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New data on the bottom topography, recent sedimentation and water balance of Cerro Prieto dam, Mexico

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Cerro Prieto Dam, a small water reservoir in the NE Mexico, is characterized by very high velocity of recent sedimentation, high sub-bottom seepage and erosion, and as a result, nonlinear water balance. These phenomenons never were studied since construction of the dam in the beginning of 1980th. So the goal of our work was to investigate the bottom topography and also sub-bottom near surface structure using the parametric acoustical effect.
High-resolution sub-bottom profiling, using the Innomar SES-2000 compact echosounder, was carried out in Cerro Prieto Dam during February-April of 2008. The survey was conducted onboard of a small motor boat. The SES transducer was mounted on the front side of the boat using light metal pipe, and all electronic equipment was installed on the deck. Accurate positioning of the boat was reached by GPS. Average speed was 8-10 km/h. Innomar's software tool ISE was provides near real-time post-processing of the collected SES data and operation procedure could be corrected on-line. Acoustic signal ensured vertical resolution of 10-15 cm at acceptable penetration up to 15 m. Bathymetry map was compiled assuming average sound velocity of 1450 m/s.
The irregular bottom topography of Cerro Prieto dam was discovered. The present elevation of the water surface is about 181 m above see level, and the lake depth varies from 1-2 to 28 m.
The SES records show a distinct bottom layer of recent sediments by 0.5 – 4 m thickness which follows reservoir floor topography. Very specific acoustic anomalies, which seem to be related with gas sediments, are observed. The integrated SES, gravity, magnetic and geoelectrical data interpretation allows assuming a series of the superficial fractures focused in a NW direction, perpendicular (NE-SW) to the general deep fault zone.
Hydrological balance for the Cerro Prieto water reservoir has been analyzed for last two decades. There are three types of water level fluctuations on the Cerro Prieto dam: long-term (yearly), seasonal (sub-annual), and short-term (daily) fluctuations. Fluctuations in Dam water levels result from several natural factor and human influences. Analysis of this data shows nonlinearity of hydrological cycle and, as a result, uncertainty in the water balance, which may range from 2.5 up to 30-35%.

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