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Hillslope-stream connectivity characterization based on joint event analysis of stream and ground water levels

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Hillslope-stream connectivity and its dynamics and spatial variability is an important control for runoff generation. In this investigation we use a joint event-based analysis of stream and ground water level series from twelve sites within the Attert Catchment in Luxembourg to address this issue.
We developed an algorithm for event detection, which extracts those intervals showing a response in stream water level. For each site between 30 and 170 events were identified. These events are then classified in hydrologic state (dry or wet) and event rainfall intensity (weak or strong). Characteristic variables for each event are calculated, such as event response amplitude, event response duration, gradient of water level increase, etc.
For the analysis of this dataset, each variable's dependency on initial hydrologic state on the one and rainfall event strength on the other hand is described by two indices. These indices describe the variable's change in value (median) and variation (interquartile range) between wet and dry initial conditions and strong and weak rainfall events, respectively.
Analysing the distribution of these two indices shows that the presence, absence or intensity of response changes as a result of initial state or driving force change allows us to identify hydrological processes governing a specific site. Some characteristic variables are more affected than others, also depending on geology, land use and headwater catchment size.