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Extreme summer precipitation in Central Europe over the past millennium: role of external forcing in ensemble of simulations with Earth System models

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Extreme precipitation in Europe over summer time is one type of climate extreme with strongest impact on societies, at present and over the past centuries. In contrast to mean and extreme temperatures, it is still unclear to what extent the external forcing may modulate the intensity and frequency of this type of hydrological extremes. This contribution focuses on the identification of the impact of external forcing on European extreme precipitation over the past millennium in one small ensemble of simulations with the Earth System model MPI-ESM-P and in the Large Millennium Ensemble with the model CESM.

Both models realistically simulate the meteorological conditions that give rise to sustained (over several days) strong precipitation, compared to present conditions. The analysis of both ensembles indicates that the role of the external forcing over the past millennium has been weak at most, with individual members of the ensemble providing different timings for period with high and low probability of extreme summer precipitation in this region. This conclusion is also valid for mean summer precipitation.

This result confirms the evidence obtained from analysis of proxy records, mostly palaeoclimatological records but also historical evidence. This analysis indicates that the frequency and intensity of extreme summer precipitation has been so far independent of the mean climate state.