

Validating daily precipitation totals by means of ETCCDI

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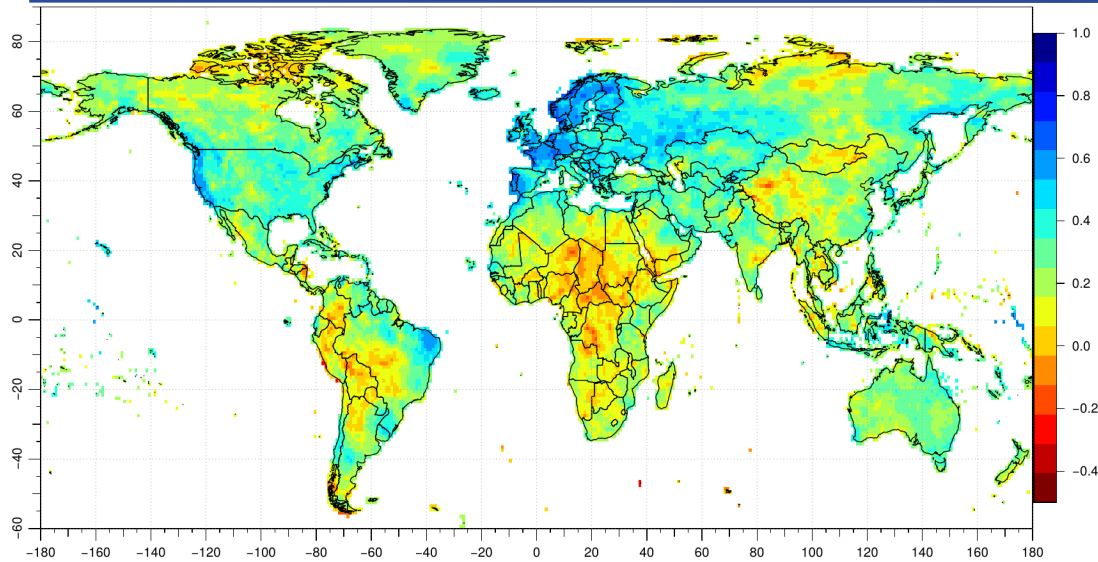
Data base for comparison

The **Full Data Daily (FDD)** (*Schamm et al., 2014*) is provided by the Global Precipitation Climatology Centre (GPCC):

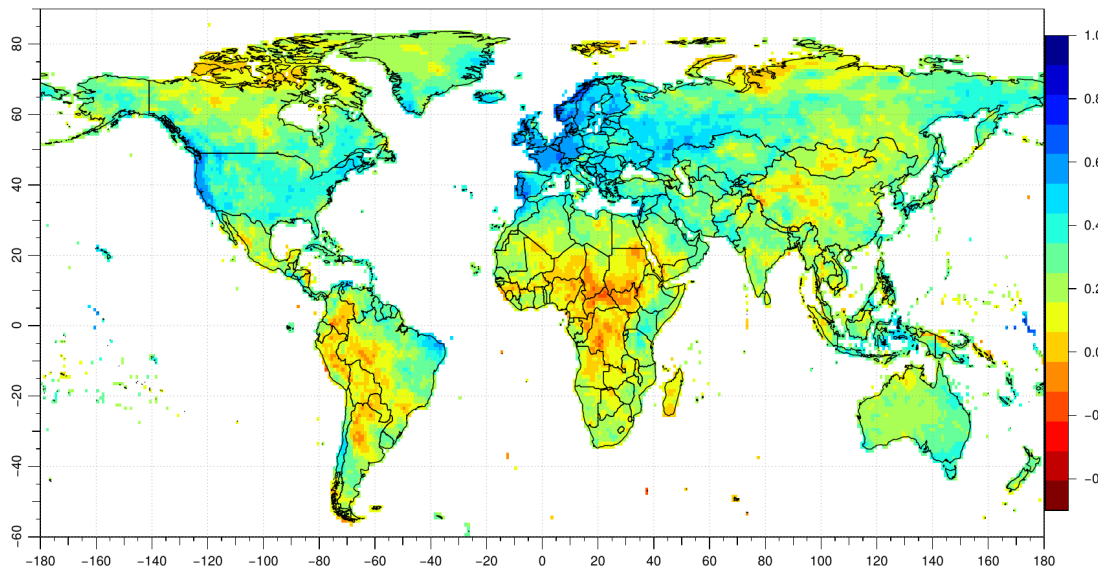
- **Observation** based dataset containing global land surface precipitation from **1988 to 2013**.
- With **daily resolution** and **1° spatial resolution**.

The **Full Data Daily (FDM)** (*Schneider et al., 2014*) is provided by the Global Precipitation Climatology Centre (GPCC):

- **Observation** based dataset containing global land surface precipitation from **1901 to 2013**.
- With **monthly resolution** and **1° spatial resolution**.



*Fig. Kendall correlation coefficient
ERA-20C vs. FDM*



*Fig. Kendall correlation coefficient
CERA-20C vs. FDM*

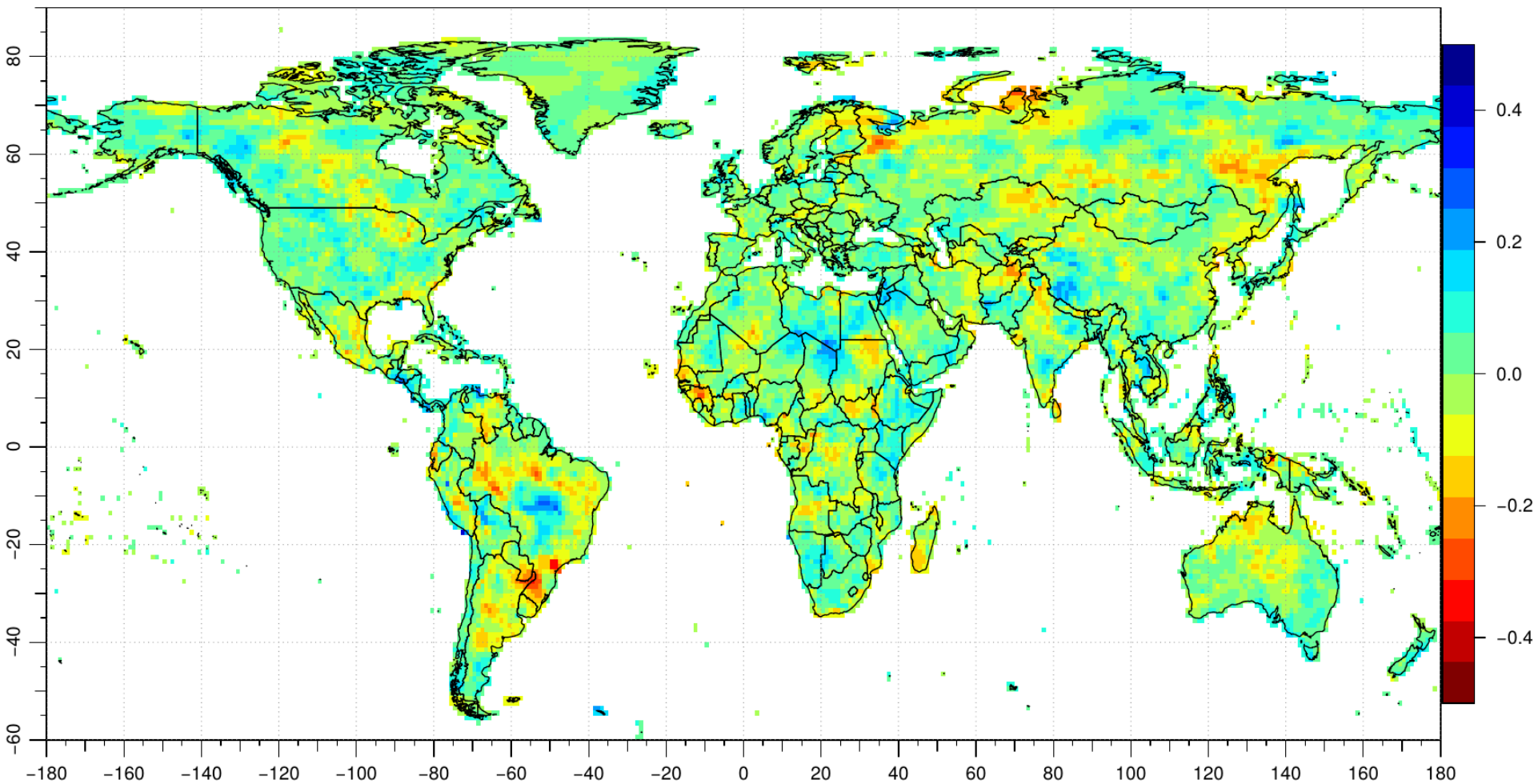


Fig. Kendall correlation coefficient
Difference CERA-20C vs. FDM – ERA-20C vs. FDM

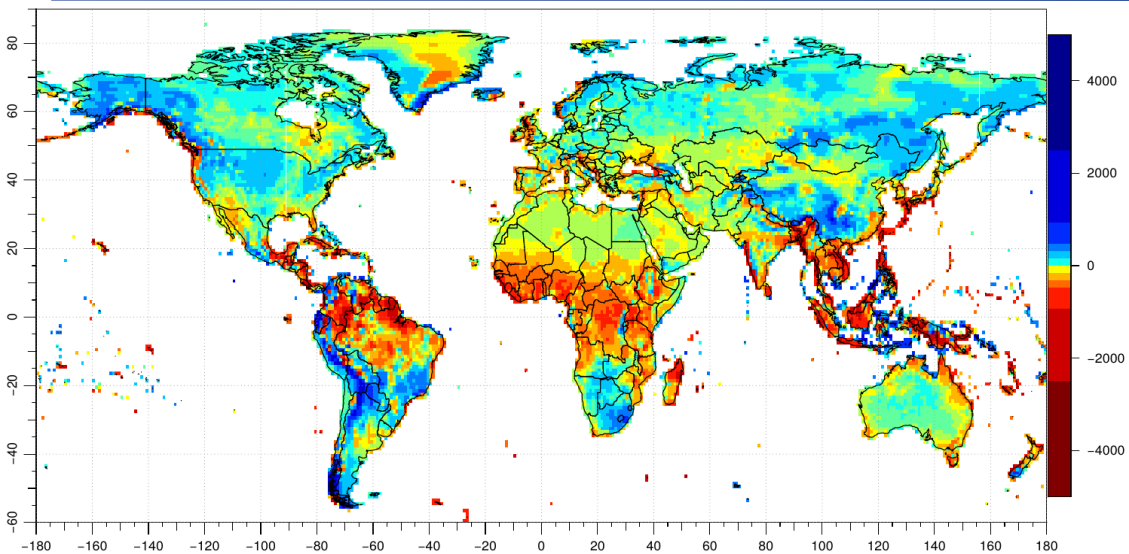


Fig. Difference ERA-20C - FDM

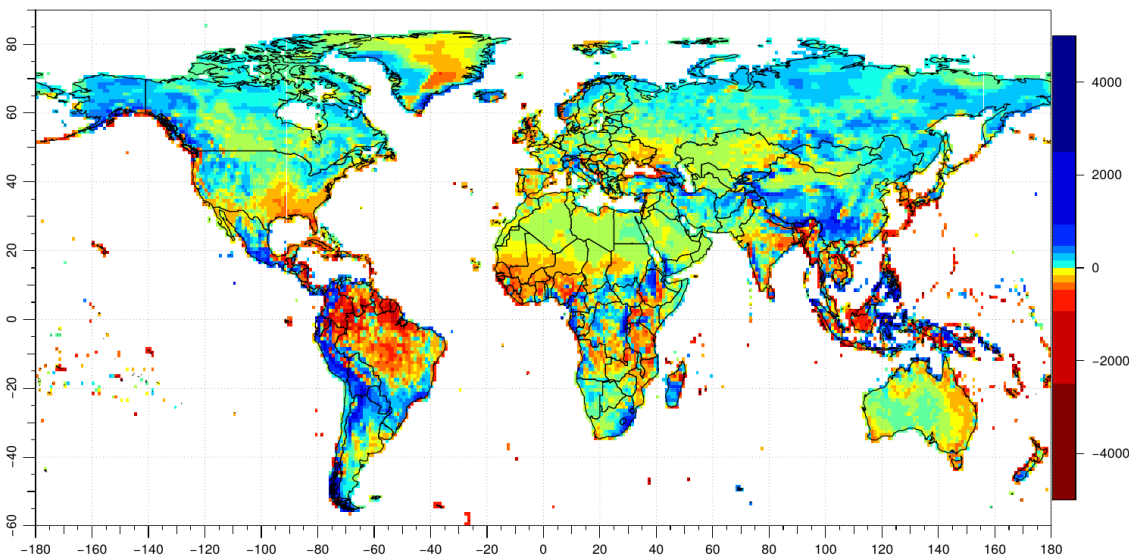


Fig. Difference CERA-20C - FDM

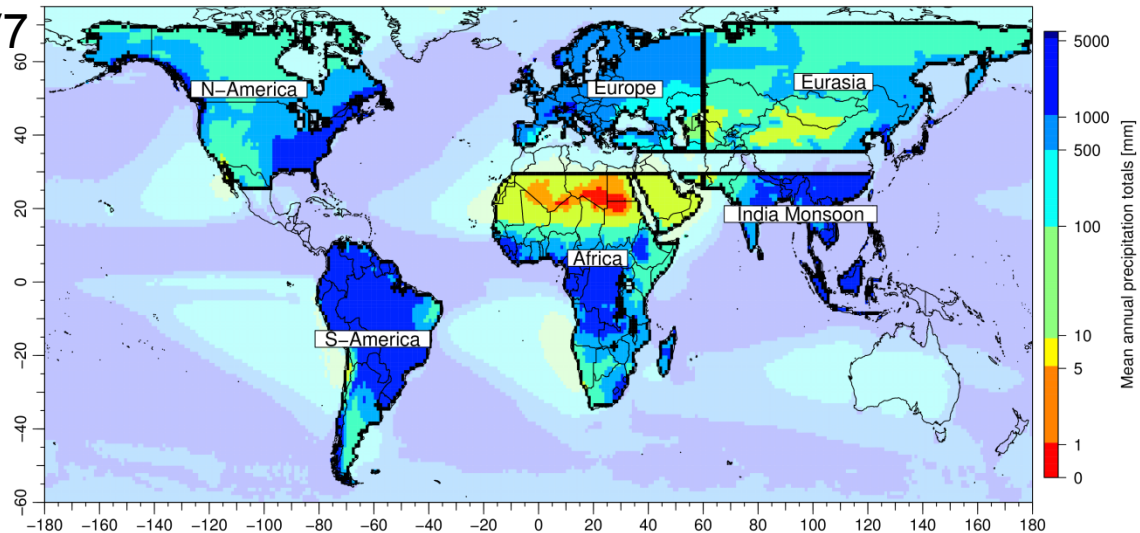
Area selection for further analyses

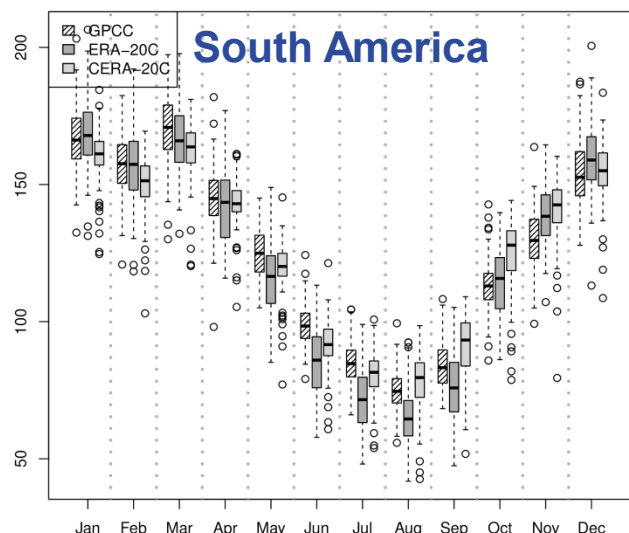
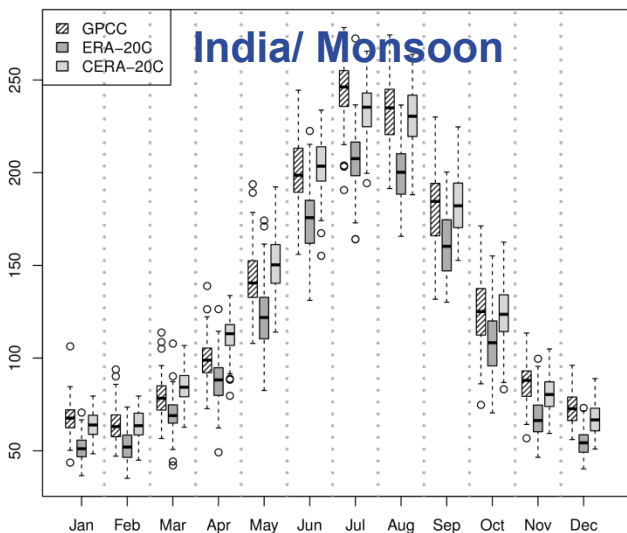
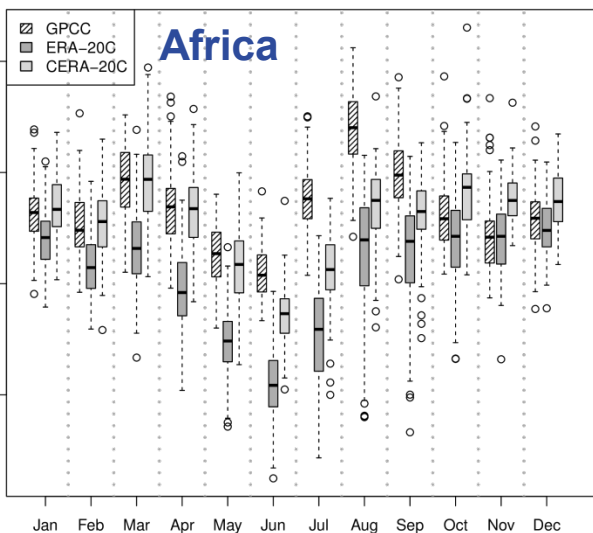
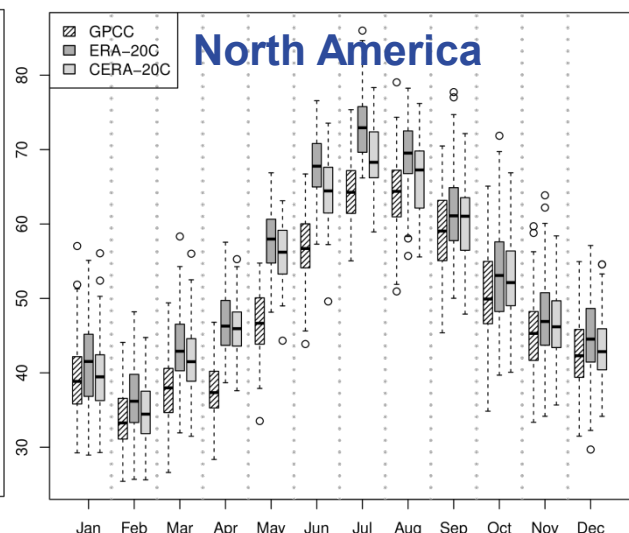
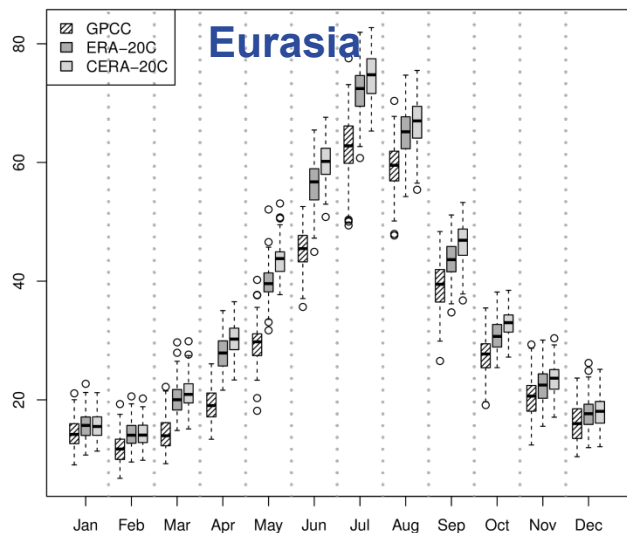
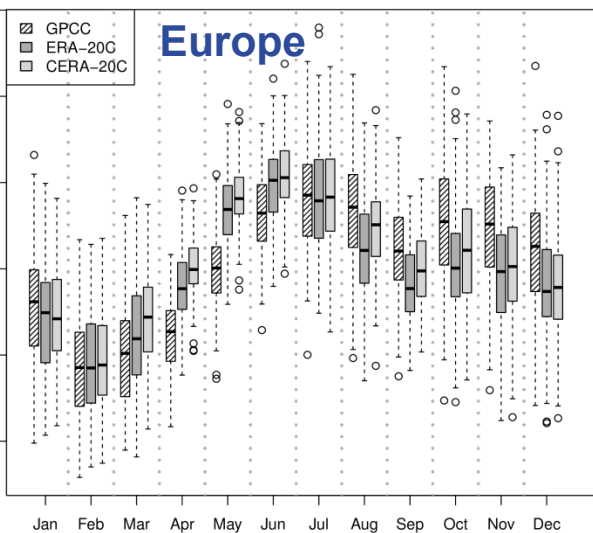
→ Boxplots monthly values (spatial mean)

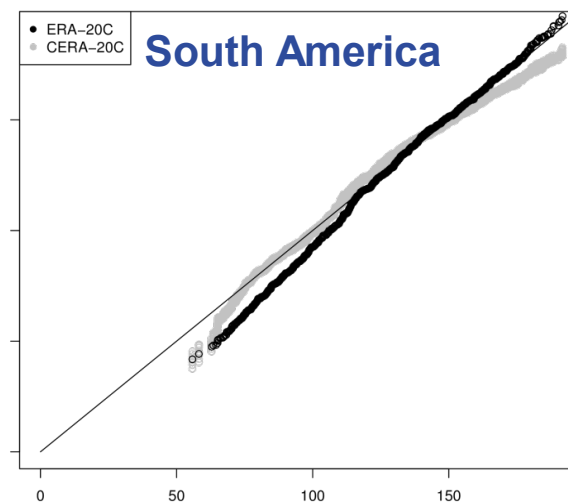
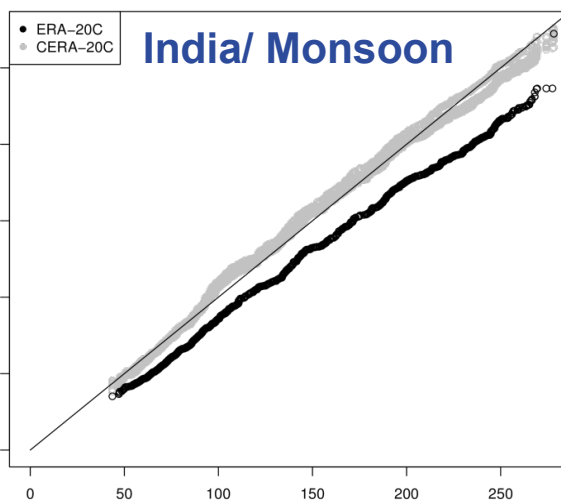
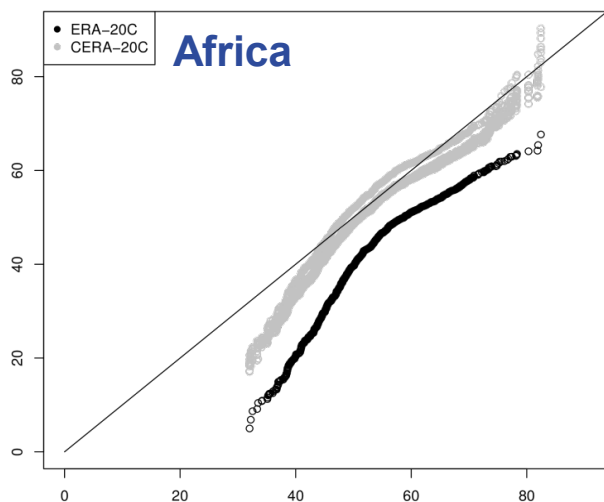
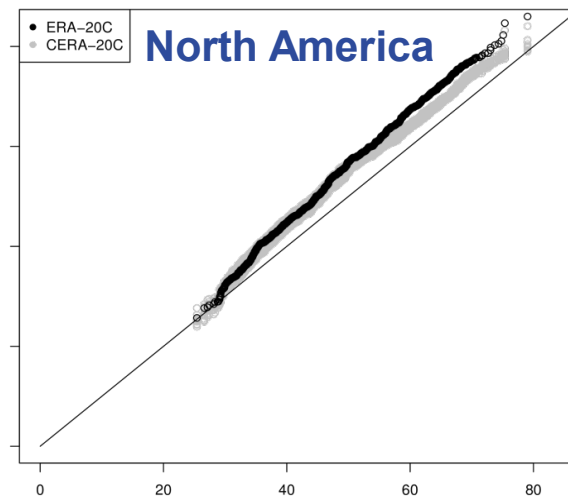
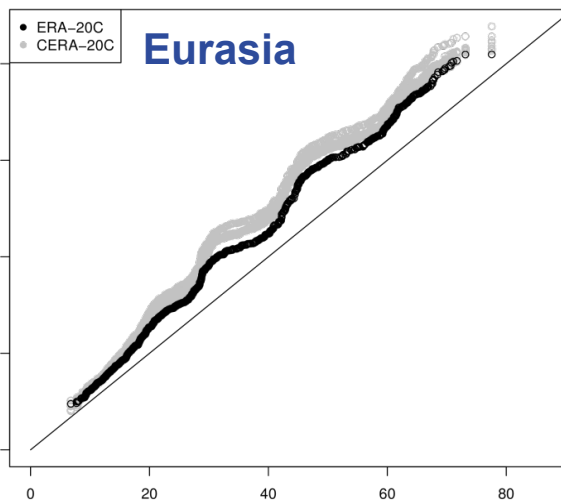
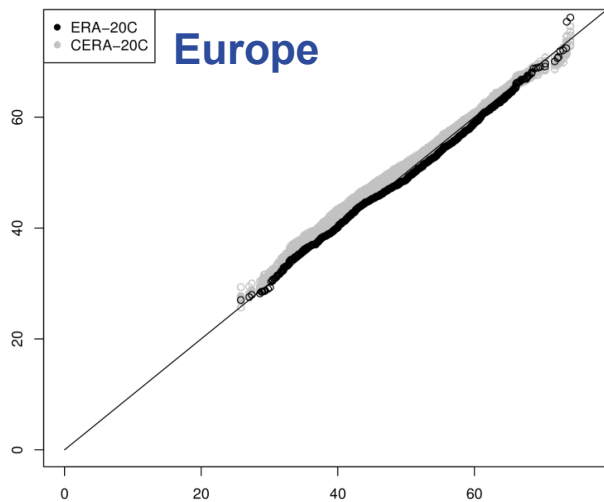
- ERA-20C
- CERA-20C ensemble mean
- GPCC Full Data Monthly V7

→ QQ-plot monthly values (spatial mean)

- ERA-20C
- CERA-20C ensemble
- GPCC Full Data Monthly V7







Full data monthly

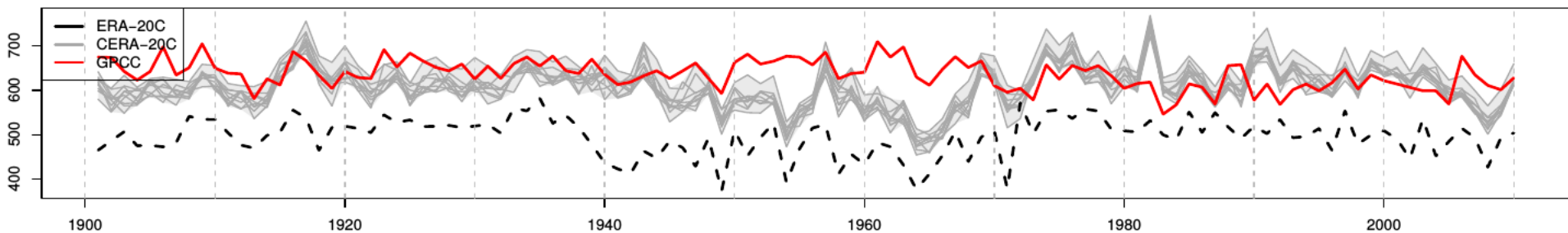


Fig. Annual time series Africa.

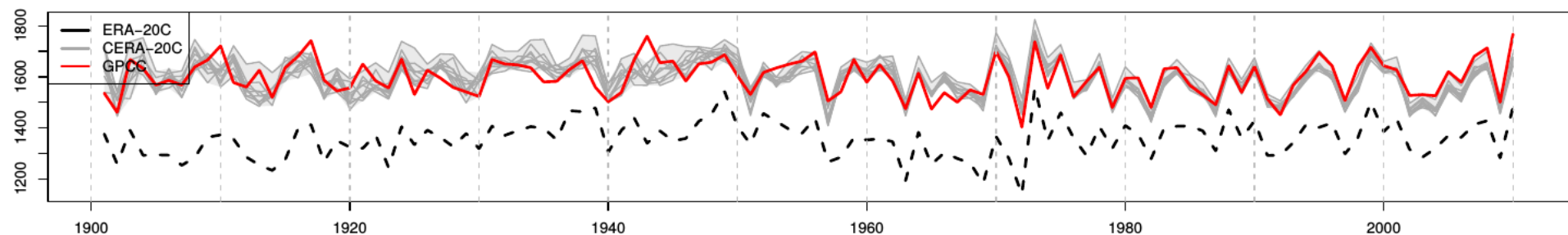


Fig. Annual time series India and Monsoon area.

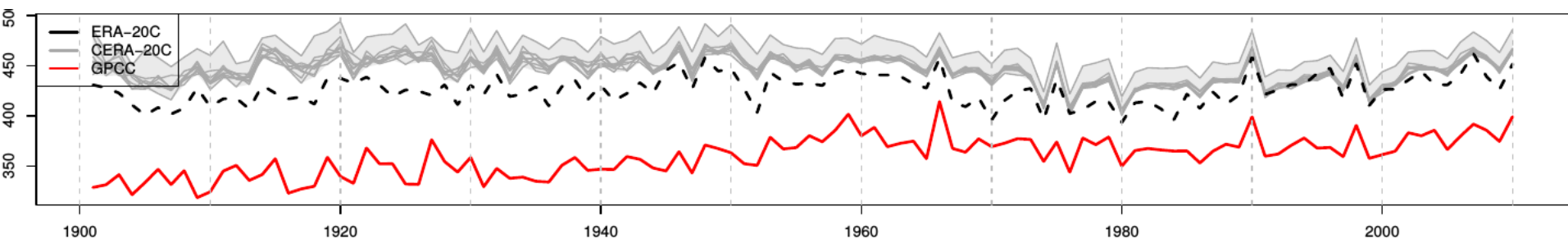


Fig. Annual time series Eurasia.

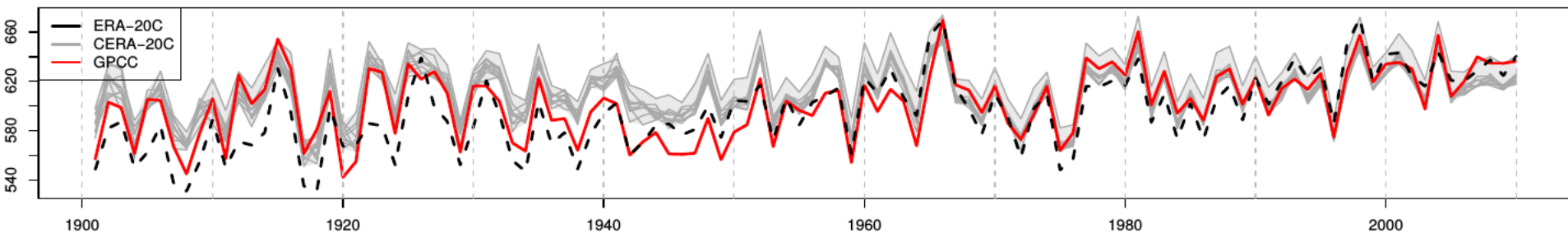


Fig. Annual time series.

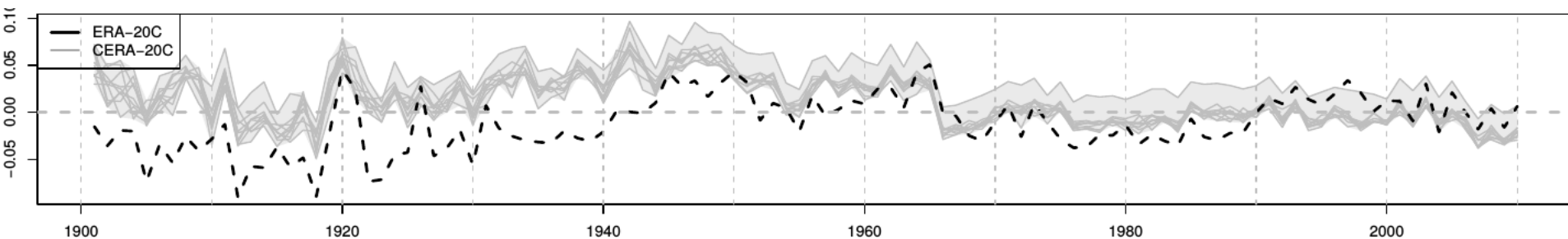


Fig. Log ratio ERA and CERA - FDM.

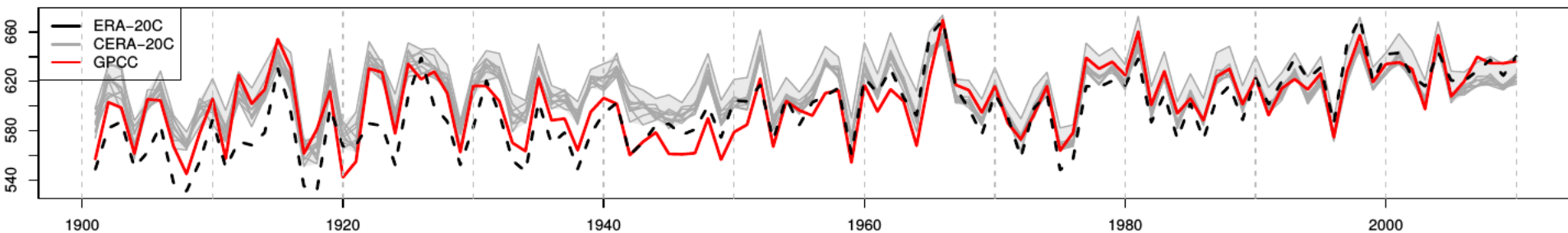


Fig. Annual time series.

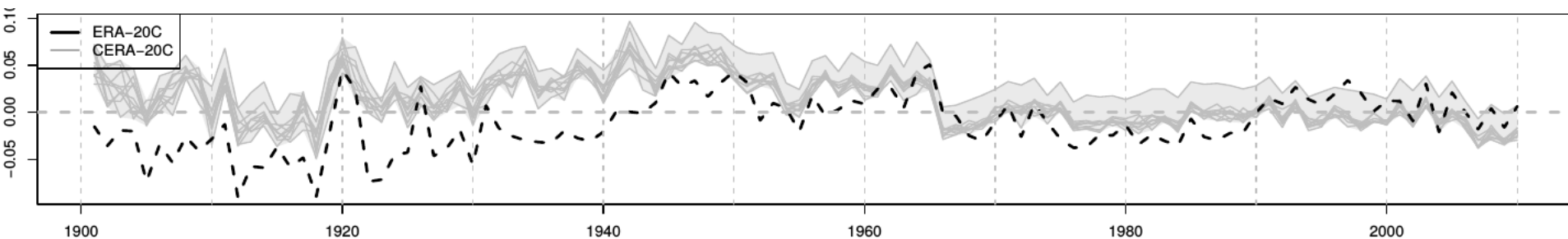
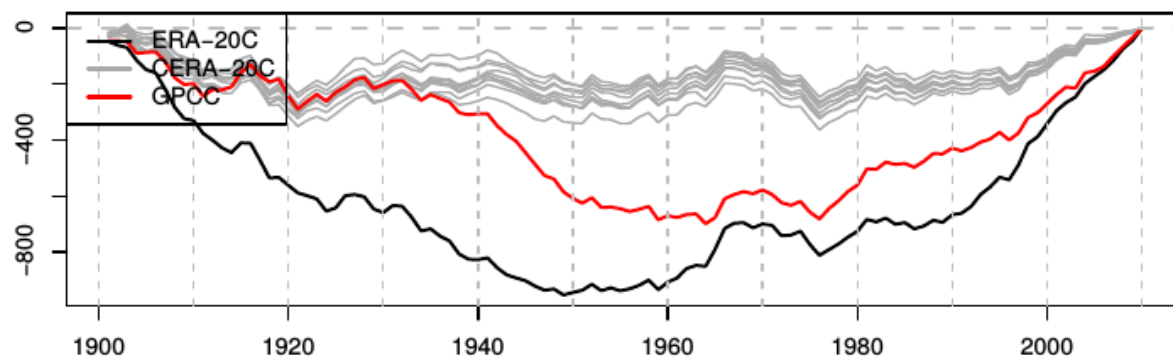


Fig. Log ratio ERA and CERA - FDM.



**Fig. Craddock test
-Accumulated totals of
anomalies.**

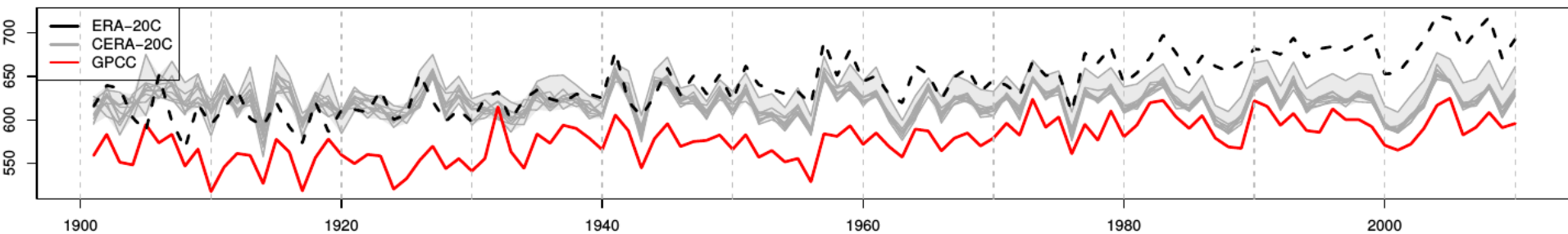


Fig. Annual time series.

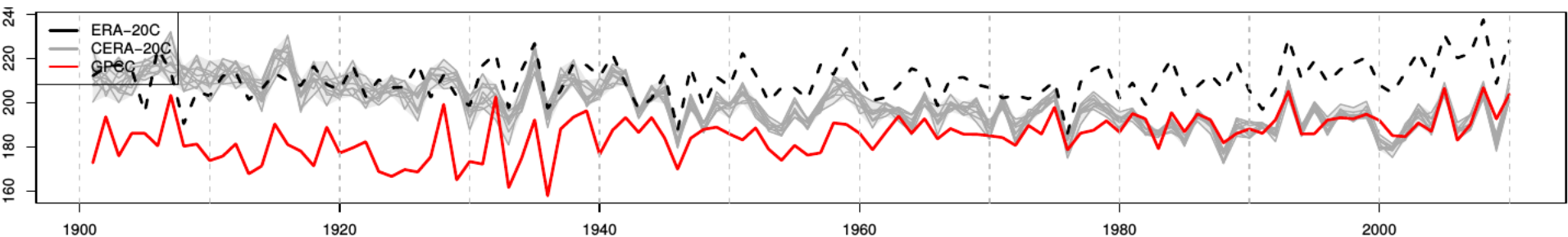


Fig. JJA time series.

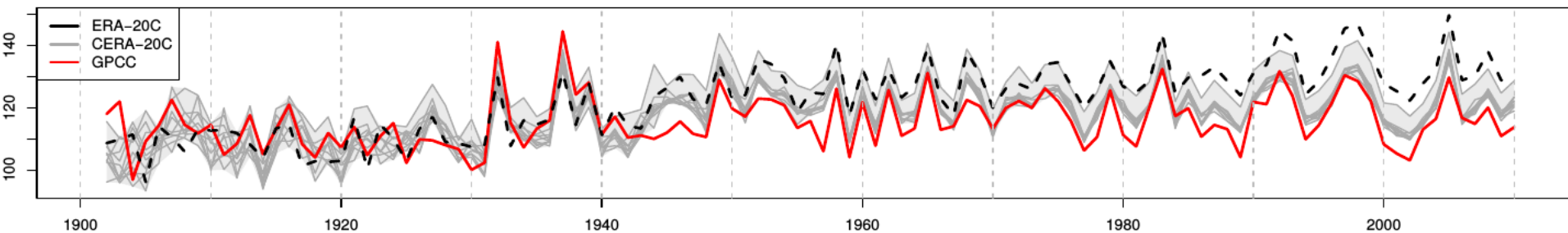


Fig. DJF time series.

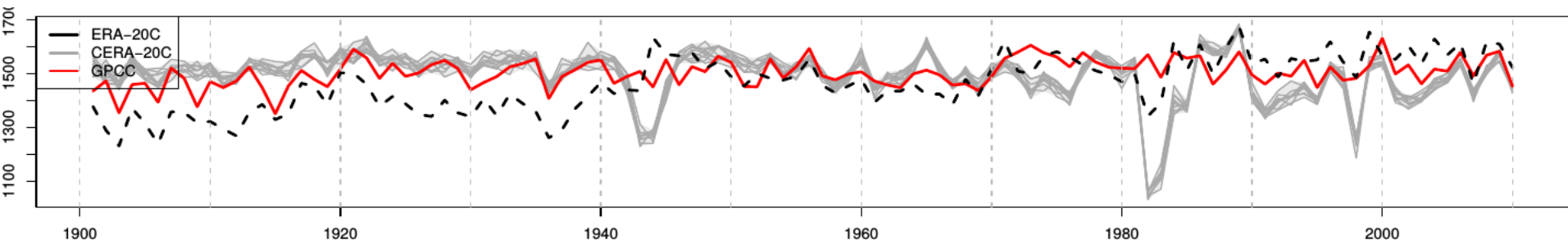


Fig. Annual time series.

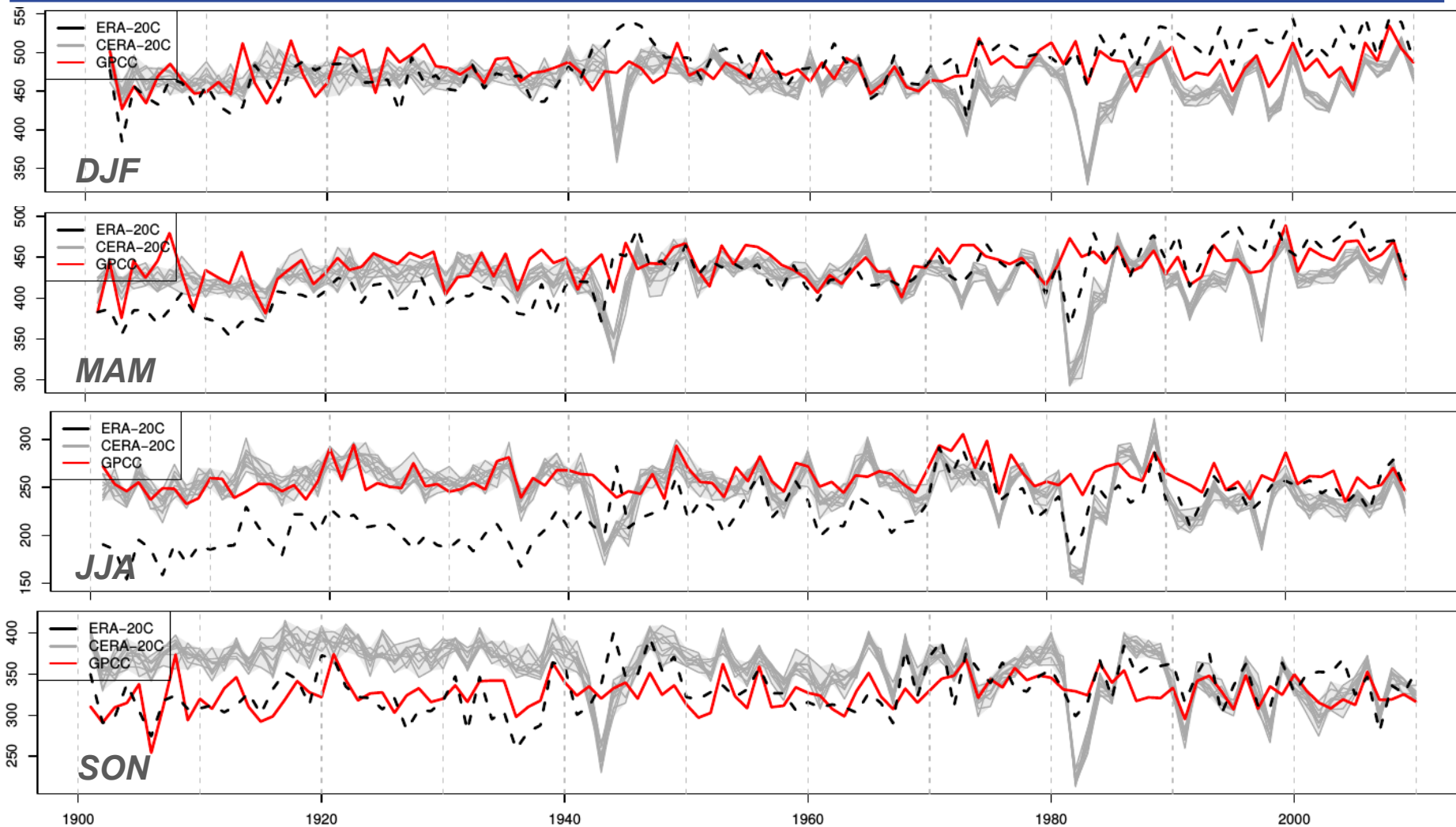


Fig. Time series.

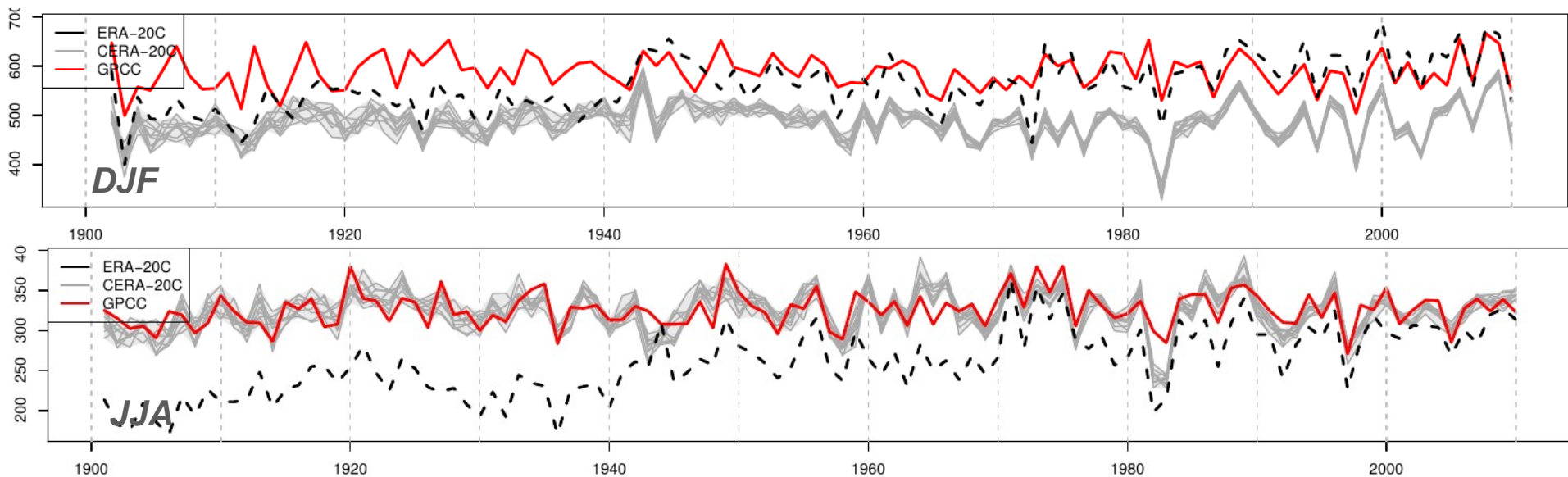


Fig. Time series.

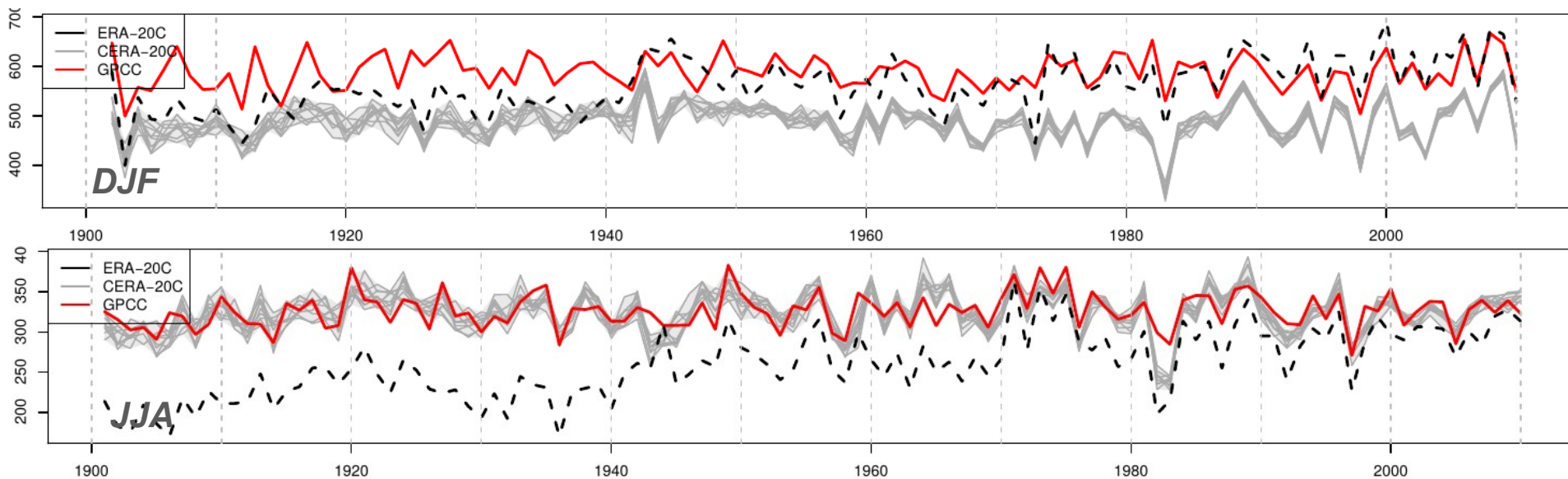


Fig. Time series.

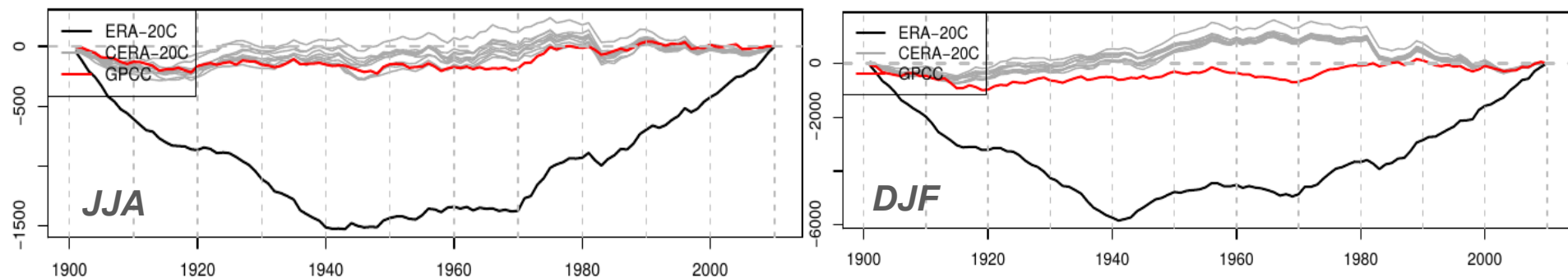


Fig. Craddock test -Accumulated totals of anomalies.

Extreme indices (ETCCDI)

Tab. Extreme precipitation indices calculated for this paper. They are adopted from the ETCCDI set by Peterson et al. (2001, Appendix A) and CCI/WCRP/JCOMM Expert Team on Climate Change Detection and Indices.

Indicator	Definition	Unit
Rx1day	Maximum 1-day precipitation	mm
Rx5day	Maximum 5-day precipitation	mm
SDII	Mean daily precipitation amount on days > 10 mm	mm
R10mm	Count of days > 10 mm	# days
CDD	Maximum length of dry spell (< 1 mm/day)	# days
CWD	Maximum length of wet spell (> 1 mm/day)	# days
R95p	95th percentile	mm
PRCPTOT	Total precipitation	mm

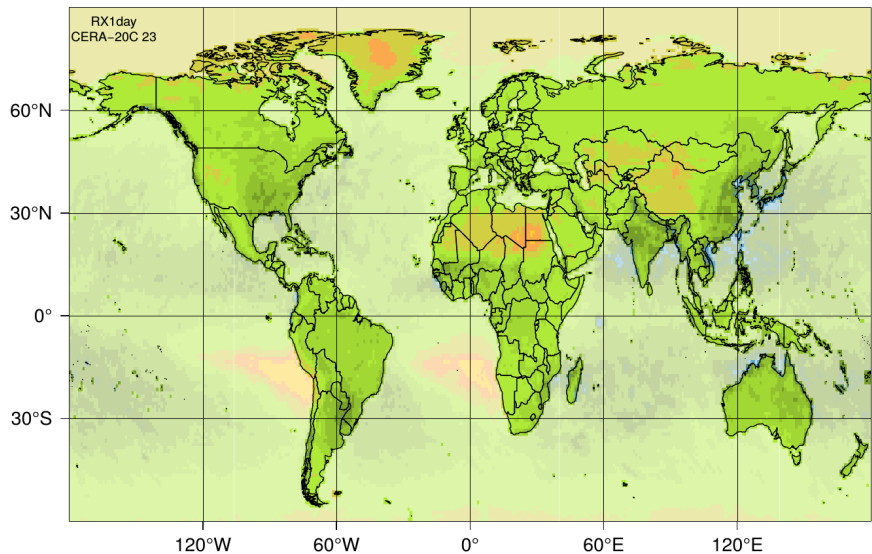
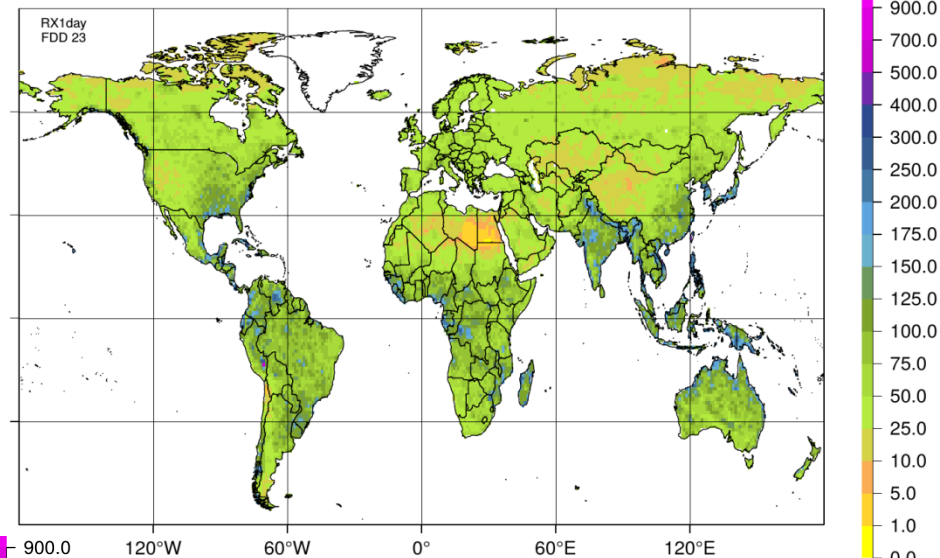
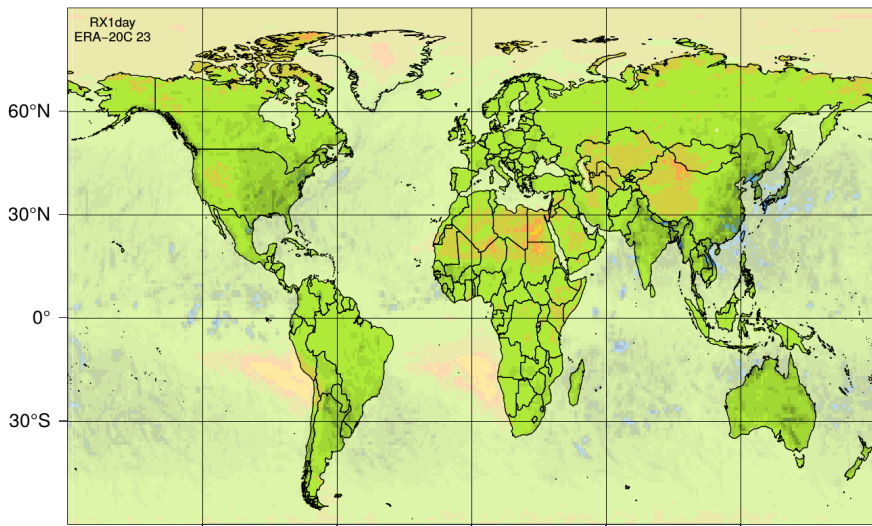
Methodology

Extreme value indices (ETCCDI) recommended by *Peterson et al. (2001, Appendix A)* are calculated for precipitation see *Tab1*.

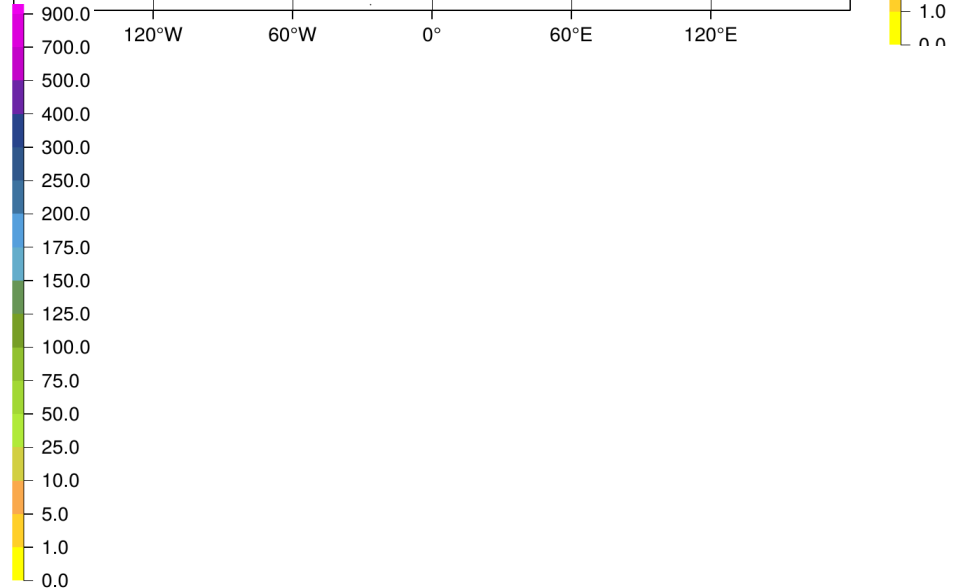
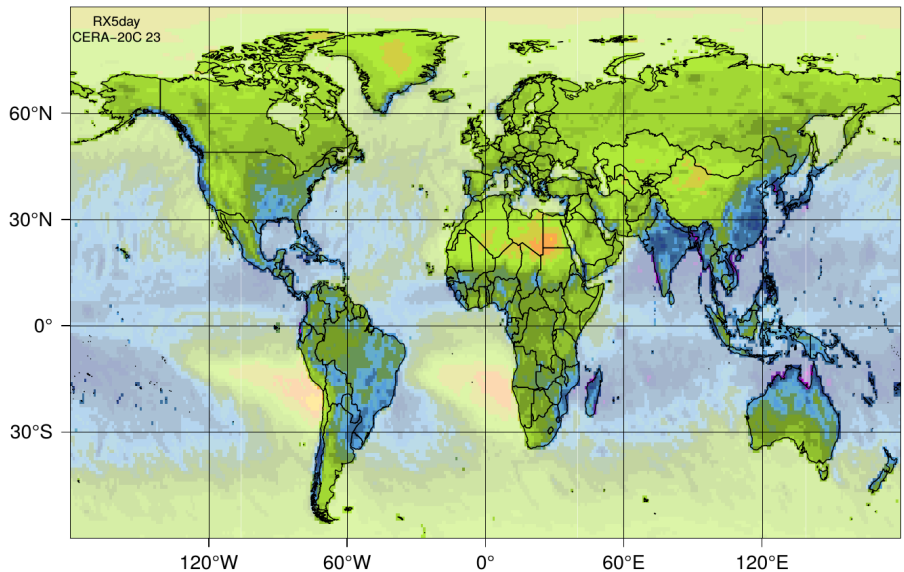
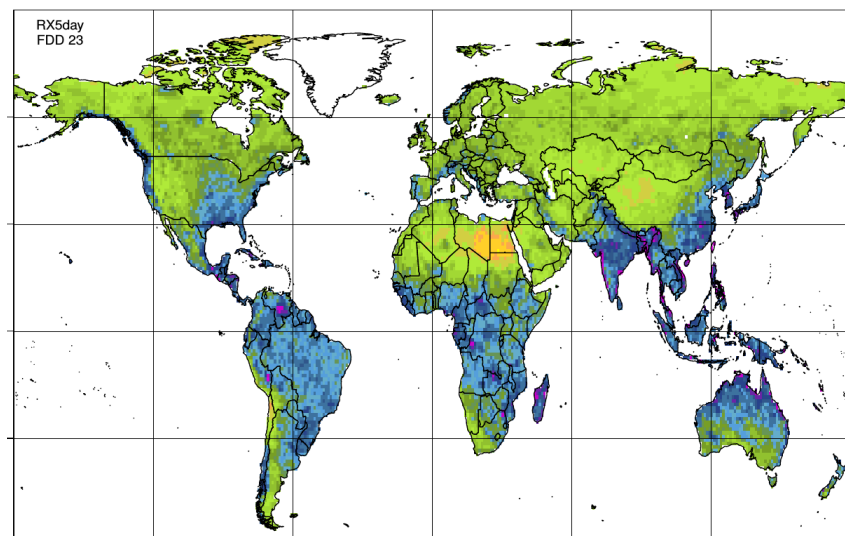
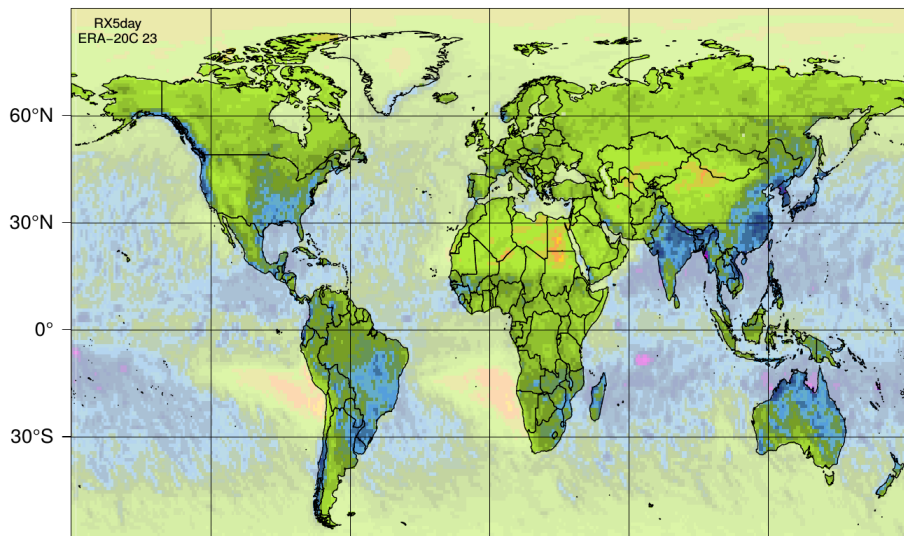
The ETCCDI are calculated

- for **Full Data Daily, ERA-20C**
- **CERA-20C** for all ensemble members and then averaged
- for the overlapping period of **23 years: 1988 to 2010**
- with a **1° spatial resolution**.

Maximum 1-day precipitation (RX1day)



Maximum 5-day precipitation (RX5day)



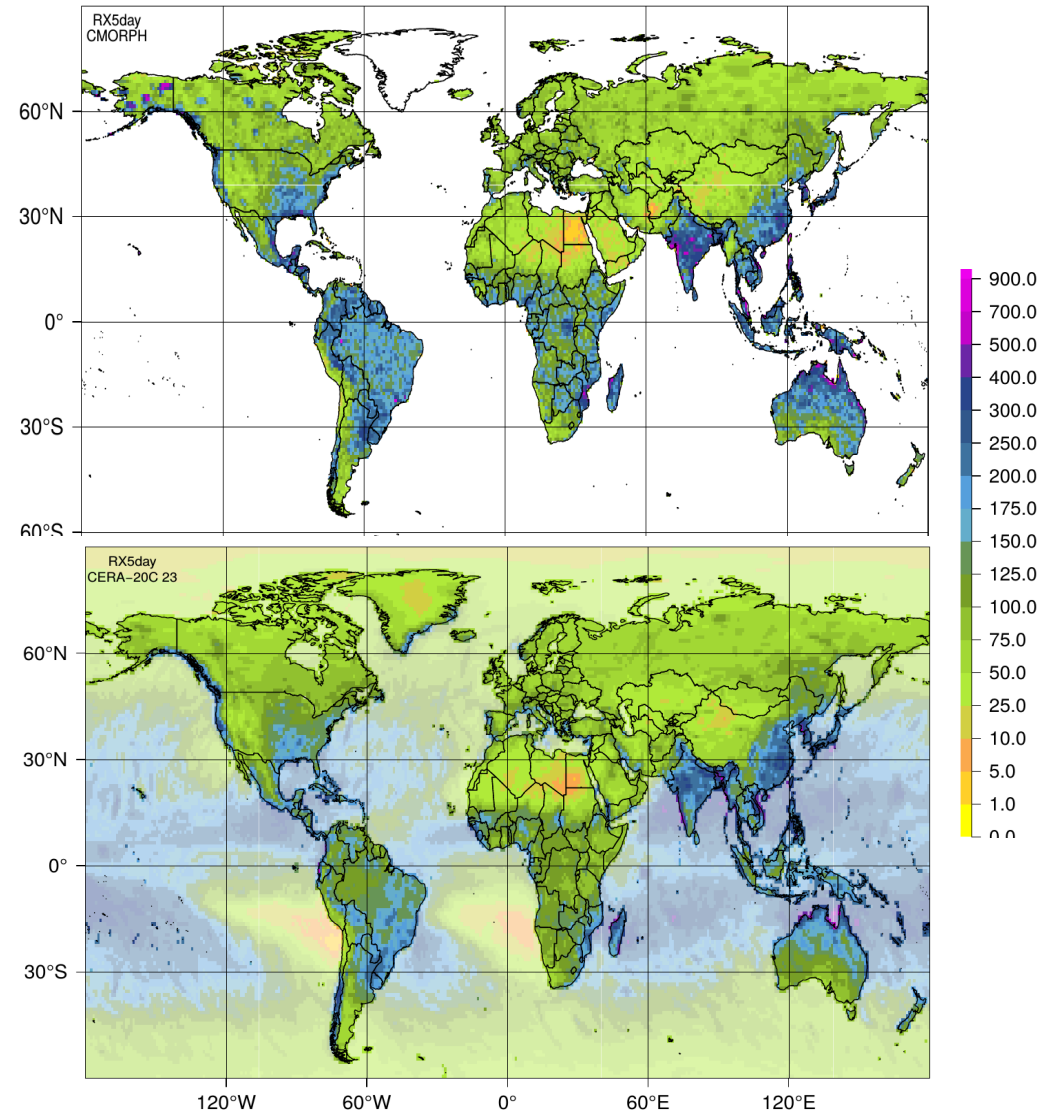
Comparison to CMORPH

- Masterthesis Raykova (2016)

CMORPH

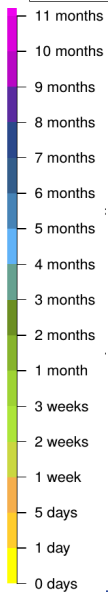
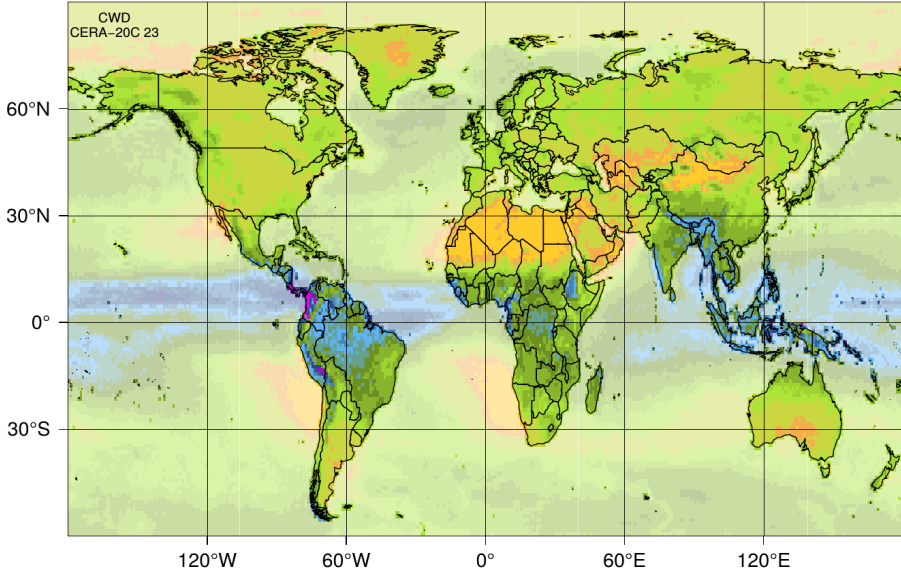
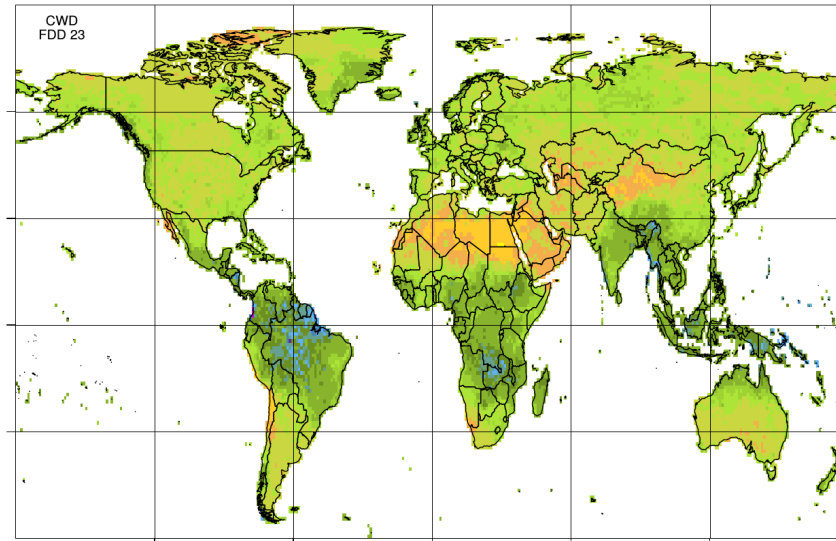
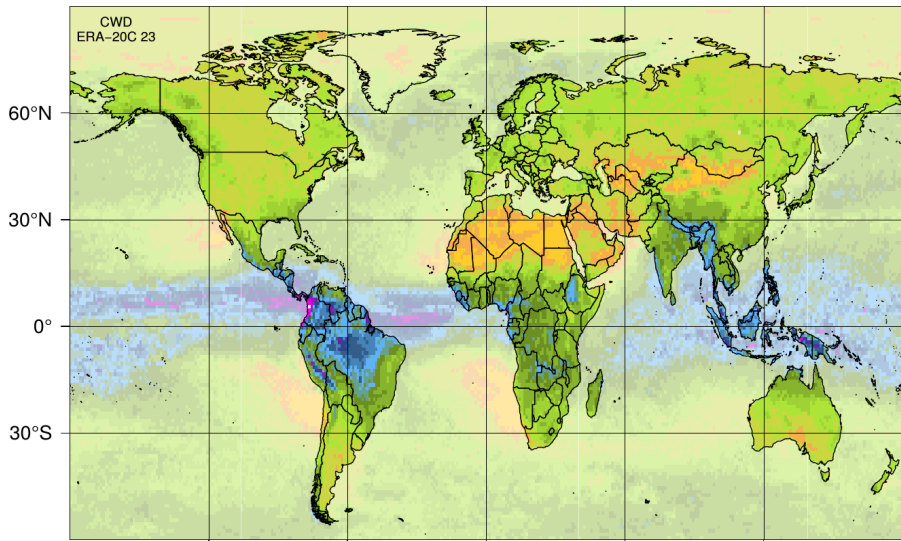
(NOAA CPC MORPHing technique)

- Global precipitation analyses
- Precipitation estimates derived from low orbiter **satellite microwave observations**
- Spatial propagation information from geostationary satellite IR data
- Bias-correction
- Combining CPC daily gauge analysis with the CMORPH.

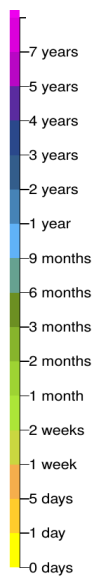
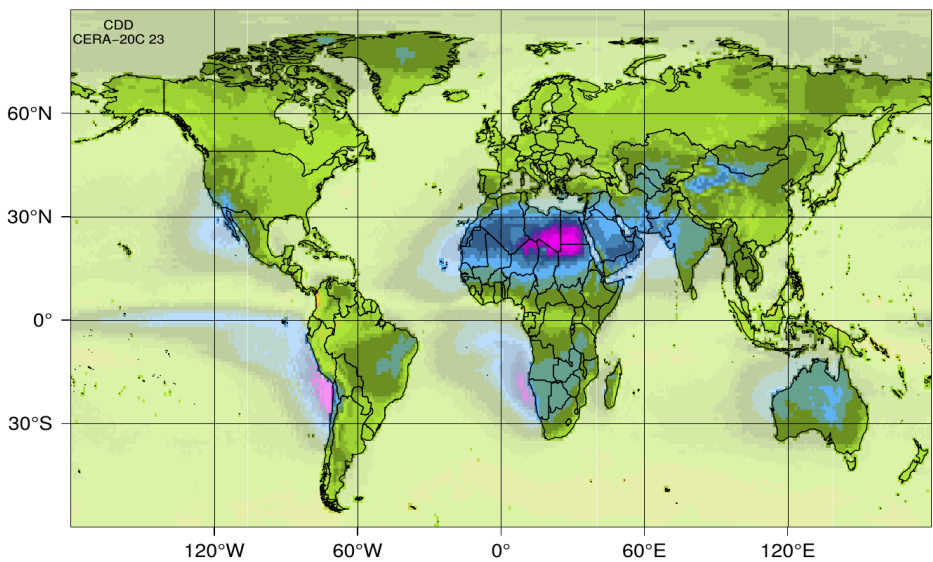
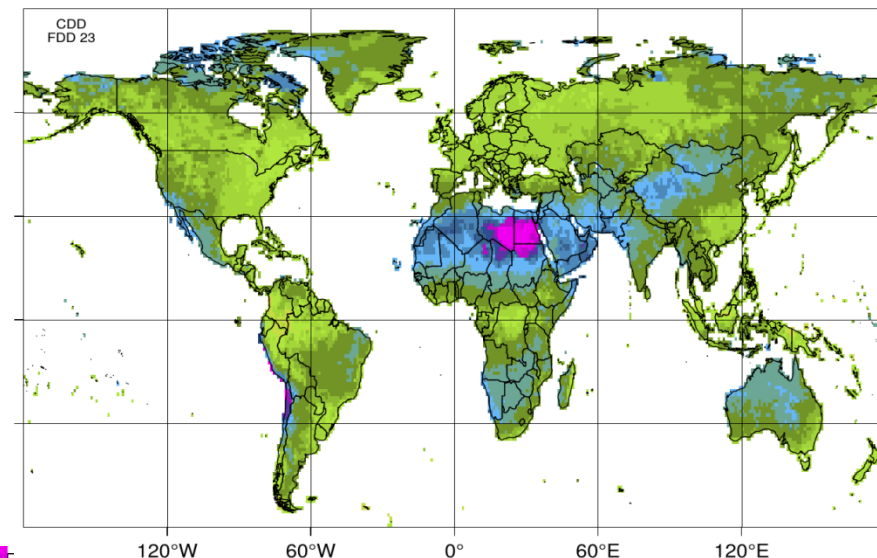
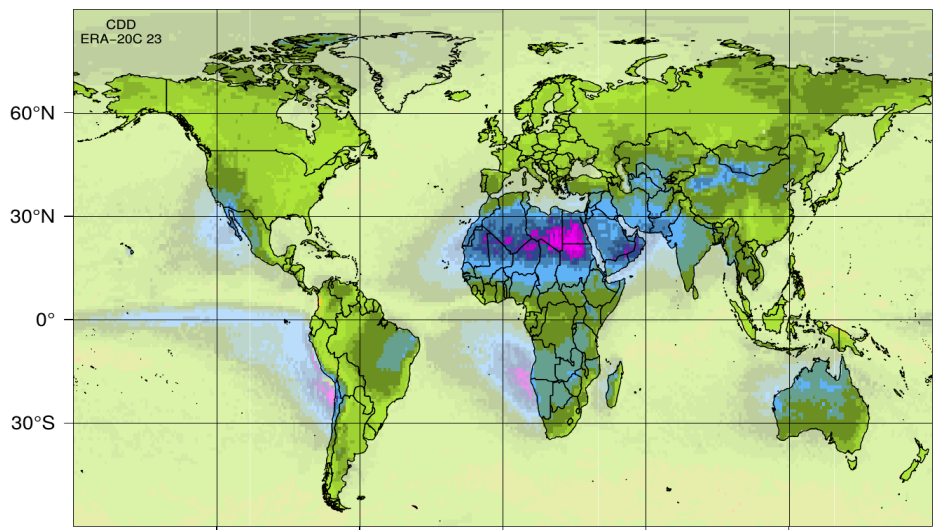


CWD

Consecutive wet days



CDD Consecutive dry days



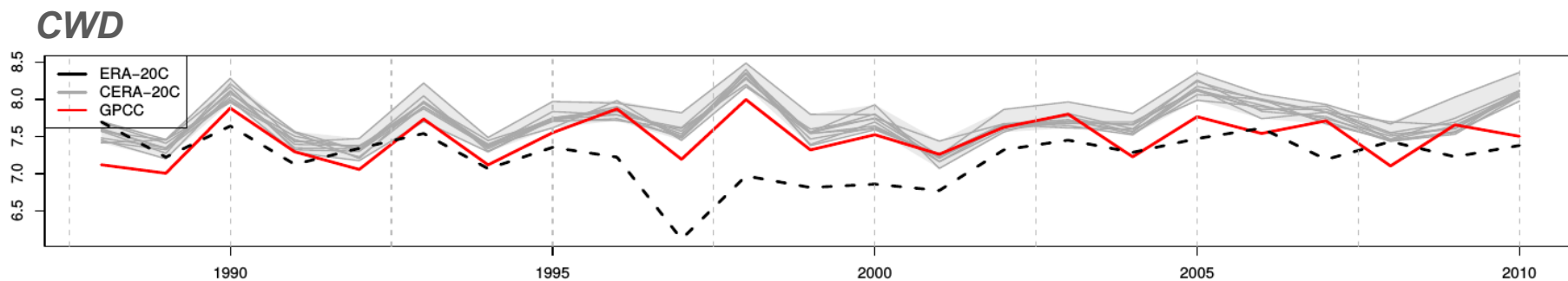
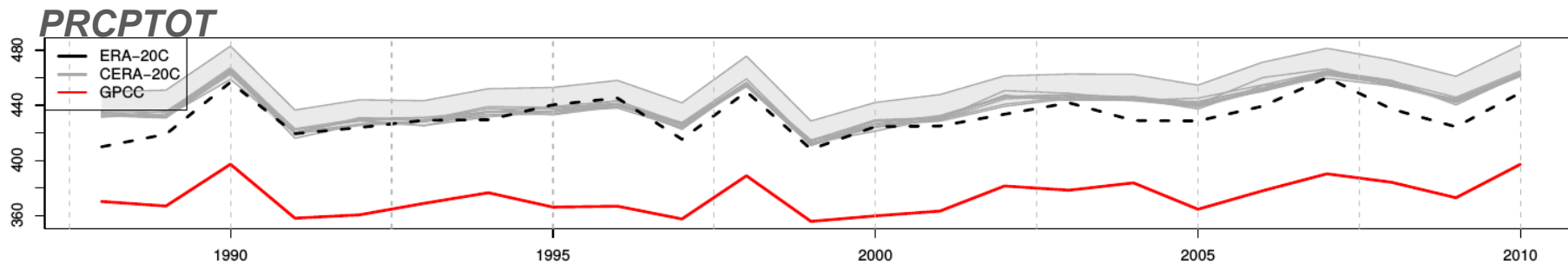
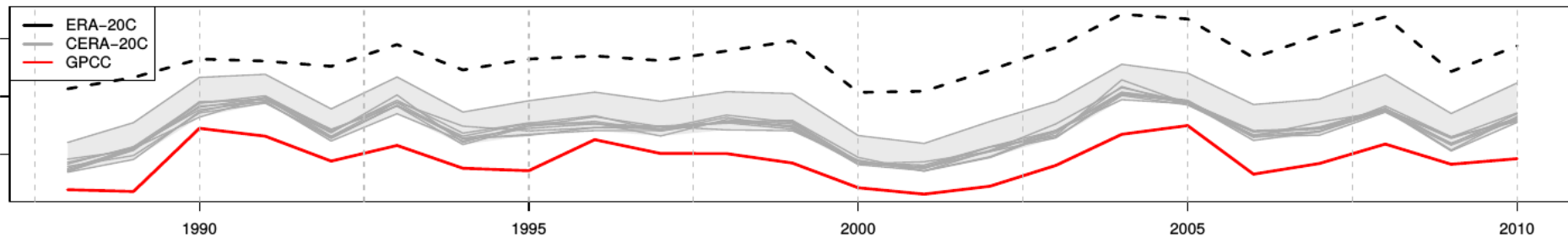
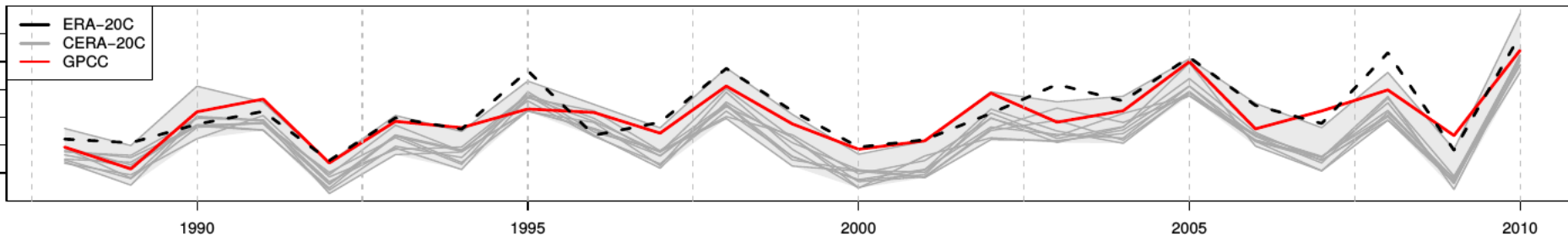


Fig. Annual values

PRCPTOT



RX5



CDD

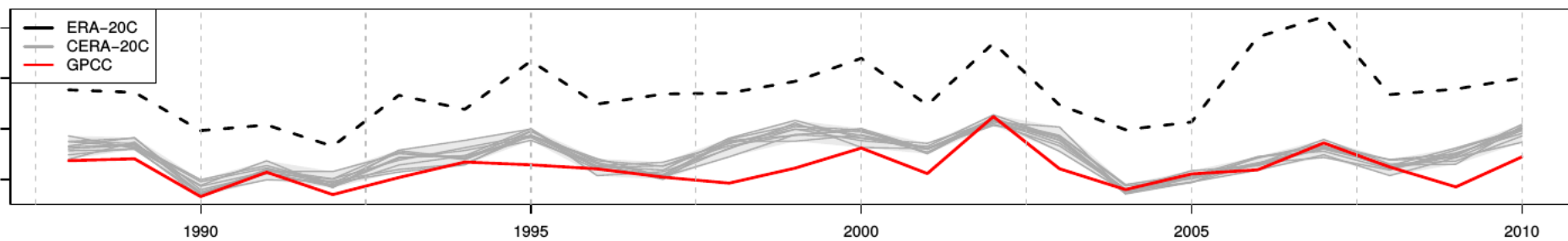


Fig. Annual values

Results

Differences between ERA_20C/ CERA_20C and FDD based on ETCCDI diagnoses were detected particularly in regions with **large precipitation totals** in the overlapping period from 1988 to 2010.

- Strong **disagreements** occur especially in Africa in the **ITCZ area/ rainforest area** and in Indonesia (*Fig. 2 and 3*).
- In general the **maximum dry spell** (CDD) shows **much better agreement than its wet pendant index** (CWD).
- A strong **BIAS** occurs in Russia, which may partly be explained by the undercatchment of solid precipitation.

Summary

The overall comparison reveals **geo-spatially heterogeneous results** with areas of similar extreme precipitation characteristics, but also areas that still remain challenging.

Outlook

- More detailed look at **smaller areas**
- Closer look at the **ensemble spread**
- Focus on **daily** precipitation

Outlook

- ➔ More detailed look at smaller areas
- ➔ Closer look at the ensemble spread
- ➔ Focus on daily precipitation

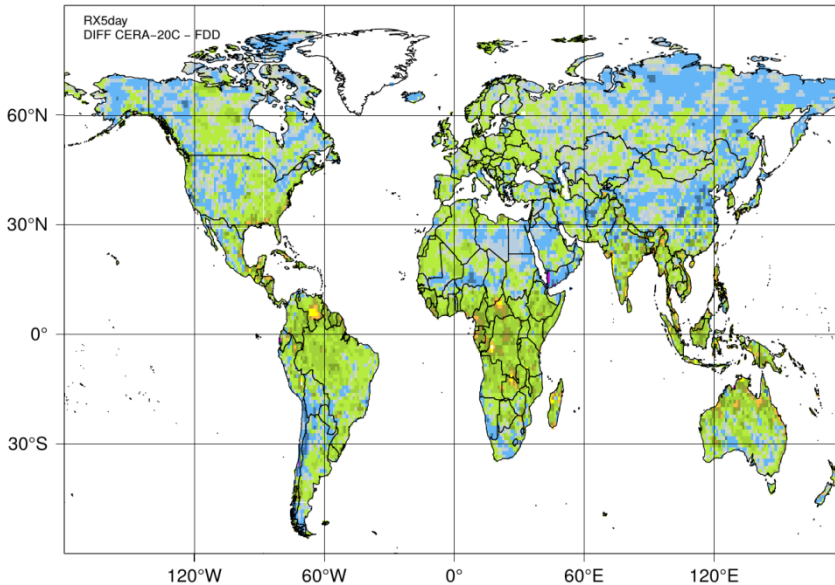
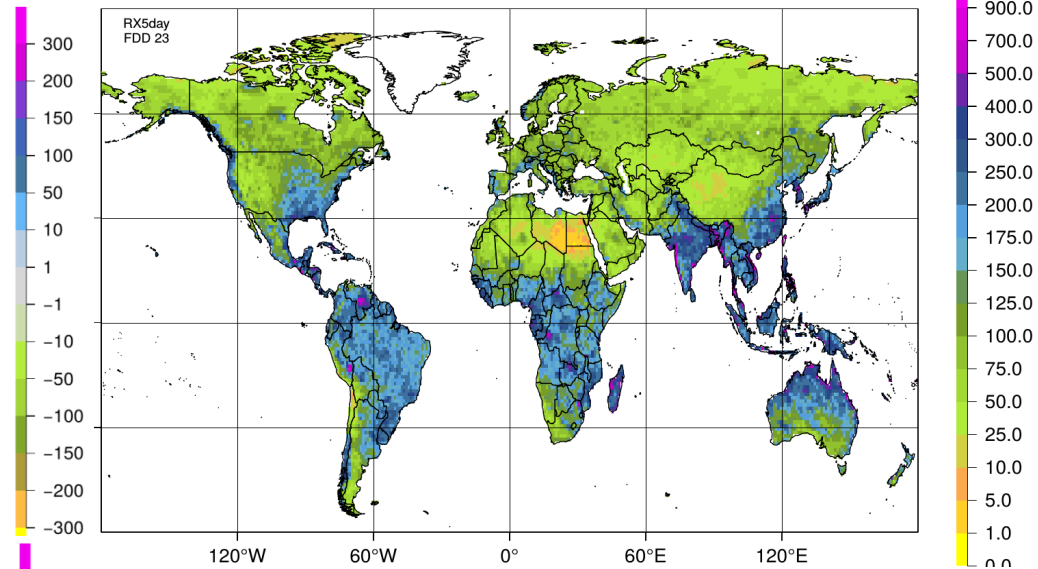
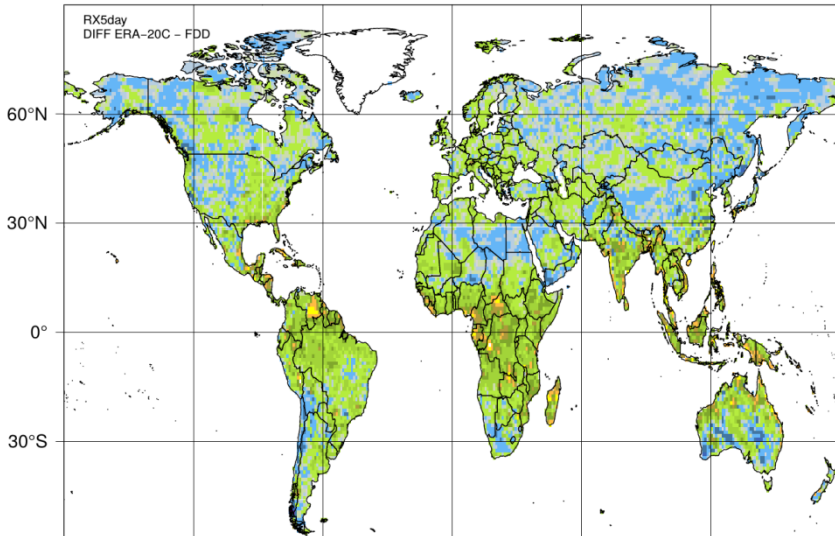
- ➔ Error assessment at GPCC monthly products
 - Helpful for the interpretation of differences between ERA-Clim2 and GPCC products

- ➔ Improved under-catchment correction of precipitation gauges

- ➔ Expertise in parameters other than precipitation, especially interpolation temperature, humidity, wind etc.
 - Due to the contribution to Copernicus' EFAS project

- CCI/WCRP/JCOMM Expert Team on Climate Change Detection and Indices: Climate Change Indices - Definitions of the 27 core indices http://etccdi.pacificclimate.org/list_27_indices.shtml, last checked 22.8.2016
- Peterson, T., Folland, C., Gruza, G., Hogg, W., Mokssit, A. and Plummer, N. (2001): *Report on the activities of the working group on climate change detection and related rapporteurs*. Geneva: World Meteorological Organization.
- Poli, P., H. Hersbach, D. Tan, D. Dee, J.-N. Thépaut, A. Simmons, C. Peubey, P. Laloy-aux, T. Komori, P. Berrisford, R. Dragani, Y. Trémolet, E. Hólm, M. Bonavita, L. Isaksen and M. Fisher (2013): The data assimilation system and initial performance evaluation of the ECMWF pilot reanalysis of the 20th-century assimilating surface observations only (ERA-20C), *ERA Report Series 14*, <http://www.ecmwf.int/publications/library/do/references/show?id=90833>
- Raykova, K. (2016): *Globale Trendanalysen von Niederschlagsextrema und Untersuchung der Extremwertverteilung basierend auf täglichen Stationsmessungen von 1988 bis 2013*, Master thesis, Institute for Atmospheric and Environmental Sciences, Goethe University Frankfurt.
- Schamm, K., Ziese, M., Becker, A., Finger, P., Meyer-Christoffer, A., Schneider, U., Schröder, M. and Stender, P. (2014): Global gridded precipitation over land: a description of the new GPCC First Guess Daily product. *Earth System Science Data*, 6(1), pp.49-60.
- Schneider, U., A. Becker, P. Finger, A. Meyer-Christoffer, M. Ziese, B. Rudolf (2014): GPCC's new land surface precipitation climatology based on quality-controlled in situ data and its role in quantifying the global water cycle. *Theoretical and Applied Climatology*, 115(1), pp. 15-40.

Difference Maximum 5-day precipitation (RX5day)



Prospective

- Error assessment at GPCC monthly products
 - Helpful for the interpretation of differences between ERA-Clim2 and GPCC products
- Improved under-catchment correction of precipitation gauges
- Expertise in parameters other than precipitation
 - temperature, humidity, wind etc.
- Due to the contribution to Copernicus' EFAS project

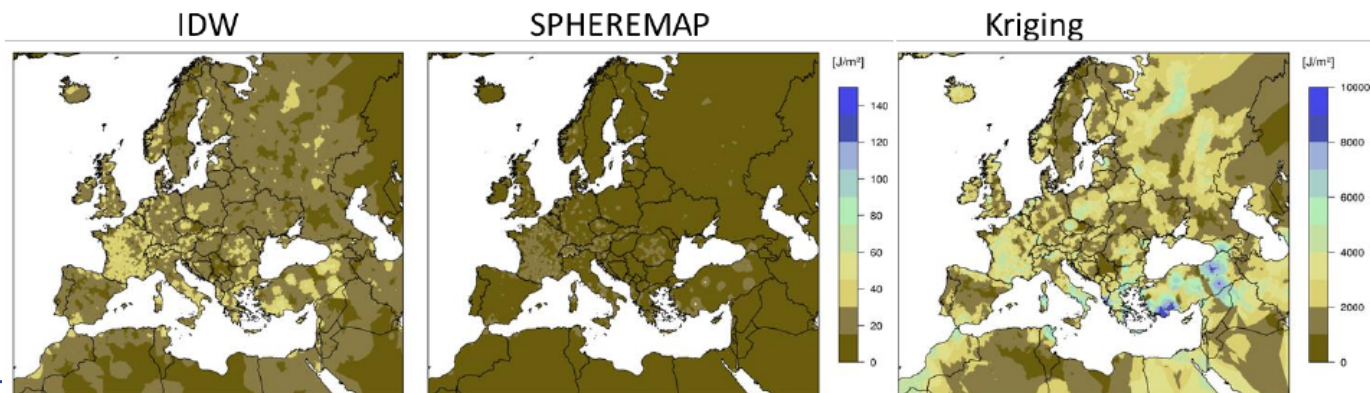


Figure 12: Uncertainty of interpolated solar radiation for 2014-05-15.