

Constructing the Hydraulic Connectivity Map of Bedretto Reservoir Volume

Subsurface reservoirs are often dominated by a major permeable structure, which acts as the hydraulic backbone of the system. Determining the hydraulic connectivity pattern and its strength in a rock volume plays an important role in understanding such dominant flow pathways, especially in hard rocks. Hydraulic connectivity can be assessed both qualitatively and quantitatively based on monitoring the pressure response in one or more observation wells (or isolated intervals within a well) while carrying out a pumping test (either injection or production) in an active well. The proposed project aims to construct a spatial map of hydraulic connectivity in Bedretto reservoir volume. The Bedretto Underground Laboratory for Geosciences and Geoenergies (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 several characterizations and monitoring wellbores have been drilled in the test volume of the BULGG and several pumping tests have since been carried out in the reservoir volume.

The first part of this investigation includes the analysis of the results from the hydraulic tests to map the connectivity pattern in the reservoir volume by identifying the wells/intervals, the pressure of which, are perturbed because of injection/production in the active well. Based on the results on this analysis, a spatial map of connected intervals/wells will be built. The pressure response will be identified based on the instantaneous changes in the pressure derivative profiles. The necessary computer programs are already available at EG group. In case of a need for further hydraulic data from a particular interval/well, additional hydraulic test can also be organized and carried out as part of this investigation. The results of this study help us to better understand the influence of the dominant flow pathways on the hydraulic response of an underground rock volume.

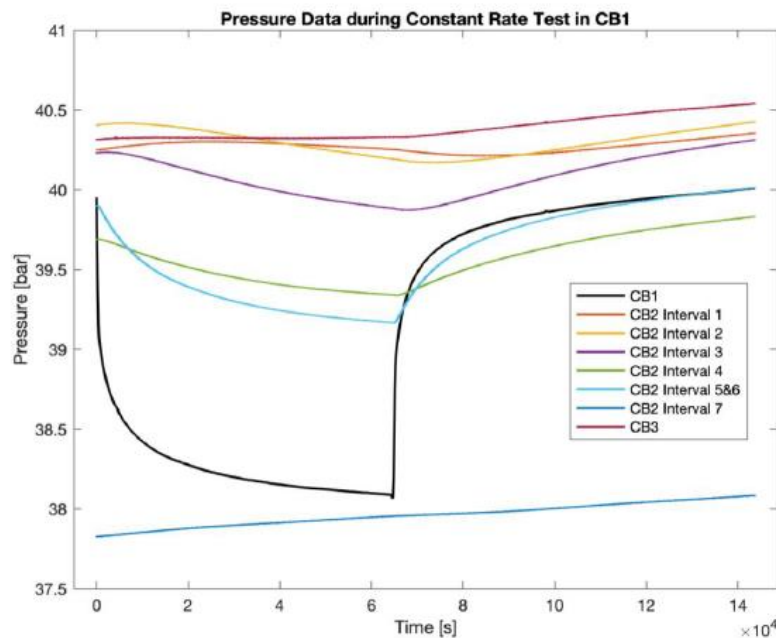


Figure 1: An example of the pressure data recorded in different intervals/wells in Bedretto reservoir while performing a production pumping test in CB1 well. The results clearly show a major hydraulic connection between CB1 well and intervals 5&6 and 4 in CB2 (After Münger 2021).

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