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Hydrogeological impact of fault zones on heterogeneous fluviatile aquifer systems: Clues from geophysical and hydrochemical investigations

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Steep fault zones close to the surface and perpendicular to the ground water flow in the Triassic strata of Southern Germany are usually considered as effective flow barriers. However, hydraulic conductivity strongly depends on the fault offset and the fault plane characteristics that are frequently difficult to characterize by boreholes or field data. In this study, we constrain the effects of a proposed fault system on ground water flow for a catchment in Southern Germany close to the city of Nürnberg. In this area, alternating fluviatile sandstone-claystone layers additionally complicate assessment of the aquifer system. However, combining various well-logs and downhole image data provides a first estimate of the fault offset by correlating the fluviatile strata – that otherwise lack distinct and correlatable time marks – and helps pin-pointing the depth of the underlying aquitard. First results confirm the NNE-SSW-striking trend of the fault system. The throw of the fault varies considerably from several meters to more than 30 meters and reveals a considerable heterogeneity and compartmentalization of the fault offset. Although the fault zone locally narrows the cross section of the aquifer unit considerably, pump test showed only minor impact on hydraulic conductivity and exploitable reserves. In contrast, electric conductance and hydrochemical data indicate that high-salinity water from underlying Middle Triassic aquifers preferentially moves upwards along the fault plane. It is concluded that only by using a combination of geophysical data along with geochemical analysis and pump tests enables an accurate characterization of the local aquifer settings.