# Climate Observations in Germany

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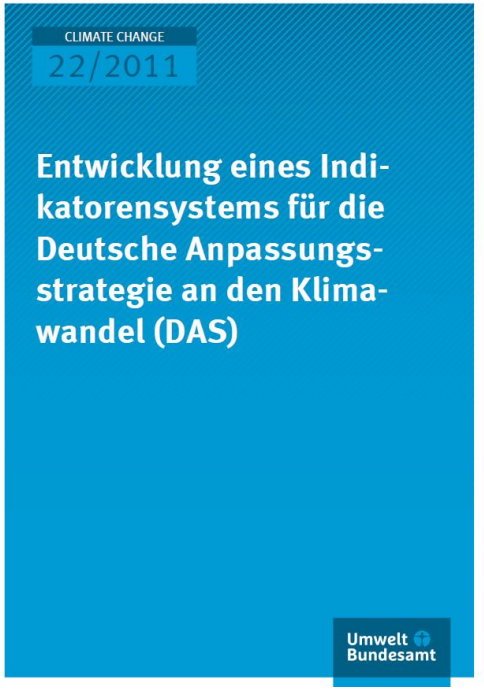
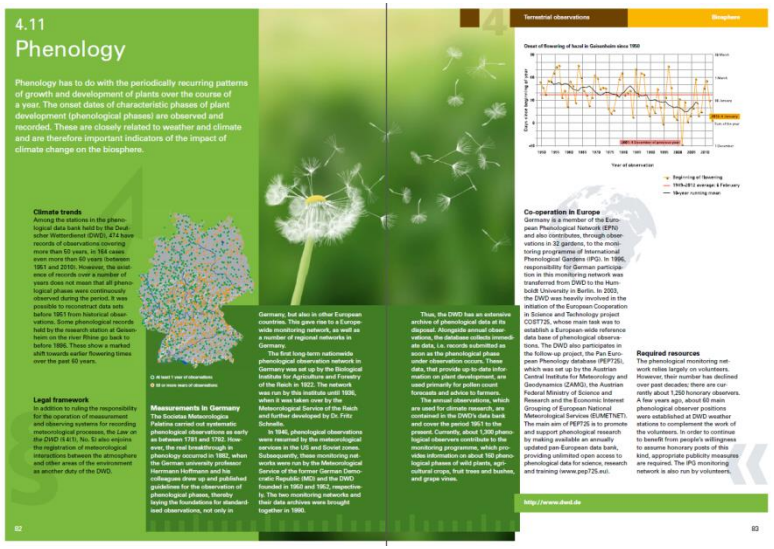
# National and regional needs

- Climate observations in support of assessment and implementation of adaptation
  - Observing systems have in most cases been developed for purposes other than climate
  - In general the spatial and temporal coverage of climate observations in Germany is considered to be sufficient
  - The German Adaptation Strategy (DAS) and its Adaptation Action Plans (APAs) are regularly being monitored w.r.t. to progress in implementation based on an indicator system (~80)
  - Sectorial vulnerability is being analysed within the Network Vulnerability comprising 16 federal agencies
  - This may lead to new and additional recommendations for climate observations



# Climate observations by Germany

- Inventory Report published in 2013
- Addresses 34 ECVs relevant for Germany
- Fed into the 6th National Communication
- Plus phenology as an additional source of information



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Phenology

Phenology has to do with the periodically recurring patterns of growth and development of plants over the course of a year. The onset dates of characteristic phases of plant development (phenological phases) are observed and recorded. These are closely related to weather and climate and are therefore important indicators of the impact of climate change on the biosphere.

Climate trends
Among the stations in the phenological data bank held by the Deutscher Wetterdienst (DWD), 474 have records of observations covering more than 50 years. In 164 cases even more than 60 years (between 1951 and 2010). However, the availability of records over a number of years does not mean that all phenological phases were continuously observed during the period. It was possible to reconstruct data sets before 1951 from historical observations. Some phenological records held by the research station at Geisenheim on the river Rhine go back to before 1896. These show a marked shift towards earlier flowering times over the past 60 years.

Legal framework
In addition to ruling the responsibility for the operation of measurement and observing systems for recording meteorological processes, the Law on the DWD (§ 4(1), No. 5) also enjoins the registration of meteorological interactions between the atmosphere and other areas of the environment as another duty of the DWD.

Measurements in Germany
The Societas Meteorologica Palatina carried out systematic phenological observations as early as between 1781 and 1792. However, the real breakthrough in phenology occurred in 1882, when the German university professor Hermann Hoffmann and his colleagues drew up and published guidelines for the observation of phenological phases, thereby laying the foundations for standardised observations, not only in Germany, but also in other European countries. This gave rise to a Europe-wide monitoring network, as well as a number of regional networks in Germany.

The first long-term nationwide phenological observation network in Germany was set up by the Biological Institute for Agriculture and Forestry of the Reich in 1922. The network was run by this institute until 1936, when it was taken over by the Meteorological Service of the Reich and further developed by Dr. Fritz Schnelle.

In 1946, phenological observations were resumed by the meteorological services in the US and Soviet zones. Subsequently, these monitoring networks were run by the Meteorological Service of the former German Democratic Republic (MD) and the DWD founded in 1960 and 1952, respectively. The two monitoring networks and their data archives were brought together in 1990.

Thus, the DWD has an extensive archive of phenological data at its disposal. Alongside annual observations, the database collects immediate data, i.e. records submitted as soon as the phenological phase under observation occurs. These data, that provide up-to-date information on plant development, are used primarily for pollen count forecasts and advice to farmers.

The annual observations, which are used for climate research, are contained in the DWD's data bank and cover the period 1961 to the present. Currently, about 1,200 phenological observers contribute to the monitoring programme, which provides information on about 160 phenological phases of wild plants, agricultural crops, fruit trees and bushes, and grape vines.

Terrestrial observations | Biosphere

Onset of flowering of hazel in Geisenheim since 1950

Year of observation

Co-operation in Europe
Germany is a member of the European Phenological Network (EPN) and also contributes, through observations in 32 gardens, to the monitoring programme of International Phenological Gardens (IPG). In 1996, responsibility for German participation in this monitoring network was transferred from DWD to the Humboldt University in Berlin. In 2003, the DWD was heavily involved in the initiation of the European Cooperation in Science and Technology project COST725, whose main task was to establish a European-wide reference data base of phenological observations. The DWD also participates in the follow-up project, the Pan European Phenology database (PEP725), which was set up by the Austrian Central Institute for Meteorology and Geodynamics (ZAMG), the Austrian Federal Ministry of Science and Research and the Economic Interest Grouping of European National Meteorological Services (EUMETNET). The main aim of PEP725 is to promote and support phenological research by making available an annually updated pan-European data bank, providing unlimited open access to phenological data for science, research and training (www.pep725.eu).

Required resources
The phenological monitoring network relies largely on volunteers. However, their number has declined over past decades; there are currently about 1,250 honorary observers. A few years ago, about 60 main phenological observer positions were established at DWD weather stations to complement the work of the volunteers. In order to continue to benefit from people's willingness to assume honorary posts of this kind, appropriate publicity measures are required. The IPG monitoring network is also run by volunteers.

http://www.dwd.de

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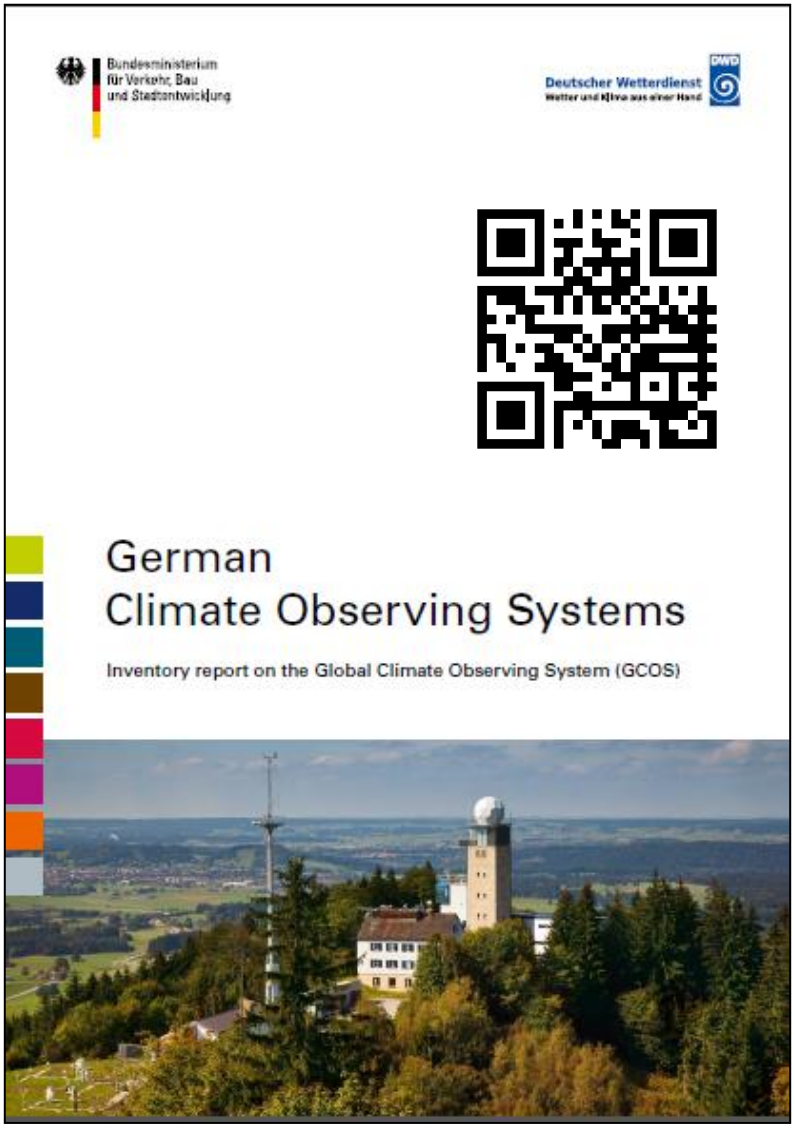
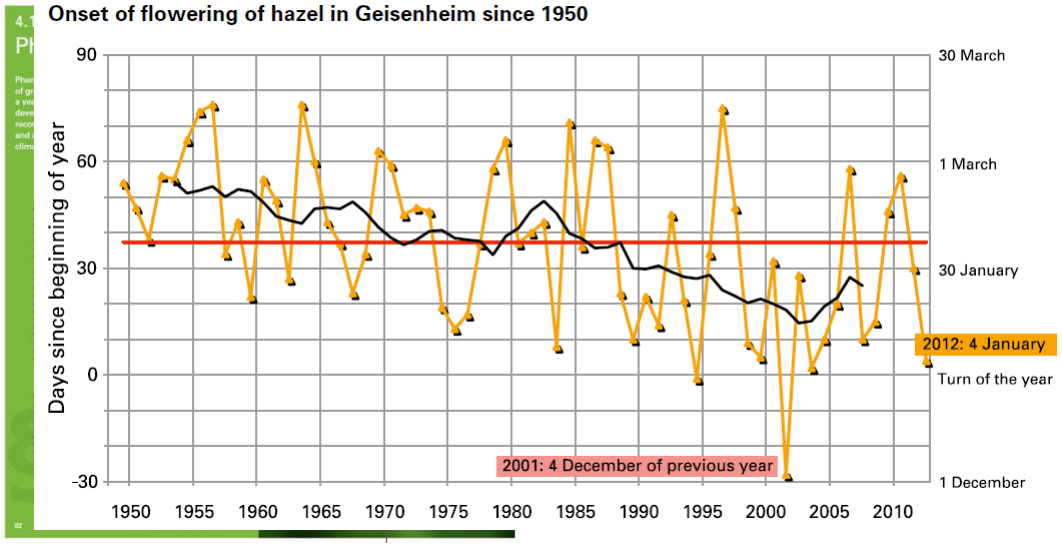


# Climate observations in Germany

- Plus phenology as an additional source of information
- GCOS German Coordinator since 1992
- Annual GCOS round tables since 1998
- D-GEO is informed about GCOS activities

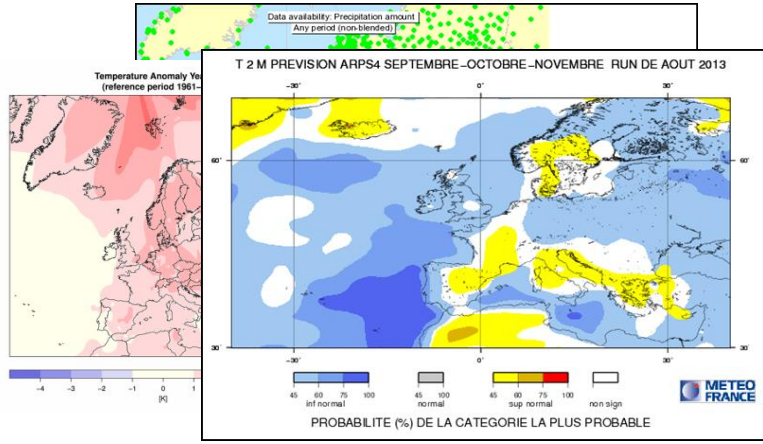



Fourth Report of the Government of the Federal Republic of Germany
on
Systematic Climate Observations in Germany
as a contribution to
Germany's 6th National Communication
under the
United Nations Framework Convention on Climate Change

Set up by the German GCOS Coordinator
Deutscher Wetterdienst

# National and regional needs

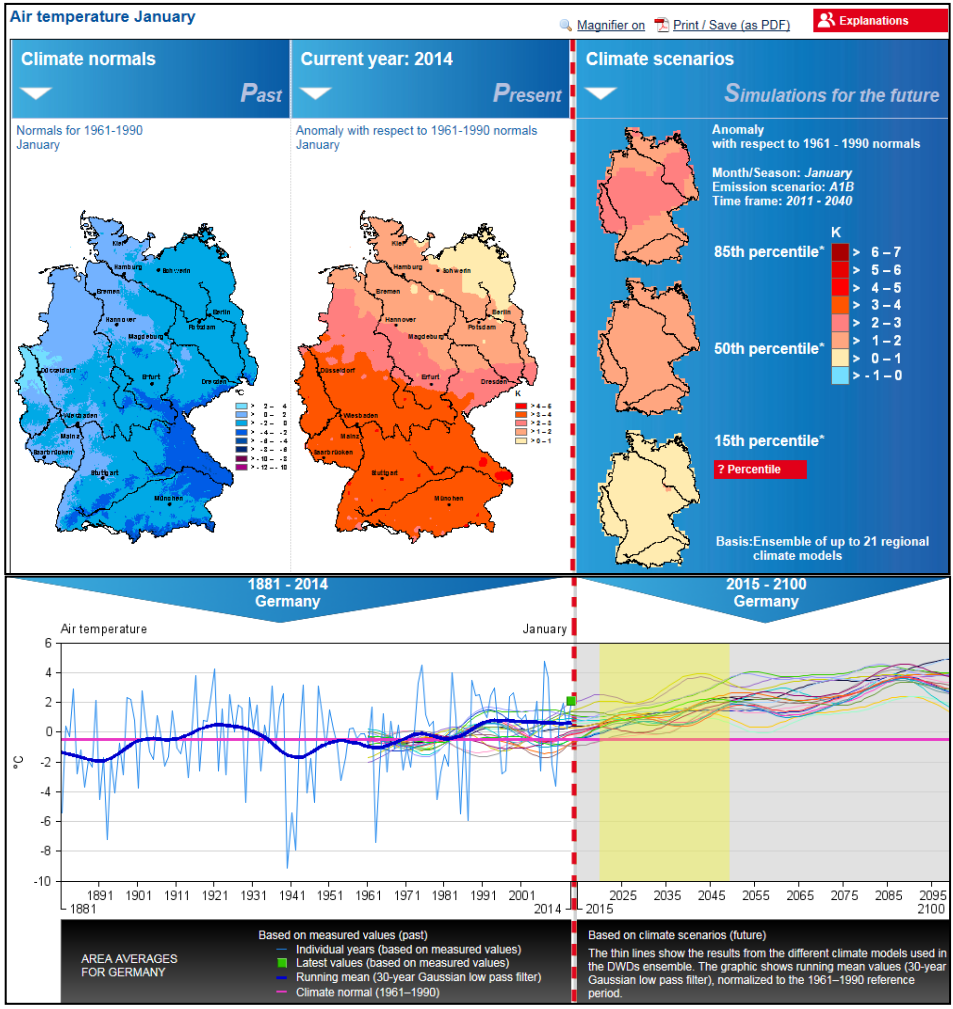
- EUMETNET Observations Programme: aiming at improving general weather forecasting and climate monitoring over Europe
- EUMETSAT: operational satellites for weather and climate
- WMO Regional Climate Centre Network fulfils regionally (RAVI – Europe) agreed functions to support members in meeting their national requirements for climate services (www.rccra6.org)
  - Functions include
    - Provision of data sets
    - Climate monitoring products
    - Longe-range forecast products



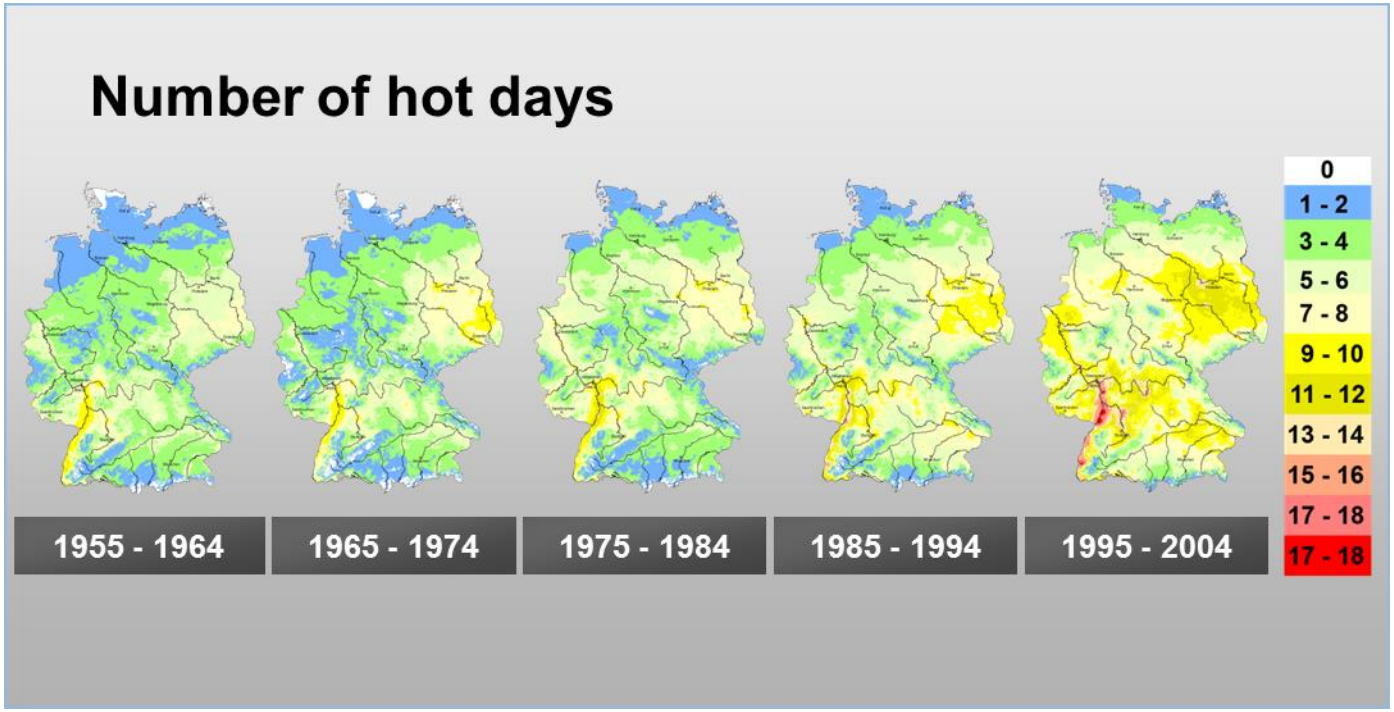

- Copernicus Climate Change Service of the European Union
  - To address additional information relevant for climate change monitoring, i.e. GHG, air quality, etc.

# National climate risk profile

- German climate atlas shows present anomalies and future developments at www.deutscher-klimaatlas.de
- Various indicators relevant for different sectors
- In general
  - Moderate changes in mean values expected
  - Additional risks from increasing extreme events
  - German Adaptation Strategy together with Action Plans working towards enhancing resilience

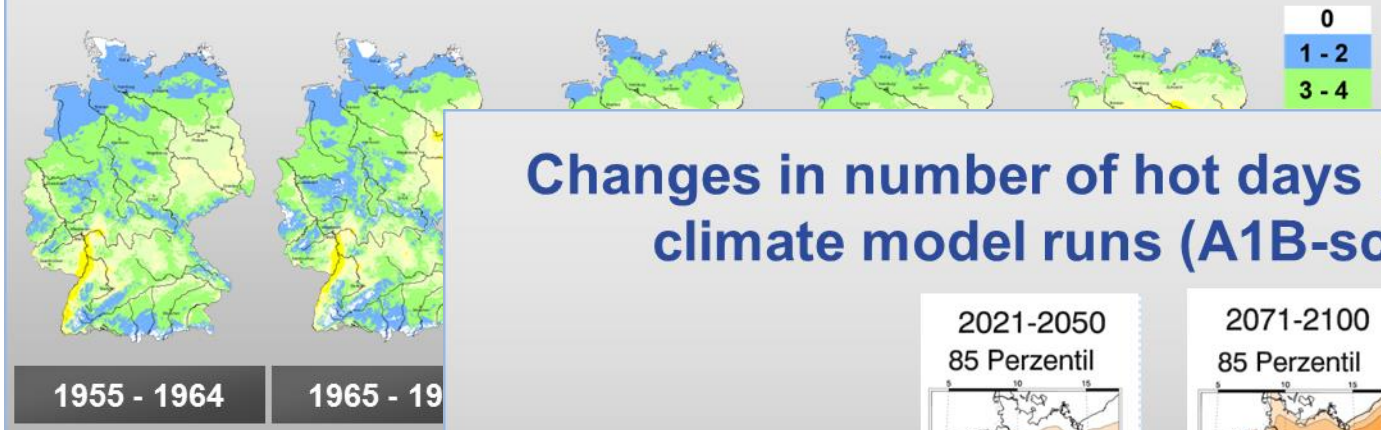


# National climate risk profile

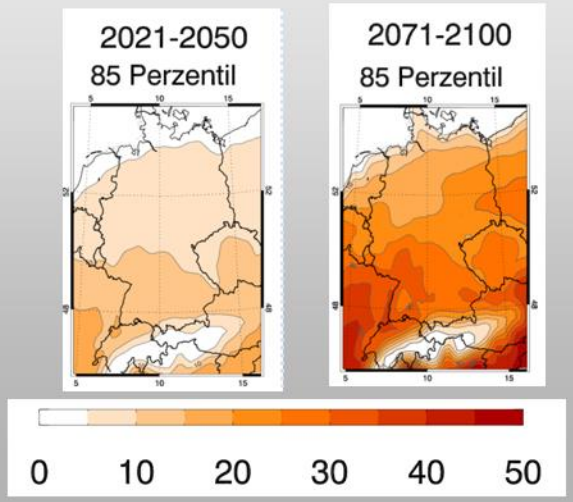


# National climate risk profile

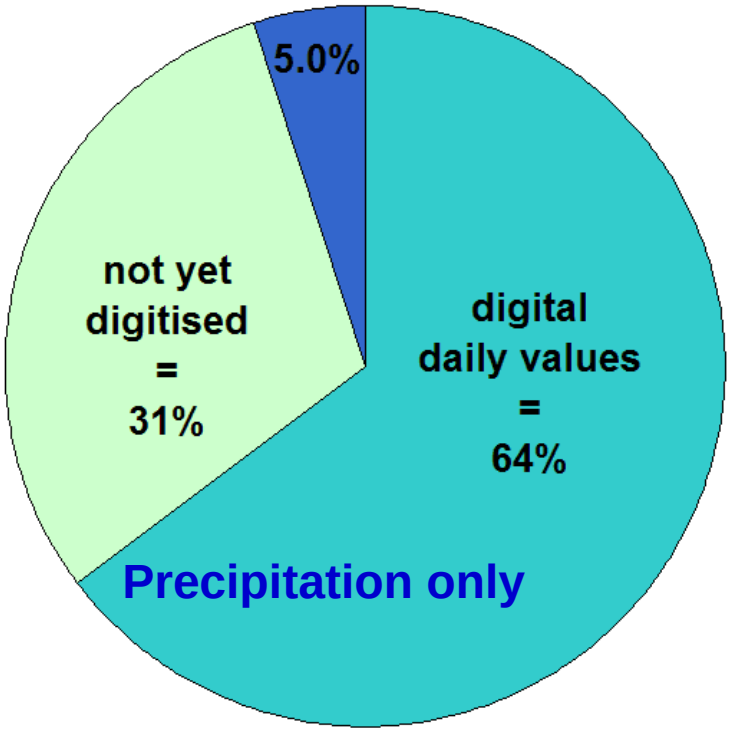
## Number of hot days



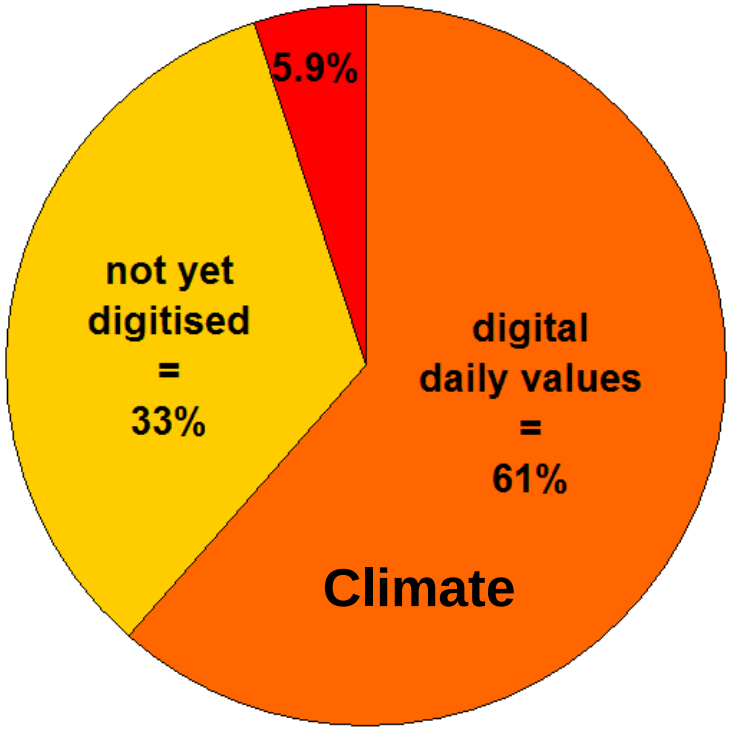

## Changes in number of hot days based on 19 climate model runs (A1B-scenario)



# Historical climate data @ DWD




Not yet digitized = 126000 station years
= 250 person years

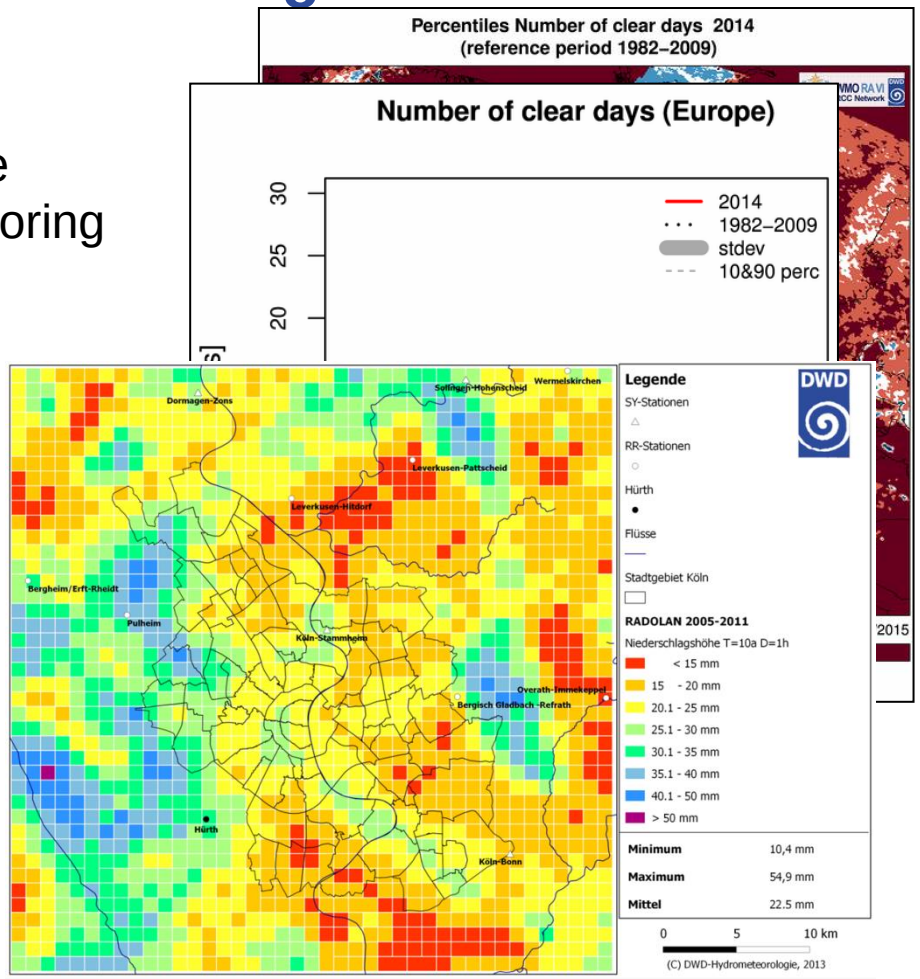



Not yet digitized = 19500 station years
= 390 person years

# New data sources for climate monitoring

- Satellites
  - DWD hosts the EUMETSAT Satellite Application Facility on Climate Monitoring (CM SAF, www.cmsaf.eu)

- Radar-based quantitative precipitation monitoring (RADOLAN)
  - decadal, geo-temporally homo-geneous and high-resolution quantitative precipitation reanalysis from 1 January 2001 until the present day



# Climate observations in Germany

➔ Main challenge:

**How to make full use of existing data?**

- ➔ Historical data still need to be digitized
- ➔ New data sources like satellites and radar
- ➔ Huge amount of model data
- ➔ How to translate data into meaningful information for decision maker?

➔ Key question:

**How to secure expensive observations in the deep ocean over the next decades?**

- ➔ Some of the German activities described in the 2013 German GCOS Inventory Report are considered not being sustainable

# Thank you for your attention!

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