What Influences Flood Generating Processes Around the World?

Lina Stein, Francesca Pianosi, and Ross Woods

University of Bristol, Civil Engineering, Bristol, United Kingdom (lina.stein@bristol.ac.uk)

River floods have serious impact on people and the environment. The number of climatological drivers that can cause flooding are limited: Heavy rainfall, rainfall on saturated ground, snowmelt, or a combination of these factors are viable flood drivers. However, for most catchments and most flood events the underlying flood processes are not well understood or documented. Yet, understanding these drivers is relevant for climate change impact studies and can potentially reduce uncertainties of extreme flood estimation.

We aim to reveal how flood drivers vary around the world and how flood drivers can vary within individual catchments. How is the mix of flood drivers influenced by climate and catchment characteristics? We approach the problem through large sample hydrology, which allows a comparison of catchments and their system properties related to flooding, thus extending previous studies covering the US and Europe.

In addition to global soil and climate data, we use the recently published Global Streamflow and Metadata Archive (GSIM), which includes magnitude and date of annual maximum flood for several thousand catchments (Do et al, Earth Syst. Sci. Data, https://doi.org/10.5194/essd-10-765-2018, 2018; Gudmundsson et al, Earth Syst. Sci. Data, https://doi.org/10.5194/essd-10-787-2018, 2018.).

A process-based decision tree allows us to generate flood driver timeseries for each catchment from which we derive the dominant flood generating mechanism and the flood driver distribution of each catchment. We apply a cluster analysis on these data to investigate which catchment and climate characteristics are causing flood drivers to be of importance.

We conclude that antecedent wetness is the most common aspect of flood events among our study catchments. However, the majority of catchments have several processes that cause floods. This combination in flood drivers is distinct across regions and can be linked to climate and catchment characteristics. Together this provides new insight into the causes of flooding around the world.