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An innovative, timeseries-analysis-based method to extract rainfall-streamflow events from continuous timeseries

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A widely accepted objective methodology to select individual rainfall-streamflow events is missing and this makes it difficult to synthesize findings from independent research initiatives. In fact, the selection of individual events is a fundamental step in many hydrological studies, but the importance and impact of the choices made at this stage are largely unrecognised.

The event selection methods found in the literature start by looking at either the rainfall timeseries or the streamflow timeseries. Moreover, most of the methodologies involve hydrograph separation, which is a highly uncertain step and can be performed using many different algorithms. Further increasing the subjectivity of the procedure, a wide range of ad hoc conditions are usually applied (e.g. peak-over-threshold, minimum duration of rainfall event, minimum duration of dry spell, minimum rainfall intensity...).

For these reasons, we present a new methodology to extract rainfall-streamflow events which minimizes the conceptual hypotheses and user's choices, and bases the identification of the events mainly on the joint fluctuations of the two signals. The proposed methodology builds upon a timeseries analysis technique to estimate catchment response time, the Detrending Moving-average Cross-correlation Analysis-based method.

The proposed method has the advantage of looking simultaneously at the evolution in time of rainfall and streamflow timeseries, providing a more systemic detection of events. Moreover, the presented method can easily be adapted to extract events at different time resolutions (provided the resolution is fine enough to capture the delay between the rainfall and streamflow responses).

Properties of the events extracted with the proposed method are compared with the ones of the events extracted with the most traditional approach (based on hydrograph separation) to show strengths and weaknesses of the two techniques and suggest in which situations the proposed method can be most useful.