

Results from some calibration experiments conducted at Strasbourg Superconducting gravity station

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Abstract

The availability of superconducting gravimeters (SGs) enabled us to collect high-precision gravity observations aimed at investigating a large number of geodynamical processes inducing weak gravity signals. As the SGs are relative meters, even though the most sensitive and stable ones currently available, they need to be accurately calibrated owing to their relative measuring principle. Actually each branch of the Earth sciences (e.g. volcanology, seismology, etc.) that benefits from the high precision gravity monitoring, demands a calibration for gravity sensors to an accuracy of better than 0.1%. In general the SGs are designed to operate in a geophysical observatory as a permanent gravity station. They are not portable then not suitable for measuring on calibration lines. Moreover, the direct methods of calibration require some special devices, sometimes turning out to be problematic as is the management of heavy reference masses, and are not feasible at every SG station. This has led users to develop *in situ* calibration methods. Currently the indirect method based on the comparison with an absolute gravimeter (AG) is the most widely used. The use of a well-calibrated relative spring gravimeter as a reference for the SG is still under discussion in the gravimetric community, because the spring meters needs itself to be calibrated against some other references.

This research deals with the calibration experiment performed in Strasbourg (France) superconducting gravity station by means of two FG5 AGs (#206 and #211) and some new generation spring meters (Scintrex Ltd. Autograv-CG3M and -CG5M and Microg-LaCoste gPhone). We discuss the results in terms of precision and accuracy of the SG calibration by means of different metrological approaches. Our main results turn out that spring gravimeters are not suitable to replace AG meters for SG calibration. Owing to the time variability of their sensitivity, the spring meters cannot be used as a stable reference for the SGs. On the contrary, the spring gravimeters could take advantage from measuring in well calibrated superconducting stations. In fact a monthly record session in a superconducting gravity observatory could provide a complete definition of the sensor's transfer function in the tidal band, both in phase and amplitude.