

Interactive comment on “Future hydrological extremes: the uncertainty from multiple global climate and global hydrological models” by I. Giuntoli et al.

Anonymous Referee #2

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This paper is a concise analysis of the potential consequences of projected climatic conditions on low-flow and high-flow frequencies globally. On the whole, the paper is very clearly written, and I only have a few concerns.

1. As Section 4 of the paper correctly notes, there are several sources of error not investigated in this study, such as bias correction, CO₂ and vegetation dynamics, emission scenarios, and internal variability. In view of these sources of uncertainty, the abstract (line 21) should not state that using multiple GCMs and GHMs is sufficient to envelop the overall uncertainty range.
2. Page 4, lines 8-15 also bear on the issue raised in my first comment. Prudhomme

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et al. (2014) and Davie et al. (2013) are reported to find that biome models which include effects of varying CO₂ produce more runoff than purely hydrologic models. This implies that using GHMs without a varying CO₂ effect not only will not envelop the overall uncertainty range, they may also bias the results toward less runoff. So some runoff possibilities may be missed by a set of hydrological GHMs, and at the same time some erroneously low runoff solutions might be improperly included within the uncertainty range.

3. A related issue not mentioned, but which should be mentioned, is that the mere inclusion of multiple models is insufficient to fully scope the uncertainty associated with models. Structural model errors are not all random; some structural errors, such as insufficient resolution, are common across all models. Using multiple models does not help with this aspect of model uncertainty.

4. Page 5, bottom should include mention of which (if any) GHMs include varying CO₂ effects. At present, the reader is left to wonder until near the end of the manuscript.

5. Page 6, lines 21-25 are written incorrectly. As written, for HFD, a cell exceeding the Q95 value may be assigned a value of either 0 or 1, while the assignment for a cell that doesn't exceed the Q95 value is undefined. The same applies to LFD. Lastly, the reference to the Appendix should be to Appendix B.

6. Page 8, line 24 to Page 9, line 4: Seasonal differences are to be expected, but there seems to be no obvious reason why the NH in boreal winter should behave like the SH in austral summer, or why the NH in boreal summer should behave like the SH in austral winter. Yet, by discussing globe-wide variations in terms of DJF and JJA, this is what you are implying. To better frame the discussion, and to see whether this surprising possibility is borne out by the data, create separate Fig. 2 charts for each hemisphere.