This manuscript describes a summertime period of nocturnal low-level jets (LLJs), observed with Doppler wind lidars, and the LLJ impact on the Urban Heat Island (UHI) intensity. The main finding of the study is that the LLJ vertical velocity variance observed at the urban site shows a clearer relation to the UHI intensity than the LLJ wind speed. The study is well-written and includes a very detailed description of methods, the observed LLJ characteristics and the conclusions. The abstract provides a clear and concise overview of the study. I have a few minor suggestions for improvement outlined below.

We thank the referee for reviewing our paper, as well as for the positive point of view and relevant feedback. Please, find our response to your comments point-by-point. Modifications on the manuscript are highlightes with blue text and here in this document we included the page and number line of the track changes manuscript.

General comments

1. The study concludes that the wind speed variance shows a clearer relation to the UHI intensity than the wind speed. I would like to make sure that the comparison is not impacted by the measurement location (near-surface wind speed at the rural site vs. wind speed variance at 238m agl at the urban site). Does the lowest-level wind speed derived from the urban site reveal the same trend (and is therefore more comparable to the variance)? Or, the other way around, are there near-surface wind speed variance measurements available from the rural site?

   According to Oke et al., 2017, the UHI intensity is proportional to the regional near-surface wind speed during cloud-free conditions. Hence, we initially selected the wind speed at the rural site of Melun as the reference. However, consistent with your remark, indeed fewer outliers are present when choosing surface wind speed at an urban site (Montsouris Park) instead (see figure below). We have updated Figure 9 now using the central urban wind measurements instead and the Table 3, in which we include winds at both measurement sites. We also implemented multiple adaptations in the the manuscript text accordingly:

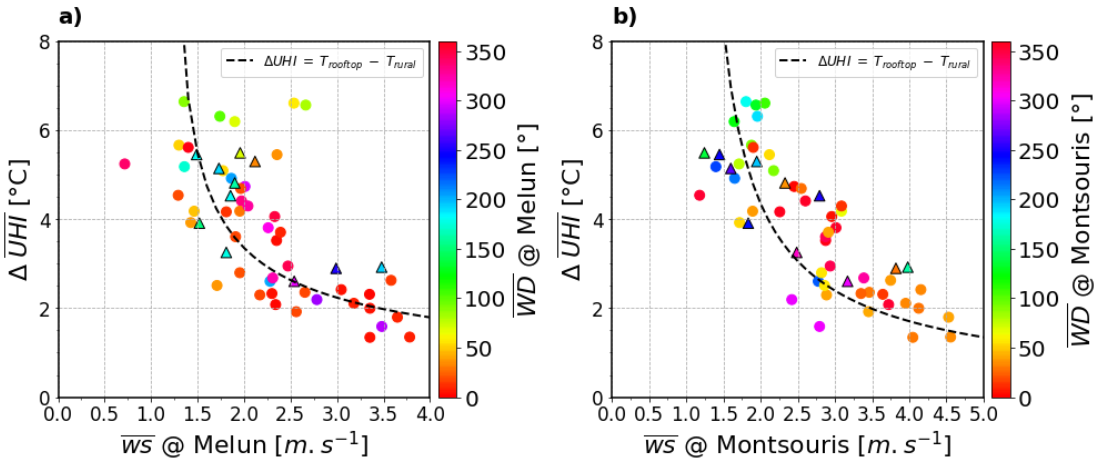
   Changes in Section 2.4

   p10, line 244: “Additionally, wind data collected from a 25 m meteorological tower installed at Montsouris Park are used in this study to assess the relationship between ∆UHI and the near-surface wind speed.“

   Changes in Section 3.7

   p20, line 481: “The urban wind direction at Montsouris suggests that weak values of ∆UHI are mostly found under prevailing northeasterly flow. This wind direction sector is characterized by LLJ with strong wind speeds and high σ^2_w values.”

   p20, line 488: “The near-surface urban wind speed, sampled at a height (25 m agl) is slightly above the mean building height of 20 m, provides insights on advection processes. However, to assess the role of vertical mixing on spatial contrasts in air temperature, the response of ∆UHI to the vertical velocity variance at 238 m agl is shown in Fig 9b. This relation is even more clearly pronounced as can be seen from the smaller error statistics listed in Table 2. Given wind observations above the urban canopy layer (as here at Montsouris Park) are rarely available, the wind speed observations at the rural site Melun were also tested to have a full view of the ∆UHI response to the regional regional winds. As the near-surface winds report higher uncertainty when predicting the ΔUHI intensity, it is concluded that turbulence observations inside the urban boundary layer show a closer link to the insensity the spatial constrar air temperature processess that drive the ΔUHI development. The curves in Fig 9b represents the best non-linear model fitted to the data collected during the nights with a LLJ event, using the air temperature data collected at QUALAIR-SU and by data collected by the IOP station located at Boulevard des Capucines (see Section 2.4). The similarity between the two curves indicates that the relationship between ΔUHI and σ^2_w is preserved even when using QUALAIR-SU data collected at roof-level."



For Fig a) the dashed curve follows the equation UHI = $3((ws-1.2)^{-0.5})$, while in Fig b) the equation is UHI = $4((ws-1.1)^{-0.8})$. Wind speeds are stronger at the urban Montsouris Park (sensor at 25m above the ground) than at the rural site Melun (sensor height at 10m above the ground). For the current study, no σ2w has been conducted at Melun.

2. Generally, the study provides a lot of details. It would be helpful for the reader to provide some guidance on how the details relate to the broader context. For example, in the methods section, start each sub-section with an introductory/ summary sentence, so that the reader can pay attention to the details of interest. (e.g. start Sect. 2.2 with something like "Two DWLs, one in the city and one in a suburban are, were used to obtain vertical profiles of horizontal wind speed and vertical wind speed variance."

   We agree that this modification will improve the clarity of the story for the reader. Particularly, the subsections 2.2 (p6, line 143) and 3.1 (p10, line 266) have been updated for clarity. The authors consider that the other subsections of the Methods section start with a clear sentence about the details related to the broader context.

3. The time periods used in this study are a bit confusing. It seems like the lidar analysis is based on the core period 15 June 2022 to 31 August 2022, but other time periods for validations are mentioned multiple times. Also, the PANAME initiative is not really introduced. Is the lidar study period part of this initiative or its Intensive Observation Period?

   The time periods have been reviewed but no inconsistencies were found. The only different mentioned time period is on Page 5, line 124 (original manuscript): "Using a comprehensive data set spanning from 2006 to 2022…". This is used to give the general context of the synoptic conditions of the study area. However, the text has been edited to ensure the clarity for the reader (p6, line 136) .

The Doppler Lidar (DL) installed at the urban site was deployed in January 2022 as part of the activities of the PhD project of Jonnathan Céspedes. The PANAME initiative started in the summer of 2022 (including multiple IOPs (Intensive Observation Period). In the framework of PANAME the DL at both the suburban and the urban sites are included as a key source of information given they provide continuous wind and turbulence (at QUALAIR) profile observations. The manuscript has been updated with a clear introduction to the PANAME initiative (p6, line 143) .

Specific comments

1. The introduction is well-researched, but can be a little more concise and details not relevant to the study could be omitted.

   After reviewing the content of the introduction, the authors consider that on Page 2 between lines 36-47 details related to the previous locations around the world where the LLJ has been observed could be edited to be more concise. The introduction has been updated according to this comment.

2. L. 160: Since the vertical velocity variance is highly sensitive to the averaging interval and sampling frequency, it might be worth pointing these out and giving an assessment about which parts of the turbulence spectrum are captured/ omitted with the used strategy.

   Thank you for pointing this out, certainly, the sampling frequency is decisive for estimating the vertical velocity variance. In the current study, the vertical stare scan records data continuously for 5-min in every 30-minute period. We consider that this is sufficient for the purpose of the investigation because an accurate sampling of the turbulence spectrum is beyond the scope of the study. The description of the scan strategy has been edited in the manuscript to highlight the 5-min of continuous vertical stare (P7, line 172).

   Based on experiments conducted in subarctic regions where the load of aerosols tends to be low, Yang et., (2019)[1] conclude that a 10-min vertical stare scan per hour is the required sampling interval to detect large-scale turbulence. While in urban areas where the content of aerosols is higher and unstable conditions are frequent, Bonin et al., (2018)[2] showed that representative turbulence can be detected at night with vertical stare sampling over 4 min per hour, allowing the detection of the mixing height layer based on the vertical velocity variance.

   On the other hand, by comparing theoretical and experimental approaches, Banakh et al., (2021)[3] showed that during nocturnal stable boundary layer conditions and the presence of a LLJ, 8 min of vertical stare measurements every hour are sufficient to identify the turbulent patterns produced below the jet core. They showed that vertical velocity oscillations are associated with the LLJ presence, and such oscillations can take between 30 min and 1 hour.

[1] https://doi.org/10.1002/met.1951
[2] https://doi.org/10.1175/JTECH-D-17-0159.1
[3] https://doi.org/10.3390/rs13112071

3. L. 210 "Note that the minimum below the core height may not be captured correctly by the observations because no information is available < 238m agl in the instrument's blind zone.": Are there near-surface wind measurements available at the urban site to close this gap? Especially, since QUALAIR-SU is referred to as a supersite.

   Wind speed sampled within the urban canopy or on the top of tall buildings tends to be strongly affected by the roughness elements and bluff body effects. Hence, the more in-depth analysis of surface or roof-based wind measurements is beyond the scope of this study. A novel shallow DBS scan and retrieval implemented for 2023 finds shallow LLJ cases with a core height below 240 m in about 75% of the cases from the SE.

4. It seems like most of the LLJ statistics are based on the measurements from the urban lidar, and the suburban lidar serves only to show that the LLJs are a regional phenomenon. Maybe mention that at an early point in the paper, so that the reader does not expect a detailed analysis from the suburban lidar.

   Section 2.2 has been edited according to this comment. The following sentence has been included:

   p8, line: 181: " The data recorded with this instrument are used in this study only to highlight the regional scale of the LLJ observed. A detailed analysis of this data collection will be the subject of future studies."

5. L. 269 "Here we assume that the σ2w observations at the first range gate (238m agl) of the DWL at the urban site provides a representative proxy for vertical mixing in the nocturnal urban boundary layer.": Is the aim getting a wind variance estimate as close as possible to the surface? I am a bit worried that the variance at a fixed height agl depends on the jet core height.

   Yes, we estimate the σ^2_w values as close as possible to the surface to study the impacts of the mechanical turbulence below the jet core on the canopy layer UHI intensity. By considering σ^2_w values at a fixed height we aim to assess the magnitude of vertical mixing exerted onto the surface layer.

   It is correct that the vertical velocity variance at this fixed level may be affected by the LLJ core height and its core wind speed as these characteristics modulate the impact on the near-surface mixing. In future studies, we aim to compare the sigma w results from this first lidar gate to turbulence observations from urban flux tower sites. However, this requires a more in-depth source area analysis and determination of the blending height of the sonic anemometer observations and is hence beyond the scope of the current study.

Technical corrections

Please be more consistent with introducing and using abbreviations (IO, ABL, …)

Abbreviations have been edited for consistency.

L. 65: access -> excess?

This word has been changed.

L. 153: could you provide a reference for the hard target method?

The hard target is a north alignment method developed by the Doppler Lidar manufacturer Vaisala. At the moment there is no public document available that can be used as a reference.