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The results of determining the gravity potential difference on the measurement of the relativistic frequency shift of the mobile frequency standard

Elena Gienko (1), Vadim Kanushin (1), Alexander Tolstikov (1,2), Alexander Karpik (1), Nikolay Kosarev (1), and Irina Ganagina (1)

(1) Siberian State University of Geosystems and Technologies, Novosibirsk, Russian Federation, (2) Siberian Research Institute of Metrology, Novosibirsk, Russian Federation

In 2015 in the research on the grant of the Russian science Foundation No. 14-27-00068 was experimentally confirmed the possibility of measuring the gravity potential difference on relativistic frequency shift of the mobile hydrogen standard CH1-1006 (relative frequency instability of the order 10E-14).
Hydrogen frequency standard CH1-1006 was calibrated in the system of secondary standard WET 1-19 (SNIIM, Novosibirsk, Russia) and transported to the place of experiment (a distance of 550 km, the Russian Federation, Republic of Altai), where it moved between the measured points at a distance of 35 km with a height difference of 850 meters. To synchronize spatially separated standard CH1-1006 and secondary standard WET 1-19 was applied the method "CommonView", based on the processing results of pseudorange phase GNSS measurements at the point of placement hours. Changing the frequency standard CH1-1006, measured in the system of secondary standard WET 1-19 and associated with his movement between points and the change of gravitational potential, was equal to 7.98•10E-14. Evaluation of root-mean-square two-sample frequency deviation of the standard at the time interval of the experiment was equal to the value of 7.27•10E-15.
To control the results of the frequency determination of the gravity potential difference between the points were made high precision gravimetric measurements with an error of 6 MkGal and GNSS measurements for the coordinate determinations in ITRF2008 with an accuracy of 2-5 cm.
The difference between the results of the frequency determination of the gravity potential difference with control data from GNSS and gravimetric measurements was estimated 16% of the total value that corresponds to the error of frequency measurement in the experiment.
The possibility of using a single moveable frequency standard to determine the gravity potential difference at spaced points using the method of "CommonView", without the use of optical communications between base and mobile frequency standards was shown. Future improvement in engineering the frequency standards and the measurement technique, developed in the course of our experiments, will allow developing one of the most promising areas of relativistic geodesy - autonomous measurement of heights in a common world system which is currently a vitally important problem of geodesy.
We got the practical results, which offer further opportunities for more accurate planning of experimental research and the creation of a global relativistic geoid for the formation of a unified global system of heights.