



Climatological variability of solar and wind energy in Germany based on high resolution climate data records

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With an increased share of electrical energy generated from weather-related renewable sources, i.e., solar and wind energy, the variability and the fluctuations in the power generation increase on many time scales. To realistically assess the possible variability of the power generated from solar and wind energy, climatological information on the available solar radiation and wind speed are required.

Here we use climatological high-resolution (temporal and spatial) data of solar radiation and wind speed to assess their electrical power generation and its variability due to fluctuations in the meteorological parameters. The solar radiation data are taken from the CM SAF SARAH-2 climate data record, which provides global and direct surface radiation with a 30-min temporal resolution at 0.05° -grid spacing from 1983 to 2017. The COSMO-REA6 regional reanalysis provides hourly wind speed data at the hub height from 1995 to 2015 with a spatial resolution of approx. 6 km. These data are used to estimate hourly capacity factors for solar and wind energy from 1995 onwards for Germany and Europe.

Using available data on the wind and solar energy generated in 2015 and information on installed solar installations and wind power systems, the simulated capacity factors and generated electricity will be compared and possibly adjusted to the reference data. This data record allows the consistent analysis of the variability of the solar and wind energy assuming a fixed distribution (here: 2015) of wind and solar energy installations. These data will be used to assess the occurrence and the frequency of situations of low energy generation from wind and solar power ("Dunkelflaute") in Germany; the meteorological situations for those cases will be analyzed and possible regions will be identified that could help to reduce the frequency of such situations.