

# ChinaCropSM1km: a fine 1km daily Soil Moisture dataset for Crop drylands across China during 1993–2018

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**Table S1** Means and medians of evaluation indexes on spatial accuracy among ChinaCropSM1km, RSSSM and ESA CCI SM, with better one in bold.

**Table S2** Means and medians of evaluation indexes on temporal accuracy among ChinaCropSM1km, RSSSM and ESA CCI SM, with better one in bold.

20 **Figure S1** An overview of the workflow to develop an irrigation module to forecast soil moisture based on RF models.

**Figure S2** Correlation coefficient of each factor and soil moisture in wheat-planted land, \*, \*\* and \*\*\* for significant levels at  $p < 0.05$ ,  $p < 0.01$  and  $p < 0.001$ , respectively.

25 **Figure S3** Correlation coefficient of each factor and soil moisture in maize-planted land, \*, \*\* and \*\*\* mean the same as that in Figure S1

**Figure S4** The accuracy (negative mean of absolute error) of the RF models with all selected hyper-parameters.

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**Figure S7** Comparison between the predicted soil moisture (ChinaCropSM1km) and in situ samples by crops and depths (cm) at training set. (a) wheat<sub>0-10</sub>, (b) wheat<sub>10-20</sub>, (c) maize<sub>0-10</sub> and (d) maize<sub>10-20</sub>. The red lines are the trend lines, the colorbar means point density, and the black lines for 1:1 lines.

35 **Figure S8** The locations of all meteorological stations in China.

**Table S1 Means and medians of evaluation indexes on spatial accuracy among ChinaCropSM1km, RSSSM and ESA CCI SM, with better in bold.**

INDEX	<i>r</i>			RMSE			bias			ubRMSE		
	maize <sub>0-10</sub>	RSSSM	ESA CCI SM	maize <sub>0-10</sub>	RSSSM	ESA CCI SM	maize <sub>0-10</sub>	RSSSM	ESA CCI SM	maize <sub>0-10</sub>	RSSSM	ESA CCI SM
Mean	<b>0.947</b>	0.376	0.303	<b>0.027</b>	0.167	0.121	<b>0.0006</b>	-0.138	-0.067	<b>0.026</b>	0.085	0.092
Median	<b>0.946</b>	0.458	0.295	<b>0.030</b>	0.166	0.120	<b>0.0006</b>	-0.133	-0.075	<b>0.029</b>	0.084	0.092
	maize <sub>10-20</sub>	RSSSM	ESA CCI SM	maize <sub>10-20</sub>	RSSSM	ESA CCI SM	maize <sub>10-20</sub>	RSSSM	ESA CCI SM	maize <sub>10-20</sub>	RSSSM	ESA CCI SM
Mean	<b>0.957</b>	—	—	<b>0.032</b>	—	—	<b>0.001</b>	—	—	<b>0.020</b>	—	—
Median	<b>0.958</b>	—	—	<b>0.035</b>	—	—	<b>0.0005</b>	—	—	<b>0.024</b>	—	—
	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM
Mean	<b>0.931</b>	0.306	0.184	<b>0.051</b>	0.181	0.111	<b>0.0006</b>	-0.153	-0.055	<b>0.031</b>	0.089	0.092
Median	<b>0.922</b>	0.324	0.193	<b>0.051</b>	0.183	0.112	<b>0.0014</b>	-0.155	-0.053	<b>0.034</b>	0.095	0.094
	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM
Mean	<b>0.947</b>	—	—	<b>0.026</b>	—	—	<b>-0.0008</b>	—	—	<b>0.025</b>	—	—
Median	<b>0.946</b>	—	—	<b>0.027</b>	—	—	<b>0.0003</b>	—	—	<b>0.026</b>	—	—

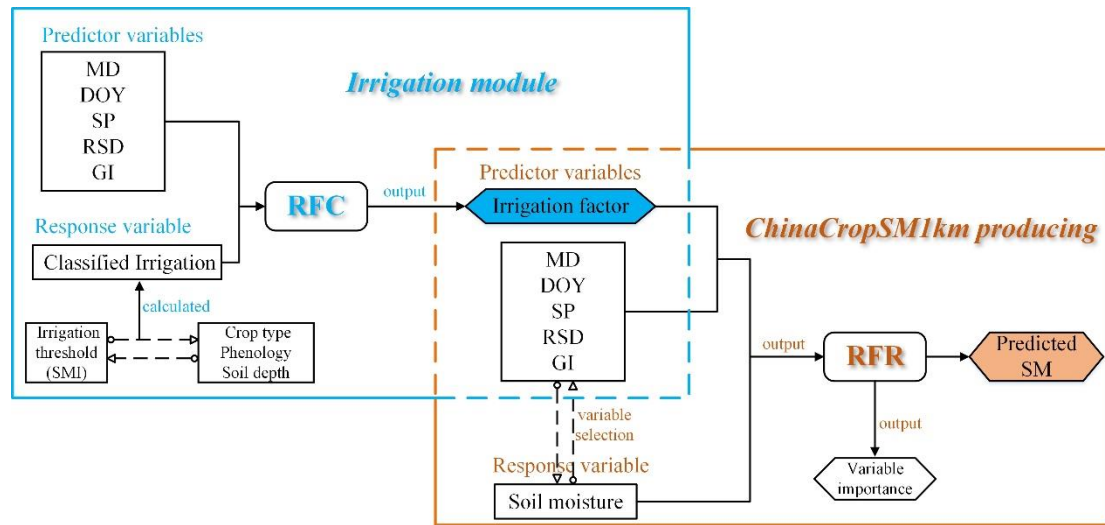
Note: *r*: Pearson correlation coefficient; RMSE: Root Mean Square Error ( $\text{m}^3\text{m}^{-3}$ ); bias( $\text{m}^3\text{m}^{-3}$ ); ubRMSE: unbiased RMSE ( $\text{m}^3\text{m}^{-3}$ ); wheat<sub>0-10</sub>: the 1km-gridded daily soil moisture dataset for wheat-planted land at 0–10 cm depth; wheat<sub>10-20</sub>: the 1km-gridded daily soil moisture dataset for wheat-planted land at 10–20 cm depth, maize<sub>0-10</sub>: the 1km-gridded daily soil moisture dataset for maize-planted land at 0–10 cm depth; maize<sub>10-20</sub>: the 1km-gridded daily soil moisture dataset for maize-planted land at 10–20 cm depth; ChinaCroplandSM1km: the 1km soil moisture dataset for dry croplands in China; RSSSM: the global remote-sensing-based surface soil moisture dataset; ESA CCI SM: the European Space Agency Climate Change Initiative soil moisture product.

**Table S2 Means and medians of evaluation indexes on temporal accuracy among ChinaCropSM1km, RSSSM and ESA CCI SM, with better performance in bold.**

INDEX	<i>r</i>		RMSE			bias			ubRMSE			
	maize <sub>0-10</sub>	RSSSM	ESA CCI SM	maize <sub>0-10</sub>	RSSSM	ESA CCI SM	maize <sub>0-10</sub>	RSSSM	ESA CCI SM	maize <sub>0-10</sub>	RSSSM	ESA CCI SM
Mean	<b>0.830</b>	0.307	0.380	<b>0.036</b>	0.156	0.110	<b>-0.0009</b>	-0.137	-0.075	<b>0.033</b>	0.058	0.054
Median	<b>0.886</b>	0.399	0.484	<b>0.033</b>	0.148	0.096	<b>0.0005</b>	-0.134	-0.074	<b>0.031</b>	0.058	0.052
	maize <sub>10-20</sub>	RSSSM	ESA CCI SM	maize <sub>10-20</sub>	RSSSM	ESA CCI SM	maize <sub>10-20</sub>	RSSSM	ESA CCI SM	maize <sub>10-20</sub>	RSSSM	ESA CCI SM
Mean	<b>0.833</b>	—	—	<b>0.027</b>	—	—	<b>-0.0004</b>	—	—	<b>0.026</b>	—	—
Median	<b>0.895</b>	—	—	<b>0.027</b>	—	—	<b>0.0008</b>	—	—	<b>0.025</b>	—	—
	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM	wheat <sub>0-10</sub>	RSSSM	ESA CCI SM
Mean	<b>0.821</b>	0.252	0.397	<b>0.038</b>	0.163	0.102	<b>0.002</b>	-0.143	-0.059	<b>0.034</b>	0.059	0.054
Median	<b>0.853</b>	0.310	0.486	<b>0.037</b>	0.157	0.085	<b>0.002</b>	-0.141	-0.057	<b>0.033</b>	0.058	0.054
	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM	wheat <sub>10-20</sub>	RSSSM	ESA CCI SM
Mean	<b>0.841</b>	—	—	<b>0.030</b>	—	—	<b>0.0009</b>	—	—	<b>0.028</b>	—	—
Median	<b>0.875</b>	—	—	<b>0.028</b>	—	—	<b>0.0007</b>	—	—	<b>0.027</b>	—	—

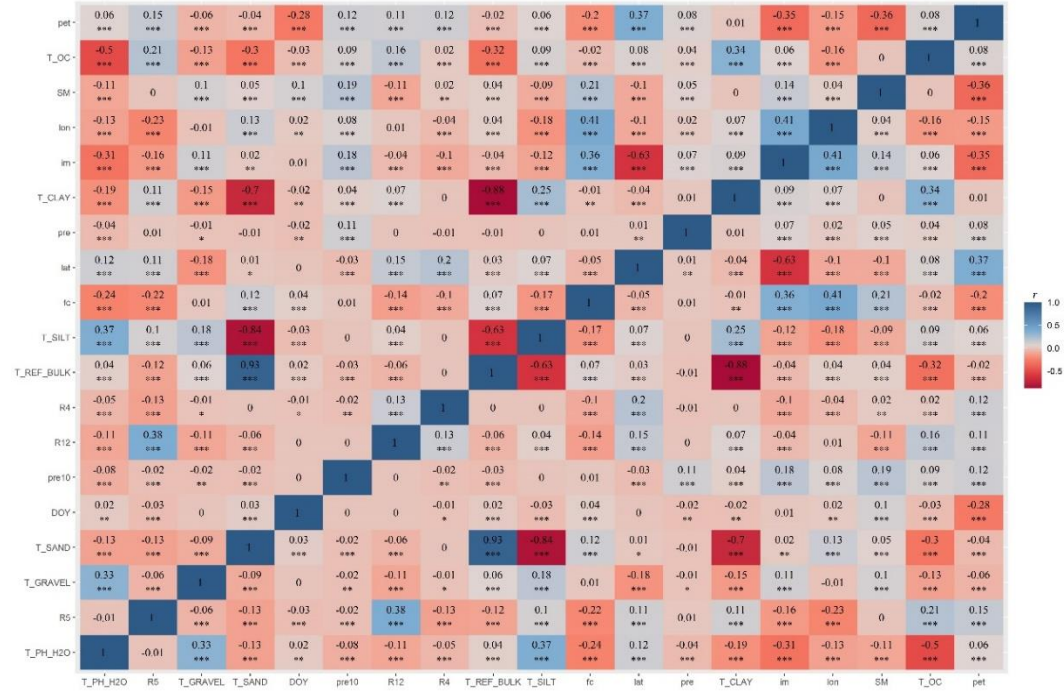
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**Figure S1. An overview of the workflow to develop an irrigation module to forecast soil moisture based on RF models.**



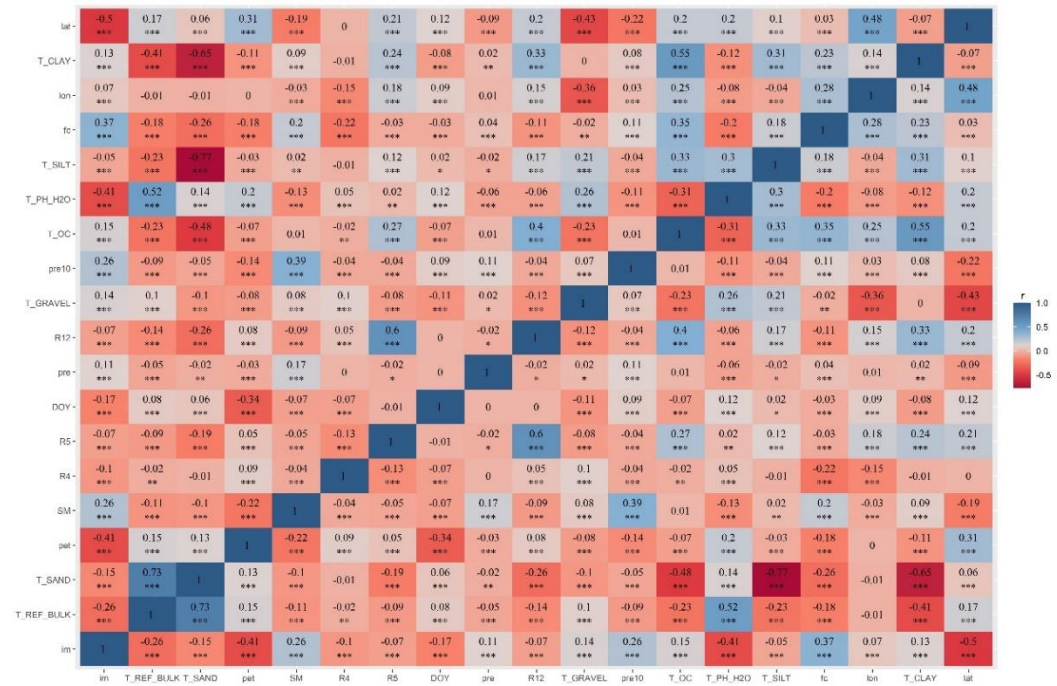
Note: SM: soil moisture; RFC: random forest classification; RFR: random forest regression; SMI: evaluation index of relative soil moisture to determine when irrigation is applied; MD: meteorological data; DOY: day of year; SP: soil properties; RSD: remote sensing data; GI: geographical information.

**Figure S2. Correlation coefficient of each factor and soil moisture in wheat-planted land, \*, \*\* and \*\*\* for significant levels at  $p < 0.05$ ,  $p < 0.01$  and  $p < 0.001$ , respectively.**



Note:  $r$ : Pearson correlation coefficient; SM: soil moisture; CIR: classified irrigation; pre10: ante-accumulated precipitation over ten days; fc: field capacity; DOY: day of year; lon: longitude; pre: daily precipitation; im: moisture index; lat: latitude; pet: reference evapotranspiration; R4: river network vector I; R5: river network vector II; R12: river network vector III; REF\_BULK: soil bulk density; PH\_H2O: hydrogen ion concentration; GRAVEL: volume percentage of crushed stone; T: the topsoil layer.

Figure S3. Correlation coefficient of each factor and soil moisture in maize-planted land, \*, \*\* and \*\*\* mean the same as that in Figure S1.



**Figure S4. The accuracy (negative mean of absolute error) of the RF models with all selected hyper-parameters.**

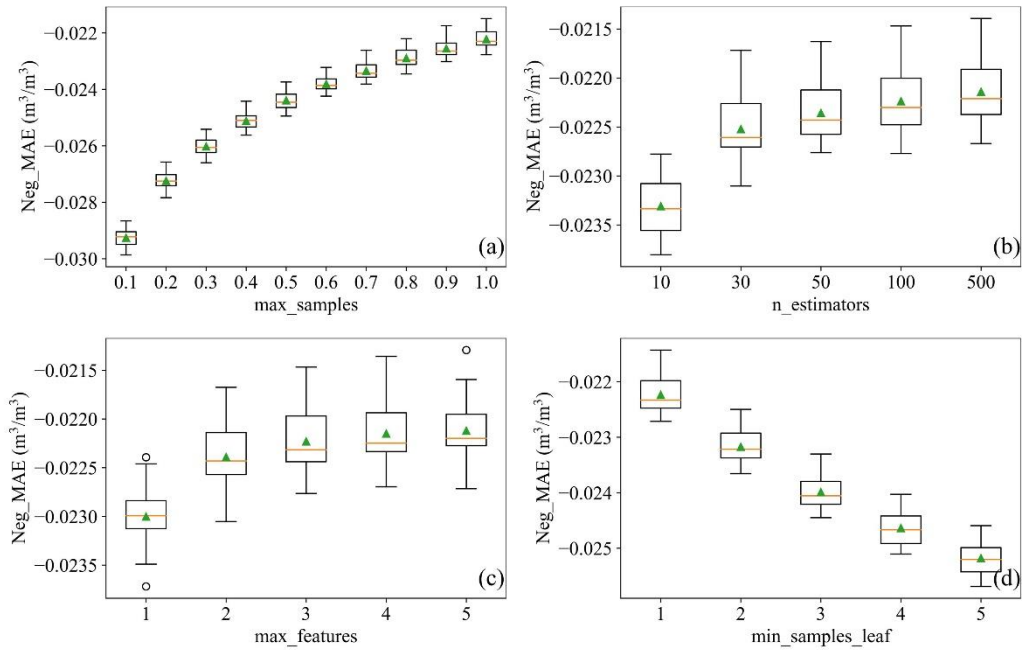
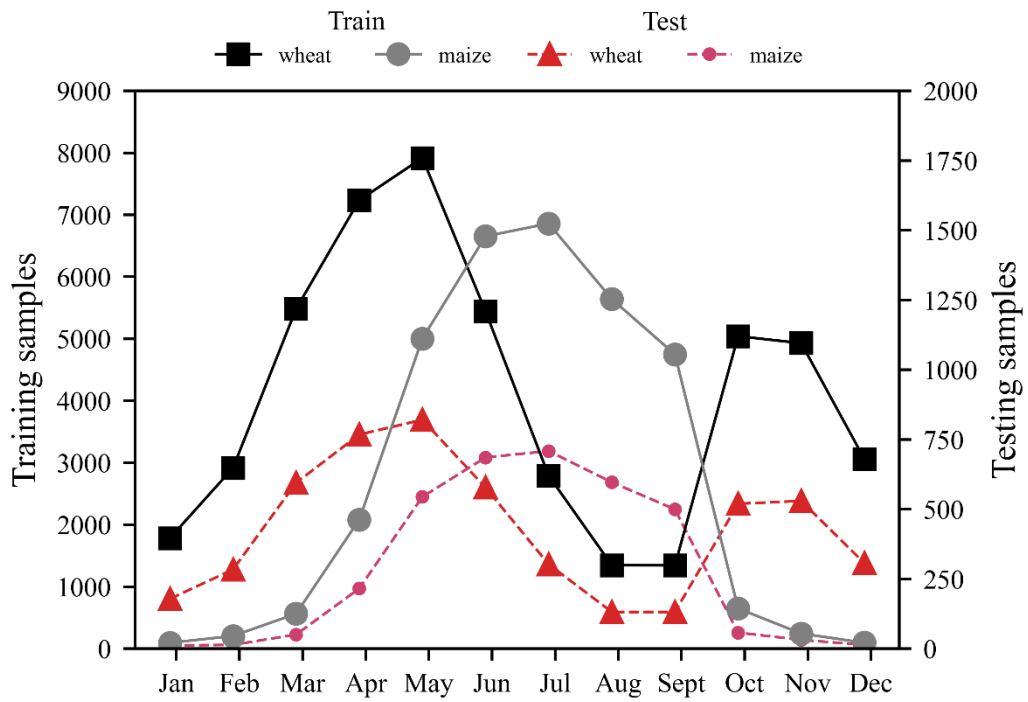
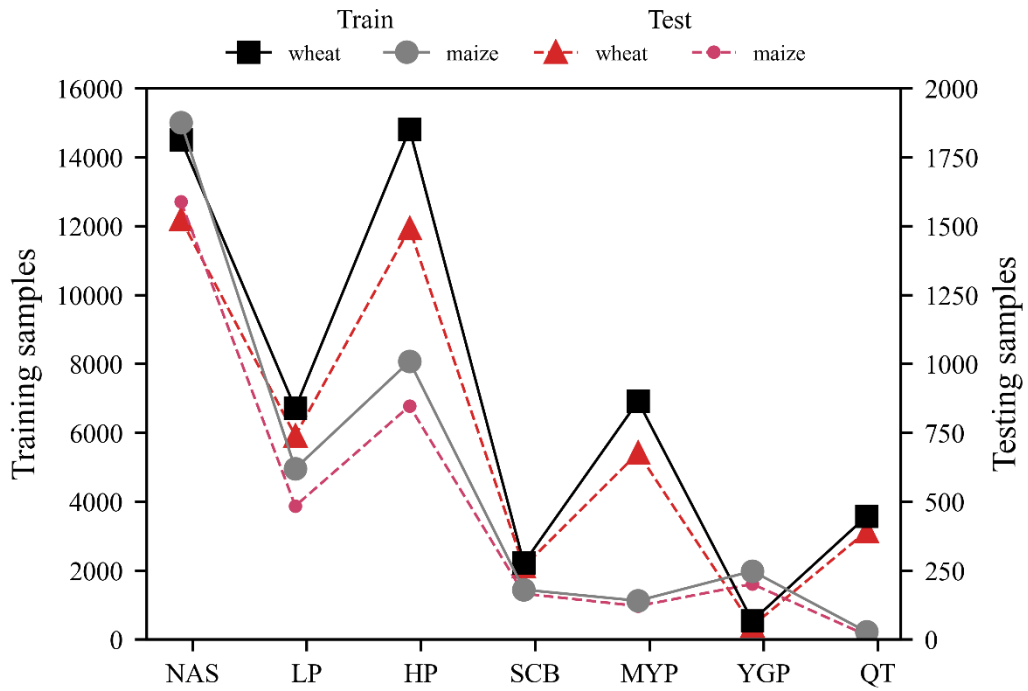




Figure S5. Training and testing samples for spatial pattern comparison between ChinaCropSM1km and in situ soil moisture observations.



**Figure S6. Training and testing samples for temporal pattern comparison between ChinaCropSM1km and in situ soil moisture observations.**



Note: NAS: Northern Arid and Semiarid region; LP: Loess Plateau; HP: Huang–Huai–Hai Plain; SCB: SiChuan Basin; MYP: Middle–lower Yangtze Plain; YGP: Yunnan–Guizhou Plateau and southern China; QT: Qinghai–Tibet region.

**Figure S7. Comparison between the predicted soil moisture (ChinaCropSM1km) and in situ samples by crops and depths (cm) at training set. (a) wheat<sub>0-10</sub>, (b) wheat<sub>10-20</sub>, (c) maize<sub>0-10</sub> and (d) maize<sub>10-20</sub>. The red lines are the trend lines, the colorbar means point density, and the black lines for 1:1 lines.**

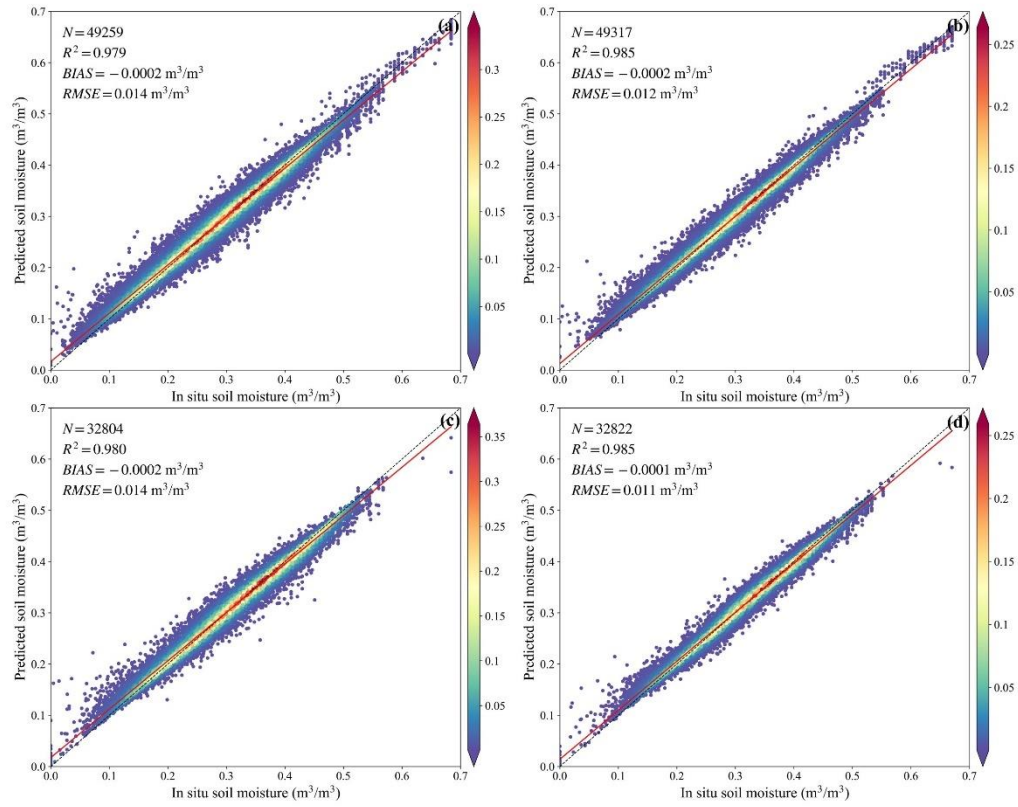


Figure S8. The locations of all meteorological stations in China.

