Hydrol. Earth Syst. Sci. Discuss., 6, C2388–C2390, 2009
www.hydrol-earth-syst-sci-discuss.net/6/C2388/2009/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Calibration analysis for water storage variability of the global hydrological model WGHM" *by* S. Werth and A. Güntner

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Received and published: 16 October 2009

We thank the reviewer for his positive and helpful feedback. We will explain the calibration process and data usage more clearly in the revised manuscript. We agree that details on the observation data were missing so we will rework the respective section 'Calibration data'. Responces to the referee's specific comments follow below.

"2.2.2 How were the two observations (TWSV, river discharge) technically used to calibrate the model, was the overall objective function Pareto based?" > We used a multi-objective calibration algorithm, as it is explained in Section 2.2. For this method, no overall objective function (such as a sum of two objective values), but a Pareto ranking is undertaken, which determines non-dominated solutions (at the Pareto-frontier)

and dominated solutions. Hence, no single most-optimal solution is determined during each calibration step, but sets with Pareto-optimality. So, yes, it is a Pareto based optimisation. This fact will be made more clear in the revised paper.

"2.3.1 Averaging the runoff data over 30 years can be misleading, if the data have a strong trend (e.g. the Niger). In this case, runoff of the last _5-10 years can be well out of the uncertainty range of 20 %. Please discuss possible implications." > We agree with the reviewer that this is a critical approach. We cannot evaluate or improve the inter-annual model dynamics in this way. Nevertheless, the focus of the current study was mainly to improve WGHM seasonality. Thus, we consider using monthly mean values as a first viable approximation to improve the general model dynamics unless more recent discharge data become available. Nevertheless, we acknowledge the limitations of this approach as one possible reason for poor calibration performance (see, e.g., page 4835, lines 1-4 and conclusions, page 4838, first paragraph). Significant trends can be noted for a few basins, as commented by the reviewer, e.g. for Nile. For future analyses the application of trend correction could be suggested for such basins. We will expand the discussion on the limitation of the approach with regard to trends in the revised manuscript.

"2.3.2 The temporal and spatial scale is not mentioned, only in the introduction, where it is said that the spatial resolution is some 100 kilometres and the temporal monthly (?). Please explicitly list in section 2.3.2 (where the data are descibed) the relevant scales." > We will add the temporal resolution (monthly) to section 2.3.2. The spatial resolution of GRACE data is not trivial to define due to the continuous nature of GRACE gravity fields and the effect of filter techniques when selecting GRACE data for specific river basins. Filters cause a leakage from surrounding areas into the area of interest. We refer to the publication of Werth, et al. (2009b, Geophysical Journal International, online early 15 Sep 2009), which analyses optimal filter methods for each river basin and gives error estimates.

"3.1 please give the improved values not only in absolute values (in mm) but also as

relative ones (in %)." > The relative values will be included in the revised manuscript.

"4. The “conclusions” are more a “summary and conclusions” and could be shortened." > This comment is similar to Reviewer 1. We thank the reviewer for his suggestion and will condense the conclusions in the revised manuscript.

Responces to Technical corrections

"Introduction, last para: change “dealiasing” to “de-aliasing”." > This will be corrected..

"2.1 first para: delete second “for”." > This will be corrected.

"Page 4820, last para: change “according Suttleworth” to “according to Suttleworth”." > This will be corrected.

"Page 4834, second last para: change “did not improved” to “did not improve”. Conclusions, last para: change “GRACE-follow on” to “GRACE follow-on”." > This will be corrected.

"Figure 8 is not readable, Figures 1, 9, 10 are too small." > The size of these Figures was supposed to be larger. The came out in this small size only after publication in HESSD. We agree with the reviewer and suggest to increase the size of Figure 1 and 8-10. Alternatively, Figure 8 and 9 could be splitted into more than two subfigures.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 4813, 2009.