Hydrol. Earth Syst. Sci. Discuss., 11, C4166–C4170, 2014
www.hydrol-earth-syst-sci-discuss.net/11/C4166/2014/

Hydrology and Earth System Sciences
Open Access
Discussions

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

Anonymous Referee #2

Received and published: 1 October 2014

Millenial scale variability in high magnitude flooding across Britain

Overall assessment

The limited agreement between modelled assessments of temporal changes in flood risk and observational evidence from many parts of the globe constitutes a major constraint on the development of effective flood alleviation strategies in a warming world. This paper makes an important contribution to the understanding of the long term variability in the frequency of major flood events in Britain and provides a unique information base (albeit a necessarily fuzzy one) to aid flood attribution studies and provide a better understanding of how future flood risk may evolve. This has a particular importance in a British context. Although the current gauging station network is dense,

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

very few river flow series extend back more than fifty years. Importantly also most commence during the relatively flood-poor 1960s and 1970s. In contrast, the early years of the twenty-first century have witnessed a series of major flood events lending credibility to a perception that flood risk is increasing substantially. This has major economic, social and environmental implications but is the recent tendency towards increased flood frequency a resilient one? There is an urgent need to place the variability of flood magnitude and frequency experienced over the last 50 years in a much broader historical context. This paper provides strong evidence of flood clustering and establishes a firmer foundation upon which to assess the relative importance of driving mechanisms which may exhibit multi-decadal cyclicities. It therefore constitutes an necessary foundation underpinning the development of more cost-effective strategies to moderate future flood risk.

The paper merits publication (subject to the points raised below being addressed) and should stimulate further initiatives to capitalise on a rich (though incomplete) legacy of historical evidence in order to better understand the factors which contribute to episodes of major flooding.

General comments

Unsurprisingly, the pre-1750 events featured in the paper constitute less than 15% of the total and the 'flood rich' period indentified in 1550-1650 is only strongly supported by the flood series for the Tay. Correspondingly, the paper would benefit from a tighter focus on the post-1750 period. In addition, the Irish material adds little of consequence and any thorough review of the European dimension would both complicate the attribution discussion and require a deeper exploration of the impact of flood alleviation measures (particularly the use of large flood retention reservoirs). It is recommended therefore that the text, like the analyses, is largely restricted to the British situation.

Some further text editing is also required particularly in the Summary.

Specific comments

HESSD

11, C4166–C4170, 2014

Series construction

What precisely is meant by the '90th percentile'. If based on daily mean flows this would be comparatively low threshold and imply the selection of many minor flood events. Does it refer to the 90th percentile of the annual maximum series covering the instrumented record (as implied by Figure 2)?

The peaks (from 1883) for the Thames featured in Figure 2 appear to correspond to the daily maxima for the Teddington/Kingston flow series at the tidal limit but Section 4 refers to 'the Thames reconstruction is based at Oxford'. This should be clarified. Note also that tidal influences have little impact on the Thames flood series through the instrumented era (Modern flows being monitored by ultrasonic techniques and earlier high flows were assessed using tailwater stage-discharge curves applied twice-daily at minimum tide levels1).

In Britain, the impact of land use on flood magnitude in large catchments is generally modest but it is unclear how the impact 'where, possible, has been accounted for using available information'. Some guidance on this would be helpful. More importantly, river engineering and other flood alleviation measures have certainly moderated flood risk primarily through increases in channel conveyance. This is particularly true for the period following the very extensive flooding in March 1947 and merits some discussion. It is important to emphasise that the paper primarily addresses estimates of flood flow magnitude (rather than peak levels).

Spatial and temporal flood variability

The flood-generating mechanisms discussed here need to be reviewed in greater detail. Extreme summer floods do occur (e.g. 1952, 1968, 2007 for example) resulting from intense rainfall (on initially unsaturated ground) and plenty of winter floods occur in the absence of snow or frozen ground. The role of snowmelt is of particular interest in a warming world and its influence on British floods is complex. For instance, whilst for the Yorkshire Ouse, the ratio of snowmelt-generated floods appears to have changed

HESSD

11, C4166–C4170, 2014

little over time, the same cannot be said for some southern catchments – the Thames in particular. Snowmelt has been a very minor contributor to floods on the Thames over the last 50 years but was a substantial factor in many major historical flood events. Whilst ice-jamming (sometimes exacerbated by upstream debris accumulations) has been a declining factor in relation to flood risk it surely would have been influential on more occasions than the 1814 event on the Tay – for example during the March 1947 flooding, and particularly on navigable rivers where many poorly maintained weirs were vulnerable to ice build-up (both on the structure itself and upstream).

Flood rich and poor phases

The contrast in flood frequency pre- and post-1950 for northern England is a particularly striking feature of Figure 4. This should be supported by a short discussion confirming (if it is true) that the contrast is a feature of each of the flood series which form the northern England group. The period 1875-1885 is identified as 'including a number of years with severe floods' but the associated reference does not feature supporting evidence relating to this particular timeframe. An appropriate reference needs to be substituted (BHS Chronology of British Hydrological Events?).

It is unfortunate that this review of GB flooding terminates just before the most protracted flooding episode experienced across England & Wales in the last 60 years at least (and probably substantially longer). The flooding reinforces the 'flood-rich' nature of the recent past but somewhat undermines the statement '..from a historical perspective that these are not exceptional'. In the light of the recent flooding 'unprecedented' would be a better term than 'exceptional'.

Flood drivers

'Flood response to solar forcing may be regionally and temporally heterogeneous (lines 18-19)' This is particularly important in relation to flood risk across the UK (see above) and merits further exploration – considering, for example, how faster melt rates (particularly in northern Britain) and the decline in snowfall (across southern England) impact

HESSD

11, C4166–C4170, 2014

on the frequency of high magnitude flood events, or how contrasting catchment geology may be reflected in differing vulnerabilities to high intensity rainfall and long duration rainfall accumulations.

Reference 1. Mander, R.J. 1978. Aspects of Unsteady Flow and Variable Backwater. In Hydrometry – Principles and Practices (Ed: R W Herschy). John Wiley & Sons. 205-246.

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