National Report of Estonia 2013

Karin Kollo, Priit Pihlak, Tõnis Oja, Ants Vain, Raivo Vallner
Estonian Land Board, Mustamäe tee 51, 10621, Tallinn, Estonia

1. GNSS Permanent Reference Stations

The National GNSS Permanent Station Network (ESTREF) consists of 9 stations of which 4 belong to the EPN network.

RTK-services are provided by two private GNSS RTK-networks, additionally there are some stations (Fig. 1), which provide RTK corrections from one base station.

Currently Estonian Land Board computes for all GNSS permanent stations coordinates, combinations are available on weekly basis since GPS week 1458. We are using Bernese GPS 5.0 software; as well implementation is ongoing with Bernese 5.2. Coordinate time series analysis is done with CATREF software.

Weekly SINEX is submitted to EUPOS Combination Centre. Co-operation is ongoing with NKG Geodetic Commission to establish similar activities to EUPOS CC.

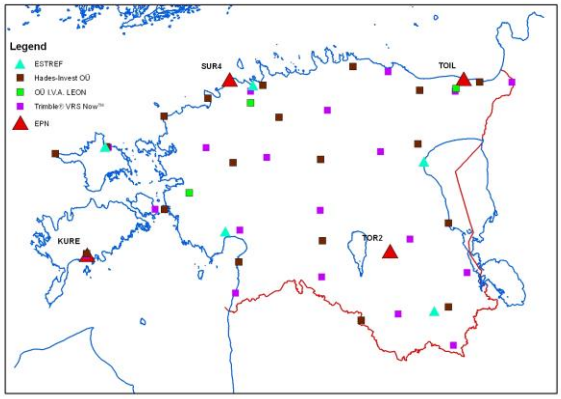

Fig. 1. Estonian GNSS Permanent Stations

2. Precise Levelling Network

In 2012 I order levelling was done for altogether 345 km. The precision of levelled lines was $\eta = 0.19 \ mm\sqrt{km}$ and $\sigma = 0.07 \ mm\sqrt{km}$ for random and systematic errors, respectively. Some of the measured lines will be re-measured in 2013.

In 2012 and 2013 the connections to newly established fundamental benchmarks are being levelled. Additionally levelling lines were established in polygons, which were too big, in order to establish better connections for municipality networks.

In 2013 about 210 km of levelling lines will be levelled. Completion of high-precision levelling in 2013 and adjustment of the whole network in 2014, all preconditions are achieved to establish a new height system in Estonia in years 2014-2015.

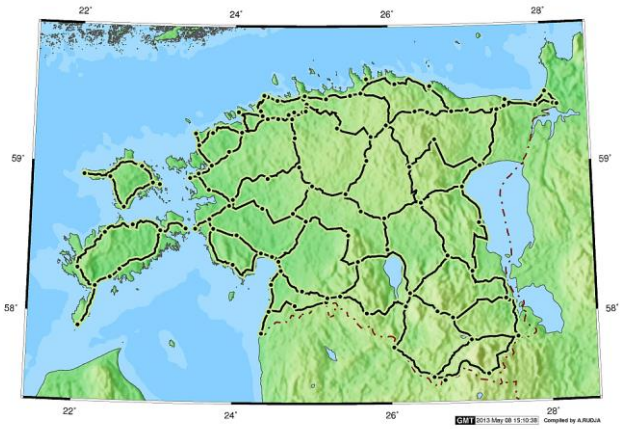

Fig. 2. The I order levelling network

3. Gravity field and geoid studies

The main works in 2012-2013 were: (i) dense gravity surveys in Western Estonia and on ice-covered large lakes and marine areas near the coast, (ii) the preparation of the Estonian gravity database and specifications for Nordic Geodetic Commission

(NKG) geoid modelling in cooperation with other Nordic and Baltic countries.

Within last few years more than 1000 new gravity survey points have been measured over the mainland of Estonia (Fig. 3). This work has been done in cooperation with Tallinn University of Technology (TUT) and Estonian University of Life Sciences. Scintrex CG5, LCR G relative gravimeters and RTK GPS positioning were operated in the field for collecting high quality gravity data. The uncertainty of the survey results was estimated to be equal or better than ±0.15 mGal for gravity and ± 0.10 m for coordinates and height (Türk et al. 2011; Oja et al. 2011).

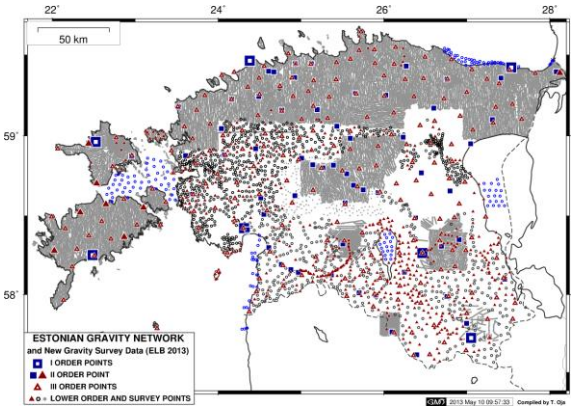

Fig. 3. The database of gravity network and survey points in Estonia in 2012. Gray dots represent dense (about 126 000 points) but good quality gravity survey data collected by Geological Survey of Estonia. Regions with sparse data in East Estonia will be surveyed in 2013. Blue dots show the gravity survey points measured on ice-covered large lakes and marine areas.

In Winter 2012/2013 gravity measurements on frozen sea were carried out in Väinameri (area between two biggest islands in Western Estonia) and along the North-Eastern coast. Scintrex CG5 gravimeter with RTK GPS positioning were used to determine gravity values on ice with uncertainty ±0.20 mGal. For safe and effective transportation of team and equipment special vehicles (lightweight crawler or all-terrain vehicle - ATV) were used on ice (see Fig. 4).

Fig. 4. Gravity survey in Väinameri in Winter 2013. Special lightweight crawler was used for transportation of 3-person team and equipment on ice with thickness of about 40 cm.

In 2012 a joint cooperation project was initiated between the Nordic and Baltic countries for the computation of new regional geoid model NKG2014. First initial specification with detailed description of the project were prepared by the NKG Working Group of Geoid and Height Systems. Currently the participating countries are preparing the input data, including the national gravity databases. The newest gravity survey data are now being inserted into the Estonian gravity database to improve the geoid accuracy in the region.

4. Laser scanning

In 2012 airborne laser scanning (ALS) was used for measuring sea surface topography in West-Estonia. Two test areas were chosen where the anomalies in gravimetric geoid were significant and where the gravimetric data was sparse. The tests showed that the ALS measurements can determine the sea surface within 20 cm. It is an alternative way to make measurements over open sea areas, instead of doing gravity measurements during the winter time over ice.

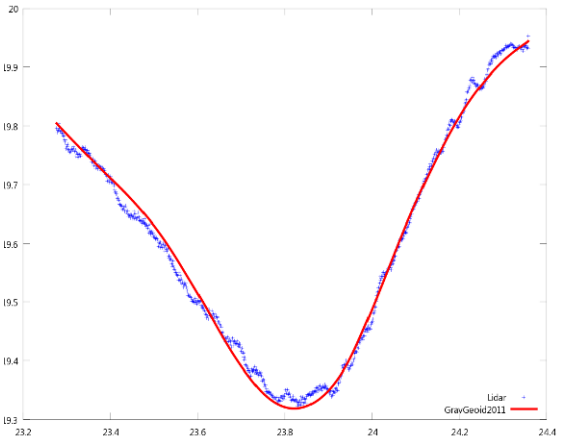

Fig. 5. ALS measurements are marked with blue colour and gavimetric geoid surface with red. The results are measured from the height of 2400 m above mean sea level. Test area is situated in the Gulf of Riga.

The ALS measurements for sea surface determination will continue in 2013 in North-Estonia covering the coastline.

5. Local networks, maintenance of geodetic marks and legislation

1st order local geodetic network was reconstructed in Tamsalu city. In 2012 about 250 points were inspected and results of this inspection are available from Geodetic Point Database (http://www.maaamet.ee/rr/geo).

In 2012 started recognition of new locations for GNSS permanent stations.

In connection of Spatial Data Act, new decree – a Decree of Geodetic Works is in progress.

Acknowledgements

Thanks to Mr Andres Rüdja for providing figure 2 for this report.

References

Oja, T.; Türk, K.; Ellmann, A.; Gruno, A.; Bloom, A.; Sulaoja, M. (2011). Relative gravity surveys on ice-covered water bodies . 8th International Conference Environmental Engineering, 1394 - 1401.

Türk, K., Sulaoja, M. Oja, T., Ellmann, A. Jürgenson, H. (2011). Precise gravity surveys in South Estonia from 2009 to 2010. 8th International Conference on Environmental Engineering, 1499 - 1505.