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Novel monitoring protocol for the Monte Cotugno Dam (Southern Italy) healthiness

Francesco Soldovieri (1) and Antonio Loperte (2)

(1) Istituto per il Rilevamento Elettromagnetico dell'Ambiente, Consiglio Nazionale delle Ricerche, Napoli, Italy (soldovieri.f@irea.cnr.it), (2) Istituto di Metodologie per l'Analisi Ambientale, Consiglio Nazionale delle Ricerche, Italy

This work is concerned with the application of an integrated approach based on a non-invasive geophysical technique, as the Electrical Resistivity Tomography (ERT) and geotechnical and visual inspections for the monitoring of the Monte Cotugno dam, the largest rock fill dam in Europe.

Monte Cotugno dam is located on the Sinni river (Basilicata District, South Italy) and represents the nodal point of 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 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, dam 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 different layers and the shallowest layers have been affected by incipient small detachments due to thermal solicitations; These detachments affect the structural behavior of the dam, since they are way for water infiltration in the dam. For this reason, on 2010 dam's owner decided to activate an integrated geophysical survey based on the integrated use of Infrared Termography, ERT and Ground Penetrating Radar, with the aim to identify and evaluate the potential loss of water through small cracks in the bituminous concrete dam [1].

Following the results achieved by this non-invasive integrated approach, it was decided to activate a long term monitoring based on periodic ERT surveys. In particular, ERT surveys were carried out for two years at two specific times of the year, in order to evaluate the water level in the inner part of dam on dependence of the minimum and maximum water level in the basin. These surveys have allowed to identify areas of the side facing upstream, at which sampling coring were carried out, and the samples were subsequently analyzed in the laboratory with the aim to evaluate the state of conservation and permeability.

ERT images also permitted to identify areas affected by water infiltration below the basin level, which underwent to a visual inspection through an underwater drone. This underwater survey confirmed the presence of deteriorated areas and submerged fractured bituminous zone. This, the flaring of the reservoir was carried out as far as the managing body saw fit. After, in correspondence of the minimum basin level, a visual inspection of all the bituminous face was performed, thus identifying fractured zones on which to intervene immediately.

As conclusion, we can state that the integrated approach here presented was crucial in order to identify, areas of the facing bituminous needing urgent interventions.

[1] A. Loperte, M Bavusi, G. Cerverizzo, V Lapenna, and F Soldovieri, "Integrated geophysical investigations by GPR and ERT on the largest rock fill dam in Europe: Monte Cotugno dam (Southern Italy)", Geophysical Research Abstracts, Vol. 14, EGU2012-9972, 2012