

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

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GENERAL COMMENTS

This is an excellent study that assesses the potential of non-stationary flood frequency analysis compared to conventional stationary flood frequency analysis, using systematic and historical data in the Tagus River in Aranjuez (Spain), a basin with a long and complete flood data series (almost 400 years); it also quantifies the estimated and acceptable uncertainty. The article tries to describe the observed variability of the hydrological response of the basin in the case of extreme events (which happens to be non-stationary) and its correlation with the variability of a climate index (North Atlantic Oscillation, NAO) and of an index (Reservoir Index, RI) that measures the impounding

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capacity of the dams (built since 1957).

The paper has a logic structure, is well written and easy to read. The methodology, highly multidisciplinary and very complicated, is well presented and well supported with references. References are adequate and recent. The results are relevant and allow a rich discussion before the conclusions are established. Tables and figures are correct and help to understand the results.

Besides the description of the conventional statistical method (based on the hypothesis of a stationary system) enlarged with the use of historical data to determine expected peak flows for low frequency events (>100 years), the most relevant contribution of the study is the description of the variability of the peak flows through the correlation of representative statistic descriptors (mean, standard deviation) with external factors as NAO index (hypothesis of a non-stationary system).

The authors find a good relationship between negative NAO index's magnitude and periods of more extreme floods. They also explain through IR index the variation caused in the series by the dams since 1957 (figures 6, 7, 8 and 9). With this, the authors determine the range of variability of the expected peak flow in a non-stationary system, which, in the last 300 years, spans between 38% and 290% of the expected peak flow in a stationary-system.

The development of a non-stationary flood frequency analysis based in NAO and RI indexes can be useful in obtaining more robust estimates of low frequency events, much needed in designing high security structures (e.g. nuclear power plants) in flood-prone areas.

SPECIFIC COMMENTS

p. 530 lines 6-10: “Moreover.....”). The sentence seems to contradict the data deduced from figure 1c

Suggestion: In section 4 (Historical flood occurrence and discharge estimates), histori-

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cal floods reconstruction methodology is described (p. 536 line 8 to p. 538 line 8). This could be presented alongside the rest of the methods in section 3.1 (Floods records database). This section 3.1 could then be retitled as Flood hydraulic reconstruction and database and section 4 as Historical flood occurrence.

Section 4: It is convenient to add a table with the reconstructed floods (year and peak flow).

Figure 1c is profusely cited in the text due to its importance. However, it is too small to be read with ease. I suggest to detach this figure from figures 1a and 1b so as to enable its enlargement.

TECHNICAL CORRECTIONS

Typing errors in the manuscript

p. 527 line 25: accent in Francés p. 529 line 14: in a basin of more than 9000 km², instead of flash floods, it would be preferable to speak of floods or riverine floods. p. 533 line 16: accent in Francés. This reference (as it appears in the text) is not included in the references section p. 536 line 1: Jiang et al. (2014) differs from Jian et al. in the references section (p. 553 line 13) p. 538 line 11: it is Figure 1c instead of Figure 1 p. 538 line 24: it is 1916 instead of 1616 p. 539 lines 9 and 10: specify the area where this happens: the Iberian Peninsula? p. 540 line 14: it is Figure 1c instead of Figure 1 p. 545 lines 4 and 10: accent in Francés p. 545 line 13-14: reference Cunderlik and Burns, 2003 differs from the one in the references section, where the second author appears as Burn p. 546 line 6: it is 1878 instead of 1787 p. 546 line 17: according to table 1 and figure 4, the return period of a peak flow of 400 m³Ås⁻¹ is 5 years instead of 10, as the text says p. 547 line 13: Hall et al., 2013 differs from Hall et al., 2014 in the references section

Typing errors in the references

p. 551 line 1: the word "Systematic" does not belong in there p. 552 line 24: accent in

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Francés p. 553 line 16: unnecessary space in Garcia

Typing errors in the tables

P 557 Table 1: Exceedance Annual Probability (%) of 0.01 instead of 0.1

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