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**INSTITUTO GEOGRÁFICO PORTUGUÊS**

# PORTUGAL

## National Report

Presented at the EUREF Symposium

Held at Bratislava, Slovakia

2-5 June 2004

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# National Report of Portugal

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## **1. Introduction**

The present report covers the activities of the Portuguese Geographical Institute, IGP, concerning the EUREF work, during the last twelve months.

The following items will be focused: National Permanent GPS Stations Network (ReNEP-GPS), National Geodetic Network (RGN), Gravimetric Measurements, Astronomical Measurements and Tide Gauges.

## **2. National Permanent GPS Stations Network (ReNEP-GPS)**

The software that controls the Leica Portuguese EUREF stations was changed for a new one: SPIDER. This program sends the data automatically from the stations to the IGP server. That allowed us to start sending hourly files for the EUREF EPN. CASC and PDEL have already started, and LAGO and GAIA will begin soon.

This year we are planning to install a new GPS station in FLORES Island, in the Azores, with Leica support.



Figure 1 – GPS Portuguese Reference Stations

### 3. National Geodetic Network (RGN)

The measurement of the 2nd order network with GPS continued in 2003, with occupation of about 20% of the total network. At the moment 60% of the network is observed and processed. We expect to complete the measurement of the last 40% of the network this year.

The following standards are used to observe the 2nd order network:

- 4 double frequency Trimble GPS receivers;
- 2 h session;
- 15 s epoch interval;
- Elevation mask 10°;
- Occupation of two first order points in each session.

The preliminary computation shows results (for ITRF96) better than 5 centimetres (at 95% of confidence level) for the coordinates. ETRS89 coordinates were also computed for 2nd order network, using the same set of observations. About 60% of our Geodetic Network have already adjusted ETRS89 coordinates, with the same precision as the coordinates in ITRF96.

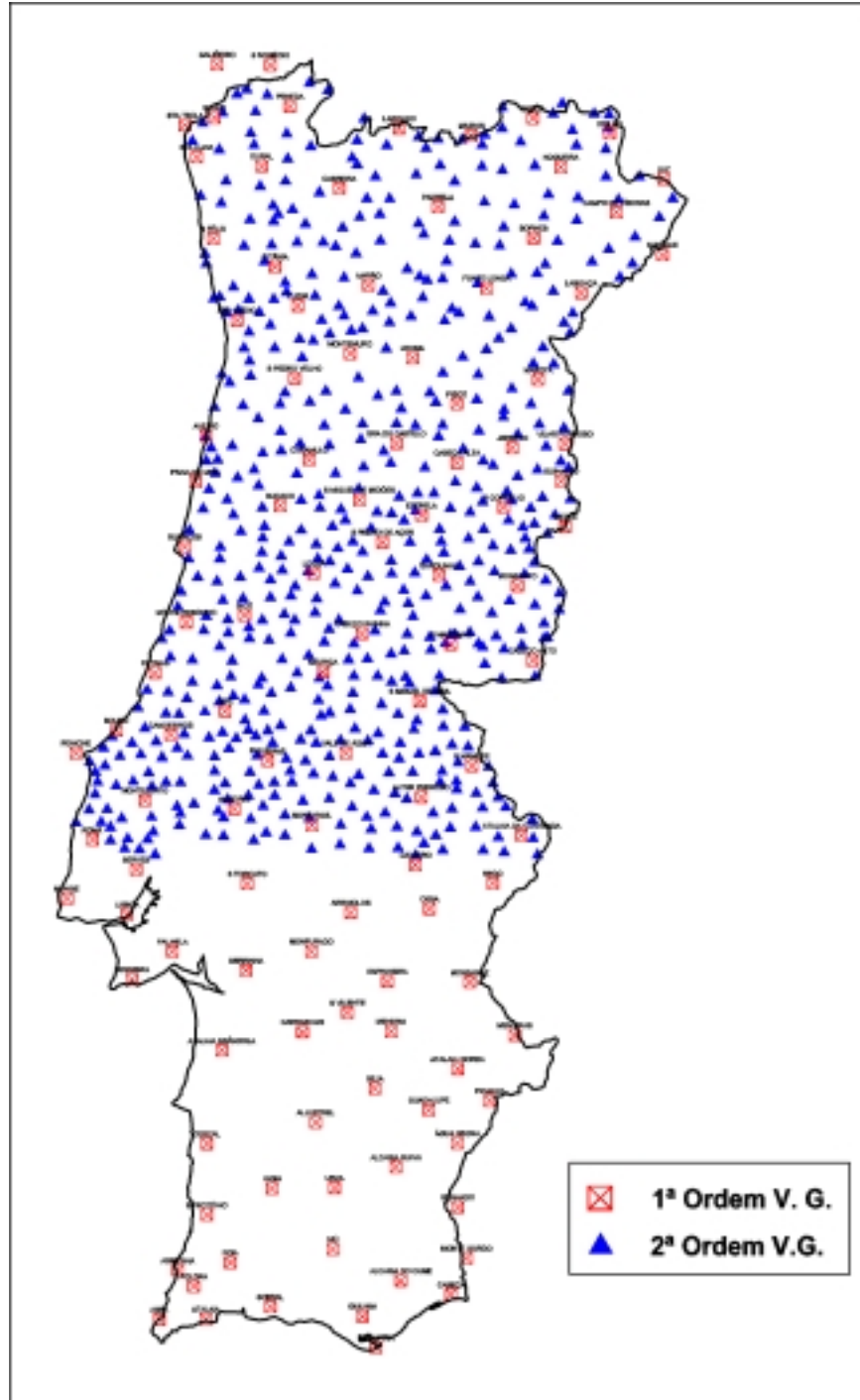


Figure 2 – Mainland Geodetic network measured with GPS until the end of 2003.

#### 4. Tide Gauges

IGP is responsible for two floating tide gauges, at Cascais and Lagos, working since 1882 and 1908, respectively. The Cascais tide gauge is the reference for the mainland ordnance datum.

In 2003, due to the technological innovations and for a better service to the scientific community, IGP acquired 2 new acoustic tide gauges, in order to replace the floating tide gauges systems. These new systems will work simultaneously with the older ones for at least one year. In that way we assure a better quality of the data and also the continuity of the secular series.



*Figure 3 – Cascais tide gauges. Left: floating, right: acoustic.*

#### 5. Gravimetric Network

The gravimetric network of Portugal mainland consists of more than 6500 points, measured with LaCoste & Romberg relative gravimeters, and has a density of about one point per 25 km<sup>2</sup>. In 1994 Dr. J. Mäkinen of the Finnish Geodetic Institute (FGI) had determined the absolute value of gravity in Gaia and Mértola, with the JILAg-5 absolute gravity meter.

In 2003 Dr. Mäkinen came again to Portugal to perform an absolute gravity survey, this time with FGI's new FG5 #221 absolute gravimeter. The Gaia and Mértola stations were re-measured, and a new point was measured in Cascais, in the same building of the GPS permanent station and near the tide gauge.

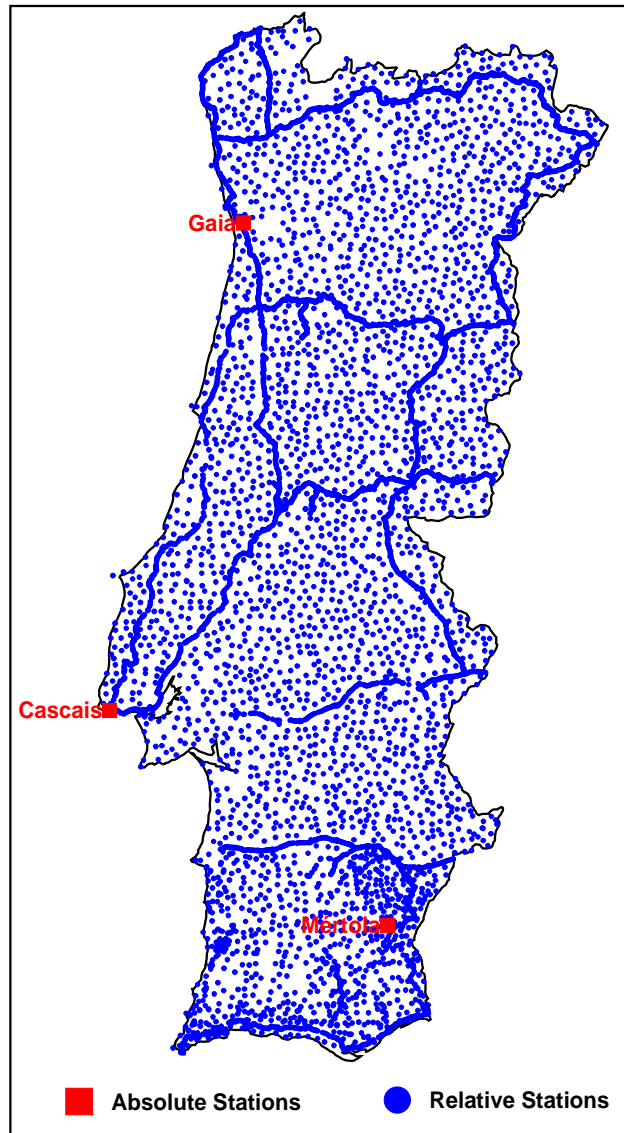


Figure 4 –Gravimetric network of Portugal mainland.

## 6. Astronomical Measurements

Having precise astronomical coordinates was a major limitation in the use of the astrogeodetic approach to the geoid determination problem. Such measurements are also very useful as an independent observation control set for the validation of other types of geoid models

In Portugal Mainland there are about 120 points where astronomical measurements were performed in the 1970s and 1980s. In 1999 we have started determining new astrogeodetic coordinates of our first order network with the

zenith camera from ETH Zürich, and then proceeded with the ICARUS system, also developed by astrogeodetic group at the Geodesy and Geodynamics Lab at ETH Zürich, lead by Beat Bürki. This year we observed about 20 first order pillars in the South part of Portugal, with the ICARUS system.

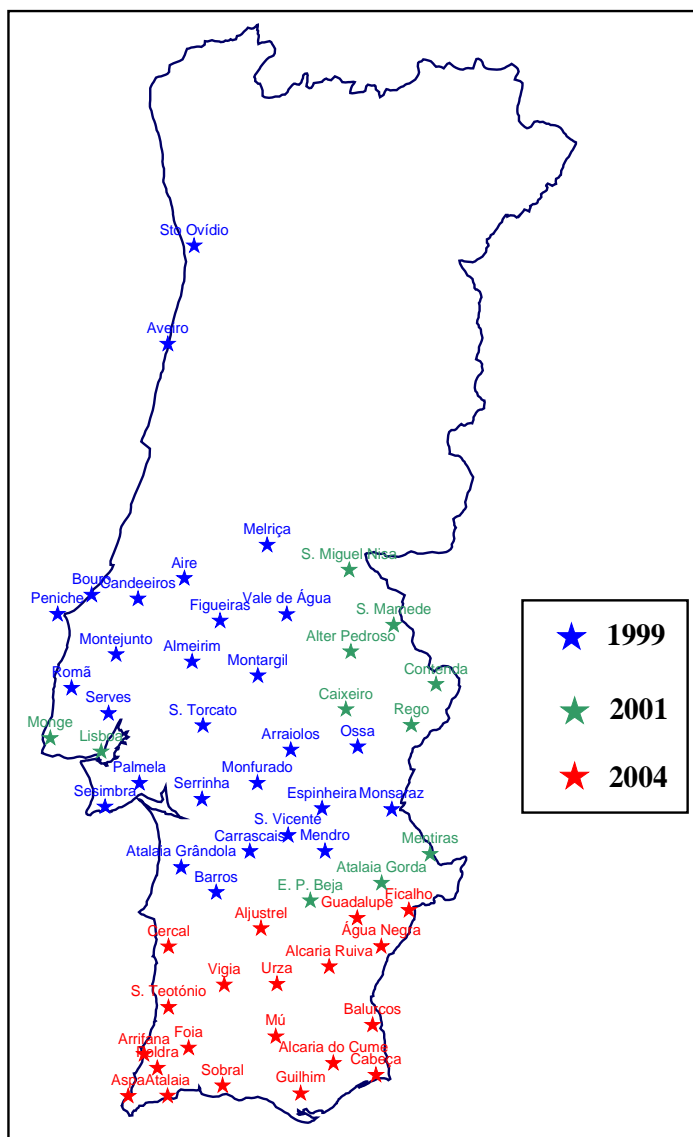


Figure 5 – Astronomical measurements with ICARUS system.

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