

## ***Interactive comment on “Sensitivity of water scarcity events to ENSO driven climate variability at the global scale” by T. I. E. Veldkamp et al.***

### **Anonymous Referee #1**

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General comment: The paper presents an analysis of what were the effects of ENSO climate variability on global patterns of water availability and water scarcity. It appears that these relationships have not been studied before in such a comprehensive way, which makes the study a new and thorough contribution to the field. The authors address their research question based primarily on outputs from a global water model.

Major comments: In the Abstract and the Introduction it should be mentioned that it is well-known that ENSO affects patterns of precipitation and drought in many regions; the new idea here seems to be to relate it to water scarcity, which should be pointed out compared to the many existing climatological analysis. The findings could also be better linked to those studies in the Discussion (i.e. ENSO tends to decrease precipitation in specific regions: is that congruent with your analysis of subsequent effects on

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runoff and water scarcity). Part of this can now be found in section 3.1, which should be removed from the results but used as a general introduction to the topic.

The percentage of affected people etc. is often mentioned in the text, which makes it somewhat difficult to follow the key results/arguments. It would be very helpful to see a table which lists the main global numbers for the different cases.

Some sections should be shortened or removed, as the paper is long and as some information is provided several times. These include the following: 1. The introductory paragraph to section 2 (I suggest to just delete it). 2. The first paragraph of section 3.3 (delete). 3. The many figures and long results section: I suggest to focus the main paper on either water scarcity or water stress, as they differ only marginally and as it is a bit lengthy to read results and look at maps for both. The respective other indicator could then be entirely (text, figures) addressed in the Appendix, or it could simply be stated that the results would not differ much when choosing another indicator. Figures could also be rearranged to highlight key findings/maps: Fig. 1b could be moved to the appendix and Fig. A2a be shown here. Fig. A3 not needed at all, I think. 4. Section 3.3: needs to be shortened. 5. The final part of the Discussion (from line 10, “The results presented. . .”) is wordy and could be shortened or substantiated with some literature references and/or more concrete examples. 6. First paragraph of Conclusions: said several times, could be deleted.

Stylistic/technical comments: Define “blue” and “green” water availability.

Page 5468 line 2 and elsewhere: “found relationships”: I think the term “found” can be removed, or reformulate “relationships found here”.

Section 2.1: Can water scarcity issues really be solved FPU-internally? I think this is just a crude assumption, not a fact.

Section 2.3: A bit more info on how water consumption was calculated would be helpful.

Section 2.4: Isn't 0.4 the conventional threshold for water stress (as opposed to 0.2)?

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Section 3.1: Clarify whether this section is about simulations with or without socioeconomic trends. Indicate what value of the correlation coefficient the 0.5 or 0.1 significance corresponds to. The 'threshold' coefficient seems to be relatively low, which could be considered in the discussion of the findings. Second paragraph of this section: from line 8 you discuss "Positive correlations" but to me it is not clear in what way these numbers differ from those presented in the preceding paragraph (what's the difference between the two). Next page line 4: what's the "memory of the soil"?

Section 3.2: define "significant anomalies" (line 20).

Section 3.3 line 24: "significant correlations" with what, the absolute WCI value or the number of scarcity events?

The Discussion should emphasize that the two water scarcity / stress metrics are rather simple, possibly masking regional ENSO effects on drought and water limitation.

Second paragraph of Conclusions: do you mean global or regional "water scarcity conditions become more extreme...?"

Fig. 1: What is SST\_bestoff? Fig. 2: Is this with or without socioeconomic change? But anyway, only water availability is responsive cf. Fig. 1. Fig. 5: Can there be dots in areas with zero frequency? What does it mean "could be" significantly correlated? Fig. A9: "(a) shows...?"

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