Compound hot and dry extremes in the warming world: projections and uncertainties in CMIP6

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Global warming is expected to increase the occurrence of compound hot and dry events, the influence of which will have huge impacts on human society. Here, we analyze changes in the occurrence of joint hot and dry extremes using Coupled Model Intercomparison Project Phase 6 (CMIP6) simulations for present-day climate (+1°C compared to pre-industrial times) and additional global warming levels (+1.5°C, +2°C, +3°C). Also, we investigate the role of warming levels, climate models and copula types in governing the total uncertainty in the projections of compound hot and dry extremes. Results show that the occurrence of compound hot and dry extremes intensifies at higher warming levels. Many regions such as the Mediterranean, South Central America, Amazonia, and Sahara regions are found to be at very high risk. The analysis reveals that compound extremes are highly susceptible to uncertainty. This is due to differences in the GCMs and the limitations arising due to small sample size when analyzing bi-variate extremes. These findings indicate that there is an urgent need to limit warming to avoid increased risks of hot and dry extremes as well as the incorporation of uncertainty in their projection estimates for deciding and implementing efficient risk management strategies.