Using high resolution reanalyses to assess solar and wind power variability (182)

Christopher Frank [1] [2] , Susanne Crewell [2] , Jan Keller [1] [3] , Christian Ohlwein [1] [3] , Andreas Hense [3] , Sabrina Wahl [3]

1. Climate Monitoring Branch, Hans-Ertel-Centre for Weather Research, Offenbach am Main, Germany
2. Institute of Geophysics and Meteorology, University of Cologne, Cologne, NRW, Germany
3. University Bonn, Bonn, Germany

The most challenging issue of renewable energies is its spatial and temporal volatility. The inhomogeneity of wind and global radiation leads to enormous variability in the energy feeds. The increasing part of volatile energy feeds requires stronger efforts to ensure the required energy demand. Of great relevance is here the knowledge about where, when and to what extent renewable energy can be generated. Atmospheric reanalyses provide all relevant meteorological quantities to estimate renewable energy ones and in a consistent way: spatially, temporally and among all given quantities. Thus, atmospheric reanalyses represent a suitable dataset to investigate the spatiotemporal variability, potential and availability of renewable energy sources.

To investigate the above mentioned questions we use the high resolution reanalyses developed within the Hans-Ertel Centre for Weather Research. The high resolution reanalyses COSMO-REA6 (6 km horizontal resolution, 40 vertical layer) and COSMO-REA2 (2 km horizontal resolution, 50 vertical layer) are based on the NWP model COSMO. REA6 covers the EURO-CORDEX region and REA2 an extended COSMO-DE domain. The coarser reanalysis is available from 1995 to 2014 and the finer from 2007 to 2013.

Since reanalyses provide estimates of the atmospheric state, a quality assessment of the relevant quantities wind speed and global radiation is done. In this assessment the Baseline Surface Radiation Network (BSRN) and SYNOP observations of global radiation and wind speeds in 10 m height are used. The comparison to observations showed deficits in the global radiation of the reanalyses data with different behavior for clear and cloudy sky. Therefore, a post-processing is applied. Using the updated COSMO-reanalyses data as input a wind and solar energy data set is produced. A reference photovoltaic module and a reference wind power plant is assumed to be installed at every single grid box. This data set provides the basis for the investigation of variability and availability of renewable energy yields. The focus will set to compensation effects of solar and wind energy.