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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Historical changes in frequency and seasonality of extreme floods in Prague" *by* L. Elleder

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Dear Juergen, Thank you very much indeed for all your comments and suggestions. My point-to point responses to your review are below:

General comments: Congratulation to the valuable contribution of a remarkable well documented historic flood event inventory from Bohemia, especially Prague. It strongly support its consideration in the special issue and its publication in HEES. The next stop to derive frequencies and periods of increased flood frequency and magnitude is a logical, useful and necessary step in addition to previous work of the quantification of historic peak discharges. Specific comments: Flood frequency analysis (FFA) is a challenge for limited data sets, especially if one cannot be sure that the data set is

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Discussion Paper

complete (note, e.g. your comment about probably missing floods of minor magnitude page 1639 line 20 (= 1639-20). This problem should be explained in the beginning, reference to appropriate publications given (e.g. Stedinger, J. R., and Cohn, T. A., 1986, Flood frequency analysis with historical and paleoflood information. : Water Resources Research, v. 22, no. 5, p. 785-793. âĂŤ âĂŤâĂŤ- Stedinger, J. R., R.M., V., and Foufoula-Georgiou, E., 1993, Frequency Analysis of Extreme Events, in Maidment, D. R., ed., Handbook of Hydrology: New York, McGraw-Hill.) and reasons explained why you have chosen your approach and what are benefits of it. It might be useful to give reference to previous publications on the topic as other approaches were applied (e.g. Glaser, R. et al., 2010a, The variability of European floods since AD 1500: Climatic Change, v. 101, no. 1-2, p. 235-256. âĂŤâĂŤâĂŤâĂŤ Mudelsee, M. et al., 2003, No upward trends in the occurrence of extreme floods in central Europe: Nature, v. 425, no. 6954, p. 166-169).

Response: Thank you for raising this point. It will be accounted for in the revised version of the manuscript.

1644-26: How can you make a conclusion for "Central Europe considered as a whole" if you only analyse data from Czech Republic? It might be useful to consider also previous studies on the topic and related your finding in detail (!) to what was found before (e.g. by Glaser, R. et al., 2010a, respectively Mudelsee, M. et al., 2003 - references like above)

Response: The explanation of CEF is at the page 1640. The idea of considering the Prague floods within the broader context is needed regarding the previous studies. I agree with you and will state in the conclusions that my results are in line with the results of previous studies as well as recent papers (e.g. Boehm et al. 2015).

After reading the manuscript, I am a little bit confused about a definite calculation of frequencies or finding clusters of increased numbers of handed-down flood events. You mention periods (periods of homogenous topography in Prague and periods of

HESSD
12, C792–C797, 2015

increased flood events 1640-40) and calculate numbers of floods per century (1639-22). I assume not being the only one who gets confused ...

Response: You are right, I did not realize that. Thank you for this comment. To avoid the confusion, I will use the term historical urbanization stage (HUS) for periods of more or less homogenous topography instead of period. So newly — in the revised version of the manuscript - I will refer to HUS1–HUS6 instead of P1–P6. Regarding the frequency of floods (1639-22) – the main purpose was to present the major part of the data set before selection of POTQ10.Both the 1639-22 and Fig. 2 present the major part of B flood data set (Brázdil et al., 2005), i. e. 159 documented floods meeting the demand of >= Q2, prior the selection of POTQ.

In your publication (Elleder et al. 2013), no data table is listed. To give some impression of the data (in addition to the marks in your Fig. 3 in this manuscript) before starting an FFA on its base, please check if a data table is useful (e.g. as online-supplement for this manuscript). Make sure to differ for the origin of the data (previous publication / added on "acceptable level of reliability" (1638-1) in this manuscript) and give data on the date, reason, water level and estimated peak discharge.

Response: It is an interesting suggestion and this was also a point raised by the second reviewer. Nevertheless, regarding the extent of the data set (more than 300 records) I am afraid it is impossible. Such an extensive table might introduce complications. Another point is that these primary data are property of the Czech Hydrometeorological Institute and are not “per se” available for publication. Instead of such a table, Fig. 2 gives an overview of distribution of floods per century. I believe it is adequate for the purpose of this paper.

Technical corrections: The structure of the manuscript might benefit of some modifications as origin of data is mentioned in the chapter of the explanation of the applied method or abbreviations are explained in details after their first use. Some details are listed below: Chapter 2.2.: Can you find e.g. names for the periods P1-P7 (or find

HESSD

12, C792–C797, 2015

another term than "period") to avoid confusion with your flood rich periods FRP, which in the text are called "periods", too?

Response: As explained before, to avoid confusion, I would suggest to use for this more or less homogenous periods the term historical urbanization stage (abbreviated as HUS).

1638-1: what level of reliability is acceptable for you to consider the handed-down water level for further analysis (I know, hard to say in general, but please give some impression about your criteria like probably: "uncertainty of water level with in few centimetres, definitely less than ....").

Response: I believe that during the flood event the uncertainty is within 10 cm – this holds for the Vltava River in Prague nowadays .That is why for historical flood events my estimations are within 10 cm unless the “accurate record from that time” is at the disposal – in such a case I did not changed the record. Before 1481 the uncertainty is higher – some 50 cm –it is estimated merely regarding the area of floodplain (no flood marks available). The discharges are estimated within 200 m3.s-1. I will mention this in the revised version of the manuscript.

1638-10: please make sure, that no ice-jam ponded waterlevels are considered as regular discharge in your data set (e.g. Feb./ Mar. 1784).

Response: I believe this is explained in 1638-10 – they are not.

1638-21: please explain the filling of missing values, was it extrapolation between two known datapoints? Probably a graphical illustration for which event data could be added could be useful (e.g. somehow a modification of your Fig. 3; cf. further comments on this figure below)

Response: I filled the missing values based on a proximate sum of discharges from the Upper Vltava River and its tributaries (the Berounka River, the Sázava River), if these values were known. During major floods of the Elbe River in Děčín or Dresden, it is

HESSD

12, C792–C797, 2015

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obvious, that the discharge of the Vltava River is needed (see 1635, 10–15.) as the Vltava River contributes significantly to the Elbe River discharge. A regression equation showing association between Děčín and Prague (e.g. Elleder et al., 2013, Fig. 6) is applicable.

1638-26: What is the "B set" of Brazdil et al. 2005?

Response: B set is a set of 159 flood events published by Brázdil et al. (2005). This was a basic set for estimations of water stages and discharges. I will highlight this in the text of a revised version of the manuscript.

1639-4f: please introduce abbreviations like AMF and POT before the first use (hence, move this paragraph towards somewhere above -POTQ10 mentioned already at 1638-11 without explanation)

Response: I will do that.

1639-12f: description of considered data again - move into previous chapter on data.

Response: I will do that.

1644-5f: this is a conclusion - move into the following chapter

Response: I will do that.

1644-20: about the current period: how can you be sure that it is already terminated? Consequently, a mean frequency of floods cannot be determined!?

Response:I did not mean it is terminated, the end is opened. I just wanted to indicate that currently we are in a period with high frequency of floods.

Fig. 3: please spread the figure on twice its recent width and please explain: # the different colours for different periods # difference between bold and regular flood event labels # avoid vertical accumulation of flood labels as they cannot be identified # FR1 might FRP1 - when does each period begin respectively end?

HESSD
12, C792–C797, 2015

Response:I will work on it.

As I am not a native speaker, I do not comment on phrases or expressions sounding slightly strange to me - I suggest to ask a native speaker for some improvements on the language after modifications of the content.

Response: A native speaker corrected my English for grammar and style.

I am looking forward to get your statements on the suggestions made above - do not hesitate to explain if I am probably too tired today and criticise obvious explanations or contexts without need. - JH

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 1633, 2015.

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