National Report of Slovenia
to the EUREF 2013 Symposium in Budapest

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1 Introduction

This paper is a review of activities regarding national geodetic reference frames and other related activities in Slovenia for the period 2011–2013.

After successful completion of the four-year project of establishing the national network of permanent GNSS stations and implementing ESRS in Slovenia [MEDVED et al., 2011], the new project has started. It focuses on the implementation of the vertical component of ESRS. One of the activities in 2013 intends to establish a national combined geodetic network.

2 SIGNAL Positioning Service

Activities of the SIGNAL Positioning Service are:

- maintenace and further development of the national permanent GNSS network,
- integrity monitoring and quality control,
- transmission of real-time data,
- archiving and distribution of RINEX data, and
- support to the users of location based services.

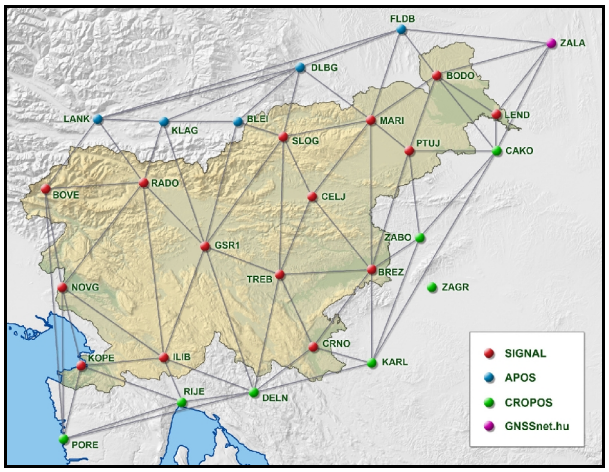

Figure 1: National permanent GNSS network of Slovenia – the SIGNAL network.

The network consists of 15 permanent GNSS stations; 5 additional Austrian stations (APOS network), 6+1 Croatian stations (CROPOS network), and 1 Hungarian station (GNSSnet.hu) are also included, see Figure 1.

The only change of the SIGNAL network configuration since the last presentation to the EUREF community – see [MEDVED et al., 2011] – is replacement of the station in Velika Polana (VELP) in NE Slovenia with the new station in Lendava (LEND). This station was included into the SIGNAL network in April 2013 after the computation of its coordinates. Fitting to the closest SIGNAL stations (local adjustment) was used. A minor upgrade of equipment at the Celje station (CELJ) was made (new GNSS antenna) in January 2012 [BAJEC et al., 2012]. The same kind of upgrades were made also at the stations Nova Gorica (NOVG) and Trebnje (TREB) in May 2013.

An analysis of ionospheric disturbances over Slovenia was carried out for the second half of 2011 and the year 2012 [BERK et al., 2013]. This could be valuable information for the users of location based services as we are in the period of the maximum of the 24th solar cycle.

3 Horizontal/Terrestrial Reference

Establishing the horizontal component of ESRS in Slovenia was one of the aims of the previous project period. One of the results of these activities is a country-wide local to ETRS89 datum transformation model. It will be used for transformation of all spatial datasets, which continuously cover the entire country and require transformation accuracy of better than one metre [BERK and KOMADINA, 2013]. Relation between the new coordinate reference system of Slovenia, which is based on ETRS89, and the NATO coordinate reference system was defined for the purposes of the Slovene Ministry of Defence [KETE and BERK, 2012].

The current realisation of ETRS89 is dated back to the 1996, which is a rounded mean epoch of the three GPS campaigns involved into computations. So, there is a need for a new realisation.

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Within the project of establishing a national combined geodetic network of Slovenia – see section 5, below – a new realisation of ETRS89 is planned. The five official EUREF sites in Slovenia shall be replaced with sites of the combined geodetic network, where – among others – permanent GNSS observations will be collected.

4 Height Reference, Gravity and Magnetic Fields

The implementation of the new height system is based on a new levelling network, which is being measured from 2006. Altogether, 1116 km of levelling lines were measured till the end of 2012, which is 59% of all levelling lines. Some levelling lines measured in the nineties will also be re-measured, see Figure 2. The mean error of the two-sided levelling is 0.42 mm/km [KOLER et al., 2012b].

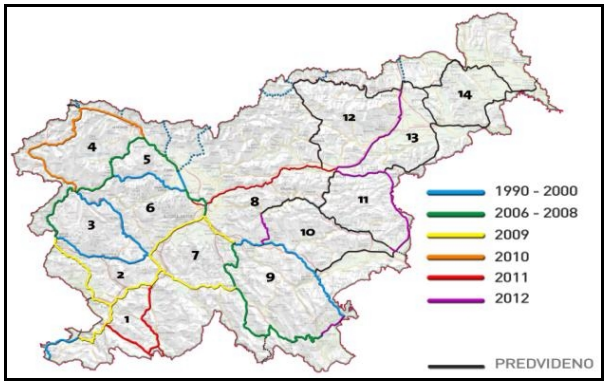

Figure 2: Epochs of the first order levelling lines (years of their last re-levelling).

Gravimetric surveys, based on the new fundamental gravimetric network [KOLER et al., 2012a], were performed along all measured leveling lines. In the last 6 years, more than 1200 new points were observed, see Figure 3.

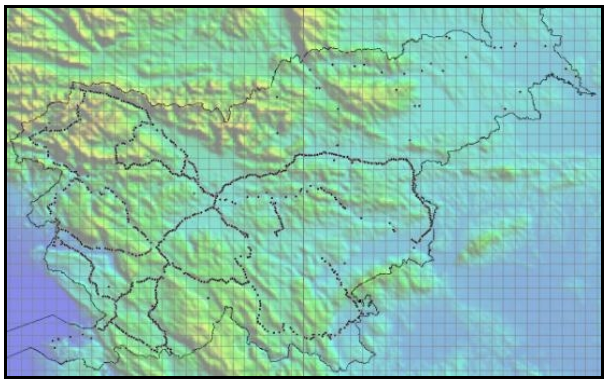

Figure 3: Measured gravity points in the period 2006–2012.

For the purpose of improvement of the height reference surface model, the GNSS measurements were carried out on homogeneously distributed points over the whole territory of Slovenia. At the moment, there are 54 GPS/levelling points to be used for fitting a new (quasi-)geoid.

A new model of magnetic declinations for Slovenia was released. The basis for the estimation of polynomial coefficients are the magnetic declination values from the 11 geomagnetic points in Slovenia, which were obtained between September 2008 and September 2009. Differences when compared to the World Magnetic Model (WMM) are considerable [ŽAGAR and RADOVAN, 2012].

5 National Combined Geodetic Network

As already mentioned above, the newly started project of implementation of the vertical component of ESRS in Slovenia also intends to establish a national (zero order) combined geodetic network. A preliminary study was carried out in order to determine its concept [BERK et al., 2012]. As an optimal number of network sites, six sites were chosen. Their macro-locations were also selected with the circles with radius of 25 km – see Figure 4. The average distance between the planned neighbouring sites in the network is about 100 km.

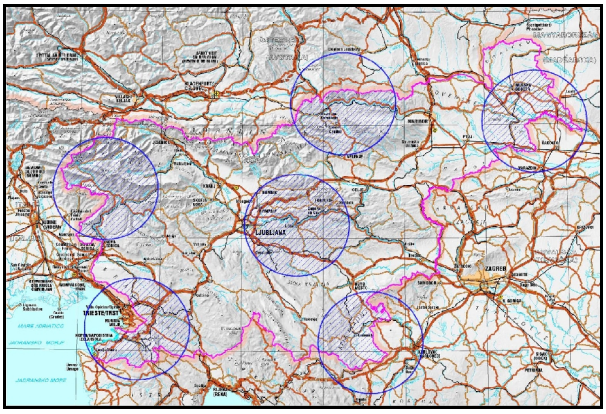

Figure 4: Macro-locations of the planned combined geodetic network of Slovenia.

The combined geodetic network of Slovenia will serve as a:

- reference frame for the national horizontal/-terrestrial system,
- reference frame for the national height and gravimetric systems,
- reference frame for the national permanent GNSS network, and
- multi-purpose calibration network.

All the sites of the network will be fixed in three dimensions, functioning as geometric (i.e. permanent GNSS stations) and gravity-referenced (levelling and gravimetric) network points. One of the six sites is placed at the coast and will be used as fundamental benchmark with the permanent tide gauge station. All the points will be monumented with concrete pillars, drilled-braced tripods, or rohn towers.

6 Other Activities

Nationwide aerial laser scanning (LiDAR) started in Slovenia in 2011. Areas with three different point densities were defined. For most of the country area (~80%), a medium point density is chosen (i.e. 5 pts/m^2). A low density (i.e. 2 pts/m^2) is chosen for mountains and woodland. The highest density (i.e. 10 pts/m^2) is chosen for some urban and flood areas [TRIGLAV ČEKADA et al., 2012].

Unfortunately, the contractor resigned soon after the project started. Less than 10% of the country area has been scanned. It is planned that the project will be continued in autumn 2013.

Acknowledgements

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