Response to Review Comments of RC1

Dear Reviewer and Editors:

We are sincerely grateful to the editor and reviewer for their valuable time for reviewing our manuscript. The comments are very helpful and valuable, and we have addressed the issues raised by the reviewer in the revised manuscript. Please find our point-by-point response (in blue text) to the comments (in black text) raised by the reviewer. We have revised the paper according to your comments (highlighted in red text of the revised manuscript).

Sincerely yours,
Dr. Yuanjian Yang, representing all co-authors

The study focuses on the contribution of the canyon urban heat island intensity in the daytime and nighttime by analysing different datasets. The analysis is comprehensive and the whole story is also very organised. However, I have one major comment which suggests the author address.

Until now, studies have focused a lot on the mechanism of the canyon UHI, especially the intensity. Many previous studies have also focused on the reason for UHI. The study has two main conclusions: 1) CUHI is larger during nighttime and under the high-pressure system; 2) synoptic weather patterns have a more pronounced influence on day CUHII, but human activities dominated night CUHII. These two points are not new findings; they can be easily found and learnt from the previous literature and even textbooks. Thus, what is the significant contribution of the current work? Indeed, authors applied more advanced and updated analysis methods, yet what are the new findings, which are similar to the previous or different to the previous?

I would also suggest the authors reconstruct the abstract and introduction. The

current version of the abstract cannot fully reflect significance. In the introduction, authors should highlight the combination of the synoptic and human activities! Similarly, more discussion and explanation should focus on section 3.3 in the results. The analysis and results in the previous sections are a bit lengthy, which makes the focus of the article not sharp enough.

Response: Thanks very much for taking time to provide us with such valuable comments that significantly improve the quality of our manuscript. In line with your comments and suggestions, we have revised our manuscript carefully and prepared a list of point-by-point responses below.

Firstly, I have accordingly refined both the abstract and conclusion sections of our manuscript. Indeed, our conclusions are built upon the foundation of existing knowledge. However, as you pointed out, we have employed more advanced weather classification and data mining techniques, which have enabled us to gain a more nuanced understanding of the formation mechanisms of the diurnal cycle of CUHI. For instance, we have quantified the contributions of SWPs and human activities to the day CUHI and night CUHI, adding depth to the existing literature. Furthermore, our study has uncovered a diurnal asymmetry in the modulation of SWPs and human activities on CUHI, resulting in a significant reduction in the daily amplitude of CUHI. This finding provides a novel perspective for investigating the diurnal cycle and formation mechanisms of the CUHI.

Secondly, I have revised the introduction accordingly, with a particular focus on highlighting the lack of sufficient attention in existing research regarding the combination of SWPs and human activities on the modulation of diurnal cycle of CUHI. Specifically, I have emphasized the gap in understanding the differences in the regulation of daytime and nighttime CUHI by these factors.

Thirdly, thank you very much for your valuable suggestion on streamlining the manuscript. I fully agree that the content prior to section 3.3 was somewhat lengthy, which may have blurred the focus of the article. In response, I have adjusted the overall structure by condensing some discussions and analyses, and have moved some figures to the appendix to enhance the clarity of the paper's logic.

Lastly, to enhance the organization and facilitate the reviewer's understanding of the manuscript, I have attached a workflow diagram in my response, outlining the datasets and methods utilized in this study.

Thank you once again for your valuable feedback, which has greatly improved the quality of our manuscript.

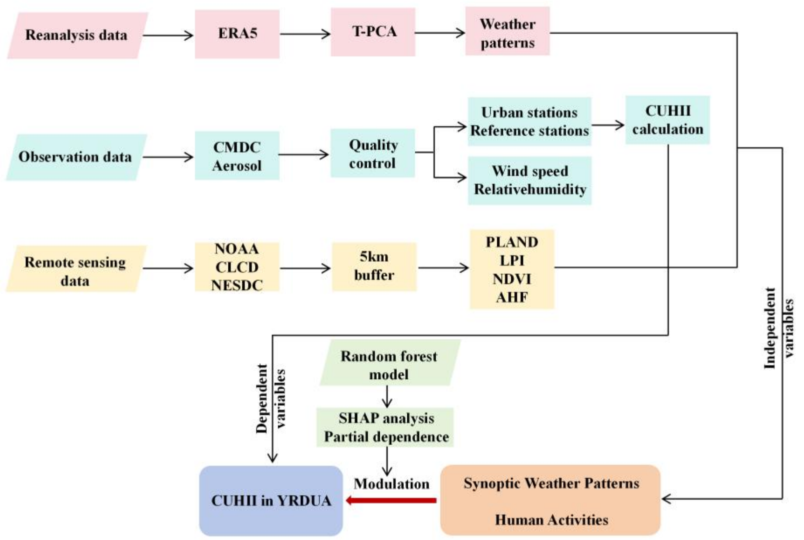

Figure R1: The workflow of the datasets and methods used in this paper.

Minor comments:

1. Line 154, reference format typo.

Response: According to your comments, the reference format typo has been corrected.

I have carefully addressed each of your minor comments and double-checked the entire manuscript for any other potential issues.

2. Please also indicate the data period and temporal resolution of the ERA5 dataset.

Response: I apologize for the lack of clarity in my previous submission.

To clarify, the data period for the specific subset of the ERA5 dataset used in our study spans the months of June to August from 2011 to 2020. The temporal resolution of the dataset is hourly, providing a detailed and comprehensive view of weather and climate conditions over this time frame.

3. Section 2.3.1: More explanation of the calculation of CUHII. There are 43 USs and 27 RSs, for each US, which RS is selected to be linked with to get the CUHII?

Response: Thank you for bringing this clarification to our attention. The method used to calculate CUHII was specifically based on comparing the air temperature differences between USs and RSs during the summertime (Ren et al., 2007; Yang et al., 2022).

$$CUHII = T_{USs} - T_{RSs} \quad (1)$$

In above equation, CUHII is the canopy urban heat island intensity during the summertime, T_{USs} is the air temperature of the USs, and T_{RSs} is the summer air temperature of the RSs (Ren et al., 2007; Yang et al., 2022).

In addition, I have attached the information of all selected USs and RSs in the YRDUA region as Table R1, including station names, station numbers, provinces, longitudes, and latitudes. Additionally, I have noticed and corrected the typographical error regarding the number of USs and RSs, which are actually 46 and 25. I apologize for the mistake and have double-checked the text to prevent such errors from occurring again.

Tab. R1 The information of USs and RSs in YRDUA

Station numbers	Types	Provinces	Station names	Longitudes	Latitudes
58236	US	Anhui	Chuzhou	118.2500	32.3500
58238	US	Jiangsu	Nanjing	118.9000	31.9300
58241	US	Jiangsu	Gaoyou	119.4481	32.7919
58242	US	Jiangsu	Yizheng	119.1586	32.2997
58245	US	Jiangsu	Yangzhou	119.4200	32.4100
58247	US	Jiangsu	Yangzhong	119.7983	32.2744
58250	US	Jiangsu	Jiangyan	120.1500	32.5200
58252	US	Jiangsu	Dantu	119.4667	32.1833
58254	US	Jiangsu	Haian	120.4125	32.5486
58255	US	Jiangsu	Rugao	120.5675	32.3675
58257	US	Jiangsu	Jinjiang	120.2500	31.9800
58321	US	Anhui	Hefei	117.0572	31.9556

58334	US	Anhui	Wuhu	118.3700	31.3800
58336	US	Anhui	Maanshan	118.5667	31.7000
58343	US	Jiangsu	Changzhou	119.9781	31.8667
58349	US	Jiangsu	Suzhou	120.5600	31.4100
58351	US	Jiangsu	Jiangyin	120.3000	31.9000
58352	US	Jiangsu	Changshu	120.7667	31.6500
58354	US	Jiangsu	Wuxi	120.3500	31.6167
58356	US	Jiangsu	Kunshan	121.0000	31.4000
58359	US	Jiangsu	Wujiang	120.6167	31.1333
58361	US	Shanghai	Minhang	121.3667	31.1000
58362	US	Shanghai	Baoshan	121.4447	31.3908
58365	US	Shanghai	Jiading	121.1994	31.3806
58367	US	Shanghai	Xujiahui	121.4300	31.2000
58370	US	Shanghai	Pudong	121.5300	31.2300
58443	US	Zhejiang	Changxing	119.8900	31.0200
58449	US	Zhejiang	Fuyang	119.9500	30.0500
58451	US	Zhejiang	Jiashan	120.9300	30.8300
58452	US	Zhejiang	Jiaxing	120.7667	30.7333
58457	US	Zhejiang	Hangzhou	120.1600	30.2300
58459	US	Zhejiang	Xiaoshan	120.2800	30.1800
58460	US	Shanghai	Jinshan	121.2667	30.8167
58461	US	Shanghai	Qingpu	121.1167	31.1333
58462	US	Shanghai	Songjiang	121.1758	31.0200
58467	US	Zhejiang	Cixi	121.2700	30.2000
58468	US	Zhejiang	Yuyao	121.1300	30.0200
58561	US	Zhejiang	Zhenhai	121.6000	29.9800
58562	US	Zhejiang	Yinzhou	121.5000	29.8000
58665	US	Zhejiang	Hongjia	121.4167	28.6167
58203	US	Anhui	Fuyang	115.7364	32.8775
58424	US	Anhui	Anqing	116.9672	30.6231
58141	US	Jiangsu	Huaian	118.9269	33.6378
58027	US	Jiangsu	Xuzhou	117.1586	34.2872
58549	US	Zhejiang	Jinhua	119.6558	29.1128
58659	US	Zhejiang	Wenzhou	120.6578	28.0250
58223	RS	Anhui	Mingguang	117.9892	32.8003
58340	RS	Jiangsu	Lishui	119.0639	31.6028
58107	RS	Anhui	Linquan	115.2611	32.9106
58235	RS	Jiangsu	Liuhe	118.8472	32.3686
58264	RS	Jiangsu	Rudong	121.2206	32.3422
58342	RS	Jiangsu	Jintan	119.5406	31.7103
58243	RS	Jiangsu	Xinghua	119.8172	32.9458
58337	RS	Anhui	Fanchang	118.2153	31.0558
58335	RS	Anhui	Dangtu	118.5544	31.5531
58339	RS	Jiangsu	Gaochun	118.9039	31.3333

58377	RS	Jiangsu	Taicang	121.1075	31.5136
58353	RS	Jiangsu	Zhangjiagang	120.5697	31.8586
58455	RS	Zhejiang	Haining	120.4919	30.4792
58553	RS	Zhejiang	Shangyu	120.8133	30.0533
58541	RS	Zhejiang	Linan	119.7522	30.2969
58420	RS	Anhui	Zongyang	117.2331	30.7125
58565	RS	Zhejiang	Fenghua	121.3869	29.6917
58454	RS	Zhejiang	Deqing	119.9839	30.5253
58559	RS	Zhejiang	Tiantai	120.9706	29.1528
58320	RS	Anhui	Feixi	117.0303	31.6081
58366	RS	Shanghai	Chongming	121.4928	31.6664
58038	RS	Jiangsu	Shuyang	118.7836	34.0911
58012	RS	Jiangsu	Fengxian	116.6561	34.6719
58546	RS	Zhejiang	Pujiang	119.8722	29.4750
58751	RS	Zhejiang	Pingyang	120.5731	27.6686

Reference:

Ren, G., Chu, Z., Chen, Z., Ren, Y.: Implications of temporal change in urban heat island intensity observed at Beijing and Wuhan stations. Geophysical Research Letters, 34, 5, https://doi.org/10.1029/2006GL027927, 2007.

Yang, Y., Guo, M., Ren, G., Liu, S., Zong, L., Zhang, Y., et al. Modulation of wintertime canopy urban heat island (CUHI) intensity in Beijing by synoptic weather pattern in planetary boundary layer. Journal of Geophysical Research: Atmospheres, 127, e2021JD035988. https://doi.org/10.1029/2021JD035988, 2022.

Response to Review Comments of RC2

Dear Reviewer and Editors:

We are sincerely grateful to the editor and reviewer for their valuable time for reviewing our manuscript. The comments are very helpful and valuable, and we have addressed the issues raised by the reviewer in the revised manuscript. Please find our point-by-point response (in blue text) to the comments (in black text) raised by the reviewer. We have revised the paper according to your comments (highlighted in red text of the revised manuscript).

Sincerely yours,

Dr. Yuanjian Yang, representing all co-authors

This study presents a comprehensive and detailed analysis of the diurnal drivers of the Canopy Urban Heat Island Intensity (CUHII) in the Yangtze River Delta Urban Agglomeration. The manuscript utilizes multiple datasets and methods, making it a robust piece of research. However, the manuscript appears a bit lengthy and the novelty of the findings is not clearly articulated.

Response: Thanks very much for taking time to provide us with such valuable comments that significantly improve the quality of our manuscript. In line with your comments and suggestions, we have revised our manuscript carefully and prepared a list of point-by-point responses below.

Firstly, I have accordingly refined both the abstract and conclusion sections of our manuscript. Indeed, our conclusions are built upon the foundation of existing knowledge. However, as you pointed out, we have employed more advanced weather classification and data mining techniques, which have enabled us to gain a more nuanced understanding of the formation mechanisms of the diurnal cycle of CUHI. For instance, we have quantified the contributions of SWPs and human activities to the day CUHI and night CUHI, adding depth to the existing literature. Furthermore, our study has uncovered a diurnal asymmetry in the modulation of SWPs and human activities on CUHI, resulting in a significant reduction in the daily amplitude of CUHI. This finding provides a novel perspective for investigating the diurnal cycle and formation mechanisms of the CUHI.

Secondly, I have revised the introduction accordingly, with a particular focus on highlighting the lack of sufficient attention in existing research regarding the combination of SWPs and human activities on the modulation of diurnal cycle of CUHI. Specifically, I have emphasized the gap in understanding the differences in the regulation of daytime and nighttime CUHI by these factors.

Thirdly, thank you very much for your valuable suggestion on streamlining the manuscript. I fully agree that the content prior to section 3.3 was somewhat lengthy, which may have blurred the focus of the article. In response, I have adjusted the overall structure by condensing some discussions and analyses, and have moved some figures to the appendix to enhance the clarity of the paper's logic.

Thank you once again for your valuable feedback, which has greatly improved the quality of our manuscript.

Major comments:

1. In the methodology section, I suggest including a workflow that outlines the datasets and methods used in the study.

Response: Thank you very much for your valuable suggestion. In response to your feedback, a workflow diagram outlining the datasets and methods used in this study has been included.

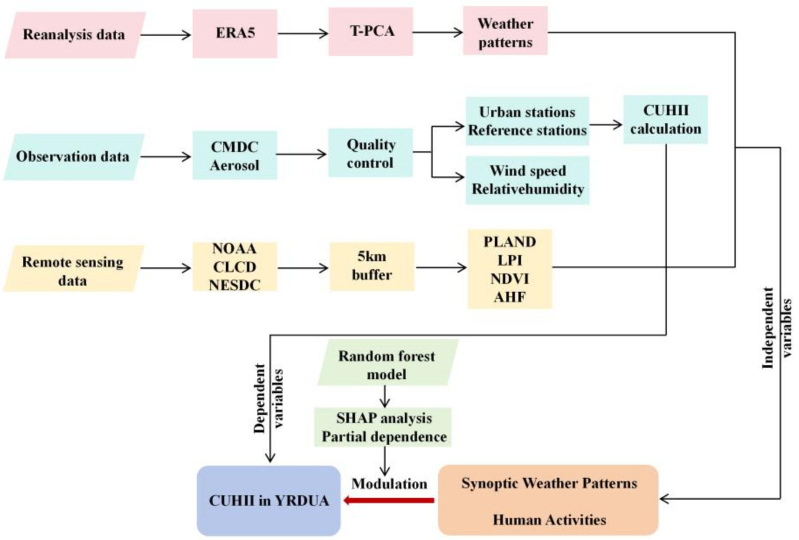

Figure R1: The workflow of the datasets and methods used in this paper.

2. Figure 1b: It is unclear whether the reference station shown in Figure 1b is the same as the one mentioned in Section 2.3.1. Could you please clarify this in the manuscript?

Response: Thank you for your valuable feedback on Figure 1b. Upon careful review of the station information as per your suggestion, I have identified and corrected a typographical error in Section 2.3.1. Specifically, the number of USs and RSs mentioned in the section were incorrectly stated, and I have now corrected them to 46 and 25, respectively. I sincerely apologize for this mistake and have thoroughly proofread the text to ensure that such errors do not recur.

Furthermore, to clarify any potential confusion regarding the stations depicted in Figure 1b and mentioned in Section 2.3.1, I have attached Table R1, which provides comprehensive information on all selected USs and RSs in the YRDUA region. This table includes station names, station numbers, provinces, longitudes, and latitudes, allowing for easy identification in Figure 1b.

Thank you again for your time and effort in reviewing my manuscript.

Tab. R1 The information of USs and RSs in YRDUA

Station numbers	Types	Provinces	Station names	Longitudes	Latitudes
58236	US	Anhui	Chuzhou	118.2500	32.3500

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58452	US	Zhejiang	Jiaxing	120.7667	30.7333
58457	US	Zhejiang	Hangzhou	120.1600	30.2300
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58559	RS	Zhejiang	Tiantai	120.9706	29.1528
58320	RS	Anhui	Feixi	117.0303	31.6081
58366	RS	Shanghai	Chongming	121.4928	31.6664
58038	RS	Jiangsu	Shuyang	118.7836	34.0911
58012	RS	Jiangsu	Fengxian	116.6561	34.6719
58546	RS	Zhejiang	Pujiang	119.8722	29.4750
58751	RS	Zhejiang	Pingyang	120.5731	27.6686

3. Line 205: The statement, "After 18:00 BJ, as the solar altitude angle decreases, the effective radiation in suburban areas gradually increases, accelerating atmospheric heat loss," is confusing. Typically, as solar altitude decreases, radiation decreases, which should not lead to an increase in effective radiation in suburban areas. Could you please provide a more detailed explanation or consider revising this statement for accuracy?

Response: I apologize for the confusion caused by my unclear statement. Let me provide a more detailed and accurate explanation in line :

"After 18:00 BJT, as the solar altitude angle decreases, the shortwave radiation from the sun correspondingly diminishes. For suburban areas, the net radiation generally turns negative after sunset, leading to a stable atmospheric stratification where the entire underlying surface is in a state of heat loss, resulting in an increased cooling rate (Zhang et al., 2005; Liu et al., 2013). However, in urban areas, due to the accumulation of more heat, long-wave radiation from the ground continues to supply heat to the atmosphere. The urban underlying surface is characterized by dense construction, leading to much lower Sky View Factor (SVF) in streets compared to suburban areas. Longwave radiation from the ground undergoes multiple reflections between walls and the ground, significantly reducing the amount of heat lost from the surface to the atmosphere (Drach et al., 2018; Tian et al., 2019). In addition, high-rise buildings in urban areas with lower SVF tend to experience lower wind speed (Hang et al., 2011). These factors collectively contribute to a rapid widening of the temperature difference between urban and suburban areas during the night."

Reference:

Zhang, J., Meng, Q., Li, X., Yang, L.: Urban Heat Island Variations in Beijing Region in Multi Spatial and Temporal Scales.Scientia Geographica Sinica, 31, 11, 6, https://doi.org/10.13249/j.cnki.sgs.2011.011.1349, 2005.

Liu, W., Yang, P., You, H., Zhang, B.: Heat island effect and diurnal temperature range in Beijing area. Climatic and Environmental Research, 18, 2, 171–177, https://doi.org/10.3878/j.issn.1006-9585.2012.11147, 2013.

Drach, P., Kru¨ger, E. L., Emmanuel, R.: Effects of atmospheric stability and urban morphology on daytime intra-urban temperature variability for Glasgow, UK. Sci. Total Environ., 627, 782–791, https://doi.org/10.1016/j.scitotenv.2018.01.285, 2018.

Tian, Y., Miao, J.: Overview of Mountain-Valley Breeze Studies in China. Meteorological Science and Technology, 47, 1, 11. https://doi.org/10.19517/j.1671-6345.20170777, 2019.

Hang, J., Li, Y., Sandberg, M.: Experimental and numerical studies of flows through and within high-rise building arrays and their link to ventilation strategy. J Wind Eng Ind Aerodyn, 99, 1036–1055, https://doi.org/10.1016/j.envsoft.2016.06.021, 2011.

4. Line 210: The manuscript states, "Before sunrise, between 0:00 and 7:00, the cooling rates of urban and suburban temperatures are similar, causing the CUHII to gradually increase to its daily maximum value of 0.65 °C." However, it is generally understood that urban areas, due to their heat storage in built materials and the canopy structure, would have a slower cooling rate compared to suburban areas. Please provide reasons that support this claim of similar cooling rates.

Response: I apologize for the error in the manuscript. You are correct in pointing out that typically, urban areas experience slower cooling rates compared to suburban areas due to their heat storage in built materials and canopy structure. The statement in the manuscript was a mistake and should be revised. The correct description is:

"Compared to urban areas, suburbs can be regarded as cooling sources (Mirzaei & Haghighat, 2010; Yang et al., 2024). Before sunrise, between 0:00 and 7:00, the cooling rate in urban areas consistently remains lower than that in suburban areas, leading to a gradual increase in the CUHII to its daily maximum value of 0.65°C."

Reference:

Mirzaei, P. A. & Haghighat, F.: Approaches to study urban heat island—abilities and limitations. Build. Environ., 45, 2192–2201, https://doi.org/10.1016/j.buildenv.2010.04.001, 2010.

Yang, M., Ren, C., Wang, H., Wang, J., Feng, Z., Kumar, P., Haghighat, F., Cao, S.: Mitigating urban heat island through neighboring rural land cover. Nature Cities, 1, 522–532, https://doi.org/10.1038/s44284-024-00091-z, 2024.

5. What factors contribute to the similarity in CUHII magnitude during the night and daytime in July?

Response: Thank you for your insightful question, which aligns well with our research direction. As shown in Fig. R2, the top three synoptic weather classifications in July are Type 2, Type 5, and Type 1. Previous studies have indeed observed a significant amplification of CUHII during heatwave (HW) periods (Li & Bou-Zeid, 2013; Founda et al., 2015; Khan et al., 2020; Ngarambe et al., 2020).

We have analyzed the diurnal variation of CUHII during HW and non-heatwave (NHW) periods under these three weather conditions. As illustrated in Fig. R3, the CUHII during HW periods (red line) is notably higher than during NHW periods (blue line) for these three synoptic weather patterns. Further analysis reveals that, under these three weather conditions, the amplified CUHII (ΔCUHII) during the daytime exceeds that at night, aligning with previous studies (Tan et al., 2010; Founda et al., 2017). This highlights the crucial role of daytime in amplifying CUHII. Consequently, the diurnal asymmetry in CUHII amplification due to heatwaves results in daytime CUHII surpassing nighttime CUHII in July.

In the future, we plan to further investigate the physical mechanisms behind this phenomenon. Thank you again for your valuable input.

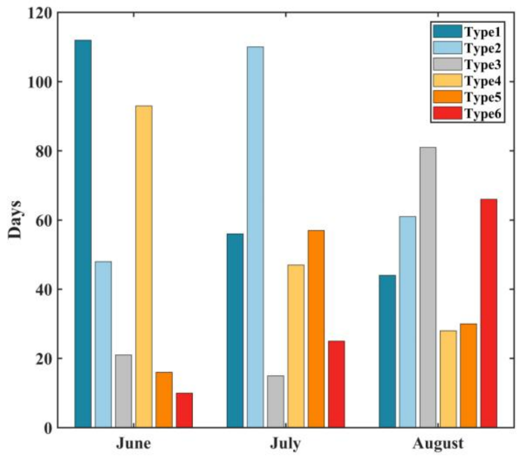

Figure R2: (a) Daily, (b) Interannual and (c) Monthly occurrence frequencies of the six SWPs in YRDUA from 2011 to 2020.

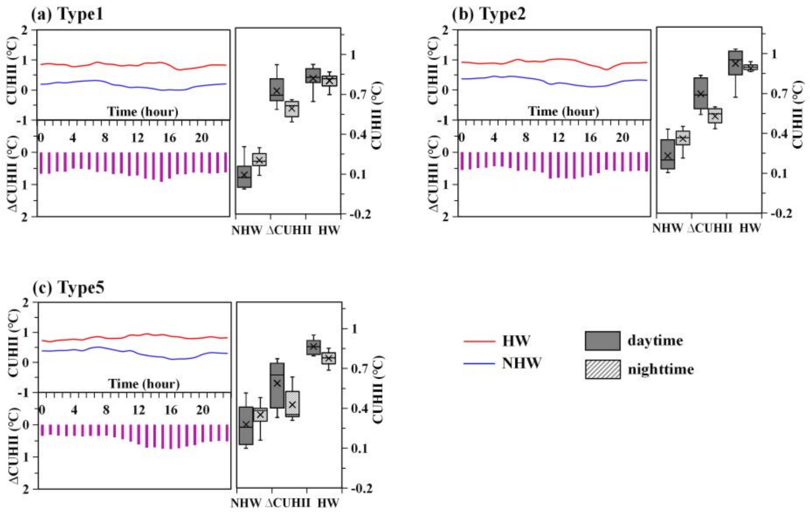

Figure R3: Synergies between HW and CUHI during HW periods under Type1 (a), Type2 (b), and Type5 (c). In each panel, the upper line chart represents the diurnal variation of CUHII, the lower bar chart represents the diurnal variation of the ΔCUHII during HW periods, and the box plot on the right presents the statistical results for both day and night.

Reference:

Li, D., Bou-Zeid, E.: Synergistic Interactions between Urban Heat Islands and Heat Waves: The Impact in Cities Is Larger than the Sum of Its Parts. Journal of Applied Meteorology and Climatology, 52,9, 2051-2064, https://doi.org/10.1175/JAMC-D-13-02.1, 2013.

Founda, D., Pierros, F., Petrakis, M., Zerefos, C.: Interdecadal variations and trends of the urban heat island in Athens (Greece) and its response to heat waves. Atmospheric Research,161, 1–13, https://doi.org/10.1016/j.atmosres.2015.03.016, 2015.

Khan, H. S., Paolini, R., Santamouris, M., Caccetta, P.: Exploring the synergies between urban overheating and heatwaves (HWs) in Western Sydney, Energies, 13, 2, 470, https://doi.org/10.3390/en13020470, 2020.

Ngarambe, J., Nganyiyimana, J., Kim, I., Santamouris, M., Yun, G. Y.: Synergies between urban heat island and heat waves in Seoul: The role of wind speed and land use characteristics. PLoS ONE, 15, 12, https://doi.org/10.1371/journal.pone.0243571, 2020.

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As we know, heatwaves are often associated with high-pressure systems. Under such systems, the prevailing sinking air currents suppress vertical air motion, reduce cloud cover, and allow the ground to receive more sunlight, leading to increased temperature gradients and enhanced atmospheric stability, which contribute to decreased wind speeds during heatwaves (Gao et al., 2023; Ji et al., 2024).

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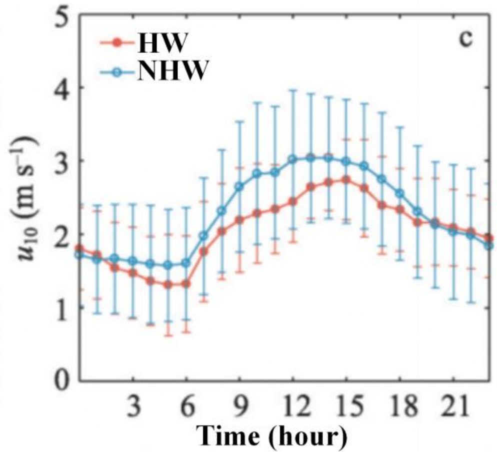
Thank you again for your valuable insights.



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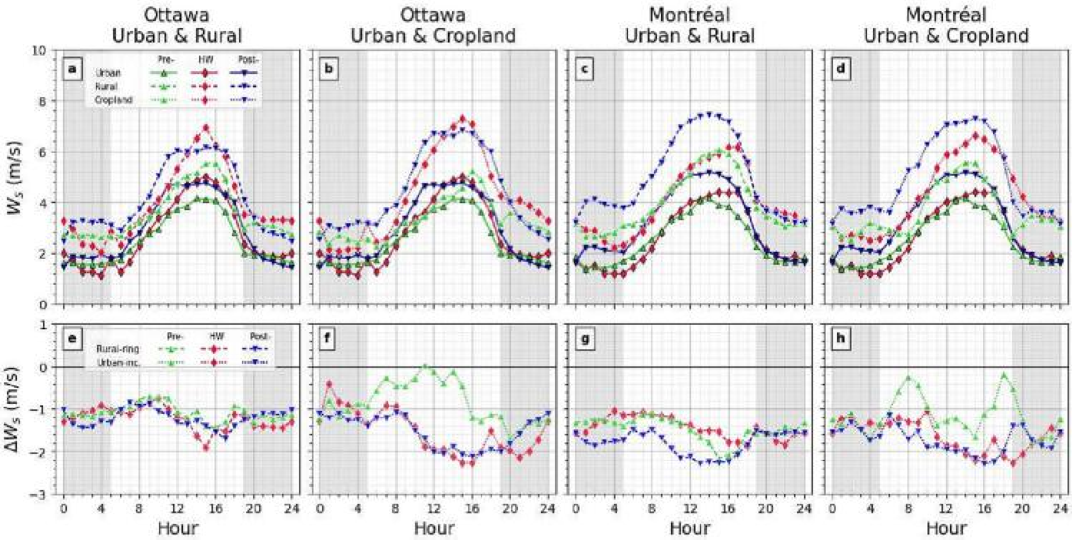

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Ao, X., Tan, J., Zhi, X., Guo, J., Lu, Y., Liu, D.: Synergistic interaction between urban heat island and heat waves and its impact factors in Shanghai. Acta Geographica Sinica, 74, 9, 1789–1802, https://doi.org/10.11821/dlxb201909007, 2019.

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Thank you once again for your valuable insights.

Minor comments:

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Response: Apologies for the oversight. I have now included the full name of the Western Pacific Subtropical High (WPSH) at its first mention and checked the entire manuscript to prevent similar errors from occurring.

Response to Review Comments of CC1

Dear Reviewer and Editors:

We are sincerely grateful to the editor and reviewer for their valuable time for reviewing our manuscript. The comments are very helpful and valuable, and we have addressed the issues raised by the reviewer in the revised manuscript. Please find our point-by-point response (in blue text) to the comments (in black text) raised by the reviewer. We have revised the paper according to your comments (highlighted in red text of the revised manuscript).

Sincerely yours,

Dr. Yuanjian Yang, representing all co-authors

This study presents a comprehensive and detailed analysis of the diurnal drivers of the Canopy Urban Heat Island Intensity (CUHII) in the Yangtze River Delta Urban Agglomeration. The manuscript utilizes multiple datasets and methods, making it a robust piece of research. However, the manuscript appears a bit lengthy and the novelty of the findings is not clearly articulated.

Response: Thanks very much for taking time to provide us with such valuable comments that significantly improve the quality of our manuscript. In line with your comments and suggestions, we have revised our manuscript carefully and prepared a list of point-by-point responses below.

Firstly, I have accordingly refined both the abstract and conclusion sections of our manuscript. Indeed, our conclusions are built upon the foundation of existing knowledge. However, as you pointed out, we have employed more advanced weather classification and data mining techniques, which have enabled us to gain a more nuanced understanding of the formation mechanisms of the diurnal cycle of CUHI. For instance, we have quantified the contributions of SWPs and human activities to the day CUHI and night CUHI, adding depth to the existing literature. Furthermore, our study has uncovered a diurnal asymmetry in the modulation of SWPs and human activities on CUHI, resulting in a significant reduction in the daily amplitude of CUHI. This finding provides a novel perspective for investigating the diurnal cycle and formation mechanisms of the CUHI.

Secondly, I have revised the introduction accordingly, with a particular focus on highlighting the lack of sufficient attention in existing research regarding the combination of SWPs and human activities on the modulation of diurnal cycle of CUHI. Specifically, I have emphasized the gap in understanding the differences in the regulation of daytime and nighttime CUHI by these factors.

Thirdly, thank you very much for your valuable suggestion on streamlining the manuscript. I fully agree that the content prior to section 3.3 was somewhat lengthy, which may have blurred the focus of the article. In response, I have adjusted the overall structure by condensing some discussions and analyses, and have moved some figures to the appendix to enhance the clarity of the paper's logic.

Thank you once again for your valuable feedback, which has greatly improved the quality of our manuscript.

Major comments:

1. In the methodology section, I suggest including a workflow that outlines the datasets and methods used in the study.

Response: Thank you very much for your valuable suggestion. In response to your feedback, a workflow diagram outlining the datasets and methods used in this study has been included.

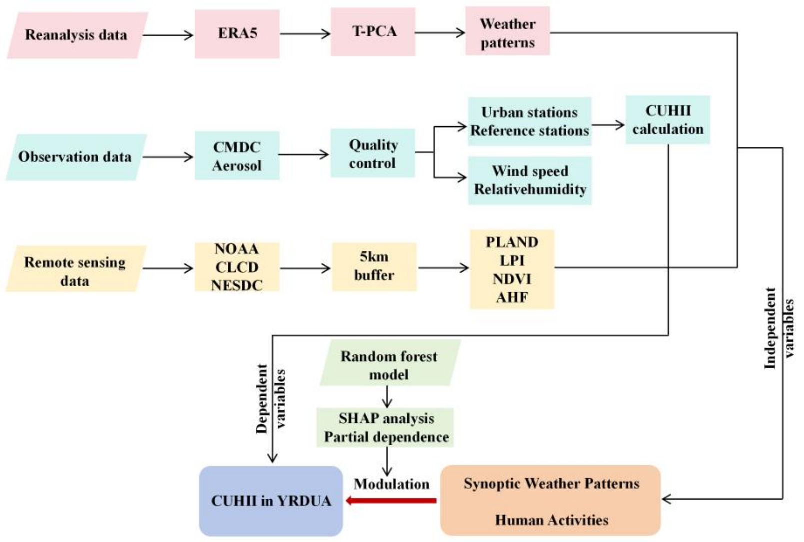

Figure R1: The workflow of the datasets and methods used in this paper.

2. Figure 1b: It is unclear whether the reference station shown in Figure 1b is the same as the one mentioned in Section 2.3.1. Could you please clarify this in the manuscript?

Response: Thank you for your valuable feedback on Figure 1b. Upon careful review of the station information as per your suggestion, I have identified and corrected a typographical error in Section 2.3.1. Specifically, the number of USs and RSs mentioned in the section were incorrectly stated, and I have now corrected them to 46 and 25, respectively. I sincerely apologize for this mistake and have thoroughly proofread the text to ensure that such errors do not recur.

Furthermore, to clarify any potential confusion regarding the stations depicted in Figure 1b and mentioned in Section 2.3.1, I have attached Table R1, which provides comprehensive information on all selected USs and RSs in the YRDUA region. This table includes station names, station numbers, provinces, longitudes, and latitudes, allowing for easy identification in Figure 1b.

Thank you again for your time and effort in reviewing my manuscript.

Tab. R1 The information of USs and RSs in YRDUA

Station numbers	Types	Provinces	Station names	Longitudes	Latitudes
58236	US	Anhui	Chuzhou	118.2500	32.3500

58238	US	Jiangsu	Nanjing	118.9000	31.9300
58241	US	Jiangsu	Gaoyou	119.4481	32.7919
58242	US	Jiangsu	Yizheng	119.1586	32.2997
58245	US	Jiangsu	Yangzhou	119.4200	32.4100
58247	US	Jiangsu	Yangzhong	119.7983	32.2744
58250	US	Jiangsu	Jiangyan	120.1500	32.5200
58252	US	Jiangsu	Dantu	119.4667	32.1833
58254	US	Jiangsu	Haian	120.4125	32.5486
58255	US	Jiangsu	Rugao	120.5675	32.3675
58257	US	Jiangsu	Jinjiang	120.2500	31.9800
58321	US	Anhui	Hefei	117.0572	31.9556
58334	US	Anhui	Wuhu	118.3700	31.3800
58336	US	Anhui	Maanshan	118.5667	31.7000
58343	US	Jiangsu	Changzhou	119.9781	31.8667
58349	US	Jiangsu	Suzhou	120.5600	31.4100
58351	US	Jiangsu	Jiangyin	120.3000	31.9000
58352	US	Jiangsu	Changshu	120.7667	31.6500
58354	US	Jiangsu	Wuxi	120.3500	31.6167
58356	US	Jiangsu	Kunshan	121.0000	31.4000
58359	US	Jiangsu	Wujiang	120.6167	31.1333
58361	US	Shanghai	Minhang	121.3667	31.1000
58362	US	Shanghai	Baoshan	121.4447	31.3908
58365	US	Shanghai	Jiading	121.1994	31.3806
58367	US	Shanghai	Xujiahui	121.4300	31.2000
58370	US	Shanghai	Pudong	121.5300	31.2300
58443	US	Zhejiang	Changxing	119.8900	31.0200
58449	US	Zhejiang	Fuyang	119.9500	30.0500
58451	US	Zhejiang	Jiashan	120.9300	30.8300
58452	US	Zhejiang	Jiaxing	120.7667	30.7333
58457	US	Zhejiang	Hangzhou	120.1600	30.2300
58459	US	Zhejiang	Xiaoshan	120.2800	30.1800
58460	US	Shanghai	Jinshan	121.2667	30.8167
58461	US	Shanghai	Qingpu	121.1167	31.1333
58462	US	Shanghai	Songjiang	121.1758	31.0200
58467	US	Zhejiang	Cixi	121.2700	30.2000
58468	US	Zhejiang	Yuyao	121.1300	30.0200
58561	US	Zhejiang	Zhenhai	121.6000	29.9800
58562	US	Zhejiang	Yinzhou	121.5000	29.8000
58665	US	Zhejiang	Hongjia	121.4167	28.6167
58203	US	Anhui	Fuyang	115.7364	32.8775
58424	US	Anhui	Anqing	116.9672	30.6231
58141	US	Jiangsu	Huaian	118.9269	33.6378
58027	US	Jiangsu	Xuzhou	117.1586	34.2872
58549	US	Zhejiang	Jinhua	119.6558	29.1128

58659	US	Zhejiang	Wenzhou	120.6578	28.0250
58223	RS	Anhui	Mingguang	117.9892	32.8003
58340	RS	Jiangsu	Lishui	119.0639	31.6028
58107	RS	Anhui	Linquan	115.2611	32.9106
58235	RS	Jiangsu	Liuhe	118.8472	32.3686
58264	RS	Jiangsu	Rudong	121.2206	32.3422
58342	RS	Jiangsu	Jintan	119.5406	31.7103
58243	RS	Jiangsu	Xinghua	119.8172	32.9458
58337	RS	Anhui	Fanchang	118.2153	31.0558
58335	RS	Anhui	Dangtu	118.5544	31.5531
58339	RS	Jiangsu	Gaochun	118.9039	31.3333
58377	RS	Jiangsu	Taicang	121.1075	31.5136
58353	RS	Jiangsu	Zhangjiagang	120.5697	31.8586
58455	RS	Zhejiang	Haining	120.4919	30.4792
58553	RS	Zhejiang	Shangyu	120.8133	30.0533
58541	RS	Zhejiang	Linan	119.7522	30.2969
58420	RS	Anhui	Zongyang	117.2331	30.7125
58565	RS	Zhejiang	Fenghua	121.3869	29.6917
58454	RS	Zhejiang	Deqing	119.9839	30.5253
58559	RS	Zhejiang	Tiantai	120.9706	29.1528
58320	RS	Anhui	Feixi	117.0303	31.6081
58366	RS	Shanghai	Chongming	121.4928	31.6664
58038	RS	Jiangsu	Shuyang	118.7836	34.0911
58012	RS	Jiangsu	Fengxian	116.6561	34.6719
58546	RS	Zhejiang	Pujiang	119.8722	29.4750
58751	RS	Zhejiang	Pingyang	120.5731	27.6686

3. Line 205: The statement, "After 18:00 BJ, as the solar altitude angle decreases, the effective radiation in suburban areas gradually increases, accelerating atmospheric heat loss," is confusing. Typically, as solar altitude decreases, radiation decreases, which should not lead to an increase in effective radiation in suburban areas. Could you please provide a more detailed explanation or consider revising this statement for accuracy?

Response: I apologize for the confusion caused by my unclear statement. Let me provide a more detailed and accurate explanation in line :

"After 18:00 BJT, as the solar altitude angle decreases, the shortwave radiation from the sun correspondingly diminishes. For suburban areas, the net radiation generally turns negative after sunset, leading to a stable atmospheric stratification where the entire underlying surface is in a state of heat loss, resulting in an increased cooling rate (Zhang et al., 2005; Liu et al., 2013). However, in urban areas, due to the accumulation of more heat, long-wave radiation from the ground continues to supply heat to the atmosphere. The urban underlying surface is characterized by dense construction, leading to much lower Sky View Factor (SVF) in streets compared to suburban areas. Longwave radiation from the ground undergoes multiple reflections between walls and the ground, significantly reducing the amount of heat lost from the surface to the atmosphere (Drach et al., 2018; Tian et al., 2019). In addition, high-rise buildings in urban areas with lower SVF tend to experience lower wind speed (Hang et al., 2011). These factors collectively contribute to a rapid widening of the temperature difference between urban and suburban areas during the night."

Reference:

Zhang, J., Meng, Q., Li, X., Yang, L.: Urban Heat Island Variations in Beijing Region in Multi Spatial and Temporal Scales.Scientia Geographica Sinica, 31, 11, 6, https://doi.org/10.13249/j.cnki.sgs.2011.011.1349, 2005.

Liu, W., Yang, P., You, H., Zhang, B.: Heat island effect and diurnal temperature range in Beijing area. Climatic and Environmental Research, 18, 2, 171–177, https://doi.org/10.3878/j.issn.1006-9585.2012.11147, 2013.

Drach, P., Kru¨ger, E. L., Emmanuel, R.: Effects of atmospheric stability and urban morphology on daytime intra-urban temperature variability for Glasgow, UK. Sci. Total Environ., 627, 782–791, https://doi.org/10.1016/j.scitotenv.2018.01.285, 2018.

Tian, Y., Miao, J.: Overview of Mountain-Valley Breeze Studies in China. Meteorological Science and Technology, 47, 1, 11. https://doi.org/10.19517/j.1671-6345.20170777, 2019.

Hang, J., Li, Y., Sandberg, M.: Experimental and numerical studies of flows through and within high-rise building arrays and their link to ventilation strategy. J Wind Eng Ind Aerodyn, 99, 1036–1055, https://doi.org/10.1016/j.envsoft.2016.06.021, 2011.

4. Line 210: The manuscript states, "Before sunrise, between 0:00 and 7:00, the cooling rates of urban and suburban temperatures are similar, causing the CUHII to gradually increase to its daily maximum value of 0.65 °C." However, it is generally understood that urban areas, due to their heat storage in built materials and the canopy structure, would have a slower cooling rate compared to suburban areas. Please provide reasons that support this claim of similar cooling rates.

Response: I apologize for the error in the manuscript. You are correct in pointing out that typically, urban areas experience slower cooling rates compared to suburban areas due to their heat storage in built materials and canopy structure. The statement in the manuscript was a mistake and should be revised. The correct description is:

"Compared to urban areas, suburbs can be regarded as cooling sources (Mirzaei & Haghighat, 2010; Yang et al., 2024). Before sunrise, between 0:00 and 7:00, the cooling rate in urban areas consistently remains lower than that in suburban areas, leading to a gradual increase in the CUHII to its daily maximum value of 0.65°C."

Reference:

Mirzaei, P. A. & Haghighat, F.: Approaches to study urban heat island—abilities and limitations. Build. Environ., 45, 2192–2201, https://doi.org/10.1016/j.buildenv.2010.04.001, 2010.

Yang, M., Ren, C., Wang, H., Wang, J., Feng, Z., Kumar, P., Haghighat, F., Cao, S.: Mitigating urban heat island through neighboring rural land cover. Nature Cities, 1, 522–532, https://doi.org/10.1038/s44284-024-00091-z, 2024.

5. What factors contribute to the similarity in CUHII magnitude during the night and daytime in July?

Response: Thank you for your insightful question, which aligns well with our research direction. As shown in Fig. R2, the top three synoptic weather classifications in July are Type 2, Type 5, and Type 1. Previous studies have indeed observed a significant amplification of CUHII during heatwave (HW) periods (Li & Bou-Zeid, 2013; Founda et al., 2015; Khan et al., 2020; Ngarambe et al., 2020).

We have analyzed the diurnal variation of CUHII during HW and non-heatwave (NHW) periods under these three weather conditions. As illustrated in Fig. R3, the CUHII during HW periods (red line) is notably higher than during NHW periods (blue line) for these three synoptic weather patterns. Further analysis reveals that, under these three weather conditions, the amplified CUHII (ΔCUHII) during the daytime exceeds that at night, aligning with previous studies (Tan et al., 2010; Founda et al., 2017). This highlights the crucial role of daytime in amplifying CUHII. Consequently, the diurnal asymmetry in CUHII amplification due to heatwaves results in daytime CUHII surpassing nighttime CUHII in July.

In the future, we plan to further investigate the physical mechanisms behind this phenomenon. Thank you again for your valuable input.

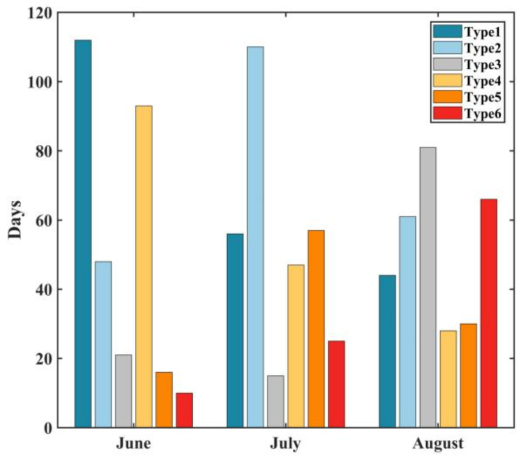

Figure R2: (a) Daily, (b) Interannual and (c) Monthly occurrence frequencies of the six SWPs in YRDUA from 2011 to 2020.

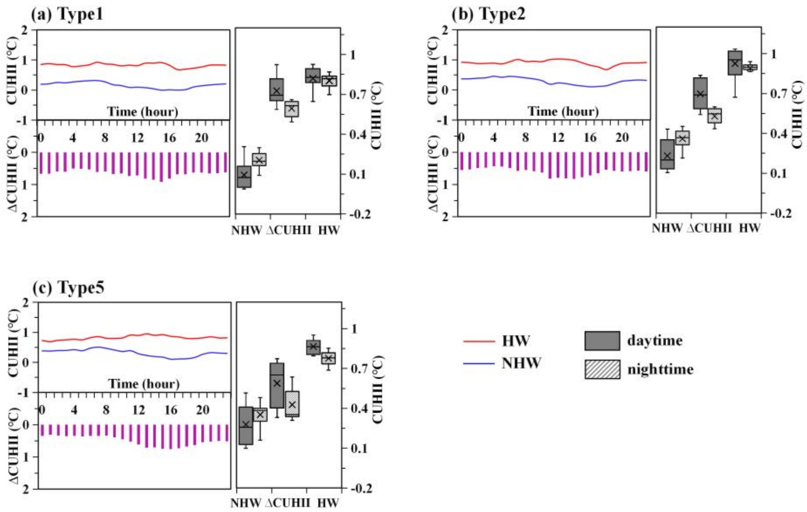

Figure R3: Synergies between HW and CUHI during HW periods under Type1 (a), Type2 (b), and Type5 (c). In each panel, the upper line chart represents the diurnal variation of CUHII, the lower bar chart represents the diurnal variation of the ΔCUHII during HW periods, and the box plot on the right presents the statistical results for both day and night.

Reference:

Li, D., Bou-Zeid, E.: Synergistic Interactions between Urban Heat Islands and Heat Waves: The Impact in Cities Is Larger than the Sum of Its Parts. Journal of Applied Meteorology and Climatology, 52,9, 2051-2064, https://doi.org/10.1175/JAMC-D-13-02.1, 2013.

Founda, D., Pierros, F., Petrakis, M., Zerefos, C.: Interdecadal variations and trends of the urban heat island in Athens (Greece) and its response to heat waves. Atmospheric Research,161, 1–13, https://doi.org/10.1016/j.atmosres.2015.03.016, 2015.

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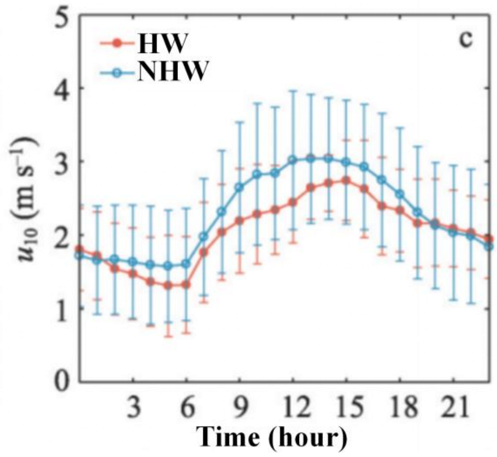
Thank you again for your valuable insights.



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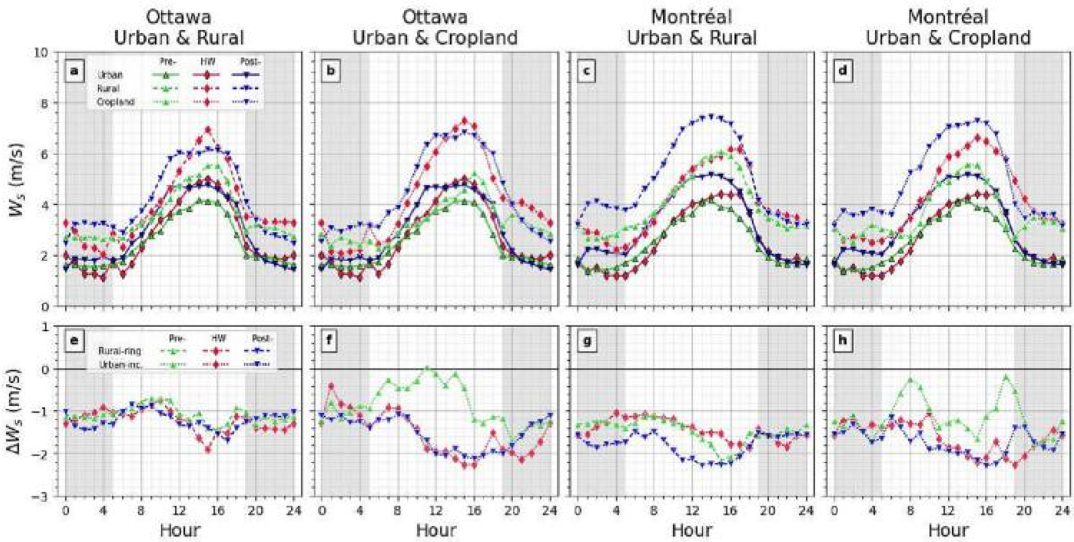

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In the future, we will utilize the methods and framework employed in this study as a useful starting point for research in other regions. By taking into account local-specific environmental factors, we aim to continue exploring the modulation of CUHII by SWP and human activities.

Thank you once again for your valuable insights.

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