Relationships between knickpoints and karst systems in the Lunain catchment: geomorphological and hydrogeological implications

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Résumé

River valleys represent major transfer zones between the source of sediments and their ultimate basin sink. The geometry of these valleys may be controlled by several factors such as tectonic deformation, climate (e.g., extreme flood events) or bedrock lithology, which could in turn influence the surface and groundwater processes. The role of karst dynamics in the formation of knickpoints-typically attributed to changes in base level, tectonic uplift, or lithology-has received limited attention. Thus, constraining karst dynamics and associated hydrogeological processes is fundamental to understanding landscape evolution in particular for the development of knickpoints. The Lunain catchment located in the Paris basin at 80 km south of Paris, represents a key compartment in hydrological-hydrogeological exchanges. This catchment is characterized by the presence of karstic Cretaceous chalk aquifer which can influence the surface and groundwater exchange. In this sense, the Lunain River flows through the chalk bedrock and contains areas with sinkholes and springs. Areas with sinkholes represent losing areas, where the river's discharge decreases, reflecting an infiltration into the underlying chalk aquifer. Consequently, the river is often dry in these areas depending on the season (generally from summer to autumn). The areas with spring, represent the karst resurgence, where river discharge increases due to the massive inflow of groundwater. Three main knickpoints were identified along the Lunain River in the losing area, indicating a spatial relationship between knickpoint locations and karst landforms within the catchment. In order to understand the complete functioning of this catchment, a physico-chimical analysis of surface and groundwater were performed. The losing areas are characterised by a decrease in Ca^2 and local enrichment in NO or Cl, reflecting a diffuse underground flow. In contrast, in the karst resurgence there is an increase in ionic concentrations, characteristic of carbonates facies. Our results suggest that knickpoint positions in a fluvial system can reflect the physico-chemical characteristics of underlying groundwater flow paths.

Mots-Clés: Lunain valley, knickpoints, karst

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