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Earth System Dynamics
Discussions

Interactive comment on "Concurrent wet and dry hydrological extremes at the global scale" *by* Paolo De Luca et al.

Anonymous Referee #1

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General Comments

The manuscript is well-organized and contextualized, with an extensive set of citations. The results presented are novel in their comprehensiveness and clearly relevant for a range of societal responses to hydrological extremes, as the authors note. There are various places where additional details are necessary to understand why a particular analytical approach was employed, or to further reflect on the implications of the results. However, these are fairly limited in number, and I am confident that the authors will be able to make appropriate adjustments with relative ease.

Specific Comments

Page 3, line 19: It would seem suitable to mention NGOs as another set of stakeholders

that typically have geographically diverse portfolios. Page 3, line 30: Do the authors mean that surface warming is attributed to changes? Or vice versa? Page 4, line 14: Given that 2.5-deg resolution is relatively coarse, the authors should somewhere have a sentence or two noting why this resolution is sufficient for their survey, or at least listing some regions where it may pose more of a challenge. Page 4, line 31: I found point (ii) unclear – over what time/space ranges is the counting done?

The co-occurrence discussion (e.g. section 3.2) is highly interesting. I wonder, however, if some sense of the closeness/connectedness of the events should be captured in order to truly reflect impacts, which is the motivation that the authors initially present. For example, it is not self-evidently clear why it matters that floods in Australia and the Northwest US, for instance, occurred simultaneously. Relatedly, some sense of the geographic distribution of co-occurring hydrological extremes might be useful in reflecting the 'widespread, simultaneous' character of event that the authors are trying to measure. I was especially struck by Figure 2b, in which it seems that the global peak is largely driven by drought in eastern Australia, while the rest of the world is in fact similar to normal conditions.

In Section 3.5 (correlations with climate indices), the approaches used aren't capable of proving that these modes of variability explain the results. In other words, there may be a wide range of amount of hydrological extremes associated with similar mode-of-variability combinations. Some analysis exploring this issue should be considered.

Page 10, lines 22-23: That the AMO has the largest overall effect is interesting & surprising. What do the authors make of the fact that while the AMO has the largest effect, for the two most extreme wet & dry events (Figure 2) it apparently plays almost no role?

Need for minor methodological comments: The authors should somewhere add thoughts on the usefulness of soil moisture metrics in addition to PDSI, SPEI, etc. Also, how much do they think that their results might be sensitive to the choice of PDSI

threshold? Lastly, calculating lagged correlations with variability modes is probably worthwhile to consider, or at the very least a sentence should be added explaining why this was not done/would not provide much more information.

The Figure 4a caption seems to be inverted. As I would state it, ET is plotted as a function of time interval, not total land area impacted. This figure might also be better posed as comparison against the distribution of times as expected from a random Poisson process. While the comparison between the modes of the wet-to-dry and dry-to-wet distributions is easy enough, for instance, it is not straightforward to interpret what the 'long tail' means – is this tail longer or shorter than would be expected by chance? A Poisson comparison (or some other such reconceptualization) would help in making this figure more intuitive.

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