Geophysical Research Abstracts
Vol. 16, EGU2014-9803-1, 2014
EGU General Assembly 2014

Precision gravimetric survey at the conditions of urban agglomerations

Tatiana Sokolova, Ivan Lygin, and Alexander Fadeev

Geophysical department, Faculty of Geology, Lomonosov Moscow State University, Moscow, Russian Federation (tb-sokolova@yandex.ru, ivanlygin@mail.ru, allexfadeev@mail.ru)

Large cities growth and aging lead to the irreversible negative changes of underground. The study of these changes at the urban area mainly based on the shallow methods of Geophysics, which extensive usage restricted by technogenic noise. Among others, precision gravimetry is allocated as method with good resistance to the urban noises.

The main the objects of urban gravimetric survey are the soil decompaction, leaded to the rocks strength violation and the karst formation. Their gravity effects are too small, therefore investigation requires the modern high-precision equipment and special methods of measurements.

The Gravimetry division of Lomonosov Moscow State University examin of modern precision gravimeters Scintrex CG-5 Autograv since 2006. The main performance characteristics of over 20 precision gravimeters were examined in various operational modes.

Stationary mode. Long-term gravimetric measurements were carried at a base station. It shows that records obtained differ by high-frequency and mid-frequency (period 5 - 12 hours) components. The high-frequency component, determined as a standard deviation of measurement, characterizes the level of the system sensitivity to external noise and varies for different devices from 2 to 5-7 μGals. Midrange component, which closely meet to the rest of nonlinearity gravimeter drifts, is partially compensated by the equipment. This factor is very important in the case of gravimetric monitoring or observations, when midrange anomalies are the target ones. For the examined gravimeters, amplitudes' deviations, associated with this parameter may reach 10 μGals.

Various transportation modes - were performed by walking (softest mode), lift (vertical overload), vehicle (horizontal overloads), boat (vertical plus horizontal overloads) and helicopter. The survey quality was compared by the variance of the measurement results and internal convergence of series. The measurement results variance (from $\pm$2 to $\pm$4 μGals) and its internal convergence are independent on transportation mode. Actually, measurements differ just by the processing time and appropriate number of readings. Important, that the internal convergence is the individual attribute of particular device. For the investigated gravimeters it varies from $\pm$3 up to $\pm$8 μGals.

Various stability of the gravimeters location base. The most stable basis (minimum microseisms) in this experiment was a concrete pedestal, the least stable – point on the 28th floor. There is no direct dependence of the measurement results variance at the external noise level. Moreover, the external dispersion between different gravimeters is minimal in the point of the highest microseisms.

Conclusions.

The quality of the modern high-precision gravimeters Scintrex CG-5 Autograv measurements is determined by stability of the particular device, its standard deviation value and the nonlinearity drift degree. Despite the fact, that mentioned parameters of the tested gravimeters, generally corresponded to the factory characters, for the surveys required accuracy $\pm$2-5 μGals, the best gravimeters should be selected.

Practical gravimetric survey with such accuracy allowed reliable determination of the position of technical communication boxes and underground walkway in the urban area, indicated by gravity minimums with the amplitudes from 6-8 μGals and 1 - 15 meters width. The holes‘ parameters, obtained as the result of interpretationare well aligned with priori data.