



Extreme-value analysis of future trends in heavy rainfall over Europe based on a multi-model ensemble of regional climate model simulations

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Extreme precipitation events are expected to change their frequency and intensity in a warmer climate due to alterations in dynamic and thermodynamic processes. Recent studies have questioned the applicability of the Clausius-Clapeyron relation for the prediction of future changes in the statistics of heavy rainfall events. We present an extreme-value analysis of projected heavy rainfall in an ensemble of eight high-resolution regional climate model simulations over the European domain. The consideration of several regional climate models that are forced by different global models allows for a robust analysis. The advanced extreme-value statistical method is based on a model that includes time-dependent parameters. The four seasons are examined separately. This allows for identifying and sharpening the understanding of physical processes inducing the changes in rainfall characteristics. Thermodynamic aspects of changes in heavy rainfall, such as moisture availability and changes in latent heat fluxes, are investigated, and the role of convective versus large-scale precipitation is explored. Regional differences in trends over various European areas and potential causes, as well as reasons for the limited validity of the Clausius-Clapeyron relation, are discussed in detail.