Review of egusphere-2024-520 "The Paris low-level jet during PANAME 2022 and its impact on the summertime urban heat island"

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This manuscript uses Doppler wind lidar measurements from two sites (one urban and one suburban) for the period 15 June – 31 August 2022 to analyse the summertime characteristics of the nocturnal low-level jet over Paris. The characteristics of the jets identified are similar to previous studies of low-level jets over Europe. Using surface wind and temperature observations, the study also investigates the relationship between the jet and the urban heat island. Vertical velocity variance over the city at 238m agl from the lidar is found to be a better predictor of the urban heat island than 10m winds at nearby rural site. There is not necessarily a relationship between jet strength and the urban heat island with some strong jet nights leading to strong urban heat islands. This is undoubtedly an interesting dataset and the continuous nature of the observations allows a study of the jet evolution which is not usually possible with less frequent radiosonde observations. However, I have some questions outlined below which need considering before the manuscript can be published.

Major comments

1) I did sometimes struggle to see what the novelty was in the results – the behaviour of the LLJ seems broadly in line with what would be expected based on other studies at similar latitudes / locations. The novelty seems to be around the interaction of the LLJ and urban environment, but the results seem to indicate the LLJ is not strongly affected by the urban land surface. The main result on the UHI seems to be the link with σ_w^2 which is irrespective of the LLJ. It would be good to focus on highlighting the novelty in a revised manuscript and particularly why the focus on the LLJ rather than UHI more generally.

2) Much of the analysis focuses on the different classes of σ_w^2 however these are somewhat arbitrarily determined based on previous research. Can you justify the choice of thresholds? Does this depend on the location / the height at which the measurements are made? Is there a more objective way of determining what they should be?

Minor comments

1) p9, line 219. I do not understand what the difference in core time < 15 h means. Just above you stated that a LLJ event must have a LLJ detected in at least 4 consecutive profiles. Does this not mean the time between consecutive LLJ detections has to be 30 mins anyway? Please clarify.

2) p10, line 270. You have chosen to use the first range gate (238m agl) to calculate σ_w^2. I have sometimes seen issues with data at the first range gate being a bit lower quality / noisier than further up. Did you see any issues with the data at the first range gate which might affect the results? Or to put it another way, are the results very dependent on whether you use the first gate, or say the 2nd / 3rd gate? In a sense this is a slightly arbitrary choice of height at which to calculate σ_w^2, so it would be good to know the results are not too sensitive to this choice.

3) p12, line 291. Here, and throughout the manuscript, you give very precise values for the heights of measurements (in this case 238m). In reality, given the range gates of the lidar are 75m, it is hard to justify this level of accuracy.

4) p13, Figure 4. The figure mentions classes 1, 2 and 3. These are not actually defined in the text. I assume these correspond to the low, medium and high vertical mixing classes?

5) p13, line 323. I wonder why you don't also give a value of the wind speeds reported in the Karipot et al (2009) study? It's hard to compare meaningfully with the current results otherwise.

6) p14, line 344. "influence" -> "influences"

7) p14, lines 348-350. I wonder if this sentence needs some qualification? I agree σ_w^2 is related to the surface layer turbulent heat fluxes in a convective boundary layer. I'm not sure this is necessarily the case in a stable boundary layer. It is also certainly true that shear generated turbulence can lead to vertical velocity variance and so surface layer turbulent heat fluxes are not solely responsible for σ_w^2.

8) p16, line 379. "the IO mechanism is highly relevant .. in the Paris region". This does seem to be the case for the example you look at, but since you have deliberately chosen an example without any other synoptic forcing this is perhaps not surprising?

9) p16, line 380. "$T = 2\pi f$" should be "$T = 2 \pi / f$"

10) p16, line 381. "θ=48.8466". Needs units (degrees). It also seems to be an unjustifiably precise number, particularly when you then give the period T as ~16 hours.

11) p16, line 384-385. "wind speed amplitude". I find this a confusing phrase. You really mean the amplitude of the variations / oscillations in wind speed. Wind speed amplitude could just be the wind speed itself. I would suggest rephrasing to make sure your meaning is clear.

12) p16, line 385. "with a ~~a~~ clockwise change"

13) p16, line 389. "cases ~~that~~ do not show"

14) p17, line 401. "decay ~~up~~ from about"

15) p17, lines 402-403. This sentence is misleading. As written, it implies that the CBL during the morning is responsible for the gradual decay in jet core wind speed overnight. This cannot be true. What I think you mean is that the onset of the CBL in the morning leads to the jet core wind speed starting to increase again and hence is responsible for the minimum wind speed being right before sunrise.

16) p18, Figure 8b. I assume the number at the start of the line is a wind direction, but the caption doesn't actually say what. Is it the wind direction at sunset or at jet formation? I assume this is what WD_{LLJ} SS means in the title? Again, not actually defined anywhere.

17) p19, lines 425-427. This sentence is confusing "These cases present differences .. regarding the 11 and 13 August…" Which cases? Differences compared to what? Are you trying to say that the 11 and 13 August are different to the other cases?

18) p20, line 460. This sentence is wrong. You have written that UHI is proportional to σ_w^2 and σ_w^2 is proportional to Z_{LLJ}. In the first case, the relationship is definitely not linear according to figure 9b, and in the second case it also does not appear to be true (though it's harder to judge from looking at the colour of the dots in figure 9b. I agree there is a relationship between these variables, but they are not proportional.

19) p21, line 475. "see ~~section~~ Section 2.4)"

20) p22, line 495. "such as ~~that~~ height, …"