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MiKlip-PRODEF: Probabilistic Decadal Forecast for Central and Western Europe

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The demand for skilful climate predictions on time-scales of several years to decades has increased in recent years, in particular for economic, societal and political terms. Within the BMBF MiKlip consortium, a decadal prediction system is currently being developed. The project PRODEF, which is part of the MiKlip-Module C (regionalisation), aims at developing a prototype for probabilistic decadal predictability of windstorms and wind energy potential for Central and Western Europe on the regional / local scale, using a statistical-dynamical downscaling (SDD) approach. SDD combines the benefits of both high resolution dynamical downscaling and purely statistical downscaling of GCM output. Hence, the SDD approach is used to obtain a very large ensemble of highly resolved decadal hindcasts with reduced computational costs.

With respect to the focal points of PRODEF, a clustering of temporal evolving atmospheric fields and a circulation weather type (CWT) analysis is applied to full ensembles of two decadal hindcast experiments of the Earth System Model of the Max Planck Institute Hamburg (MPI-ESM, baseline0 and baseline1). Up to ten realisations are initialised per calendar year for the period 1960-2010. Representatives of CWTs / clusters are dynamically downscaled with the regional climate model COSMO-CLM. For each model grid point, the distributions of the local climate parameters (surface wind gusts, wind energy potential) are determined for different periods by recombining dynamical downscaled episodes weighted with the respective large-scale weather type frequencies. CWT / cluster frequencies and local probability density functions as derived from the SDD application to the hindcasts of the MPI-ESM are compared to observations and reanalysis data. Skill scores are used to quantify the decadal predictability for different leading time periods and to analyse whether the SDD approach shows systematic errors for some regions.