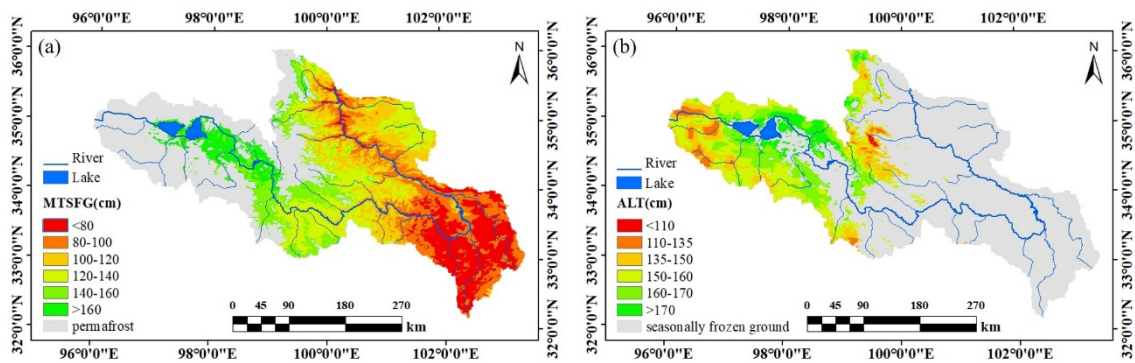


Table S1. Validation of the mean daily LST estimated by the MODIS product.

Station name	R^2	RMSE (°C)	ME (°C)
Xinghai	0.96	1.95	0.11
Maduo	0.95	2.25	-0.44
Maqin	0.96	1.93	0.49
Dari	0.95	1.95	0.31
Henan	0.95	1.99	0.12
Jiuzhi	0.95	1.91	0.54
Mqu	0.94	2.03	-0.37
Zoige	0.92	2.27	-0.33
Hongyuan	0.92	2.25	-0.46

Table S2. Comparison of the mean value of the observed and remote sensing estimated annual MTSFG at 9 meteorological stations.

Station name	Elevation (m)	Observed mean annual MTSFG (cm)	Estimated mean annual MTSFG (cm)	ME (cm)	RMSE (cm)
Xinhai	3323.2	138.69	139.31	-0.62	15.23
Maduo	4272.3	215.84	210.69	5.15	20.63
Maqin	3719.0	134.65	141.92	-7.27	13.32
Dari	3967.5	185.49	183.69	1.80	14.86
Henan	3500.0	109.70	110.00	-0.30	8.52
Jiuzhi	3628.5	75.49	76.31	-0.82	9.19
Maqu	3471.4	68.56	71.11	-2.55	6.84
Zoige	3441.4	64.19	59.77	4.42	18.43
Hongyuan	3491.6	47.24	47.85	-0.60	12.26

**Figure S1.** Spatial distribution of the (a) maximum thickness of seasonally frozen ground (MTSFG) and (b) active layer thickness (ALT) of permafrost during the period of 2003–2019. Note: The MTSFG is determined within the distribution of seasonally frozen ground from 2003 to 2010; the ALT is determined within the distribution of permafrost from 2011 to 2019

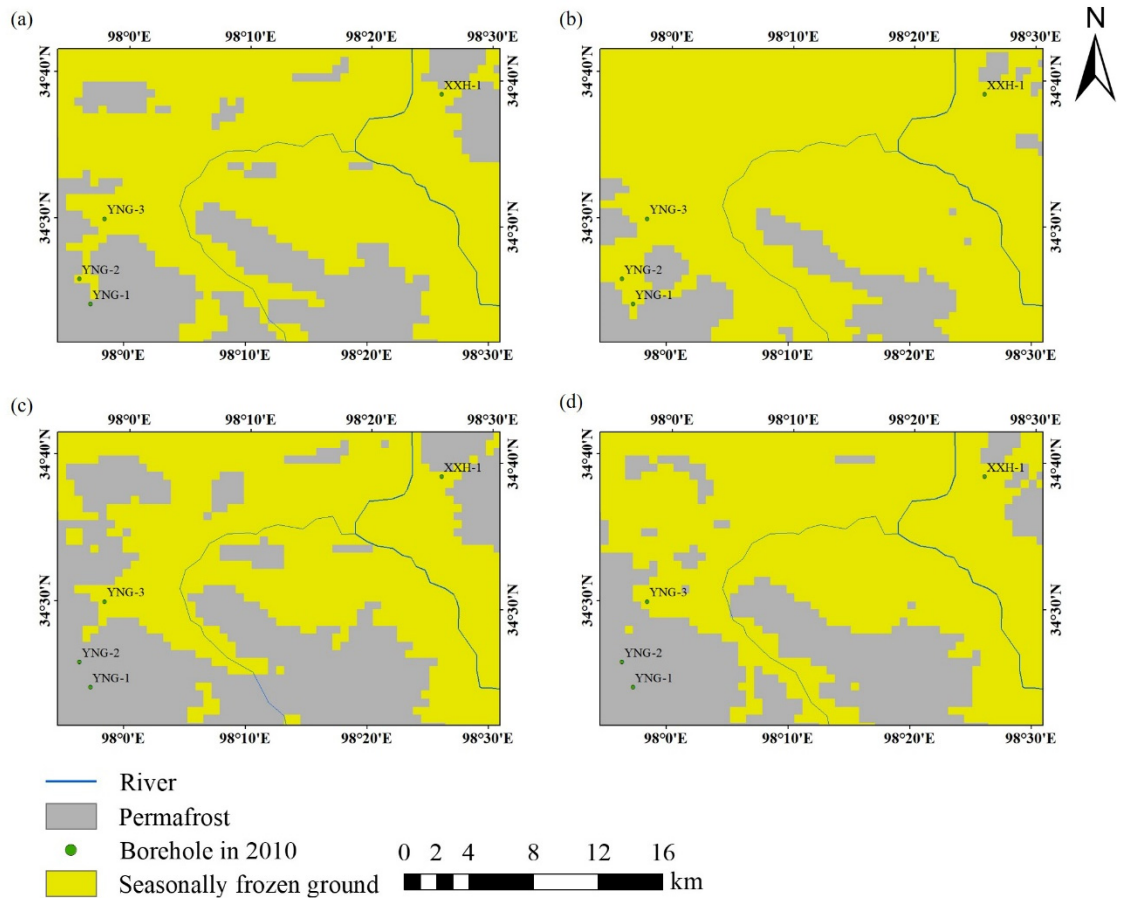


Figure S2. Enlarged map of the distribution of frozen soil in the period from 2003–2014 in the SRYR: (a) the normal run; (b) exp1; (c) exp2 and (d) exp3.

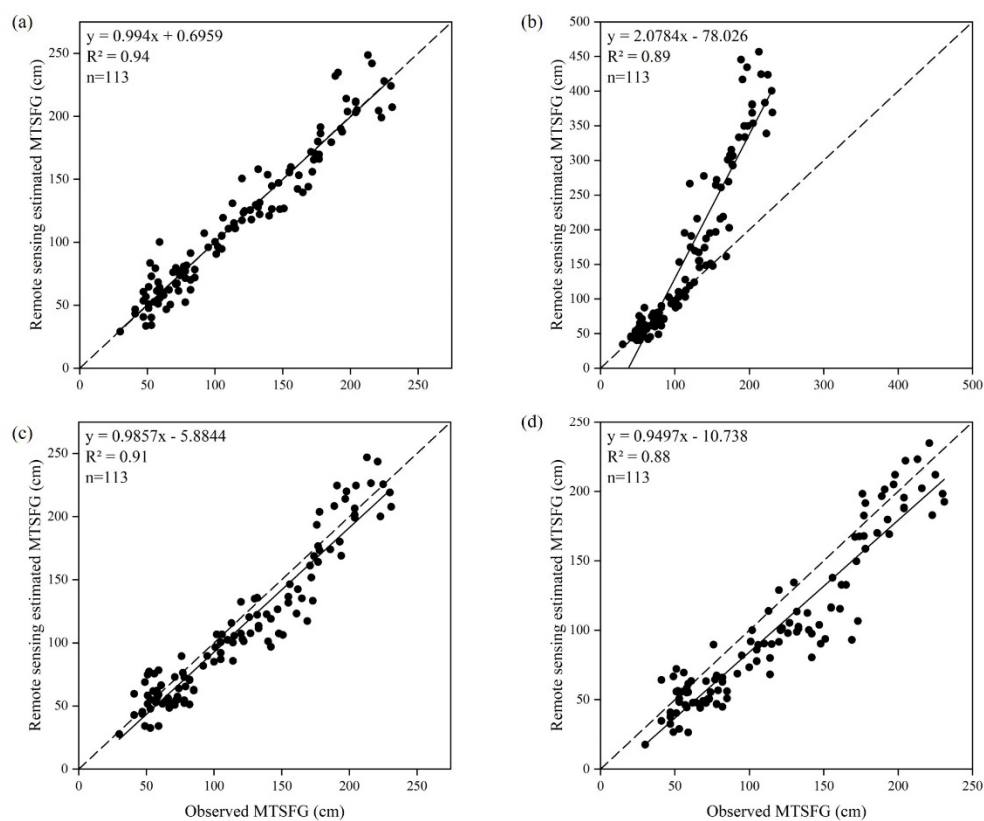


Figure S3. MTSFG estimated by remote sensing against observations at 9 meteorological stations: (a) the normal run; (b) exp1; (c) exp2 and (d) exp3.

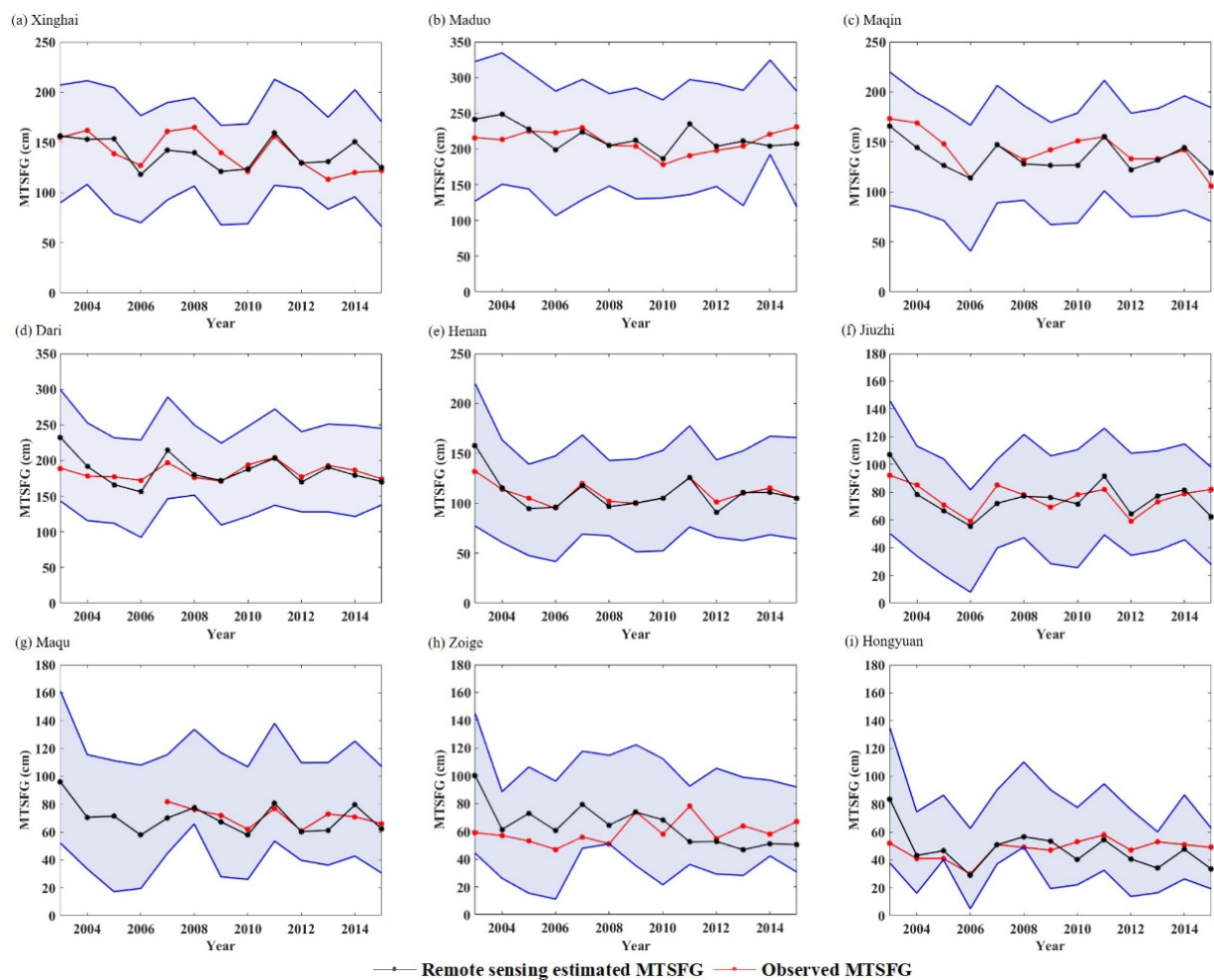


Figure S4. Comparison of the MTSFG estimated by remote sensing and its uncertainty band with observations at 9 meteorological stations. The regions filled by blue color is the uncertainty band of the estimated MTSFG with 95% confidence level.