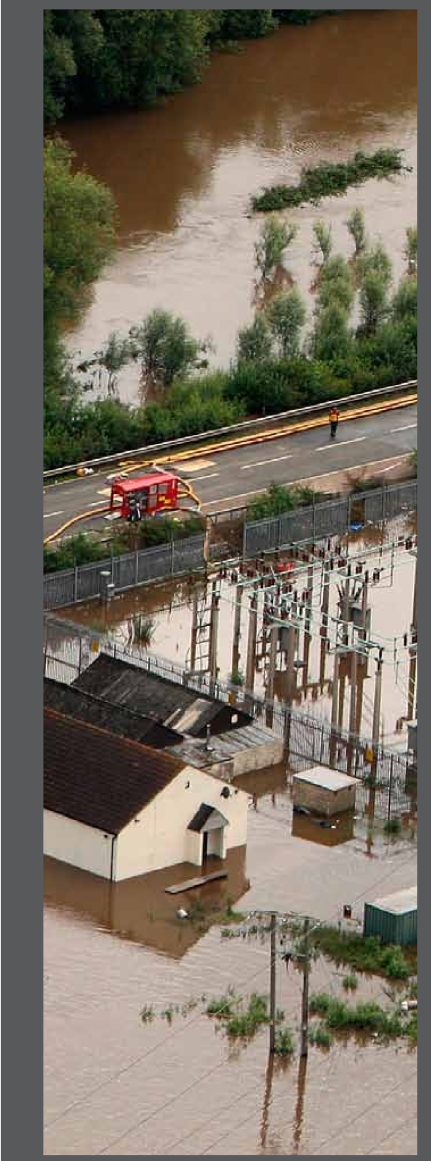

Using river discharge to assess the quality of different precipitation datasets over large-scale basins

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Introduction

In this study we evaluate different precipitation corrections applied to the ECMWF ERA-Interim reanalysis in terms of long-term means and variability of river discharge over several large-scale basins. We compare the original ERA-Interim dataset, the precipitation correction used in the ERA-Interim/Land dataset (adjusted using GPCP) and the WFDEI dataset (adjusted using CRU and GPCC, *Weedon et al.* 2014). Global simulations (see Table 1) with the land surface model HTESSEL (*Balsamo et al.* 2015) were performed with the different datasets and the simulated runoff routed using the river-floodplain model CaMa-Flood (*Yamazaki et al.* 2011). The simulations were evaluated over 35 basins in the world (see Fig. 1).

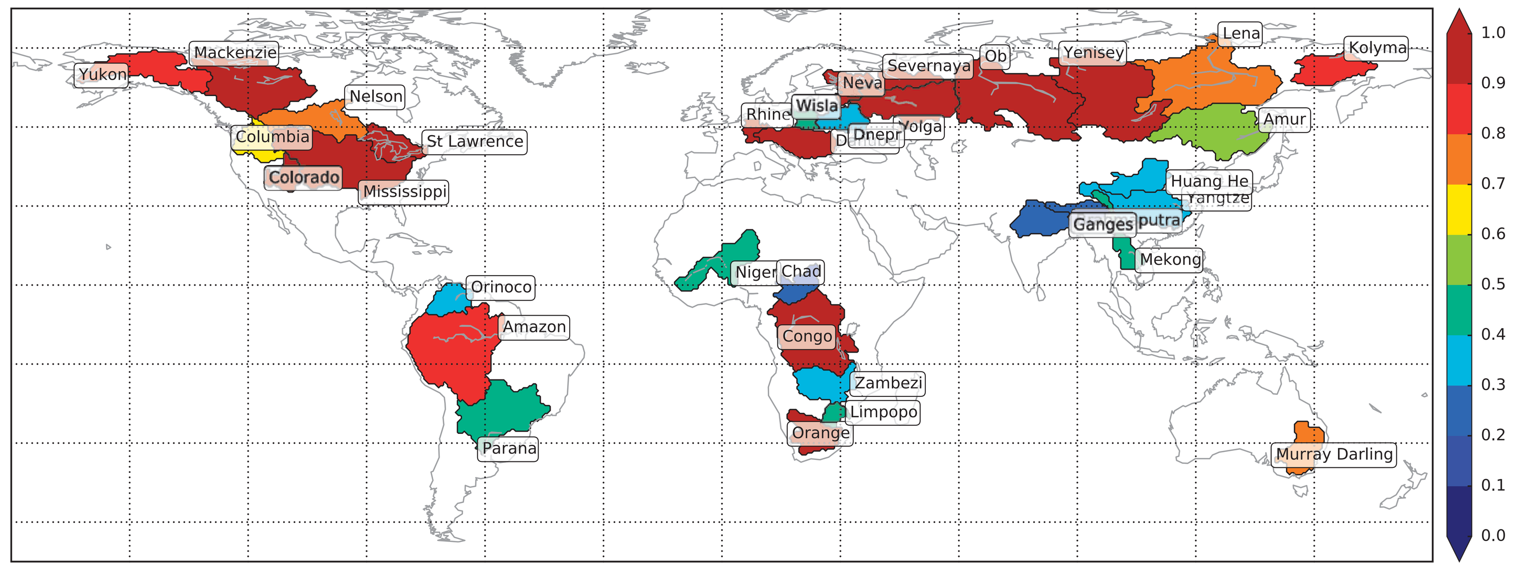

Figure 1 Overview of the basins used in the model simulations evaluation. The colours indicate the fraction of daily (or monthly) data available for the period January 1979 to December 2010.

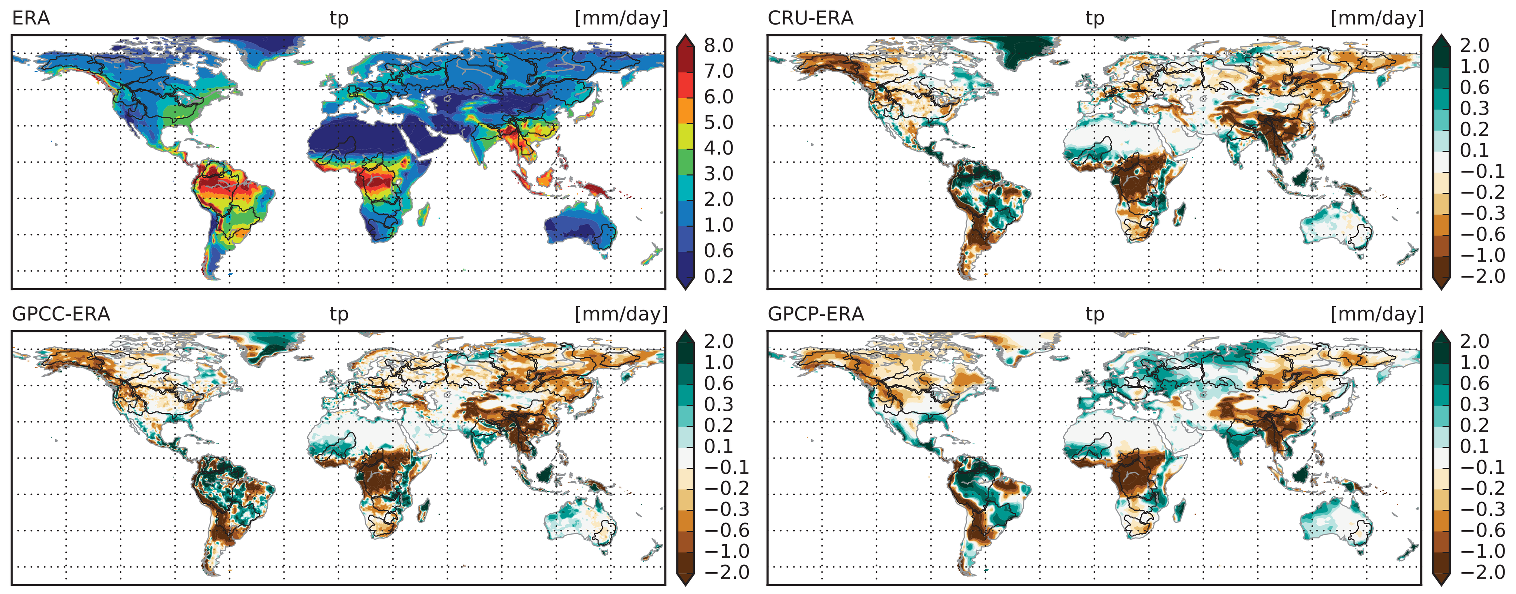

Figure 2 Long-term (1979-2010) mean daily precipitation in E_ERA (top left) and differences between W_CRU (top right), W_GPCC (bottom left) and E_GPCP (bottom right) and E_ERA.

Simulation	Atmospheric forcing	Precipitation
W_CRU	WFDEI	WFDEI : CRU
W_GPCC	WFDEI	WFDEI: GPCC
W_ERA	WFDEI	ERA-Interim
W_GPCP	WFDEI	ERA-Interim: GPCP
E_ERA	ERA-Interim	ERA-Interim
E_GPCP	ERA-Interim	ERA-Interim: GPCP

Table 1 Simulations overview

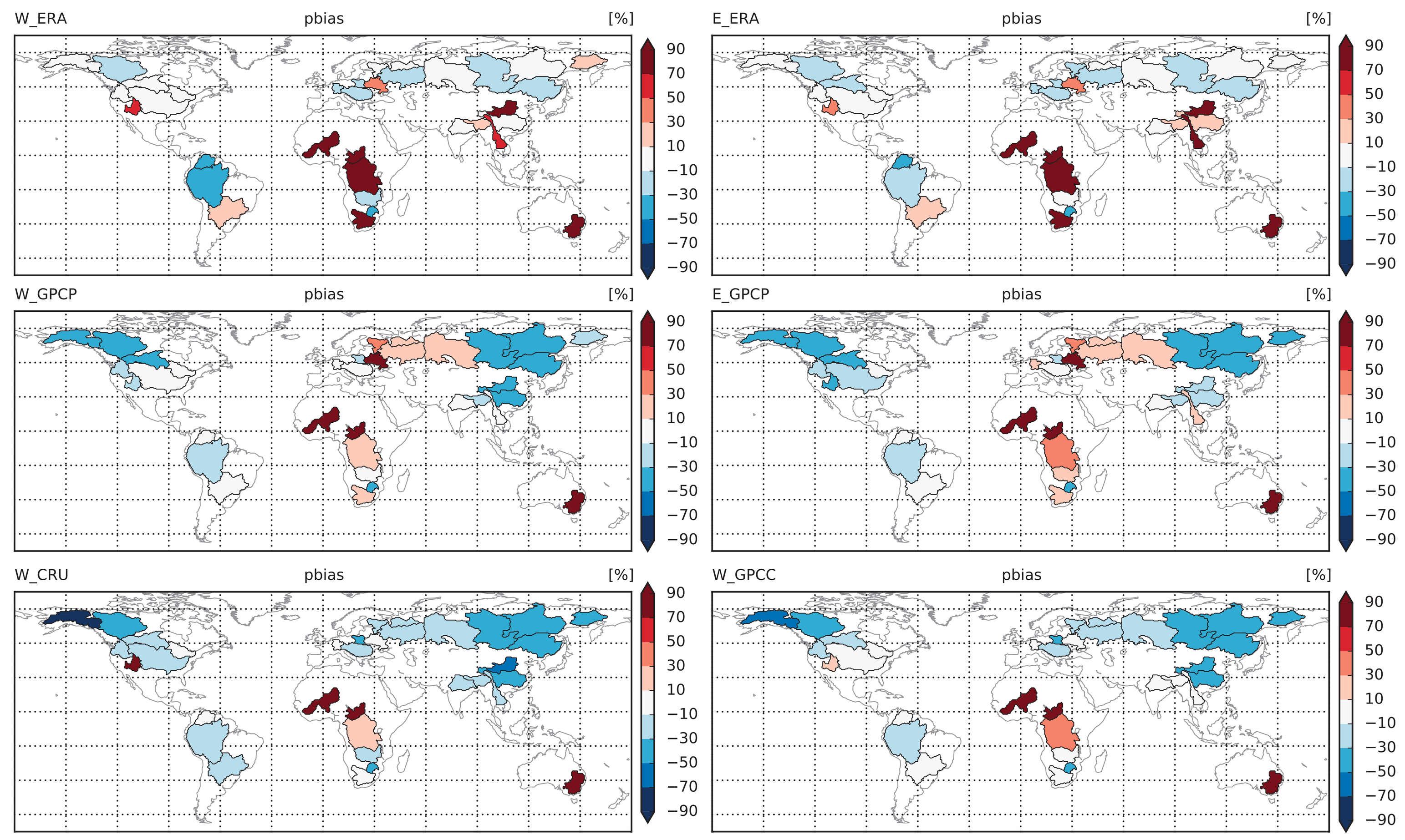

Figure 4 Percent bias of river discharge of the different simulations.

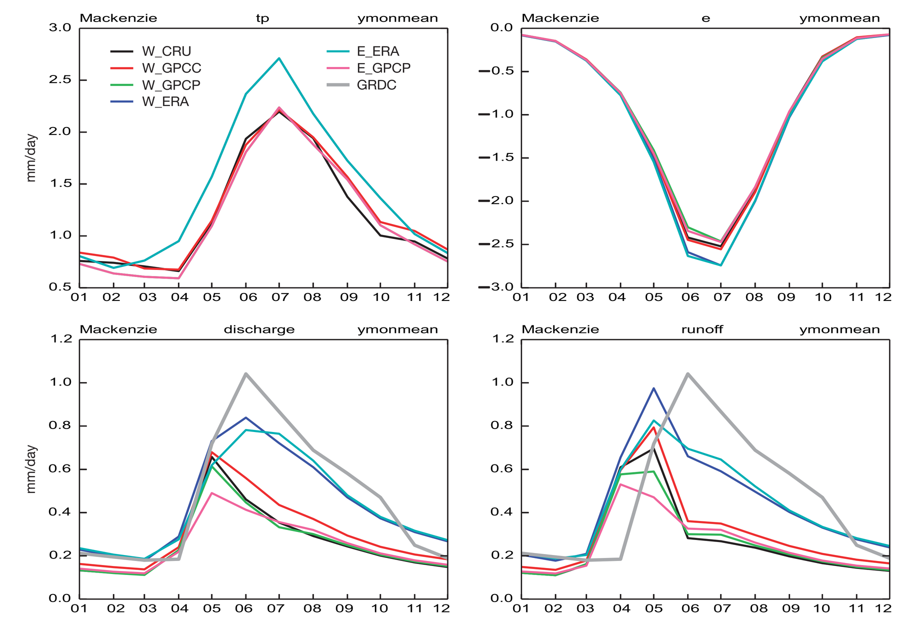

Figure 6 Examples of the mean annual cycle of precipitation, evapotranspiration, river discharge, and runoff in the Mackenzie basin.

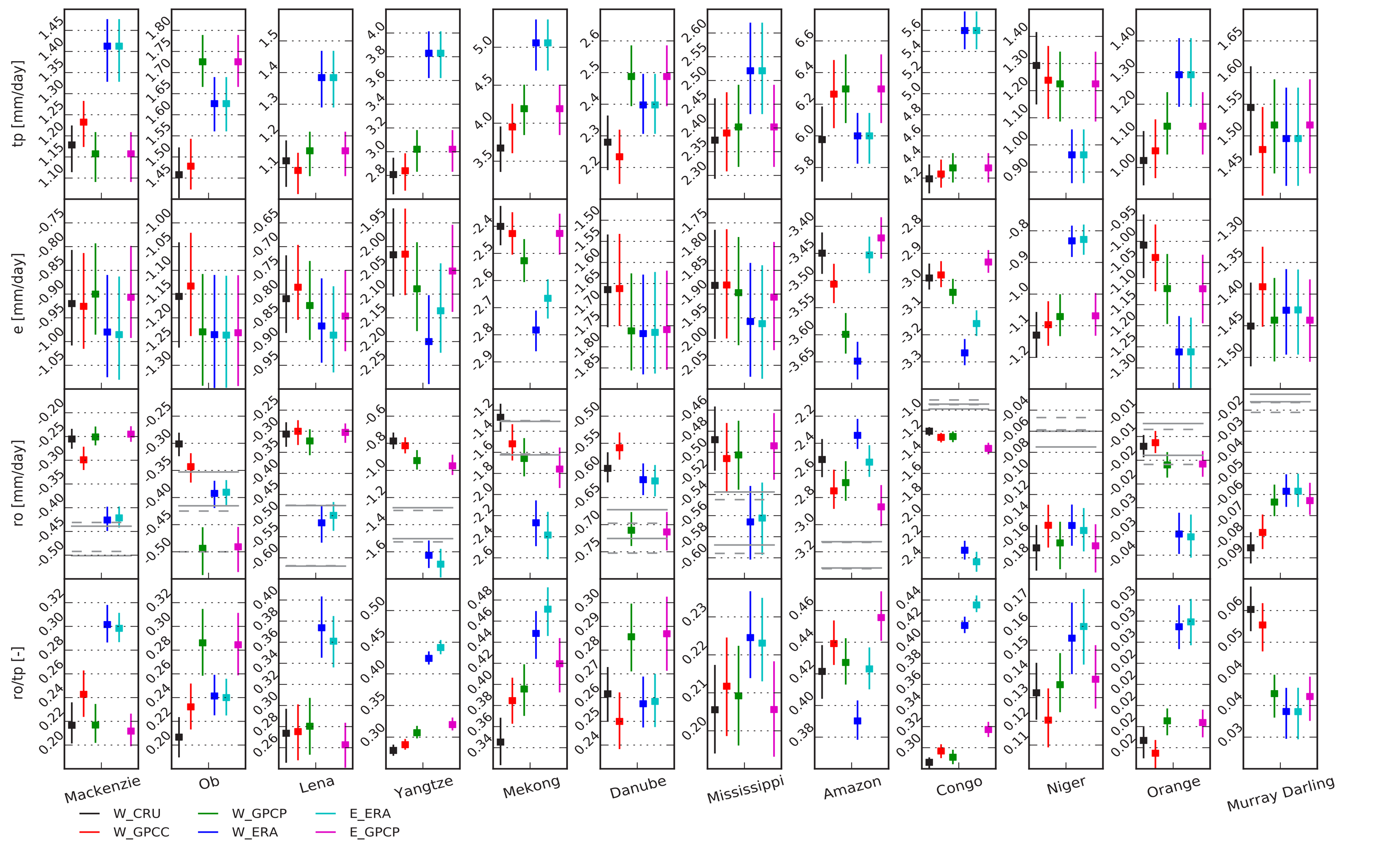

Figure 3 Long-term mean (1979–2010) precipitation, evapotranspiration, runoff and runoff coefficient (panel lines) for selected basins (panel columns) in each simulation (different colours). The symbols indicate the mean estimate and the vertical lines the 95% confidence intervals from a 10000 samples bootstrap. In the runoff panels, the horizontal grey lines indicate the 95% confidence intervals of the GRDC observations.

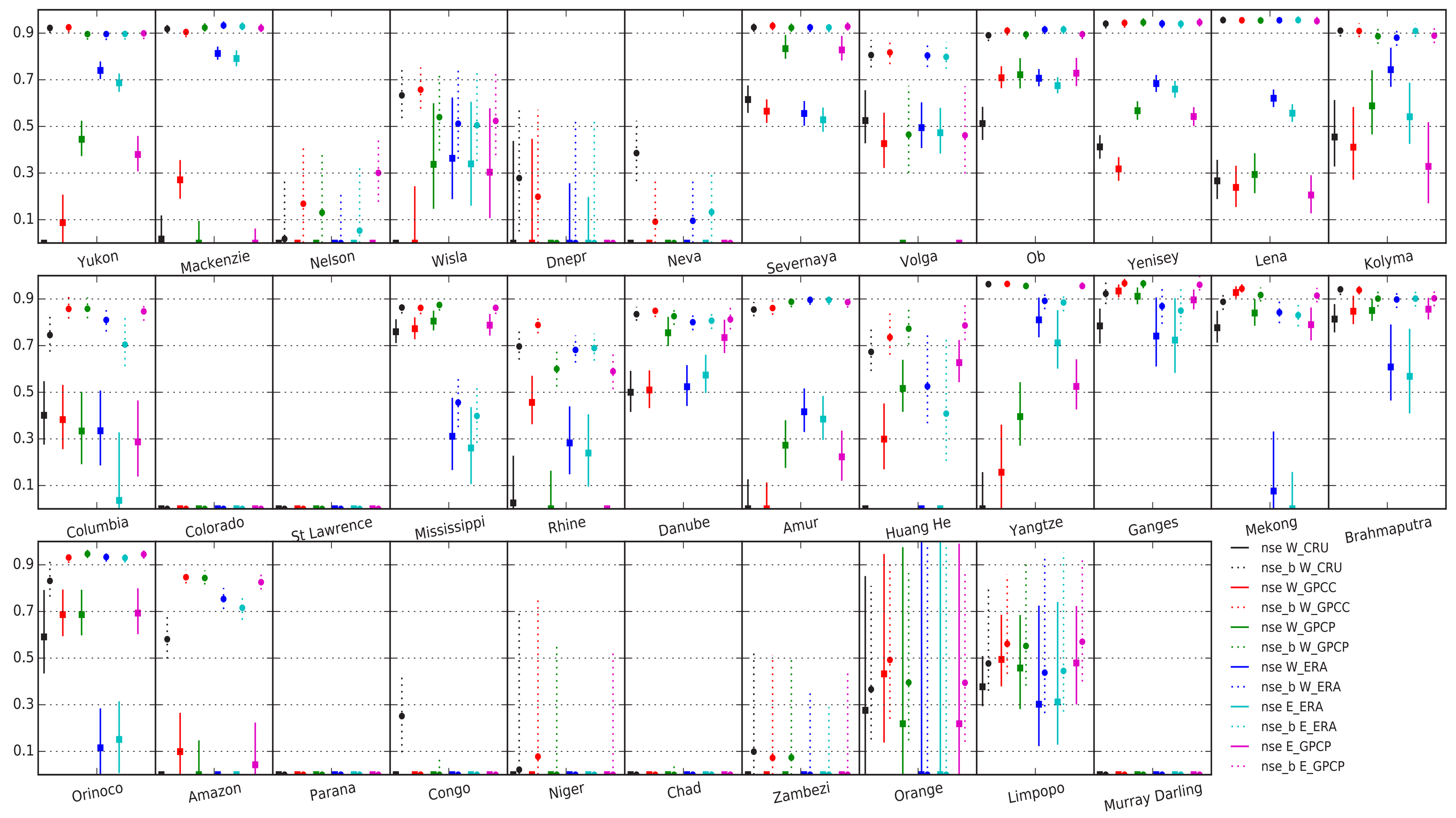

Figure 5 Nash-Sutcliffe model efficiency coefficient for the different basins using monthly discharge. The square symbols indicate the mean estimate and the solid lines the 95% confidence interval. The circles (and 95% confidence in dashed) indicate the coefficient after bias correcting the mean annual cycle of the simulations.

Results

1) The mean differences in precipitation (Fig.2) indicate an overestimation of ERA-Interim over Central Africa, South East Asia, Andes and central Argentina, Rocky Mountains and North West Canada, while there is an underestimation over the Amazon, West Africa and India.
2) When comparing the long-term mean of the water fluxes (Fig. 3) the biases found in runoff do not necessary follow those of precipitation. This is further highlighted in the discharge percent bias maps (Fig. 4) where for example the wet bias of ERA-Interim precipitation over North Canada (e.g. Fig. 6) is not reflected in an overestimation of discharge;
3) The comparison of the Nash-Sutcliffe between monthly simulated discharge and simple bias-corrected discharge (Fig. 5) identifies the basins where the biases and timing errors of discharge can be associated with the forcing/routing limitations and there is potential for improvement.

Discussion

1) It is possible to evaluate the long-term discharge over highly regulated basins (e.g. *Volga, Nelson*);
2) It is necessary to bias correct ERA-Interim precipitation over Central Africa and South East Asia (reduce the wet bias);
3) The bias correction over Northern latitudes do not consistently improve the mean biases and variability when compared with ERA-Interim (problem with gauge correction in those regions);
4) Large over-estimation of discharge in some basins might result from neglecting human activities in the model;
5) The relation between discharge and precipitation biases is also controlled by other meteorological factor (e.g. available energy), and depends on the model formulation, in particular for evapotranspiration.

References

Balsamo, G., et al. 2015: ERA-Interim/Land: a global land surface reanalysis data set, *Hydrol. Earth Syst. Sci.*,doi: 10.5194/hess-19-389-2015.

Weedon, G. P., et al, 2014: The WFDEI meteorological forcing data set: WATCH Forcing Data methodology applied to ERA-Interim reanalysis data, *Water Resour. Res.*, doi: 10.1002/2014wr015638.

Yamazaki, et al, 2011: A physically based description of floodplain inundation dynamics in a global river routing model, *Water Resour. Res.*, doi: 10.1029/2010wr009726.

Acknowledgements

This research received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 603608, "Global Earth Observation for integrated water resource assessment": eartH2Observe.

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