

Interactive comment on “Millennial scale variability in high magnitude flooding across Britain” by N. Macdonald

Dr Macdonald

neil.macdonald@liverpool.ac.uk

Received and published: 19 November 2014

I would like to thank the reviewer for making the comments on the paper and for recognising the potential of such a paper to the evidence base for long term variability of flooding in the UK, but also its potential value to a wider community.

In developing this paper I attempted to provide a short review paper of existing published series which already include detailed accounts of the factors affecting the hydrology of each of the catchments and the different source materials, and provide five additional series which have yet to be published. The intention was to provide a summary paper which provided a ‘rapid communication’ of the first attempt at a UK level to assess the different historical patterns of flooding that are starting to emerge from

C5211

this dataset. In writing this paper the intention was to limit discussion of the factors affecting the individual catchments and focus on the ‘big picture’, whilst I appreciate that the consideration of the local factors affecting the hydrology of the individual systems is important and requires careful consideration, the focus of this short ‘rapid communication’ style paper was to explore some of the potential findings of such a dataset, rather than delve into the specific aspects the impact on each of the catchments, as such references to texts addressing these issues and where available the catchments considered in detail are provided.

Below are comments directly addressing the concerns of anonymous reviewer 1.

The paper does not directly reference the long series in the Mediterranean, but as the reviewer correctly identifies the paper is focussed on the UK. A number of references to long European flood series are provided within this paper.

I appreciate there are a number of anthropogenic influences that have affected river catchments over the course of this study (lines 25-5, pg 10159-10160). The intention is not to ‘over simplify’, but to avoid a detailed discussion of the different catchment modifications that could result in changes to the catchment hydrology, particularly as we are interested in only the largest events, events which tend to overwhelm the catchment irrespective of many of the human modifications. Each of the papers specifically focussing on the individual catchments (referenced) addresses these aspects in detail. As explained above the aim of this paper was to present a more ‘rapid communication’ style paper, which does not address each of the catchments in detail; whilst this is possible this would change the style of the paper towards one of considerably extended length.

Much of the deforestation of the UK was complete by c. AD 800-1000, before the start of this study, drainage of large areas and land improvements date back to pre-Roman times, with modifications of these systems throughout the intervening period. Within n this study the points raised by the reviewer are all correct in relation to potential

C5212

factors modifying local hydrology, but a number of authors have suggested that these modifications have a diminishing influence on extreme events, whilst they will certainly have an influence on lower frequency events, as this study is focussed on extreme flows it is likely that the influence of these land use modifications will be diminished.

As above, yes, most of these systems have structures built upon the adjacent lands, or crossing the rivers themselves, with modification of the channel, as explained in the paper this is one reason why greater confidence is given to the period 1750- as most of the catchment study locations present stable cross sections from this time (line 3 pg.10160). With greater uncertainty over the longer timeframe.

I agree that the preferential recording often reflects an impact to an individual or a community (see paragraph from line 5, pg.10160)

The catchments in the UK that are used are predominantly rural with urban centres reflected points at which records are carefully recorded, for one or multiple reasons often associated with religious, political or trade centres (e.g. York). The input of urban flooding during large flood events is minimal; these systems reflect large (UK relative) catchments. The recording of the events in terms of impact I agree varies through time with the development of flood defences, but during the magnitude of the floods discussed these are often overwhelmed, even when they are not during the recent period (1750-present) the largest floods are still recorded, this period represent the timeframe within which most of the flood defences where constructed in UK cities. London is an exception and this is one of the reasons why I avoided using the city as a location (line 1, pg. 10162), even given the wealth of materials present.

When considering the catchments focus is given to specific locations, I agree attempting to merge records over large catchments is fraught with problems hence why this study focuses on relatively stable channel sections in specific settlements. I accept that this is not stated in the paper and will add a sentence addressing this point, that all accounts are for specific settlements on catchments and not catchments in full. I

C5213

accept and appreciate this oversight may have resulted in some misunderstanding an apologies for this omission.

I appreciate that this point is not explicit and will amend the manuscript to be explicit to all sites. Each of the study sites selected was intentionally above the tidal limit (see line1, 10162) and as such would not be influenced except during a potential tsunami event, none of which are noted to have affected the UK significantly during this period, the potential exception being 1607, which includes a considerable debate, with some relating to a frontal system, but this does not appear within the series.

The role of precipitation in its different states is discussed (10162) with different generating mechanisms responsible for flooding, in small steep catchments I agree catchment conditions can have an important influence, but in the systems discussed floods are generally either snowmelt, precipitation on snow or a combination in conjunction with frozen soils and persistent precipitation over a long timeframe. The role of groundwater in saturation can be important in relation to persistent precipitation and I would be happy to add a sentence explaining this further. The role of direct groundwater influence is limited in most UK catchments, those that do show strong groundwater flooding are relatively small (e.g. Pang and Lambourne).

The reviewer is correct in stating a review of the historical societal position is not included, this is intentional as previously stated for the largest events human activities have an apparent limited impact (with the potential exception of large water retention structures), therefore the social aspects have little significance for the most extreme events.

The idea behind transforming single point events to an averaged series, is that a set of single points (punctual) is not easily comparable to the potential drivers behind the flood generation, as such to analyse the data in such a way over a long time-period then we need to explore the data in a more aggregated form.

I accept the comment concerning the contradictory statement, it should read positive

C5214

forcing, so - "The flood-rich phase in different catchments around Britain (except Wales) during the late sixteenth and early seventeenth century corresponds to a phase of increased storminess in the North Atlantic (Lamb and Frydendahl, 1991) and increased solar activity (Muscheler et al., 2007), and is evidenced in flood accounts from catchments across southern and central Europe (e.g. Brazdil et al., 1999) suggesting a wider 25 flood-rich period, which relates to a particularly strong phase of positive solar forcing (Fig. 4)."

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 10157, 2014.