Paleohydrology of high magnitude floods from upper Kaveri basin, Southern India: Implication to late Holocene climate variations

Kartika Goswami¹, Manoj K Jaiswal¹, and Vishwas Kale²
¹Department of Earth Sciences, Indian Institute of Science Education and Research, Kolkata, India (kartika333@gmail.com)
²Department of Geography, Savitribai Phule Pune University, Pune, India

In recent times global climatic changes are gaining due importance. One of the ways in which climate change affects humankind is the frequent occurrence of extreme climatic disruptions, such as high magnitude climate-flooding events. In order to understand the present and future trend and pattern of the changing climate, it is important to identify high magnitude palaeoflood events and reconstruct the palaeohydrology. Instrumental/historic records have helped to understand the extreme flood-climate relationship in the modern environment. However, to understand their long-term relation (10²-10³ years) studying sedimentological archives of large magnitude floods (eg. slack water deposits) is important, also, leading us to understand the future climatic disruptions even more effectively. Robust estimation of palaeoflood discharges and frequencies will also lead to the formulation of better flood-related policies.

Current study is undertaken in the upper reaches of Kaveri basin, Southern India and shows noteworthy link between the major climatic transitions (from fluvial dormancy to sudden outburst of monsoons around 2 ka, onset of Little Ice Age (LIA) in the 14th century, end of LIA in the 19th century and then the 20th century) and increased frequency of large magnitude floods. Detailed flood chronology was established using the optically stimulated luminescence (OSL) dating technique. OSL dates the last daylight exposure of the sediment. In addition, palaeoflood discharge estimations were made based on Manning's equation. Together with numerical dating, it allowed the reconstruction of flood magnitude and frequency over an extended period of time. The study suggests that the magnitudes of recent flood events are higher than the palaeoflood magnitudes in the study area. We also observe that the two major flood events of the 20th century reported from the upper Kaveri were produced by high-intensity short-duration storm events. Rainfall precipitation analyses of the last 10 years (2010-2019) demonstrate the increase in erraticity of rainfall also causing extreme floods. Analyses of other hydrological variables such as soil moisture, basin shape, and size in producing floods in the study area suggest that rainfall alone may not always be the ultimate proxy for subsequent flooding.