Evaluating the impact of rainfall duration on the relationship between atmospheric moisture and extreme precipitation

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Abstract: The rise in global temperatures due to climate change has led to increased atmospheric moisture content, resulting in more frequent extreme precipitation events and consequential widespread flood damage. This study builds upon existing research (Kim et al., 2022) to provide a more in-depth understanding of the relationship between total precipitable water (TPW) and extreme precipitation (EP) events across a broader range of rainfall durations, from 3 hours to 10 days, thus offering a comprehensive analysis of the impact of atmospheric moisture on extreme precipitation in the context of climate change.

Utilizing observational and reanalysis data, we examined the quantitative association between TPW and EP by employing the Concurrent Extremes Index (CEI, 0~1, with values closer to 1 indicating a stronger connection). Our investigation revealed substantial regional differences in CEI variations based on the duration of precipitation events. In most mid-latitude regions, such as the Mediterranean and Central Asia, CEI values exhibited a sharp decline as the duration of rainfall increased. In contrast, East Asian regions, maintained high CEI values for long-duration rainfall events, despite their mid-latitude status. The observed trend in East Asia closely resembled that of tropical regions, suggesting that the increase in extreme precipitation in East Asia could be directly influenced by climate change.

By examining an expanded range of rainfall durations, this study offers a more comprehensive and nuanced understanding of the relationship between atmospheric moisture and extreme precipitation under the influence of climate change.

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