DATA SET DESCRIPTION

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

Version V001

Cite data set as: Krähenmann, S., Walter, A., Brienen, S., Imbery, F., Matzarakis, A.: Daily means of hourly grids of wind direction for Germany (project TRY Advancement), Version V001, DWD Climate Data Center (CDC), DOI:10.5676/DWD_CDC/TRY_Basis_v001, 2016.

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.

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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 direction [°] in 10m above ground in the data DD_*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 N7were 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 wind direction given in degree cannot directly be interpolated. This issue is tackled converting wind directions into u- (west-east) and v- (north-south) vector components of the wind. Bias interpolation is done applying 3D IDW, with a distance measure that accounts for geographical coordinates and relative elevation (Walter et al., 2006). Summation of modelled u- and v-components and interpolated residuals of both components with subsequent back transformation yields the hourly wind direction grids.

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.

REFERENCES

Alexandersson H, Moberg A (1997) Homogenization of Swedish temperature data. Part I: Homogeneity test for linear trends. Int J Climatol 17:25-34.

Dee DP, Uppala SM, Simmons AJ, Berrisford P, Poli P, Kobayashi S, Andrae U, Balmaseda MA, Balsamo G, Bauer P, Bechtold P, Beljaars ACM, van de Berg L, Bidlot J, Bormann N, Delsol C, Dragani R, Fuentes M, Geer AJ, Haimberger L, Healy SB, Hersbach H, Holm EV, Isaksen L, Kaallberg P, Kohler M, Matricardi M, McNally AP, Monge-Sanz BM, Morcrette JJ, Park BK, Peubey C, de Rosnay P, Tavolato , Thepaut JN, Vitart F (2011) The ERA-Interim reanalysis: configuration and performance of the data assimilation system. Q J R Meteorol Soc 137:553-597. doi:10.1002/qj.828

De Rooy WC, Kok K (2004) A Combined Physical–Statistical Approach for the Downscaling of Model Wind Speed. Weather Forecasting 19:485-495. DOI:http://dx.doi.org/10.1175/1520-0434(2004)019<0485:ACPAFT>2.0.CO;2

Doms G (2011) A description of the non-hydrostatic regional COSMO model part 1: Dynamics and numeric. Deutscher Wetterdienst, Offenbach. http://www.cosmo-model.org

Keil M, Bock M, Esch T, Metz A, Nieland S, Pfitzner A (2011) CORINE Land Cover 2006 - Europaweit harmonisierte Aktualisierung der Landbedeckungsdaten für Deutschland. Deutsches Zentrum für Luft- und Raumfahrt e.V., Deutsches Fernerkundungsdatenzentrum, Weßling. http://www.uba.de/uba-info-medien/4086.html.

Kljun N, Calanca P, Rotach MW, Schmid HP (2004) A simple parameterisation for flux footprint prediction. Bound Layer Met 112:503-523.

Koßmann M, Namyslo J (2007) Bestimmung effektiver aerodynamischer Rauigkeitslängen an Windmessstationen aus topographischen Karten (TK-Verfahren). Deutscher Wetterdienst, Offenbach.

Krähenmann S, Walter A, Imbery F, Brienen S, Matzarakis A (2016): High-resolution grids of hourly meteorological variables for Germany. TAAC. DOI:10.1007/s00704-016-2003-7

McNaughton KG, Jarvis PG (1984) Using the Penman–Monteith equation predictively. Agric Water Manage 8:263–246.

Obukhov AM (1971) Turbulence in an atmosphere with a non-uniform temperature. Bound Layer Meteor, 2(1), 7-29. DOI:10.1007/BF00718085

Taylor, P.A., 1987: Comments and further analysis on effective roughness lengths for use in numerical three-dimensional models. Bound. Layer Met., 39, 403-418.

Vogelsang R (1993) Plausibilitätskontrollen meteorologischer Daten. Deutscher Wetterdienst, Abschlussbericht des FE-Vorhabens, AMS-Nr. 90/08.

Walter A, Keuler K, Jacob D, Knoche R, Block A, Kotlarsk S, Müller-Westermeier G, Rechid D, Ahrens W (2006) A high resolution reference data set of German wind velocity 1951-2001 and comparison with regional climate model results. Met Z 15(6):585-596. DOI:10.1127/0941-2948/2006/0162

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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.