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Robust spatially aggregated projections of climate extremes

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Decision makers express a strong need for reliable information on changes in climatic extremes over the coming decades as a basis for adaptation strategies. Here, we demonstrate that for extremes stakeholders will have to deal with large irreducible uncertainties as a result of internal variability, even if climate models improve rapidly. A 21-member initial condition ensemble performed with an Earth System Model for the period 1950-2100 shows that trends towards more intense hot and less intense cold extremes may be masked or even reversed locally for the coming 3-5 decades even if greenhouse-gas emissions rapidly increase. Likewise, despite a trend to more intense precipitation and longer dry spells, opposite trends of multiple decades cannot be excluded over most land points. On the other hand, extremes may dramatically change at a rate much larger than anticipated from the long-term signal. Despite large irreducible uncertainties at local scale, projections are remarkably consistent in an aggregated spatial probability perspective. CMIP5 models as well as all members of the initial condition experiment agree that within only three decades about half of the land fraction will see significantly more intense hot extremes. We show that even in the short term the land fraction experiencing more intense precipitation events is larger than expected from natural variability. The proposed perspective yields valuable information for decision makers and stakeholders at the international level.
Reference: Fischer, E.M., U. Beyerle and R. Knutti, 2013: Robust spatially aggregated projections of climate extremes, Nature Climate Change, doi:10.1038/nclimate2051