

## DATA SET DESCRIPTION

### Historical hourly station observations of soil temperature station data for Germany

#### Version v006

**Cite data set as:** DWD Climate Data Center (CDC): Historical hourly station observations of soil temperature station data 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

Deutscher Wetterdienst  
CDC - Vertrieb Klima und Umwelt  
Frankfurter Straße 135  
63067 Offenbach  
Tel.: + 49 (0) 69 8062-4400  
Fax.: + 49 (0) 69 8062-4499  
Mail: [klima.vertrieb@dwd.de](mailto:klima.vertrieb@dwd.de)

#### DATA DESCRIPTION

**Spatial coverage** stations in Germany

**Temporal coverage** 01.01.1949 - 31.12.2017

**Temporal resolution** several times a day

**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 file produkt\*.txt comprises following parameters:

STATIONS_ID	station identification number	
MESS_DATUM	measurement time	yyyymmdd
QN_2	quality level of next columns	coding see paragraph "Quality information"
V_TE002	soil temperature in 2 cm depth	°C
V_TE005	soil temperature in 5 cm depth	°C
V_TE010	soil temperature in 10 cm depth	°C
V_TE020	soil temperature in 20 cm depth	°C

V_TE050	soil temperature in 50 cm depth	°C
V_TE100	soil temperature in 100 cm depth	°C
eor	end of record	can be ignored

Missing values are marked as -999. The definition of measurement time changed over time and referred to time units MOZ, MEZ or UTC (see the station specific Metadaten\_Parameter\* for the exact definition). The actual minute the measurement was taken varies according to the observation procedures valid at the respective times: in the very early days, the exact minute of reading can only be inferred approximately. Later, it can be assumed that the manual readings were taken as close as possible to hour hh. For Western Germany, with automatisisation of 1. generation the times 07:30, 14:30, 21:30 MEZ applied. In the GDR observations were taken at full hours. From automatisisation 2. generation and change to SYNOP messages, the hour hh refers to the 1min measurement of hh-10min (e.g., UTC11 is related to the observation of UTC10:49-10:50).

#### 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. Depending on the application, local, regional and influences changing with time should be considered, which can be location- and parameter specific. Sources of long-term uncertainty are (1) changes in station height when station was re-located, 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 identified 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 collected in the central MIRAKEL data base and archived, see Behrendt et al., 2011, and Kaspar et al., 2013. For details on the currently applied 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, and might be incompletely recorded in the metadata.

#### VALIDATION AND UNCERTAINTY ESTIMATE

Considerations of quality assurance are explained in Kaspar et al., 2013: several steps of quality control, including automatic tests for completeness, temporal and internal consistency, and against statistical thresholds based on the software QualiMet (see Spengler, 2002) and manual inspection had been applied. Data are provided "as observed", no homogenization has been carried out. 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

When investigating long term changes or trends, consider changes in station location, changes in instrumentation, measurement procedures and observation intervals - see the various metadata information provided `Metadaten_Parameter*`, `Metadaten_Geraete*` und `Metadaten_Geographie*`. Starting in the nineties, the metadata are electronically recorded and provided together with the station measurements. For the time before, efforts are continuing to digitize the most relevant metadata based on the paper records however, many gaps are still remaining. For detailed studies, DWD can grant access to the station records.

## 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).

## REFERENCES

Behrendt, J., et al.: Beschreibung der Datenbasis des NKDZ. Version 3.5, Offenbach, 15.02.2011.

DWD Vorschriften und Betriebsunterlagen Nr. 3 (VuB 3), Beobachterhandbuch (BHB) für Wettermeldestellen des synoptisch-klimatologischen Mess- und Beobachtungsnetzes, März 2014a .

DWD Vorschriften und Betriebsunterlagen Nr. 3 (VuB 3), Technikerhandbuch (THB) für Wettermeldestellen des synoptisch-klimatologischen Mess- und Beobachtungsnetzes, März 2014b.

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Freydank, E.: 150 Jahre staatliche Wetter- und Klimabeobachtungen in Sachsen. Tharandter Klimaprotokolle Band 21, 2014.

Kaspar, F., et al.: Monitoring of climate change in Germany – data, products and services of Germany`s National Climate Data Centre. Adv. Sci. Res., 10, doi:10.5194/asr-10-99-2013, 99–106, 2013.

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Spengler, R.: The new Quality Control- and Monitoring System of the Deutscher Wetterdienst. Proceedings of the WMO Technical Conference on Meteorological and Environmental Instruments and Methods of Observation, Bratislava, 2002.

## COPYRIGHT

The instructions in [ftp://ftp-cdc.dwd.de/pub/CDC/Terms\\_of\\_use.pdf](ftp://ftp-cdc.dwd.de/pub/CDC/Terms_of_use.pdf) should be followed. The DWD website provides comprehensive copyright information.

## 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 19.12.2018.