

Hydrol. Earth Syst. Sci. Discuss., referee comment RC3
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Comment on hess-2022-190

Anonymous Referee #3

Referee comment on "Global evaluation of the "dry gets drier, and wet gets wetter"
paradigm from a terrestrial water storage change perspective" by Jinghua Xiong et al.,
Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-190-RC3>, 2022

This is my second review of the manuscript, which has been resubmitted after the
previous discussion round.

The authors present a re-examination of the dry gets drier, and wet gets wetter paradigm
over global land, based on terrestrial water storage estimates from different sources. They
make use of GRACE reconstructions, global hydrological models, and land surface models,
as well as CMIP6 models for the future perspective. They conclude that the DDWW
paradigm is challenged both in the historical period but also in the future.

Overall, the authors took into account my points previously made and the manuscript
considerably improved compared to the initial submission. In particular, the authors
corrected the calculation of the percentage values by area-weighting the grid boxes and
added more discussion on the uncertainties inherent in their analysis.

As such, I'm happy with the changes made. However, there are still some open
methodological points that need to be addressed (see specific comments). Also, in parts
the manuscript might need to be checked for grammar and wording by a native speaker.

Specific comments:

Line 81: I suggest changing the title to "Data pre-processing"

Line 84: Change to "(see Table 1 and next sections)"

Line 86: Change to "resampled to 1° x 1° resolution to compare against the average"

Line 89: Change to "As for DATASET, the members of the CMIP6 ensemble have been resampled to ..."

Line 106: "We have implemented an ensemble ..." It's not clear in this sentence that you take the mean of the reconstructions derived from the three forcing datasets. Please rephrase.

Line 107/108: Why only listing a subset of the variables used for the derivation of the CSR reconstruction and not all?

Line 109: Change to "these three GRACE reconstructions"

Line 154: Change to "for which TWSA outputs are"

Line 158: "and future periods (Krishnan and Bhaskaran, 2020)" Why citing this specific paper about wind speed in the Bay of Bengal? This does not appear to be the standard reference for CMIP6. Please use Eyring et al. 2016 instead.

Line 162/163: "the sum of total soil moisture and snow water, which has been proven reliable to assess the TWS changes". This is already mentioned a few lines above, please merge and rephrase.

Line 192/193: Change to "... (NRMSE) between the mean GRACE TWSA and the ensemble means of DATASET and CMIP6 data after bias correction during the period April 2002-December 2014, with the NRMSE calculated as the ratio of RMSE ..."

Line 193: What is meant with "change range" of TWSA? The range of the TWSA values (i.e., max. minus min.) from DATASET and CMIP6 respectively? Please specify.

Line 201: Change to "uncertainties in the CMIP6 simulations that remain even after undergoing the bias correction"

Line 210: Change to "The GRACE TWSA ranges from roughly -20 to 20 mm and shows ..."

Line 211: Change to "A similar temporal pattern is captured ..."

Line 214/215: Change to "Moreover, the fluctuation range of DATASET is generally greater than the CMIP6 range before 2010. After 2010, DATASET tends to underestimate TWSA compared to CMIP6 and GRACE, and shows an increase in range."

Line 217/218: Please rephrase, simplify, or merge with the following sentence. You look at long-term trends here.

Line 219: "the historical period 1985-2014" Please clarify that the trend estimate for the historical period is based on DATASET (both in the text and in the figure captions). It would be interesting to see how the CMIP6 historical trends compare with the ones from DATASET.

Line 237: Change to "become wetter because"

Line 261, Figure 1: Please clarify in the caption what data source (i.e., DATASET or CMIP6) is used for the individual temporal subset.

Line 269, Figure 2: Change to "the bar plot displays the global percentage."

Line 284: "Figure 3 illustrates the test results of DDWW paradigm at a 5% significance level ($p=0.05$)" Based on what test? Does the mentioned significance level relate to the test results for long-term trends? Please clarify how you derive these results in the methods section.

Line 332, Figure 3: Please clarify the data source (i.e., DATASET or CMIP6) used for the different temporal subsets. I would be interesting to see how the results for DDWW based on the two data sources compare during the historical period. This could help to shed more light on the applicability of the CMIP6 ensemble for investigating the DDWW paradigm also in future periods.

Line 340, Figure 4: "'D" and "W" indicate regions with drying and wetting trends, respectively." I guess this does not belong to this figure caption?

Line 364: "reported to show underestimation or overestimation" -> variable-specific biases?

Line 421/422: "Despite the magnitude bias from satellite products, simulations of LSMs and GHMs, and GCMs projections, ..." Not sure what is meant here? Please rephrase.

Line 453: "significance levels from 0.01 to 0.1" For the test on long-term trends?