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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Annual flood sensitivities to El Niño Southern Oscillation at the global scale" *by* P. J. Ward et al.

Anonymous Referee #1

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This manuscript presents a study of the sensitivity of annual peak discharge to variation in the El Nino Southern Oscillation. Analyses are based on output from the WaterGAP global hydrological model, rather than observed river flow. Use of a global hydrological model enables a truly global study to be undertaken, not limited by data availability. However, although the model is validated and is deemed to provide an acceptable simulation of global river flow, for certain river basins correlation between modelled and observed annual maximum flow is below 0.5.

Overall, I find this study to be of interest, well written, and on a topic appropriate for HESS. A number of suggested modifications are listed below; however I consider these to fall into the 'minor corrections' category. In terms of the HESS manuscript evaluation criteria, I would place the manuscript between 1 and 2 (i.e. good to excellent) for

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scientific significance, scientific quality and presentation quality. As such, provided the specific points below are addressed adequately, I recommend the manuscript for publication.

Specific points

1. Meaning of the word “flood” is not immediately obvious. A common definition of a flood is a hydrological event that results in the inundation of land, as well as the definition used here, the annual peak flow of a river. However, it is not until the very end of the Introduction that this definition is provided. This is potentially confusing, especially in the abstract, where the first sentence seems to refer to inundation flood. I suggest either using a different term – e.g. annual peak flow – or a definition of the term flood both in the abstract and close to the start of the Introduction.

2. P10233. Long lists of past studies on climate change impacts on floods are given, but no indication is provided as to the kind of results these studies have found. It would be useful to provide a more select list of previous studies, in association with some detail on how these studies provide context for the present study. As they are, I find the lists too long and with insufficient detail to be useful.

3. P10235. The Watch Forcing Dataset (WFD) extends to 2001, not 2000 as stated here.

4. P10236, line 7: why specifically was the number 34 chosen (for the 34 largest basins only to be divided into sub-basins). This seems like an arbitrary decision, so some explanation is needed.

5. P10236, line 11. Why did the analysis stop in 1999 when it is stated on line 18 that the WaterGap model was run until 2000, and the WFD extends to 2001?

6. P10236, section 2.2. Definition of the water year. Whilst I appreciate the desire to categorise the world into a small number of categories, I am a little concerned that the results shown in Figure A1 are not realistic in some locations. For example, in southern

HESSD

10, C5278–C5281, 2013

hemisphere temperate locations one might expect the hydrological year to start and end in the autumn months. Can the authors comment on the basis for choosing only July-June as an alternative to October-September, and on whether there is a possibility that the definition of the hydrological year could have affected the results.

7. P10241, lines 19-20. Could the authors comment on why annual maximum flow might be more sensitive to the SOI than annual mean flow – perhaps in relation to the previous studies cited?

8. Figure 4. I'm not sure of the relevance of part a of this figure. What is the point of presenting the sensitivity to the SOI when that sensitivity does not result in statistically significant correlation? Deletion of the current part a and enlargement of part b would also help the readability of what is at present quite a complex figure to decipher.

9. P10242, line 19. Please can the authors comment on whether the apparent high sensitivity of mean annual peak flow in arid regions could be linked to the use of percentage, rather than absolute, values? For example, a relatively small change in absolute flow in a region with low peak annual flows would appear as a large percentage change – whereas a much larger absolute change in a river with high peak annual flows would appear as a much smaller percentage change.

10. P10244, line 6. Why was a 21 year moving window used? This is another apparently arbitrary choice that requires some justification.

11. P10244, line 10. Could the authors confirm the p-value used as the threshold for statistical significance.

12. P10246, line 16. The PDO is the north Pacific representation of the Pacifc-wide Interdecadal Pacific Oscillation (IPO). The IPO (and so PDO) underwent a phase change in 1977-1978, which has been linked to a change in the variation in ENSO. In this context, it would be extremely interesting if the authors could comment on whether they see any difference in SOI relationship to annual peak flows across the IPO phase change

HESSD

10, C5278–C5281, 2013

in 1977-1978.

13. P10247, line 10. Asymmetries between El Nino and La Nina influence on annual peak flows may also be indicative of a nonlinear effect on climate of El Nino vs La Nina – e.g. as shown previously in New Zealand: Mullan, 1995, International Journal of Climatology, 15, 1365-1386.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 10231, 2013.