Geophysical Research Abstracts
Vol. 18, EGU2016-3960, 2016
EGU General Assembly 2016

Decadal predictability of regional scale wind speed and wind energy potentials over Central Europe

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Regional climate predictions on timescales from one year to one decade are gaining importance since this time frame falls within the planning horizon of politics, economy, and society. In this context, decadal predictions are of particular interest for the development of renewable energies such as wind energy.
The present study examines the decadal predictability of regional scale wind speed and wind energy potentials in the framework of the MiKlip consortium ("Mittelfristige Klimaprognosen"; www.fona-miklip.de). This consortium aims to develop a model system based on the Max-Planck-Institute Earth System Model (MPI-ESM) that can provide skilful decadal predictions on regional and global scales. Three generations of the decadal prediction system, which differ primarily in their ocean initialisation, are analysed here. Ensembles of uninitialised historical and yearly initialised hindcast experiments are used to assess different skill scores for 10m wind speeds and wind energy output (Eout) over Central Europe, with special focus given to Germany. With this aim, a statistical-dynamical downscaling (SDD) approach is used for the regionalisation of the global datasets. Its added value is evaluated by comparison of skill scores for MPI-ESM large-scale wind speeds and SDD simulated regional wind speeds.
All three MPI-ESM ensemble generations show some forecast skill for annual mean wind speed and Eout over Central Europe on yearly and multi-yearly time scales. The forecast skill is mostly limited to the first years after initialisation. Differences between the three ensemble generations are generally small. The regionalisation preserves and sometimes increases the forecast skill of the global runs but results depend on lead time and ensemble generation. Moreover, regionalisation often improves the ensemble spread. Seasonal Eout skills are generally lower than for annual means. Skill scores are lowest during summer, and persist longest in autumn. A large-scale westerly weather type with strong pressure gradients over Central Europe is identified as potential source for the skill for wind energy potentials, showing similar forecast skill and a high correlation with Eout anomalies. These results are promising regarding the establishment of a decadal prediction system for wind energy for Central Europe.