

Supplementary Material 2

to 'Kraemer & Kabisch 2022. Parks under stress: air temperature regulation of urban green spaces under conditions of drought and summer heat.'

Details on random forest regression models

The random forest models for predicting hourly air temperatures from 6:00 on 30th to 6:00 on July 1st 2019 showed a wide range of performance quality. We optimized models using different combinations of predictors (cf. Supplementary Table 2.1 below). At this, NDVI turned out to be important for all 25 models to achieve best possible outcomes. On the other hand, the land-cover data improved model performance only in 12 cases. Nevertheless, we could achieve reasonable model outcomes only for eight points in time for which we found an OOB R^2 of at least 0.25 and a maximum OOB error of 0.5 °C. Ten models had OOB- R^2 values below 0.25, and another seven showed particular poor performance with a negative OOB R^2 . Validation, however, whenever applicable, showed comparably good results with a maximum standard error of 0.26 °C. Temperature offsets between modelled and measured values largely correspond to model performance. The eight best evaluated models showed relative temperature offsets below 0.42 (or 42%) whereas offsets above 0.5 (or 50%) were all related to poorly performing models (OOB $R^2 < 0.12$).

Table 2.1. Attributes (training and validation data, predictors used – marked with an X, error estimates) for the 25 random forest models. Selected models for detailed spatial assessment are highlighted in grey. Acronyms: LC – land cover, nDSM – normalized Digital Surface Model, NDVI – Normalized Difference Vegetation Index, DEM – Digital Elevation Model, DOP – Digital Orthophoto, OOB – Out-of-bag.

Model	Model number																								
attributes	T0	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24
Points available	31	25	20	20	19	20	21	22	22	25	25	25	28	27	28	29	32	32	32	32	32	32	32	32	32
Park points	19	19	19	19	18	18	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Street points	12	6	1	1	1	2	2	3	3	6	6	6	9	8	9	10	13	13	13	13	13	13	13	13	13
Validation	Yes	No	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Validation points	7	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7	8	8	8	8	8	8	8	8	8
No trees	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Predictors																									
LC	X		X	X	X	X	X		X		X							X		X	X	X			
nDSM	X	X			X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
NDVI	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DEM	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X
DOP_Blue	NA	NA	NA	NA	NA	NA	NA	NA	X	X			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OOB error	0.37	0.50	0.35	0.36	0.28	1.39	1.09	0.56	0.57	0.39	0.28	0.28	0.39	0.32	0.30	0.22	0.52	0.56	0.05	0.07	0.07	0.09	0.19	0.20	0.11
OOB R²	0.12	0.05	0.60	0.60	0.56	-0.26	-0.28	-0.08	0.08	0.46	0.39	0.38	0.11	-0.24	0.04	0.35	0.18	0.17	0.12	-0.09	-0.17	-0.07	0.04	0.01	0.29
Validation error	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.21	NA	0.19	0.08	0.12	0.12	0.05	0.10	0.07	0.08	0.16	0.17	0.17
Validation R2	0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.01	NA	0.22	0.37	0.00	0.18	0.09	0.10	0.24	0.03	0.16	0.07	0.06
Tmin pred	18.77	20.82	22.83	26.23	29.44	31.43	33.30	34.87	35.89	36.69	37.33	37.68	37.26	36.20	34.63	32.59	28.87	27.76	28.38	26.94	24.80	23.36	22.00	21.33	21.54
Tmax pred	20.08	22.54	24.99	28.52	31.19	33.93	35.12	36.41	37.65	38.82	39.01	39.32	38.69	37.19	35.91	34.03	30.60	29.52	28.94	27.44	25.24	23.93	22.98	22.33	22.45
Amplitude_pred	1.31	1.72	2.16	2.30	1.74	2.50	1.82	1.54	1.76	2.12	1.68	1.64	1.43	0.99	1.27	1.44	1.73	1.76	0.55	0.50	0.44	0.58	0.98	1.00	0.90
Tmin measured	18.29	20.33	22.48	25.93	28.98	31.15	32.72	34.15	35.13	36.17	36.94	37.13	36.93	35.90	34.04	32.12	28.33	26.73	27.95	26.70	24.53	23.14	21.74	20.60	21.34
Tmax measured	20.58	23.10	25.50	29.32	31.56	35.63	36.38	36.80	38.22	39.32	39.59	39.66	39.57	37.67	36.36	34.57	31.74	30.01	29.36	27.85	25.59	24.33	23.33	22.75	22.67
Amplitude	2.30	2.77	3.02	3.39	2.58	4.48	3.66	2.64	3.09	3.14	2.65	2.53	2.64	1.77	2.32	2.45	3.41	3.28	1.41	1.15	1.06	1.20	1.59	2.15	1.33
Tmin offset	0.48	0.48	0.35	0.30	0.46	0.27	0.58	0.71	0.76	0.52	0.40	0.55	0.33	0.30	0.60	0.48	0.54	1.03	0.43	0.24	0.27	0.22	0.27	0.73	0.20
Tmax offset	-0.50	-0.56	-0.51	-0.79	-0.38	-1.70	-1.26	-0.39	-0.57	-0.50	-0.58	-0.34	-0.88	-0.48	-0.45	-0.54	-1.13	-0.49	-0.42	-0.41	-0.35	-0.40	-0.34	-0.42	-0.22
Offset absolute	0.99	1.05	0.86	1.09	0.84	1.97	1.85	1.10	1.33	1.02	0.97	0.89	1.21	0.78	1.05	1.02	1.68	1.52	0.85	0.65	0.62	0.62	0.61	1.15	0.42
Offset relative	0.43	0.38	0.28	0.32	0.32	0.44	0.50	0.42	0.43	0.32	0.37	0.35	0.46	0.44	0.45	0.41	0.49	0.46	0.61	0.56	0.59	0.52	0.38	0.53	0.32