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Amplification of extreme precipitation response to climate change over Lake Victoria

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Casualties among fishermen operating on Lake Victoria are estimated to amount up to several thousand per year, leading to the dubious distinction of "world's most lethal lake". Most of the casualties are caused by severe thunderstorms occurring at night, when surface winds converge over the lake and trigger deep convection of air masses moistened by the lake. With the climate change induced raise in troposphere temperatures, the frequency and intensity of these extremes are likely to increase. However, up to now only very little is known about the processes underlying this nighttime convection, and how it will be affected by climate change.

We examine the impact of climate change on hazardous thunderstorms over Lake Victoria by conducting a set of regional climate model simulations which resolve individual lakes and explicitly compute lake temperatures. The regional climate model COSMO-CLM^2 is used to dynamically downscale a CORDEX-Africa projection (COSMO-CLM/MPI-ESM-LR) under RCP8.5 to 7 km grid spacing for the periods 1981-2010 and 2071-2100. Based on these high resolution simulations, we project that the increase in extreme precipitation is amplified over Lake Victoria compared to surrounding land area, consistent with projections from the (courser-scale) CORDEX-Africa ensemble. Moreover, the strongest extremes are found to follow the Clausius-Clapeyron scaling over the lake surface only. Finally, we investigate controls on the occurrence of this extreme precipitation in the present-day climate using satellite observations and a dynamical reanalysis downscaling, and detect a strong relationship with antecedent daytime land thunderstorms. Besides supplying moisture, these storms also modify mesoscale circulation in favor of strong over-lake convection the following night. Extending this analysis will make it possible to attribute the projected lake amplification effect to changes in the controlling factors.