

## Hazardous thunderstorms over Lake Victoria: climate change and early warnings

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Severe thunderstorms and associated high waves represent a constant threat to the 200,000 fishermen operating on Lake Victoria. According to the International Red Cross, presumably 3000 to 5000 fishermen die every year on the lake, thereby substantially contributing to the global death toll from natural disasters. Despite the long-known bad reputation of Lake Victoria, operational early warning systems are lacking and possible future changes of these extreme thunderstorms are unknown. Here we present the first dedicated high-resolution, coupled lake-land-atmosphere climate projection for the African Great Lakes region and analyse it in combination with new satellite data and coarser-scale ensemble projections. Our model projections for the end-of-the-century indicate that Lake Victoria amplifies the future intensification of extreme precipitation seen over the surrounding land. Under a high-emission scenario (RCP8.5), the 1% most extreme over-lake precipitation may intensify up to four times faster compared to surrounding land. Our findings are consistent with an ensemble of coarser-scale climate projections for Africa, but the lower skill of the ensemble over Lake Victoria constrains its applicability. Interestingly, the change in extremes contrasts to the change in average over-lake precipitation, which is projected to decrease by -6% for the same period. By further analyzing the high-resolution output we are able to explain this different response: while mesoscale circulation changes cause the average precipitation decline, the response of extremes is essentially thermodynamic.

Finally, the study of the satellite-based detection of severe thunderstorms revealed a strong dependency of the nighttime storm intensity over Lake Victoria on the antecedent daytime land storm activity. This highlights the potential of this new satellite product for predicting intense storms over Lake Victoria. Overall, our results indicate a new major hazard associated with climate change over East Africa but underline the potential for developing an early warning system for the region.