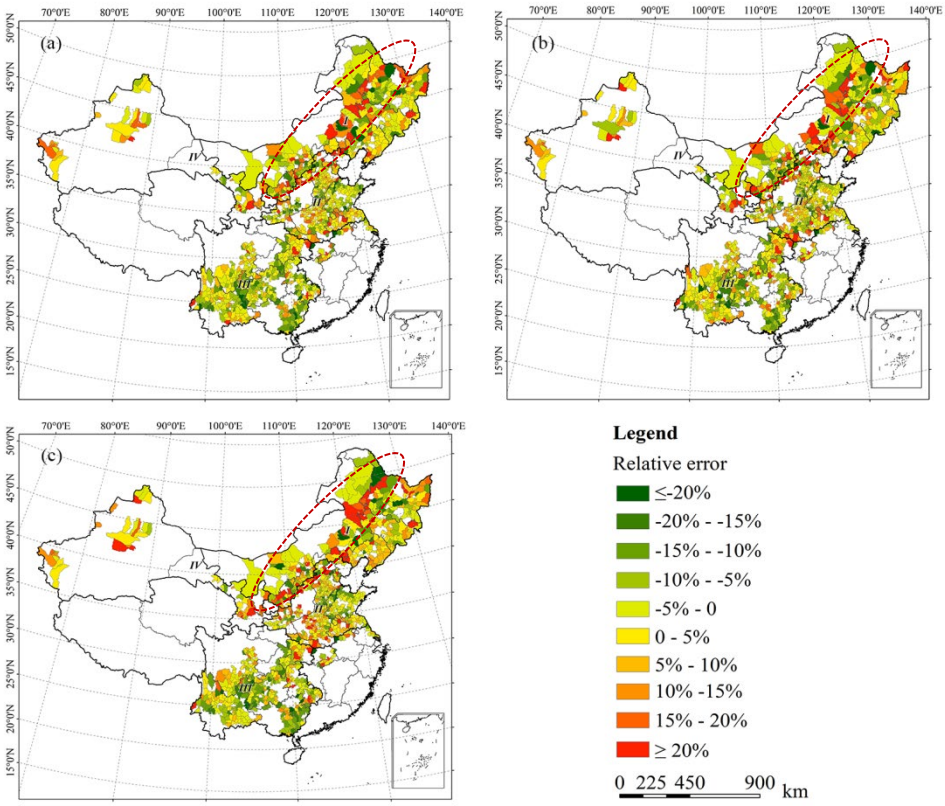

Figure S7. The spatial patterns of the relative errors for RF (**a**), XGBoost (**b**) and LSTM (**c**).

Table S1 An overview of the collected datasets in this study.

Category	Variables	Spatial Resolution	Temporal Resolution	Time Coverage	Source
Maize yield and planting area	Maize yield	County	Year	2001-2015	Agricultural Statistical Yearbook
	Planting area	1 km	Year	2001-2015	ChinaCropPhen dataset (Luo et al., 2019)
Satellite data	EVI	1 km	16-day	2001-2015	MOD13A2 EVI product (Collection 6)
	SIF	0.05°	4-day	2001-2015	CSIF datasets (Zhang et al., 2018)
Environmental data	LST (KDD, GDD, FDD)	1 km	Daily	2001-2015	MOD11A1 product (Version 6)
	Climate data (Tmin, Tmax, Pre, Pdsi, Pet, Vap, Vpd)	4 km	Monthly	2001-2015	TerraClimate datasets
	Soil properties (SCLAY, SSILT, SSAND, S_OC, S_PH, S_CEC, SREF_BULK)	1 km	-	-	Soil particle-size distribution dataset (Shangguan et al., 2012)
	Irrigation ratio	County	-	-	Science and Technology Innovation Project of Improving Food Yield and Efficiency Project

References

1. Luo, Y., Zhang, Z., Chen, Y., Li, Z., and Tao, F. ChinaCropPhen1km: A high-resolution crop phenological dataset for three staple crops in China during 2000–2015 based on LAI products, *Earth Syst. Sci. Data* Discuss., https://doi.org/10.5194/essd-2019-110, in review, **2019**.
2. Zhang, Y., Joiner, J., Alemohammad, S.H., Zhou, S., & Gentine, P. A global spatially contiguous solar-induced fluorescence (CSIF) dataset using neural networks. *Biogeosciences*. **2018**, 15, 5779-5800.
3. Shangguan, W., Dai, Y., Liu, B., Ye, A., & Yuan, H. A soil particle-size distribution dataset for regional land and climate modelling in china. *GEODERMA*. **2012**, 171-172(none), 0-91.

Table S2 The mean of predicted *RMSE* and R^2 for two combinations of inputs (i.e., "SIF +Environment" and "EVI +Environment") and four methods (i.e., LASSO, RF, XGBoost and LSTM) from 2011-2015 in each agro-ecological zone.

Zone		LASSO		RF		XGBoost		LSTM	
		RMSE	R^2	*RMSE*	R^2	*RMSE*	R^2	RMSE	R^2
I									
	SIF	1513.49	0.35	1061.99	0.68	1073.68	0.67	1115.47	0.65
	EVI	1591.26	0.28	1108.51	0.65	1093.17	0.66	1130.01	0.64

II									
	SIF	1103.82	0.22	615.11	0.75	602.47	0.77	667.41	0.73
	EVI	1107.75	0.21	651.26	0.72	647.74	0.72	679.47	0.72
III									
	SIF	951.61	0.31	601.78	0.72	577.54	0.75	594.11	0.73
	EVI	934.91	0.33	572.47	0.75	559.41	0.76	596.43	0.73
IV									
	SIF	1468.31	0.33	691.56	0.85	653.52	0.86	844.99	0.78
	EVI	1520.52	0.29	736.20	0.83	681.08	0.85	839.68	0.79