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Intergarted geophysical investigations by GPR and ERT on the largest rock fill dam in Europe: Monte Cotugno dam (Southern Italy)

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This work is concerned with the first results of a survey based on the integration of geophysical techniques for the inspection of the Monte Cotugno dam, the largest rock fill dam in Europe.
The Monte Cotugno dam, managed by National Irrigation Development and Agrarian Transformation in Puglia, Basilicata and Irpinia is located on the Sinni river (Basilicata District, South Italy) and represents the nodal point in the whole hydraulic system on the Ionic side of Italy; in fact, the dam allows harnessing of the Sinni river water for agricultural, industrial, drinking and domestic purposes.
The dam is of the zoned type and consists of a central core in sandy silt and of gravelly-sandy shoulders; its water tightness is ensured by a bituminous conglomerate facing on the upstream side, welded at the bottom to the foundation sealing system. The latter is about 1,900m long and consist of a massive concrete cut-off wall based on the marly-clay formation, 300m long on the right and 600 m long on the left side. On the valley bottom it is made up of a reinforced concrete cut-off wall that is inserted in the marly-clay formation and is surmounted by an inspection and percolation water collection tunnel. The watertight face consists of a bottom levelling layer 7-8 cm thick in semi open-graded bituminous concrete, a 5 cm separation layer in dense-graded bituminous concrete, a drainage layer in very open-graded concrete varying in thickness from 10 to 16 cm from the top of the dam down, two 4-cm top layers in dense-graded bituminous concrete with stepped joints, a finishing sealing coat containing 1.5 kg/cm2 of asphalt.
The shallowest part of this layering is started to show incipient small detachments due to thermal solicitations; these detachments represent a possible way for water infiltration in the dam. In this framework, it was decided to perform the identification, characterization and evaluation of the potential loss of water through small cracks in the bituminous concrete dam and then monitor these areas of infiltration. For such a task, the use of conventional geotechnical investigation methods was discarded since these techniques often requires invasive actions in the inner of the structure to be investigated (destructiveness) and only provide punctual information for small volumes. On the contrary, in this case, it was decided to use non-invasive sensing techniques, which make it possible to investigate and gain "global" information about all the structure without affecting its operability. In particular, Ground Penetrating Radar and Electrical Resistivity Tomography techniques have been exploited so to have possibility of quickly investigating large portions of dam with different spatial and resolution scales and without the need of destructive actions. The results of this survey well agree with direct surveys and the details of the survey and of the diagnostic results will be shown at the conference.

References

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