

Estonian-Swiss cooperation: Reconstruction of GNSS-RTK permanent station network in Estonia

Dr Karin Kollo
Head of the Department of Geodesy
Estonian Land Board



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Motivation

- + to establish real-time GNSS permanent station network in Estonia
- + to provide precise positioning service for the environmental monitoring
- + to use INSPIRE services
- + to use European satellite navigation services from GALILEO and EGNOS



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Project goals

- + to reconstruct Estonian permanent station network
- + Project implementation time 2012 – 2016
- + Altogether 4 stages
- + Amount ca 1 020 000 €



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Starting point

+ 9 CORS stations

- SUUR (SUR4) established in 1996 *
- MUS2 established in 2006 **
- TOR2, AUDR, TOIL, KURE established in 2007 *
- VOR2, MVEE, KARD established in 2008 **

* Leica GRX1200GG receivers and LEIAT504GG antennas

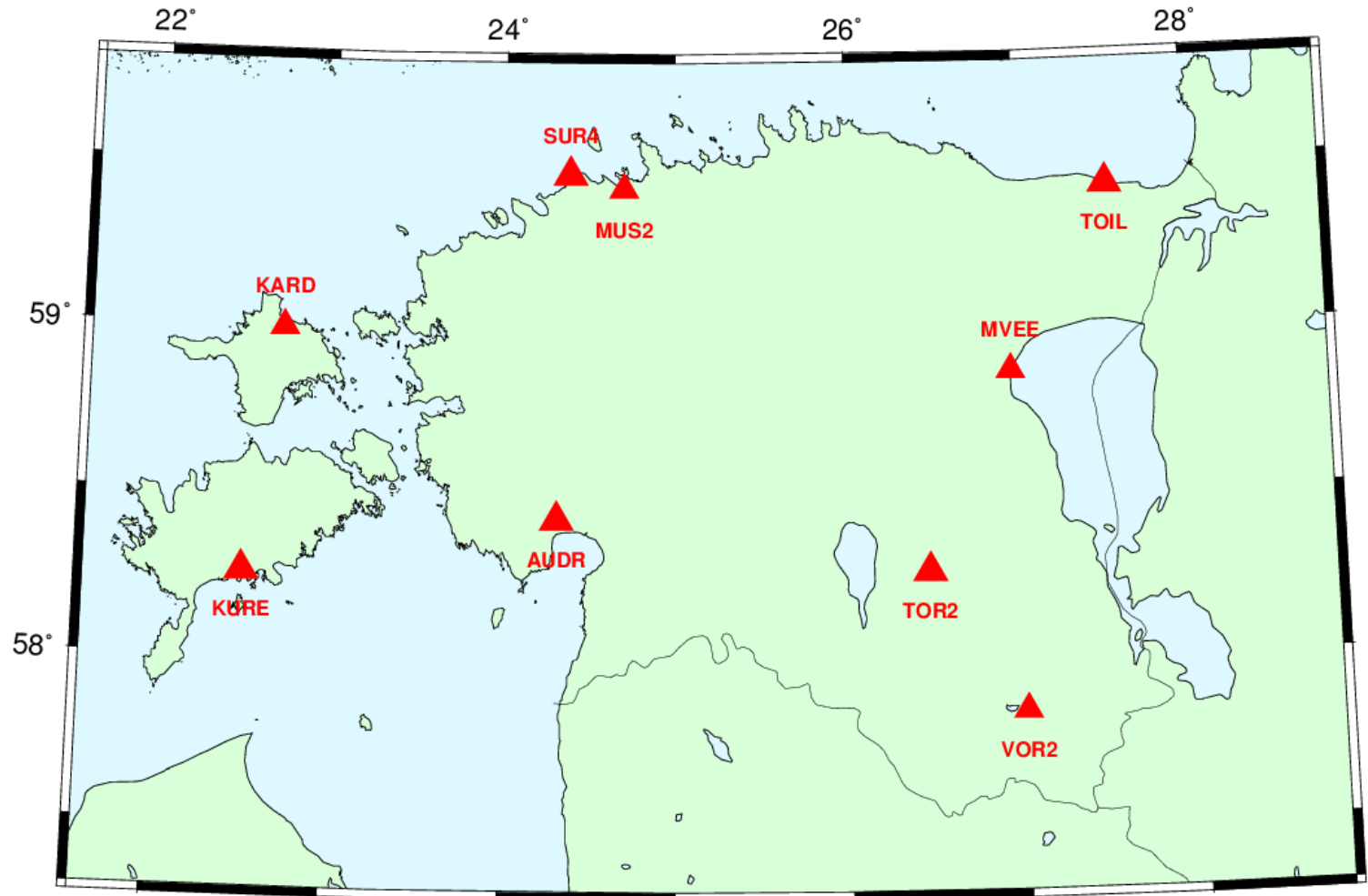
** Leica GPS500 receivers and LEIAT504 antennas

+ Software for monitoring (Leica Spider)



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

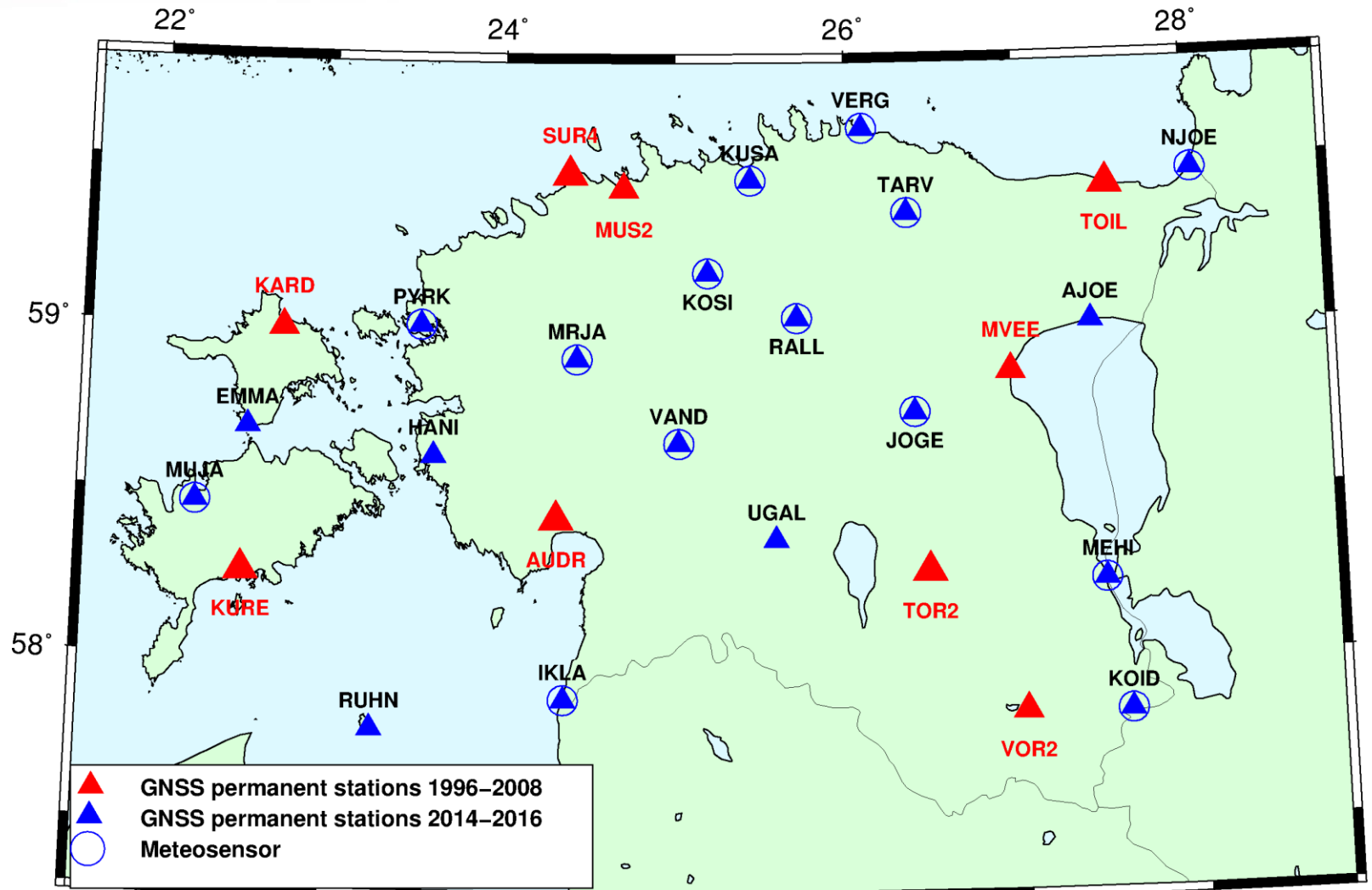
BEFORE





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

AFTER





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Project

- + 19 sets of GNSS permanent station equipment (GNSS receivers and rovers) with installation
- + 14 meteosensors
- + 11 rovers
- + GNSS-RTK permanent station network control centre
 - servers
 - Software and licences
- + Training



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Equipment

- + Leica GR25 GNSS receivers
- + Leica AR25 GNSS choke ring antenna with radome
- + 14 meteosensors Väisala WTX520
- + 11 rovers GS Viva
- + 2 servers for the GNSS-RTK permanent station network control centre



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Site installation





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Software

- + Software for the GNSS-RTK permanent station network control centre
 - Spider Site Server
 - Spider Network Server
 - SpiderWeb
 - Spider Business Centre, SBC LiveView
 - Spider QC
- + 48 licences for real-time corrections
- + 47 licences for RINEX file products



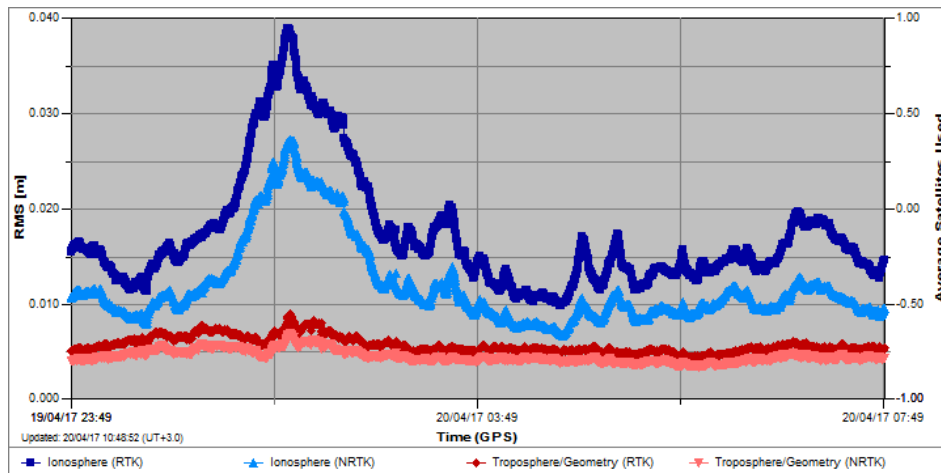
EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Products

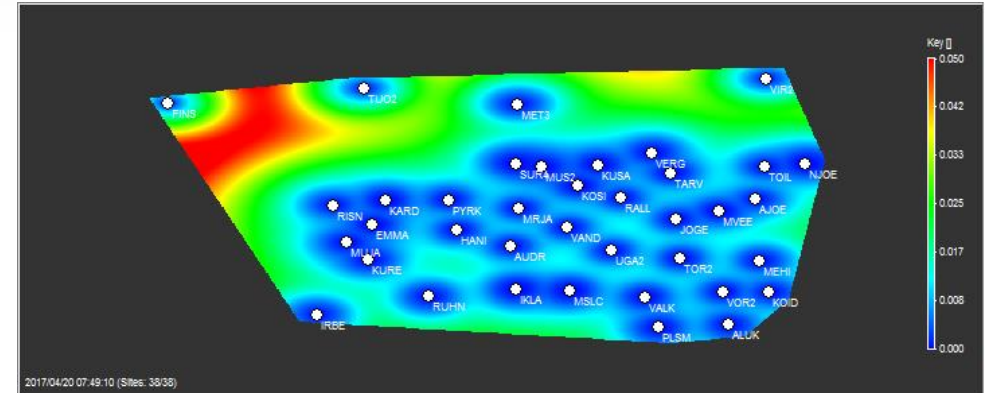
- + Static Rinex files with interval 30 s
- + Static Rinex files with interval 0.5 s
- + RTK corrections from one station
- + RTK network corrections
- + Weekly computations with program Bernese 5.2
- + Time series analysis for permanent stations



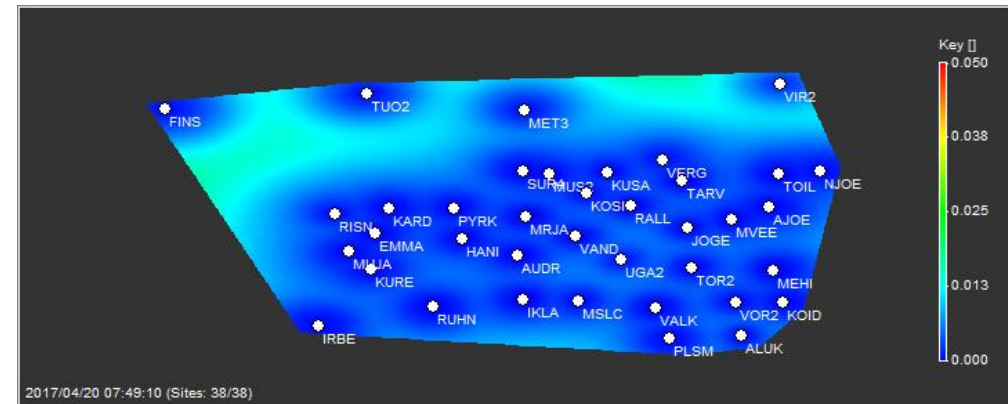
Products and service



Global RMS: A general indicator of the residual error for the whole network



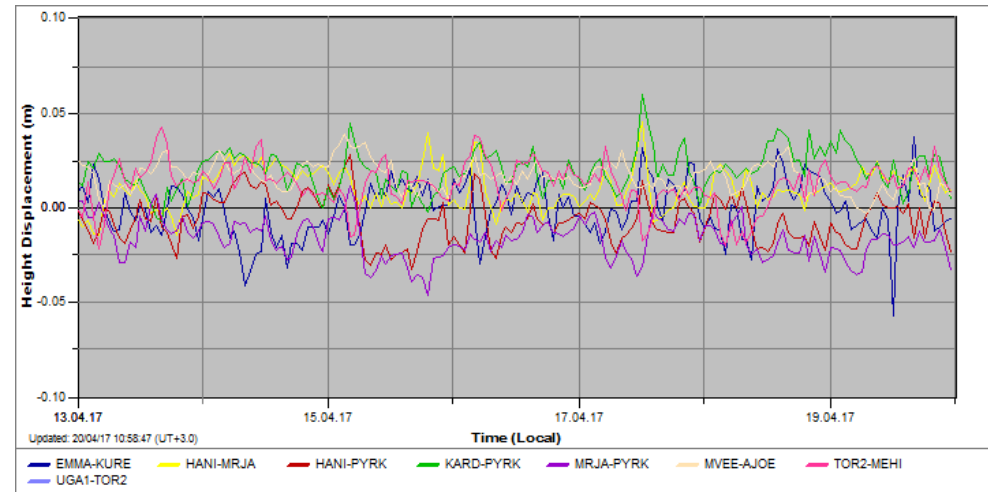
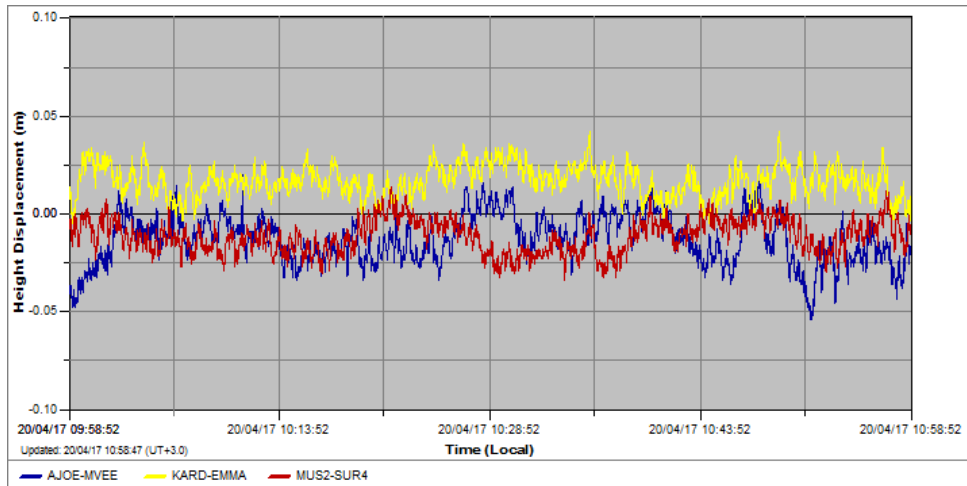
Residual Ionosphere (RTK): The estimated residual ionospheric error for a single base RTK user using data from the nearest site



Residual Troposphere/Geometry (RTK): The estimated residual tropospheric and orbit error for a single base RTK user using data from the nearest site



Products and service



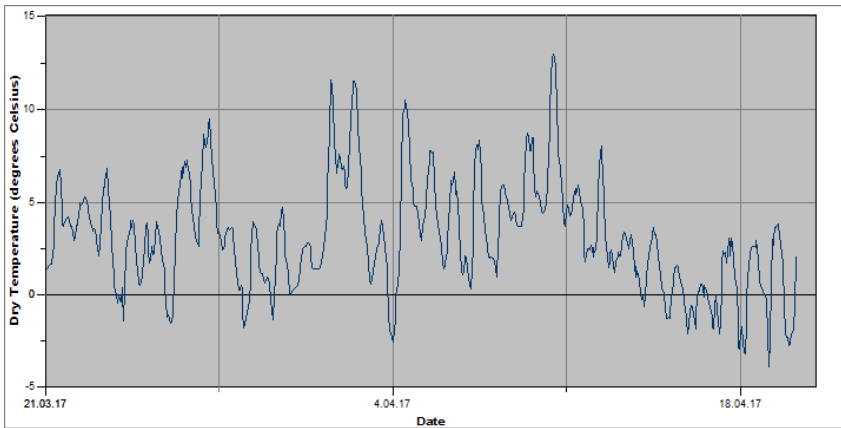
Post processing coordinate analysis for height: the difference in height from the reference coordinate

Real time coordinate analysis for height: The difference in height from the reference coordinate

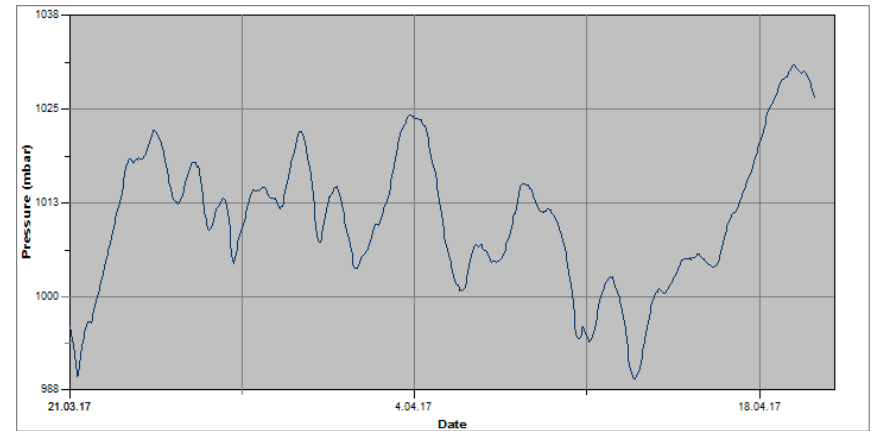


EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

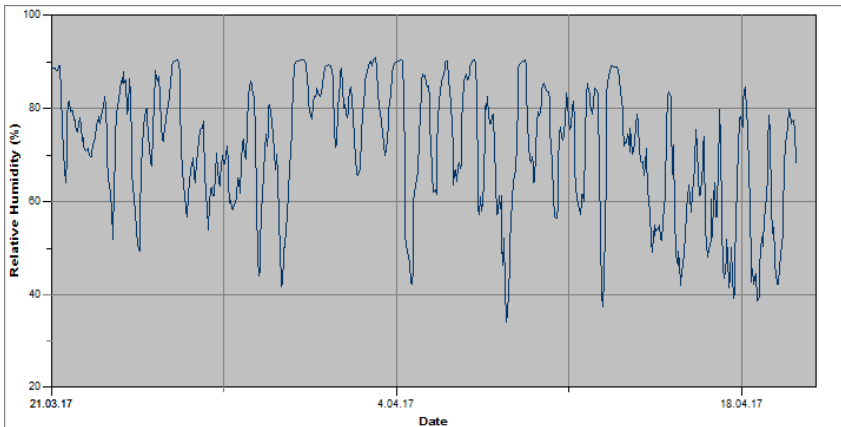
Products



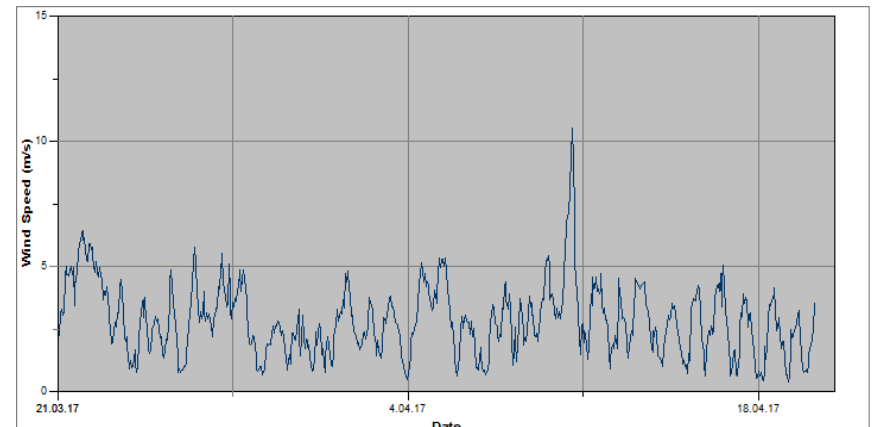
The measured air temperature



The measured atmospheric pressure



The measured relative humidity



The measured wind speed



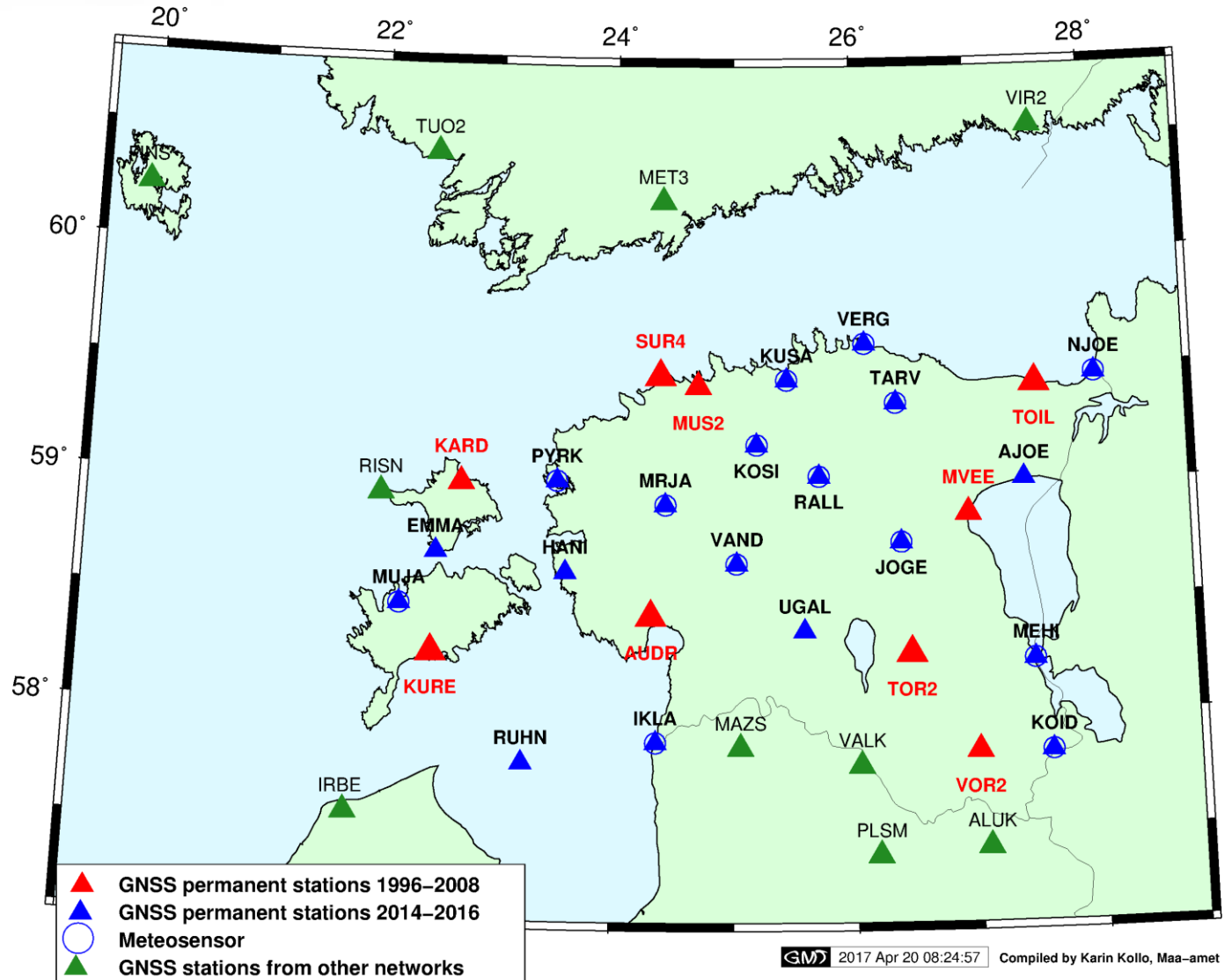
EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Improvements

- + altogether 28 GNSS permanent stations (average distance 50 km)
- + all equipped with instruments capable to send real-time corrections
- + up-to-date technology (different GNSS)
- + GNSS-RTK computation and analysis centre with software and licenses to establish GNSS-RTK network service



ESTPOS NETWORK





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Cooperation

- + Latvian Geospatial Information Agency
(5 stations)
- + Estonian Maritime Administration
(1 station)
- + Finnish Geospatial Research Institute
(4 stations)



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Usage

- + Geodetic measurements
- + Aerial photography
- + Forest monitoring
- + Shoreline mapping
- + Volumes of mines
- + Navigation
- + Weather forecasting
- + etc



EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

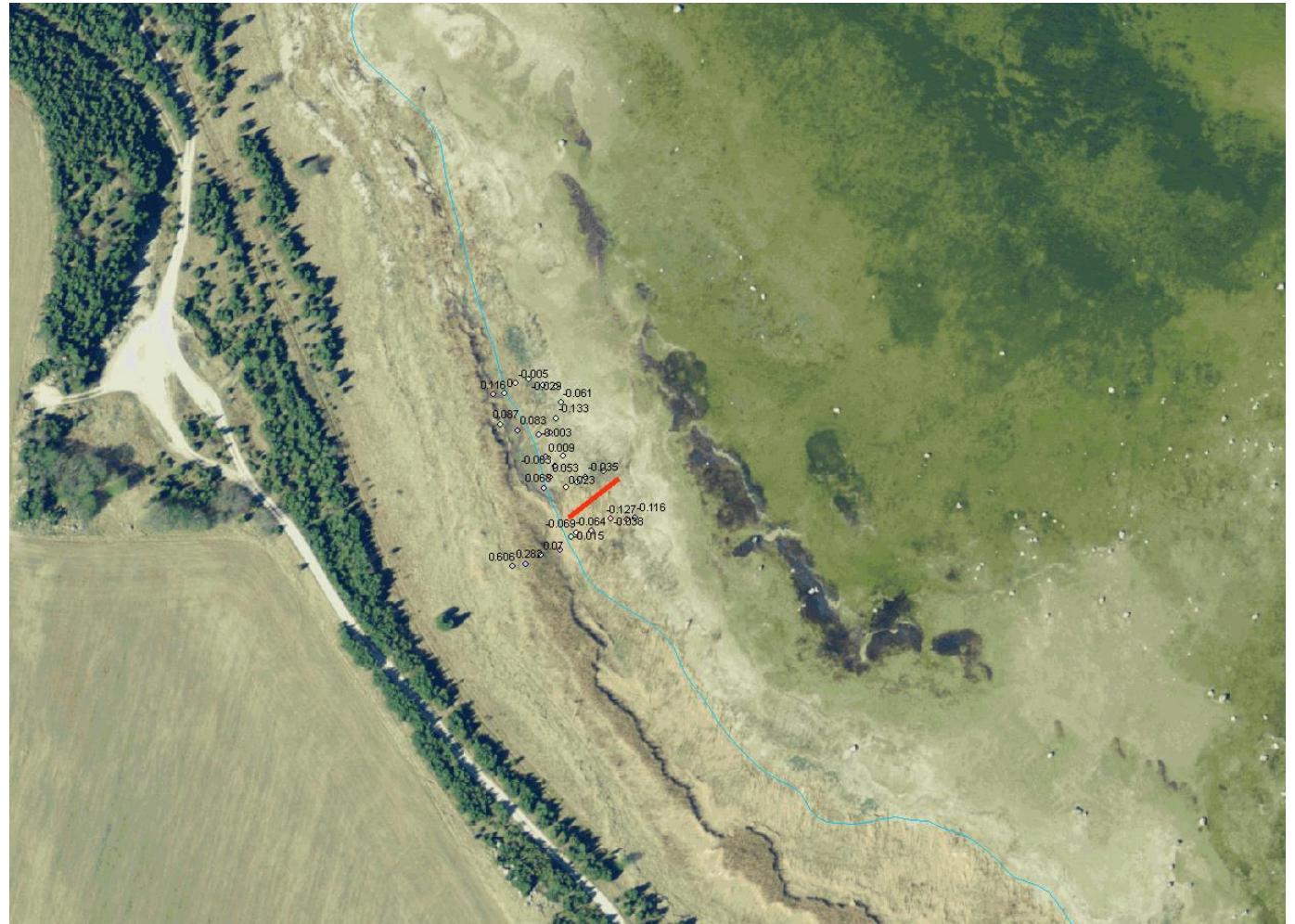
Forest monitoring





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Shoreline mapping





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Volumes of mines





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Ash mountain volumes





EESTI-ŠVEITSI KOOSTÖÖPROGRAMM
ESTONIAN-SWISS COOPERATION PROGRAMME

Thank you for the attention!

<https://www.youtube.com/watch?v=OSvxz5cY5Rs>

karin.kollo@maaamet.ee