



## **Variability of baseflow and quickflow/runoff components of a small watershed hydrological response in Northwestern France**

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In this study we investigated the evolution of streamflow in a small watershed in Upper Normandy (France) by characterizing the long-term variability of its baseflow and runoff components thanks to GIS and time series analyses. In particular, the study focuses on the potential changes in the respective contribution of these components in the framework climatic fluctuations. GIS analyses allowed us to localize preferential water supply from the aquifer to the river, which could be modelled over a 30-yr period by applying Darcy's law to piezometric variability in the hydrogeologic watershed studied. The runoff component is afterward deduced by subtracting the calculated baseflow to total streamflow. In the studied area, the karstified context implies runoff and quickflow from sinkholes to springs. It results that the runoff component actually comprises direct hillslope runoff and karst quickflow. 2-4-yr and 5-7-yr climate-induced fluctuations were detected in both components. Wavelet analysis revealed two periods with different streamflow, baseflow and runoff variability associated to strengthening of 1-yr, 2-4-yr and 5-7-yr fluctuations before and after 1985. On the other hand, cross-correlation functions of precipitation/baseflow and precipitation/streamflow indicated a clear gain in correlation after 1985, much more marked for the precipitation/runoff relationship. Along with the presence of a positive trend in runoff and precipitation, not observed in baseflow, we could relate this result to a local cause for such an evolution that could be attributed to well known changes in land use on the Austreberthe river watershed during the past two decades.

Key words: hydrology, wavelet analysis, GIS, baseflow variability, long-term analysis