

Construction and Validation of a Dawn and Dusk Land Surface Temperature for MERSI-LL FY-3E (Supplementary Material)

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TABLE SIII. A list of 46 observation sites used for validating satellite-based land surface temperature in this study.

Reference for Supplementary Material

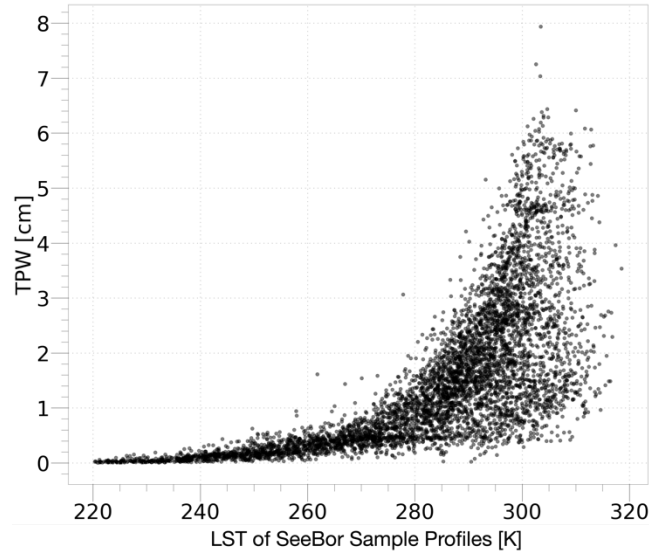


Fig. S1. Total Precipitable Water (TPW) and simulated land surface temperature (LST) for the SeeBor profile used in this study.

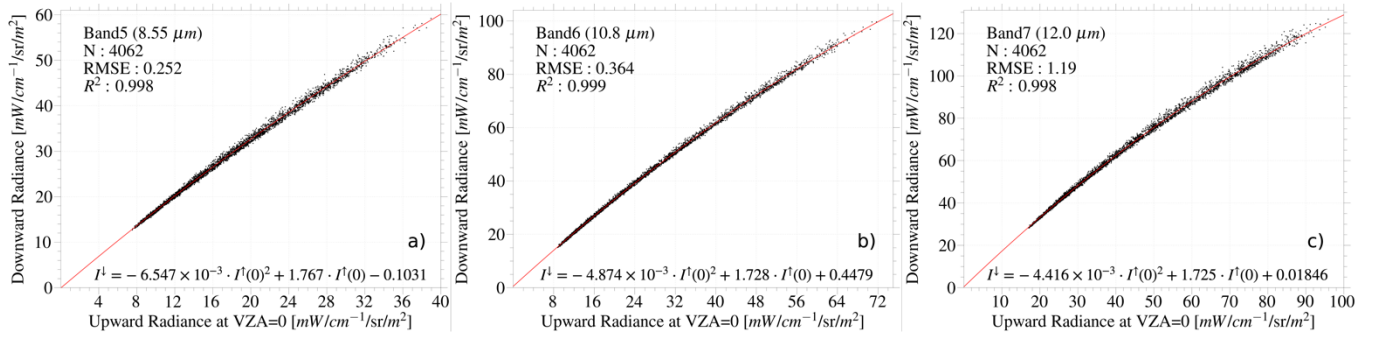


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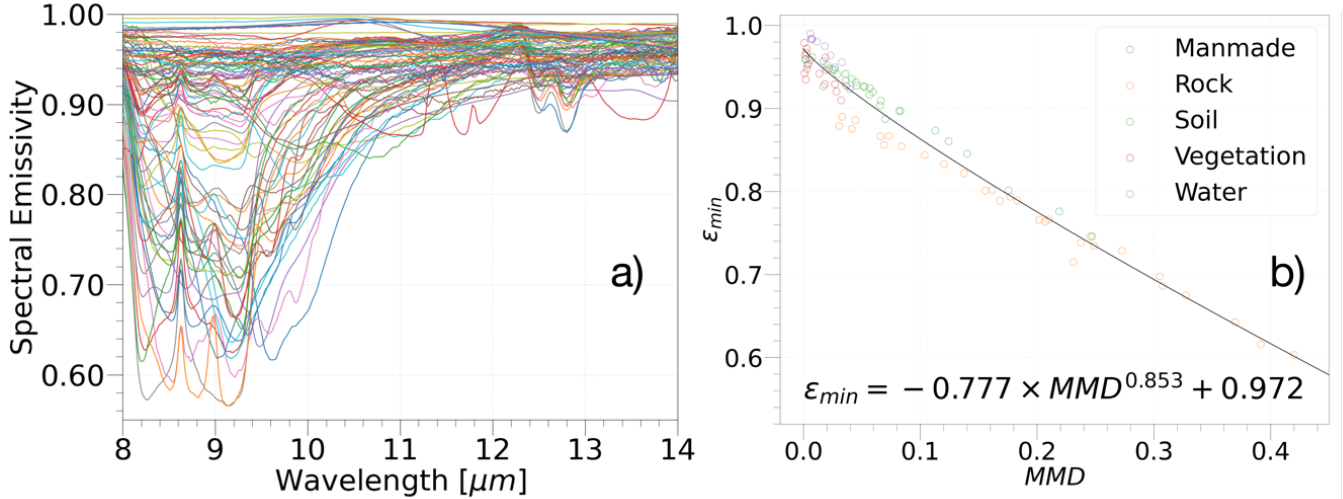


Fig. S3. a) Emissivity spectra of sample materials used for training the normalized emissivity method (NEM) module. Lines represent the emissivity spectra of sample materials. b) Minimum emissivity ($\epsilon_{\min}$) for TES channels estimated from the minimum-maximum emissivity difference (MMD) in the MERSI-LL FY-3E normalized emissivity method (NEM) module. Colored dots represent the minimum emissivity and MMD values for sample materials in the database. The black solid line represents the fitted line, with the $\epsilon_{\min}$ using MMD as a variable.

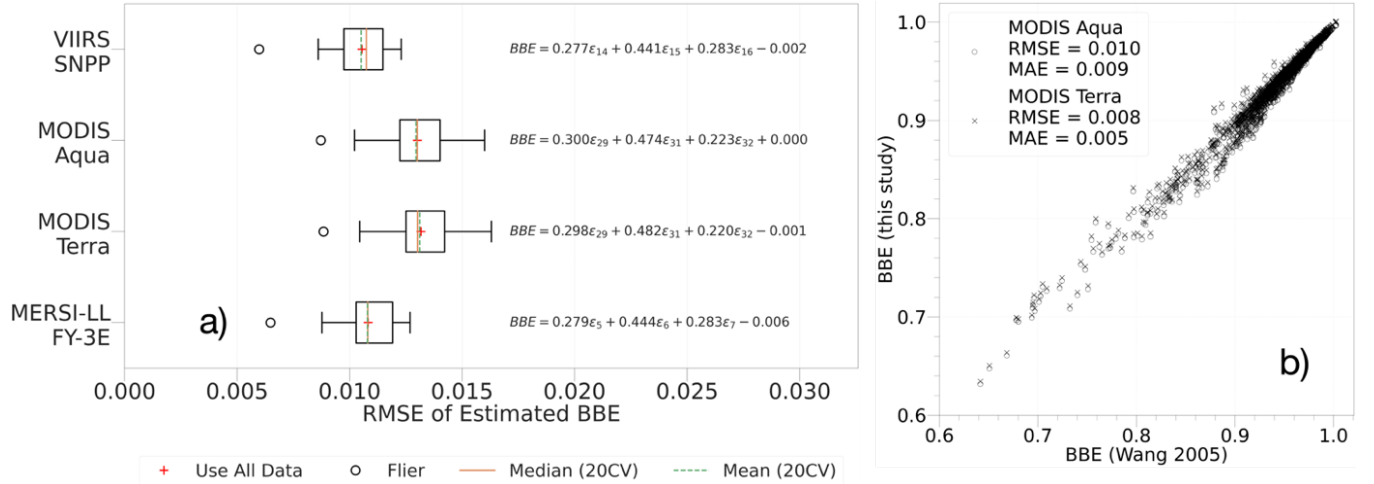


Fig. S4. a) Root Mean Square Error (RMSE) of Estimated Broadband Emissivity (BBE) using linear regression for each sensor-platform. The box plot represents the group RMSE of the estimated BBE in a 20-fold cross-validation. Red cross markers indicate training using all emissivity spectra and validation with the same data. Orange lines represent the median RMSE in the cross-validation groups, while green lines represent the average RMSE. b) Estimated BBE in this study comparing to previous study [1].

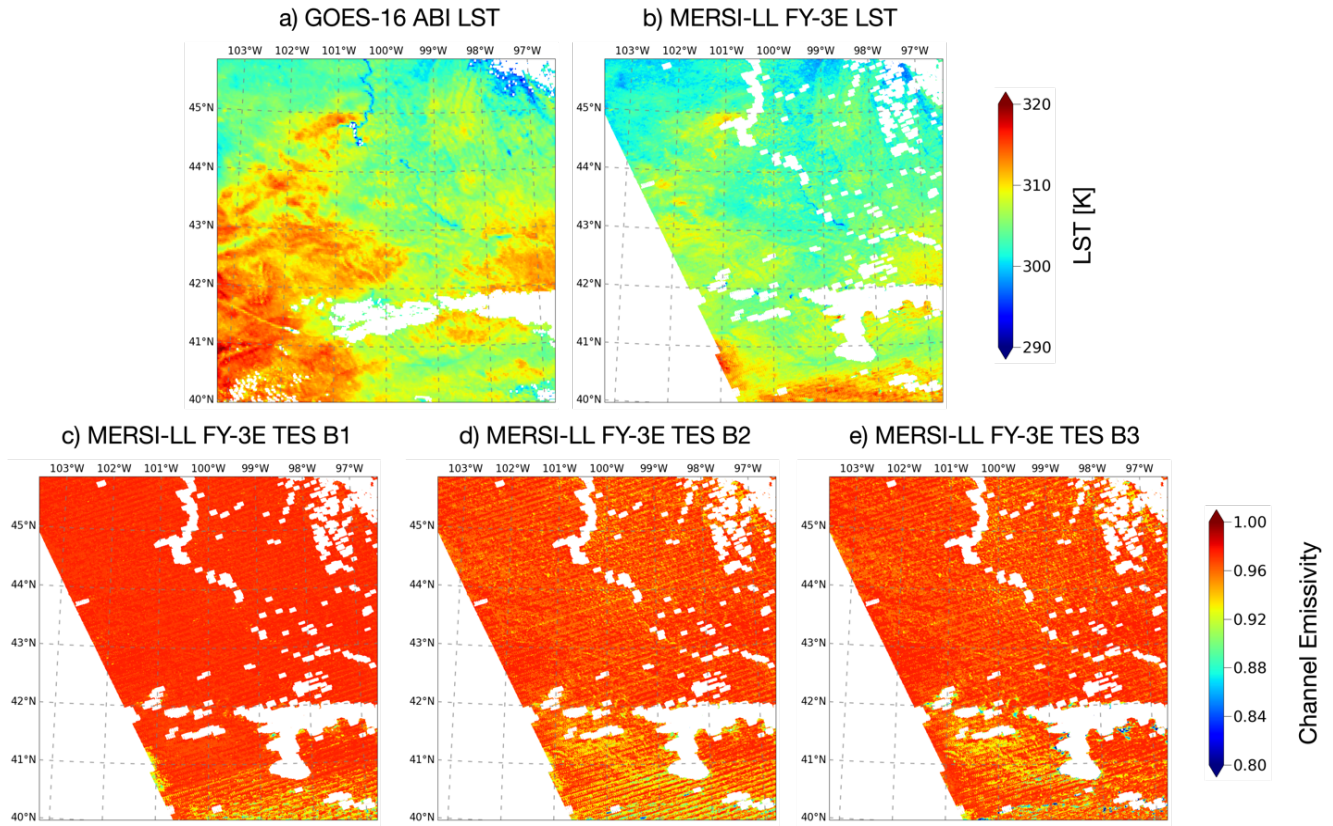


Fig. S5. Spatial patterns of land surface temperature (LST) estimated by (a) ABI GOES-16, and (b) MERSI-LL FY-3E, and MERSI-LL FY-3E channel emissivities (c-e) estimated in this study. The observation time is 16:15 on June 16 (local time), 2022 for ROI2.

TABLE SI

ROOT MEAN SQUARE ERROR (RMSE, UNIT: KELVIN) AND COEFFICIENTS OF ESTIMATED MERSI-LL FY-3E GROUND LEAVING EQUIVALENT BRIGHTNESS TEMPERATURE (BT(T_{G,i})) USING THE EMC/WVD METHOD (EQUATION 3 IN THE MAIN TEXT) AT DIFFERENT VZAS AND DIFFERENT BANDS. HERE, $p_{i,j}$, $q_{i,j}$, AND $r_{i,j}$ REPRESENT THE SIMULATED COEFFICIENTS.

VZA	Band	RMSE	$p_{i,0}$	$q_{i,0}$	$r_{i,0}$	$p_{i,5}$	$q_{i,5}$	$r_{i,5}$	$p_{i,6}$	$q_{i,6}$	$r_{i,6}$	$p_{i,7}$	$q_{i,7}$	$r_{i,7}$
0.00	5	0.191	-2.3439	0.3153	2.5702	-1.8741	0.1874	-0.2274	2.1857	-0.9583	0.8351	-0.3080	2.1821	-0.8773
	6	0.164	1.2136	0.3806	-0.1941	-0.1882	1.0315	0.3039	0.3299	-0.6363	0.0278	0.3925	0.2731	-0.6633
	7	0.185	-1.5724	-0.0052	-0.0027	0.0131	-1.3917	0.0386	-0.0983	0.0647	-1.2246	0.0293	-0.0934	0.0684
36.87	5	0.229	-2.4264	0.1893	2.5817	-1.7592	0.1864	-0.2671	2.2809	-1.0139	0.8360	-0.3372	2.2700	-0.9363
	6	0.210	1.9004	0.3824	-0.0756	-0.3110	1.4968	0.3327	0.3630	-0.6996	0.5941	0.3988	0.3259	-0.7242
	7	0.226	-2.2318	0.0174	-0.0365	0.0267	-2.0435	0.0529	-0.1203	0.0747	-1.8709	0.0463	-0.1177	0.0780
48.19	5	0.273	-2.3752	0.0835	2.6004	-1.6721	0.2325	-0.3029	2.3575	-1.0549	0.8814	-0.3649	2.3424	-0.9812
	6	0.260	2.5080	0.3939	0.0239	-0.4240	1.9392	0.3603	0.3973	-0.7628	1.1149	0.4120	0.3730	-0.7862
	7	0.274	-2.9792	0.0394	-0.0697	0.0406	-2.7835	0.0689	-0.1437	0.0849	-2.6096	0.0639	-0.1427	0.0881
55.15	5	0.322	-2.2605	-0.0036	2.6211	-1.6061	0.3006	-0.3345	2.4199	-1.0861	0.9482	-0.3899	2.4023	-1.0164
	6	0.314	3.0907	0.4072	0.1118	-0.5270	2.3999	0.3840	0.4346	-0.8250	1.6362	0.4261	0.4188	-0.8477
	7	0.326	-3.8177	0.0619	-0.1027	0.0543	-3.6161	0.0868	-0.1688	0.0952	-3.4426	0.0829	-0.1688	0.0983
60.00	5	0.376	-2.1206	-0.0752	2.6412	-1.5552	0.3748	-0.3618	2.4709	-1.1103	1.0217	-0.4121	2.4521	-1.0445
	6	0.372	3.7251	0.4178	0.1941	-0.6220	2.9410	0.4018	0.4768	-0.8867	2.2231	0.4373	0.4668	-0.9086
	7	0.382	-4.7586	0.0857	-0.1363	0.0676	-4.5517	0.1070	-0.1959	0.1055	-4.3787	0.1038	-0.1966	0.1087
63.61	5	0.435	-1.9857	-0.1339	2.6590	-1.5149	0.4375	-0.3851	2.5124	-1.1288	1.0844	-0.4312	2.4930	-1.0667
	6	0.434	4.4572	0.4241	0.2746	-0.7112	3.5987	0.4136	0.5247	-0.9484	2.9150	0.4444	0.5185	-0.9695
	7	0.443	-5.8069	0.1113	-0.1712	0.0808	-5.5945	0.1297	-0.2252	0.1161	-5.4218	0.1269	-0.2264	0.1193
66.42	5	0.606	-1.7373	-0.2222	2.6032	-1.3719	0.5262	-0.4268	2.4868	-1.0619	1.1615	-0.4668	2.4676	-1.0062
	6	0.607	5.3635	0.3849	0.4797	-0.8805	4.3609	0.3833	0.6829	-1.0790	3.7120	0.4094	0.6791	-1.0980
	7	0.613	-6.8123	0.1506	-0.2225	0.0968	-6.5754	0.1645	-0.2680	0.1278	-6.4017	0.1620	-0.2693	0.1309

TABLE SII

SIMULATED WATER VAPOR SCALING (WVS) COEFFICIENTS (a_i) FOR MERSI-LL FY-3E CHANNELS. THE ROOT MEAN SQUARE ERROR (RMSE: UNITLESS) FOR WAS CALCULATED USING A WVS FACTOR (γ) OF 0.9, γ_1 OF 1.0, γ_2 OF 0.7 (EQUATION 4 IN THE MAIN TEXT).

Band No. (i)	Band5	Band6	Band7
Coefficient (a_i)	1.453	1.841	1.783
RMSE of γ	2.752×10^{-3}	1.324×10^{-3}	1.614×10^{-3}

TABLE III

A LIST OF 46 OBSERVATION SITES USED FOR VALIDATING SATELLITE-BASED LAND SURFACE TEMPERATURE IN THIS STUDY.

ID	Network	Latitude	Longitude	Altitude	LC (Land cover category)	Reference
US-ARM	AmeriFlux	36.6058 °N	97.4888 °W	314 m	low_vegetation	[2]
US-Bi1	AmeriFlux	38.0992 °N	121.4993 °W	-2.7 m	low_vegetation	[3]
US-Bi2	AmeriFlux	38.1091 °N	121.5351 °W	-5 m	low_vegetation	[4]
US-Prr	AmeriFlux	65.1237 °N	147.4876 °W	210 m	tree	[5]
US-RGB	AmeriFlux	39.5782 °N	121.8579 °W	33 m	low_vegetation	[6]
US-Rms	AmeriFlux	43.0645 °N	116.7486 °W	2111 m	low_vegetation	[7]
US-Rpf	AmeriFlux	65.1198 °N	147.4290 °W	497 m	tree	[8]
US-Uaf	AmeriFlux	64.8663 °N	147.8555 °W	155 m	tree	[9]
US-xAB	AmeriFlux	45.7624 °N	122.3303 °W	363 m	tree	[10]
US-xAE	AmeriFlux	35.4106 °N	99.0588 °W	516 m	low_vegetation	[11]
US-xBN	AmeriFlux	65.1540 °N	147.5026 °W	263 m	tree	[12]
US-xDJ	AmeriFlux	63.8811 °N	145.7514 °W	529 m	tree	[13]
US-xKZ	AmeriFlux	39.1008 °N	96.5631 °W	381 m	low_vegetation	[14]
US-xMB	AmeriFlux	38.2483 °N	109.3883 °W	1767 m	low_vegetation	[15]
US-xNG	AmeriFlux	46.7697 °N	100.9154 °W	578 m	low_vegetation	[16]
US-xNQ	AmeriFlux	40.1776 °N	112.4524 °W	1685 m	low_vegetation	[17]
US-xRN	AmeriFlux	35.9641 °N	84.2826 °W	334 m	tree	[18]
US-xSE	AmeriFlux	38.8901 °N	76.5600 °W	15 m	tree	[19]
US-xST	AmeriFlux	45.5089 °N	89.5864 °W	481 m	tree	[20]
US-xTR	AmeriFlux	45.4937 °N	89.5857 °W	472 m	tree	[21]
US-xUK	AmeriFlux	39.0404 °N	95.1921 °W	335 m	tree	[22]
US-xUN	AmeriFlux	46.2339 °N	89.5373 °W	518 m	tree	[23]
US-xWD	AmeriFlux	47.1282 °N	99.2414 °W	579 m	low_vegetation	[24]
US-xWR	AmeriFlux	45.8205 °N	121.9519 °W	407 m	tree	[25]
BE-Bra	ICOS	51.3076 °N	4.5198 °E	16 m	tree	[26]
BE-Lon	ICOS	50.5516 °N	4.7462 °E	170 m	low_vegetation	[27]
BE-Maa	ICOS	50.9799 °N	5.6319 °E	87 m	tree	[28]
CZ-Lnz	ICOS	48.6816 °N	16.9463 °E	150 m	tree	[29]
DE-Geb	ICOS	51.0997 °N	10.9146 °E	161.5 m	low_vegetation	[30]

DE-HoH	ICOS	52.0866 °N	11.2224 °E	193 m	tree	[31]
DE-Tha	ICOS	50.9626 °N	13.5652 °E	380 m	tree	[32]
DK-Sor	ICOS	55.4859 °N	11.6446 °E	40 m	tree	[33]
FI-Hyy	ICOS	61.8474 °N	24.2948 °E	181 m	tree	[34]
FR-Fon	ICOS	48.4764 °N	2.7801 °E	103 m	tree	[35]
FR-Hes	ICOS	48.6741 °N	7.0647 °E	310 m	tree	[36]
FR-Pue	ICOS	43.7413 °N	3.5957 °E	271 m	tree	[37]
IT-Cp2	ICOS	41.7043 °N	12.3573 °E	19 m	tree	[38]
IT-Ren	ICOS	46.5869 °N	11.4337 °E	1735.6 m	tree	[39]
IT-SR2	ICOS	43.7320 °N	10.2909 °E	4 m	tree	[40]
SE-Htm	ICOS	56.0976 °N	13.4190 °E	115 m	tree	[41]
SE-Nor	ICOS	60.0865 °N	17.4795 °E	45 m	tree	[42]
SE-Svb	ICOS	64.2561 °N	19.7745 °E	267 m	tree	[43]
bon	SURFRAD	40.0500 °N	88.3700 °W	213 m	low_vegetation	[44]
dra	SURFRAD	36.6240 °N	116.0190 °W	1007 m	solid (barren)	[44]
fpk	SURFRAD	48.3100 °N	105.1000 °W	634 m	low_vegetation	[44]
sxf	SURFRAD	43.7300 °N	96.6200 °W	473 m	low_vegetation	[44]

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