Geophysical Research Abstracts
Vol. 20, EGU2018-6803, 2018
EGU General Assembly 2018

“Tinkering” the Dynamic Unit Hydrograph

Eleni Maria Michailidi (1), Antonis Koukouvinos (2), Baldassare Bacchi (1), and Andreas Efstratiadis (2)

(1) University of Brescia, DICATAM, Brescia, Italy (e.michailidi@unibs.it), (2) Department of Water Resources and Environmental Engineering, School of Civil Engineering, National Technical University of Athens

For many decades, the unit hydrograph (UH) theory has been worldwide applied for representing, in a simple and parsimonious manner, the (highly)-complicated processes of surface runoff routing. Key assumption is that the rainfall – runoff transformation is represented through a unit pulse response function of a linear system, thus the ordinates of the unit hydrograph for a given duration are proportional to the total runoff. In fact, the UH shape is mainly determined by two time characteristics, i.e. the time to peak and the base time, that are in turn associated with the response time of the river basin (either defined as the lag time or the time of concentration). However, both theoretical proof and empirical evidence imply that the response time of a basin actually exhibits significant variability against rainfall and thus should be regarded as a variable rather than a constant property. Consequently, the unit hydrograph cannot be considered a characteristic property of the basin as traditionally tackled, but a dynamic element, which also depends on the excess rainfall intensity. Evidently, as rainfall varies during a storm event, the runoff routing process and its mathematical formulation through the UH is also varying. In order to employ the concept of the dynamic unit hydrograph, whose shape is adapted to the excess rainfall intensity, we introduce a synthetic UH, with time parameters expressed as functions of the time of concentration, combined with the well-known NRCS-CN method. The validity of our approach is tested against observed flood events from a number of Mediterranean basins (Italy, Greece, Cyprus). Based on the outcomes of these analyses, we also provide regional formulas explaining, with good predictive capacity, the variability of the two time parameters across basins with different characteristics.