RESPONSE TO REFEREE COMMENT BY DAI YAMAZAKI

General comment: "The consistency of the large-scale hydrological data was analyzed in the proposed manuscript. The research is well structured, and the result shown in the paper is quite informative for hydrological community, especially for global hydrological model users. I recommend some more discussions (suggested below) to be included in the manuscript, but the paper is worth being published in HESS after the minor revision."

Response: We thank Dr. Yamazaki for the positive comments about our manuscript. We also appreciate the suggestions of further discussion, which were incorporated into the revised manuscript (see the response to the specific comments below and also the Overall Comment posted separately).

COMMENT #	*COMMENT AND RESPONSE*
1	"–P491.L2: the possibility to use high-resolution topographic data in global modelling, e.g. for runoff routing (Gong et al., 2011) > There also exists a recently-developed method which automatically delineates a global gridded hydrography and its sub-grid topographic parameters from the high-resolution hydrographic datasets [Yamazaki et al. 2009]. It allows the representation of sub-grid-scale basins within a framework of GHM river routing [e.g. Yamazaki et al., 2011]." **Response:** We found the references interesting and useful and have added them to the revised manuscript.
2	"– P492.L18: the CRU and the GPCC bias-corrected WATCH forcing data > Please describe what is the baseline data of these precipitation data, and what type of bias correction was performed. Given that the precipitation data are of the most important dataset of this study, a detailed explanation is better to be added to the manuscript." **Response:** Good point. In the data section, we have added further descriptions of all climate datasets used, not only the WATCH precipitation, to accommodate a better understanding of how they were produced and what type of data was used.
3	"– P493.L18: the symmetric error > Why the term "symmetric" is used? The errors must be randomly distributed." **Response:** We agree that the term symmetric error is misleading and have changed all instances in the text to "relative area difference", which better describes the measure. We also added a short comment to clarify that we are using the same measure as Fekete et al. (1999) and Döll and Lehner (2002), but not their wording.
4	"– P495.L10: In reality, a long-term basin RC even close to unity is implausible > Please add some explanation (or reference) to this sentence." **Response:** As the referee suggests, we have added a short explanation of the statement in section 3.2 to clarify our assumption. A long-term RC close to unity would mean that almost no losses of interception or evaporation flux to the atmosphere would occur in the basin, even over several years. For most basins evaporation substantially reduces the amount of fallen precipitation that reaches the basin outlet. Even in very cold systems, losses caused by

interception and sublimation can be substantial (e.g. Strasser et al., 2008).

5 "– P495.L13: In order to…
> I recommend to start a new paragraph from this sentence, because the topic has changed."

Response: text changed according to suggestion

6 "– P496.L9: it was decided to limit the study to basins larger than 5000 km
> The area of 5000 km approximately accounts for 2 cells of 0.5x0.5 degree grid. In this small case, sub-grid-scale variability of precipitation and evaporation within a single grid may cause an error in water balance analysis. Though I don't think the error due to the sub-grid variability of precipitation/evaporation is not so significant because we can see a similar trend in water balance errors for gauges located in a certain areas (Fig. 8), but I recommend to write the uncertainty due to the sub-grid variability of precipitation/evaporation."

Response: This is an important comment and we have addressed it in conjunction with comment #8 below, which also highlights the possible effects of sub-grid variability.

7 "– P496.L21: There was little consistency in the errors between datasets except for a few largely over- and underestimated stations in DDM30 and STN-30p.
> What is a possible cause of the large errors consistent between DDM30 and STN-30p. I suppose this is caused by the errors in reported drainage area of GRDC gauges, given that the river networks of DDM30 is modified to fit the reported drainage area of GRDC gauges".

Response: This is correct. We indicated this in the manuscript (in section 5.1) with a reference to Figure 5 in Döll and Lehner (2002), but have added a comment to clarify that changes in the reported areas are the likely causes of the consistency in errors observed for a few stations.

8 "– P497.L6: To minimize the effect of area discrepancies, results shown are based on the GIS-polygon basin delineation.
> How the gridded precipitation and evaporation are compared against the polygonbased runoff? Did the comparison consider the sub-grid-scale overlap between a 0.5deg grid box and a polygon boundary? In case of gauges with small drainage areas, the interpolation of precipitation/evaporation considering sub-grid-scale distribution may be important (though it may not be significant in long-term analysis.)"

Response: We agree that the original manuscript did not clearly enough describe how climate data were compared for polygon-delineated basins. We have therefore added a new figure (Figure 1 in the revised version) and also clarified in section 2 (Data) that evaporation and precipitation were considered uniform over the grid cell and only the part of the cell intersected by the polygon was considered to contribute to a basin. We agree that taking sub-grid variability of evaporation and precipitation into account could be important to improve the basin water balances and we have added a short discussion on this in section 5.2 (Discussion on consistency between datasets).

9 "– P499.L22: Hence, many small catchments were well represented even in the 0.5âŮę grid.
> This is generally true, but strictly we cannot say a catchment is correctly represented on a river network map only from the comparison of the drainage areas. Even though the drainage area on the river network map is close to the reported area of GRDC, the actual shape of the catchment (on polygon data) may

	not be correctly represented by rectangular grid boxes." **Response:** This is a good comment and we have addressed it by clarifying that basin area was the only metadata available to us for evaluation of the representativeness and also by adding a comment on the limitations of not considering basin shape in the Discussion (section 5.1). Uncertainties stemming from poor spatial representation of a basin are likely to be more pronounced for small basins.
10	"– P500.L14: This could be possible for individual basins by considering e.g. irrigation and inter-basin transfers, not accounted for in this study. > Moreover, in case of the basins in arid area (like the Niger), the actual evaporation higher than the potential evaporation is possible. The water precipitated in humid region can be transferred downstream via river networks, and then can be evaporated from the floodplains in arid region [e.g. Pedinotti et al., 2012]. This kind of horizontal transfer process by river s may increase the actual evaporation. In such a case, the discrepancy between the actual and potential evaporation is not disinformation, but can be an indicator of the occurrence of floodplain evaporation." **Response:** We agree that actual evaporation can show large spatial variability within a basin. This comes back to earlier remarks made by the referee (see comments #6 and #8), about sub-grid variability, which we have elaborated further on as suggested (see response to comment #8 and Overall Comment). However, we do not agree with the referee in the claim that actual evaporation can be higher than potential evaporation. In such a case, one of the two is not correctly estimated, i.e. the data are disinformative. Since we are looking at basin-scale evaporation in this study, it does not really matter where the evaporation occurs (flood plain, vegetated areas, etc). The potential evaporation at each given scale must always exceed or equal the actual evaporation at that scale in order for the concept to be meaningful. However, we agree that the potential evaporation in a basin with inundated floodplains is likely to be underestimated unless such sub-grid-scale features are taken into account. The limitations of the potential-evaporation data are further discussed in the Overall Comment.
11	"– P500.L15: However, the clear geographical patterns found in this study indicated that there were whole regions such as the Amazon basin where the inconsistencies were likely a result of systematic problems in the climate data. > Was the dependency of the potential evaporation to land surface type (i.e. open water, vegetation) considered in the dataset? The potential evaporation can be increased in the Amazon due to open waters in floodplains and dense forest canopy." **Response:** We would like to thank the referee for pointing out this important aspect of the potential-evaporation data and refer to the response in the Overall Comment.

References

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