



## Hydrological observations in the transition zone between the shallow and deep karst zone of the Southern Franconian Alb (South Germany)

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The Southern Franconian Alb is a flat karstic plateau in Germany consisting of karstified Upper Jurassic limestones and dolomites. These rocks are underlain by impermeable Middle Jurassic rocks outcropping at the northern edge of the karst plateau. Due to a slight dip to South a northern shallow karst zone is followed by a southern deep karst zone. The thickness of the karst groundwater body increases from a few ten metres in the North to more than 400 metres in the South where the karst is covered by marls, clays and sands of Miocene Age.

Hydrologically, the entire karst area is drained by several karst springs. Depending on their position within the Southern Franconian Alb these springs show a different behaviour. Springs of the shallow karst zone react quickly to rainfall events with a distinct increase and a subsequent decrease of discharge. These fluctuations are caused by the variations of precipitation relative to the small thickness of karst groundwater body. The relationships between precipitation and discharge are clearly defined. By contrast the responses of deep karst springs to the climatic development are of minor size or they cannot be observed.

The central area of the Southern Franconian Alb is characterized by the deep karst zone whereas the karst groundwater body is not very thick. Generally, from late summer to early winter the springs exhibit baseflow conditions. During late winter and spring the discharge increases independently from temporal precipitation events. Such opposed behaviour represents an annual recurrent trend. Discharge peaks only occur during winter and spring. Because of draining of the unsaturated zone such peaks were not observed in summer and autumn.

Although the central area of the Southern Franconian Alb structurally is situated within the deep karst zone, the hydrologic and chemical attributes of the springs indicate overlapping characteristics of the shallow and deep karst. The annual trend of discharge is controlled by the geological position within the deep karst zone, the short-term flood peaks occur additionally as a superimposed behaviour typical for the shallow karst. Consequently, the central area can be regarded as a transition zone between shallow and deep karst.