

The gravitational anomalies accounting method at geodetic observations

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Abstract

© SGEM2019. All Rights Reserved. This paper presents a new method of accounting the variations of the vertical due to fluctuations of water level in case of taking geodetic observations near the large reservoirs. The impact on latitude of observation and direct adjustment is estimated. The resulting correction caused by an anthropogenic interference is comparable with the adjustment effect of systematic lunar and solar tides. Accounting this effect may be useful for the solution of this higher geodesy problem and the development of high-quality public networks for adjustment. Anthropogenic interference with nature leads to the redistribution of large masses of matter in the Earth's surface layer. The largest reservoirs contain about one hundred million tons of water, and approximately half of this amount varies, increasing and decreasing from time to time, according to the hydroelectric power station schedule. The obtained amendment for anthropogenic interference is higher than the one for adjustment due to the systematic influence of lunar and solar tides. But the tidal amendments are more accurate than geometric adjustment and are accounted at analyzing the results of A class adjustment. The considered opportunity to account this effect might be very useful when solving the higher geodesy problems, including the creation of high-quality state networks for adjustment and the development of adjustment networks for the study of the Earth's crust vertical movements (ECVM). The classic optical tools of astrometry are more sensitive to the local vertical's behavior, and may be used for the study of tectonic earthquake precursors as additional instruments. Using the developed methodology, formulas, and average tabular coefficient of soil porosity of 42%, the value of the additional impact of water level fluctuations in Kuybyshev reservoir on the local vertical and the observed latitude of the Engelhardt astronomical observatory is determined. It is found to be $0.000884''$ per each meter of the change in the reservoir's surface or for six-meter, average annual mark change, which together with the previous value gives $0.0053''$. The laboratory data error is small; therefore, the produced values of the vertical's deviations are rather reliable. Nevertheless, the engineering and hydrogeological researches in the "observatory-reservoir" territory should be conducted for a more robust and complete study of the dependence of such small (several thousandths of arc second) fluctuations of the vertical on local geophysical conditions.

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Keywords

Astronomical latitude observations, Geodesy, Local geophysical conditions

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