

## ***Interactive comment on “Evaluation of the probable annual flood damage influenced by El-Niño in the Kan River Basin, Iran” by Farhad Hooshyaripor et al.***

### **Anonymous Referee #1**

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The authors present an investigation of the impact of El Nino on flood damage. The analysis is carried out by (1) establishing the average impact of El-Nino and La-Nina on the precipitation measured in a station within the study area; (2) based on this average impact, different rainfall scenaria are run through a hydrologic model to calculate inundation depths for different return periods and (3) a simple loss model is applied to quantify the damage due to the different inundation scenaria.

I think the topic is important and of broad interest because, as the authors claim, only a few studies have focused on the impact of large-scale climatic phenomena on flood damage and losses. However, I do not believe this analysis, in its current state, is

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suitable for publication. I found the following major issues with the study:

1) The impact of El-Nino and La-Nina on precipitation, as measured by equation (3), is an average impact. It is unlikely that rainfall extremes, such as those considered in the study for return periods (RP) of 10, 25, and 50 years, are impacted in the same way. Therefore, it is inaccurate to multiply the 10, 25, and 50 year RP rainfall values by the same, average factor in order to account for the impact of El-Nino and La-Nina. More generally, I do not think it is appropriate to assume that the impact of El-Nino and La-Nina on annual precipitation totals is the same as that on single precipitation events, which is, I believe, what the authors are doing.

2) The impact of ENSO on precipitation varies by season (e.g., Alizadeh-Choobari and Najafi, 2018), so it is a bit simplistic to reduce the impact of ENSO to an annual average, especially when this average impact is then applied to single events.

3) The hydrologic model is calibrated using a single event (April 2003). I think the calibration period is too short (only 4 days) to be meaningful, the model should be calibrated for longer periods, to account, for example, for antecedent conditions and seasonality of the hydrologic cycle. I do not see why the authors did not do that as data seem to be available.

4) The manuscript is not well written, and its lack of clarity makes it very difficult to follow and understand. I've reported below many different instances in which sentences are wrong or not clear. I suggest the authors to carefully check the manuscript before re-submission.

#### **SPECIFIC COMMENTS:**

P2L25: Since this is the topic of the paper, it would be good to cite some of these works in which the expected damage under El Nino or La Nina is investigated.

P3L23: SOI is a single variable ENSO index, multivariable ENSO indexes like MEI provide a more complete description of ENSO (e.g. Wolter and Timlin, 2011). Can the

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authors justify why they are not using a multivariable ENSO index instead?

P5L5to10: It is not clear how the calibration has been done. Do the authors calibrate using the storm in 2003 and validated using the storm in 2002? If so it seems like a very small calibration and validation set, especially when 15 years of data seem to be available.

P6L4: It does look like there is a small trend, however I would not say it is “obvious” as there is a lot of data scatter. It would be good to provide a level of significance for the trend.

P6L6: “with respectively 334mm and 252mm recorded rainfall”, are these annual rainfall totals? It sounds like that but in Figure 2 for Mehrabad station I don’t see a point for 334mm with  $SOI > 0.8$ .

P4L24and26: This is the first time the values 60% and 90% are introduced in the manuscript. The authors should say why they are focusing specifically on these numbers as it is not clear.

P6L4toL19: time scales (annual or event scale) are a bit unclear in this part.

P6L7: “its sufficient data”, what makes it sufficient? Perhaps it can be said that Mehrabad station was chosen because it has more data than the other stations.

P6L9: Here the time period is 1952-2017 while before it was 1950-2017.

P6L11: “22.2m and 16.96mm” is this average monthly rainfall?

P6L13toL19: This part is very unclear and should be significantly expanded: What are the “annual increased percentiles of rainfall”? How are they computed using Eq.3? Why are the increased percentiles of rainfall in Fig.3 only 4 values? Can’t the authors use more points to compute the percentiles?

P6L23: I struggle to understand why 60 and 90 percentiles are considered confidence intervals. Can the authors please explain?

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P7L1toL14: As before, I don’t understand why only two events are used, one for calibration and another for validation when the authors have many more data at their disposal.

P721: It would be helpful to know the size of these land use areas. Averaging flood depth and economic values in large areas can give very uncertain results because both flood depth and economic value usually have very large variability in space.

P7L24: Are the “flood zoning maps” the flood maps the authors obtained with Hec Ras? It is not clear whether the authors produce flood maps with Hec Ras and then apply the maps on their land use areas or if the flood zoning maps are predefined.

P7L24: How is the “average depth of land uses’ inundation” defined? It sounds like the authors calculate an average flood depth for each land use which would make sense to me, but then in table 2 they seem to have only one average flood depth common to the different land uses which is even more simplistic. Why can’t the authors calculate an average flood depth for each land use? that would be more accurate I believe.

P8L3toL4: I think such a big increase in loss warrants a deeper explanation. Why does an 8.2% increase in rainfall produces a 10-fold increase in flood depth?

#### MINOR COMMENTS

P1L25: have increased or have been increasing.

P1L27: reached to doesn’t make sense.

P2L8: “. . .by predicting the necessary measures”, it is not clear what you mean by “measures”.

P3L2: rain spouted 6 times of the annual precipitation is not clear.

P3L4: “events” not “evens” and I think they mean “that resulted”, not just “resulted”.

P3L14: It should be: “According to previous studies” or “according to Hooshyaripor et

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al. (2018)”.

P4L3: Perhaps you should specify that in Eq. 2 log is the logarithm to the base 10.

P4L9,10: Sentence should be rephrased.

P4L23: If I understood correctly it should be “for a duration equal to  $T_c$ ” not “in  $T_c$  min duration”.

P4L25: “Affected by”.

P4L24and26: These sentences are very difficult to understand. Do you mean that the rainfall intensity with  $T_c$  duration is increased by 60% and 90%? If so, why are you talking about probability? If not, could you please rephrase the sentences in a more understandable way?

P5L23: Do you mean duration of the inundation or the time at which the inundation occurred? The former is more likely I believe.

#### REFERENCES:

Alizadeh-Choobari O, Najafi MS (2018) Climate variability in Iran in response to the diversity of the El Niño-Southern Oscillation. *Int J Climatol* 38 (11):4239–4250.

Wolter, K., and M. S. Timlin ( 2011), El Niño/Southern Oscillation behaviour since 1871 as diagnosed in an extended multivariate ENSO index (MEI.ext), *Intl. J. Climatol.*, 31, 1074– 1087.

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