

The authors would like to acknowledge the time and effort spent by the reviewer RC2 on our manuscript. We provide replies to each reviewer comment.

RC2 – General comment:

In this work, the nocturnal cooling effect of urban parks within Paris is investigated using an excellent suite of measurements, which allows the authors to concurrently examine the meteorological conditions of the surface and lower atmosphere. Three stability regimes are identified, quantified, and their implications are summarized. The meteorological factors are put in context both spatially and temporally throughout the night. The manuscript has clear motivations and implications, is logically organized, well-written, and includes appropriate figures. There are only a few minor comments.

RC2 – Comment 1:

The lowest gate (~240 m AGL) is used for the vertical variance, but in Fig. 6e/7e it appears to be either at an inversion base or perhaps just above it in these examples. Is there potential that being just below or above the inversion base would have a significant impact on the analysis or conclusions? Although the limitations of the instrumentation prevents measurements closer to the surface, it might be good to at least comment on this point since any measurement near a sharp change of temperature gradient could have large differences just above or below.

Author Reply to comment 1:

We agree with the reviewer that the lowest gate at which we can retrieve vertical velocity variance is close (just below or just above) to the height of the temperature inversion, that also correspond to the height of peak horizontal wind speed.

In Fig. 6e/7e we only show the vertical velocity variance values at one height (240m AGL), but we have access to vertical profiles of vertical velocity variance from 240 m AGL up to 2000 m AGL or more. We observe that vertical velocity variance values vary significantly between 240m and about 500m AGL, in the layer where the low-level jet is observed, with peak values at heights where the wind speed is maximum. Under stagnant regime conditions, the vertical velocity variance values are significantly reduced in the 240-500 m AGL layer (i.e. values $< 0.01 \text{ m}^2 \text{ s}^{-2}$), compared to intermediary (i.e. values $> 0.05 \text{ m}^2 \text{ s}^{-2}$) or turbulent (i.e. values $> 0.1 \text{ m}^2 \text{ s}^{-2}$) regimes. Hence, we conclude that the vertical velocity variance value at 240 m AGL is representative of the nocturnal urban boundary layer turbulence regime.

We add the following sentence in the manuscript Line 518: “It should be noted that in the stagnant regime, the vertical velocity variance values are very low (less than $0.05 \text{ m}^2 \text{ s}^{-2}$) throughout the LLJ layer that extends from 240 to about 500 m AGL or more (not shown)”.

RC2 – Comment 2:

Related to the lowest gate, it is given as both 238 and 240 m AGL in the text, but please just select one to be consistent (either the 238 or the rounded 240).

Author Reply to Comment 2:

We harmonized the text with the lowest Doppler Lidar gate at 240 m AGL.

RC2 – Comment 3:

Soil moisture is mentioned around line 742, but given the impact it could have on heating/cooling processes associated with the park, it might be beneficial to comment on this earlier. Specifically, it should be stated if this period was during wet, normal, or drought conditions, and also if these parks are irrigated.

Author Reply to Comment 3:

Indeed precipitation and irrigation conditions will have an impact on plant health and their evapotranspiration capacity which contributes to about 30% of the daytime cooling effect of trees for example (70% is due to shading). Summer 2022 in Paris was both hotter and dryer than a normal year. Irrigation practices differ from one park to another and also inside each park, but quantified information is not available. As suggested, we clarify this in the paper as follows:

Line 234: On average this period is characterized by a positive temperature anomaly and near-zero precipitation anomaly.

Line 248: The three selected urban parks differ however in terms of vegetation type (species; fractions of trees, shrubs and grass) and also in terms of irrigation practices and hence soil moisture. These differences and their effects are not accounted for in this study.