The Influence of Stimulation Operation on Temporal- and Spatial-Evolution of the Reservoir's Hydrogeological Properties

The stimulation operations are carried out to a) generate new flow pathways in- and b) to increase the productivity of-the subsurface reservoirs, both of which are manifested as permanent changes in reservoir's (hydraulic) properties, such as transmissivity and storativity. The current study aims to investigate such changes as a result of stimulation operations at Bedretto Underground Laboratory for Geosciences and Geoenergies (BULGG). BULGG, developed in Bedretto tunnel in Switzerland, is a research infrastructure developed by ETH Zuerich as part of the Swiss Energy Strategy 2050. The 5.2-km Bedretto tunnel was built in 1982 as an audit to Furka tunnel. The BULGG is located at tunnel meter 2000 in Bedretto tunnel. To-date three major stimulation operations are carried out at BULGG. Despite an in-depth analysis of the permanent changes in hydraulic properties of the stimulated boreholes/intervals, the influence of the stimulation operation on the cross hole response of the pressure effects, and therefore the spatial impact of the stimulation operation, have not been investigated. In this study, the cross hole pressure responses are extracted from a large number of hydraulic tests carried out at BULGG and the corresponding cross hole hydraulic properties are calculated using standard methods (with the computer programs already available at EG). The temporal changes of the estimated reservoir properties and their correlation with the stimulation operations are then investigated. The results of this study helps us to better understand the spatial impact of the stimulation operations in an underground reservoir.

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