Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05531, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05531
EGU General Assembly 2008

Nonlinearity of hydrological cycle of Cerro Prieto water reservoir (NE Mexico) and sub-bottom infiltration: geophysical study

V. Yutsis (1), H. De León Gómez (1), F. M. Izaguirre Valdez (1), A. Kotsarenko (2), D. Masuch Oesterreich (1) and C. Pola Simuta (1)

(1) Autonomous University of Nuevo Leon, Linares, Mexico, (2) Autonomous National University of Mexico, Queretaro, Mexico (vyutsis@fct.uanl.mx / Phone: +52 821-2142010 / Fax: +52 821-2142020)

Hydrological balance for the Cerro Prieto water reservoir (NE Mexico) has been analyzed for last decades. Hydro-meteorological data of Cerro Prieto, Pablillo, Camacho, and other stations were used. The water level in the dam has been recorded daily to high precision (1 cm) since 1982. 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 the dam water level result from several natural factors and human influences. Analysis of this data shows nonlinearity of hydrological cycle and, as a result, uncertainty in the water balance.

A monitoring of the fluctuation of water storage was established too. The procedure comprises standard hydrological modeling as implemented in Arc/Info as well as a cell-based modeling of water depth and storage volumes. In both procedures the Digital Elevation Model for Linares and surrounding areas from INEGI (Instituto Nacional de Estadística, Geografía, e Informática) was used. Grid spacing is 30 x 30 m. The projection is in UTM, using the ITRF92 datum and the GRS80 spheroid. The maximum water storage of this reservoir is about of 400 billion cubic meters which corresponds to a water level of 285 meters above sea level. However, by the end of April 2007 the water level was at 275.95 m which reduced the amount of water to 120,000,000 cubic meters (less then a third of reservoir capacity).

Magnetic, gravity, and natural electric potential studies were carried out in this area. The residual gravity and gravity vertical gradient anomalies were applied to detect and delineate zones of density variations (corresponds to deep faults and shallow fractures). The first and second vertical and horizontal derivates of the total magnetic field anomaly were used in sharper resolution of near-surface features. Water infiltration (seepage flow in dam and reservoir floor) was received by self-potential investigation.

A north-west trending deep fault zone, related with gravity and magnetic anomalies, are recognized. As a result, an echelon series of northwest-trending normal faults deform basin fill. Besides, the recent (late Pleistocene) north-east trending fracture zone is characterized by up to 30 m of total displacement, as defined by geomorphology and gravity modeling. Self-potential anomalies and natural electrical horizontal gradient are associated with north-east direction of the seepage flow. The strong negative SP anomaly (-90 mV) is associated with water infiltration through the fractures of the reservoir bottom. Preliminary estimation shows water loose by infiltration up to 30 billion of cubic meters per year.