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Fine scale 3D integrated study of fluvio-glacial sediments

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The continuous improvement of numerical tools to simulate the heterogeneity distribution, water flow and contaminant transport in porous fluvio-glacial sediments permits to handle 3D fine fields at fine scales. The assessment of the reliability of geostatistical, flow and transport simulation methods when applied to practical applications requires a large set of data. Here we show the work in progress on a study which integrates different expertise in geosciences. The block (approximately 7 m $\times$ 4 m $\times$ 1.5 m) was dug into a gravel and sand unit of the Late Pleistocene sandur of the Verbano glacier. The following data were collected: sedimentological logs, photomosaics and facies maps at cm-scale accuracy, along vertical and horizontal intersecting planes, with a maximum spacing of 1 m; geoelectrical and GPR surveys on the top of the block; infiltration tests at several positions, with a spacing of about 50 cm; grain-size distribution measurements on samples; estimates and measurements of hydraulic conductivity on samples of the sandy gravel, sand and silty sand facies to work out an hydrofacies classification from the facies association. The 3D simulation of the block heterogeneity was obtained with Sequential Indicator simulations (SISIM), conditioned on the hydrofacies maps after GIS aided modeling of the major stratigraphic boundary: the simulated 3D image represents a map of the distribution of the K values assigned to each hydrofacies, and was used to compute equivalent K and dispersion coefficient, D. The future objective of the work is to conduct several numerical tests to quantify the reliability of the stochastic simulations, the ability of geophysical techniques to improve the subsurface reconstruction, the link between different connectivity indicators and equivalent K and D.