HydroGFD3: a climatological and real-time updated hydrological forcing dataset

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What is HydroGFD3?

- Bias corrected ERA5 reanalysis for land regions globally
- Background climatology based on gauge and satellite data (CHP-Clim, CPC-Temp, GPCCv8)
- Correction for each individual month using an anomaly method
- 0.25 degree resolution (~25 km); daily mean precipitation, and daily mean, minimum and maximum temperature
- 1979 to present - 5 days

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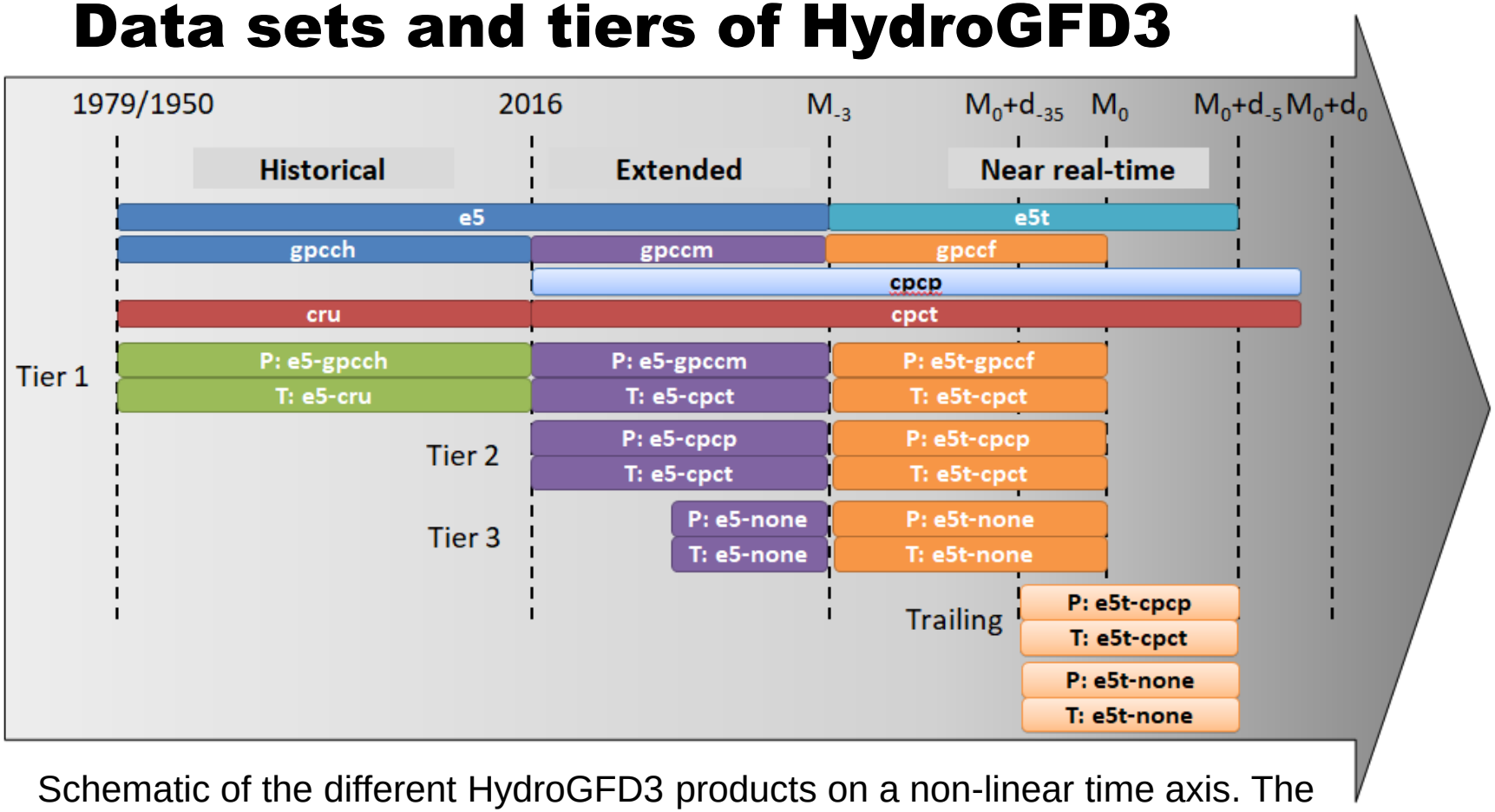
Data sources

Table 1. Table of model and data sources used in the production of HydroGFD3, as well as the WFDE5 data set used for comparison.

Data set	Name	Variables	Resolution	Period	Reference
ERA5	e5	T, P	hourly; 0.33°	1979–(t-3 months)	Hersbach et al. (2019)
ERA5T	e5t	T, P	hourly; 0.33°	(t-3 months) – (t-5 days)	Hersbach et al. (2019)
CRUts4.03	cru	T, P, N_{wet}	monthly; 0.5°	1901–(t-2 months)	Harris and Jones (2019)
GPCCv8	gpcch	P	monthly; 0.25°	1891–2016	Schneider et al. (2018a)
GPCC-monitoringv6	gpccm	P	monthly; 1.0°	1982–(t-3 months)	Schneider et al. (2018b)
GPCC-First guess	gpccf	P	monthly; 1.0°	2004–(t-1 month)	Schneider et al. (2018b)
CPC-Unified	cpcp	P	daily; 0.5°	1979–(t-2 days)	Chen et al. (2008)
CPC-Temp	cpct	T_{min}, T_{max}	daily; 0.5°	1979–(t-2 days)	CPCtemp (2017)
CHPclimv1.0	chpclim	P	climatology; 0.05°	(1980–2009)	Funk et al. (2015b)
WFDE5-CRU	wfd-cru	T, P	hourly; 0.5°	1979-2018	Cucchi et al. (2020)
WFDE5-GPCC	wfd-gpcc	P	hourly; 0.5°	1979-2016	Cucchi et al. (2020)

Data sets and tiers of HydroGFD3



Schematic of the different HydroGFD3 products on a non-linear time axis. The top bars show the original data sources, and the Tier 1–3 and Trailing products are shown below. The time axis notes the years with significant changes in data sources, and the later time marks are relative to the 1st of the current month, M0, and the current day, d0. The units of the sub-script for the month is in months, and for the day is in days.

Background climatology 1980--2009 compared to ERA5

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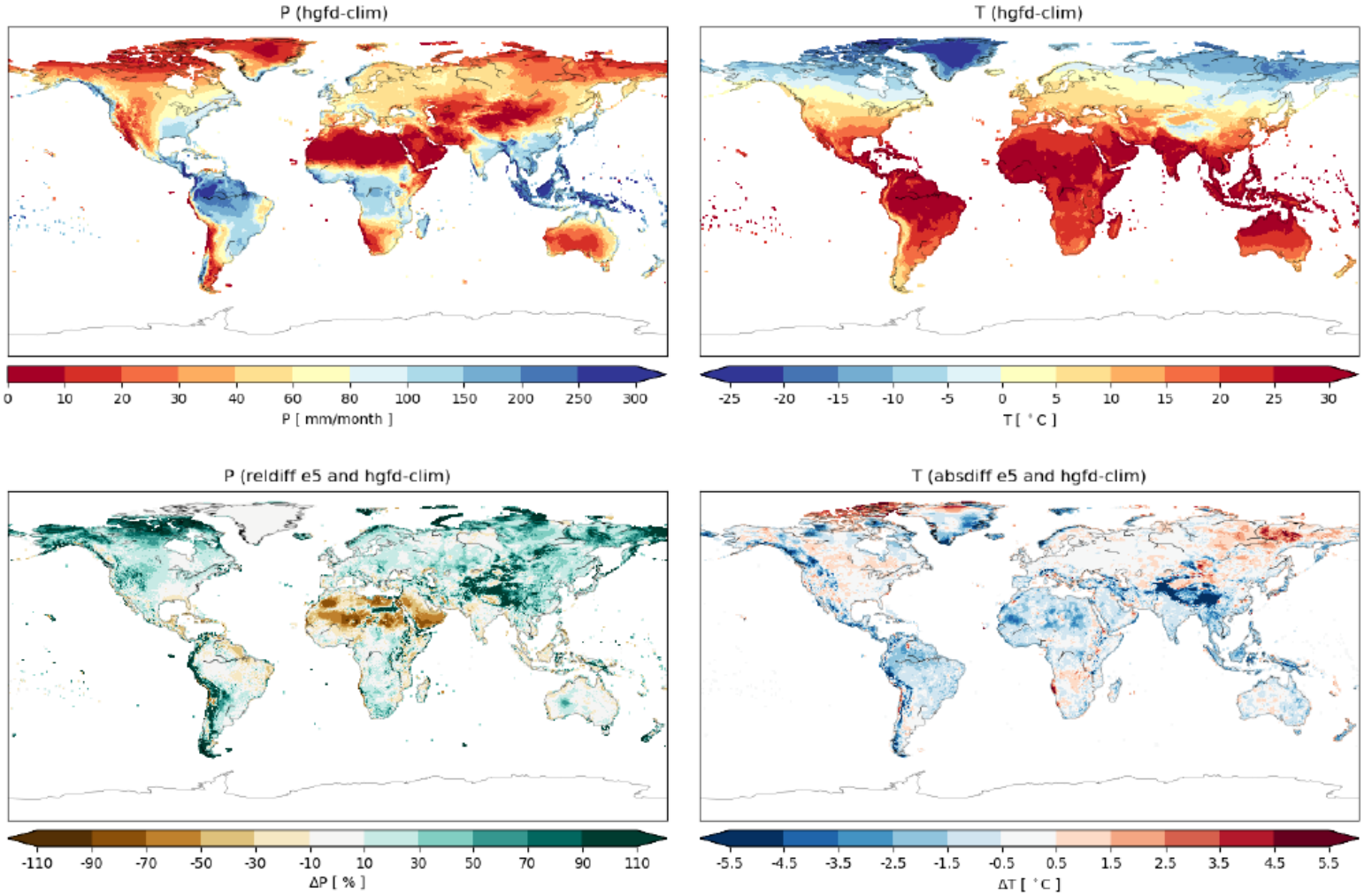

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Correction steps

The production of the corrected data consists of the following steps.

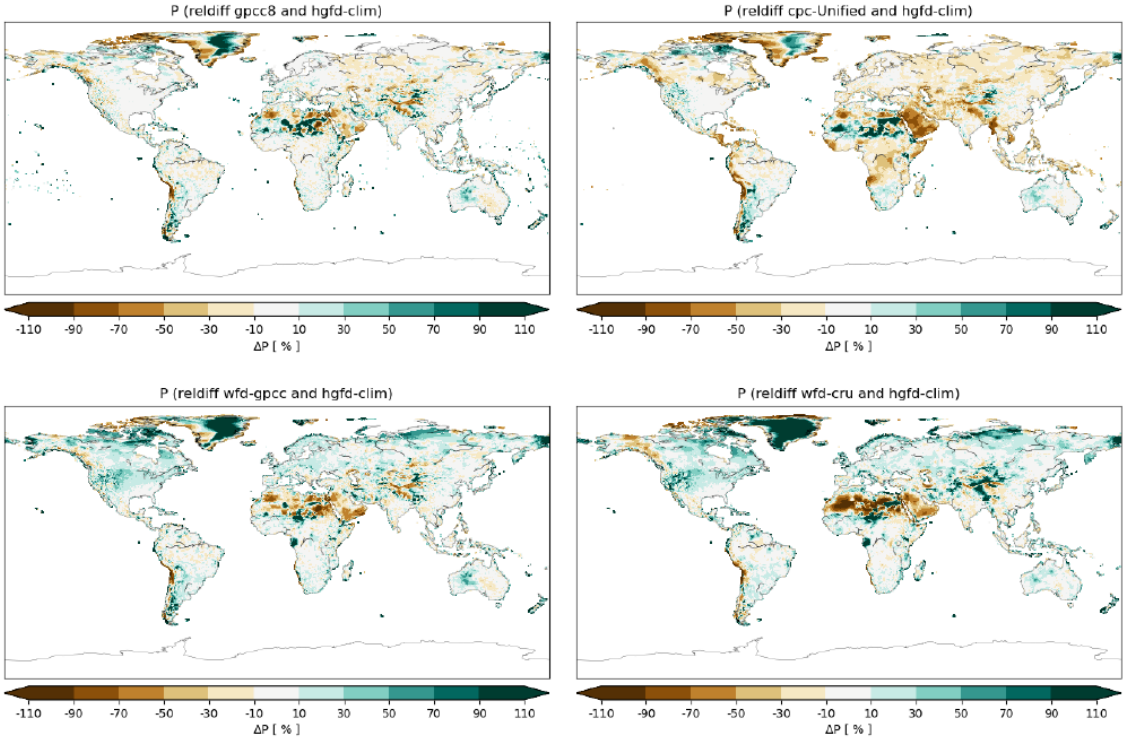
1. Calculate observed anomalies (reference period 1980—2009)
2. Construct absolute reference data by adding the anomalies to the HydroGFD3 climatology
3. (P only) Calculate the number of wet days (Stillman and Zheng (2016) empirical method)
4. (P only) Remove the weakest excessive wet days in ERA5
5. Calculate the ratio between the monthly means of the reference and ERA5
6. Apply the ratio to all time steps of ERA5
7. (T only) Calculate mean, minimum, and maximum temperature from the hourly time steps

Evaluation: precipitation climatology

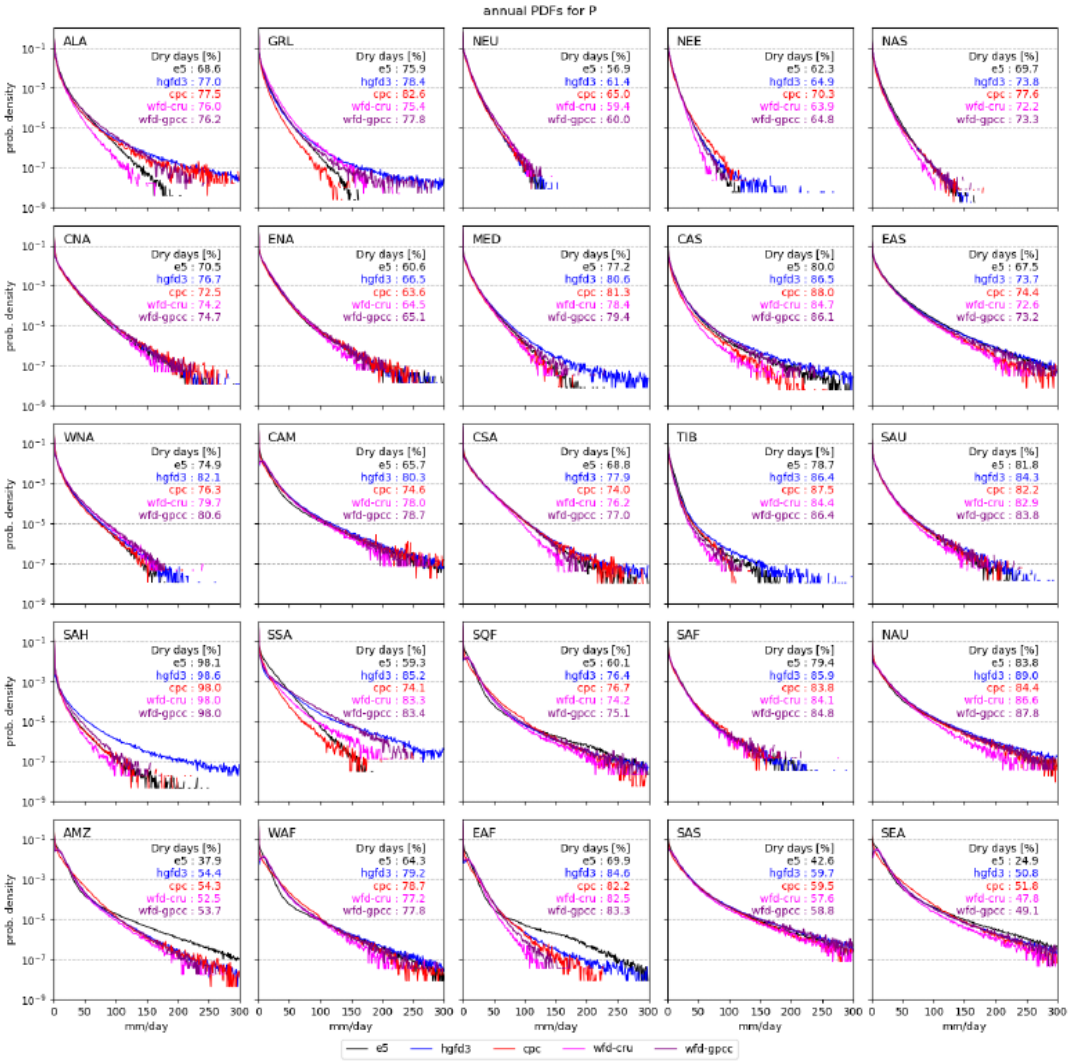
The climatology compares well to GPCC8 and CPC-Unified.

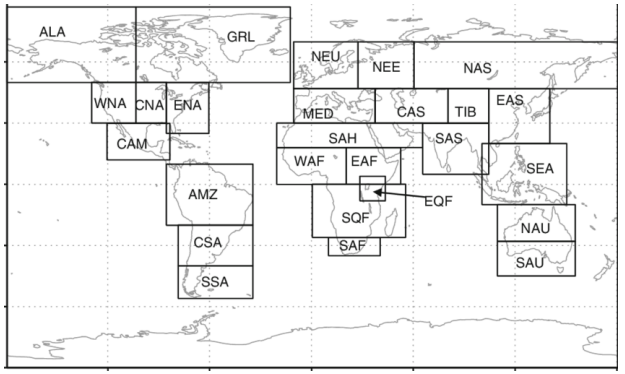
WFDE5 has more precipitation in mainly cold regions due to the undercatch correction.

Differences in dry regions such as northern Africa due to differences in gridded gauge data and satellite data.



Evaluation: Precipitation pdfs

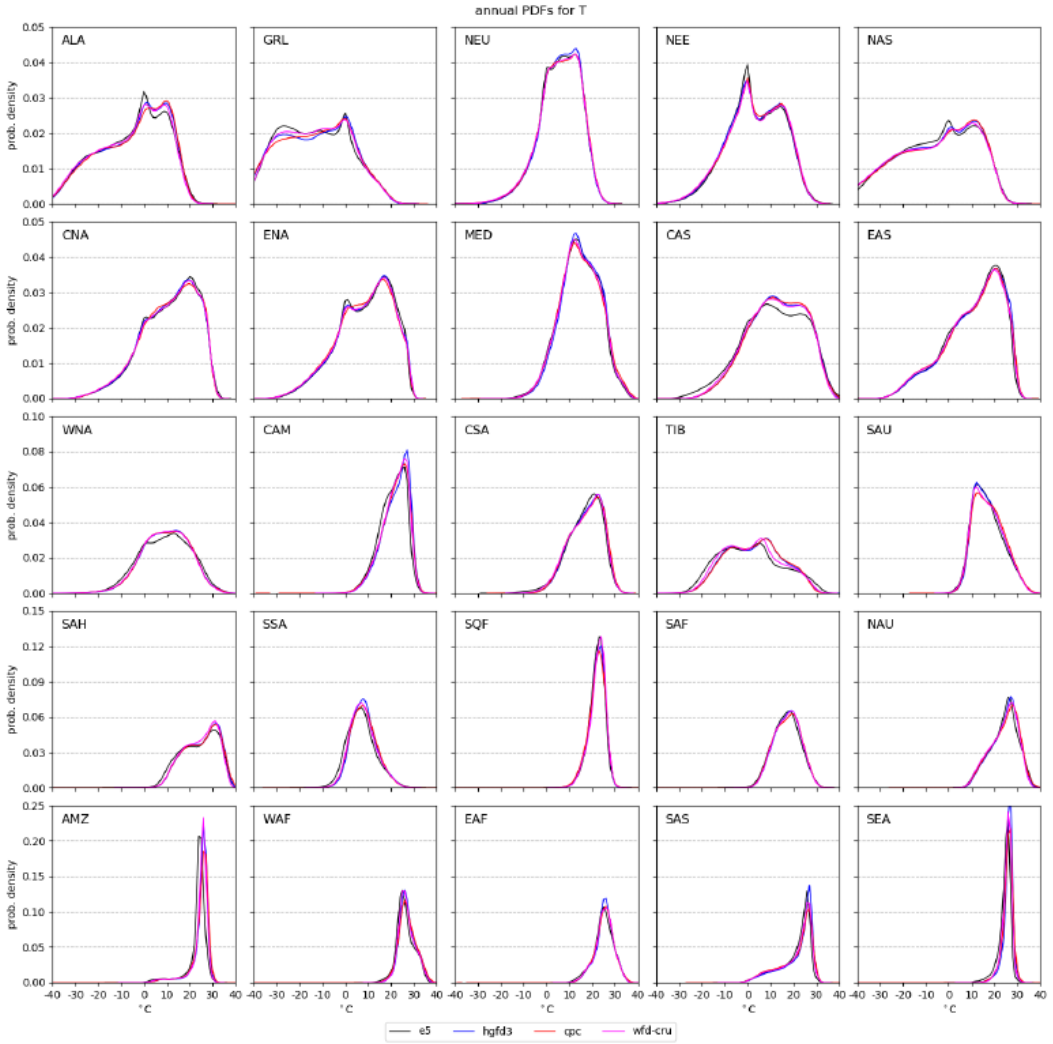


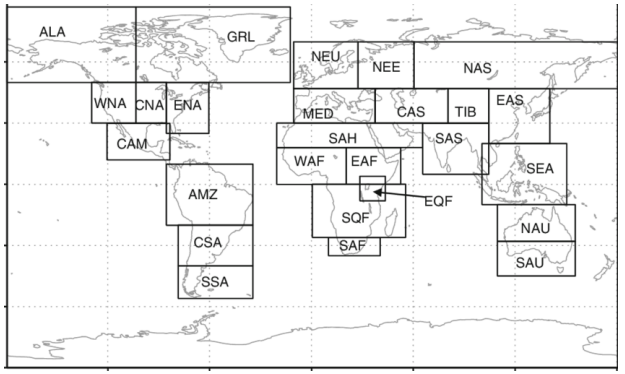


HydroGFD3 has a heavier tail, which is partly due to the higher resolution.

Uncertainty is large between the data sets, and HydroGFD is mostly within the unceratintly interval.

Evaluation: Temperature pdfs





HydroGFD3 compares well with the WFD5 data set, although some regions show larger seasonal deviations.

Access

- A paper about the HydroGFD3 data set and method is very soon to be submitted to the Copernicus journal Earth System Science Data (ESSD); (Berg et al. in prep).

- The historical period of HydroGFD3 will be provided free of charge from an online repository, to be announced in the accompanying paper.

- Single updates or subscriptions to real-time data can soon be ordered through the HYPEweb contact form for a processing charge: **https://hypeweb.smhi.se/contact-us**