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Anthropogenic land cover change impact on climate extremes during the 21st century

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Beyond global mean temperatures, anthropogenic land cover change (LCC) can have significant impacts at regional and seasonal scales but also on extreme weather events to which human, natural and economical systems are highly vulnerable. However, the effects of LCC on extreme events remain either largely unexplored at global and regional scale and/or without consensus. Here, using several Earth System Models under two different LCC scenarios (the RCP8.5 and RCP2.6 Representative Concentration Pathways) and analyzing 20 extreme weather indices, we find future LCC substantially modulates projected weather extremes particularly at regional level.

On average by the end of the 21st century, under RCP8.5 and RCP2.6 scenarios, future LCC robustly lessens global projections of high rainfall extremes. Accounting for LCC diminishes regional projections of heavy precipitation days or consecutive wet days by more than 50% in southern Africa or northeastern Brazil but intensifies projected dry days in eastern Africa by 30%. LCC do not substantially affect projections of global and regional temperature extremes projections (<5%), but it can impact global rainfall extremes 2.5 times more than global mean rainfall projections.

Under RCP2.6 scenario, global LCC impacts are similar but of lesser magnitude while at regional scale in Amazon or Asia, LCC enhances drought projections. We investigate the underlying biophysical drivers behind those projected changes.

We stress here that multi-coupled modelling frameworks incorporating all aspects of land use-land cover change and more model-data benchmarking are needed for reliable projections of extreme events.