On the effect of multiple reservoirs on peak flood quantile at the catchment scale

Stefano Cipollini[1], Aldo Fiori[1] and Elena Volpi[1]

(1) Dipartimento di Ingegneria, Università Roma Tre, Roma, Italia

Human activity significantly affects the occurrence and magnitude of flood events. Land use change and riverworks construction are drivers of hydrological change, possibly enhancing or smoothing the effect of climate variability in time. Hence, understanding their role is fundamental for disentangling the driver effects, yet also for planning purposes at the catchment scale.

In this work, we present a simple yet physically-based global index approach to assess the effect of one or more than one reservoirs on peak flood quantile at the catchment scale. The index formulation relies on linear approach, embedding the linear reservoir response into the classical Instantaneous Unit Hydrograph (IUH) method. Moreover, the index makes use of the concept of Equivalent Reservoir, i.e., a multiple reservoirs system can be described making use of an equivalent, single reservoir system whose characteristics are such that its impact on the catchment outlet approximately reproduces the effect of multiple reservoirs.

The index takes into account the most important parameters controlling the system behaviour, such as the number, relative location and relative storage coefficient of the reservoirs plus a climatic parameter determining rainfall variability in time (i.e., Intensity-Duration-Frequency, IDF, curves); note that thanks to the linearity assumption, the analytical expression of the index is independent of the return period.

References

Cipollini, S., Fiori, A., & Volpi, E. (2022). A new physically based index to quantify the impact of multiple reservoirs on flood frequency at the catchment scale based on the concept of equivalent reservoir. *Water Resources Research*, 58, e2021WR031470