Levelling and gravimetry in the National GNSS Permanent Network (ERGNSS) and Tide Gauge Network of Spain

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Abstract

In recent years, the National Geographic Institute of Spain (IGNe) has carried out levelling links to GNSS permanent stations and to different tide gauges. These stations and tide gauges are in the IGNe networks and in the networks of other national agencies. Furthermore, absolute gravity has been observed in several permanent stations of ERGNSS. The Geodesy department of IGNe has started a plan for regular observation of absolute gravity and high precision levelling of all permanent stations of ERGNSS and tide gauges. All this will contribute to a better control of vertical movements of these networks and changes in the mean sea level.

Background

The new High Precision Levelling Network of Spain (**REDNAP**) has gone through successive stages, starting in 1999 with the levelling network in the Spanish Pyrenees Zone (INTERREG-II project) [1]. In 2008, after finnishing the observation, calculation and compensation of the network nodes [2] [3], began a phase to densify the polygons that constitute it, as well as observation of various branches to different points of interest. Thus, RED-NAP now consists of about 25,000 benchmarks along about 20,000 km. These observations have been complemented by GPS and relative gravity observations, and they have served to obtain a new geoid, adapting the world gravity model EGM2008 to the vertical reference system in Spain, materialized by REDNAP [4].

REDNAP and **ERGNSS** levelling

The IGNe currently manages more than 70 stations of the National GNSS Permanent Network (ERGNSS) throughout the national territory, many of them in shared ownership with the autonomous regions [5]. About 40%of them are linked to REDNAP with levelling. (Left: ERGNSS-stations at YEB1 and ALAC, right: ERGNSS stations linked to REDNAP.)





The IGNe is now facing the replacement of lost benchmarks and the re-observation of some sections of the network, and is developing a maintenance plan for REDNAP. Soon there will be available a new compensation of the network and a new geoid with recent data.

Absolute gravimetry close to ERGNSS

Since 2001 IGNe has been observing the absolute gravity with FG5 and A10 gravimeters. The principal goal was to implement the **Spanish Absolute Gravity Network (REGA)**. Less than 30% of the GNSS permanent stations have a nearby REGA-station. (Left: gPhone at IZAN, FG5 at CACE, L&R and CG5 at IGNE, right: REGA stations linked to REDNAP, below: IGN gravimeters at YEBE)





Planning

The Geodesy department of IGNe has started a plan for regular observation of absolute gravity and high precision levelling of all permanent stations of ERGNSS and tide gauges. The observation plan consists of:

OP1 Regular FG5-observations at GNSS stations and tide gauges facilities (μ Gal-level).

OP2 Local gravimetric factors determination with earth tides gravimeter gPhone or with CG5-Scintrex (μ Gallevel).

OP3 Continuous gravity records with gPhone or CG5-Scintrex gravimeters to support vertical movement control at some stations (μ Gal-level).

OP4 Regular high precision levelling at the local networks of the tide gauges.

OP5 Regular high precision levelling at the benchmarks close to GNSS-stations.

The key point of this planning is to fix what we mean by *regular*, and if the instrumentation and technical staff currently available at IGN are sufficient for the *regularity*

Tide gauge network

Currently, the **Tide Gauge Network** of IGN has nine stations and this year will be expanded with two new tide gauges. All of them have a local control levelling network, are connected with REDNAP and have an antenna ERGNSS. They need a regular control of local levelling and absolute measurements of gravity to support these controls. (Left: Levelling at MALA and tide gauge of ALAC1, right: Tide Gauge facilities in ERGNSS.)

References

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