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Status report and outlook of the Global Precipitation Climatology Centre (GPCC)

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presented by U. Looser (GRDC)

Outline

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GPCC background

2

Data base and data sources available
(near and non real-time)

3

Different user requirements and GPCC's portfolio
of precipitation analysis products (incl. new ones)

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Contributions to the GEWEX Science Questions
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GPCC background

- **GPCC** was established at the beginning of 1989 at Deutscher Wetterdienst (DWD) on invitation by WMO; now in operation for more than 26 years
- **GPCC's** main task is the analysis of precipitation on the basis of in-situ data for the land-surface
- It is **GPCP's** component for the analysis of the in-situ measurements

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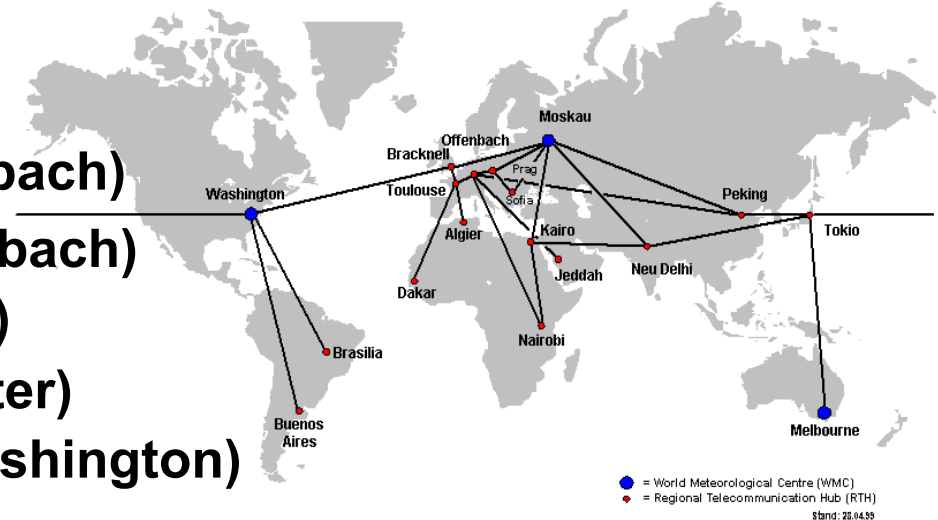
GPCC data sources

Near real-time (GTS):

- GTS SYNOP (**DWD RTH Offenbach**)
- GTS CLIMAT (**DWD RTH Offenbach**)
- GTS CLIMAT (**JMA RTH Tokyo**)
- GTS CLIMAT (**UKMO RTH Exeter**)
- SYNOP-based (**NOAA RTH Washington**)

Main Telecommunication Network (MTN)

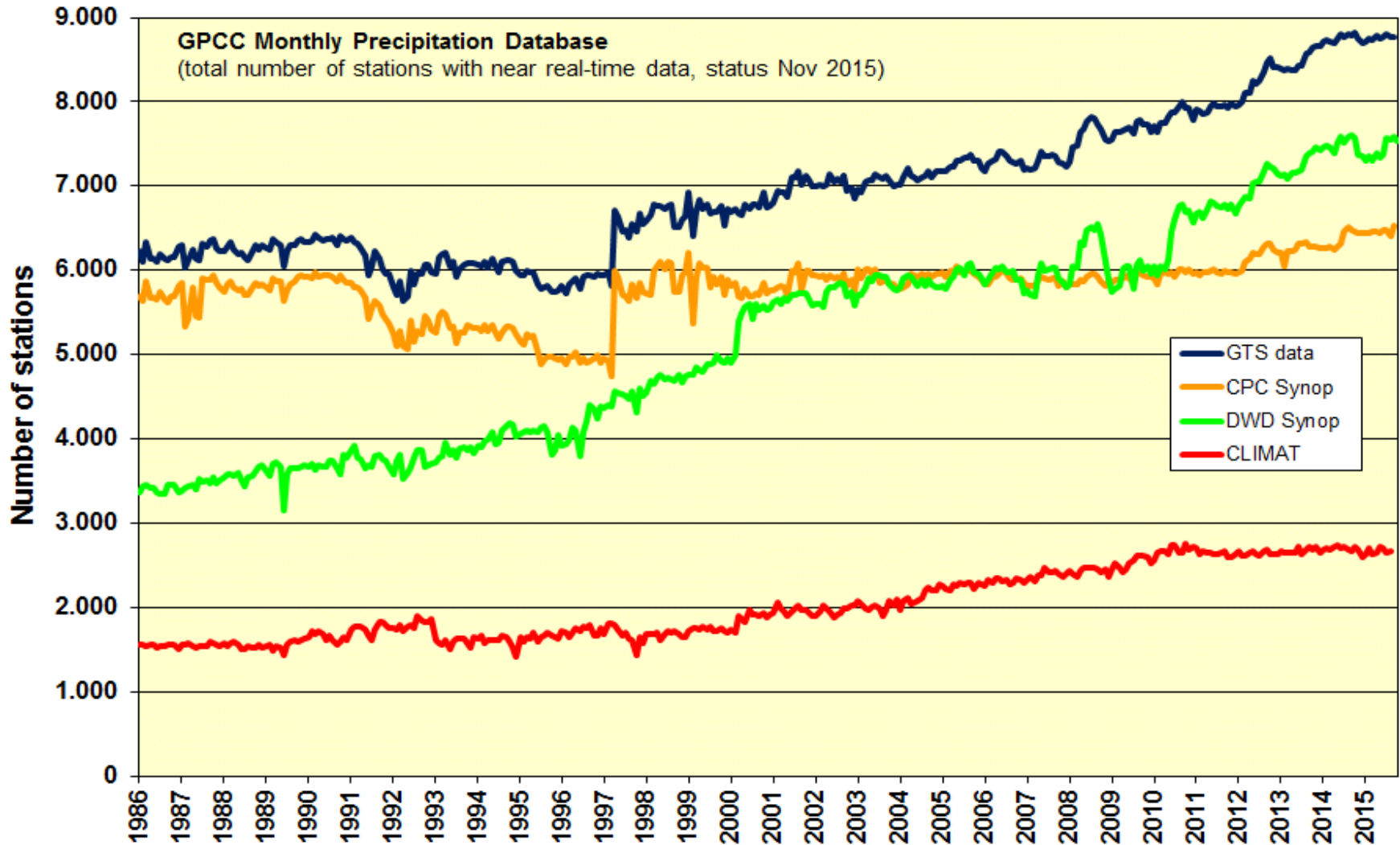
ein globales, standardisiertes Netzwerk zur Verteilung von Wetterdaten innerhalb der WMO Mitgliedsstaaten



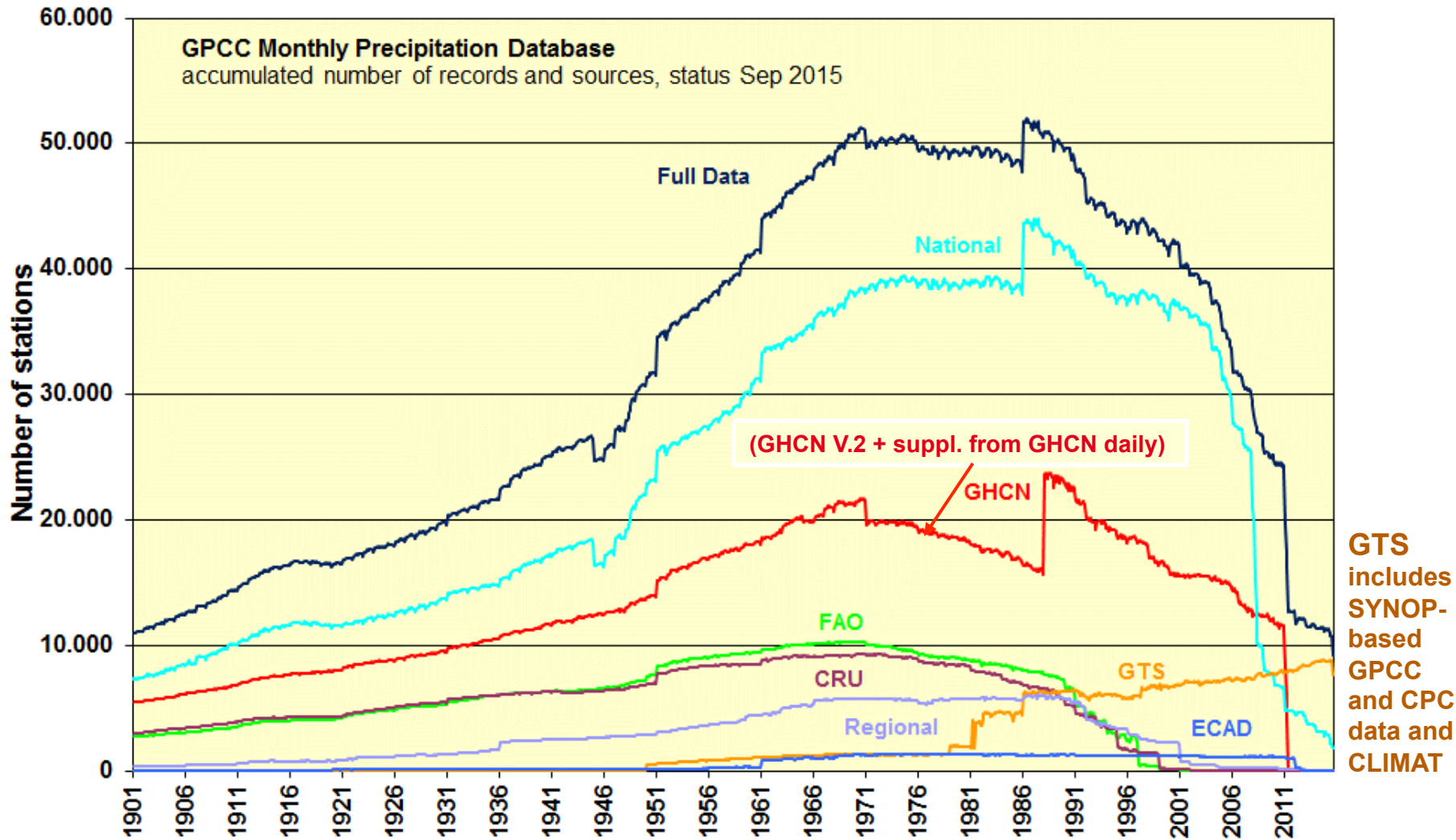
Non real-time:

- Additional data from **ca. 190 countries**
- International project data (**GEWEX-related and other**)
- Historical data collections (**CRU, FAO, GHCN, ECA&D**)
+ GHCN daily

GPCC GTS data base



GPCC data base (according to data sources)



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User requirements

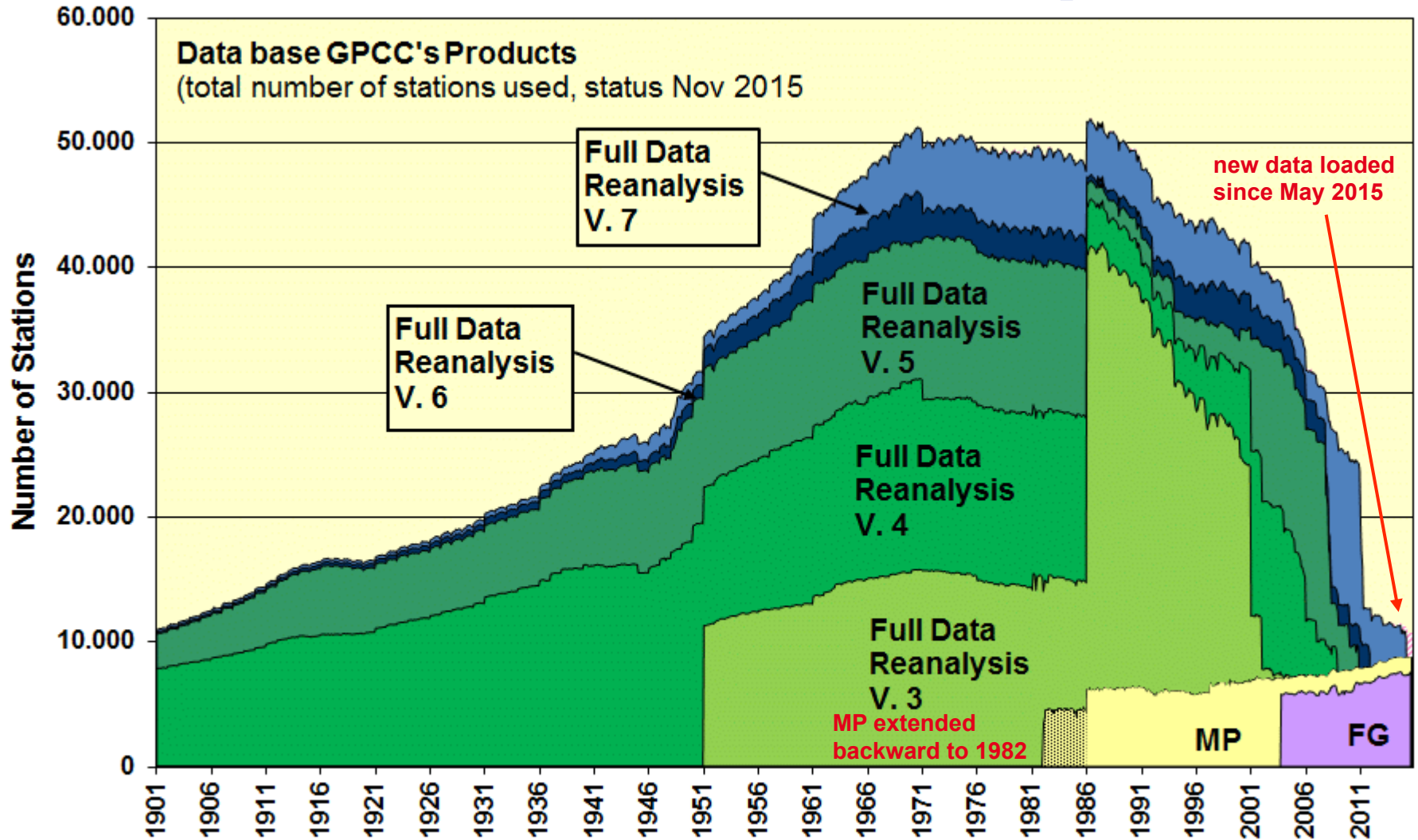
- **Features of gridded precipitation data as required by the users:**
 - **Timeliness** (for drought monitoring)
 - **High resolution** (for regional structures in global maps)
 - **High accuracy** (for verification of model results)
 - **Homogeneity** (for climate change and variability analysis)

All of these requirements cannot be met by one single gridded data set

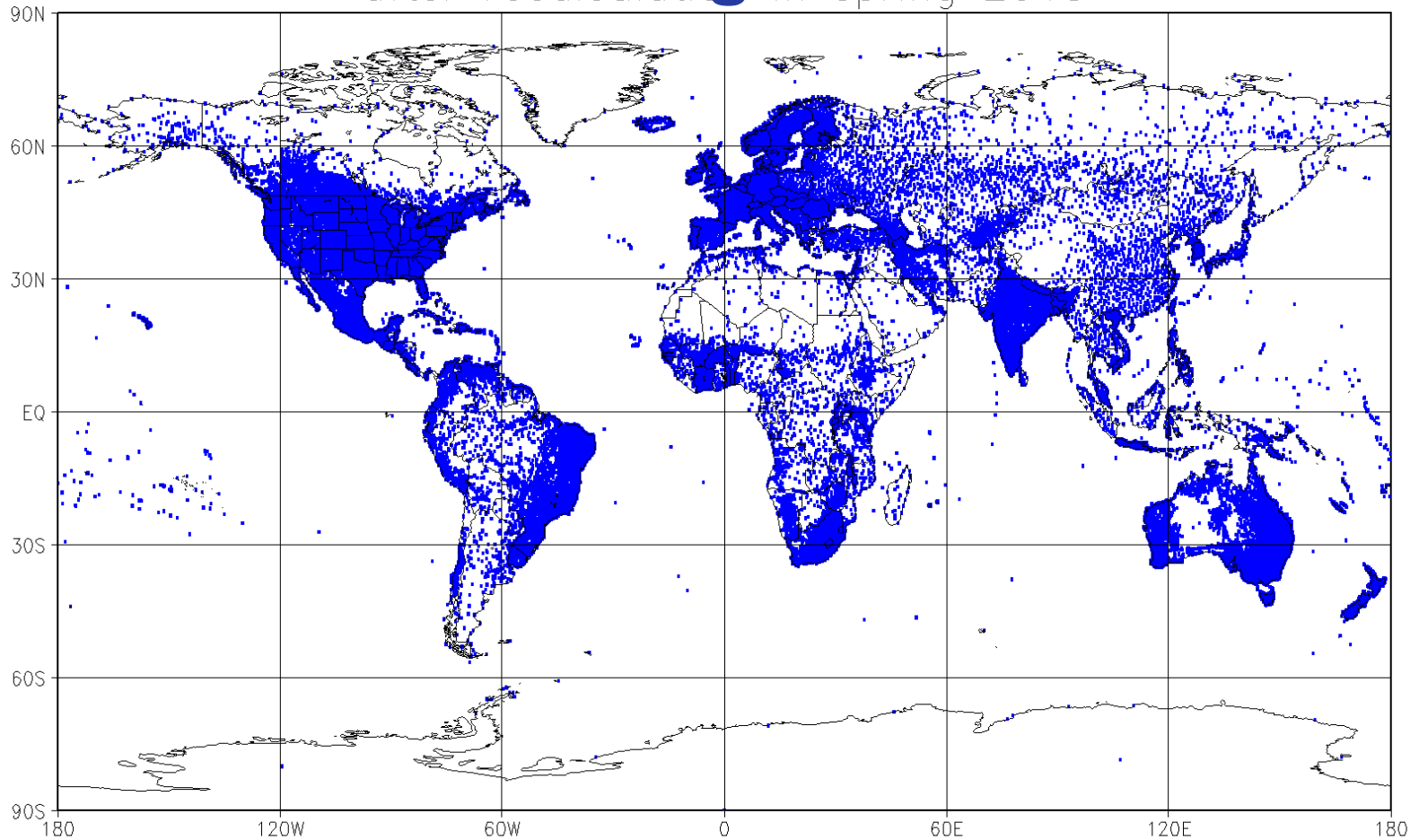
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A portfolio of different analysis products has been designed and optimized with respect to the **application purposes**

Data base for different GPCC products



GPCC Climatological data base



(c) GPCC 2015/05/05 , number of gauges : 75152

Station data base of GPCC's Precipitation Climatology V.2015 as basis for anomaly analyses (number of stations: ca. 75,100)

Near real-time (monthly) precipitation products

- **GPCC** is providing the following gridded data sets on a **quasi-operational basis** (GTS data base):
 - A **First Guess Analysis** of monthly **Precipitation** available within 5 days after the end of the month via internet, used for **drought monitoring** (e.g. by FAO)
 - The Precipitation **Monitoring Product** available within 2 months, used by GDAP/GPCP as **early in-situ reference** for the near real-time (**new V.5 !!**)

GPCC's First Guess Product

➤ Availability:

- period Oct. 2003 to present
- within 5 days after the end of the month

➤ Data base:

- monthly precipitation totals accumulated from SYNOP reports received via GTS at DWD, Offenbach a.M.
(ca. 6,000-7,600 stations)

Automatic-only QC of SYNOP reports in the calculation of monthly precipitation totals (check of large precipitation amounts against the weather information, consistency check of reports overlapping in time, etc.)

GPCC's **New** Precipitation Monitoring Product

➤ Availability:

- **period Jan. 1982 (!) up to present (V.5)**
- **within 2 months after the end of the month**
- **incl. information about precipitation type (liquid, solid, mixed) and systematic gauge-measuring error for the entire period (previously only from 2007 onwards)**
- **V.4 is currently maintained for GPCP V2.2**

➤ Data base (monthly precipitation totals, ca. 7,000-8,900 stations):

- **accumulated from SYNOP reports received via GTS at DWD**
- **accumulated from SYNOP reports received via GTS at NOAA (CPC „eve data set“)**
- **received in CLIMAT reports via GTS at DWD, UKMO and JMA**

New non real-time precipitation products

- **From time to time** (after significant enlargements / improvements of the data base) **reanalyses** of the following gridded products are generated:
 - The **Global Precipitation Climatology (over land) (V.2015)**, background for all other GPCP precipitation analysis products, based on ca. 75,100 stations with climatological normals
 - The **Full Data Reanalysis (V.7, May 2015)**, optimized for **high spatial resolution and accuracy**, used for **model verification and hydrological studies**

GPCC's **new** Full Data Reanalysis V.7

Full Data Reanalysis (Version 7, May 2015) optimized for high spatial resolution and accuracy

➤ **Availability:**

- period Jan. 1901 up to Dec. 2013
- on a 2.5°-, 1°- and 0.5°-grid

➤ **Data base:**

- some **11,000-51,000 stations per month** (overall 75,100 stations)
- including additional national/regional data collections from NMHSs and research projects of 190 countries;
- global data collections of CRU, FAO, GHCN (V.2) + supplements by monthly totals calculated at GPCC from GHCN daily

GPCC's Daily Products

With the beginning of 2012 the GPCC started with the acquisition, processing and analysis of **daily** precipitation data

- Almost from the start of this new activity the GPCC ran into the problem **“How is the day defined?”**
- **Daily precipitation - generally being observed at about 07:00 local time - should be assigned to the previous day according to WMO recommendation (most of the accumulation period is lying in the previous day)**
- **Unfortunately this is not done consistently in the different countries; most countries are assigning the daily totals to the previous day (consistent to WMO recommendation), but others are doing this differently (i.e. assigning precip to the day when the observation is taken)**

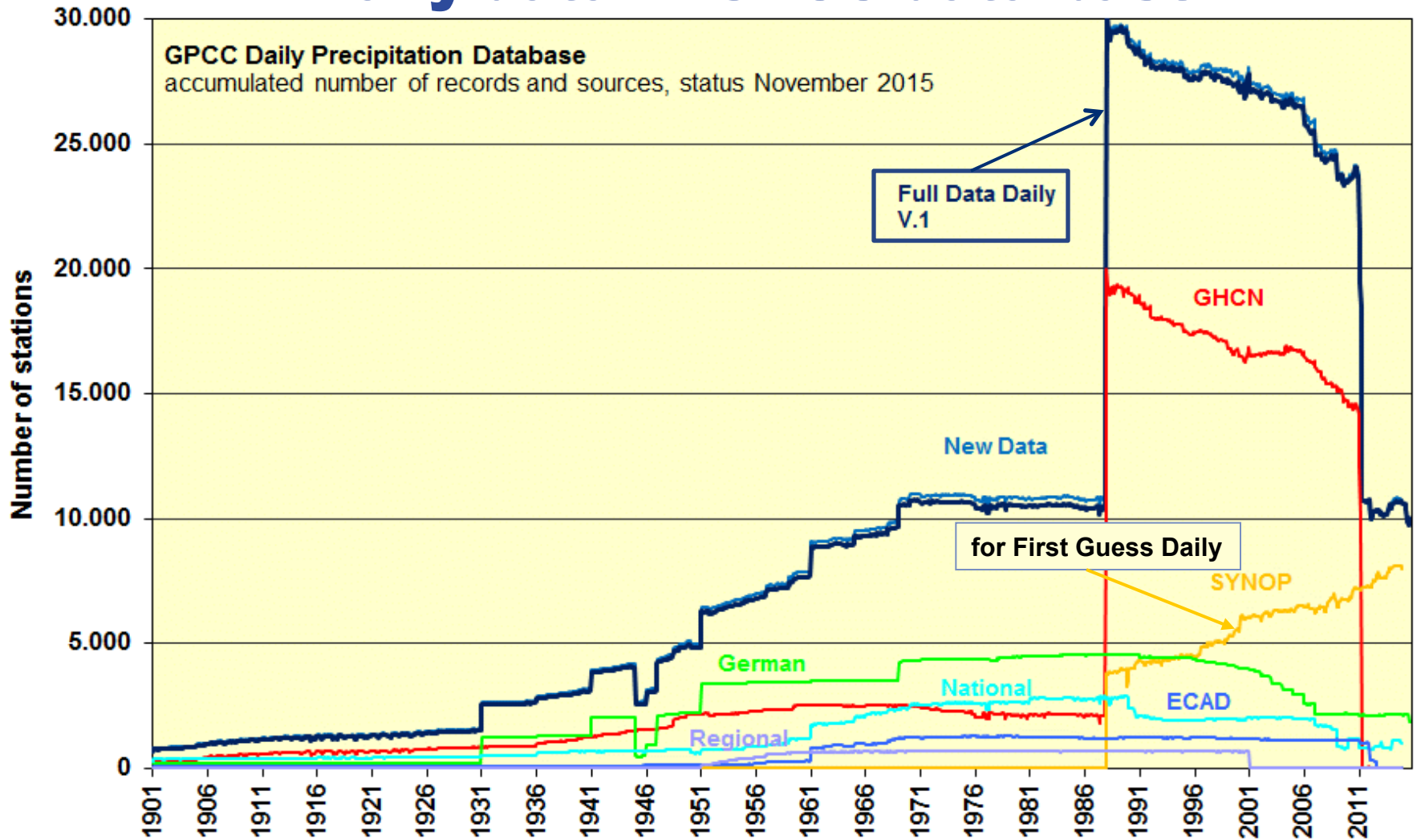
GPCC's Daily Products

GPCC calculates the daily precip totals from the SYNOP reports in a WMO consistent way (used for First Guess Daily and Full Data Daily)

GHCN daily takes the delivered daily data as they are, thus containing a mixture of data assigned to the previous day or observation day (i.e. Brazil, Australia); GPCC is checking and correcting this, as far as possible, upon integration of GHCN daily and national data sets into its data base

For the project MIKLIP/DAPACLIP ([Global DAily Precipitation Analysis for the validation of medium-range CLimate Predictions](#)) the focus was on the period 1988-2008

Daily data in GPCC data base



GPCC's First Guess Daily Product

➤ Availability:

- period Jan. 2009 to present
- on a 1° grid
- within 5 days after the end of the month

➤ Data base:

- daily totals calculated from SYNOP reports received via GTS at DWD, Offenbach a.M. (ca. 7,000-8,100 stations) in a way consistent to WMO recommendation

Automatic-only QC of SYNOP reports in the calculation of daily precipitation totals (check of large precipitation amounts against the weather information, consistency check of reports overlapping in time, etc.)

GPCC's First Guess Daily Product

- Interpolated with ordinary block Kriging
- Interpolation of relative values – fraction of daily total in relation to monthly total (only stations with monthly total could be used, at least 70% data coverage required)
- Released together with First Guess Monthly Product
- netCDF-files containing total precipitation, standard deviation regarding Yamamoto (2000), Kriging error and number of stations per grid
- Described in Schamm et al. (2014): “Global Gridded Precipitation over Land: A description of the new GPCC First Guess Daily product”, *Earth Syst. Sci. Data*, 6, 49-60, DOI:10.5194/essd-6-49-2014

GPCC's Full Data Daily Product V.1

➤ Availability:

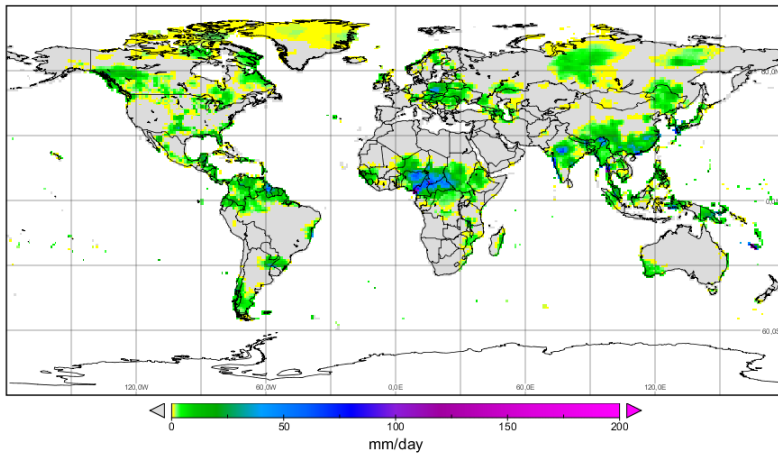
- period Jan. 1988 to 2013
- on a 1° grid on a global-scale (0.5° for Europe on request)

➤ Data base:

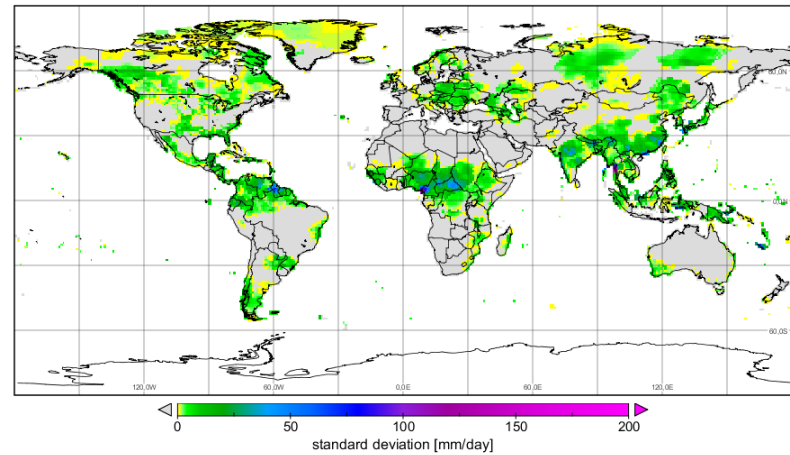
- all daily totals (ca. 10,000-30,000 stations)
consistent to WMO recommendation

Example: GPCC Full Data Daily: 06 July 1997

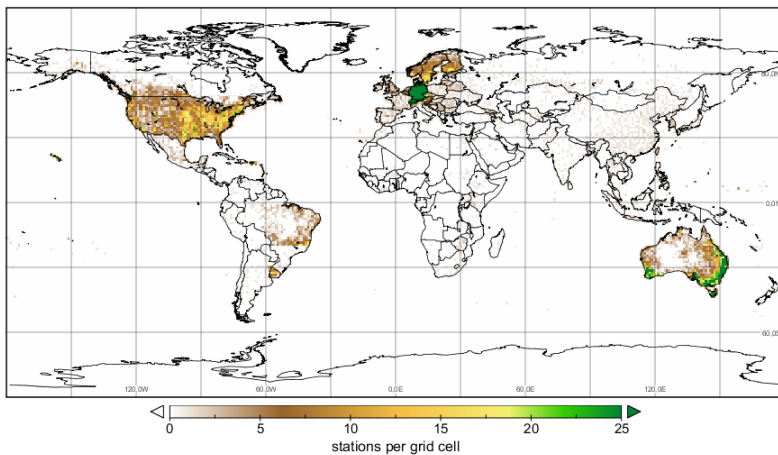
Total Precipitation



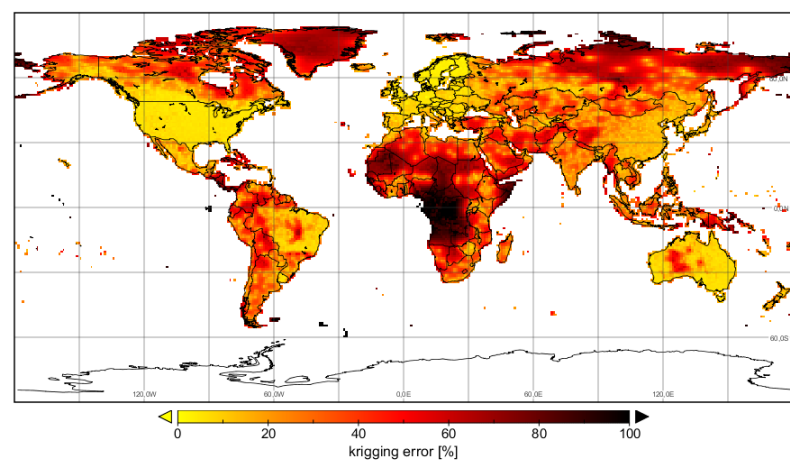
Standard Deviation



Number of Stations per grid cell



Kriging Error



GPCC's Full Data Daily Product V.1

- Preliminary Full Data Daily analysis (1988-2008) merged with the HOAPS data set
- Merging of Full Data Daily analysis (1988-2013) with the HOAPS data set is currently in work at CM SAF

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Contributions to the GEWEX Science Questions and WCRP Grand Challenges

- **GSQ1: Observations and Predictions of Precipitation**

GPCC's precipitation analysis products based on in-situ observed data in near real-time, as well as non real-time, contribute by improving the observational precipitation data sets (Becker et al., 2013)

A combination of GPCC's daily analysis with the satellite-based HOAPS data set, yielding a single sensor global data set for 1988-2008 has been done in the framework of the MIKLIP/DAPACLIP project

Contributions to the GEWEX Science Questions and WCRP Grand Challenges

- **GSQ3: Changes in Extremes**

GPCC's new daily precipitation analyses (First Guess Daily, Full Data Daily) and the underlying daily precipitation data will help to investigate changes in precipitation extremes ([Schamm et al., 2014](#))

- **GSQ4: Water and energy cycles**

The non real-time products Global Precipitation Climatology and Full Data Reanalysis help to determine the average precipitation over land ([Schneider et al., 2014](#)).

The [best estimate for average precipitation over land](#) for the period 1951-2000 is currently 786 mm/a (equivalent to a water transport of 117,000 km³/a)

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- **Homogenized Precipitation Analysis (HOMPRA) for 1951-2005 for Europe** (in cooperation with Met. Institute of Univ. Bonn) is now scheduled to become available in late 2015, on a global scale later
- **Merging of Full Data Daily V.1 (1988-2013) with the HOAPS data set is in work** (in cooperation with CM SAF)

Outlook

- **Subdaily data:**
Up to now the GPCP is using the SYNOP precipitation data (hourly up to 24-hourly totals) to calculate daily, as well as monthly precipitation amounts

Besides that, up to now, the GPCP does not have the capacity to work on subdaily data (the processing of the daily data on the global scale is a big challenge)

In its new role as Meteorological Data Collection Centre (in co-operation with Kisters) for EFAS (European Flood Awareness System) the GPCP may become enabled to deal with precipitation data on a subdaily scale



Visualize and Download GPCC Products



GPCC Product	Spatial Resolution	Time Coverage	Possible Application
<i>First Guess Monthly</i>	1.0°	2004 - present	<i>drought monitoring</i>
<i>First Guess Daily</i>	1.0°	2009 - present	<i>analysis of extremes</i>
<i>Monthly Monitoring Version 5</i>	1.0°, 2.5°	1982 - present	<i>calibration of satellite data</i>
<i>Full Data Monthly Version 7</i>	0.5°, 1.0°, 2.5°	1901 - 2013	<i>hydrological studies</i>
<i>Full Data Daily Version 1</i>	1.0°	1988 - 2013	<i>analysis of extremes</i>
<i>HOMPRA Europe Version 1 (coming soon)</i>	1.0°	1951 - 2005	<i>trend analysis</i>
<i>VASCLimo Dataset</i>	0.5°, 1.0°, 2.5°	1951 - 2000	<i>trend analysis</i>
<i>Precipitation Climatology Version 2015</i>	0.25°, 0.5°, 1.0°, 2.5°	1951/2000	<i>for application as a reference, and for utilization of the anomaly interpolation method</i>
<i>Interpolation Test Dataset</i>	1.0°	1988	<i>comparison of interpolation methods</i>
<i>Drought Index Version 1</i>	1.0°	2013 - present	<i>drought monitoring</i>
<i>GPCC Visualizer</i>			<i>access to the GPCC Visualizer, where you can create maps with your own coordinates and parameters</i>
<i>GPCC Home</i>			<i>detailed information about GPCC</i>

**Thank you
for
your attention!**

The Global Precipitation Climatology Centre (GPCC) is a specialized Centre supporting climate monitoring and research. It is operated by DWD under the auspices of WMO. Product users are kindly asked to refer to GPCC.

