



Water balance of Cerro Prieto dam (NE Mexico): hydrological monitoring and geophysical modeling

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The Cerro Prieto Dam was constructed in 1982 in the River Pablillo Valley, NE Mexico. The Dam is located 130 km SE of Monterrey City. During the last years a hydrological monitoring was carried out. The hydrological data of the basin, registered in the hydrometric station Cerro Prieto, showed an annual precipitation from 415 up to 1130 mm/a, the mean evaporation of 705 mm/a (up to 2460 mm/a in 1996). The important characteristic is water level measured directly in the dam. The maximum water storage of the Cerro Prieto reservoir is 395 millions m³ which corresponds to a water level of 295 meters. However, this level was reached only three times after the dam's construction. By the end of June 2006 the water level was at 276.2 m which corresponds to a water volume of about 127,806,300 m³ which is less than a third of maximum storage. Analysis of hydrological data showed sufficient misbalance between water recharge (by rain, river flow) and loss due to evaporation, filtration, extraction, discharge, etc.

So the purpose of geophysical research was studying a near surface as well as a deep structure of the Cerro Prieto area with the goal of an analysis of geological reasons of this hydrological phenomenon. 160 gravity reading points, 400 onshore magnetic field readings as well as about 250 offshore magnetic points were carried out. The standard corrections as instrumental drift, latitude, elevation, IGRF, etc. were applied to obtained data. Data procession includes Fourier transformation, wavelength filters, upward continuation, vertical and horizontal derivatives, etc. As a result a 2D geological-geophysical models and 3D maps were elaborated. Potential data interpretation allows assuming a series of the superficial fractures focused in a NE direction, perpendicular (NW-SE) to the general deep fault.

The analysis of the received data indicates a sharp variability of volume of fresh water in the basin, due to several complex factors. Major factors are: hydrogeological and climatic conditions of the region (1), intensive extraction of fresh water from surrounding areas (urbanization and agricultural activity of the city of Linares), which is reflected in strong fracturing of the subsurface layers and lowering of aquifer depth (2), presence of a deep fault trending northwest (3), and a high velocity of recent sedimentation (4).