

Supplementary Material for “Land Surface Model Underperformance Tied to Specific Meteorological Conditions”

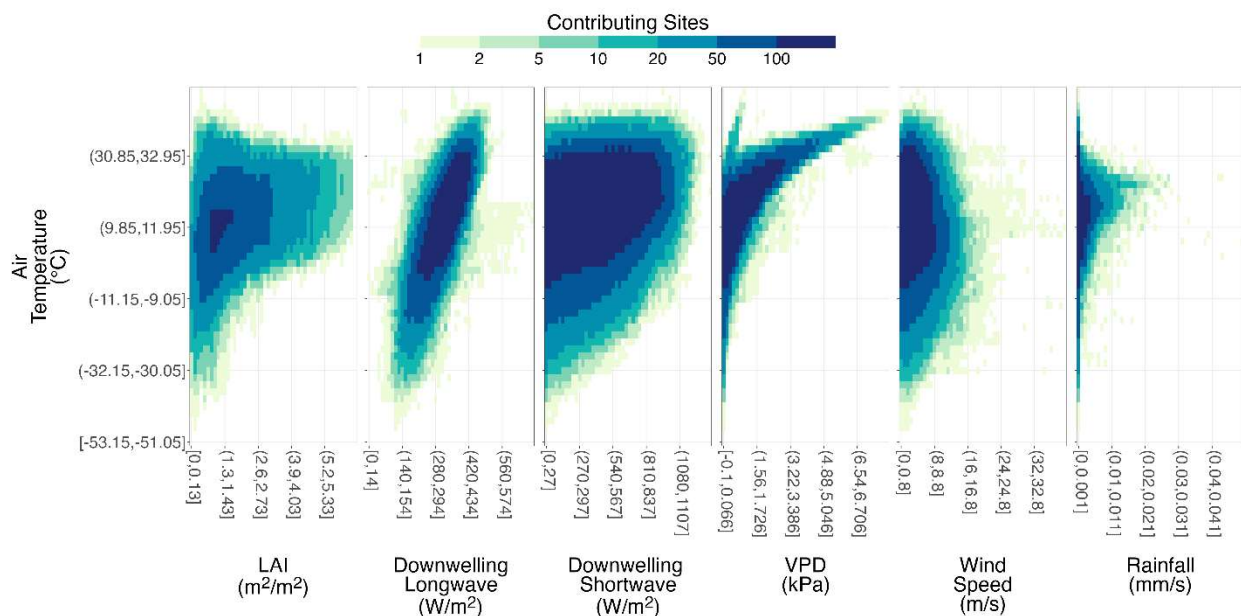


Figure S1: Number of sites contributing to each bin. The y-axis of each plot is air temperature and the x-axis the other variables, each split into 50 equal-sized bins with every 10th bin labelled. The colour indicates the number of sites for which at least one timestep fell within the corresponding 2-D variable cell.

Table S1: $iNMV$ Values for 95% LRF. 'Orig.' is the original $iNMV$ for the model. 'Diff.' is the difference between $iNMV_{original}$ and $iNMV_{95\%}$. 'Rel. Diff.' is the relative difference $Diff / iNMV_{original}$.

Model	Qh				Qle				NEE			
	Orig.	95% LRF	Diff.	Rel. Diff.	Orig.	95% LRF	Diff.	Rel. Diff.	Orig.	95% LRF	Diff.	Rel. Diff.
CABLE	2.02	0.94	1.08	53%	0.59	0.13	0.46	78%	0.42	0.26	0.17	39%
CABLE-POP	2.20	0.69	1.52	69%	0.62	0.31	0.31	51%	0.88	0.60	0.28	32%
CHTESSEL_1	2.19	1.37	0.83	38%	0.67	0.09	0.59	87%	0.71	0.39	0.32	45%
CLM5	1.37	0.58	0.80	58%	0.54	0.10	0.44	82%	NA	NA	NA	NA
GFDL	3.79	2.93	0.85	23%	2.93	1.75	1.18	40%	0.86	0.57	0.29	34%
JULES_GL9	1.98	1.23	0.75	38%	0.67	0.04	0.63	94%	NA	NA	NA	NA
JULES_GL9_LAI	2.16	1.20	0.96	44%	0.79	0.17	0.62	78%	NA	NA	NA	NA
MATSIRO	1.43	0.46	0.97	68%	0.88	0.36	0.51	58%	NA	NA	NA	NA
NoahMP	1.03	0.45	0.59	57%	0.31	-0.04	0.35	114%	1.75	1.29	0.46	26%
ORCHIDEE2	1.90	1.10	0.80	42%	0.61	0.11	0.50	81%	0.69	0.42	0.27	39%
ORCHIDEE3	2.02	1.15	0.88	43%	0.69	0.09	0.61	88%	1.04	0.69	0.35	34%

Table S2: *i*NMV Values for 50% LRF. 'Orig.' is the original *i*NMV for the model. 'Diff.' is the difference between *i*NMV_{original} and *i*NMV_{50%}. 'Rel. Diff.' is the relative difference $\text{Diff} / \text{iNMV}_{\text{original}}$.

Model	Qh				Qle				NEE			
	Orig.	50% LRF	Diff.	Rel. Diff.	Orig.	50% LRF	Diff.	Rel. Diff.	Orig.	50% LRF	Diff.	Rel. Diff.
CABLE	2.02	-0.12	2.14	106%	0.59	-0.05	0.64	109%	0.42	0.15	0.27	65%
CABLE-POP	2.20	-0.12	2.33	106%	0.62	0.12	0.50	81%	0.88	0.43	0.45	51%
CHTESSEL_1	2.19	0.34	1.85	84%	0.67	-0.18	0.85	127%	0.71	0.39	0.32	45%
CLM5	1.37	-0.13	1.51	110%	0.54	-0.08	0.62	115%	NA	NA	NA	NA
GFDL	3.79	0.52	3.27	86%	2.93	0.05	2.88	98%	0.86	0.43	0.43	50%
JULES_GL9	1.98	0.22	1.77	89%	0.67	-0.20	0.87	130%	NA	NA	NA	NA
JULES_GL9_LAI	2.16	0.19	1.97	91%	0.79	-0.18	0.97	122%	NA	NA	NA	NA
MATSIRO	1.43	-0.20	1.63	114%	0.88	0.02	0.86	98%	NA	NA	NA	NA
NoahMP	1.03	-0.01	1.05	101%	0.31	-0.19	0.50	163%	1.75	0.37	1.38	79%
ORCHIDEE2	1.90	0.17	1.73	91%	0.61	-0.11	0.72	117%	0.69	0.34	0.35	51%
ORCHIDEE3	2.02	0.21	1.81	89%	0.69	-0.14	0.84	121%	1.04	0.50	0.53	51%

Table S3: *i*NMV Values for 'Physical' LRF. 'Orig.' is the original *i*NMV for the model. 'Diff.' is the difference between *i*NMV_{original} and *i*NMV_{Physical}. 'Rel. Diff.' is the relative difference $\text{Diff} / \text{iNMV}_{\text{original}}$.

Model	Qh				Qle				NEE			
	Orig.	Physical LRF	Diff.	Rel. Diff.	Orig.	Physical LRF	Diff.	Rel. Diff.	Orig.	Physical LRF	Diff.	Rel. Diff.
CABLE	2.02	1.98	0.04	2%	0.59	0.60	-0.01	-1%	0.42	0.41	0.01	2%
CABLE-POP	2.20	2.17	0.03	2%	0.62	0.63	-0.01	-2%	0.88	0.89	-0.01	-1%
CHTESSEL_1	2.19	2.13	0.06	3%	0.67	0.63	0.04	6%	0.71	0.72	-0.01	-2%
CLM5	1.37	1.32	0.05	4%	0.54	0.53	0.01	2%	NA	NA	NA	NA
GFDL	3.79	3.76	0.02	1%	2.93	2.97	-0.04	-2%	0.86	0.85	0.01	1%
JULES_GL9	1.98	1.92	0.06	3%	0.67	0.67	0.00	0%	NA	NA	NA	NA
JULES_GL9_LAI	2.16	2.09	0.07	3%	0.79	0.79	0.00	0%	NA	NA	NA	NA
MATSIRO	1.43	1.38	0.06	4%	0.88	0.87	0.00	0%	NA	NA	NA	NA
NoahMP	1.03	0.99	0.04	4%	0.31	0.31	0.00	0%	1.75	1.68	0.06	3%
ORCHIDEE2	1.90	1.84	0.05	3%	0.61	0.61	0.00	1%	0.69	0.70	-0.01	-2%
ORCHIDEE3	2.02	1.97	0.05	3%	0.69	0.70	0.00	0%	1.04	1.04	-0.01	-1%

Table S4: iNMV Values for 'Daytime' LRF. 'Orig.' is the original iNMV for the model. 'Diff.' is the difference between $iNMV_{original}$ and $iNMV_{Daytime}$. 'Rel. Diff.' is the relative difference $Diff / iNMV_{original}$.

Model	Qh				Qle				NEE			
	Orig.	Daytime LRF	Diff.	Rel. Diff.	Orig.	Daytime LRF	Diff.	Rel. Diff.	Orig.	50% LRF	Diff.	Rel. Diff.
CABLE	2.02	2.50	-0.48	-24%	0.59	1.03	-0.44	-75%	0.42	0.56	-0.14	-32%
CABLE-POP	2.20	3.23	-1.03	-47%	0.62	1.04	-0.42	-68%	0.88	1.25	-0.37	-41%
CHTESSEL_1	2.19	2.37	-0.17	-8%	0.67	1.15	-0.48	-71%	0.71	1.47	-0.76	-108%
CLM5	1.37	1.61	-0.23	-17%	0.54	1.04	-0.50	-92%	NA	NA	NA	NA
GFDL	3.79	3.75	0.04	1%	2.93	3.25	-0.32	-11%	0.86	1.24	-0.38	-45%
JULES_GL9	1.98	1.85	0.14	7%	0.67	1.19	-0.52	-79%	NA	NA	NA	NA
JULES_GL9_LAI	2.16	2.37	-0.21	-10%	0.79	1.28	-0.49	-61%	NA	NA	NA	NA
MATSIRO	1.43	1.84	-0.40	-28%	0.88	1.30	-0.42	-48%	NA	NA	NA	NA
NoahMP	1.03	1.31	-0.28	-27%	0.31	0.67	-0.37	-120%	1.75	0.47	1.27	73%
ORCHIDEE2	1.90	1.94	-0.05	-2%	0.61	1.07	-0.45	-74%	0.69	1.22	-0.53	-76%
ORCHIDEE3	2.02	2.15	-0.13	-6%	0.69	1.21	-0.51	-74%	1.04	1.41	-0.37	-36%

Table S5: iNMV Values for 'Windy' LRF. 'Orig.' is the original iNMV for the model. 'Diff.' is the difference between $iNMV_{original}$ and $iNMV_{Windy}$. 'Rel. Diff.' is the relative difference $Diff / iNMV_{original}$.

Model	Qh				Qle				NEE			
	Orig.	Windy LRF	Diff.	Rel. Diff.	Orig.	Windy LRF	Diff.	Rel. Diff.	Orig.	Windy LRF	Diff.	Rel. Diff.
CABLE	2.02	2.34	-0.32	-16%	0.59	0.83	-0.25	-42%	0.42	0.40	0.02	5%
CABLE-POP	2.20	2.35	-0.15	-7%	0.62	0.81	-0.19	-30%	0.88	0.91	-0.02	-3%
CHTESSEL_1	2.19	2.35	-0.15	-7%	0.67	0.96	-0.28	-42%	0.71	0.84	-0.13	-19%
CLM5	1.37	1.40	-0.03	-2%	0.54	0.74	-0.21	-38%	NA	NA	NA	NA
GFDL	3.79	3.98	-0.19	-5%	2.93	3.84	-0.91	-31%	0.86	0.89	-0.03	-4%
JULES_GL9	1.98	1.99	-0.01	0%	0.67	0.97	-0.3	-45%	NA	NA	NA	NA
JULES_GL9_LAI	2.16	2.22	-0.06	-3%	0.79	1.17	-0.37	-47%	NA	NA	NA	NA
MATSIRO	1.43	1.47	-0.04	-3%	0.88	1.09	-0.21	-24%	NA	NA	NA	NA
NoahMP	1.03	1.06	-0.03	-3%	0.31	0.49	-0.18	-59%	1.75	1.67	0.08	4%
ORCHIDEE2	1.90	1.84	0.06	3%	0.61	0.83	-0.22	-36%	0.69	0.80	-0.11	-16%
ORCHIDEE3	2.02	1.98	0.04	2%	0.69	0.95	-0.26	-37%	1.04	1.08	-0.04	-4%