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Combined electrical resistivity tomography and seismic profiling of the morainic cover on the Haute-Mentue catchment monitoring site

N. Denchik, J. Demand, D. Chapellier and F. Marillier
Institute of Geophysics, University of Lausanne, Amphipôle, 1015 Lausanne, Switzerland

The aim of this study was to further investigate the sub-surface geological characteristics of the Haute-Mentue catchment, Switzerland, in absence of wells in this region, in order to deploy a permanent electrical resistivity monitoring system that follows the hydric behaviour of soil during rainfalls on the slope of the Ruzillon River. Combining of 2D and 3D electrical resistivity tomography with 2D seismic investigations made it possible to get a better understanding of the geology of the study site (Quaternary Moraine and Tertiary « Burdigalian » Obere Meeres Molasse). Moreover, because of significant variations of the thickness of the morainic cover in this region it is very important to locate the boundary between molassic and morainic deposits.

To improve our understanding of the site geology, two electrical tomography profiles parallel (143 meters in length) and perpendicular (69 meters in length) to the Ruzillon River were carried out with a multi-electrode system using an IRIS Syscal R+ resistivimeter. A Wenner-Schlumberger array was used with an inter-electrode interval of 3 meters. These measurements were completed with more local (18x24 m) 3D electrical tomography measurements on the study site area with an inter-electrode interval of 1 m (Wenner-Schlumberger array). The data were inversed using the Res2Dinv and Res3Dinv softwares. In addition, Vertical electrical sounding was carried out parallel to the Ruzillon River. Two formations are distinguished: the Burdigalian Molasse (massive interlocked sandstone) with a resistivity of 100-200 Ωm and a rather heterogeneous Quaternary Moraine cover (30-100 Ωm) composed of sandy loams and loamy sands. In places, resistivity values within this unit reach up to 2000 Ωm at the surface. This can be explained by the presence of sand, as well as by the presence of tree roots and moss that may also influence measurements in the top layers. The

difference between molassic and morainic deposits is not easily made because of the close resistivity values in the two formations. Furthermore, according to electrical tomography profiles, the thickness of the morainic cover varies from 1.5 to 5 m over short distances in this region. Therefore, two seismic refraction profiles were carried out in order to find out the depth of the Quaternary Moraine interface locally at the study site. The detailed seismic measurements indicate that the Molasse has a velocity of 1200 m/s at approximately a depth of 1.5-2.0 m below the surface. The Quaternary deposits show a velocity of 2000 m/s.