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Editorial: Hydro-climate extremes and natural disasters during global warming: observation, projection, and mitigation

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Editorial on the Research Topic
Hydro-climate extremes and natural disasters during global warming: observation, projection, and mitigation

In the face of global warming and its far-reaching consequences, understanding and mitigating hydro-climate extremes and natural disasters have become critical priorities. This Research Topic brings together a collection of research papers that shed light on the observation, projection, and mitigation of these phenomena in the context of a changing climate. In this editorial, we will delve into three key areas: hydrometeorological forecasting, climate projection, and climate impacts, drawing insights from the titles and abstracts of the selected articles.

The first segment of this Research Topic focuses on advancements in hydrometeorological forecasting. We are thrilled to showcase four research papers that explore innovative methodologies and techniques in this field. In terms of rainfall nowcasting methods, Zhu et al. proposes a nowcasting method that utilizes long short-term memory (LSTM) networks to achieve accurate rainfall predictions up to 6 h ahead. The method incorporates atmospheric conditions to reduce radar estimate errors, resulting in improved forecast performance compared to conventional extrapolation approaches. On a monthly scale, Yan et al. presents a runoff prediction model that combines machine learning and feature importance analysis, which improved the simulation capability of the monthly runoff prediction model. The model utilizes mutual information and feature importance ranking methods to select suitable predictors from global climate factors and local hydrometeorological information. The results demonstrate improved prediction accuracy compared to other commonly used models.

In order to enhance the prediction accuracy of local precipitation area and intensity, Duan et al. explores the impact of the upper gravity-wave damping layer on precipitation predictions in complex terrain. The study uses the Weather Research and Forecasting model and conducts sensitivity tests for a strong precipitation event in southern Gansu, China. The results clarified the influence of the upper gravity-wave damping layer on precipitation over complex terrain. In addition, Deng et al. conducted a case study in the Poyang Lake Basin of

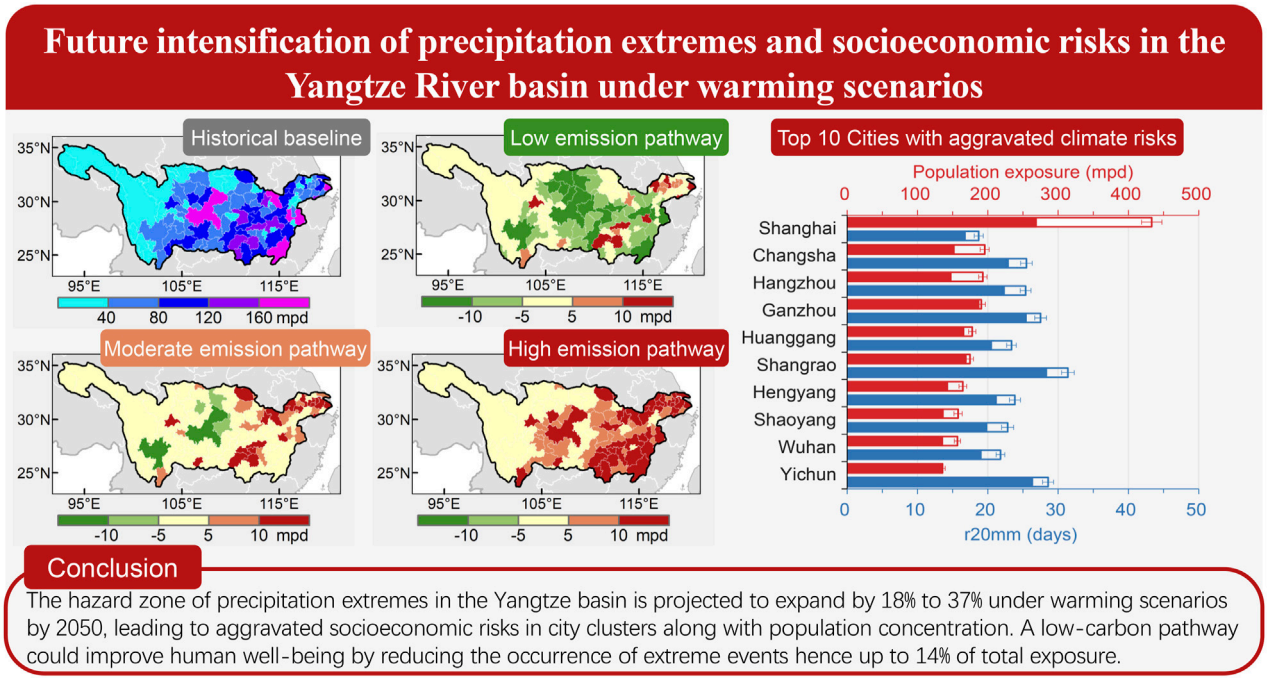

FIGURE 1
Population exposure to precipitation extremes in the historical baseline, and its projected evolutions under low, moderate, and high emission scenarios in the Yangtze River basin around 2050.

China to explore the sensitivity of different parameterization schemes in the Weather Research and Forecast model (WRF) for simulating heavy precipitation events. Various combinations of cumulus schemes, microphysical schemes, and land surface schemes are evaluated. The findings provide insights into the optimal parameterization schemes for simulating extreme precipitation events.

Moving forward, the subsequent editorials will delve into the areas of climate projection, shedding light on their significance in addressing hydro-climate extremes. New advances in climate modelling capabilities have brought higher-resolution and accurate climate simulations, which was used by Rettie et al. to provide an overview of projected changes in climate extremes indices for Ethiopia based on downscaled daily climate datasets. The analysis examines the magnitude and spatial patterns of trends in climate extremes under different emission scenarios, which contributes to a better understanding of the projected changes in climate extremes in Ethiopia. Focusing on southeast China coast, Li et al. highlighted the importance of data reliability in estimating changes in humid-heat extremes. The study compares observational and reanalysis datasets across China and identifies inhomogeneity in relative humidity series. The findings reveal underestimation of increasing rates for frequency and intensity of humid-heat extremes in southeast China due to data inhomogeneity.

The third segment of this Research Topic focuses on climate impacts and socioeconomic risks. As accelerated climate change continues to impact regions worldwide, it is crucial to understand and address the specific risks posed by extreme events in vulnerable areas. The Yangtze River basin, with its well-developed economy and susceptibility to climate extremes, represents a critical region that requires urgent attention. In a recent study, Sun et al. quantified the historical and projected population exposure to precipitation extremes in the basin, projected the expansion process of hazard zone for precipitation extremes, and revealed the contributing factors behind climate risk. The study highlighted the tendency for population growth and migration toward the lower Yangtze basin, leading to exacerbated socioeconomic risks in megacities (Figure 1). However, the research also emphasized that a low-carbon pathway could improve human wellbeing by reducing the occurrence of extreme events hence up to 14% of total exposure.

The southeastern China coast is a typical region around the globe that affected by heavy rainstorms. In this Research Topic, Ye et al. investigated and assessed the comprehensive risk of non-typhoon rainstorms in Fujian Province of China. By establishing an index system and employing risk assessment methods, the study identified the spatial pattern of non-typhoon rainstorm risks, emphasizing the dominant role of disaster-causing factors and the influence of topography on hazard distribution. The findings provide valuable insights for understanding and managing non-typhoon rainstorm risks in the region.

In southwestern China, wildfires have caused significant losses of life and property. A paper titled *Synthesized assessments of wildfire risks over southwestern China* conducted by Xu et al. contributes to localized wildfire risk assessments by considering essential elements such as hazard, vulnerability, and disaster prevention/mitigation capacity. The study revealed high wildfire risk areas in the western region of 103°E and the northern region of 28°N, particularly in low-altitude suburban regions with high climate hazards. These risk maps facilitate a comprehensive understanding of current and future

patterns of wildfire risks, aiding in the formulation of effective prevention and suppression policies.

Urbanization has a significant effect on human perceived temperatures (HPT). A case study in South China conducted by Lin and Guo quantitatively assessed the impacts of urbanization on mean and extreme HPT, highlighting the substantial increases in mean HPT and the frequency of extreme HPT events, particularly in highly urbanized areas such as the Pearl River Delta. These findings emphasize the need to consider human comfort in urban planning and adaptation strategies for subtropical humid climate zones.

Collectively, these research papers provide valuable insights into climate risks and extreme events in various regions of China. They underscore the urgency of addressing these challenges and highlight the importance of considering factors such as population dynamics, topography, and urbanization in risk assessments and mitigation strategies. Policymakers, researchers, and stakeholders must collaborate to develop sustainable approaches that enhance climate resilience, protect vulnerable populations, and ensure the sustainable development of these regions. By combining scientific knowledge with effective policies and practices, we can strive towards a more resilient and climate-ready world.

We hope that the findings presented in this Research Topic will foster further interdisciplinary collaborations, stimulate innovative research approaches, and contribute to evidence-based strategies for mitigating the impacts of hydro-climate extremes and natural disasters amidst global warming. We extend our gratitude to the authors for their valuable contributions and to the reviewers for their diligent efforts in ensuring the scientific rigor and quality of the published research. Most importantly, we would like to express our appreciation to the editorial team and the reviewers for their continuous support and guidance throughout the publication process. Their dedication and expertise have been instrumental in bringing this Research Topic to fruition.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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