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# Control of karst areas on space-time dynamics of floods, by combining annual and event-based analyses

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The study of flood risks requires a better understanding of the hydrological response of catchments, by identifying the drivers responsible for their variability, such as seasonal and regional rainfall patterns, initial catchment conditions and geology. Many catchments are not conservative, mainly due to Interbasin Groundwater Flows (IGF), that limits the application of traditional water balances methods on a regional scale. The role of karst areas on IGF is highly suspected to promote particular hydrological processes that change the annual water budgets as well as flood event dynamics.

The aim of our work is to assess the impact of IGF in karst and non-karst catchments of medium size (100-500 km²), on annual water budgets and flood dynamics. To this end, we developed a two-step methodology, applied on 120 elementary catchment in France, for which daily rainfall and runoff time series of several decades were available.

First, the traditional annual water budget method of L'vovich was adapted to non-conservative catchments, including an explicit term of IGF, as well as hydrograph decomposition. Results show that IGF occurrence is linked to the presence of karst areas, and that it affects both flood and baseflow components, sometimes in a very significant way. Second, a flood event analysis was conducted using a hydrograph characterization, including the analysis of lateral losses and gains on reaches delimited by 2 stations. The variability of these parameters was then studied as a function of seasonal and regional rainfall patterns, initial catchment conditions, and geology. Results show that geology (with the presence of karst areas) affect all parameters (flood shape and lateral exchanges), while rainfall pattern and initial catchment conditions mainly influence the flood dynamics.

Globally, our results show that, in addition to classical drivers (rainfall & initial catchment conditions), the spatial variability of flood pattern and dynamics is highly influenced by geology and notably karst areas. This study brings ways to improve the efficiency of hydrological models, by including IGF as a specific process. Results are also interesting in terms of extension to ungauged basins, as IGF occurrence is linked to the occurrence of karst areas.