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Hydrology and Earth System Sciences Discussions

Interactive comment on "Non-stationary flood frequency analysis in continental Spanish rivers, using climate and reservoir indices as external covariates" *by* J. López and F. Francés

G. Benito (Referee)

benito@ccma.csic.es

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Comments to Lopez and Frances paper on "Non-stationary flood frequency analysis in continental Spanish rivers, using climate and reservoir indices as external covariates".

The paper provides a new methodology for flood frequency analysis under the basis of non-stationary flood series, and therefore it is an important effort. The non-stationarity is attributed both to climate variability and to water reservoir constructions. The water dam construction was demonstrated to produce a change of flood regime, at least for the moderate and small floods. Since the analysed serie is short, it was not evident how dams can affect large peak flows, that, when produced, large floods are already full of water and therefore, unable to attenuate flood peak. Regarding climate variability and change, the authors have included several so called "climate indexes". These indexes are obtained from sea surface pressure values at given locations and more or less they can describe the decadal to interdecadal variability in atmospheric circulation at specific regions (North Atlantic, etc.). As indicated by different authors (e.g. Trigo etc..) these indexes describe a natural mode of atmospheric variability, but it is uncertain how antropogenic climate change might influence modes of NAO (see Corti et al., 1999; Hurrell et al., 2003). This brings some kind of "unpredictability" and lack of robutness of the resulting flood frequency quantiles, as the statistical parameters change from year to year, producing a high uncertainty on the validity of the results.

Another interesting point raised by the authors is that skewness coefficient and other high order dimensionless moments has a low sensibility to climate and dam regulation variations. How this may affect to the sensibility of highest quantiles (>100-year flood) of distribution function?.

Apart from these general comments, the paper is an excellent example on how to proceed the problem of non stationarity of flood series and the paper deserves to be published on Hydrological and Earth Science Systems, after some minor changes.

Specific comments.

Title: the word "continental" may be deleted from the title.

Page 3108. Line What is an empirical orthogonal function analysis? Can you explain what is that and what is suppose to carry out in the analysis? One general sentence explaining the concept of this would be enough.

Page 3115. Line 26.It is observed a lesser influence of PC2 due to a week correlation with WeMO in modulating flood regimes. There is a major problem in this approach, since all the PCs are apply supposing that all this climate indices are influence flood regimes in the same way. I wonder if a prelimary anlaysis of the weight of these in-

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dices in each of the gauge stations may be use to select the most appropriate index to consider in the analysis instead of consider a blend of all of them.

3117 line 1. According to the authors, there is a decreasing trend in the mean of the peak discharge values. I wonder if this trend may be bias by the short gauge record selected. I wonder if the results would be the same for longer time series. 3118 line 16. Peak floods, you may want to say "large floods"??

3121. line 5. "....which is the result of frontal systems associated with the Atlantic circulation."

3122. line 13. I guess that the term average recurrence interval (in years) is valid but understanding that it represents the average probability resulting for the period of analysis. Otherwise, the whole flood frequency analysis is under question because in the case the return intervals as used for engineeting desing, there is a high uncertainty on how this may change in the given return interval.

3137 Figure3. In the text it should be indicated what are the selected months for winter. In other words, if it was selected DJF or DJFM, etc... On the right side of the figure the correlation of peak discharge with the most negative numbers is in fact not too good. The highest discharges where obtained for values close to 0. In the case of the WeMow, the values close to 1 got the largest peak discharges. However, the values of WeMOw close to 1 also has associated very low peak flows.

3139. Figure 5. Looking figure 5, an evident comment is that how if the climate indexes are the main drivers of the non stationarity, the trends or changes in the mean values do not follow a similar pattern across the diferent stations?.

3141. Figure 7. It is interesting that the stationary model 0 makes a lot of sense, in particular if the discharge of 0.01 exceedence probability wants to be used for hydrological desing. The up and down changes on the non stationary models creates a high uncertainty since it seems to reflect the hydroclimatic variability rather than a long term

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trend (100 years and over trend). Only on the stations influenced by dams mhave more certain values, and even on those case, it is not garantee that the reservoir can be full when the intense rains affect the catchment.

Corti, S., Molteni, F., Palmer, T.N., 1999. Signature of recent climate change in frequencies of natural atmospheric circulation regimes. Nature 398, 799-802.

Hurrell, J.W., Kushnir, Y., Visbeck, M., Ottersen, G., 2003. An Overview of the North Atlantic Oscillation. In: Hurrell, J.W., Kushnir, Y., Ottersen, G., Visbeck, M., (Eds.), The North Atlantic Oscillation: Climate Significance and Environmental Impact. Geophysical Monograph Series 134, Washington DC, pp. 1-35.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3103, 2013.