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The weathered saprolitic zone as an alternative fresh water resource at the local scale in Benin/Westafrica – Field studies as decisive tool for modeling and validation

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ABSTRACT: On the local scale in Benin the existence of two different aquifers was proven by hydrochemical and isotopic water analyses: a deeper fractured basement aquifer and an overlying shallow, temporarily saturated aquifer in a weathered saprolite zone. Both aquifers have different recharge modes. A reliable calculation of their contribution to the surface discharge of the local catchment can be given. The saprolitic weathered zone aquifer is recharged by actual precipitation during the wet season and preferential flow is one of the key processes in context of the flow system in this temporarily saturated vadose zone. The groundwater in the migmatitic basement aquifer has longer residence times compared to the weathering zone aquifer clearly depicted by the hydrochemical data. There is no or only minor interaction between both aquifers. The recharge of the basement aquifer cannot take place in the local research area but has to occur in other regions and on other scales due to the results of isotopic labelling. Further indications for these recharge regions will be given by regional environmental isotopic labelling and especially by a regional groundwater flow model, which will be developed on basis of the existing hydrogeologic conceptual model and additional investigations on the regional scale in the field.

In respect to fresh water availability the temporarily saturated aquifer in the weathered zone provides great potential as resource of fresh water for the local rural population. Its mineral content is reasonable low due to leaching processes. Proved by pumping test the weathered saprolite acts as a leaky aquifer system with a lateritic strengthened horizon as overlying low permeability zone. Although the specific yield with values in the range of 6 E-5 m3/s is quite small, the excellent accessibility due to a low depth below ground surface and the sufficient protection against anthropogenic contamination by the lateritic horizon as a geogene barrier on the top, makes this aquifer a potential alternative as fresh water resource.