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DATA SET DESCRIPTION

Daily means of hourly grids of wind speed for Germany (project TRY Advancement)

Version V001

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INTENT OF THE DATASET

This document describes freely available data of the DWD Climate Data Centre which are the raw data set used for input to generate the German Test Reference Years (2017). The commissioned research project "TRY Advancement" was supported with funding from the Research Initiative Future Building through BBSR.

POINT OF CONTACT

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DATA DESCRIPTION

Spatial coverage	Germany
Temporal coverage	01.01.1995 - 31.12.2012
Spatial resolution	1 km x 1 km
Temporal resolution	daily
Projection	ETRS89 / ETRS-LCC, ellipsoid GRS80, EPSG: 3034, see http://spatialreference.org/ref/epsg/3034/.
Format(s)	NetCDF
Parameters	mean wind speed [1/10 m/s] in 10m above ground in the dataFF_*daymean.nc
Uncertainties	Uncertainties result from the roughness correction. the interpolation procedure, from erroneous or missing observations, and from errors inherent to the model simulation. When comparing grids of different years, changes of the station network over the time have to be taken into account.

DATA ORIGIN

The data source for the gridding are synoptic station data from the DWD MIRAKEL database, supplemented by data of the regional climate model COSMO-CLM Doms et al., 2011) driven by reanalysis data (ERA-Interim; Dee et al., 2011). Gridding is done using the interpolation method described below. It is applied to hourly values. Daily means are derived by averaging the hourly grids. Since the generated wind dataset is to represent wind speed in 10 m height, yet the anemometer height significantly influences wind speed, model wind speed was solely localized at stations with anemometer heights of 10 m ±2 m. The station time series underwent a number of quality tests to identify and remove suspicious values (Vogelsang, 1993) and homogeneity (SNHT-test; Alexandersson, 1997). Station observations were solely used where the difference in relative elevation (Walter et al., 2006) between the station and the model grid node is less than 50 m to ensure comparability in terms of upwind/downwind. Finally, data of about 150 stations were used in the gridding procedure. The wind speed fields are produced using a multi-step procedure. The regional climate model COSMO-CLM provides a first guess field of hourly wind speed and wind direction of 2.8 km resolution. Station data are used for bias correction of the modelled wind. The 1 km² resolution is reached by transformation of the wind speed to the local roughness length using the logarithmic wind profile law.N4 For every station aerodynamic roughness lengths were assigned to CORINE land use data (Keil et al., 2011) within a 3 km radius and for eight wind directions following the topographical maps approach by Koßmann and Namyslo (2011). Wind direction dependent z0-values were calculated for 25 distance classes. Subsequently, according to the so-called footprint method, distance weights were calculated using the 2-parameter Weibull distribution function (Kjun et al., 2004). The roughness lengths for the model grid and the 1 km² grid amount to the spatial average (e.g. logarithmic averaging) of the assigned roughness length within each grid node. Model wind speed and roughness length are both valid for grid node averages, station data provide point-wise information valid for local roughness lengths. To make both model and station data comparable, model wind and local roughness information are used to estimate 10 m wind speed at the station locations. A methodology proposed by De Rooy et al. (2004) is applied, which makes use of the theoretical concept of the internal boundary layer and assumes that there exists a height above ground at which wind speed becomes independent from the local roughness length. At the so-called blending height the average wind profiles above a certain grid node and a station located within that grid node converge to a common wind speed. Since the blending height is unknown and subject to changing weather, modelled 140 m wind speed is used as reference wind speed. To transform the model wind at blending height to 10 m and local roughness, the flux profile relation (Monin-Obukhov, 1971) is used. To account for atmospheric stability, the following assumption is made: Transforming model wind speed in 140 m, considering the model roughness length but not the stability function, the estimated u10 will deviate from the modelled wind speed in 10 m. This deviation corresponds to the stability correction to be applied when transforming wind speed from 140 m to 10 m and is simply added to the estimated wind speed. In the second step a statistical bias correction is applied. Two assumptions are made: 1) the regional climate model describes the wind field overall correctly, 2) the model bias depends on the geographical position, thus Germany is split into four overlapping regions. The bias, which is only known at the station locations, is interpolated using multiple linear regression, with the predictors being spatial coordinates, relative elevation (elevation of a grid node compared to the average elevation within 5 km radius; see Walter et al., 2006) and distance to the coast. Regression coefficients are updated on an hourly basis, using observations of the current hour ±1 hour to increase the sample size and to reduce the impact of observing errors.

VALIDATION AND UNCERTAINTY ESTIMATE

The 1 km² resolution of the grids matches the resolution of the digital elevation model. Representativity of the wind data is limited by the station network and due to the coarse resolution (2.8 x 2.8 km²) of the digital elevation model used by the COSMO-CLM model. Topographically induced air flows such as channeling effects are only representative on the resolution of the underlying digital elevation model. Over the period 1995-2012 data from about 150 stations contributed to the gridding. The station number varies with time. Changes of station elevations due to station relocations are consider within the interpolation process.

CONSIDERATIONS FOR APPLICATIONS

The interpolation of hourly values focuses on temporal consistency over a day and consistency between parameters. Due to changes in the station network (openings and closings of stations and relocation), climatological analysis (e.g. identification of long-term trends) are not possible. Topographically induced air flows such as channeling effects are only representative on the resolution of the underlying digital elevation model. Over the period 1995-2012 data from about 150 stations contributed to the gridding. The gridding procedures (and the roughness correction) are based on the assumption that the logarithmic wind profile is independent of time of day and year and that wind speed is spatially well correlated. However, this assumption does not always hold. The grids represent a first pragmatic estimation of a pattern which varies strongly in space and time and should therefore be used with caution. Application of the dataset requires thorough validation before any application.

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REVISION HISTORY

The data are output of a project and not subject to change. This document is maintained by the Climate and Environmental Consultancy Department (KU11), DWD, last edited 27.02.2017.