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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Reassessing flood frequency For the Sussex Ouse, Lewes: the Inclusion of historical Flood Information since AD 1650" *by* N. Macdonald et al.

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The broad content of this paper is an important one and the methodology and sensitivity analysis of sufficient originality that the paper is recommended for publication. However, I have serious problems with the detail. In particular I am concerned with the reliability of the data used to demonstrate the method. The answers to these questions may (or may not) be in previously published papers but for this paper to stand alone, it needs to address more thoroughly the reliability and homogeneity of the historic record.

General The paper makes comparisons between short gauged records and records

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extending using historical information. It makes no mention of the alternative method of extending a local record by the use of pooled information from similar catchments. Whilst it is legitimate in the context of the paper to omit a pooled estimate, I believe that the method should at least be mentioned as it is the recommended first choice of FEH. If I were an EA flood risk manager, I would definitely like to see a comparative pooled estimate. The paper skips too easily over the problems associated with the use of historical flood information in flood risk assessment. Whilst you note that 'during the largest flows, relatively minor modifications within the channel and catchment may have minimal impact on flood discharge', this needs to be addressed more comprehensively than reference to a previous paper. 1. How well does the measurement of flow at the two gauging stations correspond with the flow at Lewes? You state (page 7 last line) that 'no other significant flows enter the system between the town and Ouse (presumably you mean Gold) Bridge. However there is quite a large catchment area which includes the Longford Stream and the Bevern Stream. At least you might indicate the additional area contributed by this ungauged inflow. 2. What changes have occurred in the catchment and channel above the point of interest (Lewes) that could have affected the homogeneity of the historical record of discharge with the more recent gauged record? Your remarks about drainage and canalisation are relevant but you fail to make the connection. Presumably the works to permit navigation to Balcombe (which is a long way upstream) involved straightening and deepening the river such that it would increase its capacity to carry floods (and less on the floodplain) and reducing the attenuation in the reach especially from the confluence of the Ouse and Uck to Lewes. Google maps shows some continuing effects of this canalisation for example at the Pellbrook cut. As this navigation fell out of use the effects of the canalisation would have diminished as the channel silted up (possibly again increasing the attenuation and allowing more overbank flow). All this since 1790! These changes could have affected the proportion of flow generated in the headwaters that reaches Lewes and caused the historical flow information to be non-homogeneous with the gauged record. River canalisation has been found to have a major effect on flood fre-

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quency in Ireland, for example Bailey and Bree (1981). At least you might indicate whether there is significant overbank storage in this reach between Ouse and Uck confluence and Lewes and whether it is protected by flood banks. Pearce (2002) indicates the presence of floodplain flooding in the Middle Ouse in the Oct 2000 flood. 3. Other upstream changes include the reservoir at Ardingley whose catchment area you fail to note and its date of construction (1978) and changes in land use (you mention forestry in the upper catchment but the catchment has much woodland – has this changed). 4. To match the gauged and historical flows at Lewes, there needs to be some specific point or points where the height (for example on a bridge) or depth (in one or more properties) can be obtained for both gauged and historical flows. You note (for gauged flows) that 'estimates are derived using a single stage-discharge relationship', so presumably you used such information. You give no indication in Section 3.1 that points in Lewes have been matched up with the gauged flow assessment from the two gauging stations. With respect to historical floods, the fact that 'boats were sailing about' gives no real indication of the depth and hence of the discharge – though I agree it gives a qualitative assessment of the magnitude of the flood. Similarly the information included in Table 1 is very general and unless there is more specific information available in Macdonald 2004, I would be sceptical of the assigned discharge figures for each of the events.

Title The title notes 'since 1650' but this figure is not mentioned again in the paper and the Abstract says 'back to 1750'. The title is linguistically correct but one could equally say 'since 1450' and is therefore confusing. P 4 line 2 Not sure what the upside down question mark is meant to indicate. Spanish? P 4 line 10. What area (and what proportion of the total) does the Ardingly reservoir catchment impound? P 4 line 12 High water here refers to tidal level but 'high water' in line 24 refers (presumably) to groundwater. The latter should be specified to avoid confusion. Page 5 Section 2.1 Channel management. This section is interesting but you fail to indicate how this is relevant to the use of historical information in flood estimation. Sec 2 and 3 In neither section do you give catchment areas either to the point of flooding or to the gauging

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stations or to the confluence. This is surely a key piece of information to put the study in context and should be included. (You do give it for the Winterborne stream and for the Lewes Levels). P 7 line 6 Single stage discharge relationship – for Where? P 7 line 29 You refer here to Ouse Bridge but don't mention such a bridge name in your bridges section – it is not clear which reach you refer to. Although there may be no significant tributaries between the gauging stations and Lewes, there is a significant catchment area (Fig 1) which would be contributing to flows at Lewes. As noted above you don't indicate what proportion of the catchment this represents. Section 3.1 It is not clear how you combined these records. Did you simply add the annual max from the two stations whether or not the AMAX occurred on the same day? Alternatively did you take the AMAX for the larger flow and add the daily maximum for the other station on the same day? Alternatively did you take the AMAX from the larger flow and add the flow at the same time from the other station (perhaps adjusted by travel time)? Do the annual maxima at the two stations tend to occur on the same day and at a similar time? Did you make any allowance for ungauged inflow in the reach to Lewes – or alternatively attenuation due to channel and floodplain storage? Is there any way of checking whether the Rank order of the gauged floods created from the two gauging stations corresponds with the Rank order at Lewes – either in terms of measured levels at Lewes or descriptions of flood damage? P 8 line 3 When you say complete series do you mean complete series of AMAX or complete series of daily maxima from which AMAX are selected? P12 lines 16 et seq. You acknowledge that the uncertainty estimates you quote are only those associated with the sampling uncertainty associated with the chosen distribution and use this as the basis for comparison with gauged uncertainty. I think you should add further comment in your discussion or conclusion concerning the fact that uncertainty in the magnitude of the historical floods could add significantly to the uncertainty of your 100 year RP estimate (and would be difficult to assess). This applies even to the qualitative estimates of extremes over a threshold as the evidence you have presented in the paper for the magnitudes selected would make it difficult even to say whether a particular event was above a given threshold or not.

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Section 4 p 9 to 12. I think it should be mentioned that an adaptation of the Stedinger and Cohn (1986) procedure using maximum likelihood has previously been applied by Archer (2010) (with both GLO and GEV distributions) for catchments in northeast England. This also uses alternative procedures based on a) using the full gauged data and quantitative historical discharge data, where available and b) using only the number of exceedences above a threshold, where quantitative estimates of historic flood discharges cannot be made. P 14 line 24-25 Fig 5 shows symbols for gauged and historical events in the key but are not included in the figure. Presumably in the third case where the historical events are only known to exceed the chosen threshold, these values cannot be plotted.

References Archer, D.R. (2010) Applying historical information to flood risk assessment in northeast England, BHS Third International Symposium, Managing Consequences of a Changing Global Environment, Newcastle 2010. Bailey, A.D. and Bree, T (1981) Effect of improved land drainage on river flood flows, Flood Studies Report – Five Years on, Thomas Telford Ltd, London, 1981. Pearce, J. (2000) Hydrologist experiences in times of flood: Sussex 2000, BHS 8th National Hydrology Symposium, Birmingham, 2002.

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