MAA-AMET
Estonian Land Board

National Report of Estonia 2009

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High-precision levelling

- Altogether 2 412 km have been levelled since 2001.
- The inner consistency of measurements is promising:
  - random and systematic errors are $\eta = 0.18$ mm/km, $\sigma = 0.03$ mm/km
  - the precision estimated from the misclousures of 18 loops is $\sigma = 0.23$ mm/km.

- The field works are expected to be finalised in 2010
  - In 2008, high-precision levelling was performed on 602 km in South East Estonia.
  - In 2009, about 573 km will be levelled on the mainland of Estonia and the island of Hiiumaa
  - In 2010 the scope of levelling will be 342 km to be performed on the island of Saaremaa.

- Pilot project "Precise sea level measurements in Väinameri" has been initiated in cooperation with the Marine Systems Institute.
  - the transference of heights will take place simultaneously with tide gauges at three stations (Virtsu, Rohuküla, Heltermaa).
  - The observation period is 6 months (February – August 2009),
  - the accuracy of transference will be checked with the I order levelling line Virtsu – Rohuküla.

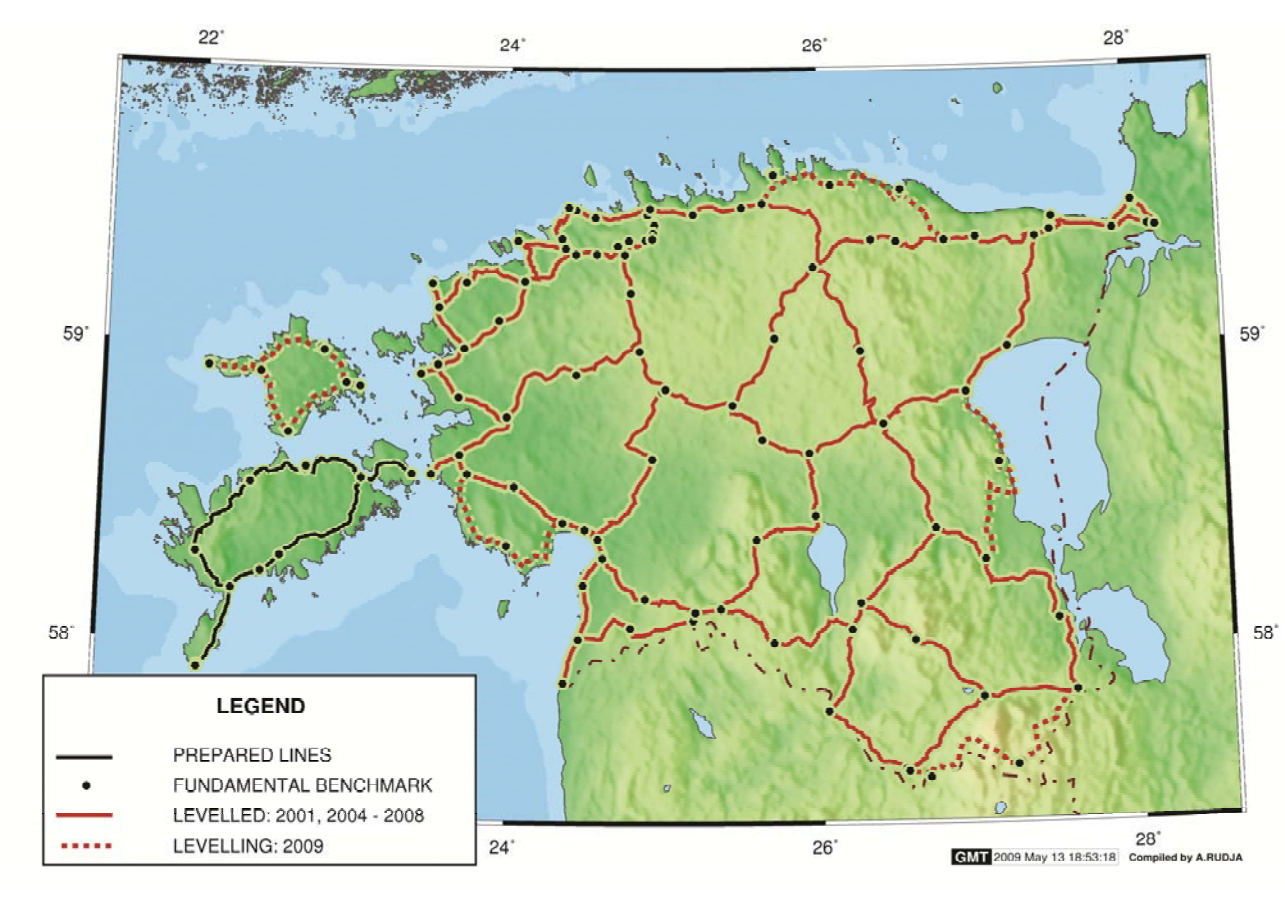


Fig. 1. The High-Precision Levelling Network

Photo 1. Latvian (left) and Estonian (right) teams during the across-border levelling in 2008. Photo: A. Rüdja.

Vääna Calibration Baseline

- The Vääna Calibration Baseline, established in 1987, was fully renovated in 2007
- The 1 344 m long baseline (Photo 2) consists now of 13 observation pillars and 5 ground benchmarks. From the pillars seven are new.
- In October 2008, a scale transfer from the Nummela Standard Baseline was made by the Finnish Geodetic Institute.

Photo 2. Vääna Calibration Baseline

Re-measurement of Estonian Geodetic Network

- In 2008, the Estonian Land Board carried out high-precision GPS measurements on the points of the I order National Geodetic Network
- Different structural units of the Land Board participated in the measurements. GPS measurements were coordinated by Prof. Artu Ellmann from the Tallinn University of Technology.
- The final length of GPS field mission was from July 28 to August 08, 2008 (altogether 7 days, GPS weeks 1490 and 1491)

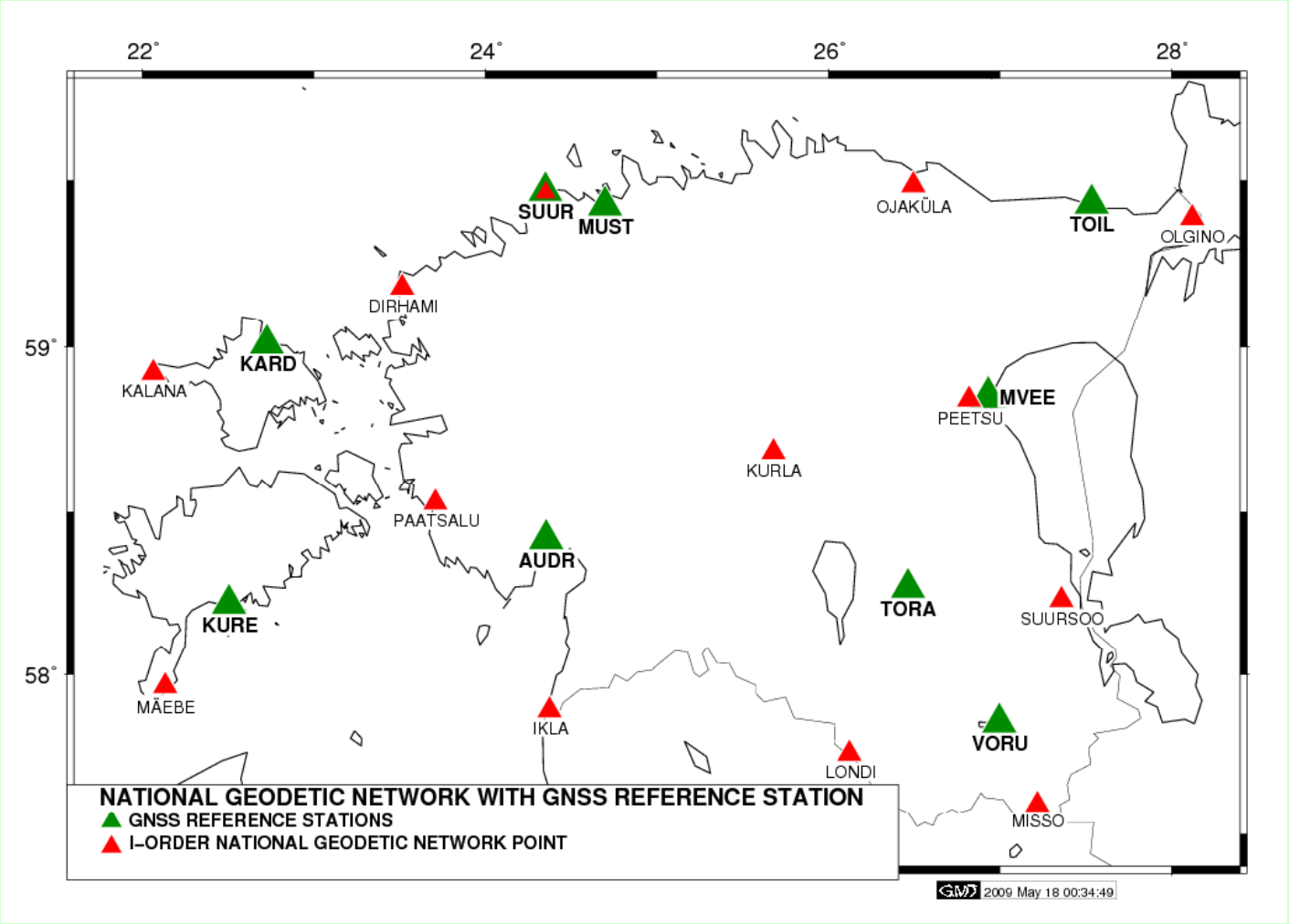


Fig.3. I order Estonian National Geodetic Network

- For this mission the Land Board loaned GPS receivers and antennas from the Finnish Geodetic Institute (8+1 sets of Ashtech Z-12).
- The Land Board's own 4 sets of similar equipments were also used.
- Thus, it was possible to make observations simultaneously on all 12 RGP points.

- In the data processing of RGP 2008 campaign, the principles of the RGP observation campaign of 1997 as well as the guidelines of EPN and NKG were followed.
- Repeatability - 1.1 1.3 2.6 mm
- Comparison to ITRF1996 1997.56

  2.9 3.8 5.5 mm - 14 points

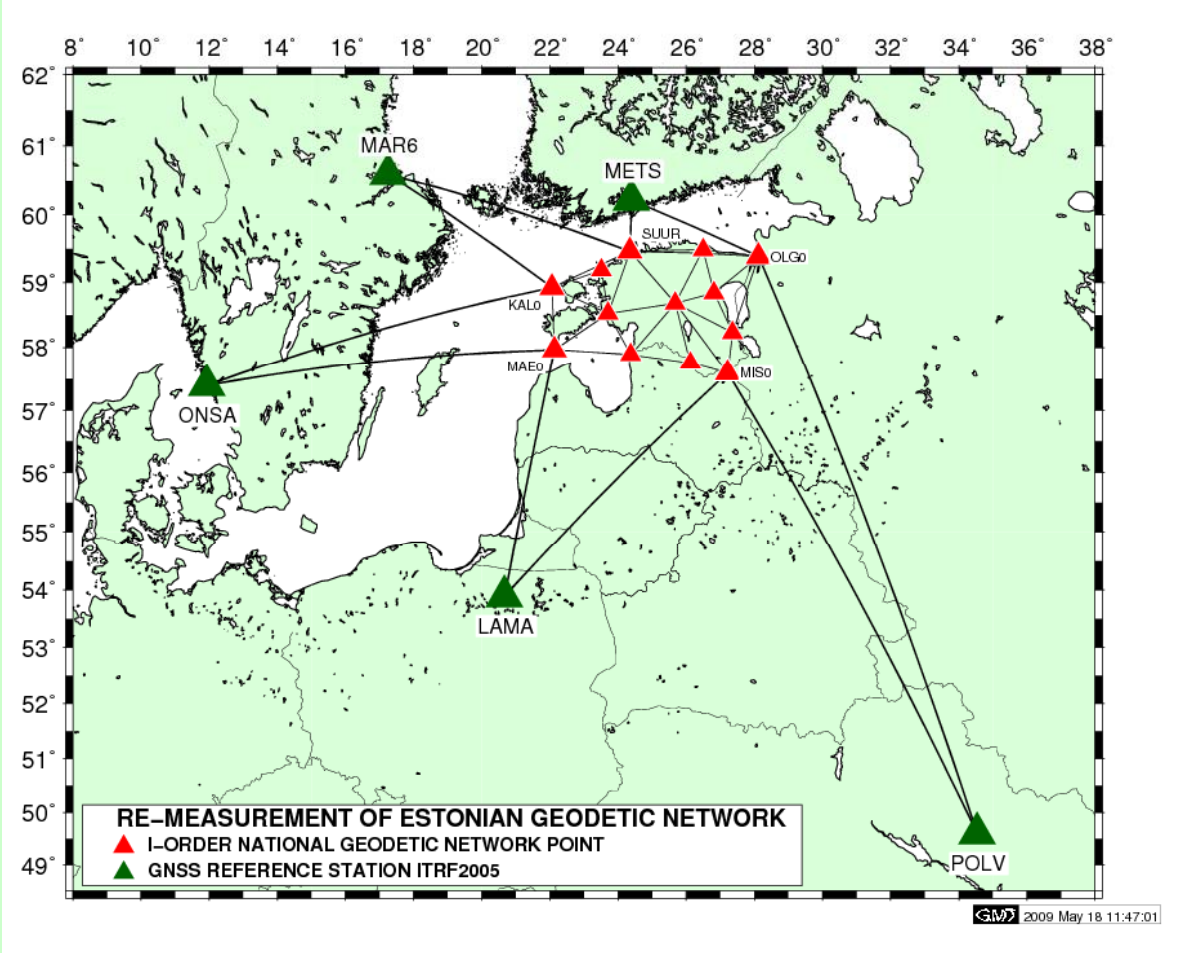
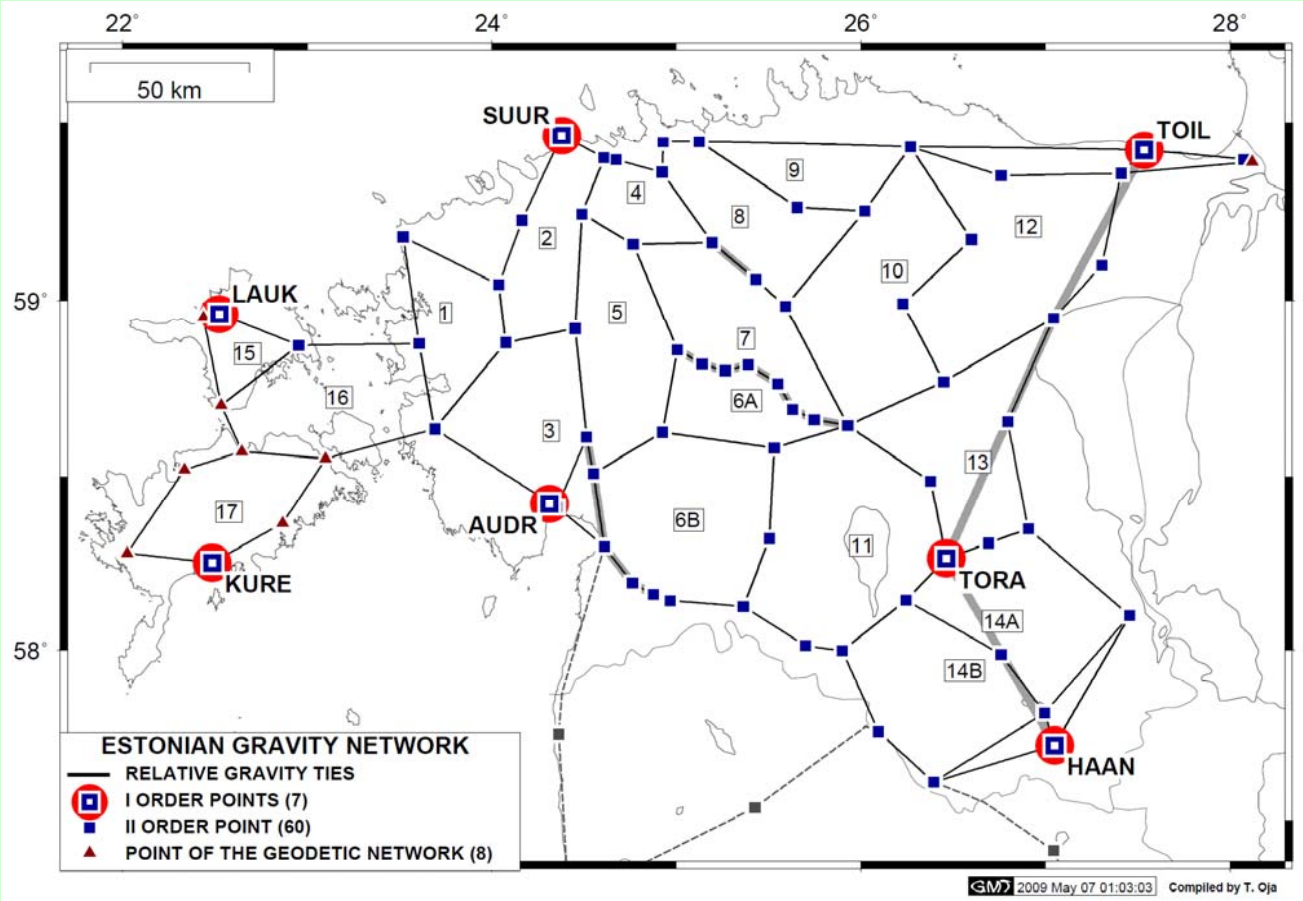


Fig.4. Vector Schema for National Geodetic Network with reference points

Gravity networks

- In July-August 2008, in international cooperation with the Finnish Geodetic Institute (FGI), absolute gravity values were determined at seven I order gravity network points
- In cooperation with scientists from FGI and IfE (Institut für Erdmessung, Gottfried Wilhelm Leibniz Universität Hannover, Germany) the method for the calculation of vertical gradient of gravity above the pillar of I order points is currently being improved and the non-linearity of gradient evaluated.
- In 2008, all I order network points (absolute points) were tied with the points of II order gravity network by using relative gravimeters Scintrex CG5
- The Estonian Gravimetric Network was adjusted in September 2004. Due to new additional data, a new adjustment is currently ongoing (Oja 2008).



- Fig.5. Points of the Estonian I and II order gravity network with relative gravity ties between the points.

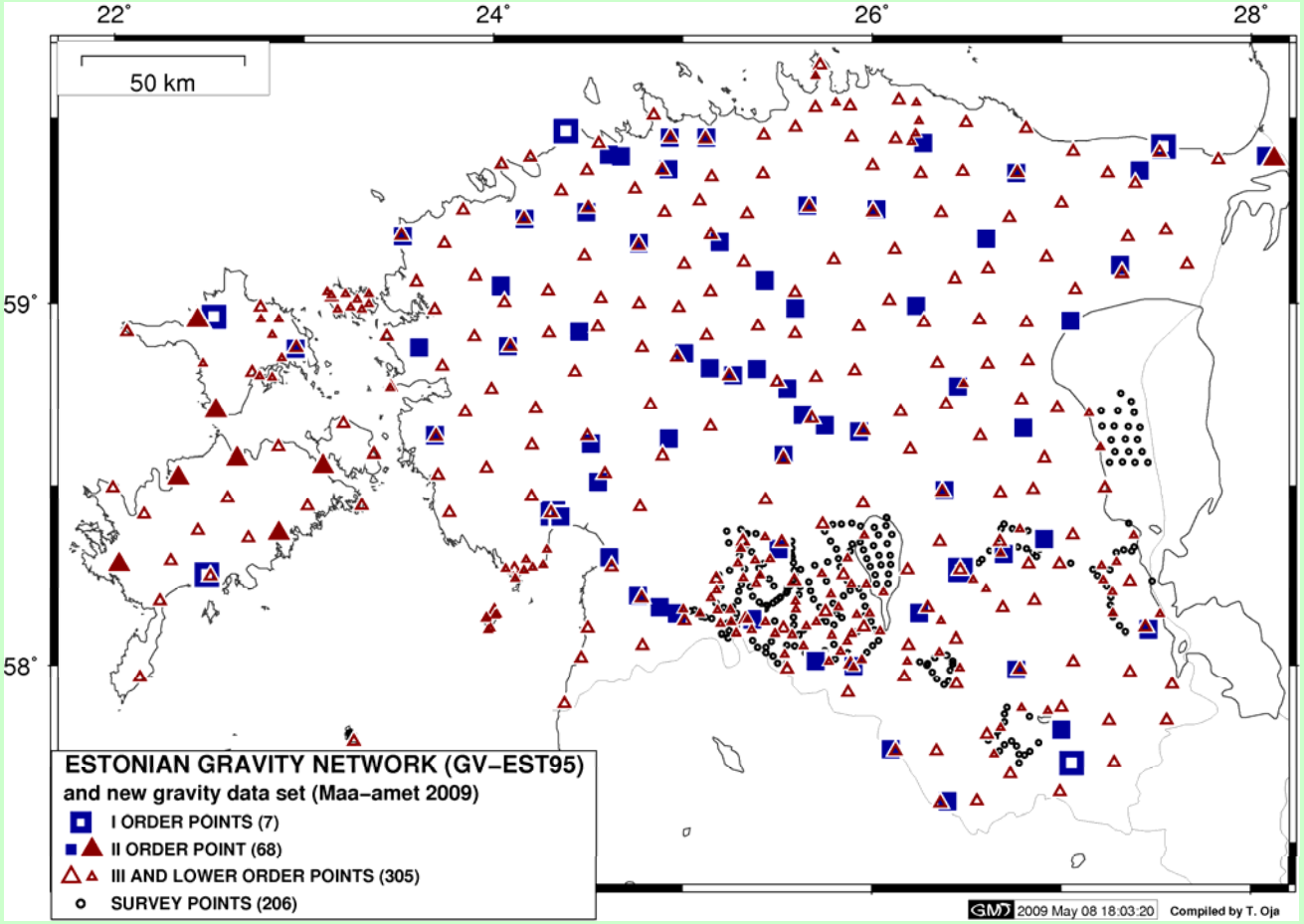


Fig.6. Dataset of the Estonian gravity network (GV-EST95) and new gravity survey data

Thank you for the attention!