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Modelling of gravity variation and crustal deformation due to the variable load in vicinity of the Lake Nasser, Aswan, Egypt

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Abstract

Variable loading of artificial reservoirs changes the geodynamical regimes around the reservoir and causes mass redistribution around it. Thus, variation of the gravity field and geoid level as will as crustal deformation are expected.

The Aswan High Dam is located above the first cataract of the Nile, 15 km south of Aswan city. The dam impounds Nasser's lake, the second largest man-made reservoir in the world. the lake extends 500 km and has a capacity of 133.8 km^3. The water level of the lake fluctuates four times during the year according to the cycles of inflow and discharge. Variable loading of the water mass of the reservoir causes the equilibrium state to be broken and a time variation of the Earth's gravity field and crustal deformation are expected.

in The current study a model has been developed to estimate time variation of gravity field and crustal deformation due to mass loading. These effects have been mod-

elled applying the load-induced deformation theory and utilizes computed load Love numbers. To evaluate the modelled effects, gravity and GPS have been observed in a network pounds the northern part of the lake. Three epochs of observations within one year indicate significant variations of the gravity field and vertical displacement attributed to the water level fluctuations.

Comparing modelled and observed gravity and vertical displacement indicates that loading deformation theory are not able to explain these variations completely. Discrepancies between modelled and observed variations has been discussed.

Moreover, Gravity and GPS observations must be corrected due to the water level variation of the reservoir before using it in the geodynamical studies of this seismoactive region.