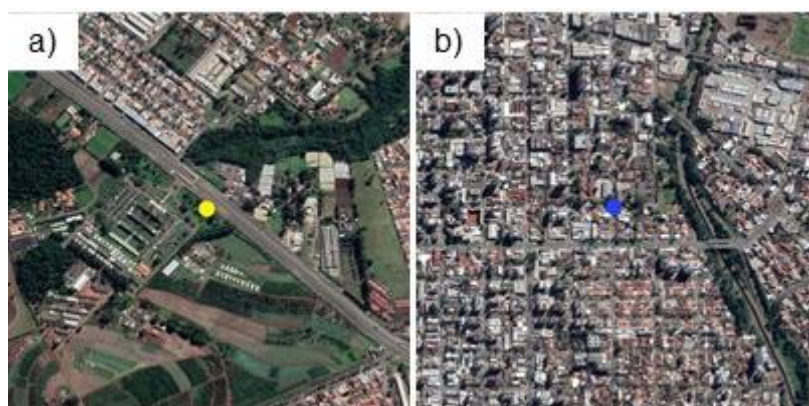**Supplementary Material**

Figure S1. a) SIMEPAR and b) IAT monitoring station.
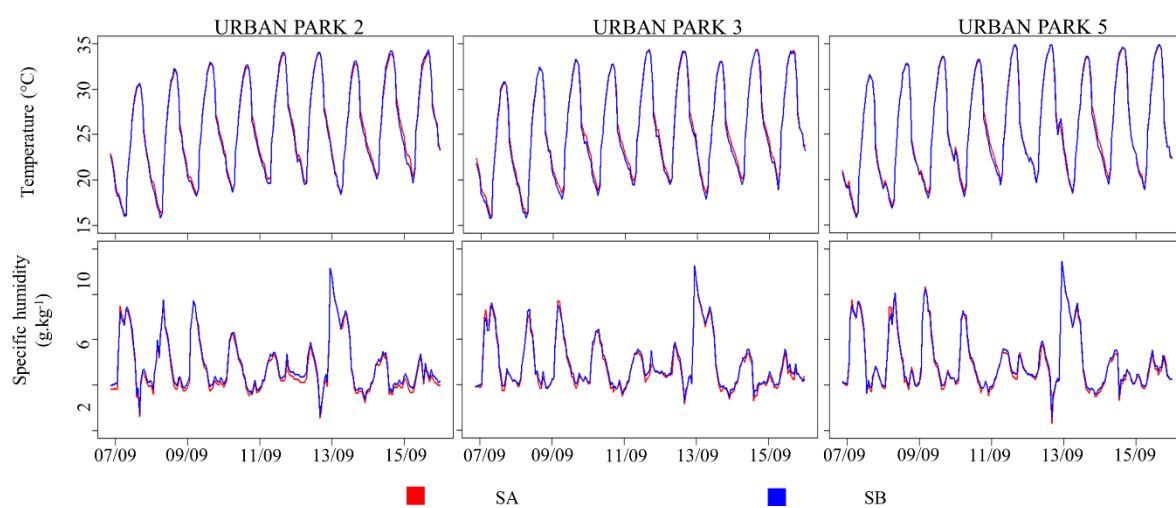

Figure S2. Temporal evaluation of temperature and specific humidity simulated at urban parks 2, 3 and 5.
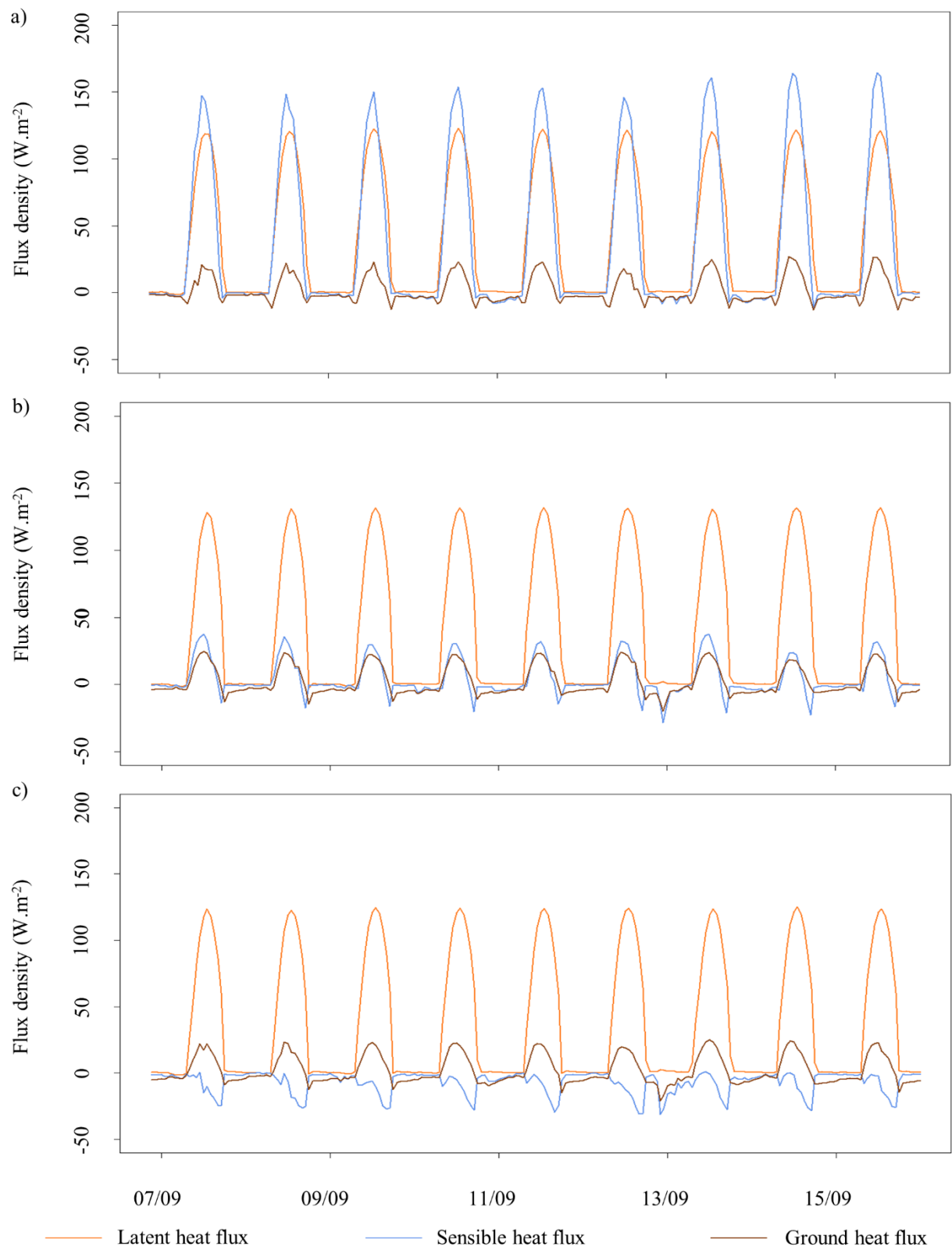
Figure S3. Diurnal difference (SB - SA) of simulated surface energy fluxes (W.m^{-2}) at a) UP 2, b) UP3, and c) UP5.

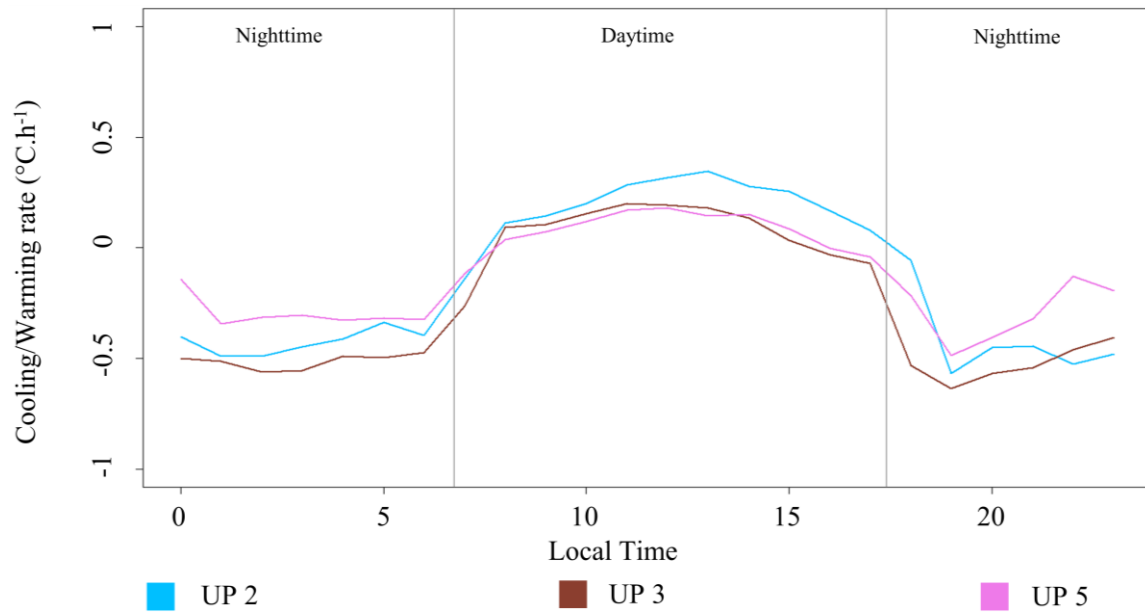**Figure S4.** Diurnal cooling/warming rates (∘C.h⁻¹) calculated from the SA and SB simulations. compared to rates calculated from hourly air temperature observations at UP2, UP3, and UP5.

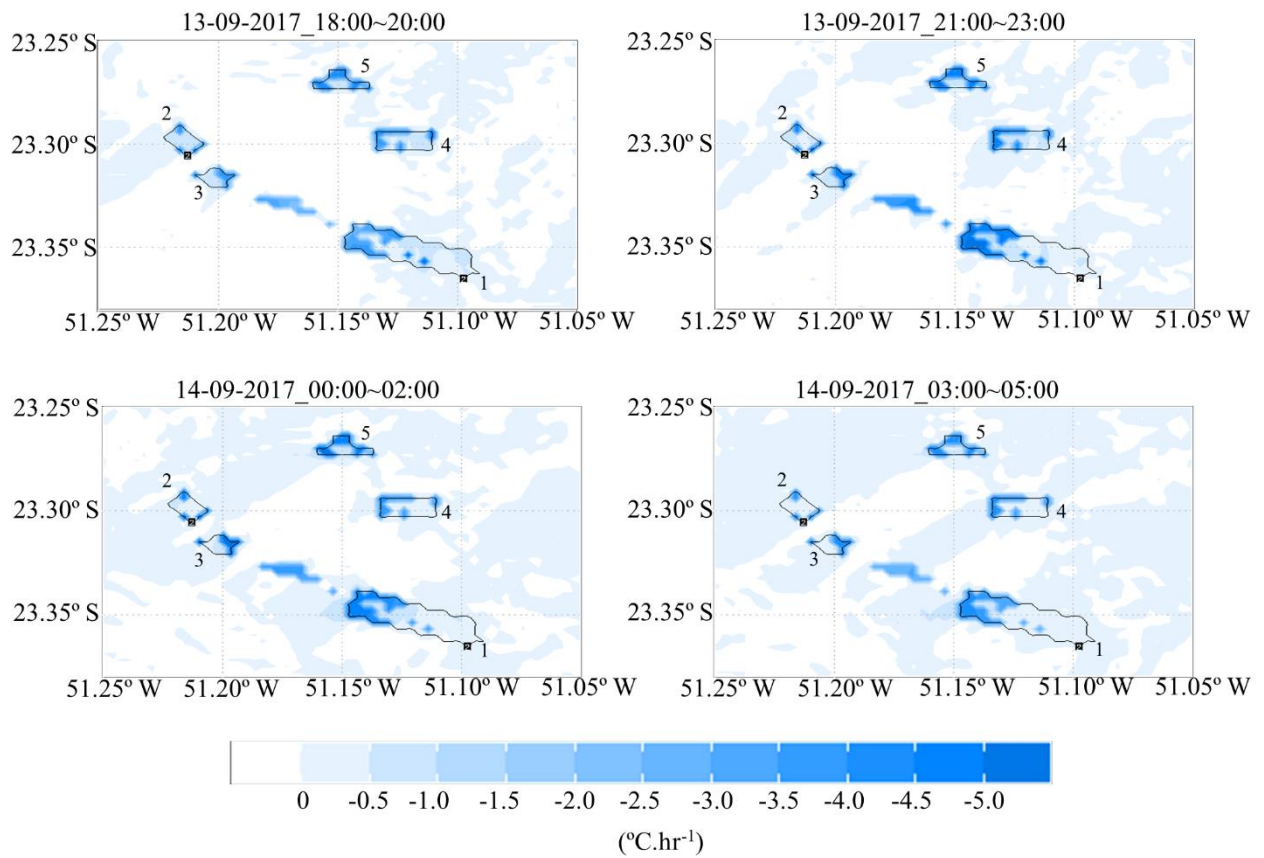**Figure S5.** Mean spatial differences (SB - SA) of T2 temperatures (ºC.h⁻¹) during nighttime (September 13th to 14th). Note: Park's delimitation in black outline).

Table S1. Characteristics of LCZ urban classes.

Class	Mean height (m)	Street width (m)	Mean building width (m)
31	37.5	6.0	25.0
32	17.5	6.0	17.5
33	7.5	6.0	6.5
34	37.5	6.0	25.0
35	17.5	6.0	17.5
36	7.5	6.0	6.5
37	7.5	5.3	10.0
38	7.5	12.5	35.0
39	7.5	5.3	6.5
40	3.3	12.5	225.0

Table S2. Dimensions of urban GIs (Lake and Parks).

Urban Parks	Centroid (°)		Area (km²)	Grid points
	Latitude	Longitude		
1	-23.35	-51.13	8.00	72
2	-23.30	-51.22	2.00	18
3	-23.32	-51.20	1.56	14
4	-23.30	-51.13	4.00	36
5	-23.27	-51.15	2.78	25
Lake	-23.33	-51.16	1.77	16
Total			20.11	181

Table S3. Accuracy Matrix for MAL WUDAPT Level "0", with known (vertical axis) vs. predicted (horizontal axis) test-class frequencies.

Defined/Predicted	31	32	33	35	36	37	38	39	40	∑ Pixels	User's accuracy (%)
31	7	0	2	4	16	0	9	12	0	50	14
32	0	20	18	0	0	0	12	0	0	50	40
33	0	1	37	3	3	0	2	4	0	50	74
35	1	3	3	2	1	0	3	0	0	13	15
36	0	3	1	3	41	0	1	1	0	50	82
37	0	0	0	0	0	4	0	0	0	4	100
38	2	3	7	1	0	0	36	1	0	50	72
39	0	0	0	0	2	0	1	47	0	50	94
40	0	0	2	0	5	0	1	28	14	50	28
∑ Pixels	10	30	70	13	68	4	65	93	14	367	
Producer's accuracy (%)	70	67	53	15	60	100	55	51	100		57
Overall Accuracy (%)									67		

Table S4. Statistical performance of simulations for meteorological variables at domain d03.

Variable	Station	Simulation	Mean$_{obs}$	Mean$_{sim}$	σ_{obs}	σ_{sim}	r	BIAS	RMSE	S$_{pielke}$
T2 (°C)	IAT	DEFAULT	26.99	27.59	4.75	4.08	0.97	0.59	1.47	0.66
		WUDAPT		27.11		3.76	0.96	0.11	1.55	0.92
	SIMEPAR	DEFAULT	25.19	27.67	5.30	4.26	0.96	2.48	3.00	0.89
		WUDAPT		27.07		3.88	0.96	1.88	2.71	1.00
Q2 (g.kg^{-1})	IAT	DEFAULT	6.49	6.86	0.71	1.33	0.51	0.37	1.16	3.21
		WUDAPT		6.85		1.29	0.51	0.36	1.20	3.09
	SIMEPAR	DEFAULT	6.94	6.68	0.65	1.36	0.43	-0.25	1.20	4.15
		WUDAPT		6.87		1.33	0.43	-0.01	1.26	3.86
WS10 (m.s^{-1})	IAT	DEFAULT	0.65	2.43	0.40	1.15	0.51	1.78	2.04	7.26
		WUDAPT		1.12		0.52	0.39	0.47	0.69	2.49
	SIMEPAR	DEFAULT	2.15	2.45	1.01	1.23	0.58	0.29	1.08	1.94
		WUDAPT		1.25		0.60	0.48	-0.91	1.27	5.31