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RUNOFF EVENTS CLASSIFICATION BASED ON STREAMFLOW- WATER TABLE HYSTERESIS

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Sommario/Abstract

A framework for rainfall-runoff events classification helps reduce information into a manageable number of classes, and it allows watersheds comparisons. Hydrological signatures serve as proxies for tracking the catchment behaviour and represent a powerful tool for characterising the catchment response to a storm event. Despite that, they have rarely been used for rainfall-runoff event typology identification.

In this study, we propose a general framework for the classification of rainfall-runoff events based on the analysis of the hysteretic relation between streamflow and depth to the water table, and its relation with the event characteristics. Particularly, this study aims to: i) analyse the temporal variability of hysteretic patterns between streamflow and depth to water table in a small headwater catchment, ii) relate a set of hydrological and meteorological characteristics to the hysteretic index at event scale, and iii) identify clusters of events with similar characteristics.

The study area is a small forested catchment located in the Italian Pre-Alps, where hydro-meteorological data have been recorded since August 2012. A set of 112 rainfall-runoff events, occurred between 2012 and 2016, was investigated. A simple hysteresis index was applied to each event. The hysteresis index was used to characterize the direction (clockwise or anti-clockwise), the size and the shape of the hysteretic loops.

Results show that the hysteresis analysis was particularly useful for the identification of three main clusters of rainfall-runoff events. A first cluster was characterised by a clockwise loop, i.e., there was a faster streamflow response compared to the depth to the water table. The events in this cluster were short, with dry antecedent conditions, small streamflow peaks, event runoff depths and runoff coefficients. A second cluster of events was characterised by an anti-clockwise loop, i.e., there was a faster response of the depth to the water table compared to the streamflow. The events in this cluster were long, with wet antecedent conditions, large streamflow peaks, event runoff depths and runoff coefficients. A third cluster had characteristics similar to the first cluster, i.e. clockwise hysteretic loop and similar storm characteristics, but on average displayed a narrower hysteretic loop. The statistical showed a significant difference ($p<0.05$) among the clusters.

This analysis allowed us to successfully identify three clusters of rainfall-runoff events with specific characteristics and a distinct hydrological behaviour. Concluding, the analysis of the hysteresis between streamflow and depth to the water table can be considered a useful tool for classifying rainfall-runoff events.

Indicare l'opzione per la presentazione:

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