Supplementary material

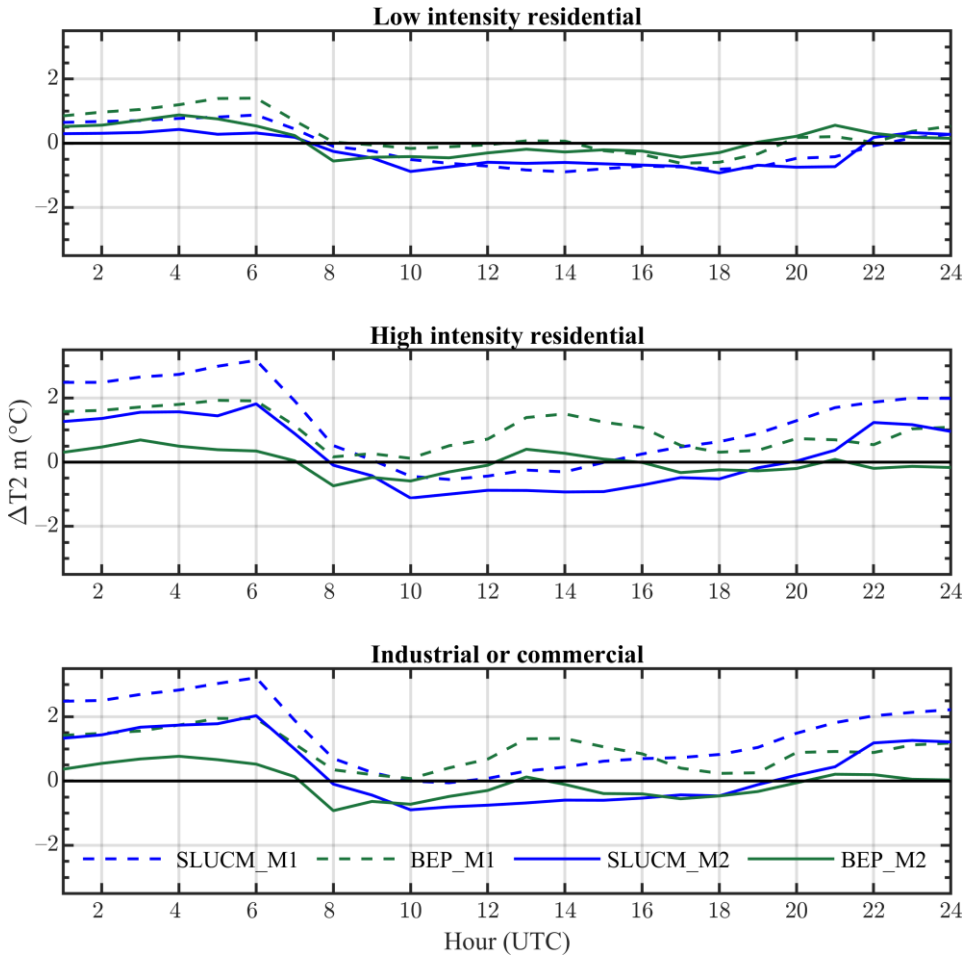

Figure S1. Heatwave mean diurnal cycle decomposition of the near-surface UHI into *Low intensity residential* (top), *High intensity residential* (middle) and *Industrial or commercial* (bottom) using Method 1 (M1 - dashed lines) and Method 2 (M2 - solid lines), for SLUCM (blue lines) and BEP (green lines) UCMs.

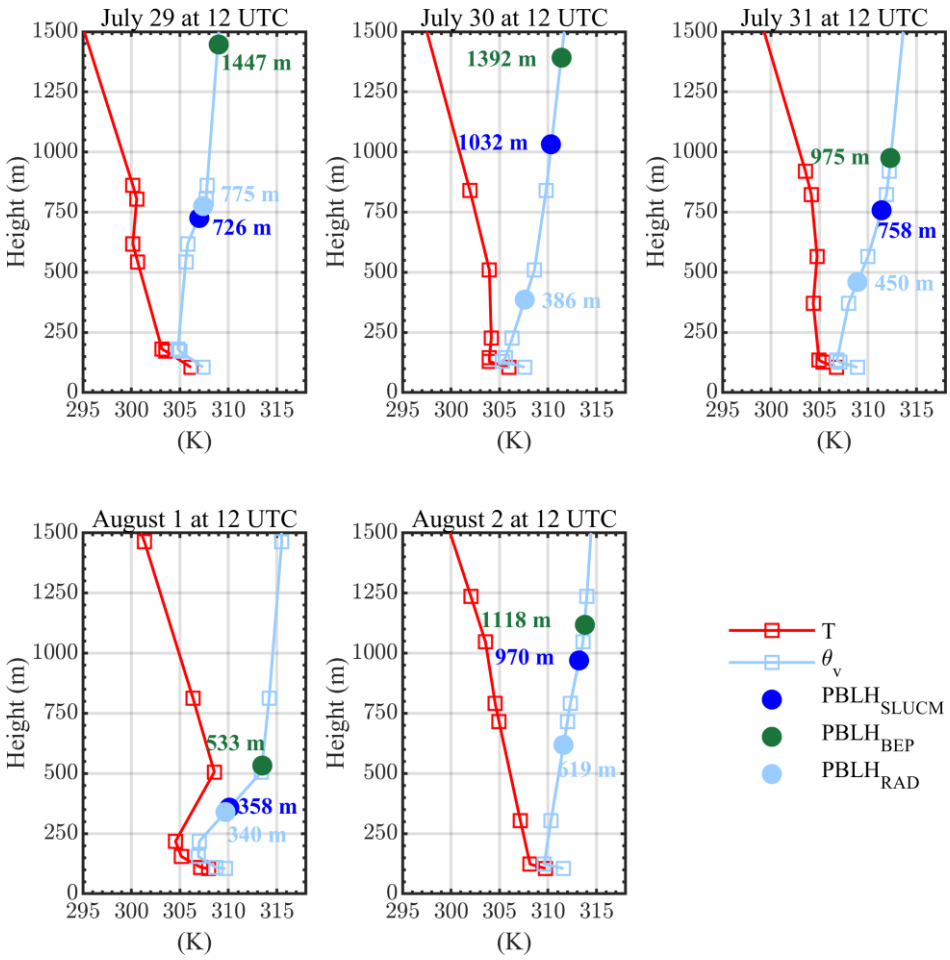

Figure S2. Vertical temperature (T) and virtual potential temperature (θ_v) profiles from sounding at Gago Coutinho meteorological station location, and comparison between modelled ($PBLH_{SLUCM}$ and $PBLH_{BEP}$) and observed ($PBLH_{RAD}$) PBLH.

Table S1. Equivalences between land use categories from CORINE 2012 and USGS33 classification system, together with the respective surface properties for the summer period. Adapted from Pineda et al. (2004) [1] and Carvalho et al. (2017) [2].

Category equivalence				Surface properties (summer values)					
CORINE 2012	Description	USGS33	Description	Albedo [%]	Soil moisture [%]	Surface emissivity [%]	Roughness length [cm]	Thermal inertia [cal cm^{-2} K^{-1} $s^{-1/2}$]	Thermal capacity [10^5 J m^{-3} K^{-1}]
1	Continuous urban fabric	32	High intensity residential (HIR)	10	10	97	80	3	18.9
2	Discontinuous urban fabric	31	Low intensity residential (LIR)	10	10	97	80	3	18.9
3	Industrial or commercial units	33	Industrial or commercial (IC)	10	10	97	80	3	18.9
4	Road and rail networks and associated land								
5	Port areas								
6	Airports								
7	Mineral extraction sites								
8	Dump sites								
9	Construction sites								
11	Sport and leisure facilities								
12	Non-irrigated arable land	2	Dryland cropland and pasture	17	30	98.5	15	4	25
18	Pastures								
10	Green urban areas	3	Irrigated cropland and pasture	18	50	98.5	10	4	25
13	Permanently irrigated land								
14	Rice fields								
15	Vineyards	6	Cropland/woodland mosaic	16	35	98.5	20	4	25
16	Fruit trees and berry plantations								
17	Olive groves								
19	Annual crops associated with permanent crops								
20	Complex cultivation patterns								

21	Land principally occupied by agriculture, with significant areas of natural vegetation								
22	Agro-forestry areas								
26	Natural grassland	7	Grassland	19	15	96	12	3	20.8
27	Moors and heathland	9	Mixed shrubland/grassland	20	15	95	6	3	20.8
28	Sclerophyllous vegetation								
29	Transitional woodland-scrub								
23	Broad-leaved forest	11	Deciduous broadleaf forest	16	30	93	50	4	25
24	Coniferous forest	14	Evergreen broadleaf forest	12	30	95	50	4	29.2
25	Mixed forest	15	Mixed forest	13	30	97	50	4	41.8
40	Water courses	16	Water bodies	8	100	98	0.01	6	9
41	Water bodies								
42	Coastal lagoons								
43	Estuaries								
44	Sea and ocean								
35	Inland marshes	17	Herbaceous Wetland	14	60	95	20	6	29.2
36	Peat bogs								
37	Salt marshes								
38	Salines								
39	Intertidal flats								
30	Beaches, dunes and sands	19	Barren or sparsely vegetated	25	2	90	1	2	12
31	Bare rocks								
32	Sparsely vegetated areas								
33	Burnt areas								
34	Glaciers and perpetual snow	24	Snow or ice	55	95	95	0.1	5	9

Table S2. Statistics and error measures of observed and modelled (for SLUCM, BEP, NO_SLUCM, and NO_BEP) T2m during the heatwave period at the nine meteorological stations locations. Values for NO_SLUCM and NO_BEP are shown only as averages of all the stations, except for BIAS that shows values for every station. Temperature units are °C.

	Observations				SLUCM/BEP (NO_SLUCM/NO_BEP)								
Station name	Min. T	Max. T	Mean T	STD_OBS	Min. T	Max. T	Mean T	BIAS	RMSE	STDE	STD_MOD	RMSD	r
Lisbon/Alvalade	20.3	43.5	30.5	5.7	20.7/21.9	39.8/40.7	29.8/30.5	-0.7/0.0 (0.9/0.9)	2.8/2.7	2.7/2.7	5.3/4.9	2.7/2.7	0.88/0.88
Amadora	20.6	43.3	30.0	5.6	20.6/22.5	39.2/39.7	29.7/30.4	-0.3/0.4 (1.0/1.2)	2.5/2.8	2.5/2.7	4.9/4.5	2.5/2.7	0.89/0.87
Lisbon/Baixa	20.5	42.3	30.6	5.7	23.1/22.8	40.5/41.1	31.0/30.9	0.4/0.3 (1.4/1.3)	2.9/2.7	2.9/2.7	4.8/5.2	2.9/2.7	0.87/0.88
Lisbon/Benfica	18.7	45.3	30.5	6.6	20.0/22.4	40.2/40.8	29.5/30.4	-1.0/-0.1 (1.0/1.1)	3.2/3.3	3.0/3.3	5.4/4.9	3.0/3.3	0.90/0.87
Barreiro	19.3	43.0	30.0	5.7	21.9/21.6	40.6/41.7	30.5/30.5	0.5/0.5 (1.4/1.3)	2.6/2.8	2.5/2.8	5.2/5.8	2.5/2.8	0.90/0.88
Cacém	18.9	46.1	28.6	6.8	18.9/19.5	40.3/40.0	29.0/29.3	0.4/0.6 (1.1/1.1)	3.4/3.0	3.3/2.9	5.5/5.4	3.3/2.9	0.87/0.91
Lisbon/Estefânia	21.1	44.7	31.4	5.5	22.4/22.1	40.4/41.2	30.8/30.7	-0.5/-0.6 (0.3/0.2)	2.9/2.7	2.8/2.7	4.8/5.2	2.8/2.7	0.86/0.88
Lisbon/Airport	19.8	41.5	30.0	5.1	22.7/22.2	40.1/39.9	30.9/30.5	0.9/0.4 (1.3/1.3)	2.8/2.6	2.7/2.6	4.7/4.9	2.7/2.6	0.86/0.87
Lisbon/Geofísico	20.7	41.4	30.1	4.8	21.8/22.4	40.4/40.6	30.4/30.8	0.3/0.7 (1.7/1.6)	2.7/2.9	2.7/2.9	5.0/5.0	2.7/2.9	0.85/0.83
Mean	20.0	43.5	30.2	5.7	21.3/21.9	40.2/40.6	30.2/30.4	- / -	2.9/2.9	2.8/2.8	5.1/5.1	2.8/2.8	0.88/0.87
					(22.2/22.4)	(40.9/40.7)	(31.3/31.3)	- / -	(3.3/3.3)	(3.1/3.1)	(5.1/4.9)	(3.1/3.1)	(0.84/0.84)

References

1. Pineda, N.; Jorba, O.; Jorge, J.; Baldasano, J.M. Using NOAA AVHRR and SPOT VGT Data to Estimate Surface Parameters: Application to a Mesoscale Meteorological Model. *Int. J. Remote Sens.* **2004**, *25*, 129–143, doi:10.1080/0143116031000115201.
2. Carvalho, D.; Martins, H.; Marta-Almeida, M.; Rocha, A.; Borrego, C. Urban Resilience to Future Urban Heat Waves under a Climate Change Scenario: A Case Study for Porto Urban Area (Portugal). *Urban Clim.* **2017**, *19*, 1–27, doi:10.1016/j.uclim.2016.11.005.