The perfect storm? Concurrent climate extremes in East Africa

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1 Introduction

The intensity, frequency and spatial distribution of various extreme events on the earth’s surface have increased as a result of the current global warming of 1°C (Seneviratne et al., 2021). However, the extent to which these extreme events interact with each other, possibly boosting or buffering each other, has not been sufficiently modelled.

2 Data

Yearly maps indicating exposed area for six categories of climate extreme events as defined by Lange et al. (2020)

River Floods
Droughts
Heatwaves
Crop Failures
Tropical Cyclones
River Floods
Droughts
Heatwaves
Crop Failures
Tropical Cyclones

Fig 1. Climate extreme events defined by Lange et al. (2020) using simulations from ISIMIP2b

50-year periods considered:
➢ Early industrial period (1861-1910)
➢ Present day (1956-2005)
➢ End of century at RCP2.6, RCP6.0 & RCP8.5 (2050-2099)

3 Results

Percentage of East African region affected

Fig 2. Box plots showing the percentage of the region affected by 15 co-occurring pairs of extremes under different climate scenarios. Note: A multi-model ensemble approach is undertaken by considering all available impact models in the dataset driven by the same GCM

Probability of Joint occurrence

Fig 3. Average probability of joint occurrence of climate extremes considering multi-model ensembles

4 Discussions

Bivariate distribution of extremes

Fig 4. Bivariate distributions of (1) Heatwaves & Crop failures [Left]; and (2) River floods and Heatwaves [Right]

The bivariate distributions of the co-occurring pairs show an increase in the mean and variance of the percentage of area affected with warmer climate scenarios, and in addition more dependence of extremes in some pairs shown by higher values of ρ.

Main drivers of the concurrent extremes

Fig 5. Contributing Probability Ratios (PRs) to change in probability of joint occurrence of heatwaves and wildfires by comparing end of century conditions under RCP8.5 to early industrial period conditions

5 Conclusions

➢ Climate change influences the frequency, spatial distribution and dependence of concurrent climate extremes
➢ Most affected locations: areas close to River Nile and parts of the Congo basin
➢ Concurrent extremes will become the norm rather than the exception even under low-end warming scenarios

References