

## ***Interactive comment on “Flood frequency analysis of historical flood data under stationary and non-stationary modelling” by M. J. Machado et al.***

### **Anonymous Referee #1**

Received and published: 12 February 2015

The manuscript proposed a stationary analysis of long runoff time series observed in Spain using historical and systematic data.

The topic is interesting and the paper is easy to understand and pleasant to read.

I have some concerns that make me difficult to provide a clear evaluation. Indeed the analysis is so articulated that conclusions are not fully clear. The main contribution of the paper is the accurate reconstruction of the historical time series and the consequent non-stationary analysis. However, since the case study site is affected by severe human impact I do not know if the paper can provide general suggestions or conclusions. At the end, it seems more a regional analysis. I let the Handling Editor to verify if the content is appropriate or what is the best paper type (Regular paper, Technical

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note, etc.) for this manuscript.

Concerning the proposed analysis, while I really appreciate it from the engineering point of view (above all the historical analysis) I am skeptical from statistical hydrology perspective. Discharge time series are the worst one to make any kind of conclusions in term of climatological forcing. Rainfall and Temperature are surely better since they are direct measurements and the human effects are limited.

As the authors well known, homogeneity and uncertainty of measured data are not only a statistical hypothesis to be followed but also a philosophical constrain to include in the analysis.

While the historical reconstruction is really accurate and fascinating, I do not think that can have a statistical relevance to support any general conclusion. Maybe it can be useful for local hydrological analysis to have an idea of the historical behavior of the river and so can suggest some operational rule for the dam.

The uncertainty that affects historical values is not quantifiable and surely is variable event by event. Moreover, it is totally different to the systematic data uncertainty, that is still very high since they are indirect observations.

As usual, the discharge time series are flagellated by human activities. Authors underlines that there is an abrupt changes in 1957 for the dam constructions, however I think their influence (statistically speaking) should be related to several years (i.e. 1952, 1953, 1954, 1955, show very low values). If I am not wrong we are talking about reservoirs of several cubic kilometers that affects 80% of the watershed. From the beginning of the construction to the end there are surely some effects on the discharges. Furthermore, the dam operations, at the beginning of the dam life, surely influences data. Maybe contemporaneously rainfall data would have been helpful for understanding what happened in these years as well as the reconstruction of natural discharge could be also useful.

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Finally, I kindly disagree with the authors when they say (page 540 - lines 7-11) that the land use changes are out of scope of the paper. In my opinion, this is one of the most important reason of non-stationarity in a discharge time series that usually is much more relevant than a potential climate change (hydrological change, in my opinion, is more impacting than the climate change). Maybe this watershed is not affected, however, it is important to support it showing land use maps of the past comparing it to the present ones.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 525, 2015.