

The global monthly climate data archive at DWD

A collection spanning more than 70 years of climate observations

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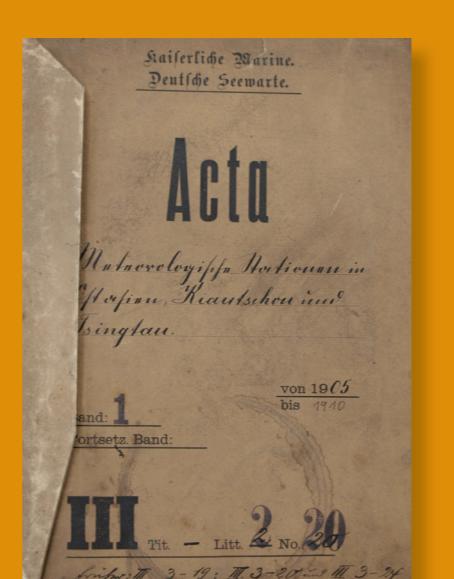
The heart of the archive – CLIMAT messages

Deutscher Wetterdienst (DWD) operates an archive containing monthly surface climate data of nearly 4000 weather stations worldwide. The National Meteorological and Hydrological Services (NMHSs) compile climate data of land and island stations by the end of every month. They encode this data according to the regulations of the WMO as so-called CLIMAT reports and disseminate them worldwide. The DWD archive comprises primarily the mandatory contents of these reports, but also from other sources, e.g. monthly publications of NMHSs or World Weather Records (WWR). Increasingly monthly values have been calculated from synoptic observations in recent years in order to fill data gaps. Within the database the data source is flagged.

The archive contains monthly averages of air pressure (at station and sea level), temperature (mean, maximum, minimum), partial vapour pressure and totals of precipitation and sunshine duration. The main part of the data comprises the timespan from 1949 onwards. Not all climate elements are available for the whole period, as the data collection standards have changed over the years. Furthermore the methods of calculating the monthly values have been varying in the course of time and depending on the generating NMHS.

History

The German Naval Institute (Deutsche Seewarte) started to gather, check and analyse weather observations from its overseas stations systematically at the end of the 19th century. This data served as a basis for climatological research, but also for consulting customers like merchants. The observations were discontinued after the end of World War II.



With the foundation of DWD its foreign climate department started to collect worldwide monthly climate data (CLIMAT) disseminated by NMHSs following resolutions of IMO and WMO.

Before the implementation of WMO's Global Telecommunication System (GTS) DWD received the CLIMAT messages by mail or airmail. NMHSs that are not or not well connected to the GTS still send their messages by e-mail directly to DWD, from where they are subsequently disseminated worldwide.

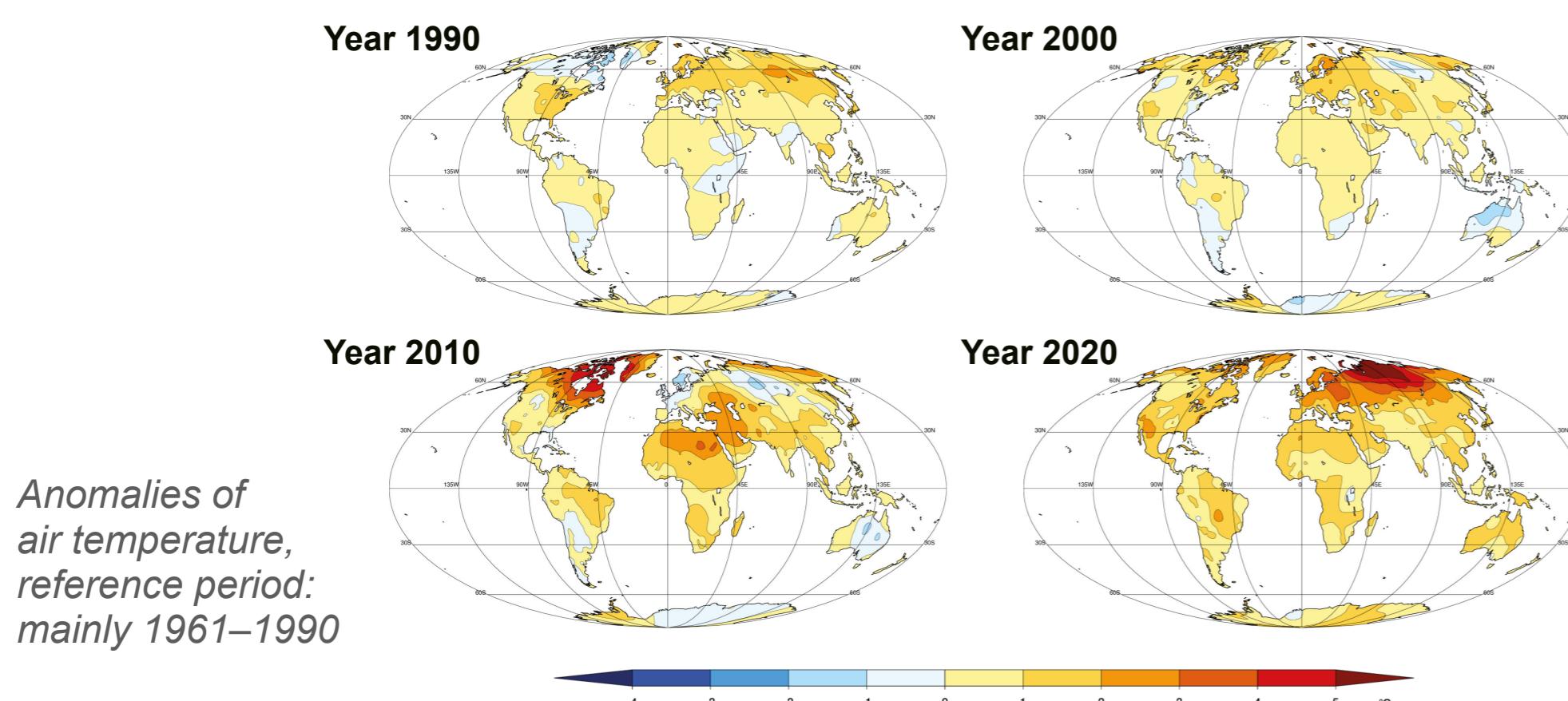
Quality control and products

For several decades CLIMAT reports have been encoded in Traditional Alphanumeric Code (TAC). With the extension of contents over the years the error rate within CLIMAT messages has increased. Systematic and numerous random errors occur, making it impossible to further process the messages automatically.

DWD performs a multi-tiered, semi-automatic quality control on the data and also tries to heal corrupt messages.

The first step is a format check of the TAC CLIMAT reports. A software developed by DWD analyses the messages received via the GTS. It is able to detect a variety of common errors and to rectify some of them. The remaining format errors have to be corrected manually. By this step and by processing the reports received via e-mail, DWD rescues about 350 CLIMAT messages every month, that would have gone lost due to non-conformity.

Raw and quality controlled data are available via DWD's Climate Data Center (CDC):
https://opendata.dwd.de/climate_environment/CDC/observations_global/CLIMAT/monthly/

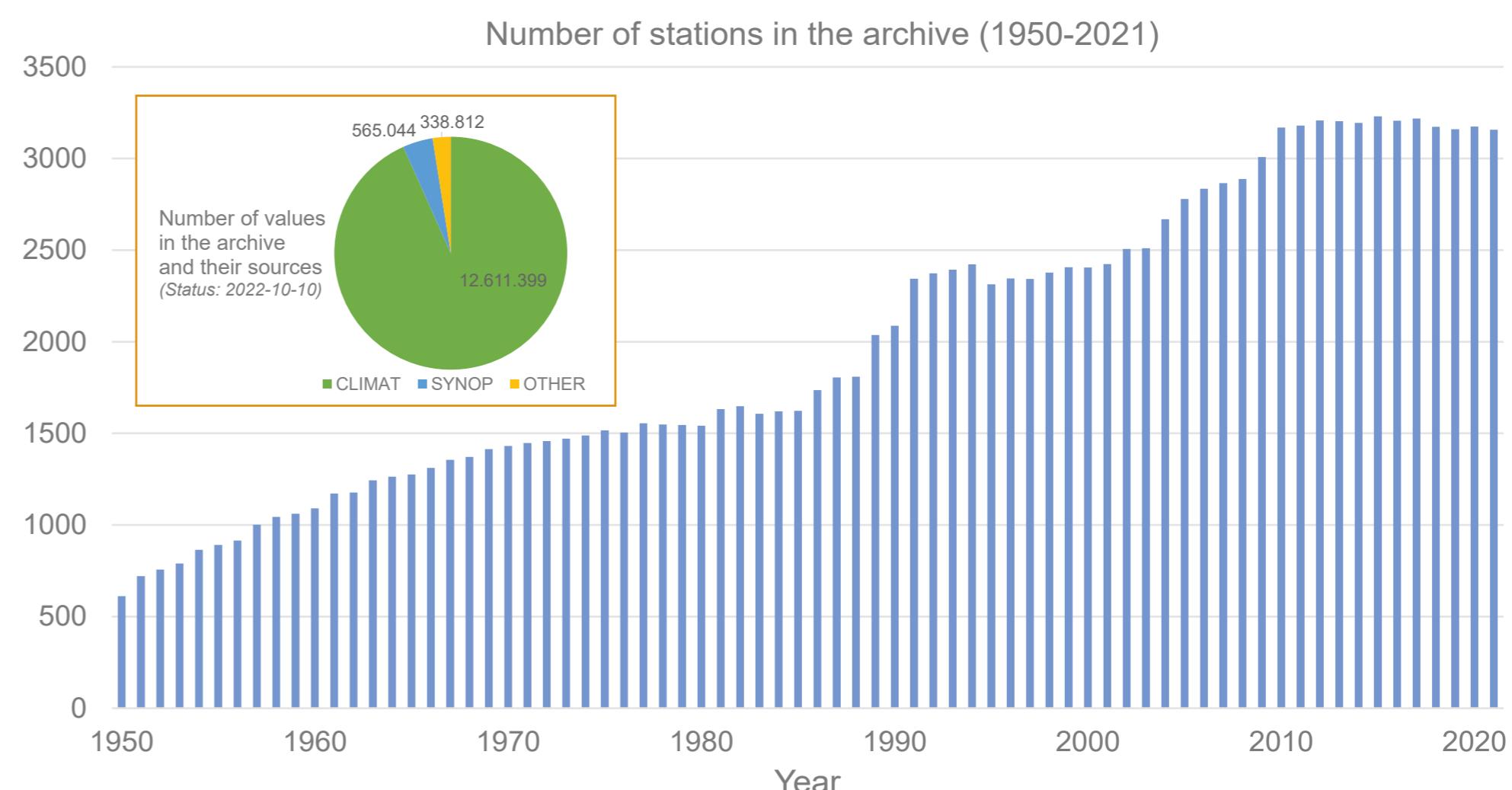


Another format for encoding CLIMAT is BUFR (Binary Universal Form for the Representation of meteorological data). By now, almost 50 percent of the CLIMAT reports are disseminated in BUFR format. Here the format error rate is lower.

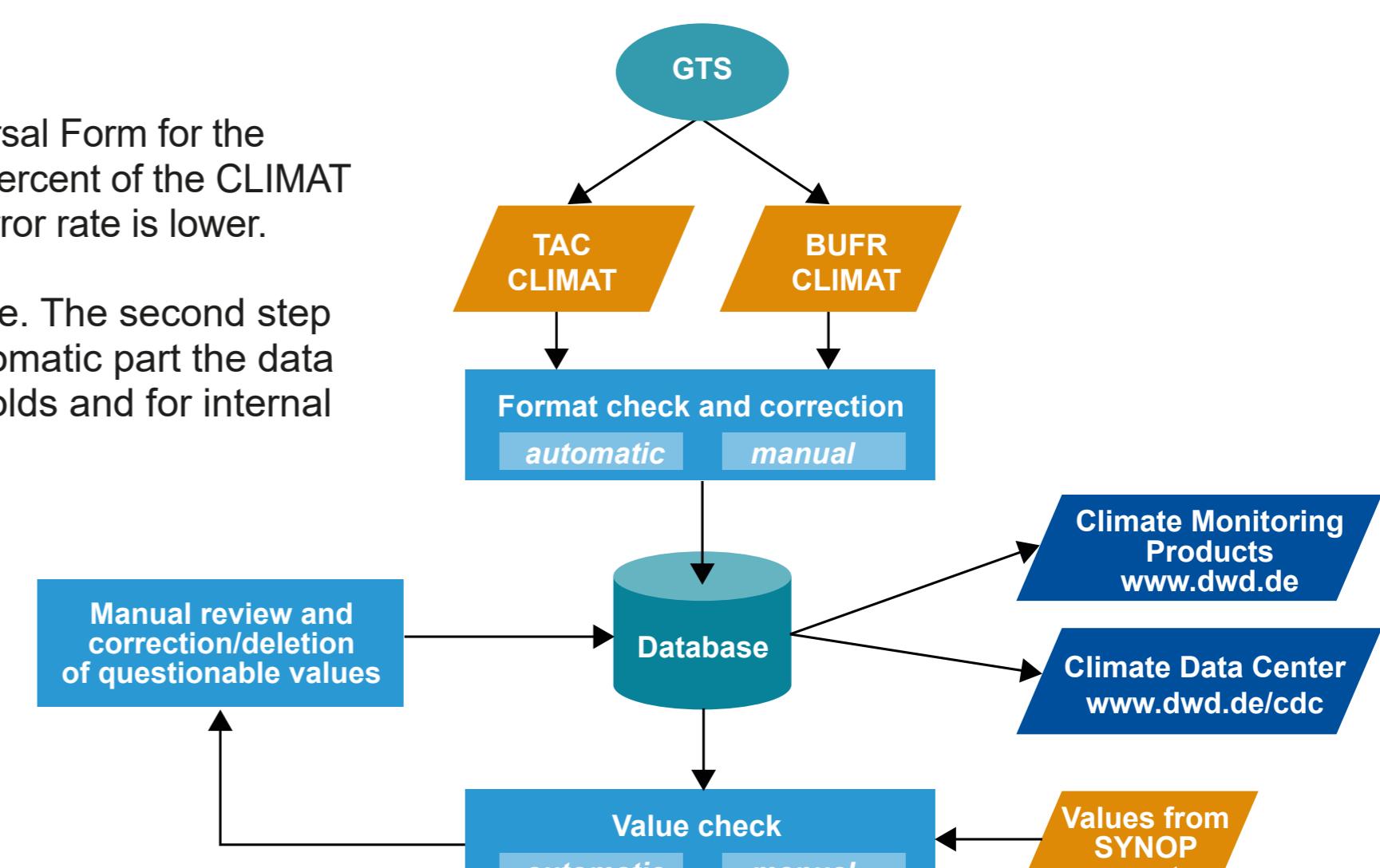
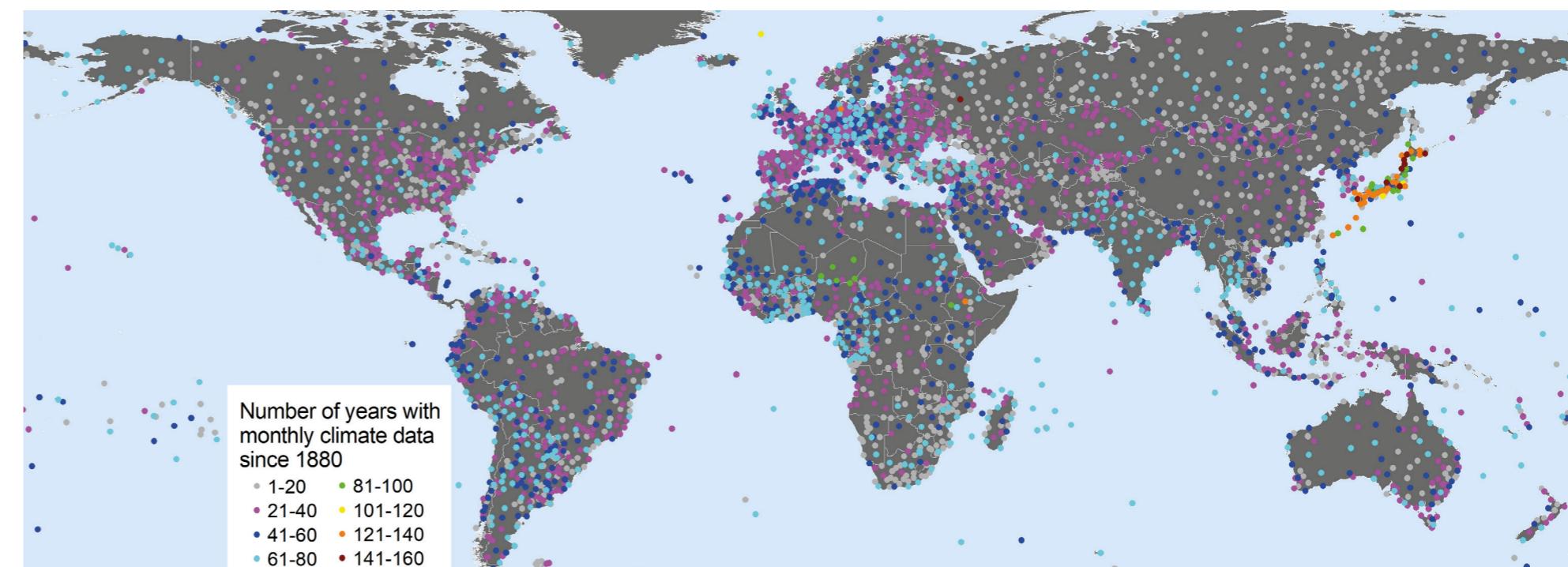
The correctly formatted messages are stored in a database. The second step is a semi-automatic quality check of the values. In the automatic part the data of a station are first checked against climatological thresholds and for internal consistency. Questionable data are flagged.

Beyond this the CLIMAT values are compared with monthly values calculated from synoptic observations, if available and applicable. The following manual check of questionable data, although time-consuming, is essential in order to improve the data quality. Obvious errors are corrected, if possible, otherwise incorrect values are deleted. In case of systematic errors (TAC/BUFR) or missing reports NMHSs are contacted to fix these issues.

The quality controlled data serve as a basis for several climate monitoring products.



The number of stations reporting CLIMAT data has increased successively. In the last decade the number is nearly constant. Changes due to closures or establishments of stations are frequent. Not all stations report regularly and/or completely. The time series of some stations are longer than 70 years.



Monitoring of GSN stations

About 1000 stations reporting CLIMAT messages are selected as reference stations for global climate monitoring following special quality criteria. They constitute the GCOS Surface Network (GSN). The GSN Monitoring Centres (GSNMC) of DWD and the Japan Meteorological Agency regularly check the data of these stations regarding availability, completeness and quality. The monitoring results are issued monthly (<http://www.gsnmc.dwd.de>). They also serve as a basis for the GCOS surface land observations monitoring within the WMO WIGOS Data Quality Monitoring System (<https://wdqms.wmo.int>).

To increase the availability and reduce errors in the CLIMAT messages nine regional CBS Lead Centres for GCOS were established by the WMO Commission for Basic Systems (CBS) in 2006. Each CBS Lead Centre for GCOS has its own area of responsibility. The CBS Lead Centre for GCOS for the WMO region Europe (RA VI) is located at DWD.

The global exchange of monthly CLIMAT reports is essential for the production of Climate System Monitoring (CSM) products. These products include a continuing series of monthly bulletins, the regular publishing of biennial Global Climate System Reviews, annual statements on the global climate, and other information concerning El Niño, drought, and temperature and precipitation extremes.

Source: Handbook on CLIMAT and CLIMAT TEMP Reporting (2009 edition), WMO/TD-No. 1188

