STAHY2017-32
STAHY 2017 workshop,
21–22 September 2017, Warsaw, Poland

Improving flood frequency analysis through upstream/downstream constraints

Daniele Ganora, Francesco Laio, and Pierluigi Claps
Politecnico di Torino, Department of Environment, Land and Infrastructure Engineering, Torino, Italy
(daniele.ganora@polito.it)

Flood frequency analysis is nowadays considered a rather mature topic. The efforts of the scientific community in the last decades lead to effective techniques to estimate the flood frequency curve not only in gauged basins, but virtually in any point on the river network. This allow one to create “high resolution” maps of the flood frequency curve. In such case, many additional modeling opportunities and issues arise, and the importance of the river network structure become more and more important.
In this context, prediction of flood frequency curve performed with large-scale models can be locally improved by using data from nearby upstream/downstream gauge stations, by properly accounting for the uncertainty of both the large-scale and the local information. In this work, we discuss some recent applications that allows one to account for the river topology to provide flood estimates along the streams in a probabilistic framework.
Particular emphasis is devoted to the assessment of the influence of nearby local gauged data in the correction of large-scale models and how such information can be weighted in the final estimation of the frequency curve. While we can always define a general “maximum influence distance”, i.e. the distance within which the local information is suitable to be used, based on the quality of local information we can refine the domain of applicability of the correction. A proper use of local information is shown to be able to improve final estimates of the flood frequency curve.
This framework can be further extended to include information not directly provided by flow measurement, but available from the analysis of the conveyance performances of a river reach. This generalization is very important to study the flood frequency curve in complex morphological contexts and in the presence of human-made infrastructure, and helps one to evaluate how these effects propagates downstream.
An application of the use of upstream/downstream data to improve flood frequency analysis in a probabilistic framework is provided, together with some insights emerged from the analysis of recent significant flood events.