A pragmatic approach to build a reduced regional climate projection ensemble for Germany using the EURO-CORDEX 8.5 ensemble

Clementine Dalelane, Andreas Walter, Barbara Früh, and Christian Steger
Deutscher Wetterdienst, Offenbach, Germany

The application of an ensemble reduction technique to the combined EURO-CORDEX11 and ReKliEs-De Ensemble under the RCP 8.5 scenario is presented. The technique is multivariate and takes into account the monthly mean changes between a reference and two future time periods, calculated for 8 regions in Germany, of the climatological parameters Mean-Near-Surface-Air-Temperature (tas), Precipitation Totals (pr), Contribution of precipitation from very wet days to precipitation totals (R95pTOT), the first order autocorrelation coefficient of daily precipitation (rho), and Mean-Near-Surface-Wind-Speed (sfc-wind). It is based on Principal Component Analysis to reduce the dimensionality. The uniqueness of each ensemble member is calculated from pairwise distances in the reduced space. The most unique projections are selected such that the reduced ensemble maximizes an Independence Score. The aim of this reduction is to have a small number of regional climate projections covering the range of climate change signals spanned by the full ensemble as well as possible.

The reduction procedure is sensitive to a number of tuning parameters: climatological variables included, Definition of regions, inclusion of future periods, and number of principal components retained. The impact of Parameter selection on the reduction result is investigated. When the optimal combination of tuning parameters is applied, the technique allows the reduction from around 50 to less than 10 ensemble members, while the reduced Ensemble reproduces more than 90% of the multivariate spread of the full ensemble. Keeping in mind that climate projection ensembles are expected to grow substantially in the near future, this ensemble reduction technique can be useful to limit the computational efforts necessary for further processing and applications like impact modelling.