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## Introduction

- Compound drought and hot events (CHDE) are the concurrent or successive occurrence of drought and hot, leading to impacts more severe than either hazard alone(Hao et al., 2022a).
- CDHEs are increasing due to climate change, and East Africa is particularly vulnerable
- In recent years, compound extremes have gained significant attention due to the increasing frequency and severity of their impacts (Guo et al., 2025).
- In this study, we investigate the projected changes in the characteristics of compound drought and hot events in the upper Blue Nile Basin, Ethiopia.



Fig. 1. Compound drought and Hot events (Wang et al., 2021)

## Data and Methods

### Study Area

- This study was conducted in the upper Blue Nile River basin.
- The drainage area covers 176,000 km<sup>2</sup>.
- It contributes about 60% of the average annual stream flow of the Nile River.



Figure 2. Map of the study area

## Data

### Table 1. Data used in this study

Data Source	Spatial Resolution	Period	Variable	Reference
MSWEP	0.1°	1982-2014	pr	Beck et al., (2019)
MSWX	0.1°	1982-2014	tas, tasmax, tasmin, relahum,solar rad, wind speed	Beck et al., (2022)
NEXGDDP ACCESS-ESM1-5 MRI-ESM2-0 MPI-ESM1-2-LR EC-EARTH	0.25°	1982-2014	pr, tas, tasmax, tasmin, relahum,solar rad, wind speed	Thrasher et al., (2022)

MSWEP: Multi-Source Weighted Ensemble Precipitation  
MSWX: Multi-Source Weather  
NEXGDDP CMIP6: NASA Earth Exchange Global Daily Downscaled Projections Coupled Model Intercomparison Project Phase 6  
NEXGDDP CMIP6 was regridded to 0.1° 0.1° using bilinear interpolation

## Results and Discussion

### Spatial distribution of the frequency of Compound Drought and Hot events



Fig. 3. Spatial Distribution of the frequency of moderate compound drought and hot events a) Historical period b) Future period

- The spatial distribution of the frequency of compound drought and hot events was detected in the basin at different levels of frequency in the basin.
- In the historical period, western parts of the basin showed a high frequency of CDHEs while the easter part of the basin shows lower frequencies(Fig. 3a).
- Future projections show a significant increase in moderate CHDEs, especially in the western and northern Upper Blue Nile Basin, under a high-emissions scenario (Fig .3b).

### Spatial extent of Compound Drought and Hot events



Fig. 4. Temporal changes in the spatial extent of moderate compound drought and hot events

- The area affected by CDHEs shows a clear increasing trend in both periods, with a stronger expansion in the future (SSP5-8.5), indicating accelerated intensification under climate change(Fig. 4).

## Conclusions

- Moderate CHDEs are increasing in both frequency and extent. Hotspots expand from the west to the central and northern areas.
- The spatial extent rises from +2.26% to +2.93% per decade, indicating stronger and more widespread future events under high emissions.

## Future work

- To investigate the population's exposure to the CDHEs under climate change

## References

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## Acknowledgment

This research is supported by the Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT); Monbukagakusho Scholarship (Interdisciplinary Resilience Engineering Program Powered by Project-Based Learning: 22016)