The PCR-GLOBWB global hydrological reanalysis product

N.Wanders[1], E.H. Sutanudjaja[1], L.P.H van Beek[1] , M.F.P. Bierkens[1,2]
1 Department of Physical Geography, Utrecht University, The Netherlands
2 Unit Soil and Groundwater Systems, Deltares, The Netherlands

Introduction

Accurate and long time series of hydrological data are important for understanding global land surface water and energy budgets, as well as for improving real-time hydrological monitoring and detecting climate change. The ultimate goal of the present work is to produce a multi-decadal hydrological reanalysis data set with retrospective and updated hydrological states and fluxes that are constrained to available in-situ river discharge measurements.

Material and Methods

The global Hydrological Model PCR-GLOBWB (Figure 1) was used to simulate global river discharge. Parameters of PCR-GLOBWB were estimated with an Ensemble Kalman Filter (EnKF) based on observations of 256 discharge stations from the GRDC. A total of 64 members were used. Next to the hydrological parameters, GPCP- corrected ERA-Interim precipitation was used and updated using the hydrological model, the DA framework and the discharge observations of. Precipitation was updated using upslope and downslope precipitation and distance from the sea. Monthly wind observations were used to calculate wind direction and the travelled distance of clouds.

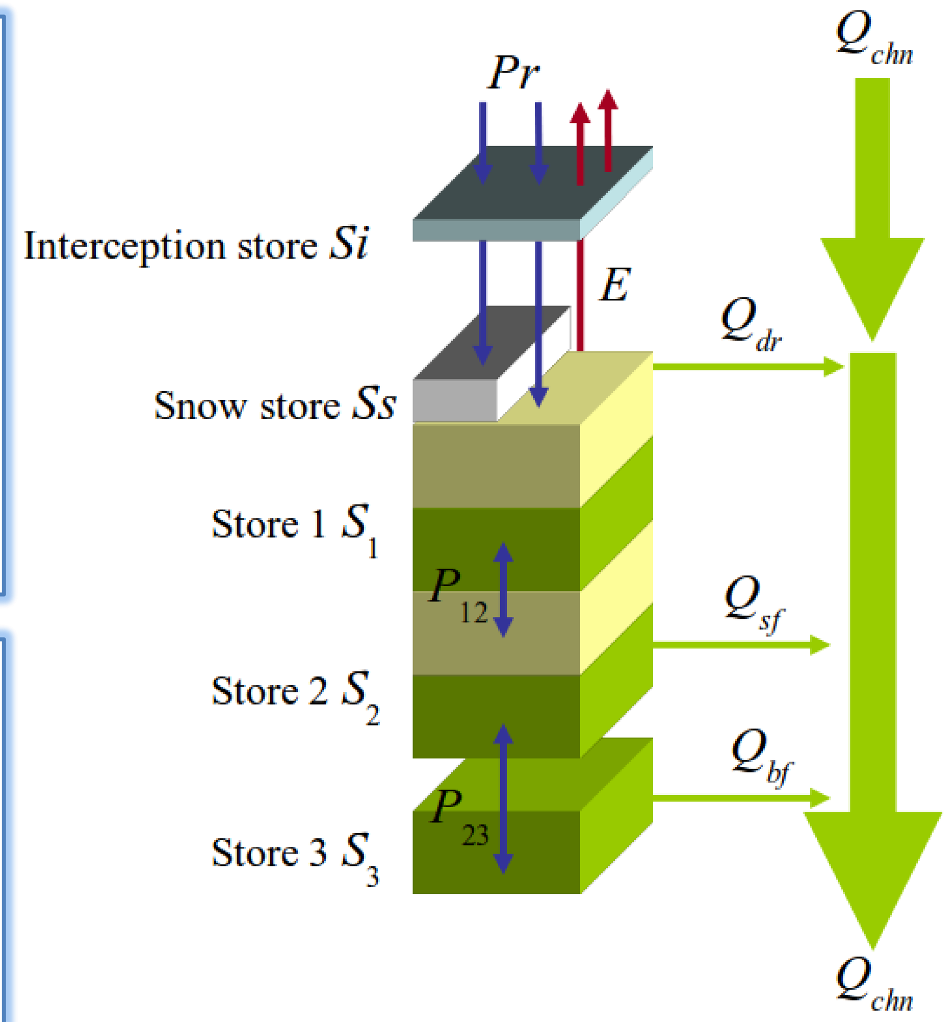

Figure 1: Model concept of PCR-GLOBWB
Left: layers describing soil hydrology including the canopy, snow cover, soil layers and groundwater reservoir, as well as the exchange between them.
Right: specific local runoff components, routed as discharge along the channel

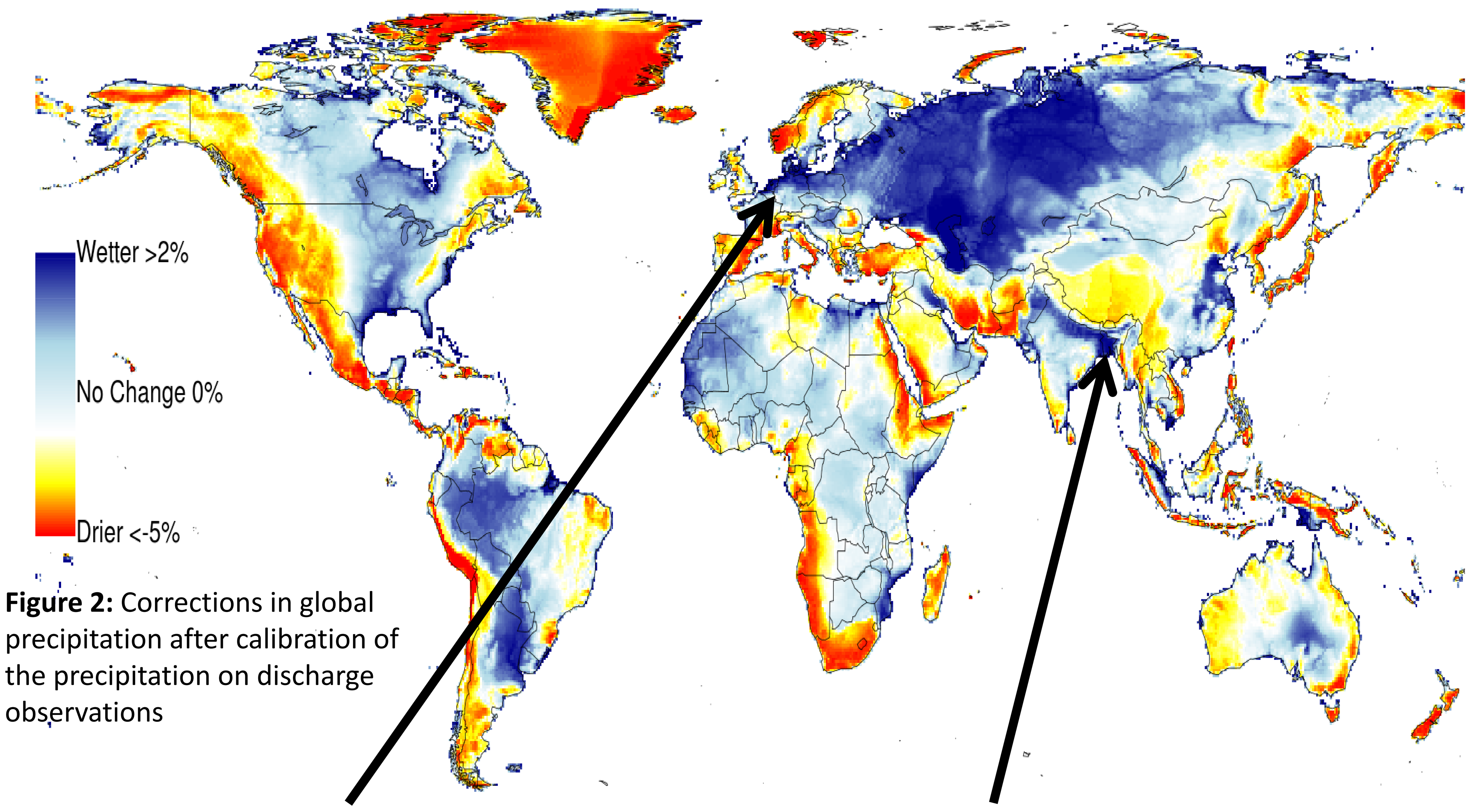

Figure 2: Corrections in global precipitation after calibration of the precipitation on discharge observations

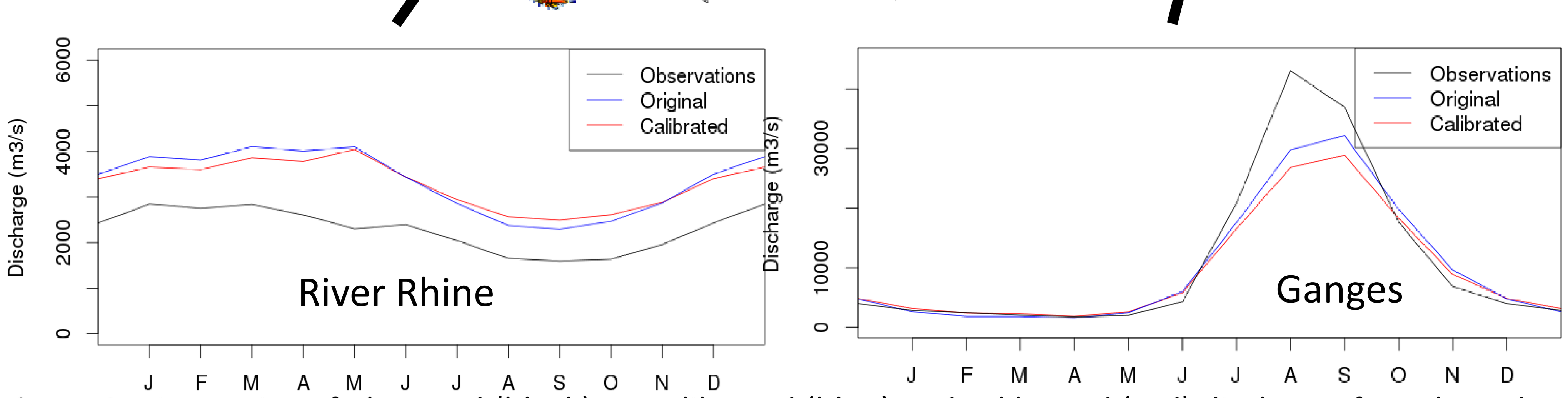

Figure 3: Timeseries of observed (black), uncalibrated (blue) and calibrated (red) discharge for selected stations.

Results

Results show that globally precipitation is reduced by 2%, while the spatial pattern shows mainly a decrease leeward of mountainous regions (Figure 2). Furthermore, it is shown that discharge simulation improves. This shows that it is possible to improve the PCR-GLOBWB parameterization globally, while at the same time, correcting the precipitation data field.

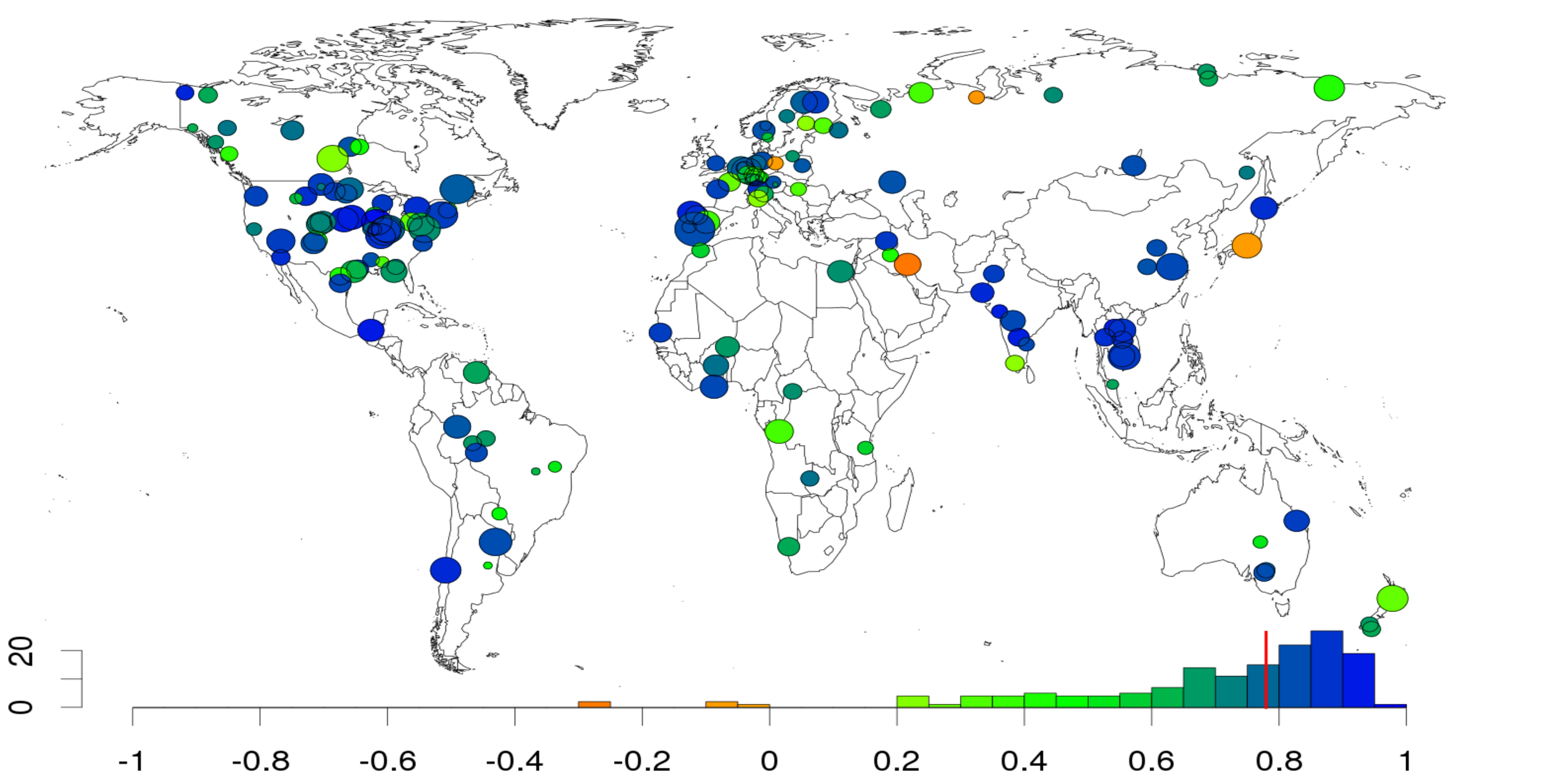

Figure 4: Correlation of simulated discharge and observations from GRDC (256 stations). Size of the circle indicates the mean discharge.

Conclusion and future work

The main outcome of this work is a 1960-2010 global reanalysis dataset that includes extensive daily hydrological components, such as precipitation, evaporation and transpiration, snow, soil moisture, groundwater storage and discharge. This reanalysis product may be used for understanding land surface memory processes, initializing regional studies and operational forecasts, as well as evaluating and improving our understanding of spatio-temporal variation of meteorological and hydrological processes.
In the future, we plan to include more observations of discharge and of additional hydrological variables from remote sensing to further improve the hydrological reanalysis product.

Universiteit Utrecht

7th International Scientific Conference on the Global Water and Energy Cycle
14-17 July 2014, The Hague, The Netherlands

Netherlands Organisation for Scientific Research