DWD Capabilities in drought monitoring and prediction

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Drought monitoring at DWD

- National monitoring: support for agrometeorological advisory
  - SPI, STI based on national observation network
  - SCI, SPEI and flash droughts under development

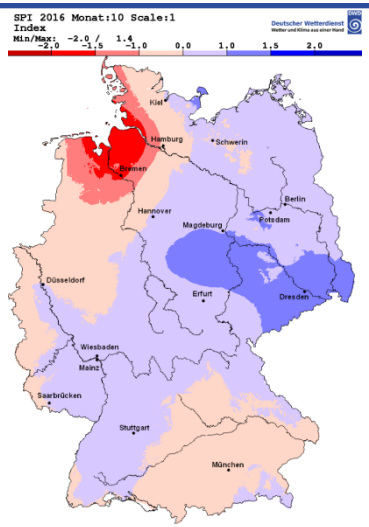
- Global monitoring: support climate science and relief organizations
  - GPCC-DI based on gridded precipitation and temperature data
- Global drought “climatology”: support climate science
  - Retrospective calculation of GPCC-DI back to 1952
- Global drought prediction: support relief organizations
  - GPCC-DI calculation based on seasonal forecasts

SPI, STI, SCI, SPEI & flash drought

- Standardized Precipitation Index (SPI)
  - Based on precipitation anomalies
- Standardized Temperature Index (STI)
  - Based on temperature anomalies
- Standardized Combination Index (SCI)
  - Based on difference between SPI and STI (SCI ~ SPI - STI)
- Standardized Precipitation Evapotranspiration Index (SPEI)
  - Based on difference between precipitation and potential evapo(transpi)ration
- Flash Droughts
  - Soil moisture < 40% usable field capacity
  - STI > 1(pentads, daily moving time window)
  - potential evaporation > long term mean

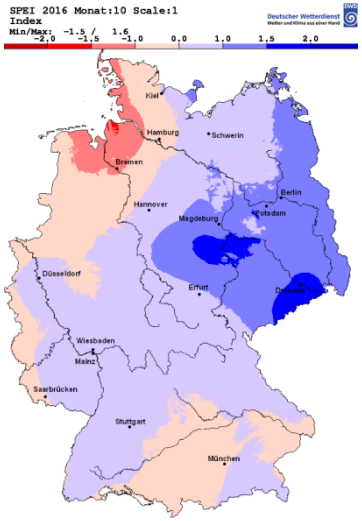
National drought monitoring

- Monthly calculation of SPI, STI, SPEI and SCI
- Several aggregation intervals:
  - 1, 3, 6 and 12 months
- Flash drought monitoring in research status
- Example: October 2016, 1 month aggregated



SPI

STI



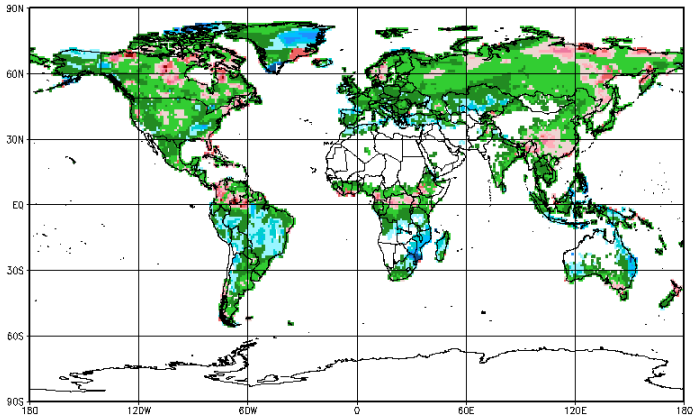
SPEI

SCI

Global drought index

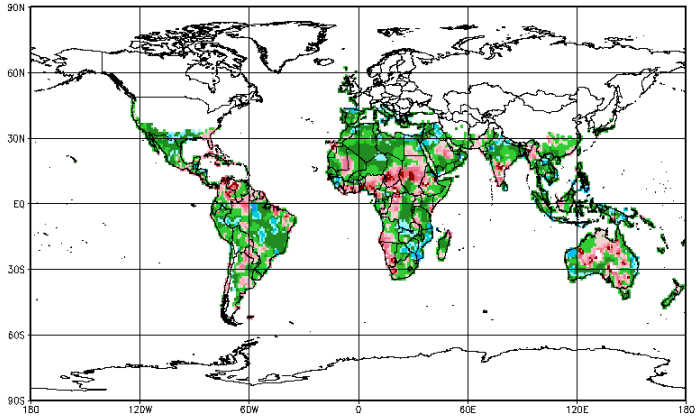
- GPCC-DI is combination of SPI and SPEI
  - SPI not applicable in arid regions
  - SPEI not applicable in cold regions, due to used Thornthwaite PET parameterization
  - GPCC-DI uses mean of SPI and SPEI, otherwise the one which can be calculated
  - Nearly global coverage, except cold-dry regions like southern Andes or parts of Tibet

Global drought index



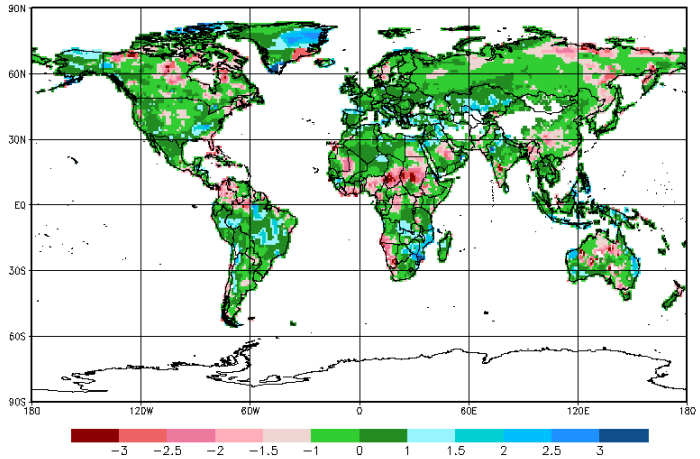
SPI-DWD

+



SPEI

=>

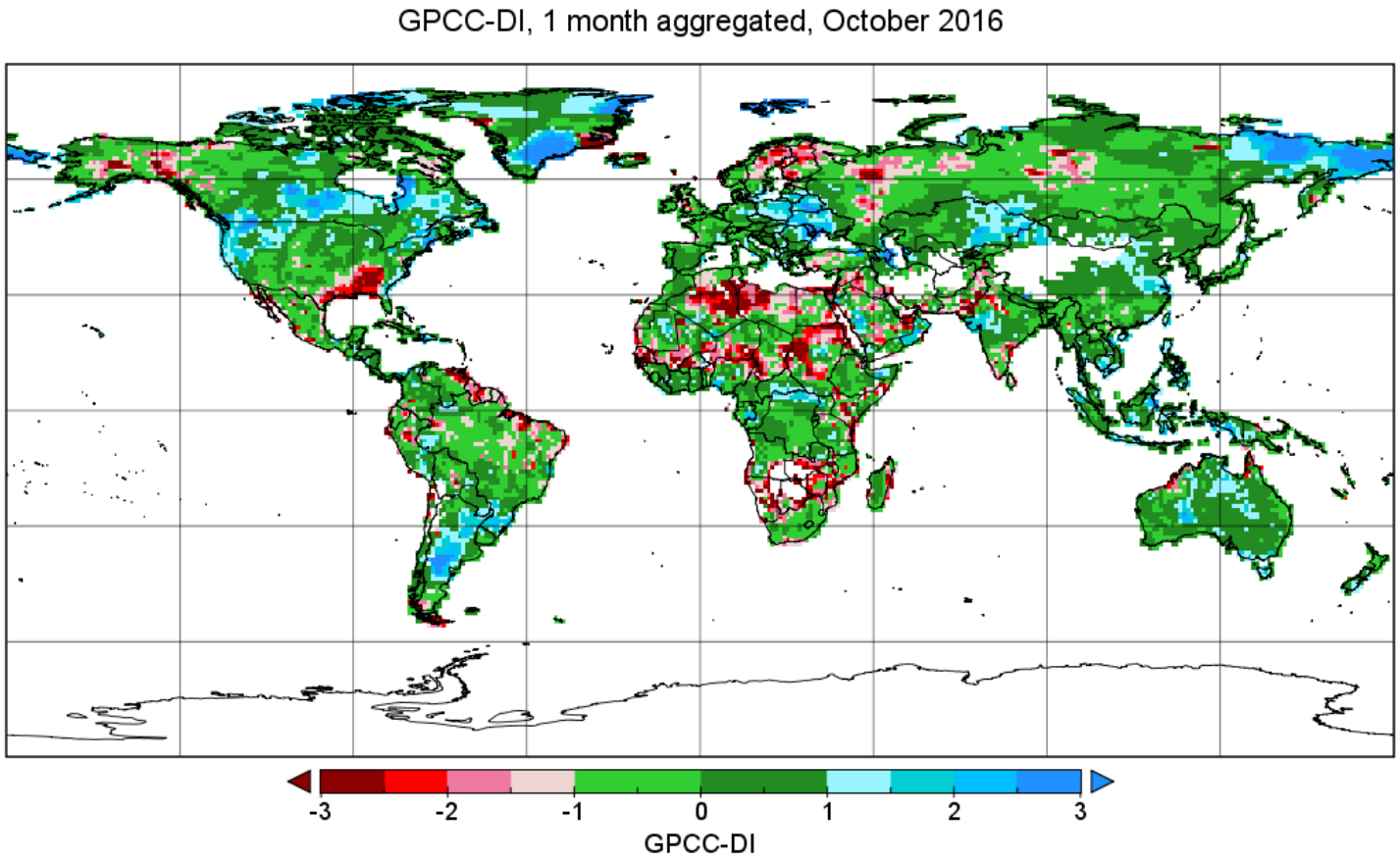


GPCC_DI

Global drought monitoring

- GPCC-DI based on:
  - Precipitation analyses from GPCC (First Guess Monthly)
  - Temperature analyses from CPC
  - Available 10 days after the end of each month
  - Multiple aggregation periods: 1, 3, 6, 12, 24 and 48 months
  - Reference period for parameter 1961-1990
  - Operational calculation since 2013
- Utilized also for monitoring of WMO RA VI (Europe and Middle East) from WMO RCC-CM

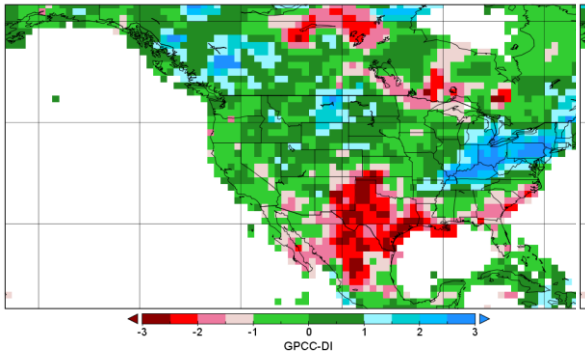
Global drought monitoring



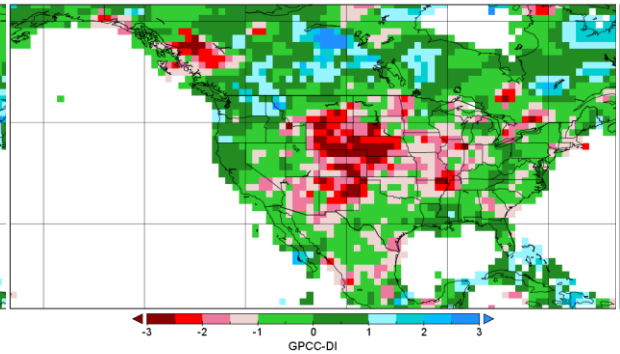
Global drought monitoring - California

GPCC-DI, aggregation period 12 months

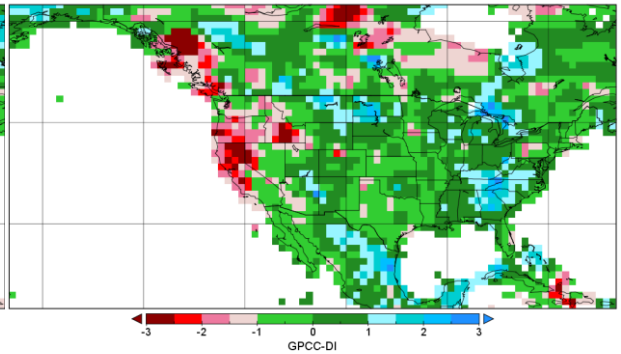
2011



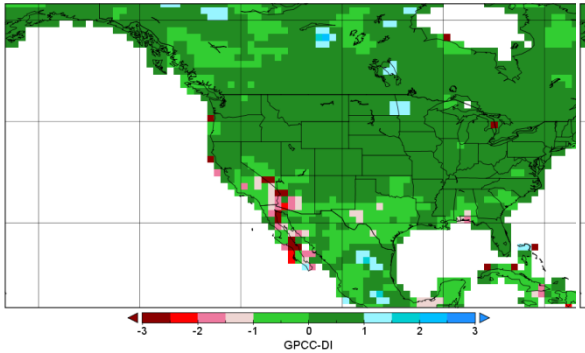
2012



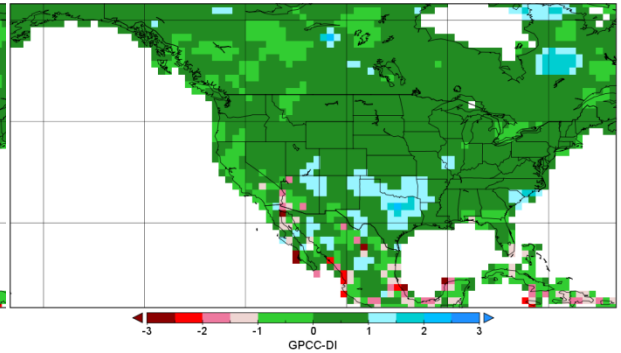
2013



2014



2015

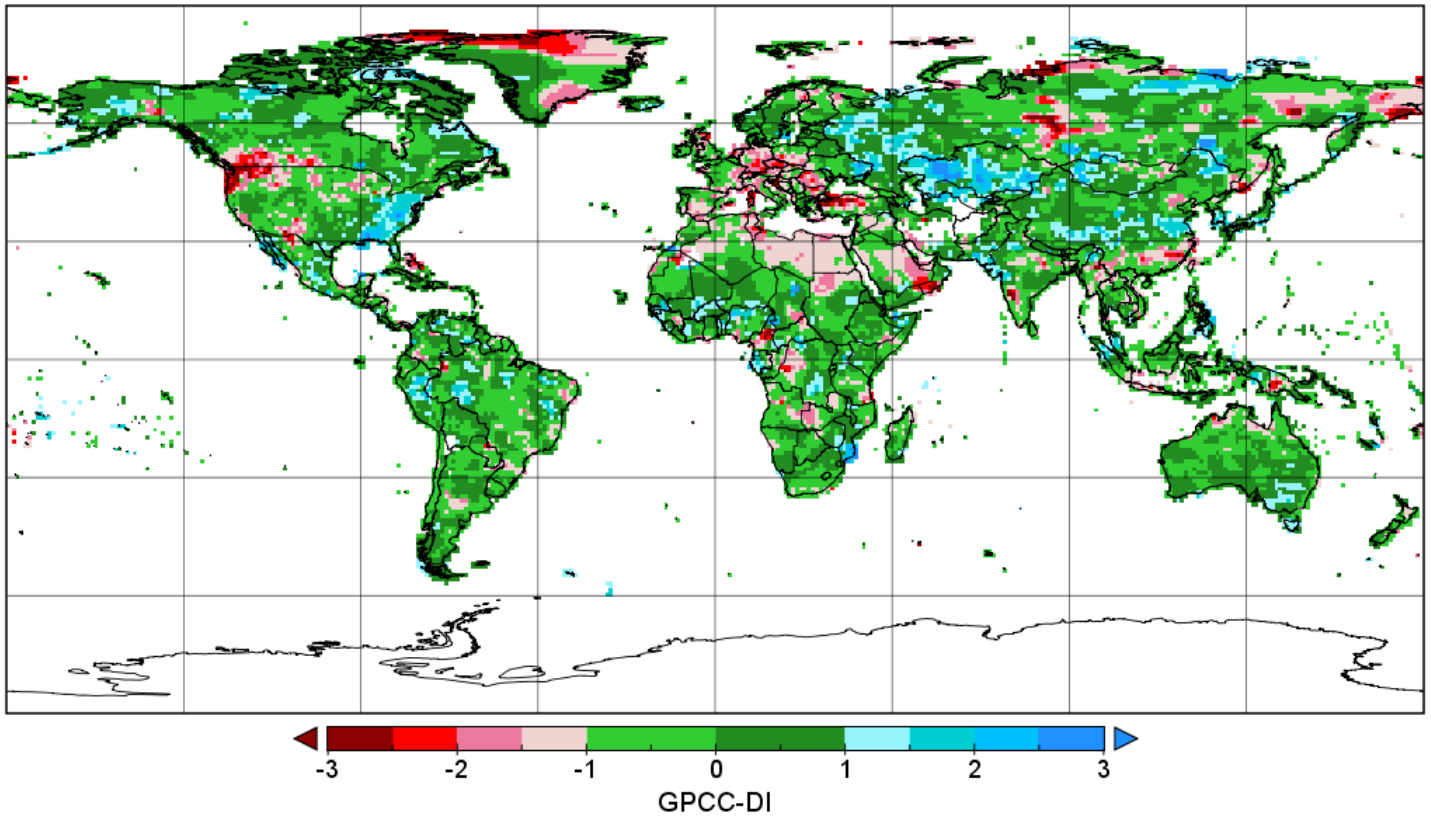


Global drought “climatology”

- Retrospective calculation of GPCC-DI from 1952 to 2013
  - Precipitation analyses from GPCC (Full Data Monthly, version 7)
  - Temperature analyses from CPC
  - Multiple aggregation periods: 1, 3, 6, 12, 24 and 48 months
  - Reference period for parameter 1952-2013

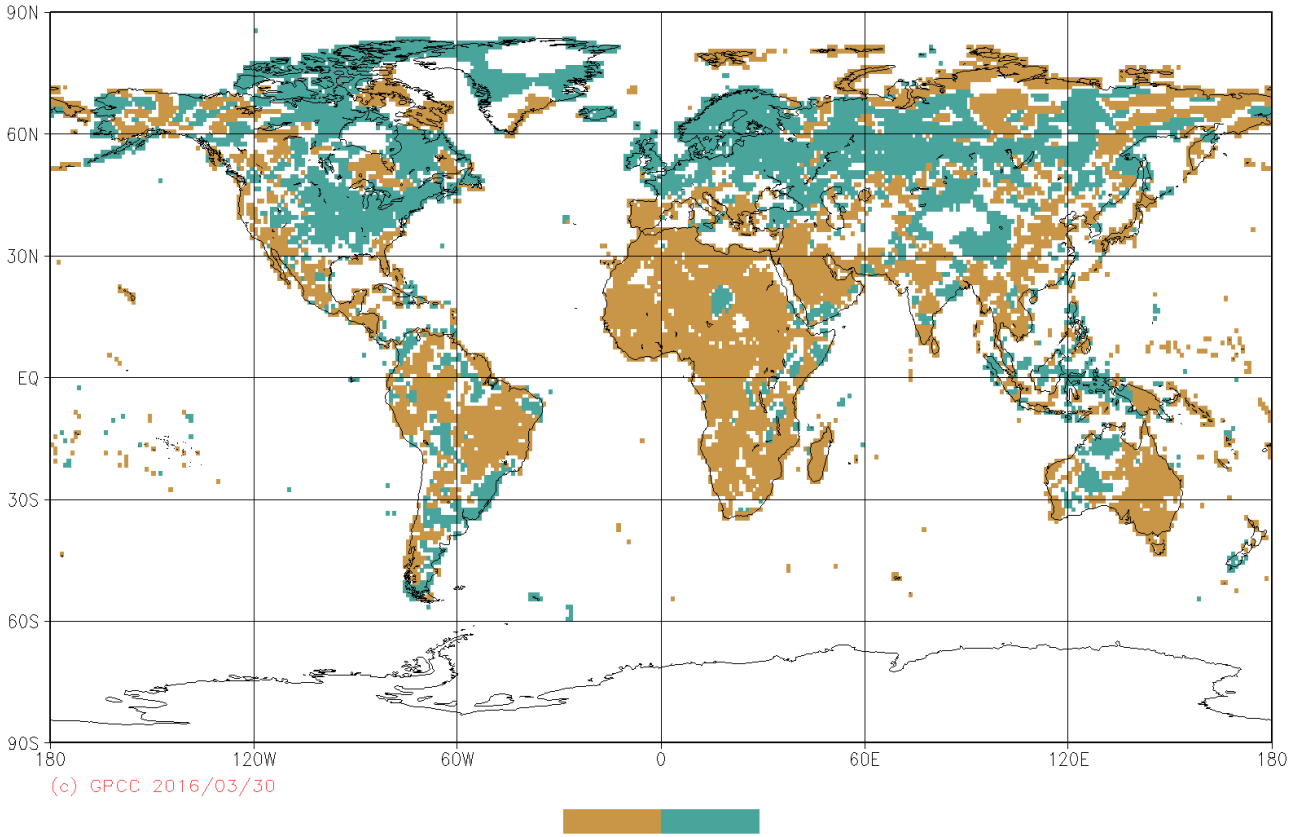
Global drought “climatology”

GPCC-DI, 3 months aggregated, June/July/August 2003



Global drought “climatology”

- Trends in drought events (GPCC-DI <= -1)
- Aggregation period 3 months
- Long lasting droughts counted several times
- Trend patterns in Europe same as precipitation trend



Droughts in recent years (events increase)

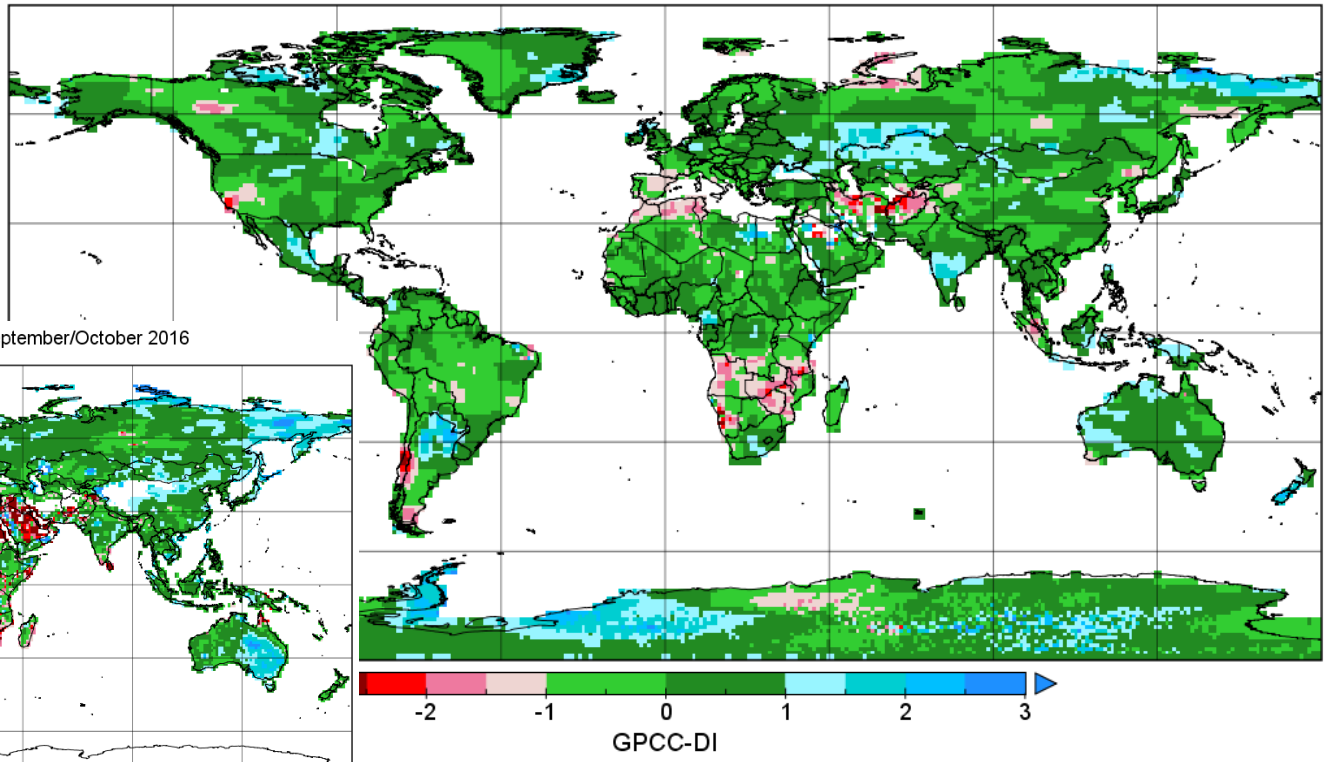
Droughts in early years (events decrease)

Global drought prediction

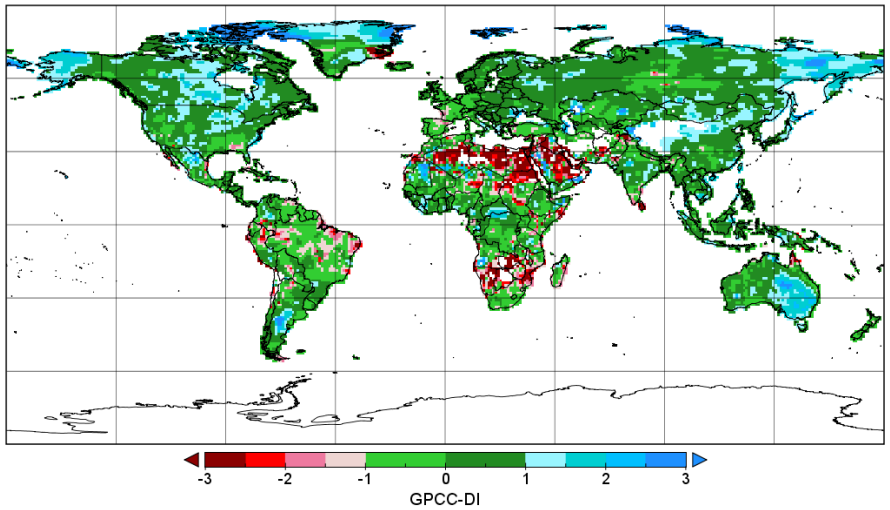
- DWD operates seasonal forecast system (GCFS) based on MPI-ESM
- GPCC-DI calculated using precipitation and evapotranspiration from ensemble mean
- Aggregation of forecast months 2 to 4, first month spin-off
- Parameter based on hindcasts 1982 to 2015

Global drought prediction

GPCC-DI (prediction), 3 months aggregated, August/September/October 2016



GPCC-DI, 3 months aggregated, August/September/October 2016



Summary

- Drought monitoring for Germany based on SPI, STI, SPEI, SCI and flash droughts
- Global based on GPCC-DI:
  - Drought “Climatology” (retrospective calculation)
  - Drought Monitoring
  - Drought prediction, based on seasonal forecasts
- Analyses based on meteorological observations, no impact data as in US drought monitor