Finnish Geodetic Institute

FGI activity report on geodynamics 2009-2010

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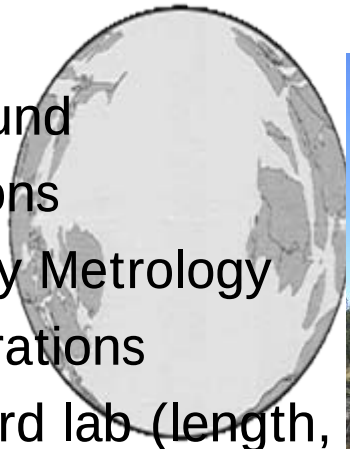
Tasks of the Dept. of Geodesy and Geodynamics FGI

- Coordinate and height systems
  - Finnish Geodetic Reference Fram EUREF-FI
  - Finnish Height System N2000
  - Metsähovi Fundamental Station

- Gravity
  - Geoid model FIN2005
  - National gravity networks
  - Research and measurements abs/rel/SC
- Geodynamics
  - Postglacial rebound
  - Local deformations
- Geodetic and Gravity Metrology
  - baselines, calibrations
  - National standard lab (length, gravity)



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Content

- Absolute gravimetry
- Relative gravimetry
- Superconducting gravimetry
- Satellite gravimetry
- Long interferometrical watertube tiltmeter
- Geo-VLBI
- Satellite Laser Ranging (SLR) modernization
- DynaQlim
- Geodetic metrology for geodynamics

Absolute gravity 2009

FG5-221

- hardware problems in 2009
- Metsähovi 10 measurements (JM, MBK, HR, JN)
- Kevo 2 measurements (JM)
- ICAG/BIPM comparison (JM)

First Order Gravity Net (FOGN) remeasurement with A10

- **Cooperation of Institute of Geodesy and Cartography, Warsaw Poland / FGI, (**Mäkinen & Sekowski)
- A10 tests in Borowa Gör, Poland in July 2009
- **Metsähovi AA,AB,AC, AG** stations measured
- **19** FOGN stations in Southern Finland
- VaasaAB, Joensuu and Ilomantsi old absolute sites
- A10 **Laser** comparison in Centre for Metrology and Accreditions (MIKES)

- Preliminary results to be presented in EGU General Assembly 2010 in Vienna

2010 plans

- rest of the FOGN stations to be measured with A10.
- vertical gravity gradients, GPS coordinates and height (levelled) to be determined for all measured FOGN stations

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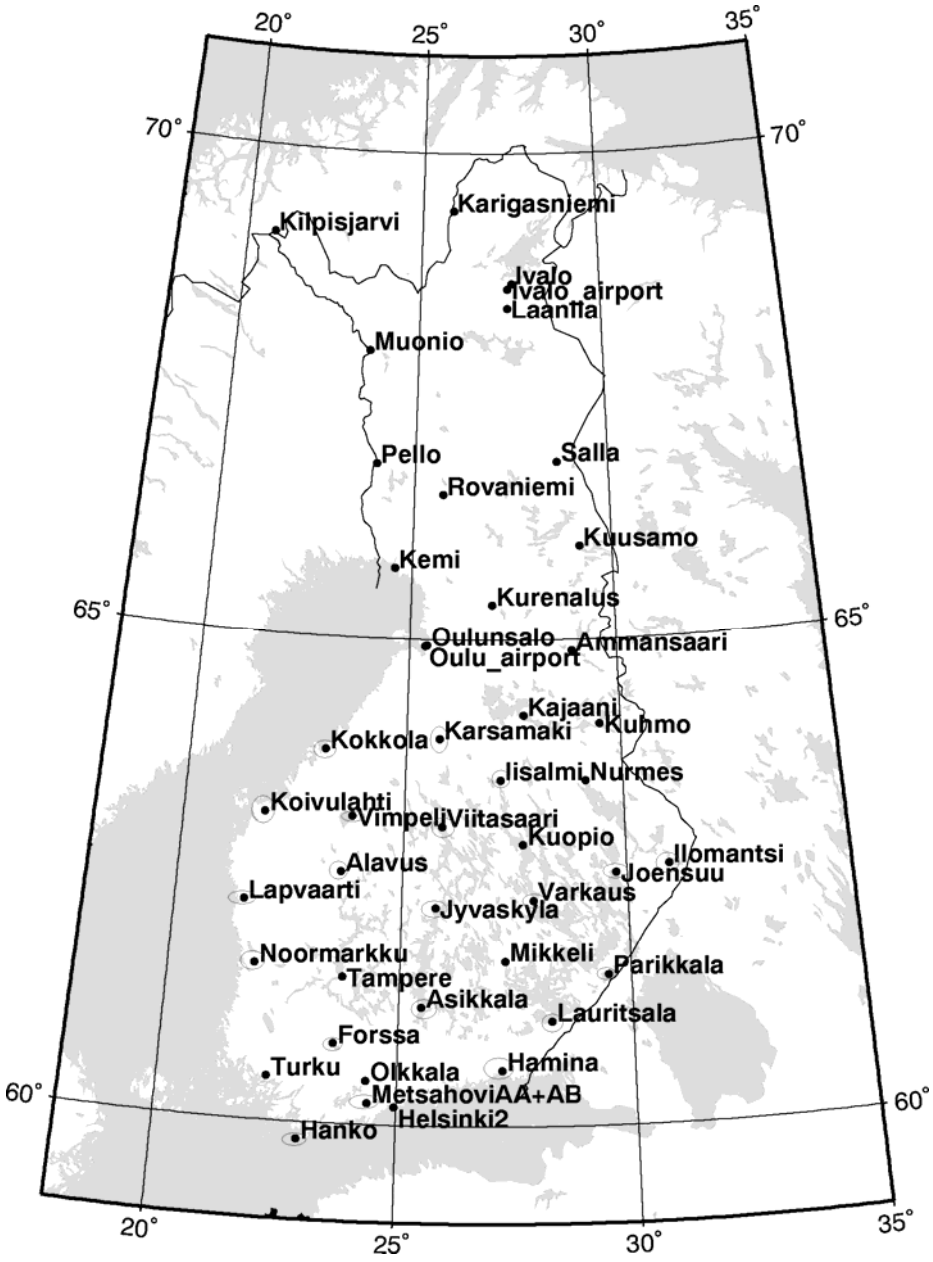
FOGN remeasurement with A10



Polish A10 on Metsähovi_AA

A10 at FOGN station 620003 (Asikkala)

Relative gravimetry

- Vihti_AA and Masala AA absolute gravity values compared to 1996 JILAg-5 and Masala AB & AC and new gravity difference for the Masala-Vihti line obtained.

- Scintrex-CG5 calibrated along the Masala-Vihti line before **ICAG relative campaign** and **Watt-balance** experiment in BIPM

SG-TT20, Metsähovi

Virtanen H., et al.

Photo: H. Virtanen

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SG cont.

H. Virtanen et al.

- GWR-TT20 in operational in Metsähovi since 1994
- GlobalGeodynamicsProject member
- Precise time domain gravity corrections of different geodynamical signals
- Atmospheric and Baltic Sea mass influence on gravity in SG in cooperation with FIMR
- HYDROGRAV hydrological models for loading studies in cooperation with Aalto University, Finnish Environmental Institute and Ohio State University
- **11 ground water wells** in the vicinity of the gravity laboratory Metsähovi for modelling gravity because of local hydrology in 2009.

Satellite gravimetry

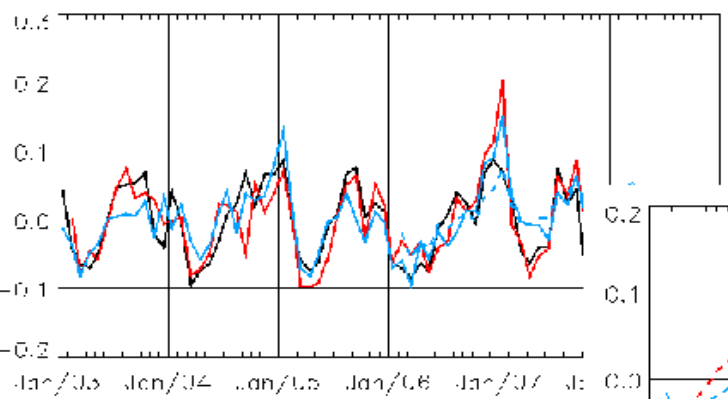
J. Virtanen et al.

- GRACE gravity data have been used to study mass variations over Fennoscandia and Baltic Sea for regional analysis
- Project is financed by Academy of Finland and carried out in collaboration with the Finnish Institute of Marine Research, the Ohio State University, USA and NASA Goddard Space Flight Center
- Baltic Sea can be used for validation of GRACE solutions even that it is close to spatial resolution
- New regional modelling using new GRACE data with better spatial solution is planned to carried out.

Monthly GRACE vs. altimetry

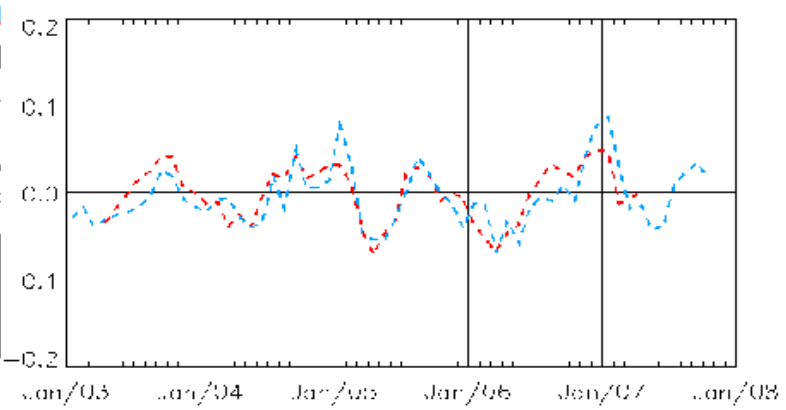
black – GRACE/CSR
red – GRACE/GFZ
blue – PSMSL TGs

cross-corr.	var. expl.
0.77	0.71
0.81	0.70



cross-corr.	var. expl.
0.79	0.55

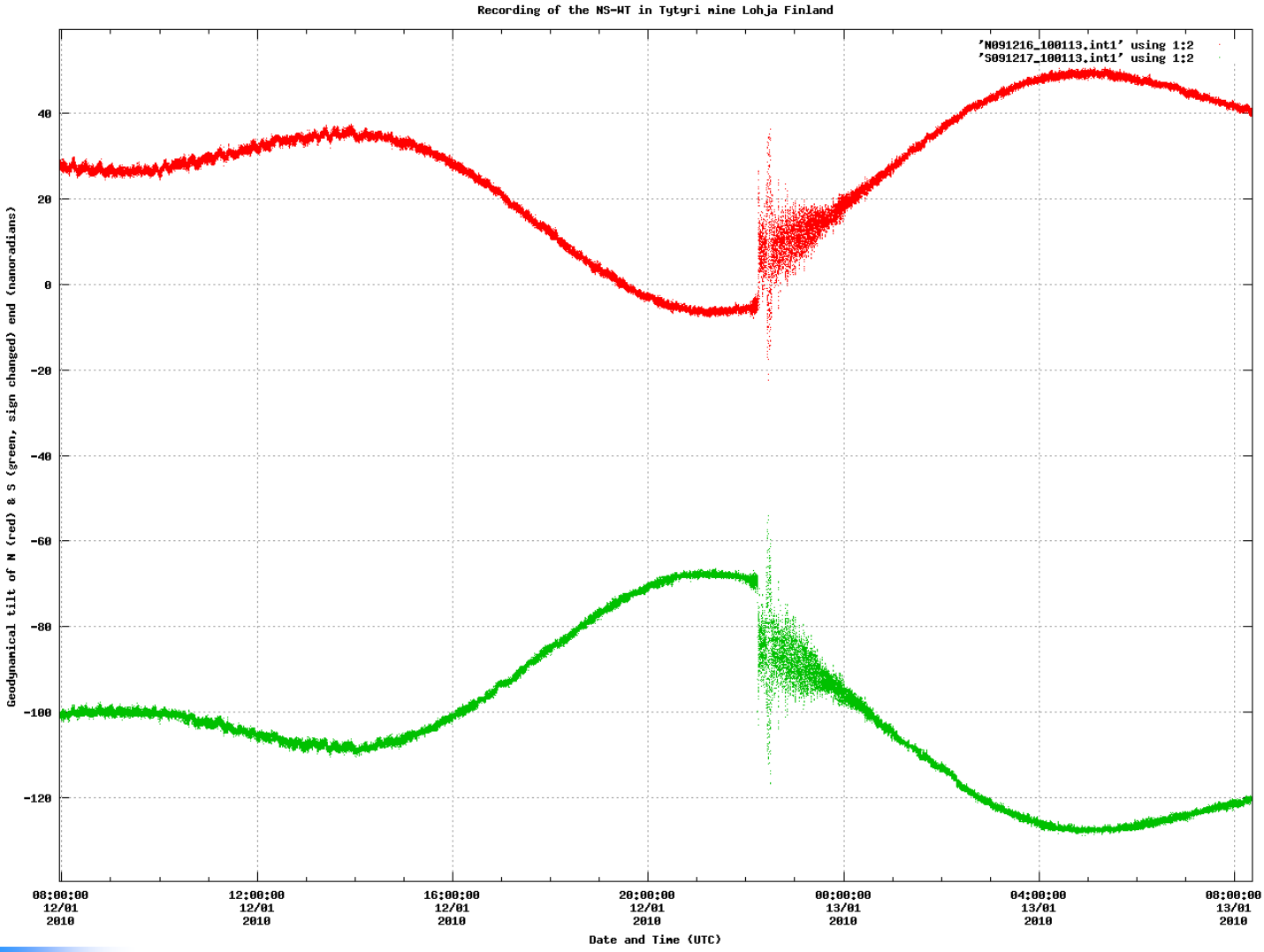
red – GRACE/GSFC
blue – Jason altimetry (from OSU)



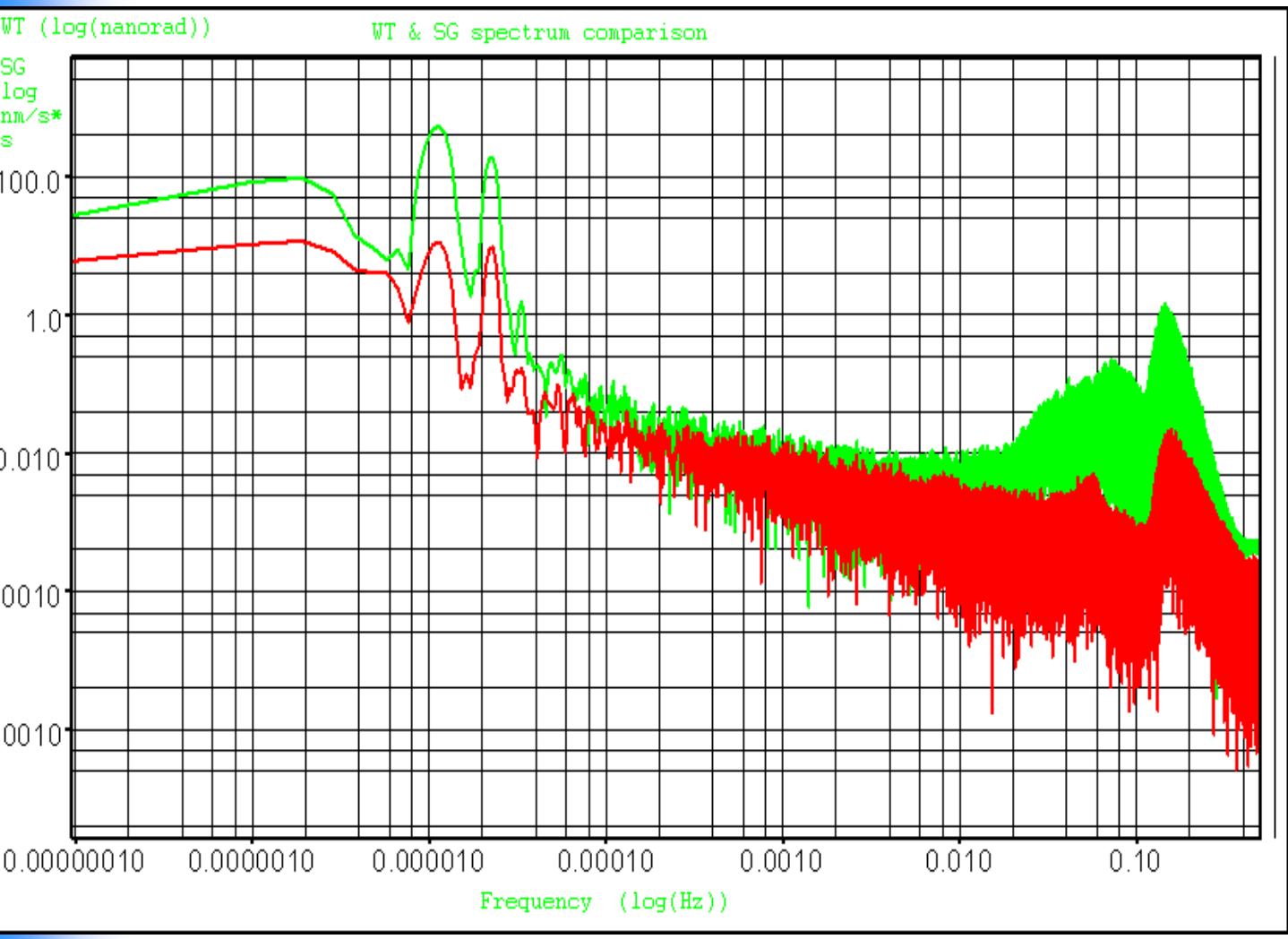
Interferometrical water tube tiltmeter, Lohja

- NSWT recording continued, GGP filters tested and tidal tilt analyse carried out with old and new data
- Baltic Sea loading studies continued
- Microseismic storms –and its spectral response together with SG in Metsähovi studied
- Free oscillations after big earthquakes (Chilean earthquake under study)

Haiti earthquake 1/2010 recorded by NSWT, in Lohja mine southern Finland



NSWT/SG spectra from microseismic storm 26.1.- 2.1.2010



Red - NSWT-spectrum

Green SG GWR-TT20 spectrum

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Geodetic- **VLBI**

FGI: Saaranen, Arsov, Kallio

Aalto Univ., Metsähovi Radio Observatory: Molera, Mujunen,Ritakari, Wagner,Oinaskallio, Uunila

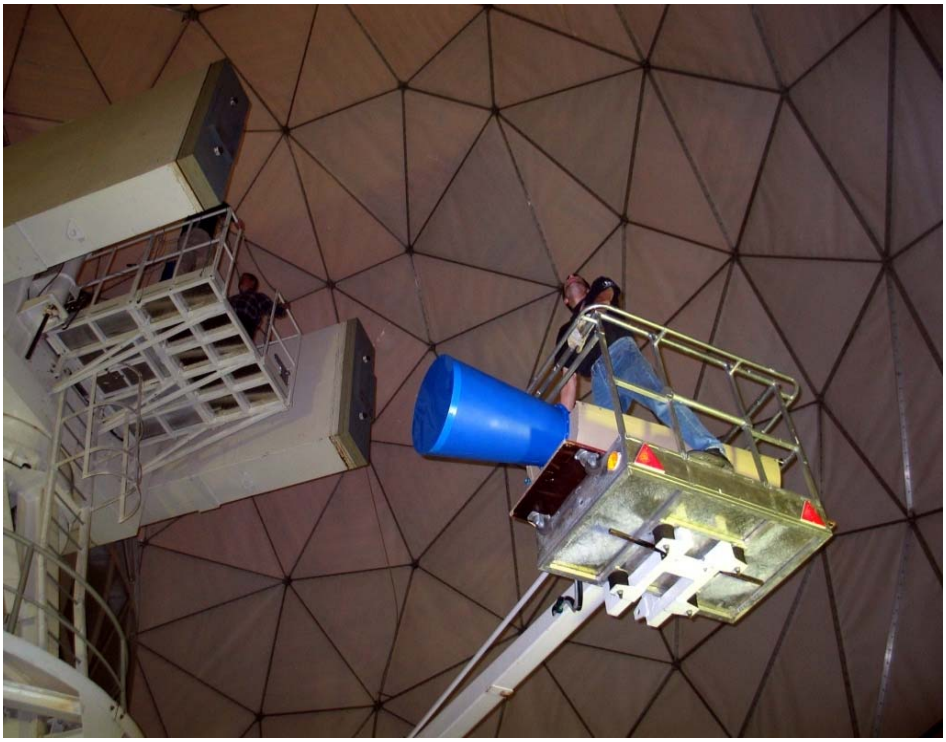

Photo. M. Poutanen

- 6 observations session, 4 EUROPE, 2 IVS-T2 in 2009
- **Europe**: geodetic VLBI station coordinates and intraplate evolution study
- **IVS-T2**:Monitor TRF via bi-montly sessions. All geodetic stations participate in at least two T2 sessions each year.
- Ulla Kallio (HUT,FGI) is modelling the reference point, axis and eccentricity errors of the Metsähovi VLBI-antenna.

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SLR renovation, Metsähovi

Arsov, Näränen, Raja-halli

Photo: M.Poutanen

SLR cont.

Arsov et al.

1. renovation concentrated to **enable 2 kHz SLR with modern hardware and software**

   modification of telescope by separate beams, different focus, receiver design, recoated main mirror.

2. In situ **Closed loop sessions simulations** and identifying critical items and improvements

3. Development of **FPGA based board** for controlling laser, C-SPAD, laser photo detector and generation of range gate signals and event timing with 5 nanoseconds resolution. Possible improvement to few tens of picosecond resolution.

DynaQlim

Poutanen et al.

Source:www.dynaqlim.fi

The ILP (International Lithosphere Program) Regional Coordination Committee DynaQlim (Upper Mantle Dynamics and Quaternary Climate in Cratonic Areas)

Workshop was arranged in 23.-26.6.2009 in Otaniemi, Espoo, hosted by the Geological Survey of Finland (GSF), Espoo and Finnish Geodetic Institute.

Geodetic metrology for geodynamics

Jokela, Kallio, Häkli, Poutanen, Ahola

- Väisälä baseline distance measurement techniques (EDM)used for control of GPS length and scale traceability for local geodynamical measurements
- EDM control measurements of geodetic observation sites at Metsähovi

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