The perfect storm? Concurrent climate extremes in East Africa

Derrick Muheki[1], Axel A. J. Deijns[1,2], Emanuele Bevacqua[3], Gabriele Messori[4], Jakob Zscheischler[3], and Wim Thiery[1]
[1]Department of Hydrology and Hydraulic Engineering, Vrije Universiteit Brussel; [2]Department of Earth Sciences, Royal Museum for Central Africa;
[3]Department of Computational Hydrosystems, Helmholtz Centre for Environmental Research; [4]Department of Earth Sciences, Uppsala University

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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)

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

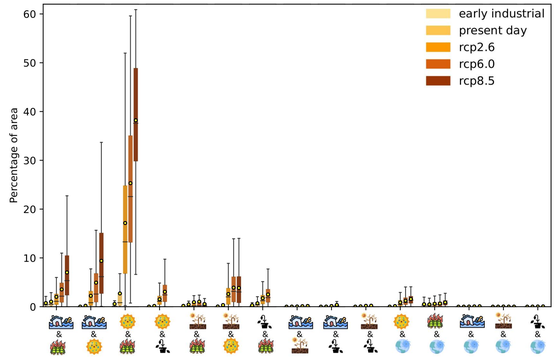

Fig 2. Box plots showing the percentage of the region affected by 15 co-occurring pairs of extremes under different climate scenarios . Note: A multi-model ensemble approach is undertaken by considering all available impact models in the dataset driven by the same GCM

Probability of Joint occurrence

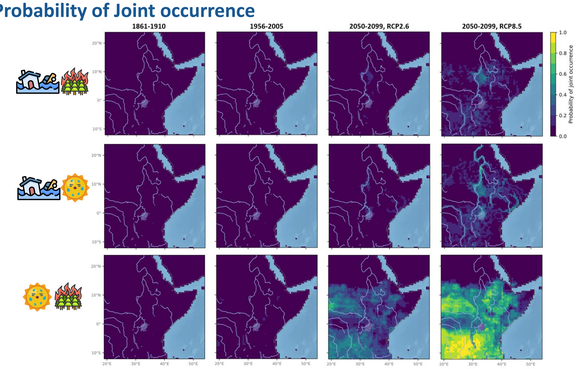

Fig 3. Average probability of joint occurrence of climate extremes considering multi-model ensembles

4 Discussions

Bivariate distribution of extremes

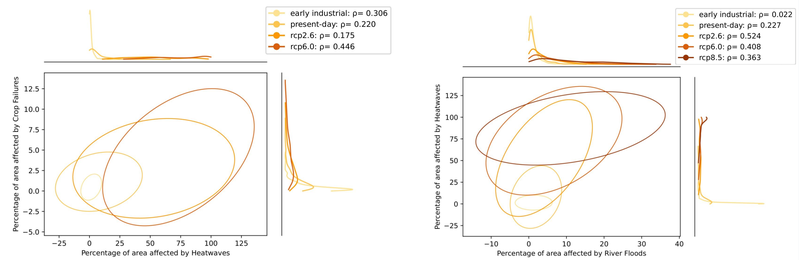

Fig 4. Bivariate distributions of (1) Heatwaves & Crop failures [Left]; and (2) River floods and Heatwaves [Right]

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

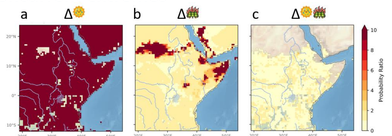

Fig 5. Contributing Probability Ratios (PRs) to change in probability of joint occurrence of heatwaves and wildfires by comparing end of century conditions under RCP8.5 to early industrial period conditions

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 the exception even under low-end warming scenarios

References Lange, S., et al.: Projecting Exposure to Extreme Climate Impact Events Across Six Event Categories and Three Spatial Scales, Earth's Future, 2020 | **Thiery, W.**, et al.: Intergenerational inequities in exposure to climate extremes, Science, 2021 | Seneviratne, S., et al.: Weather and Climate Extreme Events in a Changing Climate: The Physical Science Basis. Contribution of Working Group I to the AR6 of the IPCC, 2021 | **Zscheischler, J**, et al.: A typology of compound weather, Nature Reviews Earth Environment, 1, 2020