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Comment on gmd-2021-431

Anonymous Referee #1

Referee comment on "Assessment of the Paris urban heat island in ERA5 and offline SURFEX-TEB (v8.1) simulations using the METEOSAT land surface temperature product" by Miguel Nogueira et al., Geosci. Model Dev. Discuss.,
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Review of Nogueira et al.: Assessment of the Paris urban heat island in ERA5 and offline SURFEX-TEB (v8.1) simulations using METEOSAT land surface temperature product

The present article evaluates the Paris Surface Urban Heat Island (SUHI) and Urban Heat Island (UHI) in the ERA5 re-analysis data and Offline simulations with the land surface model SURFEX using a "rock-type" urban parametrisation or the urban canopy model TEB to simulate the urban surface energy balance.

Observed SUHI is derived from LSA-SAF (SEVIRI) satellite observations, UHI from station data.

Results show that ERA5 does not capture the SUHI or UHI, which is no surprise given that the underlying IFS model has not been using an urban parametrisation and no urban stations have been assimilated.

A major improvement of the results for SUHI and UHI is found when using SURFEX-TEB. This shows that even with an Offline application of SURFEX-TEB, re-analysis products like ERA5 could be strongly improved and spatially refined in urbanised areas, which is a very useful finding.

The present paper is interesting, very well structured and written, the results are clear, so I have only very minor comments:

There is a recent study on the Paris urban climate including the SUHI: Benjamin Le Roy, Aude Lemonsu, Raphaëlle Kounkoud-Arnaud, Denis Brion, Valéry Masson: Long time series spatialized data for urban climatological studies: a case study of Paris, France.

International Journal of Climatology, Wiley, 2019, [doi:10.1002/joc.6414](https://doi.org/10.1002/joc.6414).
The results from the present study should be compared with this study.

The absolute value of the bias ($|\text{Bias}|$) is used throughout the paper. I don't understand why this is done, since the information on the sign of the bias is lost. I propose to use the Bias as is, and change the related figures and text.

L114: I am wondering how to simulate the UHI with a single-column approach. In fact, the advection of cool air from the rural areas around the city towards the city cannot be taken into account. Do these simulations parametrise the advection via a forcing term?

L121: I guess all observations are for the same 2004-2018 period? It seems not to be stated explicitly for the station observations.

L177: Schoetter et al. (2020) has only dealt with simulations on Hong Kong, so did not formally show that the single-layer TEB is adequate for mid-rise cities. So I think this statement has to be changed.

Figure 2: The comparison is a bit unfair since the ERA5 resolution is so coarse. You could add a third column with the other datasets interpolated to the ERA5 grid.

Figures 3, 5 and 6: More space should be added between the different lines of figures.

Figures 6 and 9: In the legend you should use points instead of lines for ERA5, SFX-ROCK, SFX-TEB.

Figure 8ace: There are some weird features (rectangle-shaped). What is their origin?

L403: high-resolution simulation.