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Hydrology and Earth System Sciences Discussions

Interactive comment on "Detection of global runoff changes: results from observations and CMIP5 experiments" *by* R. Alkama et al.

Anonymous Referee #1

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This a very interesting paper that brings new insights about the question of past and future runoff trends. The paper is well structured and easy to follow. The key points are to combine historical data with future projections from the CMIP5 exercise, and to use a recent statistical method, the Temporal Optimal Detection (TOD) method, with interesting capacities in case of spatially heterogeneous changes.

My main suggestions are the following:

1. Explain better the advantage of the TOD in case of spatially heterogeneous changes (cf p2126, L3-11). In particular how does this relate to the principles of the method (beginning of section 2.2 until p2125 L7) ? Can this method provide significance of trends at the continental scale ? If so, why not give this information too ?

2. Still about the statistical method, the authors could explain better why high/low α are conservative/permissive, including a definition of these terms. It would also be useful to give the null hypothesis of the inference test.

3. The title and the paper are focused on global runoff changes, in opposition to basin-scale or continental scale changes. But, the studied changes are not really global, as they are restricted to 161 river basins in one case, and 687 when using reconstructed data. This should be stressed, for instance by giving the fraction of global terrestrial areas that are analyzed.

4. I am surprised that the influence of direct human intervention is so quickly ruled out in section 2.1 (p2122 L 9 to p2123 L11). There are many recent evidences that water withdrawals by humans did change the water balance, at large scales, even on annual means, and especially in the most recent decades (e.g. Lvolvel et al., 2010, Wada et al., 2010, Sterling et al., 2013).

5. In section 3.2, why not comment about the way simulated trends fit with observed and reconstructed trends ? Also, the end of this section is no more about the comparison of simulations vs observation, but on simulated trends over the 21st century: this is not consistent with the section title, and this part is really (too) short, with no reminder of the bibliographical background on the matter.

6. In section 3.3, the differences found in “detection date” with 161 or 687 river basins raise a lot of questions. It would deserve a deeper discussion. For instance, could this also be explained by the fact that climate change is not the dominant driving factor in the past ?

Minor questions/comments/suggestions:

Section 2.1 mentions about a third pre-processing (p2122, L4-5): has it been done by the authors, or does it come from Dai et al. (2009) ?

p2122 L9: in addition to beING

HESSD

10, C1517–C1519, 2013

p2122 L28: uptream in one word; not without final e

p2124: the first sentence of section 2.2 is not very clear to me

p2124 L20: I suspect that “as” should be changed to “a(s)”

p2126 L 22-23: what is explained for year 1980 is true for any year

p2126, M23-26: this sentence is misleading: the larger year-to-year variations are the ones of the P-value and not of runoff, and the main point is not about the larger variations in P-values, but on the larger P-values.

P2128, L18: change “Even” to “Despite”

p2129 L9: add “model” after CMIP5

p2129 L11; replace “average” by “central”

Cited references:

Llovel W, Becker M, Cazenave A, Crétaux JF, Ramillien R (2010). Global land water storage change from GRACE over 2002–2009 - Inference on sea level, Comptes Rendus Geoscience, 342, 179-188.

Sterling S, Ducharne A, Polcher J (2013). The impact of global land-cover change on the terrestrial water cycle. Nature Climate Change, 3, 385-390, doi:10.1038/nclimate1690.

Wada, Y., van Beek, L., van Kempen, C., Reckman, J., Vasak, S. et Bierkens, M. (2010). Global depletion of groundwater resources. GRL, 37(L20402).

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