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Rapidly intensifying extreme weather events in a warming world: how important are large-scale dynamics in generating extreme floods?

Hayley Fowler
Newcastle University, School of Engineering , Newcastle upon Tyne, United Kingdom of Great Britain – England, Scotland, Wales (h.j.fowler@ncl.ac.uk)

The intensification of extreme precipitation in a warming climate has been shown in observations and climate models to follow approximately theoretical Clausius-Clapeyron scaling. However, larger changes have been indicated in events of short-duration which frequently trigger flash floods or landslides, causing loss of life. Global analyses of continental-scale convection-permitting climate models (CPCMs) and new observational datasets will be presented that provide the state-of-the-art in understanding changes to extreme weather (rainfall, wind, hail, lightning) and their compounding effects with global warming. These analyses suggest that not only warming, but dynamical circulation changes, are important in the manifestation of change to some types of extreme weather, which must be addressed in the design of new CPCM ensembles. We use our projections to provide the first analyses of impacts on infrastructure systems using a new consequence forecasting framework and show the implications for adaptation. It will be argued that a shift in focus is needed towards examining extreme weather events in the context of their 'ingredients' through their evolution in time and space. Coupled with exploration of their causal pathways, sequencing, and compounding effects – 'storylines' –, this can be used to improve both early warning systems and projections of extreme weather events for climate adaptation.