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Absolute and Superconducting Gravimetry in Argentina

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Abstract:

High accuracy absolute and relative terrestrial gravity observations provide the basis for a stable and homogeneous gravity reference system and long term monitoring of the system Earth.

Recently both observation methods were established at the Argentinian-German geodetic observatory AGGO close to the city of La Plata and are operated in close cooperation of Argentinean and German colleagues. The observations of both gravimeters contribute to global initiatives, such as the International database for absolute gravity observations AGrav, jointly operated by the International Gravity Bureau (BGI, Toulouse, France) and BKG and the International Geodynamics and Earth Tide Service (IGETS), both are service of the International Association of Geodey (IAG). The location of AGGO at the southern hemisphere makes these efforts most important.

After short a general introduction into spatial and temporal gravity field variations, the working principles of both instrument types are explained. While the state-of-the art absolute gravimeters (AG) still realize the free fall of a macroscopic test mass, the development of a new technology based on atom interferometry opens a new field of applications. Contrary to absolute gravity observations, which are usually limited to short observation epochs, Superconducting gravimeters (SG) are the most precise but stationary relative instruments, allowing to monitor temporal gravity changes with highest resolution. The combination of collocated observations of both types results in the best possible realization of an absolute reference function for time variations in gravity and serves as a reference for the comparison and validation of different AGs, ensuring their traceability. Considering aspects of metrology, such comparisons are an essential part of the new absolute gravity reference system, which is currently established according to IAG resolution No. 2 of 2015. For this purpose, a globally homogenous absolute level for gravity observations should be transferred to the national networks and infrastructure, which is now supported by AGGO.

Long term stable precise gravity observations at selected station become important in many fields, reaching from monitoring of geodynamics processes like the glacial isostatic uplift or regional deformation effects up to local water storage changes or the comparison with GRACE derived gravity field models. Examples are presented for stations and different projects.