Editorial: Historical and palaeo-floods in Earth's history

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High-magnitude flood events over the last decade in Europe and elsewhere across the world have caused extensive damage. Consequently, questions are being raised of potential changes in the frequency, magnitude and seasonality of flood events as a result of climate change and heightened public awareness of flood risk in many communities internationally. This has resulted in a call for longer and better hydrological records (Brázdil et al. 2012), providing time series incorporating sufficient high-magnitude events to improve flood risk estimation. Unfortunately a sufficient sample of high-magnitude low-frequency floods are rarely present in instrumental series, with relatively few series at a European level beginning prior to 1900 and only a handful beginning prior to 1850s. As such alternative approaches are needed to provide a better indication of the potential frequency and magnitude of such events, this is primarily achieved though examining the pre-instrumental period for evidence of large floods, in the form of historical hydrology and/or palaeohydrology.

Palaeoflood hydrology is recognized as an integral component of the broader discipline of hydrology (Baker et al., 1987), with historical hydrology only recently receiving recognition as providing important information (see e.g. Thorndycraft et al. 2003) that can be incorporated into risk analysis. Brázdil & Kundzewicz (2006) in a Special Issue on Historical Hydrology brought together the principal developments in the field of historical hydrology; Brázdil et al. (2006) identified the following future research priorities for historical hydrology in Europe:

- Completion of existing databases of historical floods; verification, cross referencing and application of different data types (e.g. documentary and epigraphic) for reconstruction of past floods.
- Compilation of flood information for different countries in Europe and evaluation of floods in terms of generating mechanism, seasonality, severity and impacts; and studying flood behaviour over time, particularly in relation to change detection and attribution.
- Improving multi-disciplinary and inter-disciplinary collaboration in reconstruction of the occurrence and severity of past floods, as well as in study of impacts of past hydrological extremes upon human society and its adaptation to extremes.

These three priorities are being addressed; the first through increased analysis of historical records and the compilation of national chronologies (see e.g. Macdonald, 2006). The second through a European action (Kjeldsen, 2011), which is examining the temporal variability of floods at a European scale, whilst this special issue addresses the third priority. It provides key developments within the multi-disciplinary fields, which are advancing current understanding of palaeo and historical hydrology. Recent papers examining the impact on society at the large scale have developed this field (e.g. Brázdil et al. (2010), though recent research has moved the focus of historical flood analysis from the wider national-international perspective, to the community. The aim is to better understand the impacts at a

smaller scale, with a particular focus on developing localised mitigation strategies for future events.

This special issue has evolved from a session 'Palaeofloods in Earth's History' at the International Union of Quaternary Research (INQUA) conference in Bern, 2011. The last decade has witnessed a proliferation of studies examining past flood events in a range of environments and over different timescales. While historical floods by definition took place in a historic timeframe constrained by the presence of documentary or epigraphic records, flood events prior to the historic period are considered as palaeofloods. The toolset though available to those studying palaeofloods permits analysis of evidence until the last couple of years, an increasingly important aspect as it permits corroboration and comparison to recent events, permitting questions of frequency and magnitude signal retention in sedimentary sequences to be better understood. As a result of the different time ranges of documented history (millennia in the old cultures of China or Egypt to just a century or two in some parts of the world), the term Earth's History covers historic through to geological timescales and consequently the contributions to this issue cover the same broad temporal range. The field of palaeohydrology has developed rapidly, and this special issue seeks to draw examples of the different approaches being applied within the field, from the broad background disciplines of hydrology, geomorphology, dendrochronology and geology These broad discipline fields provide their own specific and particular expertise within the different environments and timeframes to showcase the toolset now available to researchers for reconstructing past flood events.

The special issue is roughly divided into two, based on timeframe, with the first three papers addressing floods during the late Holocene; the final three papers examine late Pleistocene events. The issue starts with a paper by Elleder et al. (this issue) in which the challenges of reconstructing historical discharges is addressed using the hydraulic properties of well described historic flood events at Prague during the period 1481-1825. This is followed by a paper from Macdonald (this issue) in which historical flood events from the River Trent at Nottingham (1320-2010) are reconstructed and approaches for inclusion into contemporary flood frequency analysis assessed. The paper by Toonen et al. (this issue) examines flood events in the mid-Holocene on the River Rhine, through the examination of sediment properties, coupled with reconstructed palaeohydraulic floodplain properties to estimate flood event discharge. The final three papers examine events over much longer timescales, with all three examining different types of events dating from around the end of the last phase of glaciation. A paper by Szafraniec (this issue) examines sedimentary deposits from NW Poland and analogous deposits from contemporary glacial systems to explore the potential of palaeoflood marks on sandur morphomentry, using a morphomentric classification scheme. The paper by Völkel et al. (this issue) considers variations in sediment structure and rates of incision and deposition on Mount Sinia, Egypt, and the potential role of flood events as individual and phases of activity in landscape evolution. Finally Herget et al. (this issue) examines the hydraulic characteristics of megafloods (flood events with a discharge greater than 10^6 m^3s^{-1}) based on geomorphic evidence derived from field and laboratory based experiment.

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