On the new portfolio of "climate service ready" gridded precipitation data products issued by the Global Precipitation Climatology Centre (GPCC)

M. Ziese, U. Schneider, A. Meyer-Christoffer, P. Finger, E. Rustemeier, and A. Becker

Deutscher Wetterdienst, Global Precipitation Climatology Centre, Offenbach/M., Germany

Background of GPCC

- analysis of precipitation on the basis of in-situ data for the land-surface
- established at the beginning of 1989 at Deutscher Wetterdienst (DWD) on invitation by WMO → more than 25 years of experience with precipitation data
- Contributing to GEWEX (Global Energy and Water Exchanges Project) and GCOS (Global Climate Observing System)
- Data sources: SYNOP, CLIMAT, SYNOP from CPC, ECA&D, CRU, FAO, GHCN, national meteorological services, regional data collections

Several products

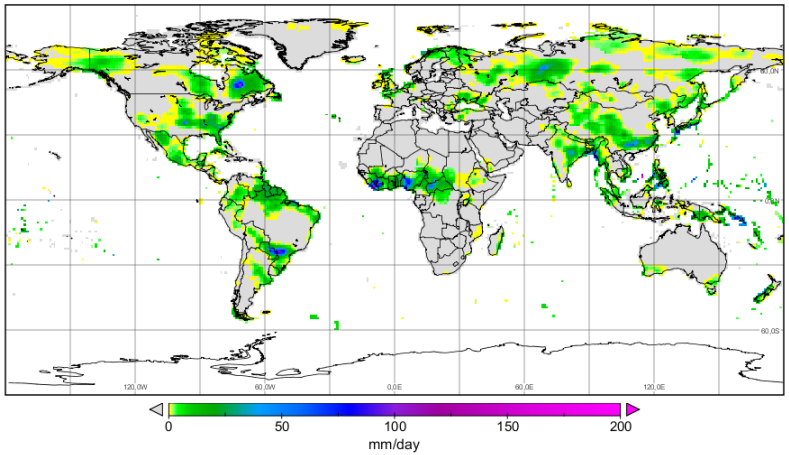
- Temporal resolution: daily ↔ monthly
- Timeliness: near-real time ↔ non-real time
- Test data

First Guess Daily, First Guess Monthly

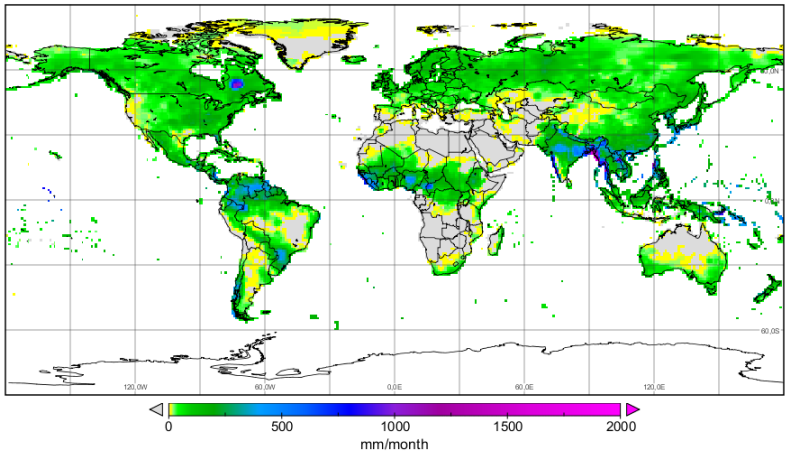
- Based on SYNOP-reports, roughly 7,200 stations
- Available within 3 to 5 days after the analysed month
- Automated quality control
- First Guess Monthly interpolated by means of a modified SPHEREMAP
  - Interpolation of monthly differences from long-term means (absolute anomaly)
  - Anomalies superimposed on the Precipitation Climatology
- First Guess Daily interpolated applying Ordinary Block Kriging
  - Interpolation of daily fraction from monthly total (relative anomaly)
  - Anomalies superimposed with First Guess Monthly
- Providing precipitation totals and number of station per grid cell
- Additionally provided within First Guess Daily: Kriging error, standard deviation regarding Yamamoto (2000)

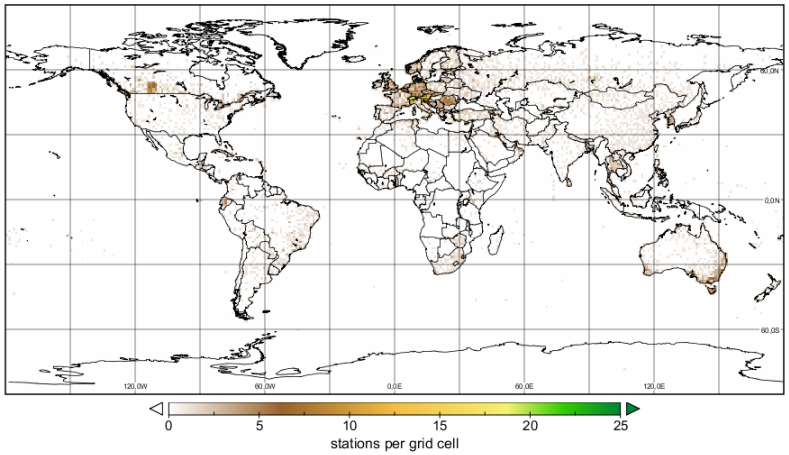
Example: First Guess Daily, First Guess Monthly

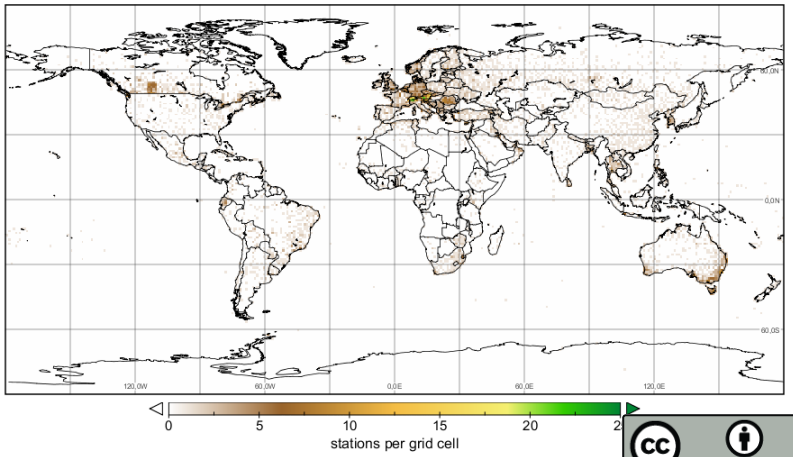
First Guess Daily, 2015/07/02



First Guess Monthly, 2015/07





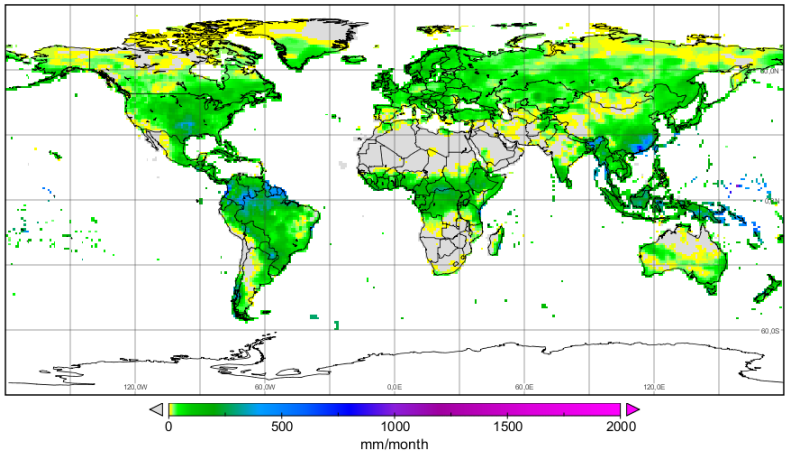


Monitoring Product

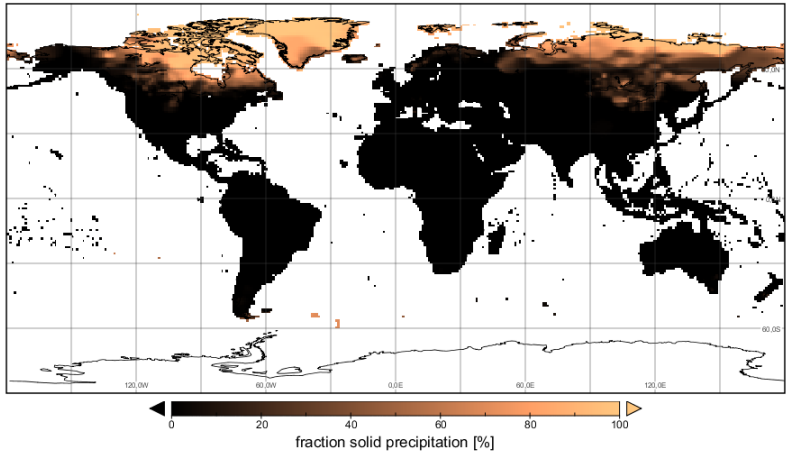
- Based on SYNOP- and CLIMAT reports, roughly 8,000 stations
- Available within 2 months after the analysed month
- Automated plus interactive quality control
- Interpolation utilizing a modified SPHEREMAP
  - Interpolation of monthly differences from long term means (absolute anomaly)
  - Anomalies superimposed on the Precipitation Climatology
- Providing precipitation totals and number of stations per grid cell
- Additionally provided within Monitoring Product: correction factor, absolute and relative systematic measuring error, solid and liquid fraction
- Spatial resolution: 1° and 2.5°

Example: Monitoring Product, 2015/05

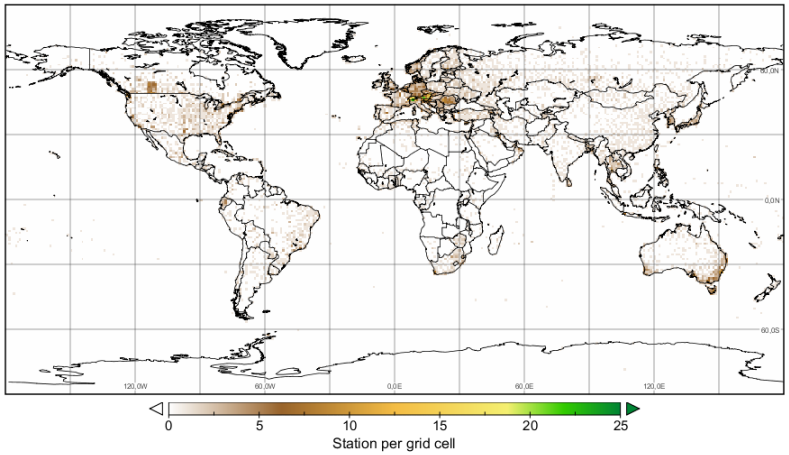
Total Precipitation



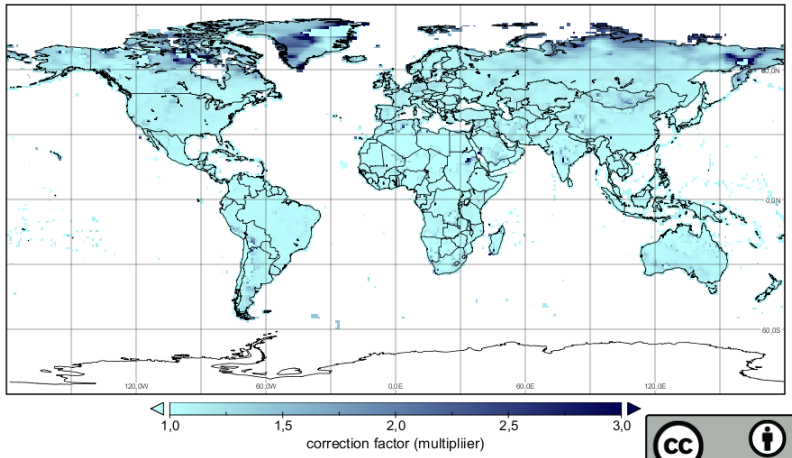
Fraction of Solid Precipitation



Number of Stations per Grid Cell



Correction Factor (Multiplier)

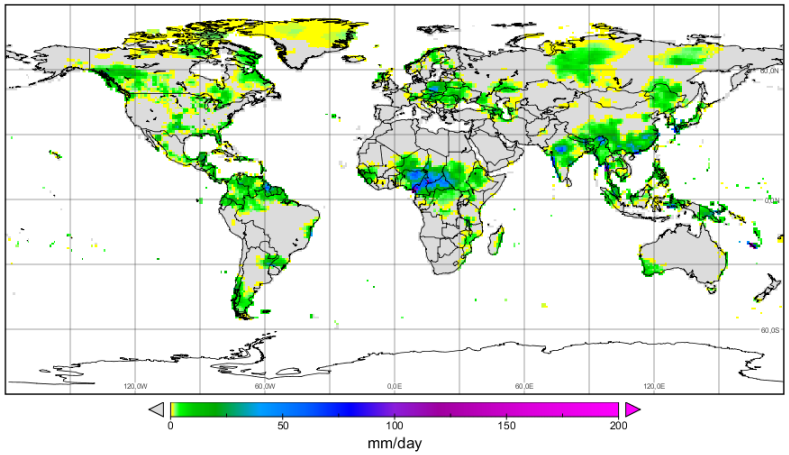


Full Data Daily

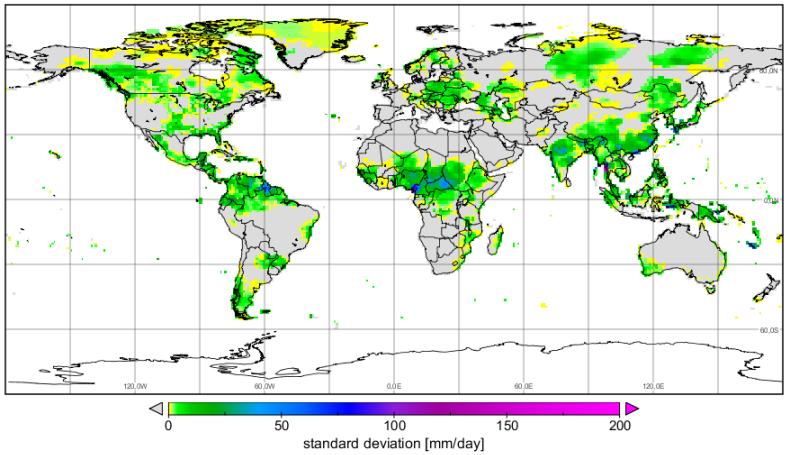
- Based on data from national meteorological and hydrological services, global and regional data collections, and SYNOP-reports
- Covers period 1988 to 2013
- Additional manual quality control
- Interpolated applying Ordinary Block Kriging
  - Interpolation of daily fraction from monthly total (relative anomaly)
  - Anomalies superimposed on Full Data Monthly Version 7
- Providing precipitation totals, number of station per grid cell, Kriging error and standard deviation regarding Yamamoto (2000)
- Spatial resolution: 1°

Example: Full Data Daily, 1997/07/06

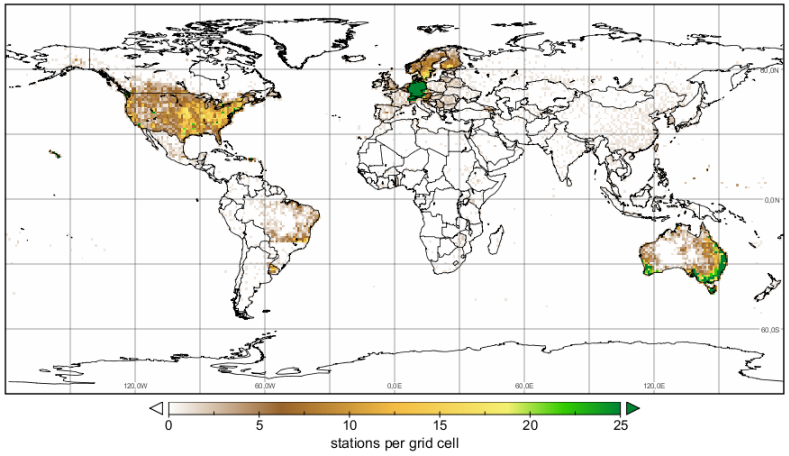
Total Precipitation



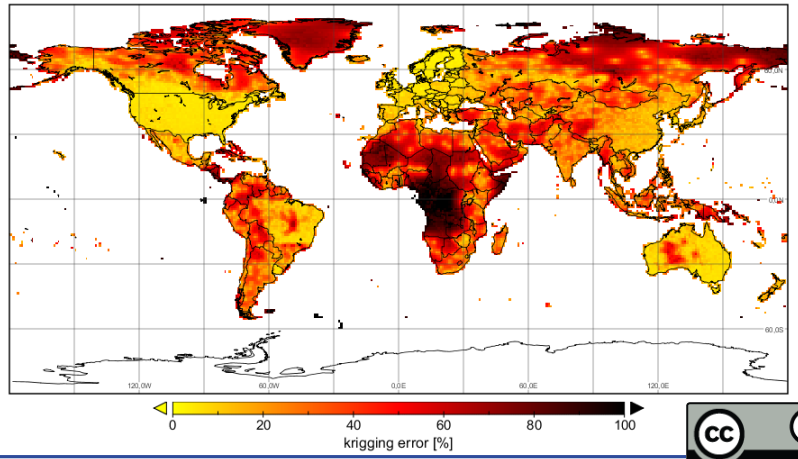
Standard Deviation



Number of Stations per grid cell



Krigging Error

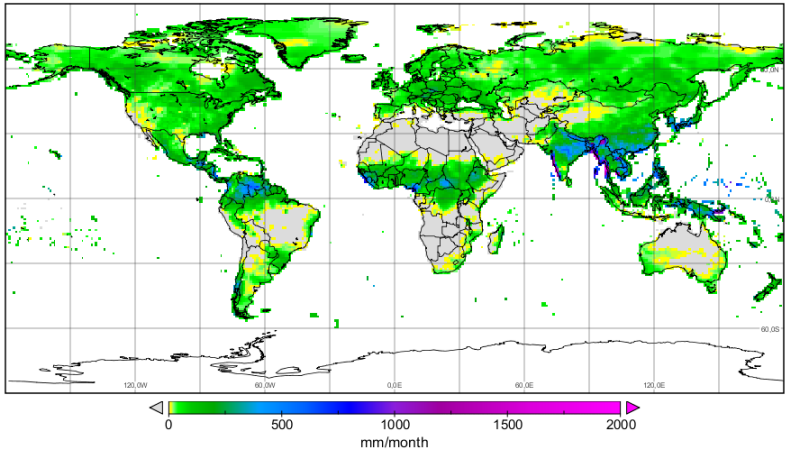


Full Data Monthly

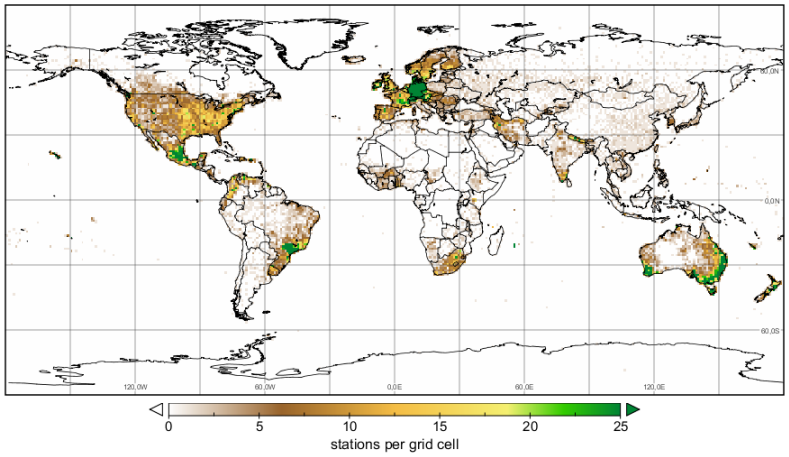
- Based on data from national meteorological and hydrological services, global and regional data collections, and SYNOP- and CLIMAT-reports
- Covers period 1901 to 2013
- Additional manual quality control
- Same stations as Precipitation Climatology, with at least 10 years of data
- Interpolation utilizing a modified SPHEREMAP
  - Interpolation of monthly difference to long term means (absolute anomaly)
  - Anomalies superimposed to Precipitation Climatology
- Providing precipitation totals and number of stations per grid cell
- Spatial resolution: 0.5°, 1° and 2.5°

Example: Full Data Monthly, 1997/07

Total Precipitation



Number of Stations per Grid Cell

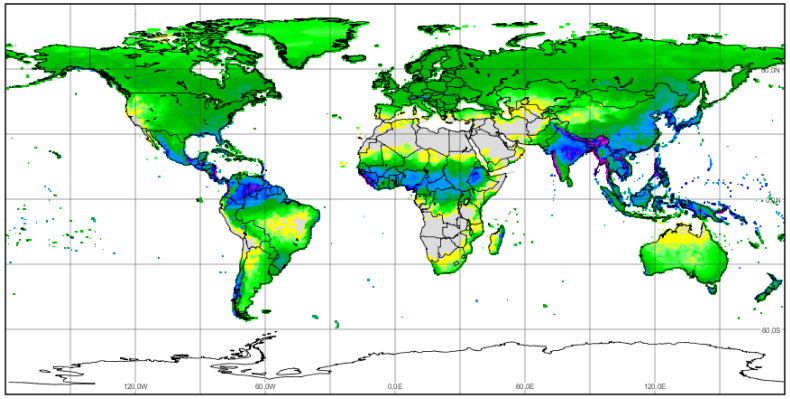


Precipitation Climatology

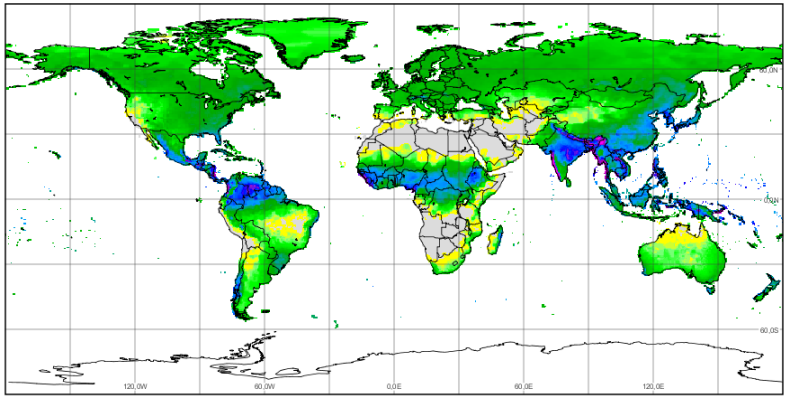
- Long term means of monthly precipitation totals
- Based on 75,100 stations
- Target reference period 1951-2000, if not possible other periods used:
  - 1931-1960, 1941-1970, 1951-1980, 1961-1990, 1971-2000, 1981-2010
    - 10 years of consecutive data
      - 10 years mixed from several periods
- Interpolation utilizing a modified SPHEREMAP
- Background climatology for GPCC products:
  - Station long term means to compute station based anomalies
  - Gridded long term means to superimpose interpolated anomalies to get monthly totals
- Spatial resolution: 0.25°, 0.5°, 1°, 2.5°

Example: Climatology, July

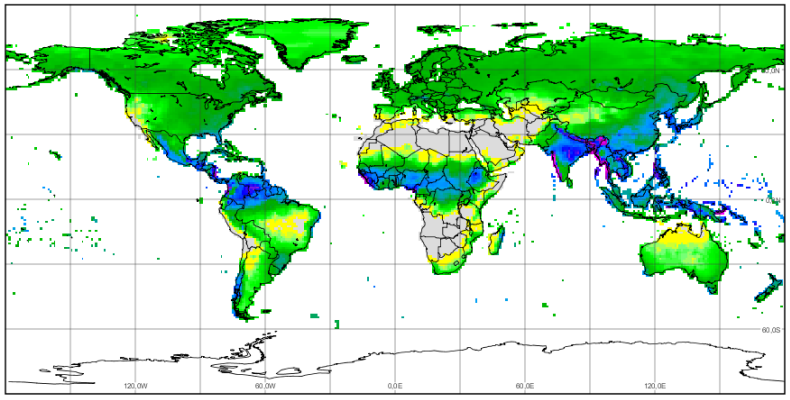
0.25°



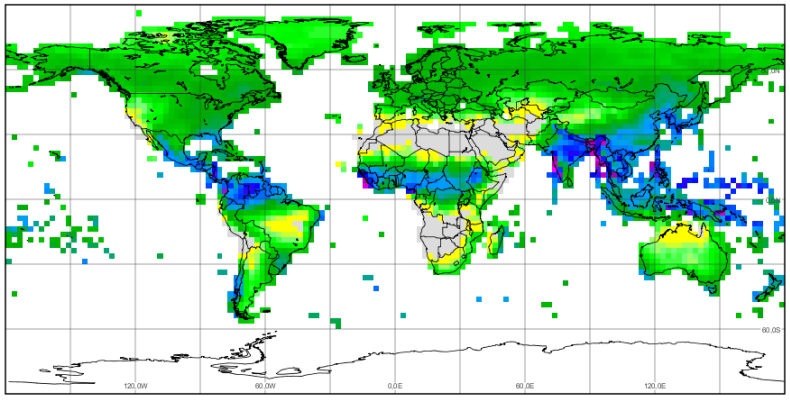
0.5°



1.0°



2.5°

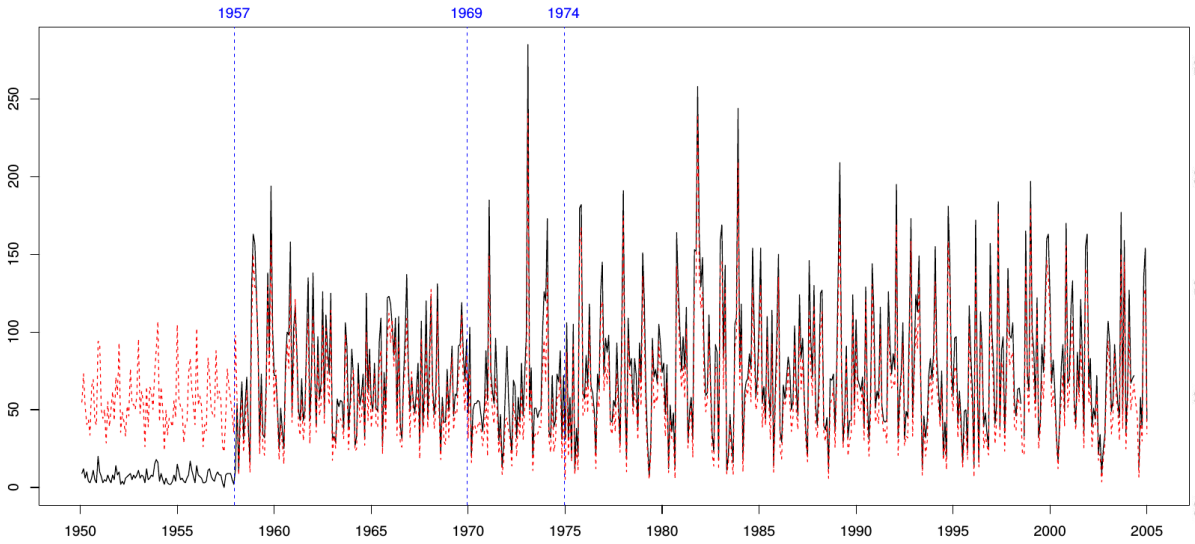


HOMPRA-Europe

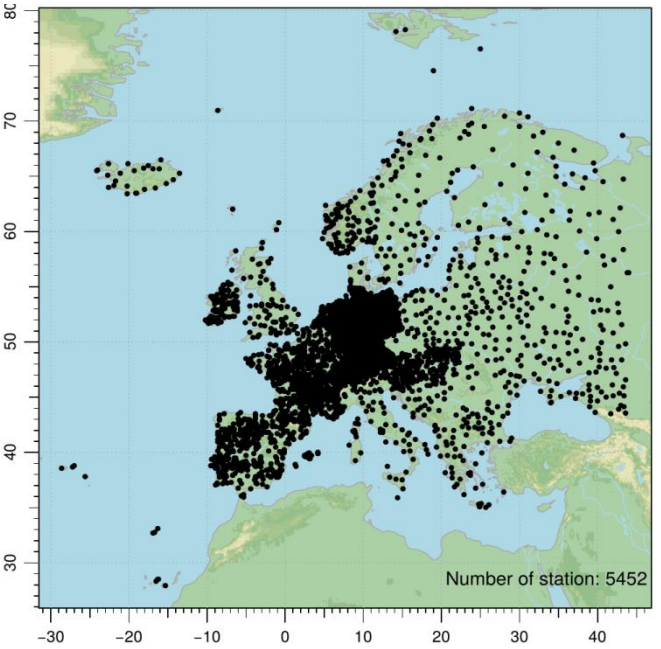
- Based on 5,500 homogenized data from European stations
- Homogenizations by means of an automated version of PRODIGE
- Covers 1951-2005
- Stations with at least 90% temporal coverage
- Interpolation by applying a modified SPHEREMAP
- Spatial resolution: 1°

Example: HOMPRA-Europe

homogenized time series



Stations

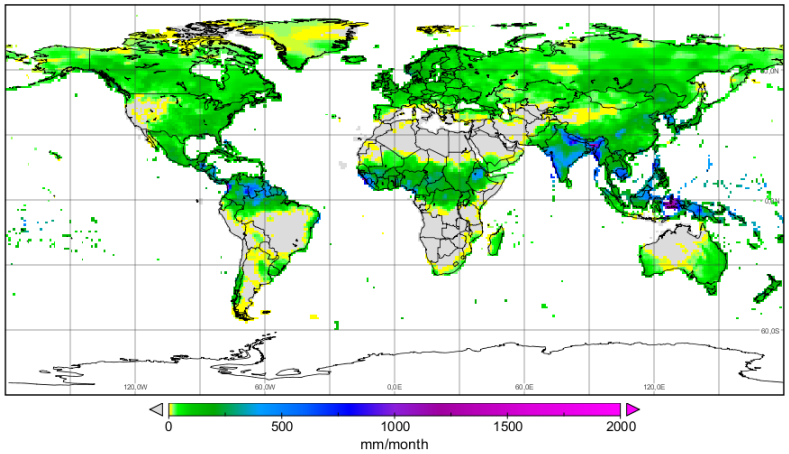


Interpolation Test Dataset (ITD)

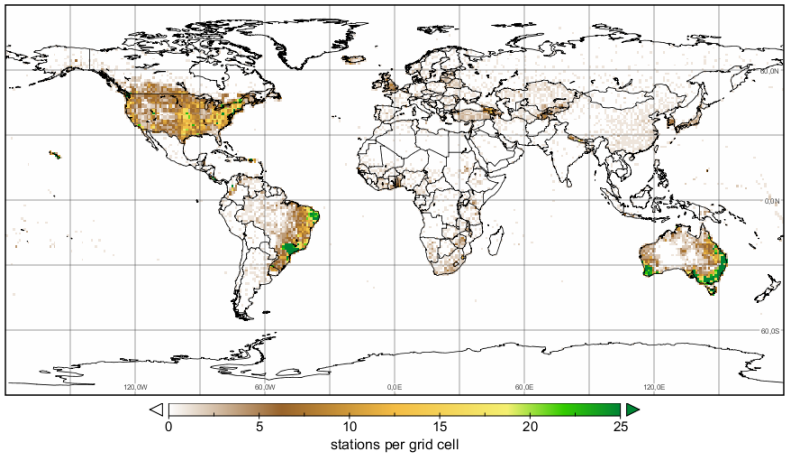
- Based on roughly 23,000 GPCC quality controlled GHCN stations
- Monthly analyses for only one year (1988)
- Interpolation of precipitation totals using an modified SPEREMAP to 0.5° subgrid
- Reduced to final 1° grid by means of land portion and area weighting
- Gridded analyses as well as station input data provided
- For comparison of interpolation schemes, NOT for hydrological or climatological research
- No regular updates

Example: Interpolation Test Dataset (ITD), July

Total Precipitation

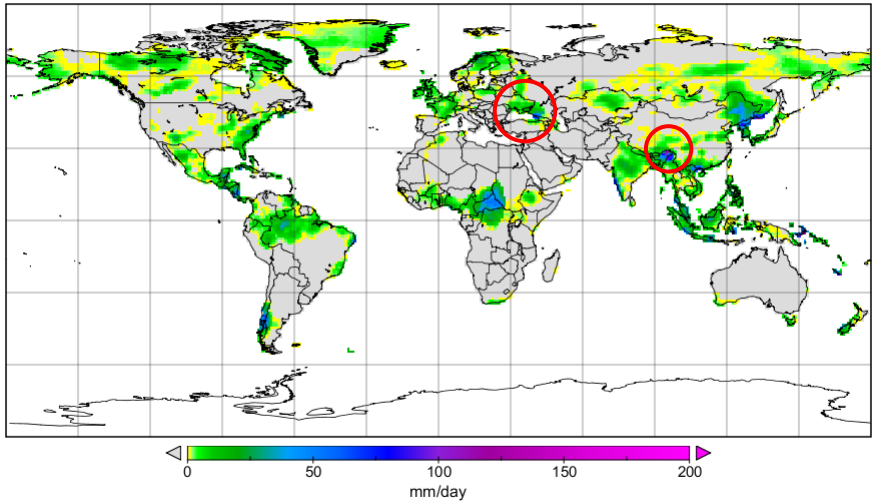


Number of Stations per Grid Cell

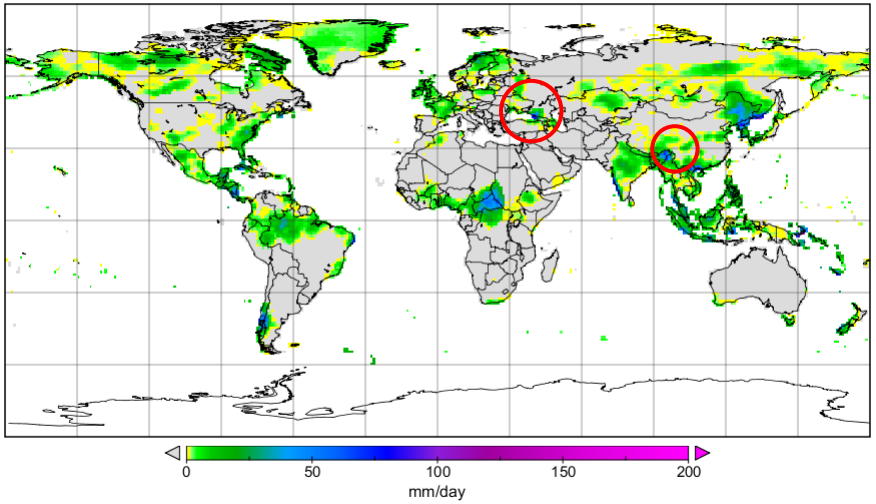


Comparison Daily Products, 2013/07/02

First Guess Daily

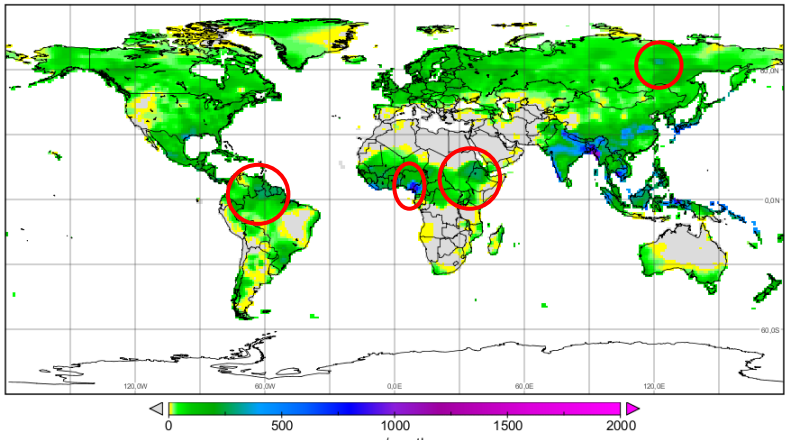


Full Data Daily

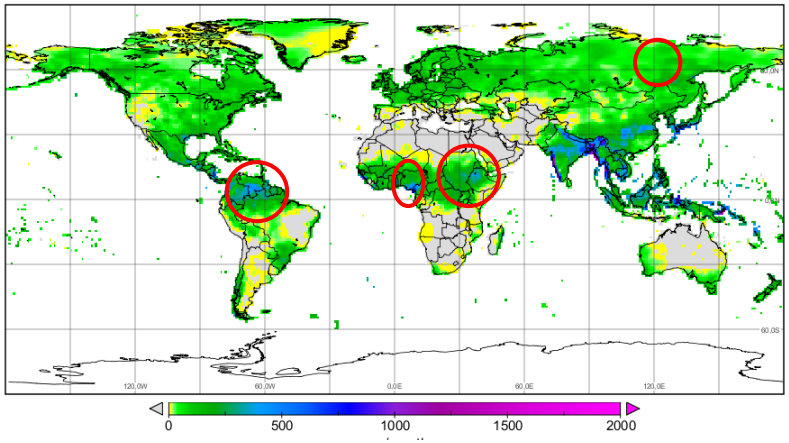


Comparison Monthly Products, 2007/07

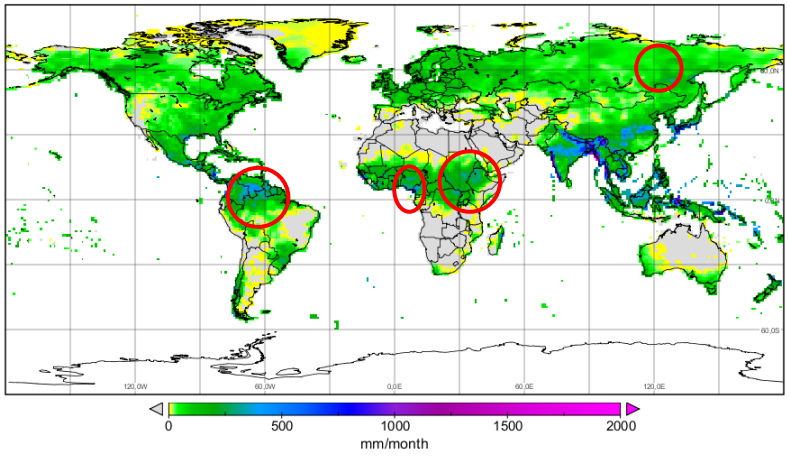
First Guess Monthly



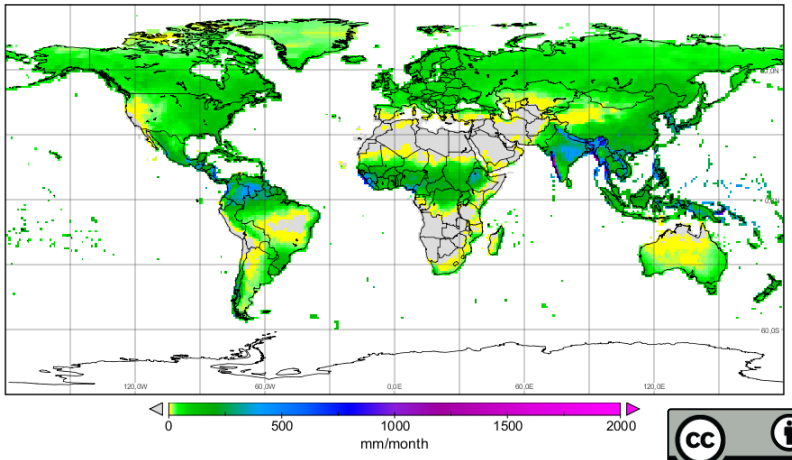
Monitoring Product



Full Data Monthly

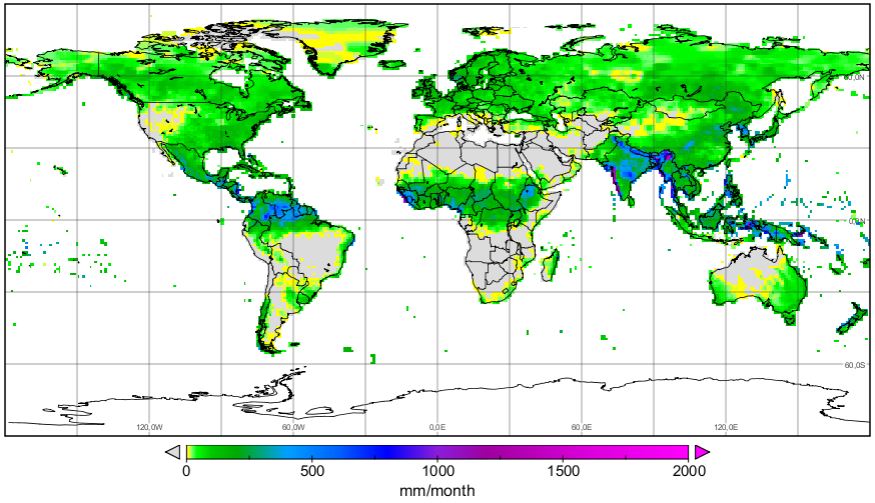


Precipitation Climatology

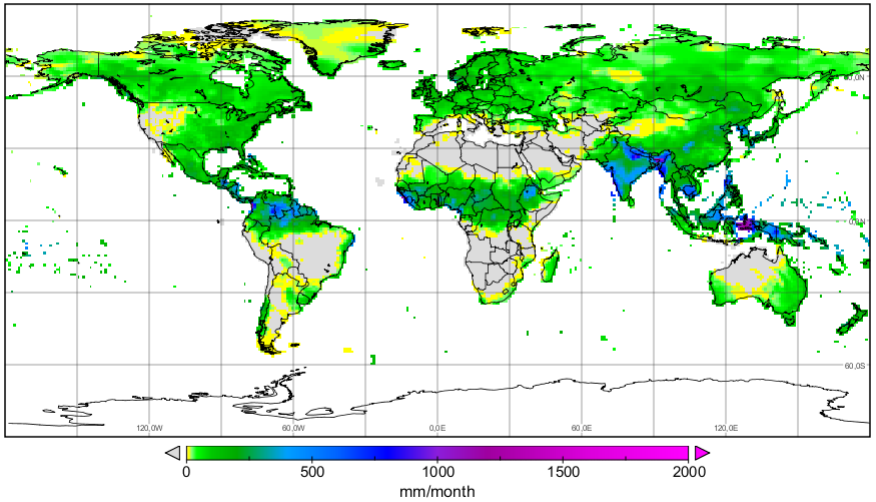


Comparison Full Data Monthly ↔ ITD, 1988/07

Full Data Monthly



Interpolation Test Dataset

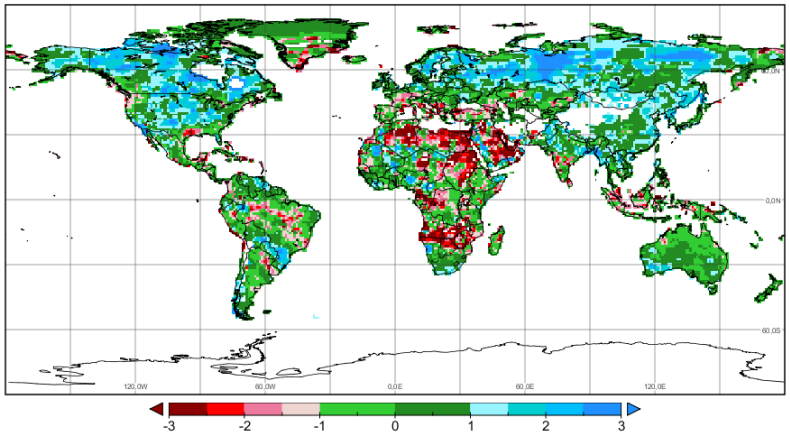


GPCC drought index

- GPCC-DI: gridded drought index with nearly global coverage
- combination of SPI-DWD and SPEI
- precipitation data from GPCC; First Guess Monthly
- monthly mean temperature from CPC
- uses mean of SPI-DWD and SPEI, if both can be calculated, otherwise the one which can be computed
- parameters derived from Full Data Monthly V.6, period 1961-1990
- several averaging intervals: 1, 3, 6, 9, 12, 24 and 48 months
- using gridded fields, no interpolations
- analysis from January 2013 until present
- provided as netCDF-files
- updated 10 to 13 days after each month

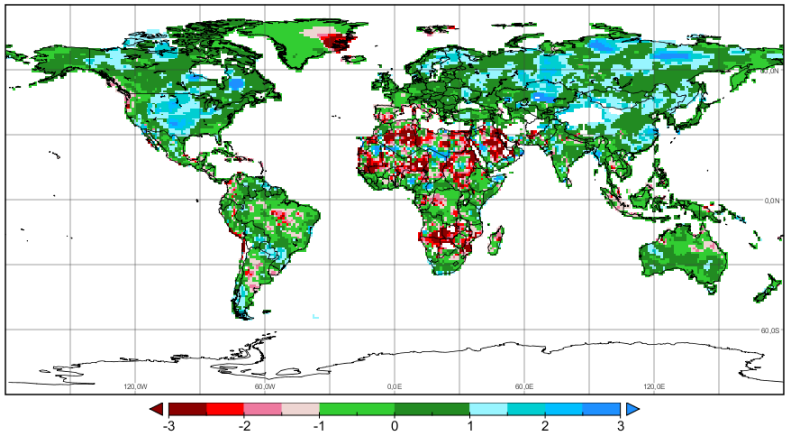
Example GPCC drought index, July 2015, 1 & 3 Months

1 month



drier than normal wetter than

3 months



drier than normal wetter than

Summary

Dataset	Spatial Resolution	Time Period	Possible Application
First Guess Monthly	1.0°	2004 – present	Drought monitoring
First Guess Daily	1.0°	2009 – present	Analysis of extremes
Monitoring Product (V5)	1.0°, 2.5°	1982 – present	Calibration satellite data
Full Data Monthly (V7)	0.5°, 1.0°, 2.5°	1901 – 2013	Hydrological studies
Full Data Daily (V1)	1.0°	1988 – 2013	Analysis of extremes
HOMPRA-Europe (V1)	1.0°	1951 - 2005	Trend analyses
Climatology (V2015)	0.25°, 0.5°, 1.0°, 2.5°		
Interpolation Test Dataset	1.0°	1988	Comparison of interpolation schemes
Drought Index (V1)	1.0°	2013 - present	Drought monitoring