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Near future changes of extremes and compound extremes on the regional scale

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Reliable knowledge of near future changes of extreme and compound extreme events on the regional scale is of great importance for impact studies and planning of adaptation/mitigation strategies. Different types of extremes might intensify each other, e.g. heat waves and droughts via evapotranspiration and heat flux.
Compared to projections for the end of the century, the climate change and variation signals for the near future are weaker and more contaminated by to natural variations. On the other hand several studies (e.g. Feldmann et al. [1]) have shown that extremes are likely to undergo more pronounced changes than mean values.
To derive reliable estimates of these changes, ensembles of simulations are a useful method since the larger number of data allows for a better estimate of probability density function parameters and higher signal-to-noise ratios which are especially needed for the analysis of extreme events and compound extremes. Furthermore, using ensembles enables an assessment of the uncertainty of the deduced changes.
Our work is based on an ensemble of high resolution regional climate simulations with a resolution of 7 km with the COSMO-CLM regional climate model using different global driving data. Our ensemble is enlarged by results from the ENSEMBLES project, thus also including different regional and global driving models. Changes between a control period (1971-200) and the near future (2011-2040) are assessed with a special focus on central Europe.
The analysis focuses on extreme events related to temperature and precipitation such as heat and cold waves or dry spells with a subsequent examination of compound extreme events. Compound extreme events are defined as the simultaneous or successive occurrence of two or more extreme events (IPCC Special Report on extreme events, 2012), e.g. the simultaneous occurrence of dry periods and heat waves or cold spells and extreme precipitation. Extremes are expressed in terms of return values and conditional return values for the case of compound extremes and other typical climate indices. Changes in the occurrence of extremes are calculated for the individual ensemble members and the ensemble mean. By using the ensemble technique, a measure for the uncertainty can be derived through the ensemble consistency and -spread.
In addition the results for the control period will be compared to statistics calculated from available observational data (e.g. E-Obs, HYRAS).

[1] Feldmann, H., Schädler, G., Panitz, H.-J., and Kottmeier, C., 2012: Near future changes of extreme precipitation over complex terrain in Central Europe derived from high resolution RCM ensemble simulations. Int. J. Climatol., DOI: 10.1002/joc3364.