

***Interactive comment on “Rainfall-runoff modelling and palaeoflood hydrology applied to reconstruct centennial scale records of flooding and aquifer recharge in ungauged ephemeral rivers” by G. Benito et al.***

**Anonymous Referee #2**

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Nice work, specially the proper combination of different disciplines. The objective (“hydrological reconstruction”) is clearly stated in title and introduction and almost perfectly reached in the rest of the paper.

IMPORTANT COMMENTS (I am sure easy to solve):

1.- Volume units

P9636 L4 and through all the text. Mm<sup>3</sup> is cubic megameters, i.e., 1 Mm<sup>3</sup>=1e18 m<sup>3</sup>.

C5073

Even the Amazon cannot produce 1 Mm<sup>3</sup> in one year! From the Spektakel aquifer dimensions, I think all volumes and balance annual flows in this paragraph and the rest of the text should be in hm<sup>3</sup> (1 hm<sup>3</sup>= 1e6 m<sup>3</sup>). Please, check it.

2.- Hydrological modelling time discretization

P9640 L1. It is said “modelled daily discharge and annual flood series”. And it is confusing, because: - Are there two different models? - Which is the model time discretization? I think it is explained only in conclusions: too late!

This should be very clear, because in section 4.3 you cannot mix annual maximum daily discharges coming from modelling with instantaneous censored discharges from palaeofloods.

3.- Stationarity

In this paper is assumed flood population is stationary. It will be important to find some discussion, at least in the introduction, about this topic within a paper dealing with a flood period of 600 years.

4.- Section 5

To improve the results of this section, which are the objective of this paper, I would add the mean annual recharges (by statistical integration of quantiles) with and without the palaeoflood data. For two reasons. First, mean annual recharge is a number water managers will understand better. Second, it is clear the importance of palaeoflood information for FFA (figure 8 right), but from the recharge point of view, it should be computed (is it high or low?).

Also, it will be possible to do a sensitivity analysis to support the conclusion in P6947L1, which in my opinion is a combination of the percolation limitation (as stated by authors) but also because the low weight of large floods in the statistical integration of the mean annual recharge.

C5074

MINOR CORRECTIONS/COMMENTS:

P9633

L17. Clarify the sentence: which period is five times greater?

P9634

L8 “produce” better than “do”

L17 erase “ephemeral”

L21. Define “non-systematic” and/or reference the work which first introduced this term:

Frances, F., J. Salas and D. Boes (1994). Flood Frequency Analysis with Systematic and Historical or Paleoflood Data based on the Two-Parameter GEV Models. *Water Resources Research*, v 30 (6), 1653-1664.

P9637

L11. Hu, as a parameter, must be a “capacity” instead of “availability”.

L21. For what was used the vegetation map? If it was irrelevant, eliminate the figure.

P9638

L11. Which was the final selected distribution? It is explained later, but the question when reading was immediately for me.

L17 and 20. The discharge 50m<sup>3</sup>/s, is it daily or the instantaneous peak flow? Same at least in P9639 L16. I suppose daily, but clarify using “daily discharge” or “instantaneous discharge”.

L28. Manning’s eq. is for energy losses estimation. I suppose you use uniform flow hypothesis (or other?) in combination with Manning’s eq. for the rating curve computation.

P9639

C5075

L21. RMSE is not easily comparable. In fact have dimensions. Better use a dimensionless index as Nash-Sutcliffe index or correlation index. Can you give the calibrated value of the correlation coefficient between precipitation and elevation? It can be interesting to know much underestimate the rainfall network the precipitation due to this effect.

P9640

L27. Can you support statistically this affirmation? It should be done a stationary test (e.g., Kendall’s test)

P9641

L20. Define the term “systematic” and/or reference the work which first introduced this term, in this case Stedinger and Cohn (1986) cited already in the paper.

P9644

L4. Should be “... flood (Table 2).”

Table 2 caption. Should be “... large floods (>50 ...”

Figure 4a. It is very difficult to see how good is the hydrological modelling. It seems it is not excellent. Justify it within the text.

Figure 4b. In caption, should be “daily rainfall and daily discharge ...”. Or time discretization is smaller than daily?

Figure 5 caption. Add the period for anomalies.

Figures 6a and 7a. In the legend, should AD be at the end? Explain “n”: I guess number of palaeofloods during each period.

Figure 8. What is “annual modelled series”? Should be “modelled peak discharge series”. Or use the same term in the graphic and legend.

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