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Controls on event runoff coefficients in the eastern Italian Alps

D. Norbiato (1), G. Blöschl (2), R. Merz (2), A. Carton (3)

(1) Department of Land and Agroforest Environments, University of Padova, Italy, (2) Technical University of Wien, Austria, (3) Department of Geography, University of Padova, Italy

Analysis of event runoff coefficients provides essential insight into catchment response, particularly if a range of catchments and a range of events are to be compared by a single indicator. In this study we examine the effect of climate, geology, land use, flood types and initial soil moisture conditions on the distribution functions of the event runoff coefficients for a set of 14 small-to-medium sized mountainous catchments located in the eastern Italian Alps. Runoff coefficients were computed from hourly precipitation and runoff data and estimates of snowmelt. A total of 535 events, including flash floods, synoptic floods and rain-on-snow events, were analysed over the period 1989-2004. We classified each basin using a "permeability index" which was inferred from a geologic map, ranging from "low" to "high permeability". A continuous soil moisture accounting model was applied to each catchment to trace the soil moisture conditions of catchments in a continuous way and to classify 'wet' and 'dry' initial soil moisture conditions. The results indicate that the spatial distribution of runoff coefficients is highly correlated with mean annual precipitation, with mean runoff coefficient increasing with mean annual precipitation. Geology, through the 'permeability index', is another important control on the runoff coefficient for catchments with mean annual precipitation of less than 1200 mm. Land use, as indexed by the SCS curve number, influences the runoff coefficient distribution to a lesser degree. An analysis of the runoff coefficients by flood types indicates that, for flash floods, runoff coefficients are smallest, while they increase for events with increasing snowmelt. Results also show that there exists an optimum region of soil moisture ca-

pacity, as indexed by a flow duration curve-based index, which maximises the impact of initial soil moisture conditions on the runoff coefficient. This means that the difference between runoff coefficients characterised by wet and dry initial conditions is negligible for basins with very large groundwater capacity (given by largely karstified aquifers) and for basins with reduced groundwater capacity. For basins characterised by intermediate conditions, the difference (and hence the impact of the initial soil moisture conditions) may be relatively large.