Table S1. Error classification and categorization of ARMAE. The range of ARMAE for each category is determined based on the validation results using in situ measurements considering the literature [58]. Note that the range values are arbitrary depending on the in situ data types and sources.

Class	Range of ARMAE
Excellent	<0.02
Good	0.02-0.03
Reasonable	0.03-0.04
Poor	0.04-0.05
Bad	>0.05

Table S2. The training accuracy of the results of the optimized DINCAE model by tile. The optimized DINCAE model was selected by the least Root Mean Square Error (RMSE) during optimization after 800 epochs. The RMSE and loss were calculated using the sum of errors from minibatches. Independent DINCAE models were run on a computer with Intel(R) Xeon(R) Silver 4215R CPU @ 3.20 GHz and NVidia Quadro RTX 8000 GPU (48GB of memory), resulting in the runtime of 6.5 hours for 1000 epochs for each model.

Satellite	Tile	RMSE (°C)	Loss (°C)	Epoch
MODIS	1	0.66	0.12	880
	2	0.59	0.03	940
	3	0.54	-0.14	930
	4	0.46	-0.71	990
	5	0.47	-0.82	930
	6	0.48	-0.42	990
AMSR2	1	0.45	-0.78	990
	2	0.36	-1.12	1000
	3	0.42	-0.58	900
	4	0.25	-1.95	930
	5	0.26	-1.74	940
	6	0.23	-2.09	930

Table S3. Accuracy metrics of the original, reconstructed MODIS SSTs, and the Leave-One-Year-Out-Cross-Validation (LOYOCV) results of scheme 1 and scheme 2 when compared to the in situ data on 6 November 2018.

SST	Validation area (i.e., pixels)	Coefficient of determination (R^2)	Bias (°C)	RMSE (°C)	rRMSE (%)	MAE (°C)	ARMAE	The number of data (N)
Original MODIS	Original MODIS SST pixels	1.00	-0.07	0.19	0.77	0.15	0.006	25
Reconstructed MODIS	Reconstructed MODIS SST pixels	0.98	-0.39	0.81	3.55	0.52	0.022	39
Reconstructed MODIS	The entire study area	0.98	-0.26	0.64	2.74	0.38	0.016	64
Scheme 1-improved	Original MODIS SST pixels	0.99	0.20	0.35	1.44	0.27	0.011	25
Scheme 1-improved	Reconstructed MODIS SST pixels	0.98	0.08	0.78	3.44	0.51	0.022	39
Scheme 1-improved	The entire study area	0.98	0.13	0.65	2.78	0.42	0.017	64
Scheme 2-improved	Original MODIS SST pixels	0.99	0.26	0.41	1.67	0.32	0.012	25
Scheme 2-improved	Reconstructed MODIS SST pixels	0.99	0.04	0.66	2.88	0.38	0.016	39
Scheme 2-improved	The entire study area	0.99	0.13	0.57	2.45	0.35	0.015	64

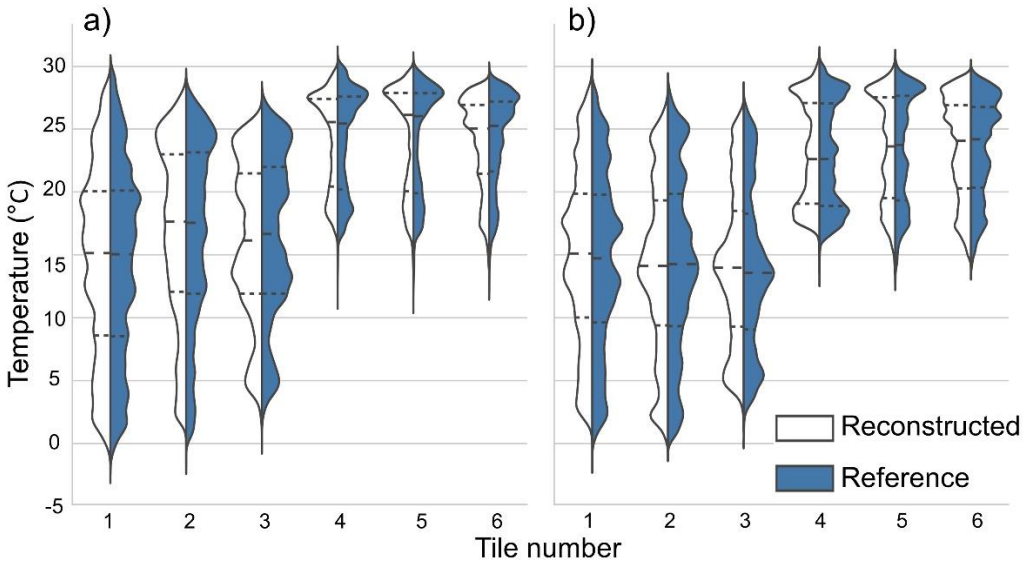

Figure S1. The violin plots of the reconstructed and reference SST data for validation by tile. The range of temperature between tiles 1–3 and 4–6 was quite different. (**a**) and (**b**) are MODIS and AMSR2, respectively.

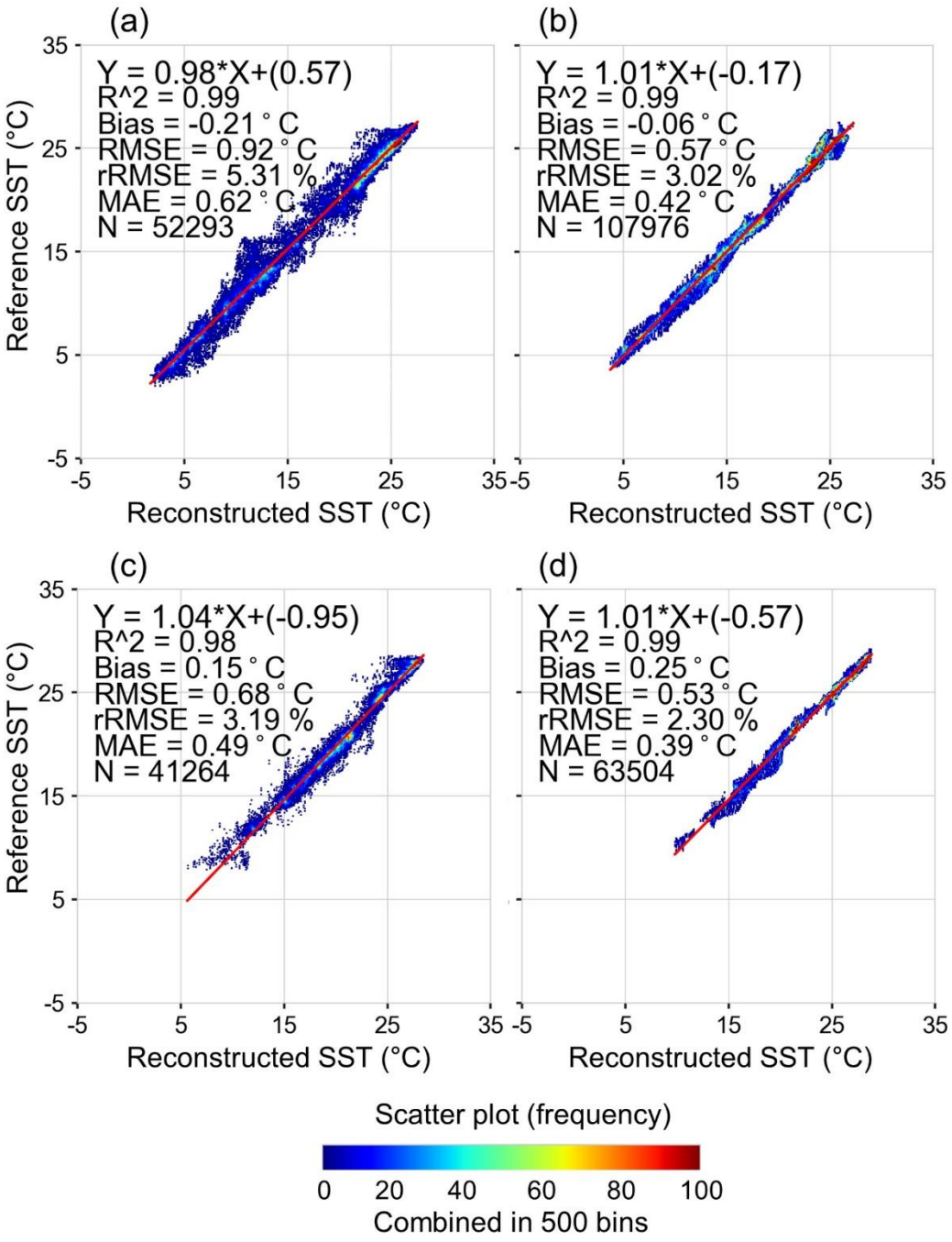

Figure S2. The density scatterplots of the validation results for the reconstruction MODIS and AMSR2 SSTs on 25 May 2015 ((**a**) and (**b**), respectively) and on 06 November 2018 ((**c**) and (**d**), respectively).

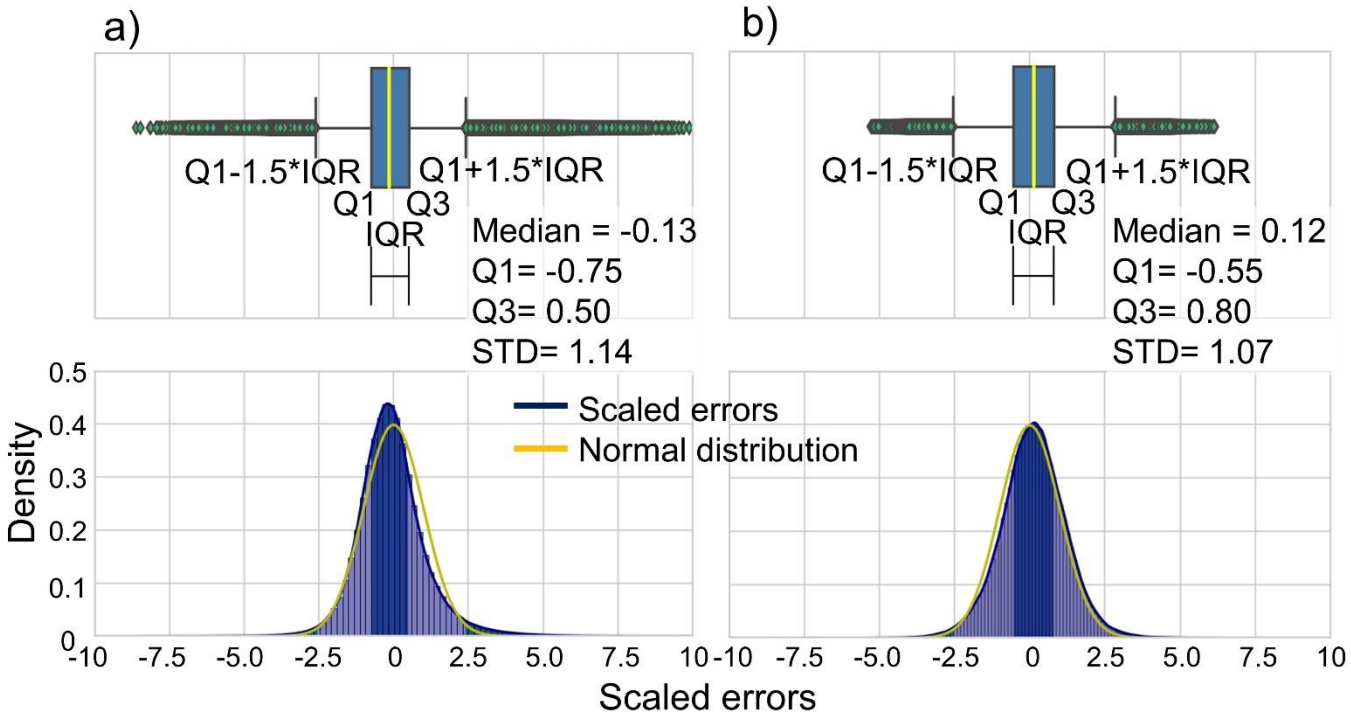

Figure S3. (**a**) The box plot and Guassian Probability Density Function (PDF) of the scaled errors (dimensionless) for the MODIS SST. (**b**) The same as a) but for the AMSR2 SST. The Gaussian PDF was estimated via Kernel Density Estimation (KDE) plot of the scaled errors which divided the difference between the reconstructed and reference SST by the expected error standard deviation of SST. Q1, Q3, IQR, and STD indicate the first quantile, the third quantile, the interquartile, and the standard deviation, respectively. On the PDF plot, dark blue bars mean the scaled errors between Q1 and Q3. The validation data were used to generate the plots. The numbers of the MODIS and AMSR2 validation data are 2,358,620 and 3,857,768, respectively.

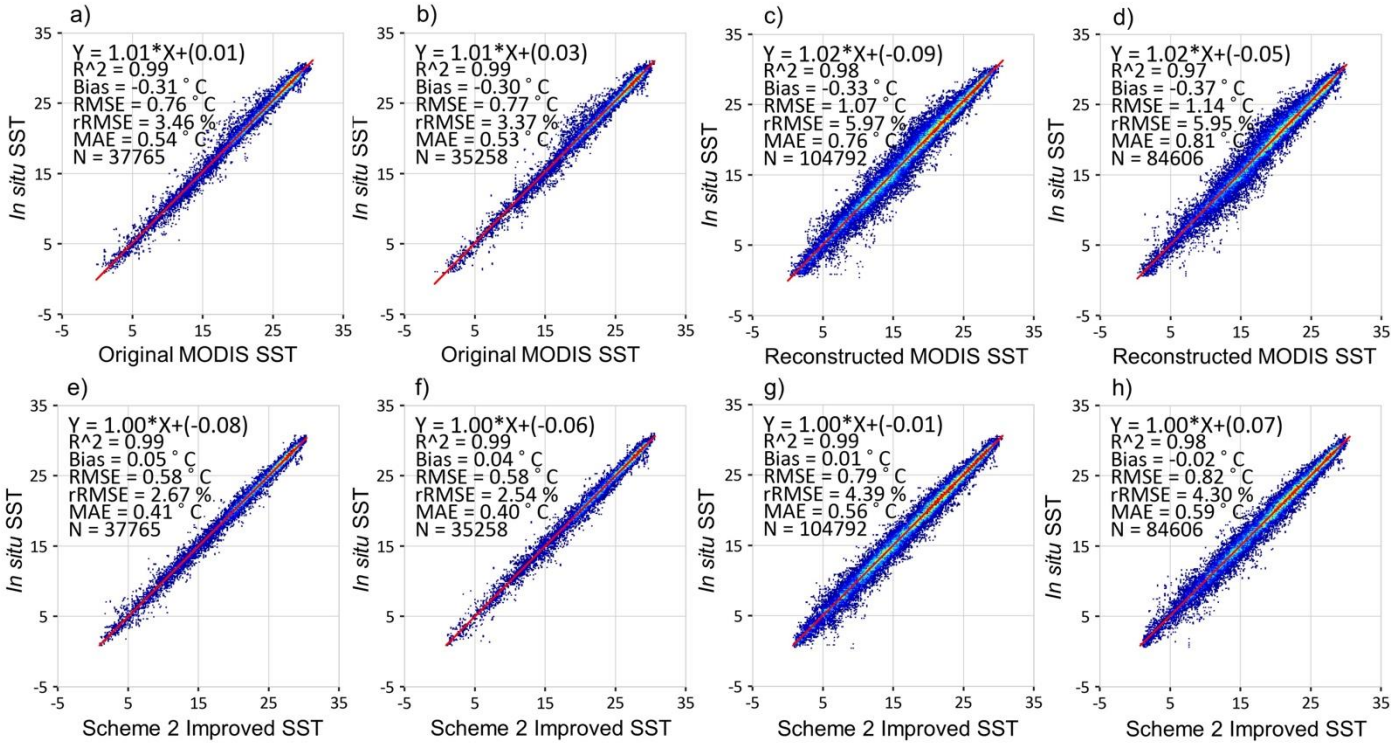

Figure S4. The scatterplots of the original, reconstructed MODIS SST pixels, and scheme 2-improved SST compared to the in situ measurements for the following four cases: where both the original MODIS and AMSR2 SSTs exist (**a**) and (**e**), where the original MODIS SST exists, but no original AMSR2 SST (**b**) and (**f**), where the AMSR2 SST exists, but no MODIS SST (**c**) and (**g**), and where both SSTs do not exist (**d**) and (**h**).