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Discussions

Interactive comment on "Quantitative historical hydrology in Europe" *by* G. Benito et al.

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The authors are very gratefully for the very constructive comments of the reviewer, and their high value to improve the submitted manuscript. Most of them have been included in the updated version of the text.

Regarding the specific comments:

a) P. 4435, L. 9-15: The overview paper presents in chapter 5.2 recent trends of multi-proxy analysis (P.4435, L. 9-15).

We appreciate this comment, and following the suggestions, several new sentences were included in the section 5.2 Multi-proxy analysis of past hydrological extremes, as follow:

"Recent developments on palaeoflood reconstruction from floodplain sediments analysed geochemical proxies from continuous alluvial records and investigate local documentary flood data to calibrate the palaeohydrological records (e.g. Swiss Alps, Shulte et al., 2008, 2015; River Severn in mid-Wales, Jones et al., 2012; River Rhine in The Netherlands, Toonen et al., 2015). Flood sediments accumulated on floodplain sinks (e.g. palaeomeanders and flood-basin environments) can be analysed with high resolution techniques (e.g. X-Ray-scanned samples) to obtain continuous records of grain-size and geochemical content (Zr/Ti, Zr/Rb and Sr/Ti) indicative of detrital fraction deposited by floods (Schulte et al., 2015). The reconstructed palaeoflood magnitudes are obtained after calibrating their ages obtained by geochronological techniques (radiocarbon) with known historical events and normalizing grain-size and geochemical content, where the coarse tail of grain-size distribution is used to estimate peak flood discharges or severity indexes (Toonen et al., 2015). "

The reference by Dominguez-Castro et al., (2008) was not included because it is related to historical reconstructions of floods in Toledo, and there is not any use of proxy data. The refernce by Wirth et al., 2013 is also included in the sentences related to lake records and documentary floods.

b) P.4434 L.1: Also in many mountain catchments the historical floods are considerable larger than the instrumental data. There are several reasons (Schulte et al., 2015; Peña et al. 2015, HESS this issue):

Following the suggestions by the referee, the following sentence was modified: The largest difference in discharge between historical and gauged flood is mainly characteristic for small catchments, in mountain basins and in Mediterranean rivers (e.g. Llobregat, Ter, Ticino, Tiber and Isère rivers).

A new sentence was added as follow: In many mountain catchments historical floods are considerable larger than the instrumental data, that can be explained by different reasons (Schulte et al., 2015; Peña et al., 2015): (i) changes on atmospheric dynamics

(e.g. from 1930s to 1977 in Switzerland); (ii) possible inaccuracy of instrumental data during flood peak conditions (inundation o malfunction of gauge station); (iii) changes on discharge contribution from snow and glacier melt during past cooler climate periods (e.g. Little Ice Age), as well as influence of other flood producing mechanism (e.g. ice jams).

c) P. 4434, L. 1: As the paper is concerning the quantification of European floods I recommend the authors to write a short paragraph (or some lines) about the characteristics of European mountain catchments and progress in related research activities

The reviewer arise a very interesting topic, although include a detail analysis on European mountain catchments may be a different paper by itself. Our paper do not intent to provide a detail analysis of historical floods and their frequency across Europe, since different reviews have been published by qualified authors (e.g. Pfister, 1999, Brázdil et al., 2005 and Glaser et al, 2010). Our paper only address those papers on historical floods with some hydraulic calculations about the rconstructed records. This narrow focus limits the number of papers to be included in our discussion.

d) P. 4467, Figure 8; PP. 4436-4438: Did you identified periods of enhanced flooding when comparing the bi-decadal flood frequencies of the 8 European rivers?

As indicated in the previous comments, we didn't want to discuss on the historical flood episodes on the records provided in figure 8, because other previous papers have been addressed this topic (Glaser et al., 2010). Figure 8 shows several examples where discharge magnitudes could be estimated or classified in the indicated categories. The focus of the analysis was to provide a perspective of the current flood magnitudes in relation to the historical discharge record.

3. Technical comments: e) P. 4467, Figure 8: There are some minor problems with the typesetting of the text of figure 8 (text overlaps text or symbols).

The figure has been revised to solve the problems of the text and symbol overlapping.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 4413, 2015.

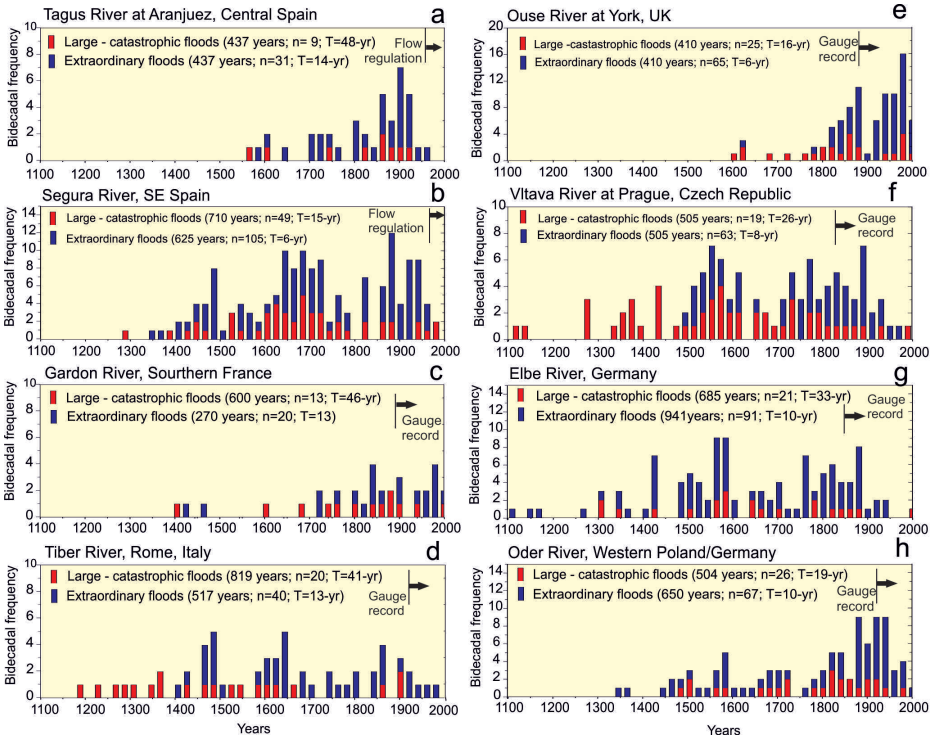
Tagus River at Aranjuez, Central Spain
a
Large - catastrophic floods (437 years; n= 9; T=48-yr)
Extraordinary floods (437 years; n=31; T=14-yr)
Flow regulation
Ouse River at York, UK
e
Large -castastrophic floods (410 years; n=25; T=16-yr)
Extraordinary floods (410 years; n=65; T=6-yr)
Gauge record
Segura River, SE Spain
b
Large - catastrophic floods (710 years; n=49; T=15-yr)
Extraordinary floods (625 years; n=105; T=6-yr)
Flow regulation
Vltava River at Prague, Czech Republic
f
Large - catastrophic floods (505 years; n=19; T=26-yr)
Extraordinary floods (505 years; n=63; T=8-yr)
Gauge record
Gardon River, Sourthern France
c
Large - catastrophic floods (600 years; n=13; T=46-yr)
Extraordinary floods (270 years; n=20; T=13)
Gauge record
Elbe River, Germany
g
Large - catastrophic floods (685 years; n=21; T=33-yr)
Extraordinary floods (941years; n=91; T=10-yr)
Gauge record
Tiber River, Rome, Italy
d
Large - catastrophic floods (819 years; n=20; T=41-yr)
Extraordinary floods (517 years; n=40; T=13-yr)
Gauge record
Oder River, Western Poland/Germany
h
Large - catastrophic floods (504 years; n=26; T=19-yr)
Extraordinary floods (650 years; n=67; T=10-yr)
Gauge record
Bidecadal frequency
Years

Fig. 1.