Geophysical Research Abstracts,
Vol. 11, EGU2009-9271, 2009
EGU General Assembly 2009
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Regionalization of storm hydrographs in the rescaled width function framework

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In this study the capability of the Width Function based Instantaneous Unit Hydrograph (WFIUH) as a tool for transferring hydrologic information and obtain the prediction of flow hydrographs in ungauged basins is evaluated, attempting to relate the two kinematic parameters to some easily identifiable characteristics of a catchment (Agnese et. al, 1988; . Al-Wagdany et al., 1997). As a first step to this scope, the kinematic parameters of the WFIUH were estimated for a variety of Italian basins. Different gauged catchments located within the Upper Tiber valley, some major tributaries of the Tiber river itself and the Amaseno river (Central Italy) were selected to asses a regional analysis of hillslope and channel velocities for catchments with different morphology and lithology. According to recent works (Di Lazzaro, 2008), the analytical expression of the first and second moment of the WFIUH has been revised taking into account the statistical dependence between hillslope and channel lengths. Velocities are estimated through a moment fitting procedure based on rainfall records, runoff data and on the metrics of the catchment. Results have shown that longer lag times and variances are observed in basins underlain by carbonaceous formations with respect to others. For these basins the estimated coefficients of variation of the IUH appear also increased. This hints that this type of geologic formation introduces a delay and a variance-generating mechanism in the flow process. This behaviour can be well interpreted with the introduction of lower hillslope velocities in the rescaled Width Function schematization. Lower hillslope velocities were effectively estimated for these basins through the application of the method of moments. Thus, hillslope velocities in the WFIUH model appear to be significantly related to the lithology of the catchment. Channel velocities appear instead to be related to the average slope of the basin. Thus, steep mountainous catchment shows higher channel velocities with respect to alluvial catchments. The values obtained for both hillslope and channel velocities appear always to maintain a physical meaning. With regard to the question of the relative role of hillslope and channels on the hydrologic response (Robinson, 1995), the contribution of hillslopes to the average residence time appears in all cases comparable to that of the channel component, up to basins with a drainage area of 4000 km^2, and in some cases it is prevalent. The analysis of the variance of the travel times corroborates the hypothesis that the role of hillslopes is primary in defining the catchment dispersion.

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