

Point-by-point Response to Reviewers

Dear Editor,

We sincerely thank the Editor and the Reviewer for the careful evaluation of our manuscript and for providing constructive comments and valuable suggestions. We greatly appreciate the reviewer's insightful observations, which have substantially helped us improve the scientific clarity, methodological rigor, and overall quality of the manuscript.

We have carefully revised the manuscript in response to all comments raised during the previous review process. In particular, we have improved the conceptual clarity of biometeorological terminology, revised the Introduction and Methods sections, strengthened the justification for the use of WBGT and UTCI, clarified the thermal stress classification framework, and improved the consistency of terminology throughout the manuscript. Detailed point-by-point responses to the reviewer's comments are provided below.

Reviewer's Comments and Authors' Responses

Reviewer's comment

1. Introduction: p. 3: Two first paragraphs give the same information, please summarize.

Authors' response

We thank the reviewer for this valuable suggestion. The Introduction section has been thoroughly revised to reduce redundancy and improve the overall flow and coherence of the narrative. The first two paragraphs were carefully condensed and reorganized to avoid duplication while maintaining the scientific context and relevance of the study. The changes have been incorporated in first 2 paragraph of introduction section.

“Anthropogenic climate change has emerged as one of the most significant environmental and public health challenges of the twenty-first century, with rising global temperatures progressively altering the thermal environments experienced by human populations worldwide (Buhaug et al., 2023; Rossati, 2016). The increasing concentration of greenhouse gases, driven primarily by fossil fuel combustion, industrialisation, and land-use change, has intensified atmospheric warming and pushed global temperatures to unprecedented levels in recorded history (IPCC, 2021; Ripple et al., 2025). According to the World Meteorological Organization (WMO), the past decade has been the warmest on instrumental record, with global mean temperature temporarily exceeding the 1.5 °C threshold above pre-industrial levels during 2024 (Hausfather, 2025; WMO, 2025). Beyond mean warming, climate change is altering precipitation regimes, atmospheric moisture transport, and the frequency and intensity of hydro-meteorological extremes, thereby amplifying climatic variability across many regions of the world (Allan et al., 2022; Trenberth et al., 2015).

Such changes have important implications for water availability, food systems, ecosystem functioning, and disease environments, particularly in densely populated regions characterised by high social vulnerability and limited adaptive capacity (Chou & Lan, 2012; Pendergrass et al., 2017). Among the various manifestations of climate change, increasing thermal stress exposure has emerged as one of the most direct and pervasive threats to human health and socio-economic well-being. Heatwaves are

becoming longer, more frequent, and more spatially extensive, increasingly affecting populations beyond traditionally warm climatic zones (Coumou et al., 2018; Perkins-Kirkpatrick & Lewis, 2020). Recent evidence suggests that South Asia, Southern Europe, North Africa, and North America have become major hotspots of extreme thermal condition during recent decades (Boboc et al., 2025; Copernicus, 2022; Kornhuber et al., 2024). Simultaneously, compound climatic events such as drought–heat and flood–heat interactions are intensifying, thereby amplifying overlapping risks for vulnerable populations (Raymond et al., 2020; J. Yang et al., 2024). These climatic extremes disrupt livelihoods, strain healthcare systems, reduce labour productivity, and elevate heat-related morbidity and mortality, particularly among populations engaged in outdoor and informal occupations (Kjellstrom et al., 2018; Mora et al., 2017). From a biometeorological perspective, however, human thermal conditions cannot be adequately characterised using air temperature alone, since atmospheric humidity, radiation, and wind speed collectively regulate heat exchange between the human body and the surrounding environment (Błażejczyk et al., 2014). In biometeorology, thermal stress refers to the integrated thermal load imposed on the human body by the external atmospheric environment, whereas thermal strain denotes the physiological response of the body to such thermal loading depending on exposure duration and individual adaptive capacity (De Freitas & Grigorieva, 2015; de Freitas & Ryken, 1989). Consequently, researchers increasingly rely on biometeorological indices such as the Wet Bulb Globe Temperature (WBGT) and Universal Thermal Climate Index (UTCI), which provide a more physiologically meaningful representation of outdoor thermal stress and heat-related health risk compared to temperature-based metrics alone (Di Napoli et al., 2021; Kjellström et al., 2019).”

Reviewer’s comment

p. 3, second paragraph: Please notice that there are two terms that should be separated: thermal stress and physiological strain do not mix them! (See de Freitas and Ryken 1989, p. 158: Thermal stress is the integrated, net thermal load on the body imposed by the external environment, whereas thermal strain is the physiological effect on the body as a consequence of this stress, depending on the period of time spent within the stressful environment). Please ensure that you use both terms correctly.

Authors’ response

We sincerely thank the reviewer for highlighting this important conceptual issue. Following the reviewer’s suggestion, we carefully revised the manuscript to ensure consistent and scientifically accurate use of biometeorological terminology throughout the text. The distinction between “thermal stress” and “thermal strain” has now been explicitly clarified in the Introduction section with appropriate citation to de Freitas and Ryken (1989), and the terminology has been standardized across the manuscript. These changes have been incorporated in first two paragraph of introduction section.

“Anthropogenic climate change has emerged as one of the most significant environmental and public health challenges of the twenty-first century, with rising global temperatures progressively altering the thermal environments experienced by human populations worldwide (Buhaug et al., 2023; Rossati, 2016). The increasing concentration of greenhouse gases, driven primarily by fossil fuel combustion, industrialisation, and land-use change, has intensified atmospheric warming and pushed global

temperatures to unprecedented levels in recorded history (IPCC, 2021; Ripple et al., 2025). According to the World Meteorological Organization (WMO), the past decade has been the warmest on instrumental record, with global mean temperature temporarily exceeding the 1.5 °C threshold above pre-industrial levels during 2024 (Hausfather, 2025; WMO, 2025). Beyond mean warming, climate change is altering precipitation regimes, atmospheric moisture transport, and the frequency and intensity of hydro-meteorological extremes, thereby amplifying climatic variability across many regions of the world (Allan et al., 2022; Trenberth et al., 2015).

Such changes have important implications for water availability, food systems, ecosystem functioning, and disease environments, particularly in densely populated regions characterised by high social vulnerability and limited adaptive capacity (Chou & Lan, 2012; Pendergrass et al., 2017). Among the various manifestations of climate change, increasing thermal stress exposure has emerged as one of the most direct and pervasive threats to human health and socio-economic well-being. Heatwaves are becoming longer, more frequent, and more spatially extensive, increasingly affecting populations beyond traditionally warm climatic zones (Coumou et al., 2018; Perkins-Kirkpatrick & Lewis, 2020). Recent evidence suggests that South Asia, Southern Europe, North Africa, and North America have become major hotspots of extreme thermal condition during recent decades (Boboc et al., 2025; Copernicus, 2022; Kornhuber et al., 2024). Simultaneously, compound climatic events such as drought–heat and flood–heat interactions are intensifying, thereby amplifying overlapping risks for vulnerable populations (Raymond et al., 2020; J. Yang et al., 2024). These climatic extremes disrupt livelihoods, strain healthcare systems, reduce labour productivity, and elevate heat-related morbidity and mortality, particularly among populations engaged in outdoor and informal occupations (Kjellstrom et al., 2018; Mora et al., 2017). From a biometeorological perspective, however, human thermal conditions cannot be adequately characterised using air temperature alone, since atmospheric humidity, radiation, and wind speed collectively regulate heat exchange between the human body and the surrounding environment (Błażejczyk et al., 2014). In biometeorology, thermal stress refers to the integrated thermal load imposed on the human body by the external atmospheric environment, whereas thermal strain denotes the physiological response of the body to such thermal loading depending on exposure duration and individual adaptive capacity (De Freitas & Grigorieva, 2015; de Freitas & Ryken, 1989). Consequently, researchers increasingly rely on biometeorological indices such as the Wet Bulb Globe Temperature (WBGT) and Universal Thermal Climate Index (UTCI), which provide a more physiologically meaningful representation of outdoor thermal stress and heat-related health risk compared to temperature-based metrics alone (Di Napoli et al., 2021; Kjellström et al., 2019).”

Reviewer’s comment

p. 4, last paragraph, the aim: (i) please add districts of Uttar Pradesh; (iv) please specify if you are talking about temporal (on which resolution) or spatial shifts.

Authors’ response

We appreciate the reviewer’s suggestion, which helped improve the clarity and precision of the study objectives. The aims of the study have been revised accordingly by explicitly specifying the districts

of Uttar Pradesh and clarifying that the analysis focuses on annual temporal shifts in thermal stress categories across districts. The comment is incorporated in the fifth paragraph of revised manuscript.

“Previous literature indicates that global warming began to accelerate during the 1970s (IPCC, 2021). Moreover, enhanced climate datasets during this period have enhanced the reliability of long-term climatic assessments (Hersbach et al., 2020). Taking these developments into account, the present study examines the spatio-temporal evolution of thermal stress across all districts of Uttar Pradesh during 1975–2024 using Wet Bulb Globe Temperature (WBGT) and Universal Thermal Climate Index (UTCI). Specifically, the present study aims to – (i) analyse long-term spatial heterogeneity in mean thermal stress across the districts of Uttar Pradesh, (ii) quantify changes in thermal stress between historical and recent climatic periods, (iii) assess monthly, seasonal, and annual trends in WBGT and UTCI, and (iv) evaluate the annual temporal shifts in the frequency and intensity of different heat-related thermal stress categories derived from WBGT and UTCI across districts of Uttar Pradesh. By focusing at the district level, where public health planning, disaster management, and heat action strategies are implemented, the study aims to provide policy-relevant evidence on evolving thermal stress patterns, contributing towards framing climate adaptation policies for reducing heat-related health risks in one of India’s most vulnerable regions.”

Reviewer’s comment

2. Study area: p. 5: please add classification of the climate according to the updated Köppen-Geiger classification (Beck et al. 2018). Please add references to this paragraph.

Authors’ response

We thank the reviewer for this helpful recommendation. The Study Area section has been revised to incorporate the updated Köppen–Geiger climate classification following Beck et al. (2018). Appropriate references have also been added to strengthen the climatological description of the study region.

“The present study focuses on the state of Uttar Pradesh (UP), located in the northern part of India within the Indo-Gangetic Plains (Figure 1). Uttar Pradesh is the most populous state in the country and one of the most densely populated regions in the world, covering an area of about 240,928 km², making it particularly vulnerable to climate-related environmental stressors. Administratively, the state is divided into 75 districts, which serve as the primary units for governance, disaster management and public health planning. Physiographically, the southern portion of the state transitions into the Bundelkhand plateau, characterised by relatively undulating terrain, rocky outcrops and comparatively drier climatic conditions. According to the updated Köppen–Geiger climate classification, Uttar Pradesh is predominantly characterised by a humid subtropical climate with dry winters and hot summers (Cwa), while parts of the south-western and Bundelkhand regions exhibit transitional semi-arid climatic characteristics (BSh) due to relatively lower precipitation and higher summer aridity (Beck et al., 2018). Climatically, the state experiences three distinct seasons: a hot pre-monsoon summer (March–June), a humid monsoon season (June–September) and a relatively cool winter season (Dec–Feb). The pre-monsoon period is characterised by extremely high temperatures, often exceeding

45°C particularly across western and Bundelkhand regions. In contrast, eastern districts experience comparatively higher humidity, which significantly intensifies thermal stress condition through combined temperature-humidity effects. Average annual rainfall varies from nearly 600 mm in western districts to more than 1200 mm in the eastern parts of the state, with approximately 80% of precipitation occurring during the southwest monsoon season. Socio-economically, Uttar Pradesh represents a complex landscape where climatic exposure intersects with high population density, rapid urbanisation and widespread dependence on climate-sensitive livelihoods such as agriculture, construction and informal outdoor labour. Major urban centres including Lucknow, Kanpur, Varanasi, Agra and Ghaziabad have experienced rapid expansion, contributing to localised urban heat island effects that may further intensify thermal stress conditions. At the same time, large rural populations remain directly exposed to adverse outdoor thermal environments because of their dependence on outdoor occupations and limited adaptive infrastructure.”

Reviewer’s comment

3.1 Data: please add references to both C3S and description of WBGT and UTCI. Please explain why you use these two indices (more than 170 bioclimate indices are developed, see de Freitas, Grigorieva, 2015, 2017).

Authors’ response

We are grateful to the reviewer for this important suggestion. The Data and Methods section has been substantially revised to include relevant references for the Copernicus Climate Change Service (C3S), WBGT, and UTCI datasets. Additionally, we have expanded the methodological justification for selecting WBGT and UTCI by highlighting their physiological relevance, widespread application in biometeorological and climate–health studies, and their suitability for assessing long-term thermal stress variability. It is incorporated in the second paragraph of revised manuscript.

“Among the numerous biometeorological indices developed for assessing human thermal environments and thermal stress (De Freitas & Grigorieva, 2015), WBGT and UTCI were selected because of their strong physiological basis, extensive validation, and widespread application in climate–health and biometeorological research. WBGT is widely applied for evaluating occupational and outdoor heat-related thermal stress (ILO, 2021), whereas UTCI provides a physiologically based assessment of outdoor thermal environments across diverse atmospheric conditions (De Freitas & Grigorieva, 2015; Jendritzky et al., 2012). The combined application of WBGT and UTCI enables a comprehensive assessment of long-term thermal stress variability by incorporating multiple atmospheric controls relevant to human heat exchange across the climatically heterogeneous districts of Uttar Pradesh.”

Citation of dataset were incorporated in the section 3.1.1 and section 3.1.2

“3.1.1 Wet bulb globe temperature (WBGT)

The WBGT is an empirical index that is used to assess heat stress, especially in occupational and sport environments, based on the air temperature, humidity and radiation. This index was developed by the

U.S. Navy in 1950s to assess heat-related injuries during military training. The formula to calculate the WBGT is–

$$WBGT=0.7T_{nw}+0.2T_g+0.1T_d \quad (\text{Eqn. 1})$$

where, T_{nw} is natural wet bulb temperature ($^{\circ}\text{C}$), T_g is black globe temperature ($^{\circ}\text{C}$), and T_d is dry bulb temperature ($^{\circ}\text{C}$). As the ERA land hourly data does not have these information, a simplified equation, provided by the Australian Bureau of Meteorology (ABM) was used to calculate the WBGT temperature (following Kong & Huber, 2024; Yan et al., 2021).

$$WBGT = 0.567 * T_a + 0.393 * e + 3.94 \quad (\text{Eqn. 2})$$

where, T_a is the air temperature ($^{\circ}\text{C}$), and e is the water vapour pressure (hPa). The daily mean WBGT was calculated by using the ERA5 land-hourly ECMWF climate reanalysis dataset (**Copernicus Climate Change Service, 2019**), which is available for the whole world from the 1950s onwards at $0.1^{\circ} \times 0.1^{\circ}$ spatial resolution on an hourly basis.

3.1.2 Universal thermal climatic index (UTCI)

The UTCI is a bioclimatic index used to describe the physiological comfort of the human body under specific meteorological conditions. The daily mean UTCI data for the districts of Uttar Pradesh was extracted from the ERA5-HEAT dataset, for the denoted study time period. The ERA5-HEAT project provides the mean, maximum and minimum UTCI values for the whole globe. The spatial resolution of the ERA5-HEAT dataset is $0.25^{\circ} \times 0.25^{\circ}$, with a daily temporal resolution, covering the years from 1940 to till the present. This dataset was also obtained from the Copernicus Climate Change Service (CCCS) (**Di Napoli et al., 2021; Napoli, 2020**).”

Reviewer’s comment

3.2 Statistical analysis: what do you mean on two different cycles, the more recent cycle and the older cycle; please ensure that UTCI is divided into thermal (not heat) stress categories. Please give more information on these categories (with references).

Authors’ response

We thank the reviewer for this valuable observation. Section 3.2.1 has been revised to improve the clarity of the temporal comparison framework by replacing the terminology “older cycle” and “recent cycle” with “historical period (1975–1999)” and “recent period (2000–2024)”, respectively. Furthermore, the terminology related to UTCI classification has been revised throughout the manuscript to ensure consistency with standard biometeorological nomenclature, specifically referring to “thermal stress categories” rather than “heat stress categories.” Additional methodological details and references regarding WBGT and UTCI thermal stress classifications have also been incorporated in the revised manuscript. Comment is incorporated in the section 3.2.1 of revised manuscript.

“3.2.1 Mean changes

The time period of the study was divided into two equal duration climatic period: a historical period (C1: 1975-1999) and a recent period (C2: 2000-2024). Mean WBGT and UTCI values were calculated for each district for both periods, and the mean of the historical period was subtracted from that of the recent period to estimate the absolute changes in mean thermal stress condition during entire study period. The formula to calculate the mean change is thus–

$$\Delta C = C_{\{2\}} - C_{\{1\}} \quad (\text{Eqn. 3})$$

where, ΔC is the mean change in WBGT or UTCI, $C_{\{2\}}$ is the mean WBGT or UTCI for 2000-24, and $C_{\{1\}}$ is the mean WBGT or UTCI for 1975-99. This mean difference was calculated for monthly, seasonal and annual scales to evaluate temporal changes in thermal stress conditions across districts of Uttar Pradesh.

3.2.2 Stress category

Following previous literature, the number of days under different thermal stress category was enumerated at the district level using both WBGT and UTCI indices (Brimicombe et al., 2024; Jendritzky et al., 2012). For UTCI, thermal stress categories were defined according to the standard UTCI thermal stress classification framework proposed by Jendritzky et al. (2012) (Antonescu et al., 2021; Blazejczyk et al., 2012; Pecelj et al., 2020), while WBGT categories were classified using established heat-related thermal stress thresholds commonly applied in occupational and environmental health research (Table S1-S2) (Kamal et al., 2024; NIOSH, 2016; X. Yang et al., 2024). Given the climatic setting of the study region, Accordingly, the analysis specifically focused on warm-side UTCI thermal stress categories, including moderate, strong, and very strong thermal stress conditions. The annual number of days under different thermal stress categories was subsequently estimated at the district level using both WBGT and UTCI indices. Thereafter, the Mann-Kendall and Sen's Slope test were applied to estimate the temporal trend and magnitude of change in the number of days under different heat-related thermal stress category across districts.”

Reviewer's comment

4. Results: Table 1: please show here Annual mean WBGT and UTCI separately for two periods, to get an idea of temporal changes.

Authors' response

We appreciate the reviewer's valuable suggestion. Table 1 was originally designed to present the overall average WBGT and UTCI values across the entire study period. The temporal changes between the historical and recent periods are currently presented in detail in Section 4.2 through spatial representations in Figure 2 and Figure S3. To avoid redundancy between tabular and spatial presentation of similar results, we retained the current structure. However, we would be happy to incorporate additional tabular presentation of period-wise annual mean WBGT and UTCI values if recommended by the Editor or Reviewer.

Reviewer's comment

Table 3 (and in text, and in Discussion): please specify if you are talking about Moderate (Strong, Very Strong) thermal heat Stress or Moderate (Strong, Very Strong) thermal cold Stress.

Authors’ response

We thank the reviewer for identifying this important issue regarding terminology consistency. The manuscript has been carefully revised to clarify that the analysis focuses specifically on heat-related thermal stress categories derived from WBGT and UTCI. Accordingly, the terminology used in the tables, Results section (section 4.3), and Discussion section (paragraph 2 & 3) has been revised and standardized throughout the manuscript.

“Result

4.3 Changing condition of days under different heat-related thermal stress category

The number and pattern of days under different heat-related thermal stress category have changing across the districts. Days under strong and very strong heat-related thermal stress categories have increased with concomitant decrease in days under low heat-related thermal stress category (Table S3). Based on the WBGT, days under low heat-related thermal stress category denoted a significant decreasing trend across all districts, with an average decrease of 4.9 days per decade. These days seem to be then shifting and adding on to the very-high heat-related thermal stress category, with significant increasing trend on an average increase of 5 days per decade across all districts. The days under moderate heat-related thermal stress had significantly increased only across 5 districts (Baghpat, Bulandshahr, Ghaziabad, Hapur, and Meerut) with an average increase of 3.6 days per decade (Table 2).

Table 2: Pattern of days under different heat-related thermal stress categories based on WBGT across districts of Uttar Pradesh during 1975–2024

<i>Thermal stress category</i>	<i>Districts</i>	<i>Increasing (n)</i>	<i>Mean Slope</i>	<i>Decreasing (n)</i>	<i>Mean Slope</i>
<i>Low heat-related thermal stress</i>	75	0	0	75	-4.9
<i>Moderate heat-related thermal stress</i>	75	5	3.6	0	0
<i>Strong heat-related thermal stress</i>	75	0	0	12	-3.6
<i>Very strong heat-related thermal stress</i>	75	75	5.0	0	0

Note: n represents the number of districts with significant trend; Slope – Days/Decade

Analysis of UTCI values also show a similar trend, where days under no thermal stress have declined across 62 districts of the state, with an average decrease of 2.8 days per decade. This is reflected in the amplified number of days under the strong heat-related thermal stress category, with an average increase of 3.9 days per decade across 55 districts of the state. The number of days under moderate heat-related thermal stress category has increased in only a single district (Lalitpur), while 2 districts (Chitrakoot, and Sonbhadra) denote a significant decreasing trend with an average decrease of 2.6 days per decade. A single district (Baghpat) has recorded a significant increasing trend in the number of days under very strong heat-related thermal stress with average increase of 1.8 days per decade (Table 3).

Table 3: Pattern of days under different heat-related thermal stress categories based on UTCI across districts of Uttar Pradesh during 1975–2024

<i>Thermal stress category</i>	<i>Districts</i>	<i>Increasing (n)</i>	<i>Mean Slope</i>	<i>Decreasing (n)</i>	<i>Mean Slope</i>
<i>No thermal stress</i>	75	0	0	62	-2.8
<i>Moderate heat-related thermal stress</i>	75	1	2.6	2	-2.6
<i>Strong heat-related thermal stress</i>	75	55	3.9	0	0
<i>Very strong heat-related thermal stress</i>	75	1	1.8	0	0

Note: n represents number of districts with significant trend; Slope – Days/Decade

Discussion

The study's findings indicate a systematic shift in the distribution of thermal stress days across districts of Uttar Pradesh, with a marked decline in the frequency of low to moderate heat-related thermal stress days and a corresponding increase in strong to very strong heat-related thermal stress days. This pattern is consistent across both the results from WBGT and UTCI analyses, reinforcing the robustness of the observed changes in thermal stress exposure (Table S3). This increasing thermal stress suggests that populations are frequently exposed to conditions exceeding physiological comfort thresholds. Similar outcomes have been reported in previous studies from the national and global level, especially from tropical regions, which indicates that rising thermal stress has become a persistent issue of everyday outdoor exposure in the ongoing warming climate scenario, rather than the occasional extreme event (Kjellstrom et al., 2018; S. Singh & Mall, 2023). This shift in days to high and very high heat-related thermal stress condition is likely being driven by a combination of rising minimum temperatures, increased atmospheric humidity, and reduced nocturnal cooling, which together contribute to the prolonged daily exposure to thermal stress (Mazdiyasi et al., 2017; Rohini et al., 2016). Land-use change, irrigation expansion, and urbanisation may further amplify these effects by modifying the distribution of surface energy balance and altering the local humidity regimes, which leads to intensifying thermal stress in both urban and rural areas (Chen et al., 2023; Douglas et al., 2006; Wei et al., 2024). Alongside this, the unprecedented increase in urbanization that is ongoing across India (and especially in the Global South) (Haque & Patel, 2018) adds further burden of UHI induced thermal-stress in congested urban environments that become more and more densely built-up as they expand by infilling and outlying growth expansion, and transform their peri-urban locales into more concretized neighbourhoods (Chakraborty et al., 2021, 2022; Sahana et al., 2023).

The spatial patterns observed in this study are broadly consistent with the outcomes of previous studies. Higher mean heat-related thermal stress is recorded in the eastern part of Uttar Pradesh for both indicators, suggesting a robust mutually-validated finding. This aligns with previous studies that have shown the humid regions of the Indo-Gangetic Plain to progressively experience elevated heat-related thermal stress due to a combined influence of high temperatures and moisture availability, which suppresses evaporative cooling (Shukla et al., 2022; Singh et al., 2020). In contrast, the consistent increase in WBGT and UTCI values across Bundelkhand and the south-western districts of the state highlights these semi-arid regions as emerging hotspots of heat stress under ongoing climate change, driven by land-atmosphere feedbacks, declining soil moisture, and vegetation stress (Anand et al., 2022; Wouters et al., 2022). The statistically significant upward trends across most months and seasons also align with several national and global findings which suggest accelerating heat-related thermal stress under rising land surface temperature (Morakinyo et al., 2024; Perkins-Kirkpatrick & Lewis,

2020; Shukla et al., 2022), reinforcing that the patterns seen in Uttar Pradesh are part of broader regional and global warming trajectories.”

We once again sincerely thank the Reviewer and the Editor for their constructive comments and valuable suggestions, which have significantly improved the quality and clarity of our manuscript. We hope that the revised manuscript is now suitable for reconsideration for publication in the International Journal of Biometeorology.

Thank you for your time and consideration.

Sincerely,
On behalf of all authors

Anurag Yadav

Govind Ballabh Pant Social Science Institute
Prayagraj, Uttar Pradesh, India
Email: anuragy910@gmail.com