

I have entered a decision of minor revisions because I think you still need to be more transparent about the possible overestimation of the urban drying. While I agree that it is plausible that the seasonal averages available in the extant literature \*could be\* less than in individual cases, this has not actually been demonstrated. Please explicitly state that the moisture reductions (and CAPE reductions) in your simulation are significantly larger than what has been published so far (and please quantify these differences). You may then add your plausible speculation that individual cases could potentially have larger moisture reductions than longer-term averages.

Note that reviewer 1 recommended rejection over this matter, so this concern must be transparently addressed.

Best regards,

Johannes Dahl

Dear Johannes,

We have added a new paragraph to the Discussion that quantitatively compares the moisture and CAPE reductions we obtain with the values currently reported in the literature. We note that our values are larger, and we acknowledge that the urban parameterization may cause excessive urban drying.

The new paragraph is at lines 471–484, and I have attached it here for convenience.

Thank you

Francesco De Martin

The urban-induced reductions in moisture and CAPE obtained in our simulations are larger than those published so far. The simulated reduction of relative humidity (13%) is in line with the annual mean reductions observed in Moscow (9%, Lokoshchenko 2017) and Beijing (~12%, Luan et al. 2022), whereas the reduction of specific humidity (~2 g kg<sup>-1</sup>) is about 0.6 g kg<sup>-1</sup> larger than the peak summer reduction of 1.4 g kg<sup>-1</sup> found by Meili et al. (2022) over 1089 stations worldwide and 29 years. The difference is larger for CAPE: our reduction of up to 1000 J kg<sup>-1</sup> is about twice the ~450 J kg<sup>-1</sup> obtained by Reames and Stensrud (2018), and one order of magnitude larger than the 40–100 J kg<sup>-1</sup> reported by simulations averaged over several summers (Wang et al., 2012; Yang et al., 2014) or over a 4-day period (Yang et al., 2021b). A plausible explanation is that most previous studies consider seasonal or multi-year averages, which smooth out the diurnal and seasonal cycles of UDIs (Huang and Song, 2023): in terms of specific humidity, UDIs are strongest in the warm season and in the late afternoon (Meili et al., 2022), when severe storms are more frequent, so that individual events may exhibit larger moisture reductions than long-term averages. In addition, our idealized city was designed to represent an extreme case (30 km wide, with a high urban fraction and no

water bodies), whereas Dallas–Fort Worth, the city considered by Reames and Stensrud (2018), includes several rivers and lakes that may attenuate the UDI. Finally, we cannot exclude that BEP-BEM contributes to enhancing the urban drying.