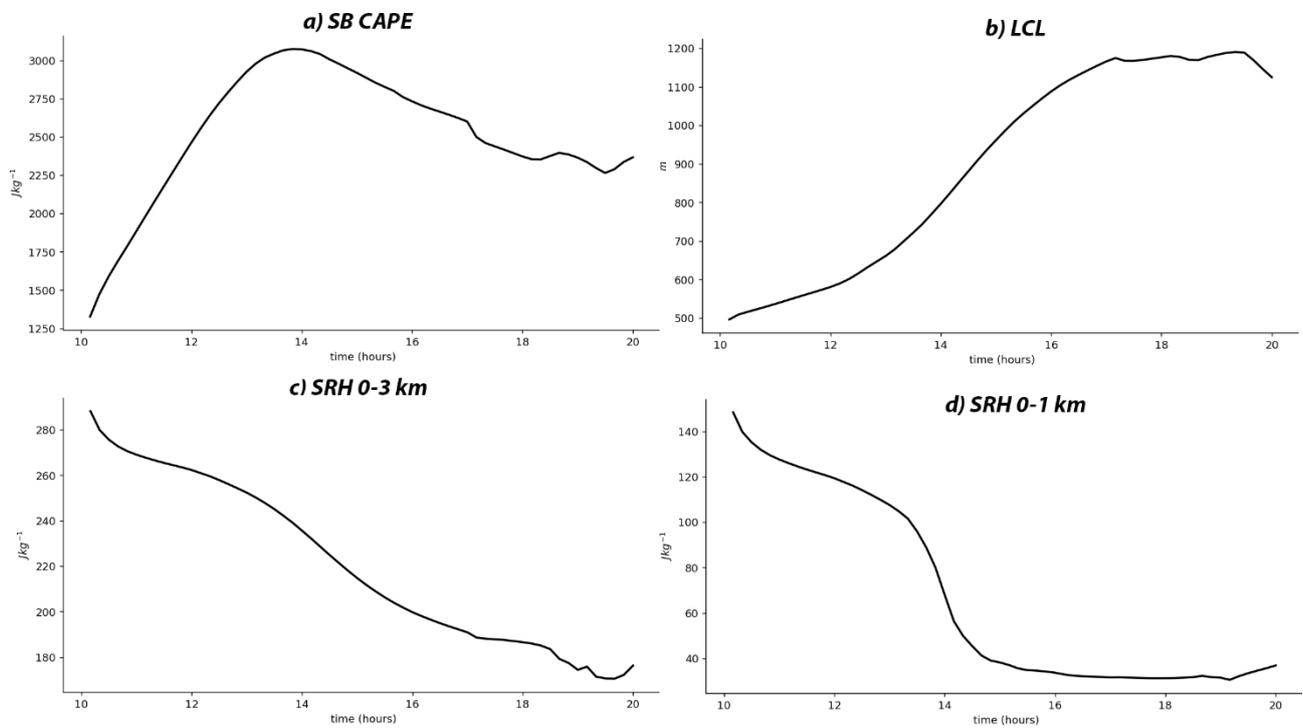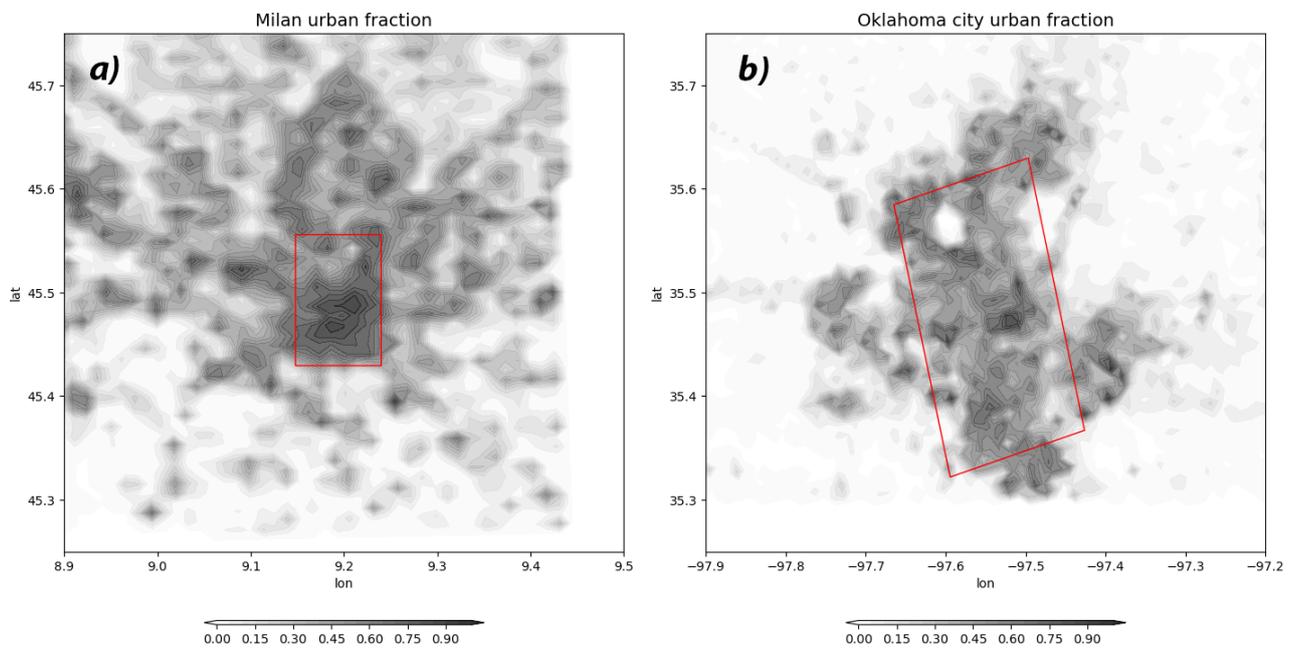# The Dual Effect of Urban Areas on Supercell Storms

Supplemental Material

Figure S1: Time evolution of domain-averaged (a) SB CAPE, (b) LCL, (c) SRH in the 0-3 km layer, and (d) SRH in the 0-1 km layer. No convection is triggered in the simulation considered to produce these plots.


Figure S2: Urban fraction of (a) Milan and (b) Oklahoma city. The red boxes show the area within where the GLOBUS parameters are averaged.

| city	size (km)	h_b (m)	s (m)	b (m)	urbfrc	λ_b	λ_p
Chicago	30x15	9.2	17.1	8.7	0.68	0.72	0.23
Oklahoma City	30x15	8.4	26.4	9.1	0.42	0.30	0.10
New York City	26x15	19.9	30.2	14.6	0.62	0.75	0.20
London	20x20	11.8	17.7	9.7	0.55	0.66	0.19
Dallas	19x12	11.3	25.5	12.9	0.47	0.43	0.16
Berlin	15x10	20	10.4	8.7	0.52	1.32	0.23
Milan	14x7	18.6	26.8	16.6	0.63	0.78	0.24
New York City downtown	12x6	44.6	41.6	21.8	0.65	1.12	0.22
Kansas City	10x7	11.9	50.8	14.9	0.49	0.29	0.11
Atlanta	8x5	20.5	31.2	17.5	0.51	0.61	0.18
Chicago downtown	2x2	114.5	49.76	29.5	0.75	2.45	0.28

Table S1: Mean urban morphological parameters sourced from the GLOBUS dataset of some representative mid-latitude European and US cities frequently affected by severe storms.

| Parameter name	Brief description	Terwey and Rozoff (2014)	This study
MINUPLEVEL	First level to be scanned	6 (1255 m)	20 (901 m)
WTHRES	Threshold value for checking by how much a local maximum must exceed its neighbors	0	0
NUMLEVELS	How many vertical gridpoints the code will be searching for updrafts starting from MINUPLEVEL	20	30
MINUPHEIGHT	Minimum updraft height to be considered (in vertical levels)	15	10
SPACETHRES	Spatial threshold that must be satisfied for the vertical linking of updrafts	4 km	3 km
RANKTHRES	Spatial threshold that must be satisfied for the temporal linking of updrafts	10 km	7 km
POINTTHRES	Vertical spatial threshold that must be satisfied for the temporal linking of updrafts (in vertical levels)	6	3
OUTPUTTIMETHRES	Minimum number of time steps that a tracked updraft must be to be considered	3 (18 min)	2 (20 min)
velCorrect	Correction factor for the advective process in temporal linking	1.0	0.35
checkValues	Minimal vertical velocity for each level's maxima to be qualified for updraft status	1.5 ms^{-1}	1.0 ms^{-1}

Table S2: Values of SPOUT parameters set to track the updrafts in the Terwey and Rozoff (2014) work and in the present study.
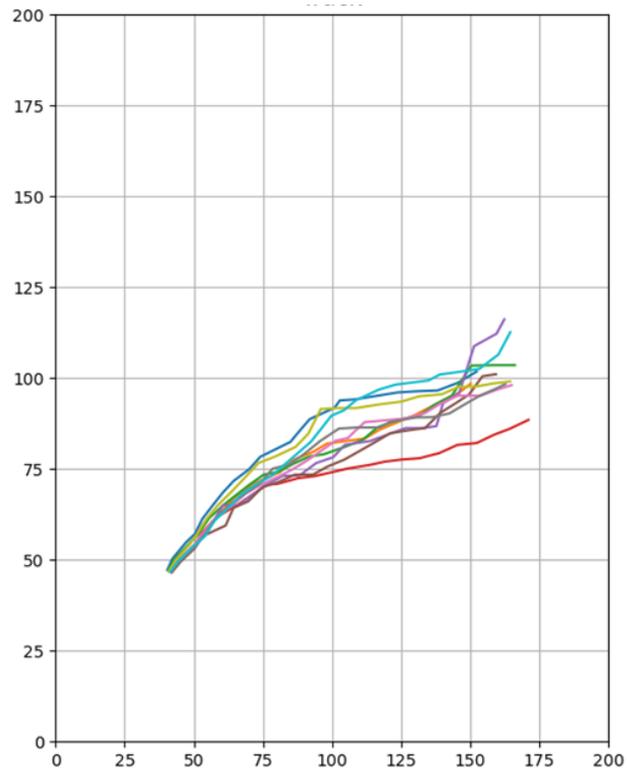
Figure S3: Example of the supercell tracks as detected by SPOUT and the further filtering. The ten tracks obtained with the ensemble generated by SKEBS and the track of the control run are plotted.
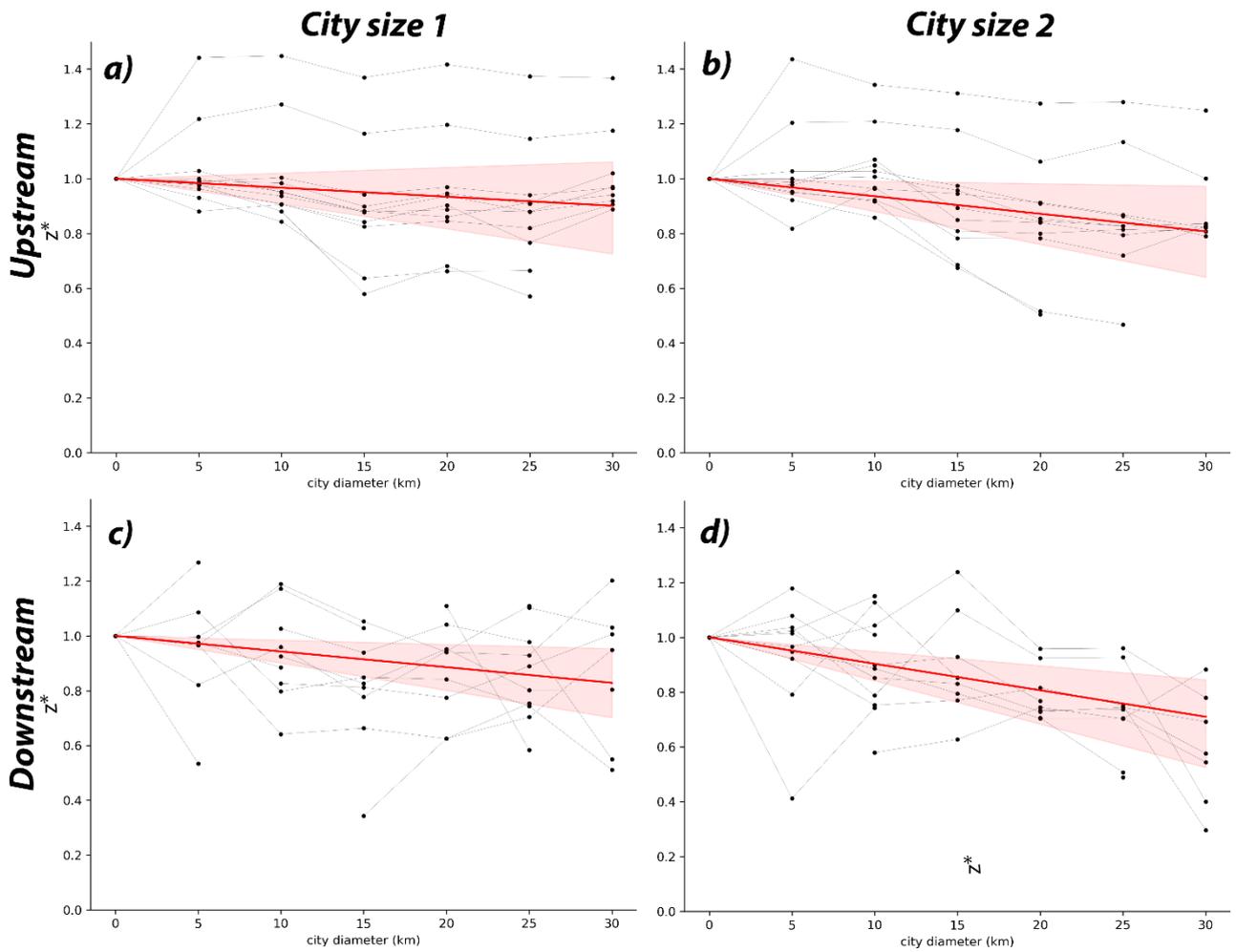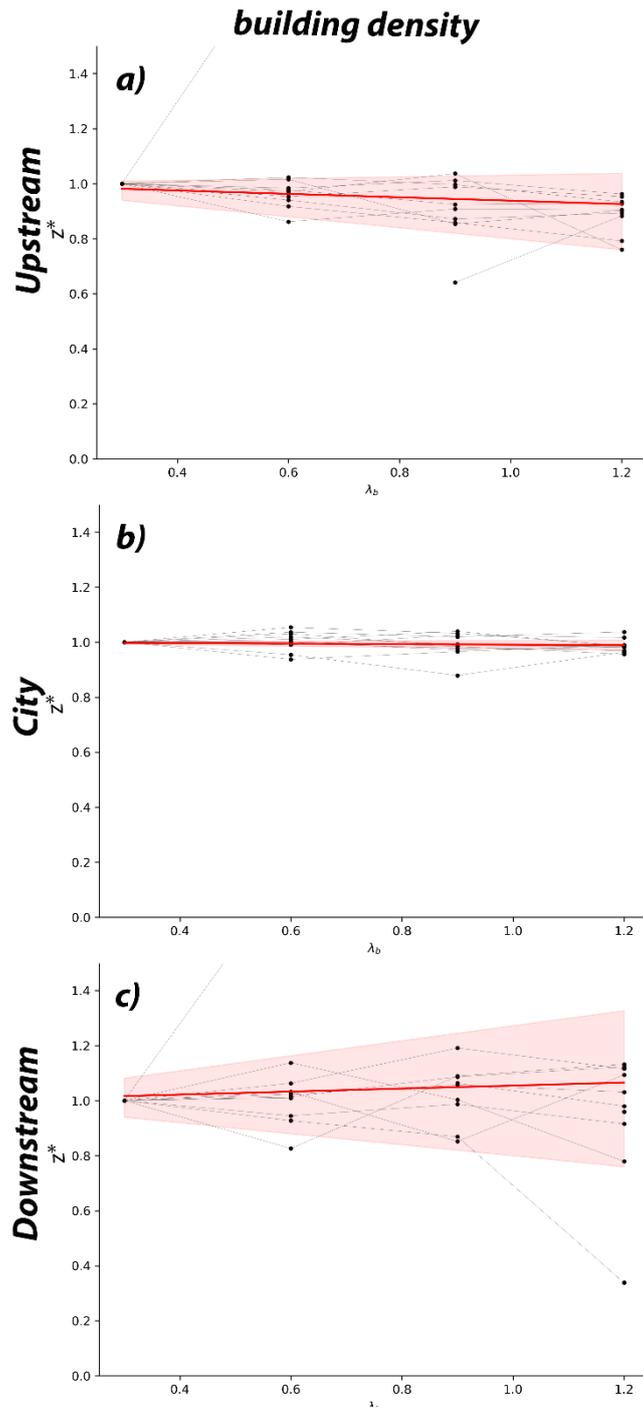
Figura S4: Normalized mean UH (z*) in each ensemble member (black dots) of the city size 1 set of experiments in function of the city diameter (km) in the a) upstream region and b) downstream region. Ensemble members obtained with the same seed are connected. The mean linear fit is shown with a red line, while the 5-95% confidence interval is red shaded. b) and d) as in a) and c), respectively, but for the city size 2 numerical experiments.
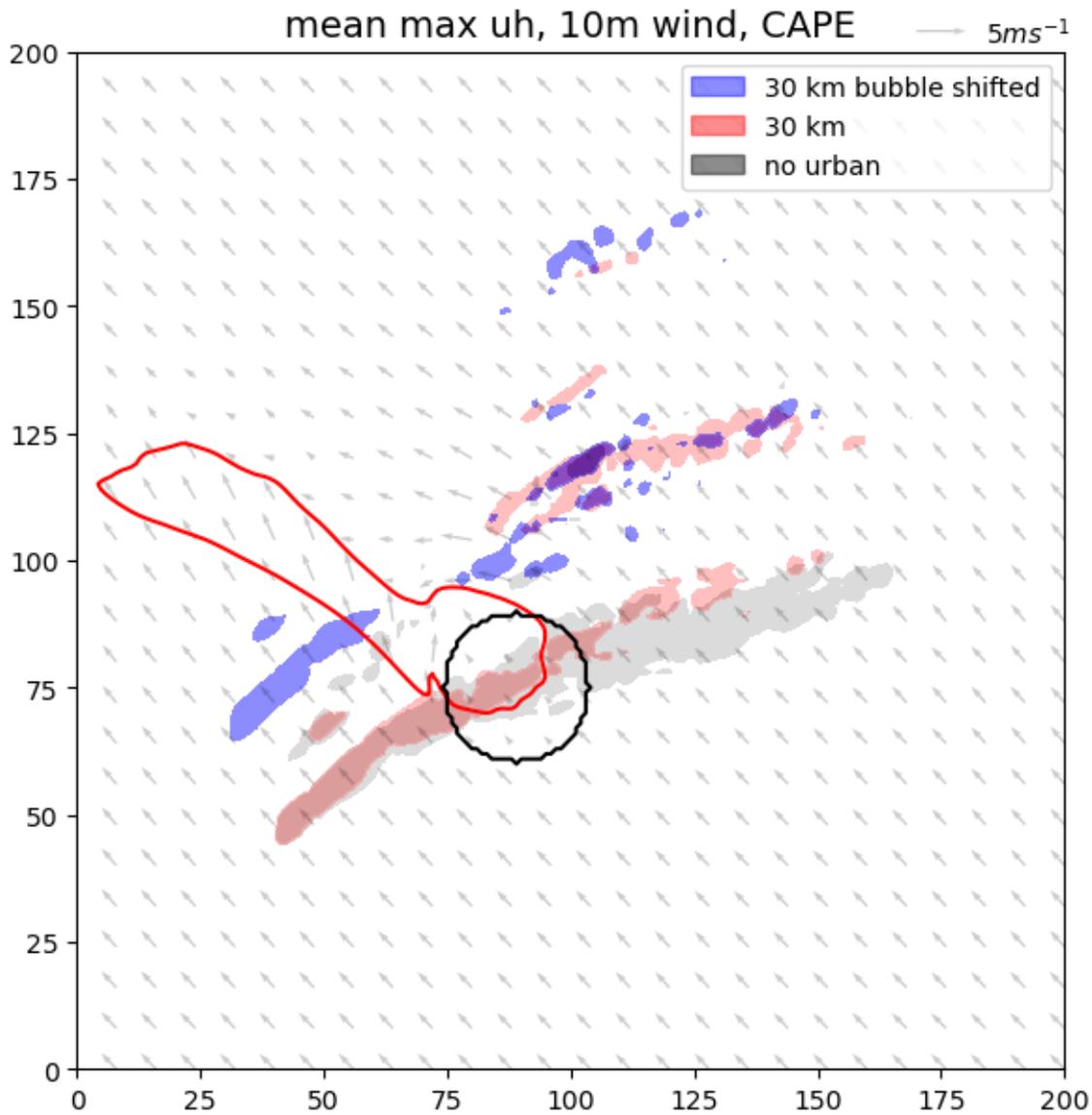
Figure S5: The ensemble mean of UH values exceeding 80 Jkg^{-1} is shown for the no_urban simulation (black shading), the 30km_2 simulations (red shading), and the bubble experiment (blue shading). The difference in CAPE greater than 400 Jkg^{-1} between the ensemble mean in the 30km_2 experiment and in the no_urban experiment is indicated with a red contour. The ensemble mean of 10 m wind field from the 30km_2 experiment at 04:00 pm is shown with grey arrows. The city location is outlined with a black contour.
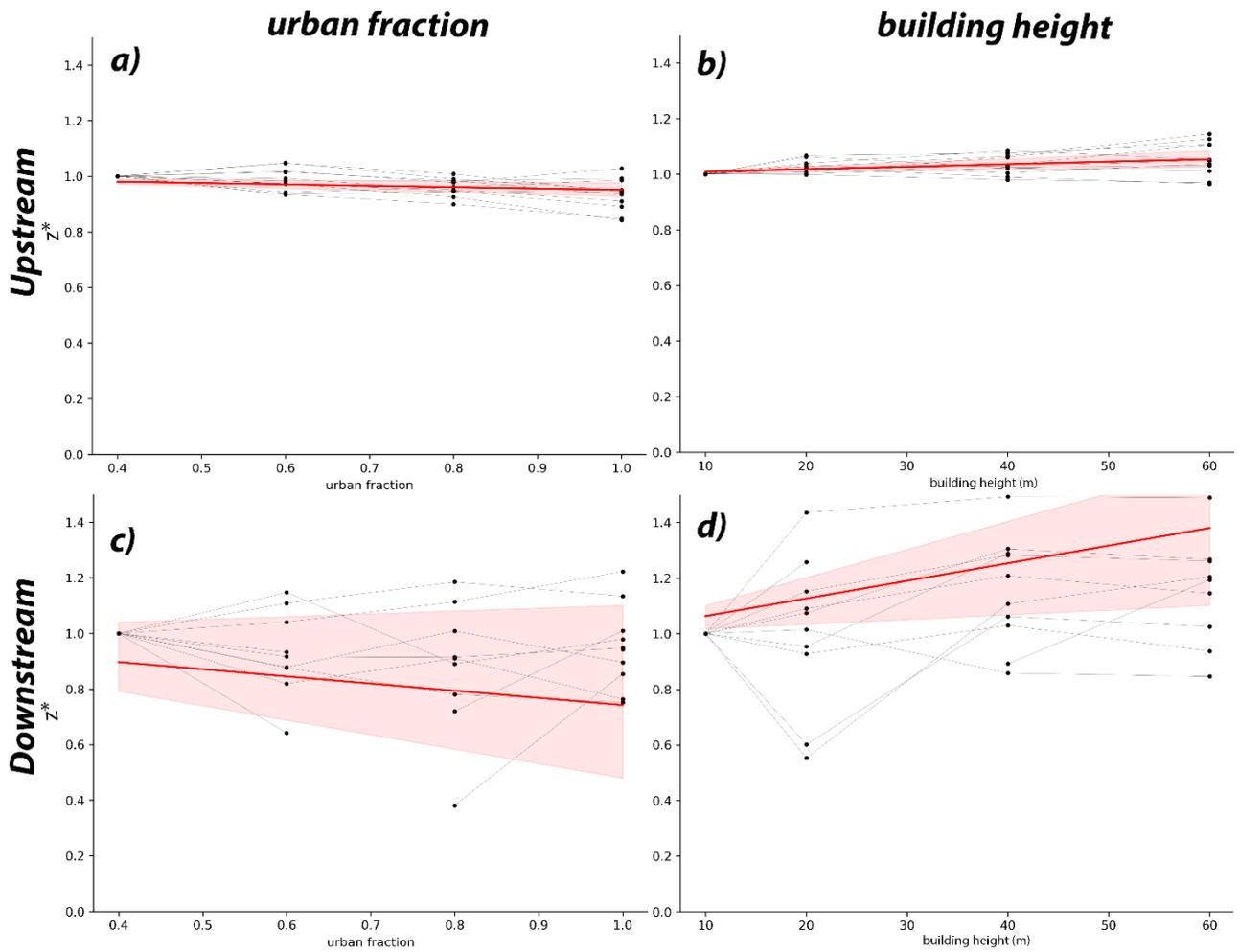
Figure S6: As in Figure S4, but for the urban fraction numerical experiment in a) and c), and for the building height experiment in b) and d).

Figure S7: Normalized mean UH (z*) in each ensemble member (black dots) of the building density set of experiments in function of the city diameter (km) in the a) upstream region, b) city region and c) downstream region. Ensemble members obtained with the same seed are connected. The mean linear fit is shown with a red line, while the 5-95% confidence interval is red shaded.
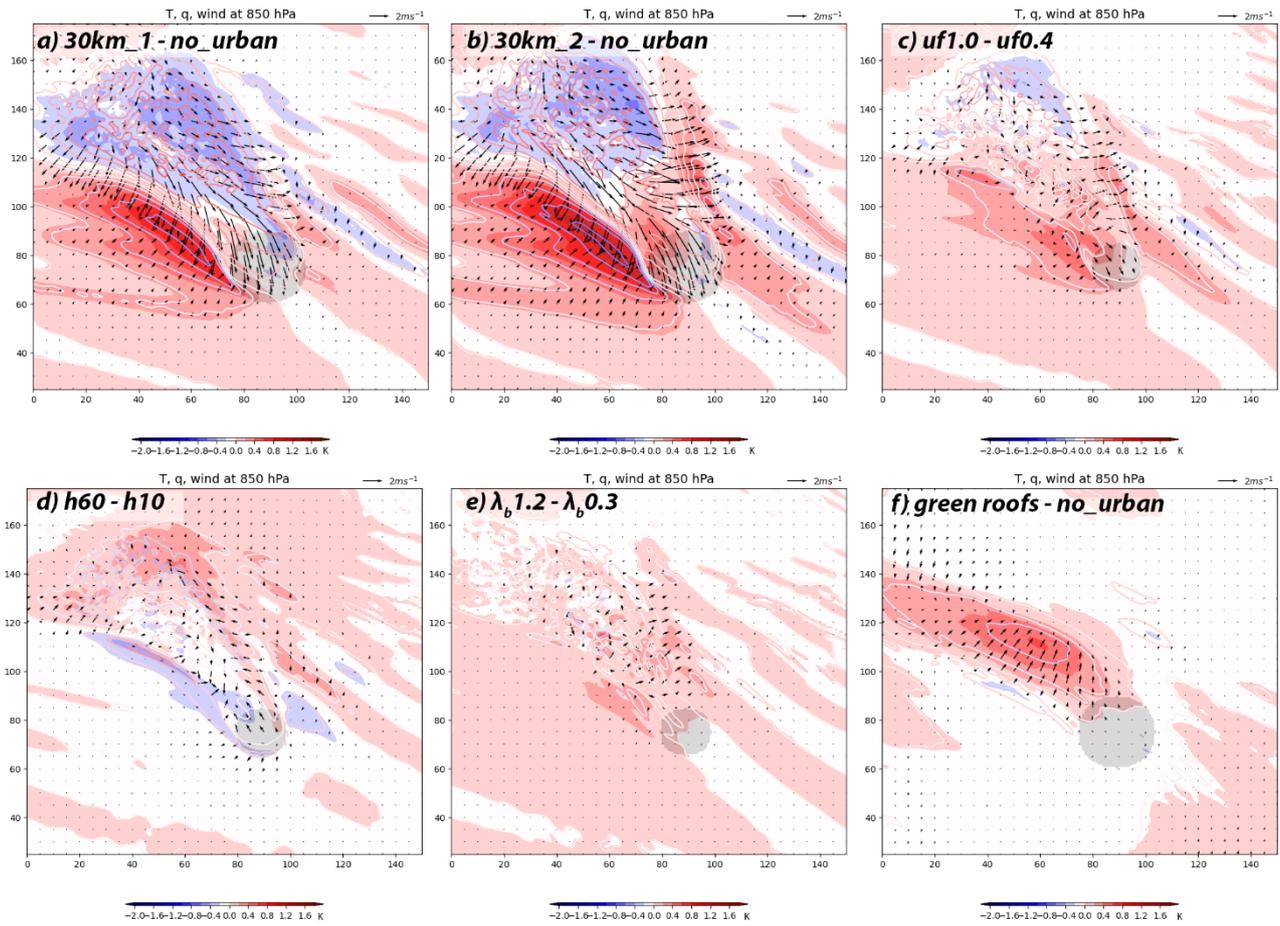
Figure S8: Ensemble mean of temperature (colour shading), specific humidity (contours every 0.5 g/kg, blue negative, red positive) and wind difference (vectors) at 850 hPa between a) 30km_1 and no_urban experiments; b) 30km_2 and no_urban experiments; c) uf1.0 and uf0.4 experiments; d)h60 and h10 experiments; e) λb1.2 and λb0.3 experiments; f) green roofs and no_urban experiments. The city is shown with grey shading.