EGU24-1395, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-1395
EGU General Assembly 2024

Appraisal and Prognosis: Towards Projecting the Future Changes in Urban Extreme Temperature Events over India under Climate Change Scenarios

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Global warming results in increase in the intensity and frequency of extreme temperature events across the world. This study used multivariate copula approach to comprehend variations in intensity and frequency of extreme temperature events over 54 urban agglomerations in India. The current study uses the Coupled Model Intercomparison Phase 6 (CMIP6) framework to explore the relationship between temperature intensity duration frequency for 1.5°C, 2°C, and 3°C global warming levels (GWL) over the two time periods, T1(2021-2050) and T2(2071-2100). Using bivariate copulas, we analyse the changes in return estimates for temperature extreme considering 10, 20, 50, and 100-year return periods over 2, 5, and 10-day durations. Amongst various distributions, the lognormal and extreme value distribution appeared as the most suitable distributions to represent duration and temperature intensity, respectively. As far as copula analysis is concerned, the Gumbel-Hougaard copula was found to be most suitable to illustrate the joint behaviour. With respect to base period, more than 60%, 64% and 80% of urban agglomerations report an increase in the extreme temperature return values under 1.5°C, 2°C, and 3°C GWL respectively. By the end of the century, more than 83% of urban agglomerations will experience an increase in the extreme temperature return values. A significant regional variation has been observed in the percentage change of the return estimates. Cities such as Mysore, Bangalore, Pune, Dharwad, Coimbatore report 9-18% decrease in the extreme temperature return values. Whereas, cities such as Amritsar, Jalandhar, Delhi, Shimla, and Kanpur report 23%-28%, increase in return values. Furthermore, these cities are projected to experience an increase of 30% by the end of the century. The findings highlight the urgent necessity for the implementation of climate change mitigation strategies that are more closely aligned with the objectives outlined in the Paris Agreement. By implementing strategies aimed at limiting global warming, we can effectively alleviate the detrimental impacts and increasing hazards linked to extreme heat events.