EMS Annual Meeting Abstracts
Vol. 11, EMS2014-365, 2014
14th EMS / 10th ECAC

Selecting an optimum subset of climate models for climate impact studies – a case study

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Model inter-comparison experiments as well as regional downscaling experiments produce large matrices of GCM-RCM combinations. Such ensembles intend to sample a range of model assumptions and possible future climates. But for climate change impact studies it is not always feasible to use all GCM-RCM scenarios. Therefore, the question of selecting an optimum of representative subset of models needs to be answered.
Mendlik and Gobiet (2014, subm.) proposed a method to aid the user to select an optimum subset of climate scenarios which covers the spread of the full ensemble with scenarios being as independent as possible. The method is based on hierarchical clustering of loadings from a PCA on various climate change signals.
Here we apply this method in a case study to reduce the EURO-CORDEX (EUR-11 and EUR-44) ensemble for different climate impact applications for the European project CLIP-C and the Swedish research programme Mistra-SWEICA. The focus is on analysing the sensitivity of the scenario selection process on variables and indices used for it.
The spread in climate change signals (ccs) is multidimensional and includes models, variables, temporal and spatial components. The dimension of variables can be expanded including uni- and multivariate impact-relevant climate indices in the analyses. The choice of variables/indices varies with the applications in impact studies. The ccs of those indices can differ substantially from the ccs of the variables they are derived from.
In this study standard climate model output like temperature (mean, max, min), precipitation, humidity, and wind are used and indices like degree days and temperature-humidity index are derived.
The spatial variability in ccs is covered by using different sets of subregions in Europe. The ccs of variables is calculated for the four seasons separately. The model dimension is spanned by the GCM-RCM matrix given by EURO-CORDEX. Another time dimension is added by analysing the results for different ccs periods.
Results will be presented on the sensitivity of the ensemble reduction process on the choice of variables/indices as well as periods of the ccs.

References

Mendlik, T., Gobiet A. (2014) Selecting climate simulations for impact studies based on multivariate patterns of climate change, Climatic Change, submitted.