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3D Groundwater Flow Model of an Alpine Valley as working tool for the design of a 1km long section in soft rock for the Brenner Base Tunnel Project

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The Brenner Base Tunnel (BBT) will cross the Isarco Valley near the village of Fortezza (BZ) at a depth of approximately 20 m below the riverbed of the Isarco river. The design of this roughly 1 km long stretch through alluvial sediments and below groundwater level required detailed knowledge of the prevailing hydrogeological conditions. In particular, it was necessary to determine if dewatering procedures were feasible and what the impacts on natural water flows in the aquifer after completion of the infrastructure will be.
The study area is a typical Alpine valley, filled with alluvial sediments to a maximum depth of approximately 120m. The valley is bounded by granitic rocks with regional, water saturated main fault zones. In addition to the Isarco River, the area is shaped by two
lateral rivers. The deposits of these lateral rivers form main alluvial fans.
A 3D flow model of the aquifer was elaborated as part of the framework of the study. The model was calibrated and validated on the basis of two subsequent analyses:
- a preliminary hydrogeological characterization of the area by means of a pumping test carried out in a well.
- an experimental pumping test in five wells with a significant drawdown of the aquifer level in a broad area of the study zone.

In addition to providing basic data for the planning of eventual dewatering procedures and for the simulation of the impact of the completed infrastructure, the model highlighted the complex interaction between the Isarco River and the aquifer. Significant variations in the rate of infiltration of water from the river into the groundwater were ascertained that are caused by changes in the permeability of the riverbed over very short distances. The Isarco River, which in the simulation domain extends over 1.5 km, was divided into nine segments with variations in riverbed permeability of more than an order of magnitude.
The causes of these variations were not analysed in detail during this study. However, this phenomenon could in theory be due to the morphology of this stretch o