DATA SET DESCRIPTION

Historical daily station observations (temperature, pressure, precipitation, sunshine duration, etc.) for Germany

Version v006

Cite data set as: DWD Climate Data Center (CDC): Historical daily station observations (temperature, pressure, precipitation, sunshine duration, etc.) for Germany, version v006, 2018.

INTENT OF THE DATASET

These historical data are quality controlled measurements and observations derived from DWD stations and legally and qualitatively equivalent partner stations operated for climatological and climate related applications. Comprehensive station metadata (station relocation, instrument change, time zones, change of algorithms) are included.

POINT OF CONTACT

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DATA DESCRIPTION

Spatial coverage stations in Germany

Temporal coverage 01.01.1781 - 31.12.2017

Temporal resolution daily

Format(s) The station observations (produkt_*.txt) are zipped together with the station metadata. The latter are given in *.txt as well as *.html. The file Metadaten_Parameter* contains a listing of the parameters measured at the station (the parameter portfolio) with begin, end, units, measurement procedures, averaging formulas, measurement times and applied time units (e.g., MOZ or UTC) which are all related to the Station Id and the station name valid now. The instrument history is sorted according to the parameters (see file Metadaten_Geraete*). There the history of sensor height, type of instrument and measurement procedure is given, together with the historical station names. The station ID is unique and does not change over time. For a convenient documentation of station name change, see Metadaten_Stationsname*. The geographical metadata of the station (longitude, latitude, height) is listed in Metadaten_Geographie*.txt together with the Stations_id and the current station name. All these information is combined into a single zip-file for each station: *_[Stations_id]_[from]_[to]_hist.zip. An overview over all stations with start and end dates is given in the station list: Stationsliste. Note that for convenience, the list comprises not only stations given here, but also stations with more complicated copyright regulations which may be obtained for certain applications, requiring discussion with the point of contact.

Parameters The parameter portfolios differ between various stations. Overall, following parameters are contained in produkt*.txt:

STATIONS_ID	station id	
MESS_DATUM	date	yyyymmdd
QN_3	quality level of next columns	coding see paragraph "Quality information"
FX	daily maximum of wind gust	m/s

FM	daily mean of wind speed	m/s
QN_4	quality level of next columns	coding see paragraph "Quality information"
RSK	daily precipitation height	mm
RSKF	precipitation form	
	no precipitation (conventional or automatic measurement), relates to WMO code 10	0
	only rain (before 1979)	1
	unknown form of recorded precipitation	4
	only rain; only liquid precipitation at automatic stations, relates to WMO code 11	6
	only snow; only solid precipitation at automatic stations, relates to WMO code 12	7
	rain and snow (and/or "Schneeregen"); liquid and solid precipitation at automatic stations, relates to WMO code 13	8
	error or missing value or no automatic determination of precipitation form, relates to WMO code 15	9
SDK	daily sunshine duration	h
SHK_TAG	daily snow depth	cm
NM	daily mean of cloud cover	1/8
VPM	daily mean of vapor pressure	hPa
PM	daily mean of pressure	hPa
TMK	daily mean of temperature	°C
UPM	daily mean of relative humidity	%
TXK	daily maximum of temperature at 2m height	°C
TNK	daily minimum of temperature at 2m height	°C
TGK	daily minimum of air temperature at 5cm above ground	°C
eor	End of data record	

Missing values are -999. Note that within the time series the time definition changes, depending on parameter and station. For instance, the time interval of precipitation is nowadays defined as 5:50 UTC to 5:50 UTC of the next day, this was different in earlier years. At which exact times the measurement was taken, and whether this relates to true local time (WOZ), legal time (GZ), mean local time (MOZ), mean european time (MEZ) or Universal Time (UTC) can be found in Metadaten_Parameter* . The daily maximum of wind gust was determined from instrument readings as detailed in the instrument metadata (Metadata_Geraete*). In former time, it was reported in the speed unit knot, today all values are converted to m/s. Stations from the meteorological service of GDR (East Germany) did not report daily maximum wind gust before 1967. Between 1967 and 1972 a daily maximum wind gust was reported when exceeding the threshold 12 m/s, from 01.01.1973 a threshold of 5 m/s applied. The daily mean of wind velocity was calculated normally from at least 21 hourly means. In former times, the hourly means were taken from the graphical recordings of electromechanical anemographs (see instrument metadata). In particular cases, the values can be based on estimates (Beaufort scale). To exclude estimates use hourly values only.

Uncertainties

The stations are nowadays selected and operated according to WMO guidelines. Though these guidelines aim at minimizing possible local effects, still some applications of certain parameters may require the consideration of local and regional effects. Note that when going back to historical times, such guidelines might not have been in place. In special circumstances, local or regional influences on the meteorological parameters have to be considered, possibly also with a time dependency. Sources of long-term uncertainty are (1) changes in station height when station was re-located (especially for wind and temperature), information on this is within the station's zip-files in Metadaten_Geographie* ; (2) changes in the observation times and (3) changes in the averaging interval. Details on (2) and (3) can be found in the stationwise zipped Metadaten_Parameter*. Uncertainties are also expected from (4) changes in instrumentation, see Metadaten_Geraete* and possibly also from (5) varying quality control procedures (Behrendt et al., 2011). Further, uncertainties are known to come from (6) errors during data transfer or errors in the software, (7) change of observing personnel, and (8) others, see Freydank, 2014.

Quality information

The quality levels "Qualitätsniveau" (QN) given here apply for the respective following columns. The values are the minima of the QN of the respective daily values. QN denotes the method of quality control, with which erroneous values are identified and apply for the whole set of parameters at a certain time. For the individual parameters there exist quality bytes in the internal DWD data base, which are not published here. Values identifed as wrong are not published. Various methods of quality control (at different levels) are employed to decide which value is identified as wrong. In the past, different procedures have been employed. The quality procedures are coded as following:
quality level (column header: QN_)
1- only formal control during decoding and import
2- controlled with individually defined criteria
3- ROUTINE control with QUALIMET and QCSY
5- historic, subjective procedures
7- ROUTINE control, not yet corrected
8- quality control outside ROUTINE
9- ROUTINE control, not all parameters corrected
10- ROUTINE control finished, respective corrections finished

DATA ORIGIN

These climate data are from the station networks of Deutschen Wetterdienst which are regularly updated with recent data, and with recovered historical data. From 1997 onwards, the data are operationally collected in the central MIRAKEL data base and archived, see Behrendt et al., 2011, and Kaspar et al., 2013. For details on current measurement and observation procedures see VuB 3 Beobachterhandbuch (DWD, 2014a), VuB 3 Technikerhandbuch (DWD, 2014b) and VuB 2 Wetterschlüsselhandbuch (DWD, 2013). Note that when going back to historical times, guidelines on observation procedure, instruments and observation times were issued by the authority in charge (see, e.g., Freydank, 2014), and might be incompletely recorded in the metadata. As explained in Kaspar et al., 2013 in the early years numerous meteorological agencies were active in the area of todays Germany. After establishment of the der International Meteorological Organization (IMO) in 1873, the various standards were gradually harmonized, resulting in a single standard 1936. After 1945, the standards in East and West Germany developed differently, and were harmonized again after re-unification in 1990. Between the end of the nineties and 2009 many stations were changed from manual to automatised.

VALIDATION AND UNCERTAINTY ESTIMATE

Considerations of quality assurance are explained in Kaspar et al., 2013: several steps of quality control, including and manual inspection and automatic tests for completeness, temporal and internal consistency, and against statistical thresholds based on the software QualiMet (see Spengler, 2002). The automatic quality control aims to identify and to correct random and gross errors. No systematic corrections (like "Richter correction") are applied. The values collected electronically from 2003 onward are checked with QualiMet. Some doubtful values remain, especially in data prior to 1979. The digitized paper records are quality controlled. The data given here were not subjected to homogenization procedures. The history of instrumental design, observation practice, and possibly changing representativity has to be considered for the individual stations when interpreting changes in the statistical properties of the time series. It is strongly suggested to investigate the records of the station history which are provided together with the data. Note that in the 1990s many stations had the transition from manual to automated stations, entailing possible changes in certain statistical properties.

CONSIDERATIONS FOR APPLICATIONS

For studies of long-term change, the metadata in Metadaten_Parameter*, Metadaten_Geraete* and Metadaten_Geographie* have to be considered. With the change to SYNOP at the end of the nineties, the metadata were collected electronically. These metadata are provided for each station within the *.zip. For the time span before, relevant station metadata are extracted from the paper records and digitized by DWD. These metadata are also included, note this is work in progress. For detailed studies, you can apply for access to the paper archive. For statistical analysis, consider the formula (which may be changing over time, and for each station individually) used to calculate the daily means (see Metadaten_Parameter*). Only from 1936 onwards standardized formulas were applied. From 1900-1935 the regulations of the respective small German states were applied, and before 1900 such regulations were station specific (and not all regulations are electronically recorded yet). For temperature trends, note especially the changes in station height and the changes in the "Klimatermine", i.e., changes in the definition of fixed times were measurements had been performed,the latter effect was shown to be marginal when changing from traditional observing times (“Mannheimer Stunden”) to automatic measurements with higher temporal resolution (Kaspar et al., 2016). For long-term effects in precipitation note that the height of the instrument changed systematically over time: in earlier years, and at mountain stations, was the precipitation measurement 1.5 m above ground, afterwards at lower heights at an increasing number of stations (details are not included in the metadata yet). Missing precipitation observation during 1940-1950 were derived from neighbouring stations. Before 1969, in East Germany, and before 1971 in West Germany, the integrated precipitation recordings were stored for the day on which the morning reading was performed. Here, all values are converted and related to the day contributing the largest part of the measurement interval. Generally, all data given are converted to the same units. The recording units differ, though. For instance, temperature before 1880 was recorded in different units, and converted to degree Celsius many decades later. Cloud cover was observed in 1/10 before the seventies, but had been converted to the common 1/8 here.

The wind data in this data set are meant to be used as auxilliary data for the interpretation of the other parameters, as wind velocity was partly estimated with the Beaufort scale in the years before the automatization. Such observations were used for the time periods where in Metadaten_Geraete* no instrument is given. However, in early years also measured wind velocities were converted to Bft. Only with the automated transfer of wind values at the beginning of this millenium the change to m/sec occured, see Metadaten_Parameter* for details. For wind velocities which were exclusively measured (i.e., not observed with Bft scale) use https://opendata.dwd.de/climate_environment/CDC/observations_germany/climate/hourly/wind/. Before 1967, for the stations of the 'Meteorologische Dienst der DDR ' (i.e., East Germany) no daily maximum of wind gust was given. In the period 1967-1972, a daily maximum of wind gust was given only when the threshold of 12 m/s was exceeded, from 01.01.1973 onwards it was given only when the threshold of 5 m/s was exceeded.

ADDITIONAL INFORMATION

For extending the time series with recent data (where quality control is not completed yet), see subdirectories ../recent/. When data from both directories "historical" and "recent" are used together, the difference in the quality control procedure should be considered. There are still issues to be discovered in the historical data. We welcome any hints to improve the data basis (see contact).

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REVISION HISTORY

The data in the directories */historical/ are provided in approximately annual intervals as versioned data sets to take into account the dataset extension in time and any updates and the historical data rescued in the meantime. Compared to the previous versions, this version includes additional historical data. This document is maintained by the National Climate Data Centre (NKDZ) of DWD, last edited 29.01.2019.