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### **Climate Data Processing at DWD for the NKDZ (Nationales Klimadatenzentrum)**

At the NKDZ (Nationales Klimadatenzentrum) of the DWD the climate data for Germany are processed and archived. The climate data processing is designed to integrate all data in one database system and to produce and provide climate products like climate indices and grid fields. Source of the data is the climate data archive containing time series of German climate stations back to the 18<sup>th</sup> century actualized by the data production of the actual station networks of the DWD. All data and the related metadata are stored in one relational database management system (MIRAKEL).

The actual network of surface stations is characterized by three types of automated stations.

AMDA I: at SYNOP-stations with hourly or half hourly visual observations

AMDA II: at SYNOP-stations without observer (fully automated stations)

AMDA III at climate and precipitation stations with visual observations  
once or three times a day

These stations generate 10-minute-values of different elements. For radiation and precipitation one minute values are available. At AMDA I and AMDA III stations there is an interface for input of visual observations. The station network is completed by an aerological network, a conventional precipitation network and a network of phenological observers.

Automated quality control of surface observations is performed in the department for technical infrastructure using the software QUALIMET. Corrections and substitution of data is controlled by trained staff. From these quality controlled high resolution data SYNOP-bulletins are generated, being the basis for hourly, daily and monthly climate values. Corrections in the 10 minute values result in the production of corrected SYNOP-bulletins and the generation of hourly and daily values. The climatological post processing provides monthly, seasonal and yearly climate elements for single years and integration periods of 10 or 30 years at stations but also on a 1km grid for Germany.

A subset of time series and grid fields is described by metadata according to ISO 19115 metadata standard. The DWD provides online access to these data and metadata by the portal WebWerdis. This portal acts as a predecessor of the GISC portal which will be developed in the framework of WIS (WMO Information System). Features being developed during the EUMETNET programme UNIDART have been integrated in WebWerdis.



# The Climate Data Management at DWD for the NKDZ (Nationales Klimadatenzentrum)

**Johannes Behrendt, Deutscher Wetterdienst  
Copenhagen, November 2009**



## Overview

- **Station network as source for climate data**
- **Data archive and integration of current and recently digitized historical data**
- **Data processing to get valuable climate data**
- **Data access (internal and external via WWW)**

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## **MESSNETZ 2000**

### **A project for the redesign of the DWD station network**

**successfully completed in 2009**

**with three types of automatic stations**

**AMDA 1** at meteorological watch offices (Wetterwarten)  
manned around the clock or part time  
some reference stations with  
additional conventional observations

**AMDA 2** at fully automatic weather stations  
without observer

**AMDA 3** at stations run by voluntary staff  
with manual observations 1-3 times per day



## Reference Station Potsdam AMDA1 + conventional observation



## Network of land stations (31.12.2008)

**182 meteorological watch offices and weather stations of the primary network**

51 with observer around the clock (AMDA 1) including

12 reference stations with conventional observations

34 with observer part time (AMDA 1)

97 fully automatic weather station without observer (AMDA 2)

**1856 weather stations run by voluntary observers including**

802 with additional automatic station (AMDA 3)

1054 conventional precipitation stations

**1362 phenological observation sites including**

76 at meteorological watch offices

**34 weather stations of the military service**

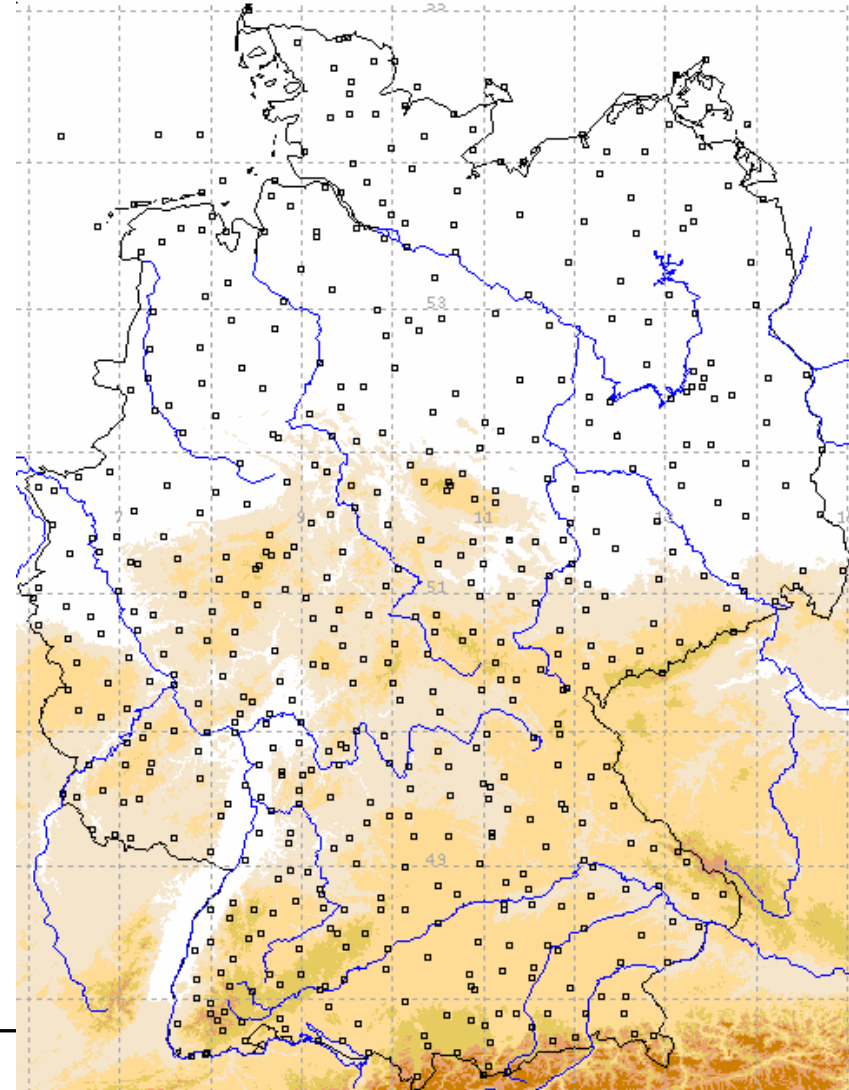
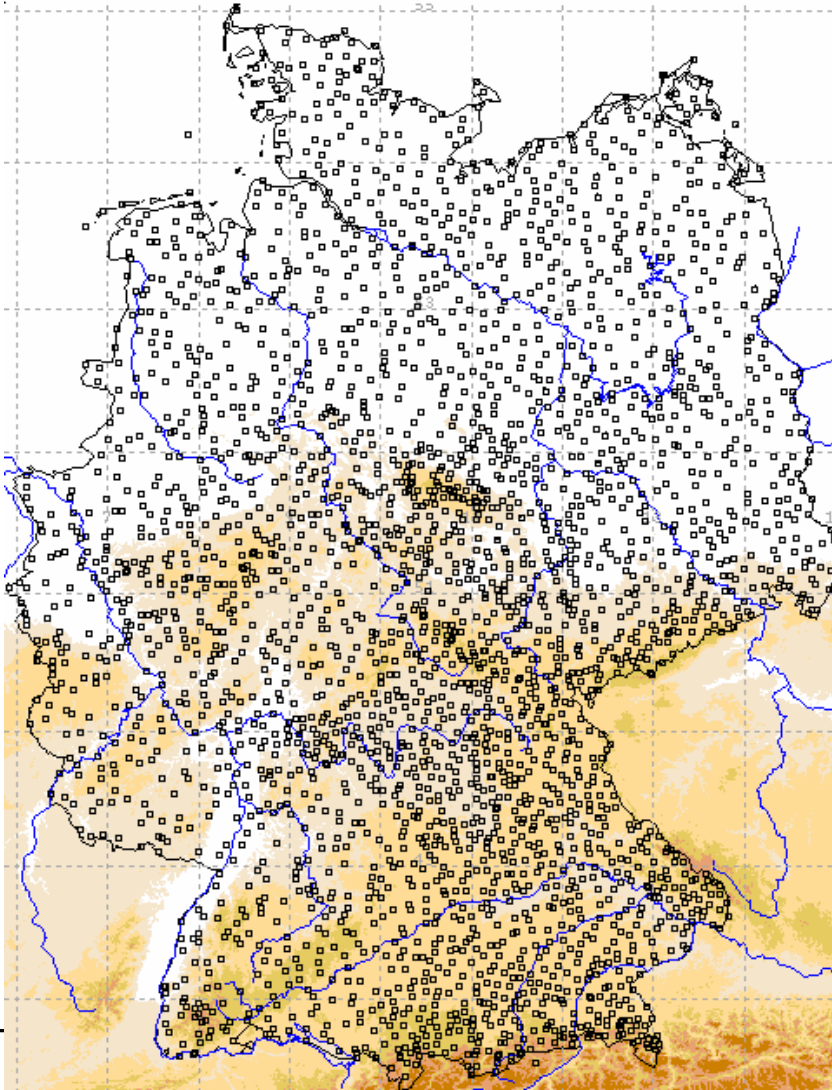
**9 aerological stations**



**precipitation (2019)**

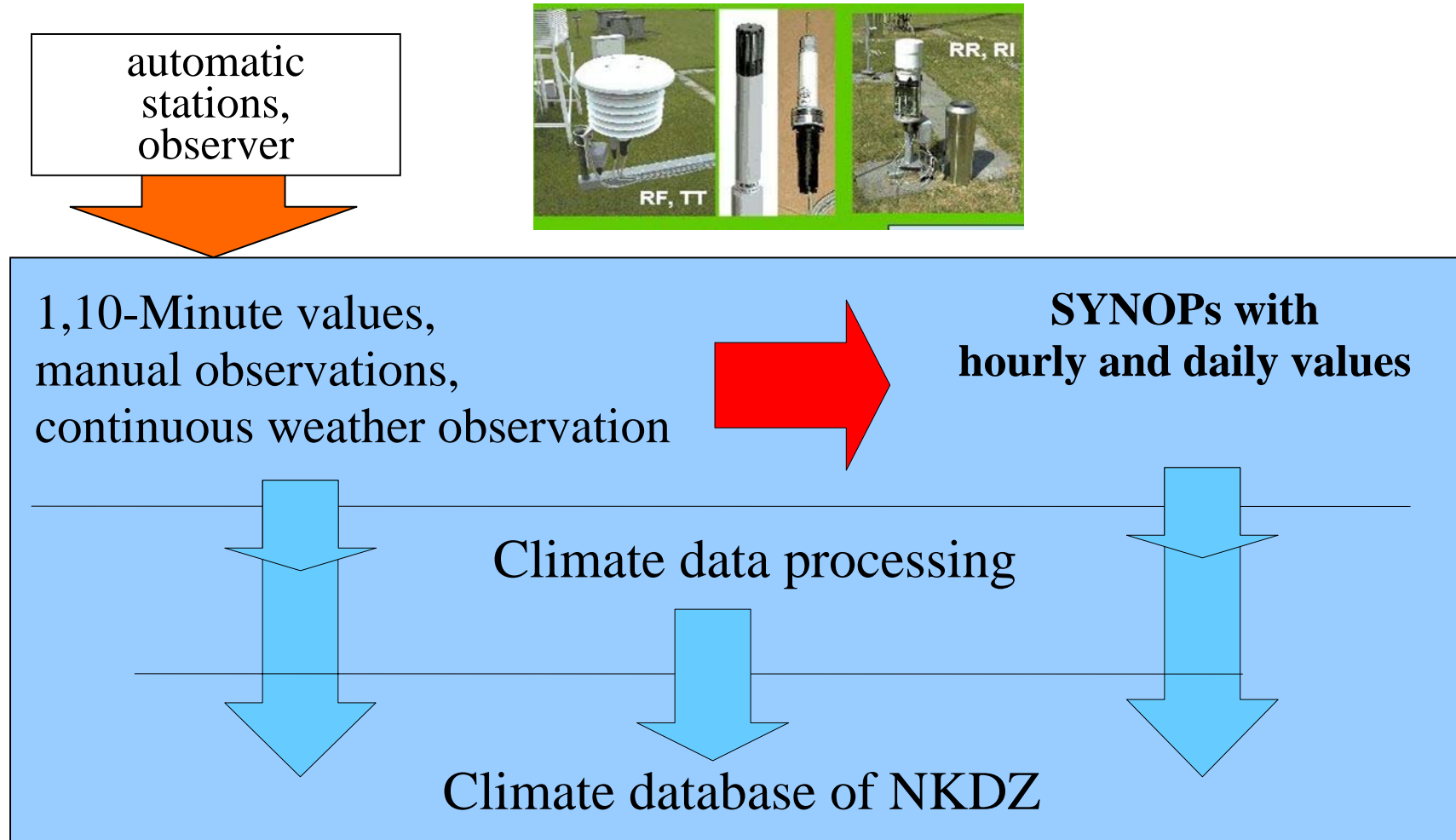
**2008**

**temperature (533)**





## Current generation of in-situ data



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### *Data*

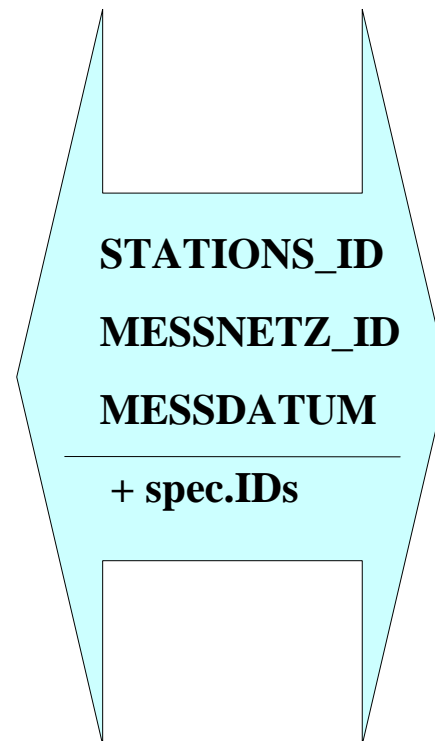
<b>Surface data</b>	<b>SYNOP</b>
	<b>Climate</b>
	<b>Precipitation</b>
	<b>Hourly values</b>
	<b>1-10-Min-values</b>
	<b>Cont. weather</b>

<b>Multi Level data</b>	<b>Aerolog. Data</b>
	<b>Soil temperatures</b>

<b>Integrated values</b>	<b>Monthly values</b>
	<b>Longterm means</b>

<b>Special data</b>	<b>Weather type class.</b>
	<b>Phaenol. data</b>

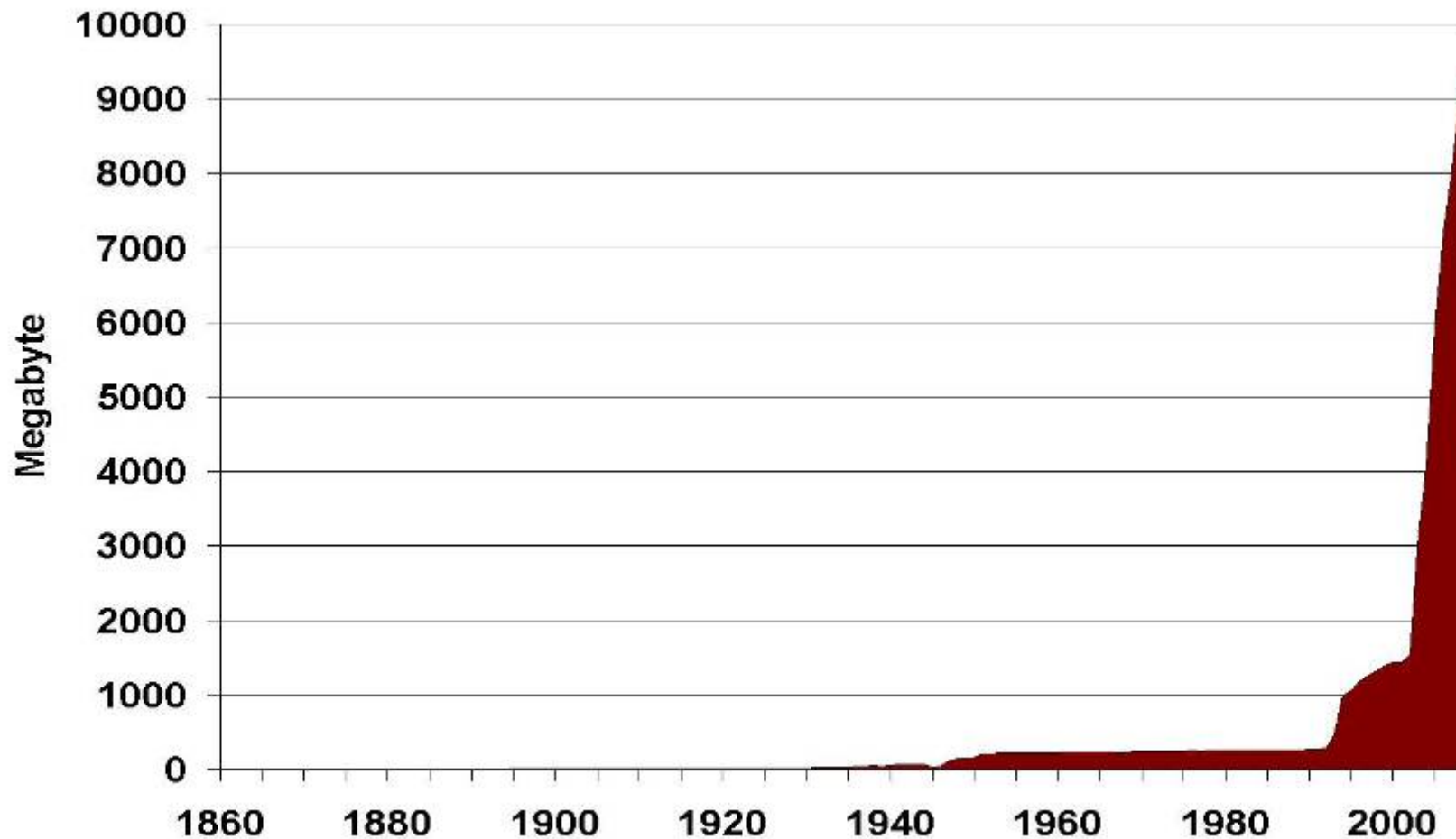
### Data in MIRAKEL



### *Meta data*

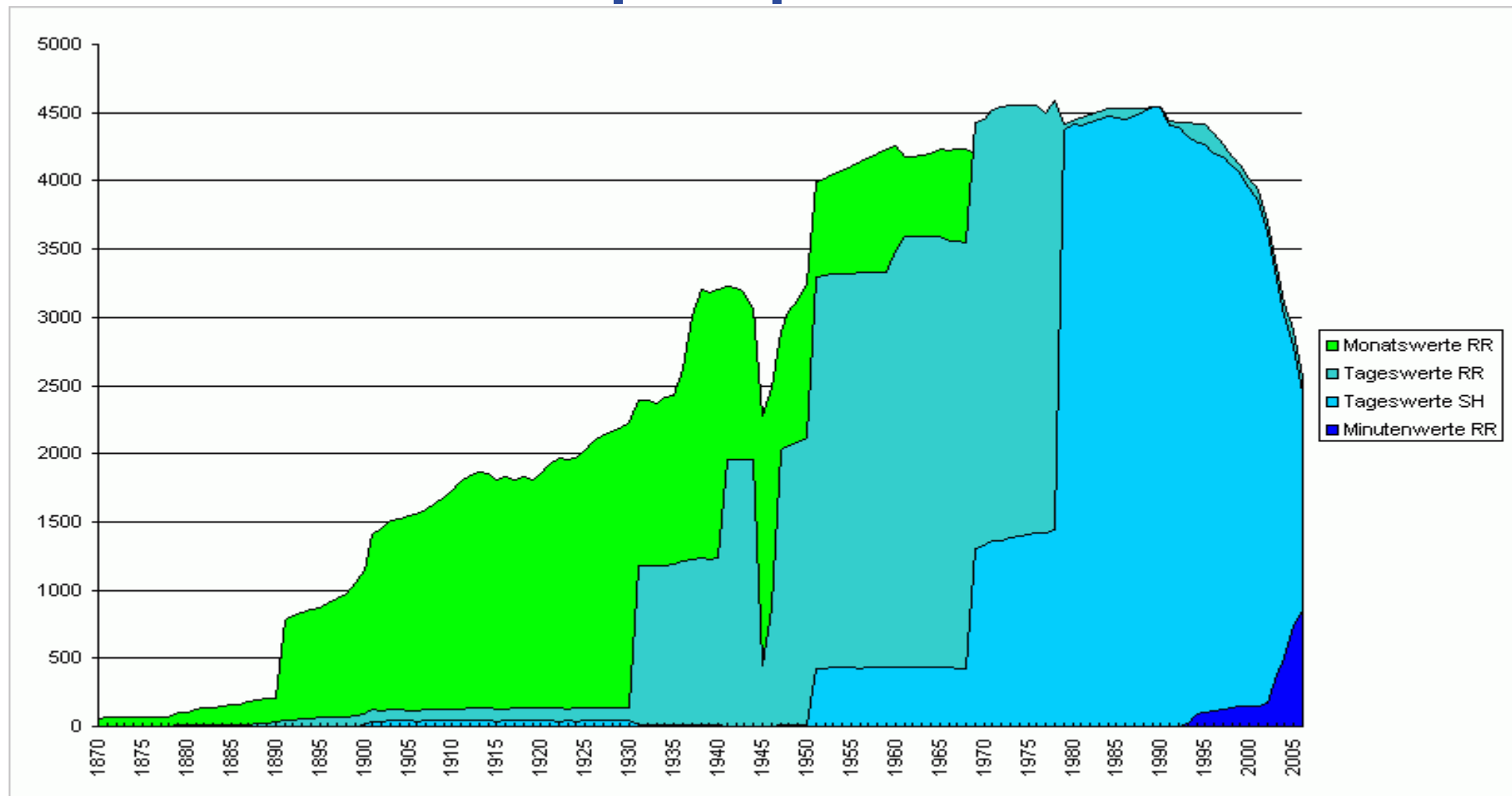
<b>Station history</b>
<b>Station networks</b>
<b>Instruments</b>
<b>Weather types</b>
<b>Plants and phases</b>

## Volume of in situ climate data for Germany (growth per year)





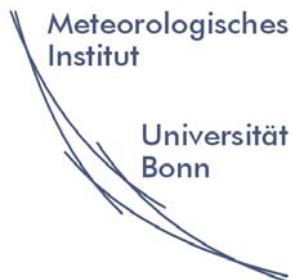
## Stations with precipitation observations





# KLIDADIGI, Digitization of Historical Climate Data in Germany

**Hermann Mächel, Johannes Behrendt, Alice Kapala**  
German Weather Service (DWD), University Bonn



**Max-Planck-Institut für Meteorologie**  
Max Planck Institute for Meteorology



Bundesministerium  
für Bildung  
und Forschung

**bmb+f**



## Aims of KLIDADIGI

- **Inventory of original documents with climate data**
- **Systematic digitization and rescue**
- **Upgrade of the number of time series spanning hundred years and more**
- **Adaptation and development of procedures for digitizing, data rescue and quality assurance**
- **Coordination of the involved groups**  
(Univ. Bonn, regional hydrological authorities)

## Original precipitation records (before 1935)

Station: *Münstereifel* Monat *Mai* 190*9*  
 Kreis *Rheinbach* Provinz *Rheinland* Beobachter *Schnitzler*  
 Höhe d. Station über d. Meere *290* m. Höhe d. Regenmessers üb. d. Erdboden *1,0* m. Zeitpunkt der Messung *7a*

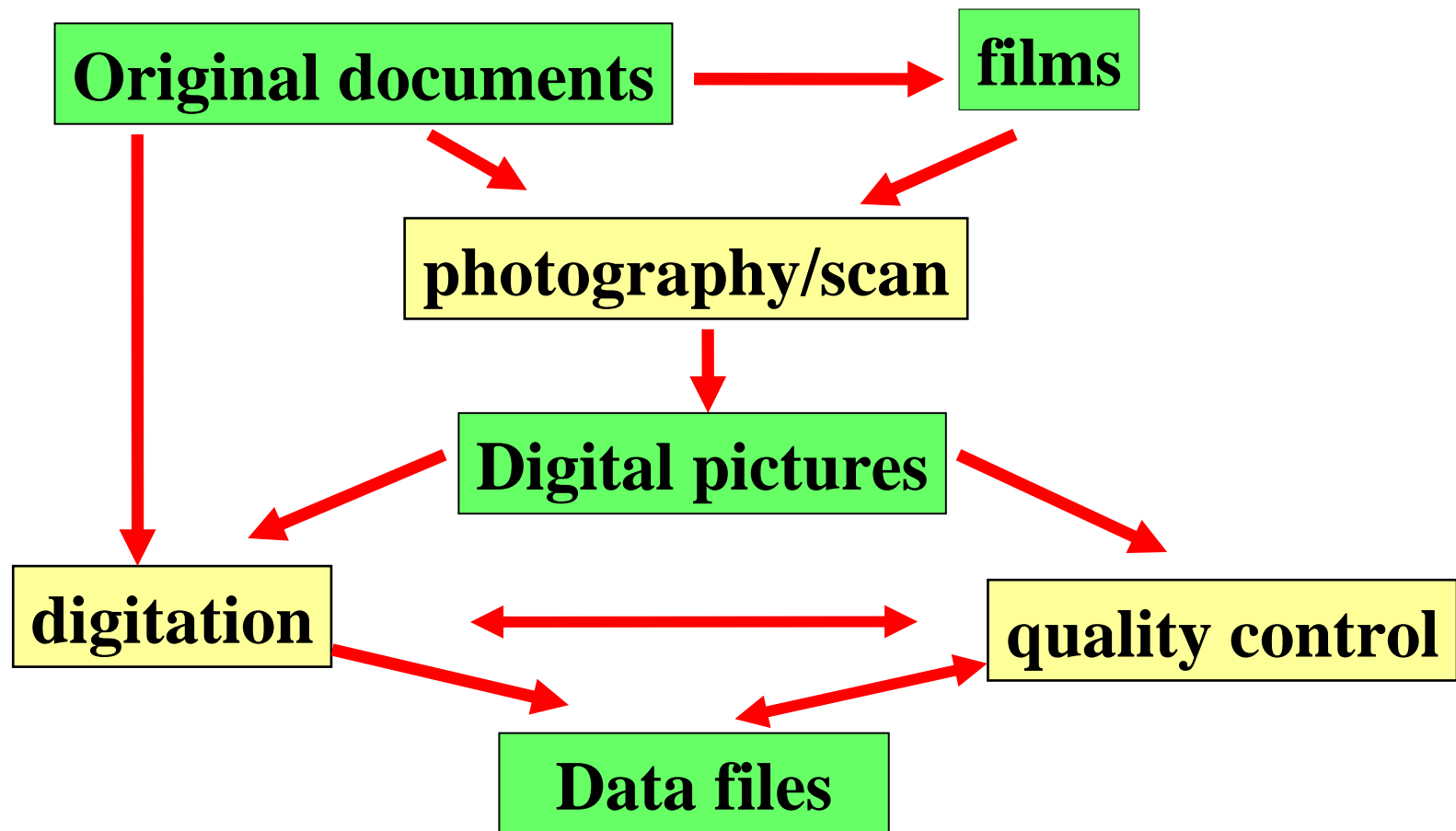
Da- tum	Höhe mm	Form und Zeit	Da- tum	Höhe mm	F
1	<i>6,2</i>	<i>☉ n *</i>	11		
2	<i>3,5</i>	<i>☉ n *</i>	12		
3	<i>4,0</i>	<i>☐ n.</i>	13	<i>0,9</i>	<i>☉ n</i>
4			14		
5			15		
6			16		
7			17		<i>☉ n</i>
8			18	<i>0,9</i>	
9			19		
10			20		
Sa. <i>13,7</i>			Sa. <i>1,8</i>		

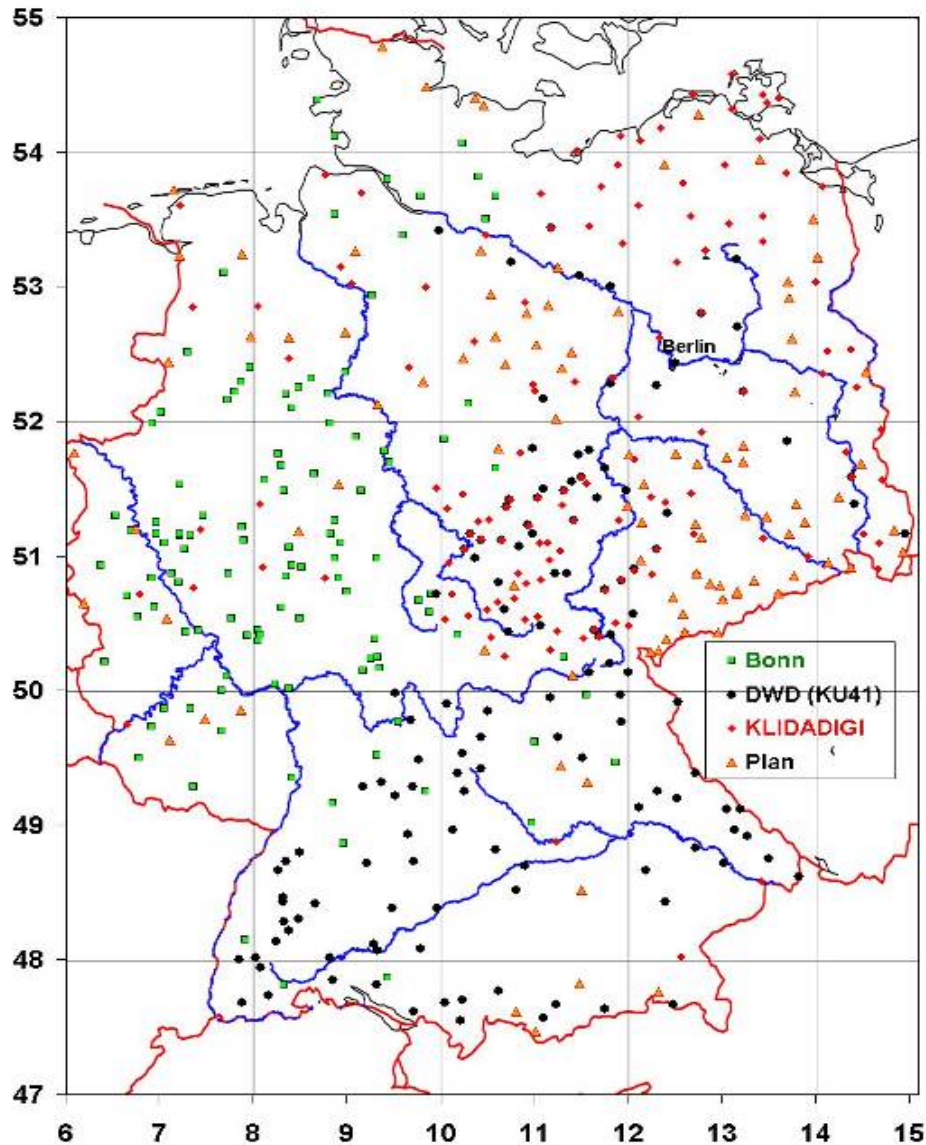
Zahl der Tage mit Niederschlag *8*  
 mit Schnee *2*  
 Grösste Höhe *6/7* in 24 Std.





## Digitization of data in Klidadigi





## Prolonged precipitation time series (Sept. 2009)

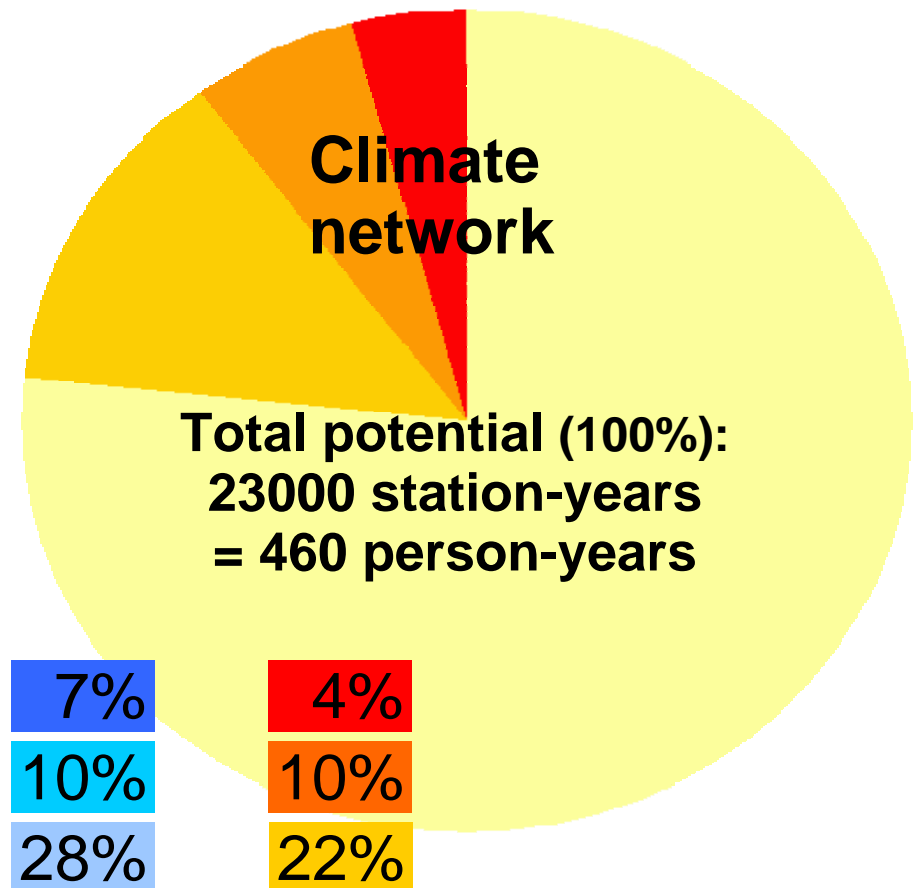
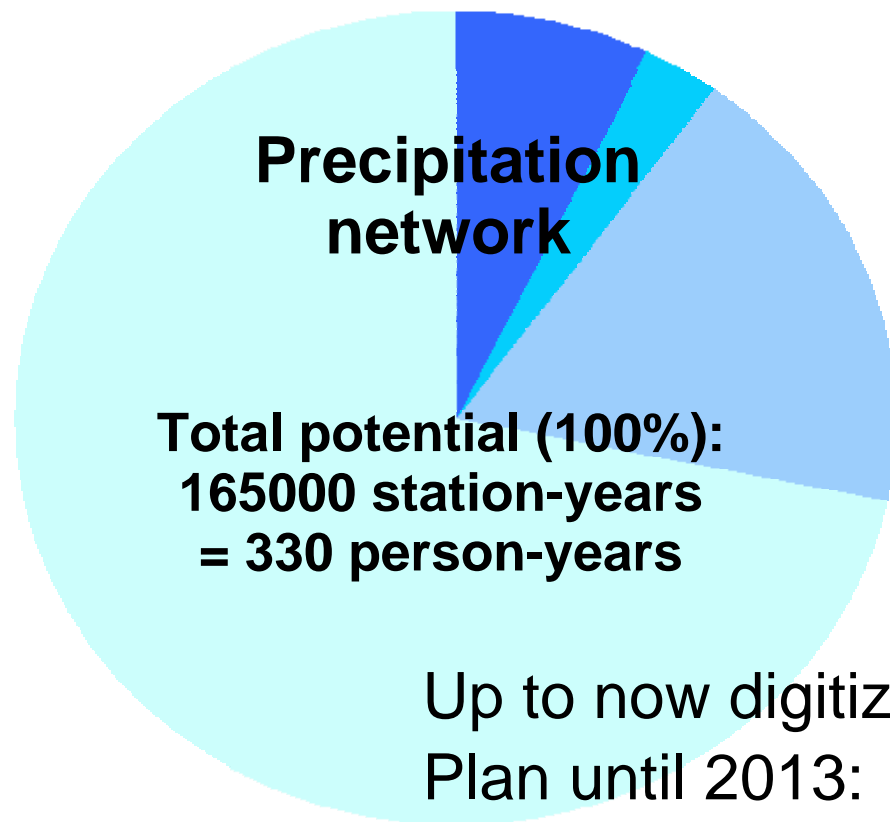
◆ DWD/KLIDAdigi (77)

▲ DWD/KLIDAdigi (70)  
plan until 2010

● DWD/co-operation (78)

■ Uni Bonn (114)

## Digitized amount and future plans



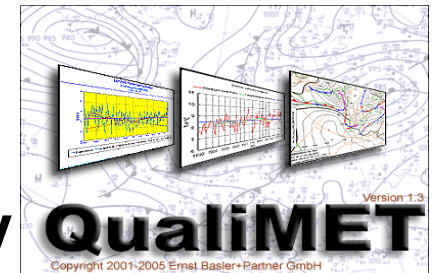
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## Quality control procedures for climate data

- Operational quality control for the current data by

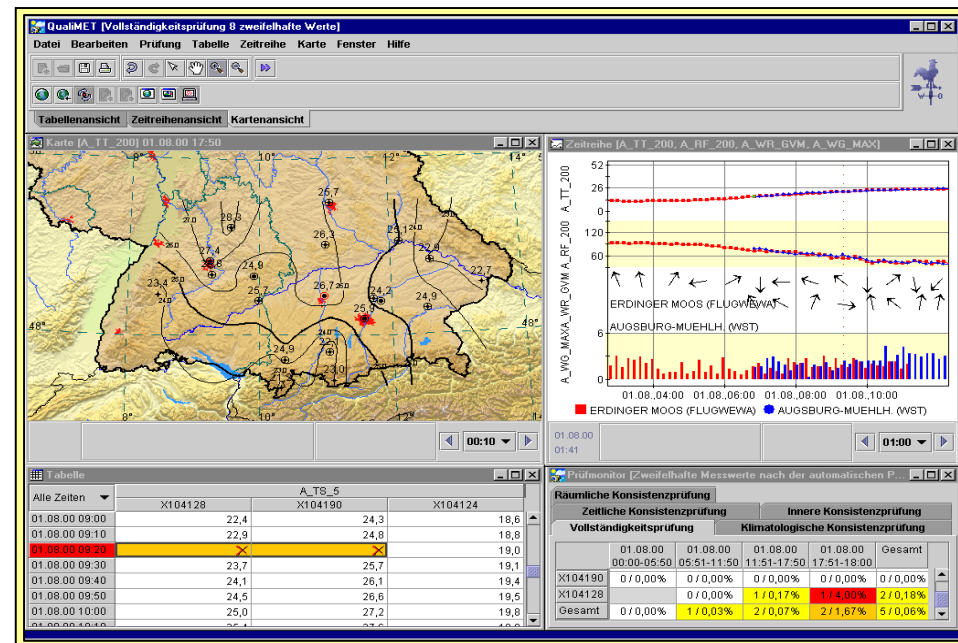
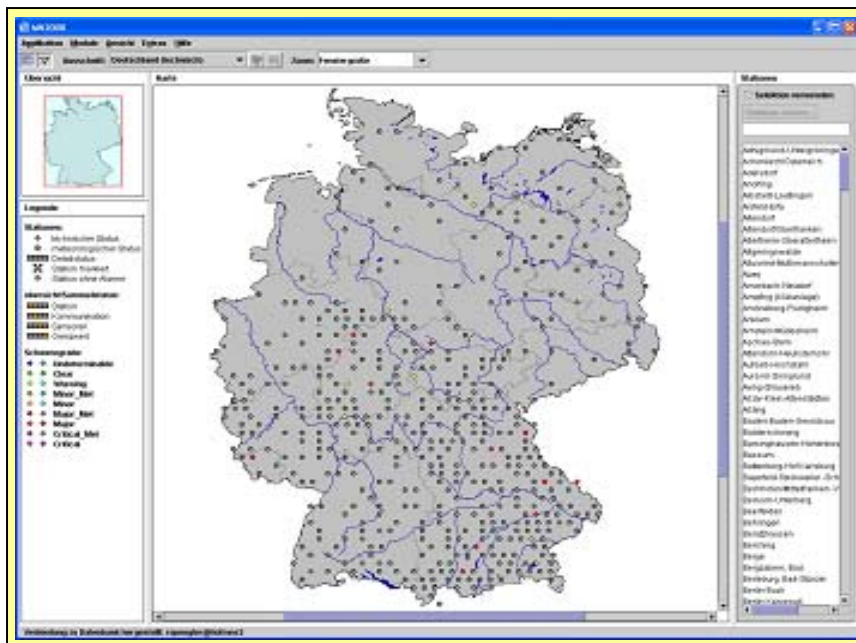


- Quality control for historical data at NKDZ

technical monitoring

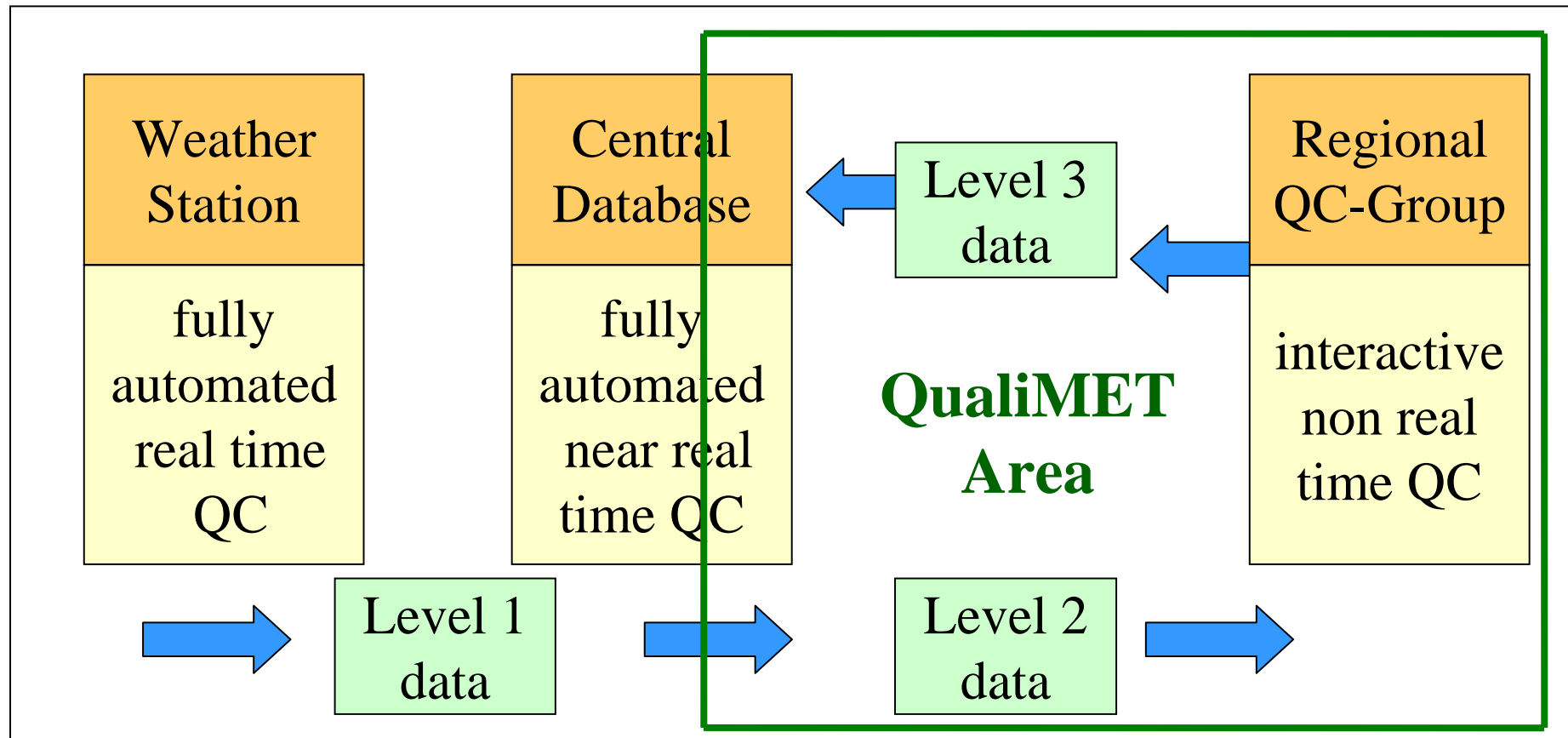
+

data monitoring



to improve and assure the quality of the data

### 3 steps of Quality Control for operational data

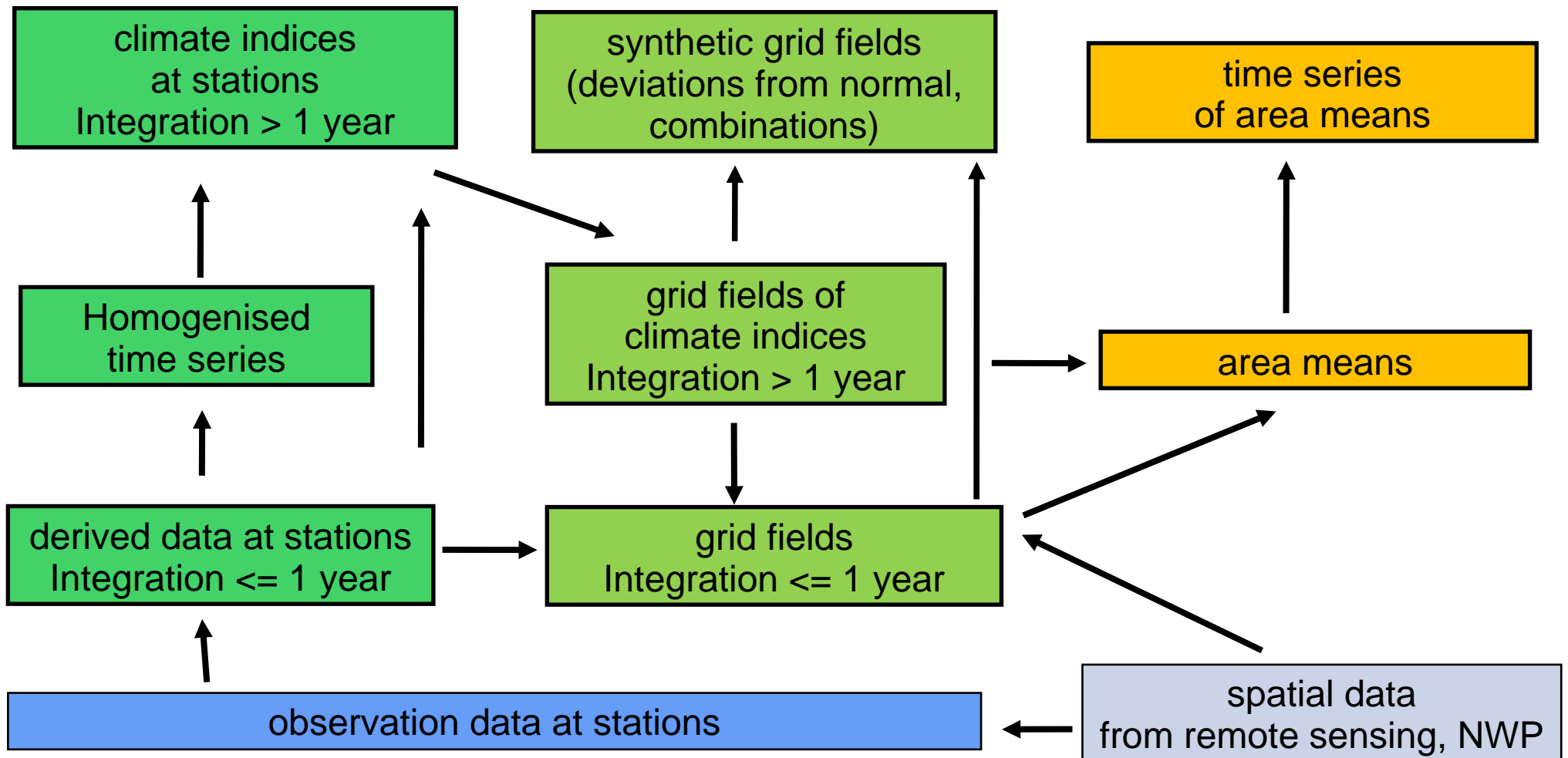


## Systematic quality control of historical daily surface observations

### Check of data generated before installation of automated quality control procedures (1980)

- Internal, spatial, time consistency, limits
- Comparison of daily values from different sources
- Elimination or correction of obvious errors
- Flagging of corrected or confirmed values
- Description of systematic problems

## Processing of climate data





## Generation of homogenized time series

### Proceeding

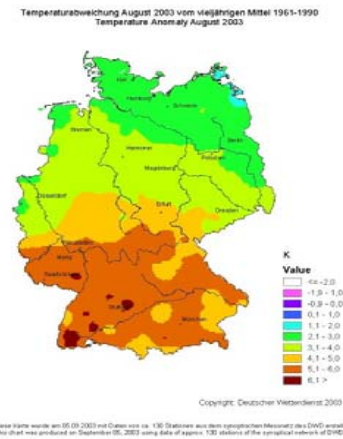
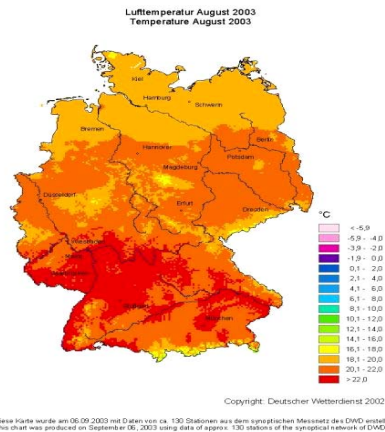
- Application of Standard Normal Homogeneity Test (SNHT, H. Alexanderson)
- Exact allocation of inhomogenities by inspection of metadata
- Adjustment to state at the end of the time series

### Result: Homogenized time series since 1891

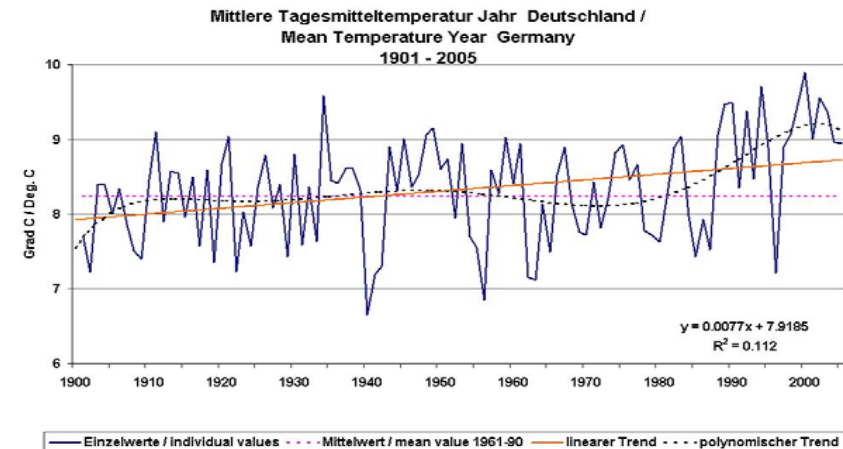
- Monthly sums of precipitation
- Monthly means of temperature

**Development of standard procedures for homogenization of additional elements and of daily values is still needed (COST ES0601)**

## 1 km grid fields absolut deviations



## time series of area means



- normals (1961-1990, 1931-1960, 1901-1930)
- long term means (decades, 1971-2000, 1979-2008)
- monthly, seasonal, yearly 1-km-grid for Germany  
precipitation, temperature since 1881  
sunshine duration since 1951
- Time series of area means (for Germany or regions)

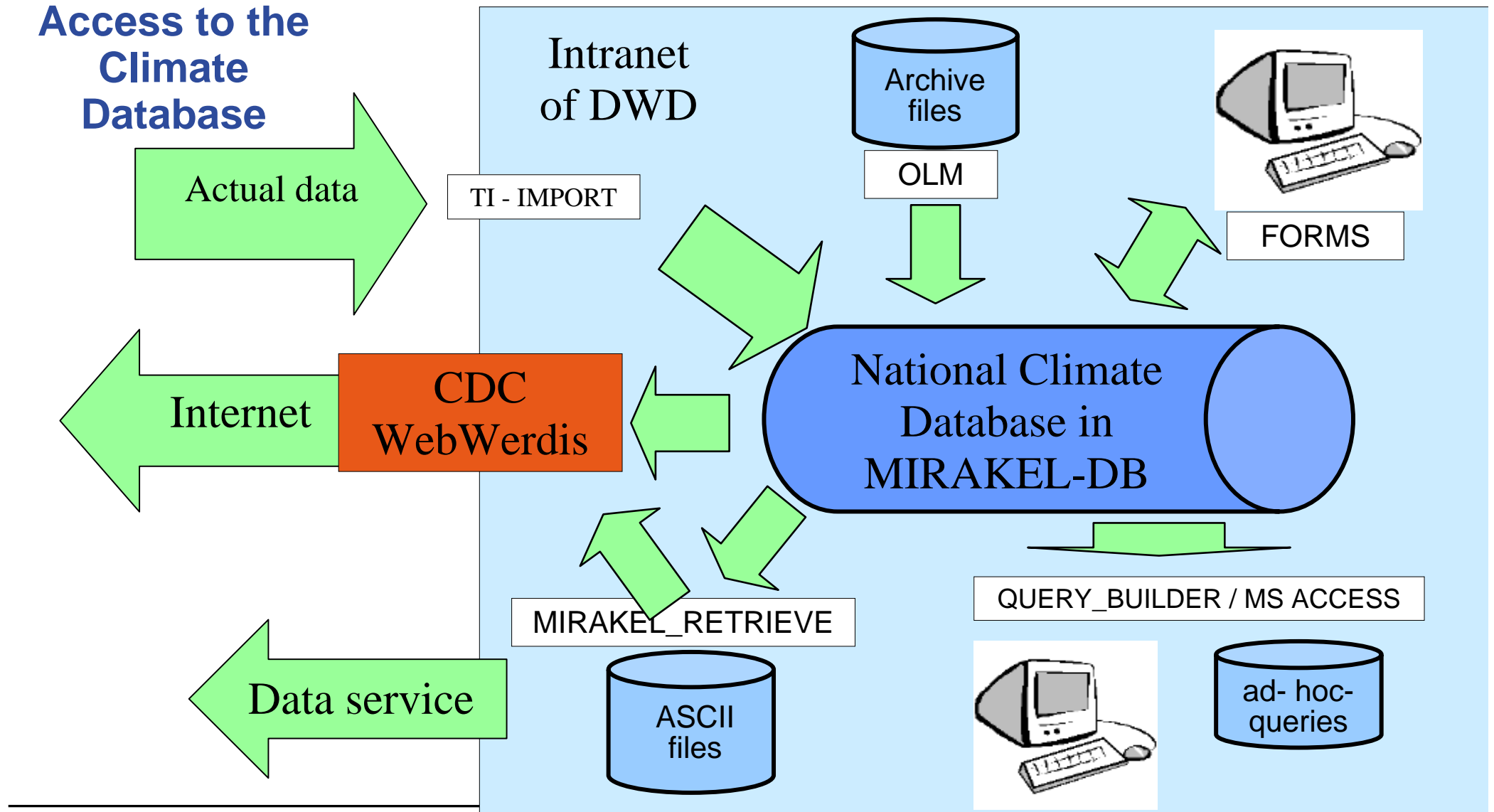
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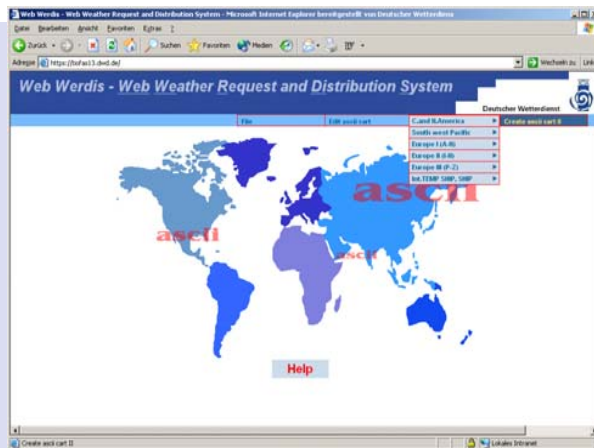
# Deutscher Wetterdienst Nationale Klimaüberwachung



## Access to the Climate Database



## Origin of WebWerdis



### WebWerdis 2001/2

- <https://tiofas13.dwd.de/>
- Without meta data catalogue
- Fixed navigation
- Global GTS data set
- DWDSat-products
- Unflexible acc to products und structure



### CBS-Prototype 2005

- <http://vgisc-2.dwd.de/vgisc/>
- WMO-Metadats Version 02
- User specific products
- Use of structures developed for the EUMETNET programme UNIDART
- 'pull' und 'push' für GTS- and DWDSat products

[http://werdis.dwd.de/werdis\\_en/WebWerdis\\_start.do](http://werdis.dwd.de/werdis_en/WebWerdis_start.do)



## Characteristics of WebWerdis

**Catalogue information according to ISO 19119 and 19139**

**On-line access to**

**Relational database system**

**File system on ftp-server**

**data catalogue**

**Push and Pull Functionality**

**Data sources**

**Climate time series and grid fields of Germany (NKDZ)**

**Global precipitation grid fields (GPCC)**

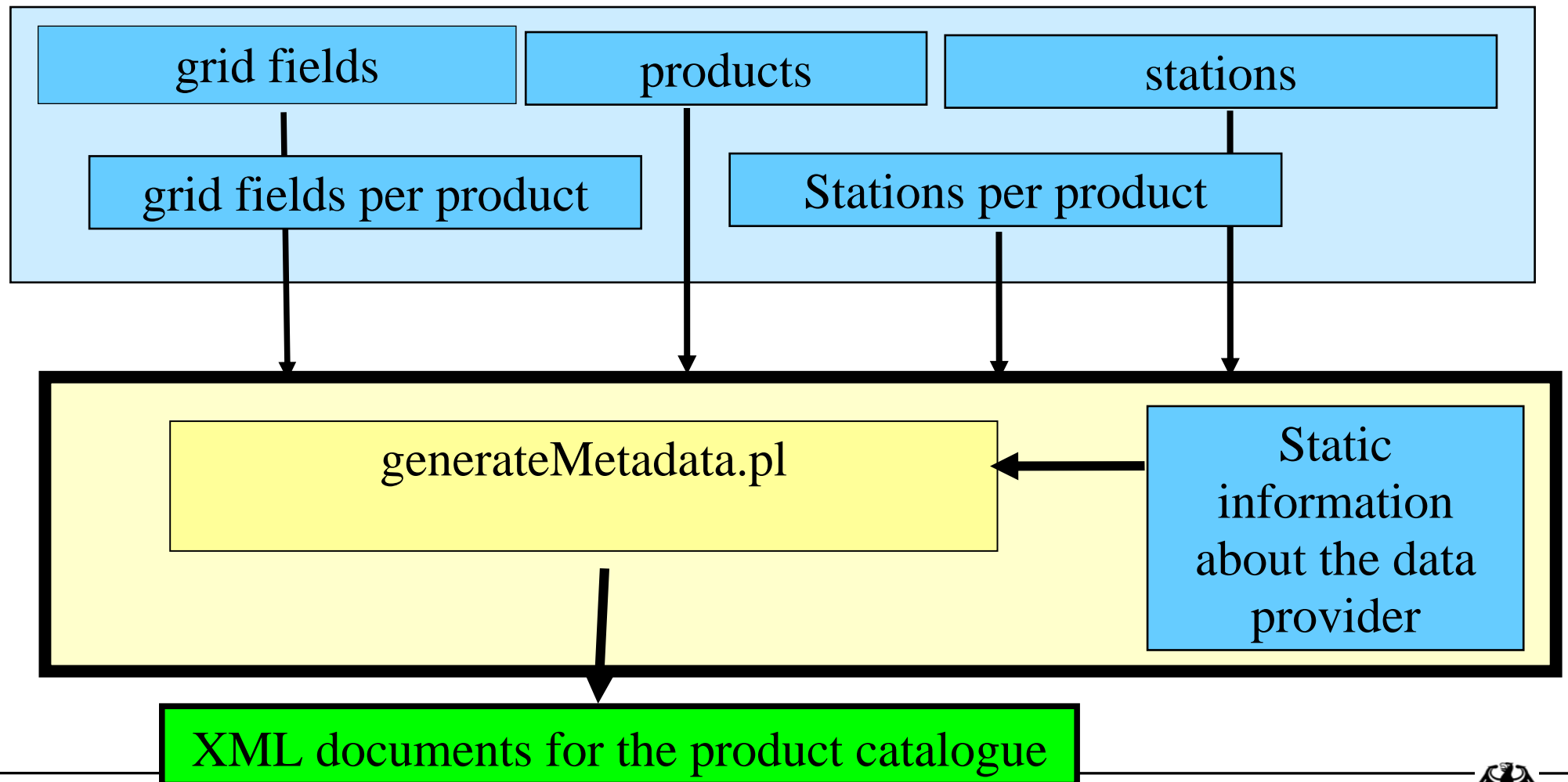
**Synoptic products distributed by GTS**

**Data sources will be expanded**

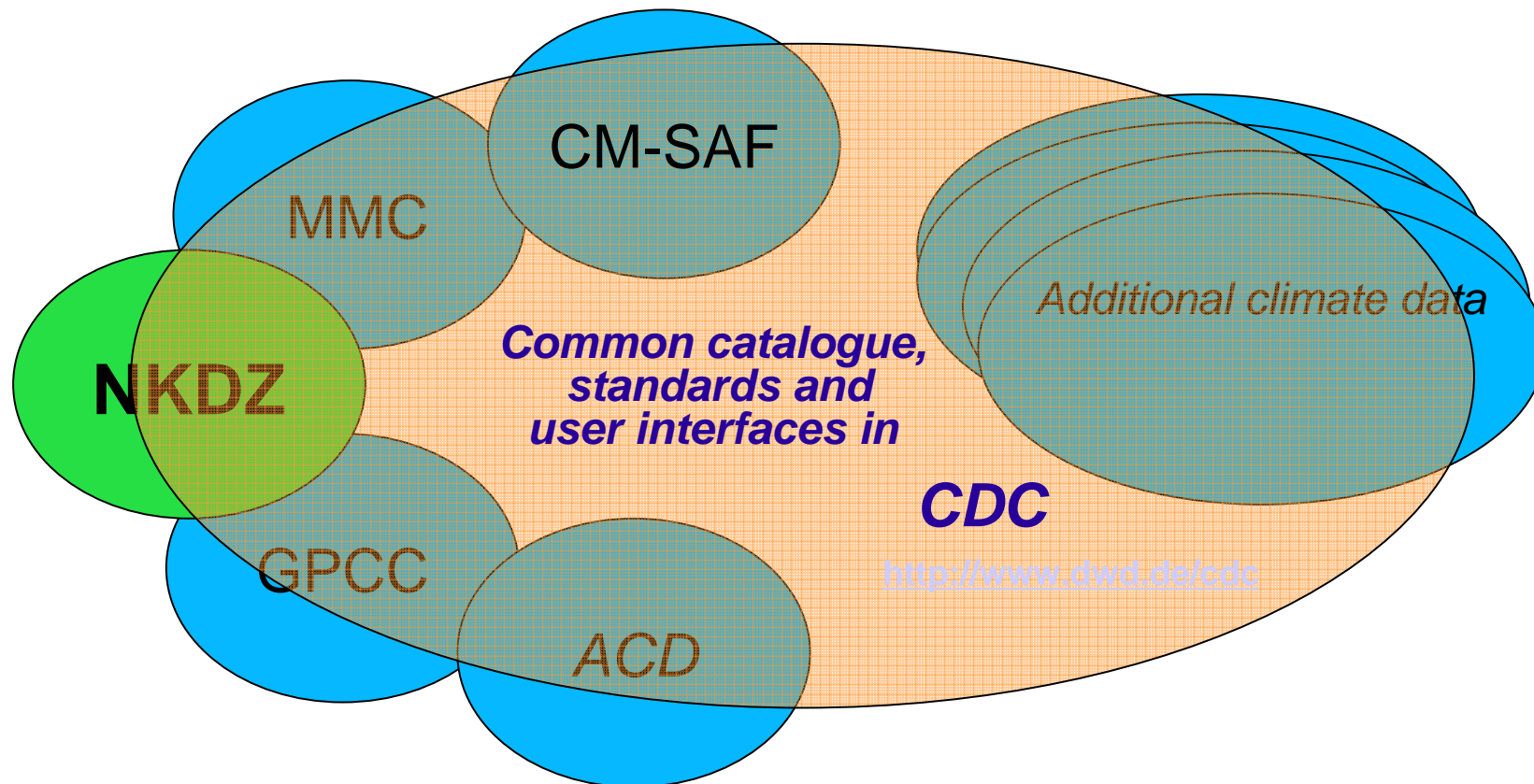
## WebWerdis and UNIDART

- WebWerdis is the portal that was used for the EUMETNET programme **UNIDART**
- WebWerdis is a prototype for the development of **GISC** at DWD
- We had some problems in maintaining the access to remote data sources, so actually WebWerdis allows **only access to databases at DWD**
- Realistic perspective:  
**Generation and exchange of catalogue information with information on data access**

## Creation of metadata



## NKDZ as one of the Data Centres in the Climate Data Center (CDC) at DWD



## Summary

- **Generation of data by new network of automatic stations (AMDA) partly completed by observer**
- **Quality control of current data by QUALIMET and additional QC for historical data**
- **Digitization by KLIDADIGI**
- **Operational product generation**
- **Extent of Web access**
- **Further development of the data catalogue using metadata standards and exchanging catalogue information**