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環境

Projected Changes in Compound Drought and Hot Events under Climate Change in the Upper Blue Nile Basin, Ethiopia

■ Introduction

Compound drought and hot events (CHDE) are concurrent or consecutive occurrences of these extremes that can cause larger impacts on natural systems and human society than each occurring alone(Hao et al., 2022). Due to climate change, climate extremes have become more frequent and intense globally. Zhang et al., (2022) found that CHDE occurrences are predicted to rise significantly by the end of the twenty-first century, with increased frequencies of 0.37 and 0.49 months under the SSP2-4.5 and SSP5-8.5 scenarios, respectively, over the global land areas.

CDHEs are increasing due to climate change, and East Africa is particularly vulnerable. Climate extremes in the upper Nile Basin, coupled with recurring water and food insecurity and unstable geopolitical conditions, can contribute to conflict and humanitarian disaster. Compound extremes have attracted attention in recent years due to the more frequent and amplified impacts of the events(Guo et al., 2025). Hence, this study addresses the impacts of CHDE under global warming.

■ Research Activity

1. Data

The Multi-Source Weather (MSWX) dataset for the historical period (1981-2014) and the NASA Earth Exchange Global Daily Downscaled Projections Coupled Model Intercomparison Project Phase 6 (NEX-GDDP-CMIP6) dataset for the future period (2071-2100) were used to investigate projected changes in CHDE.

2. Methods

Identification of Compound drought and hot events

CDHEs were identified using a threshold-based approach combining temperature and drought indices.

Compound drought and hot events characteristics

In this study, we emphasized the frequency and the spatial extent of the compound drought and hot events to assess the spatial and temporal variation. The frequency and spatial extent of compound drought and hot events show a significant increase in the future period compared to the historical period (1981-2014). The spatial extent of drought shows a significant trend that could be a gradual expansion of areas experiencing concurrent drought and hot conditions.

■ Contribution of the study

This study investigates CHDE in the upper Blue Nile River basin in Ethiopia. The findings support basin-level water resource management and policy planning under climate change.

References

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