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The Climate Response of Heavy Precipitation Events over the Alps and in the Mediterranean

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We here present a climate study on Heavy Precipitation Events (HPEs). To this aim we use an ensemble of convection-permitting regional climate models on a domain that covers the alps and large parts of the Mediterranean. These HPEs are generally meso-scale convective systems, which often are related to a landfall or orographic blocking. For society they are of major interest as they may damage infrastructure and threaten lives through flash floods and strong winds.

From the models' output of precipitation we identify HPEs by applying an well-established clustering and tracking algorithm (MET MTD).

Our study is organized into an evaluation and a climate study part. We evaluate the models by comparison of the evaluation scenario, driven by reanalysis data, against observations. In order to evaluate the tracking algorithm we analyse three specific historic events, occurring in southern France, central Italy and Germany. Eventually we investigate the climate response by comparison of the far future projection (2090-2100) under the rcp85 forcing against the historical scenario (1996-2006).

In regards of the model evaluation we find that the annual cycle is very well captured by model ensemble, although the models overestimate HPEs over orography and underestimated HPEs over flatter terrain.

Concerning the climate response our main result highlights that precipitation associated with HPEs is increasing in the far future, even though total annual precipitation is decreasing. Overall more HPEs occur in the far future, but only for an extended winter season (October to April), while for months May to September the occurrence of HPEs is decreasing. This behaviour motivates us to investigate the annual cycle of HPEs in greater detail.