National report of Slovakia 2012

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EUREF 2012, annual symposium
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Outline

- Activities related to *EPN*

- National Reference Frames - positioning
  - SK*POS* – Slovak real time positioning service

- National Reference Frames - heights
  - National Height System - Bpv

- Gravity activities

- Geodynamics

4 EPN stations

MOPI

- from: 1996
- GPS only
- admin: SUT

GANP

- from: 2003
- GNSS
- frek.: L1,L2,L5
- IGS/EPN
- SKPOS
- admin: GKU

EUREF Permanent Network

| NETWORK & DATA | PRODUCTS & SERVICES | DOCUMENTATION |

L. Maps. Tracking status. ns. Proposed sites. Site log n. Site picture submission

Data analysis. Weekly EPN solutions. Coordinates. Time series. Tropospheric delays. ETRS89/ITRS transformation

Formats. Guidelines. Equipment & calibration. Papers. FAQ

Active
Locate site on map
- Select a station -
Site criteria selection
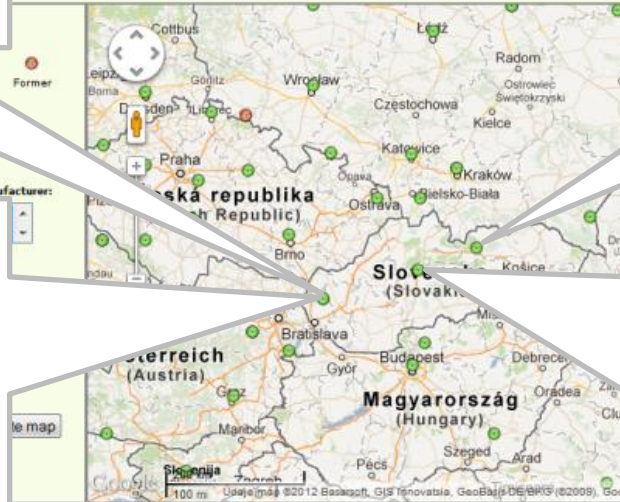Receiver manufacturer: Antenna manufacturer:

MOP2

- from: 2008
- GNSS
- SKPOS
- admin: SUT

BBYS

-from: 2007
-GPS only
-admin: GKU+TOPU

Activities related to EPN
EUREF-IP (2 stations)

- **GANP** (active)
  - RTCM 3.0

- **MOP2** (inactive)
  - RTCM 3.1

REAL-TIME

ACCESS : free, using Ntrip

AVAILABLE FROM

ASI (broadcaster, registration)
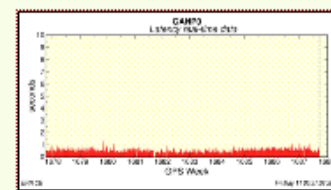 GANP0 : RTCM 3.0
  (1004(1),1006(10),1008(10),1012(1),1013(10),1033(10))
BKG (broadcaster, registration)
  GANP0 : RTCM 3.0
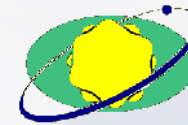 (1004(1),1006(10),1008(10),1012(1),1013(10),1033(10))
ROB (broadcaster, registration)
  GANP0 : RTCM 3.0
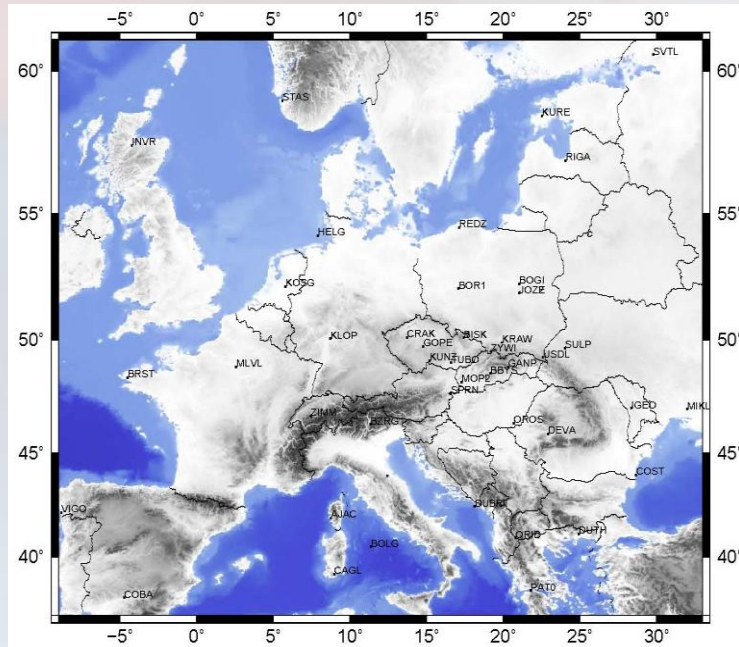 (1004(1),1006(10),1008(10),1012(1),1013(10),1033(10))

DATA LATENCY

LAC SUT

- **Local Analysis Center of Slovak University of Technology**

Current network configuration (out of boundary: REYK, QAQ1)

```
----------------------------------------------------------------
PROCESSING STRATEGY
----------------------------------------------------------------
Software              : Bernese GPS Software, version 5.0
Orbits and EOPs       : IGS final
Observations          : GPS
Elevation Cutoff      : 3°
Antenna PCV Model     : absolute
Ambiguity Resolution  : QIF
Troposphere           : dry Niell (a priori), wet Niell (estim.), gradients
Ocean Loading         : FES2004
Reference Frame       : IGS05 / IGS08 (since week 1632)
Reference Point       : BOR1
Products submitted    : SUTWWWW7.SNX weekly snx file
                        SUTWWWWN.SNX daily snx file
                        SUTWWWWN.TRO daily troposphere solution
----------------------------------------------------------------
ALL PROCESSING OUTPUTS
----------------------------------------------------------------
Daily solution        : CRD, COV, SNX, ION, INX, TRO, TRP
Weekly combination    : CRD, COV, SNX, OUT, SUM
4-hour solution       : CRD, COV
----------------------------------------------------------------
```

- Standard continual processing of EPN subnetwork

- Future planned: extension of network
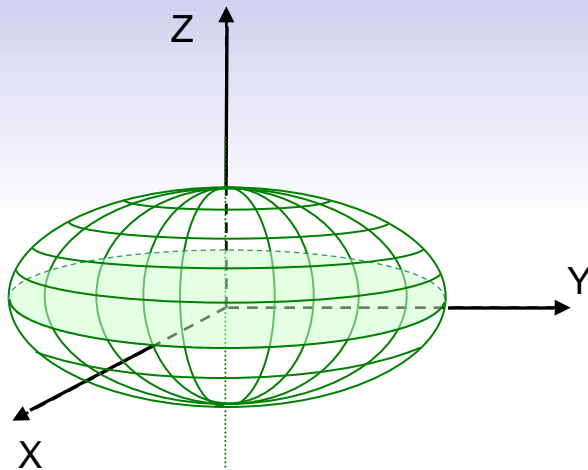 - 5 stations (Croatia, Serbia)

Positioning

7 Helmert transformation parameters (2 sets)
3 translations + 3 rotations + Scale factor = 0 (1m = 1m on both ellipsoids)
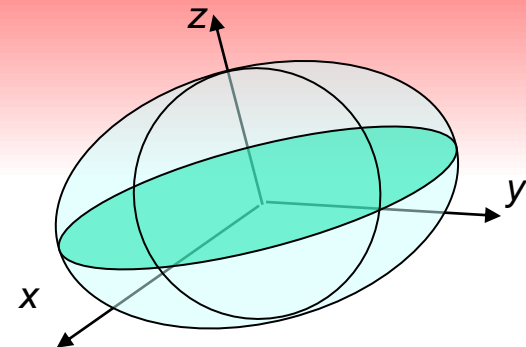
Spatial coordinates (XYZ or φλh)

ETRS89 system
SKTRF2009 = ETRF2000 (epoch 2008.5)

- **GRS80 ellipsoid**
- physical representation: National Spatial Network

Plane coordinates (X,Y)

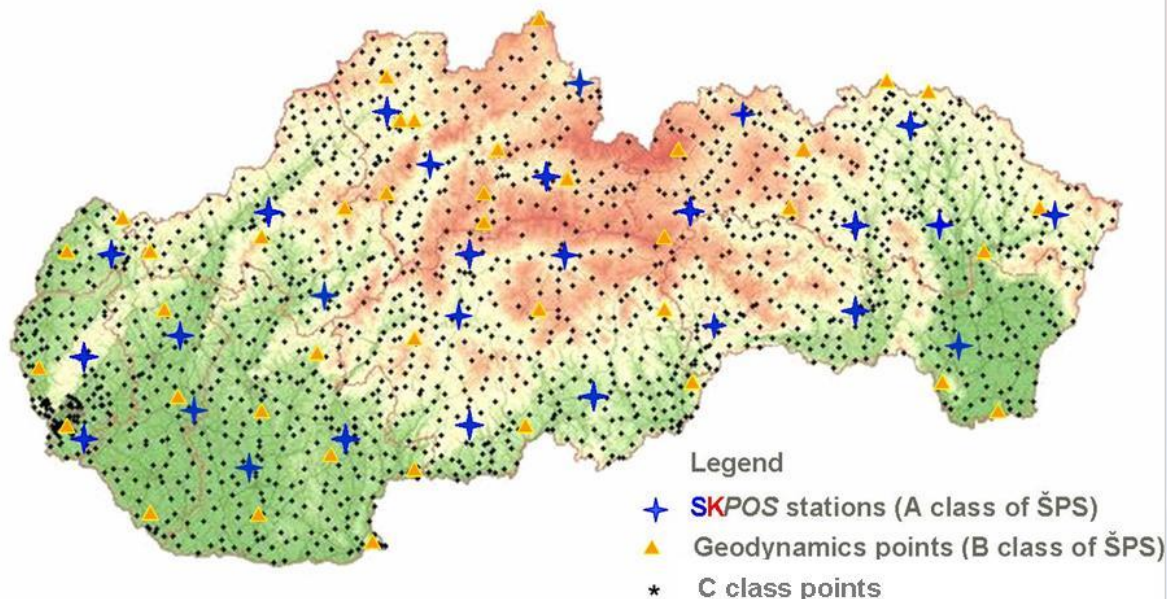**S-JTSK system**
JTSK03 realization

-**Bessel 1984 ellipsoid + Křovák projection**
-physical representation: National Spatial Network

National spatial network
ETRS89 & JTSK03 physical representation

- Active part (permanent stations) – **A** class (**SKPOS**)
- Passive part (stabilized points)
  - **B** class – points for geodynamical research (Hz 5-6mm, V 12-15mm)
  - **C** class – reference points (Hz 1cm, V 2cm)
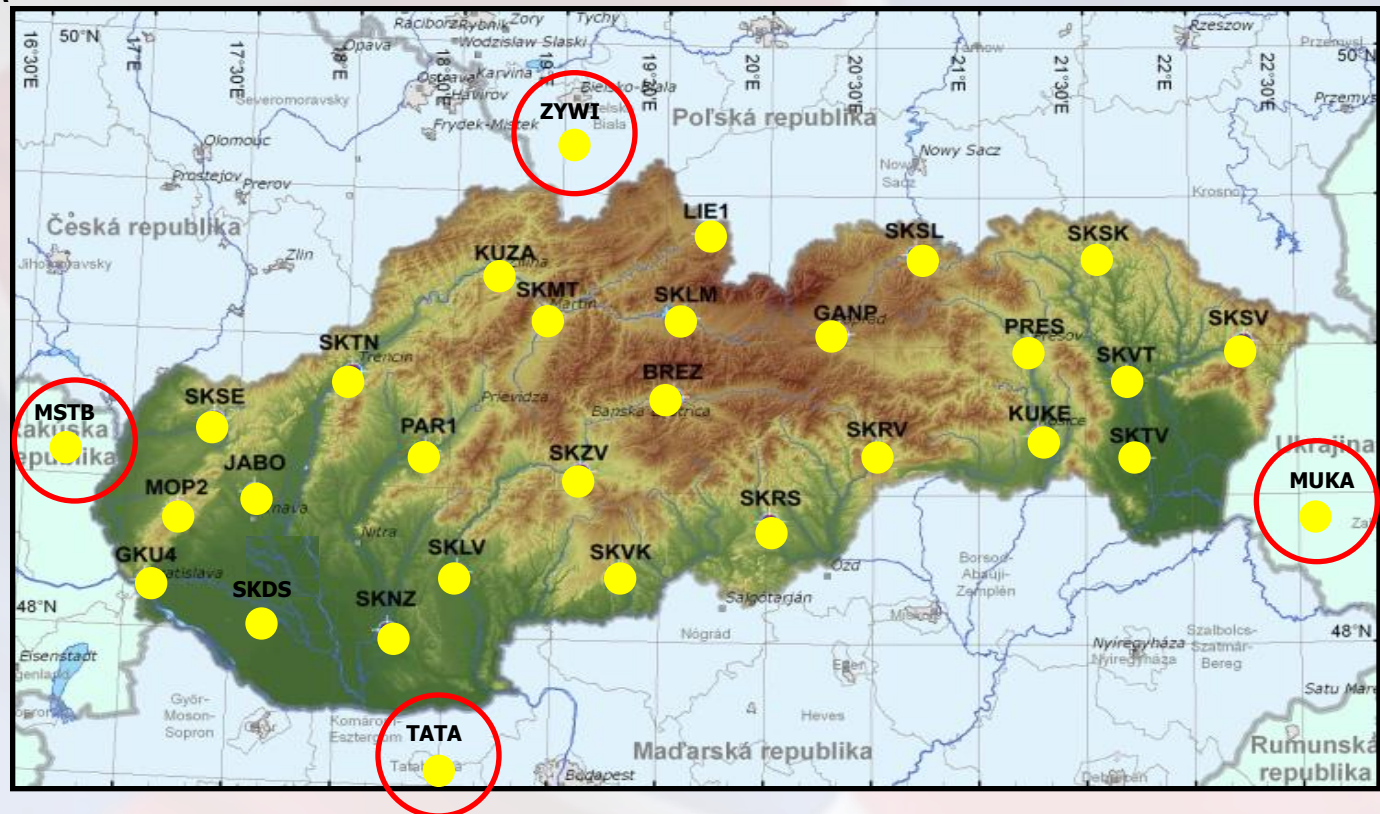 - **D** class – other points with ETRS89 coordinates (Hz 3cm, V 5.5cm)

Legend
- **+** SKPOS stations (A class of ŠPS)
- ▲ Geodynamics points (B class of ŠPS)
- ✳ C class points

ŠPS class	Number of points
A	27
B	71
C	1 650
D	2 900

Slovak real time positioning service - SKPOS

- **26 permanent stations (May 2012)**
  - All stations equipped with TRIMBLE receivers and antennas
  - All stations observe GPS+GLONASS signals + ready for Galileo

- Trimble NetR5 receiver
- Trimble NetR9 receiver
- Individual calibrated antenna

Foreign permanent station introduction

- **11.11.2011** - 4 foreign permanent station was introduced into SKPOS solution
  - Hungary: TATA
  - Poland: ZYWI
  - Ukraine: MUKA
  - Austria: MSTB

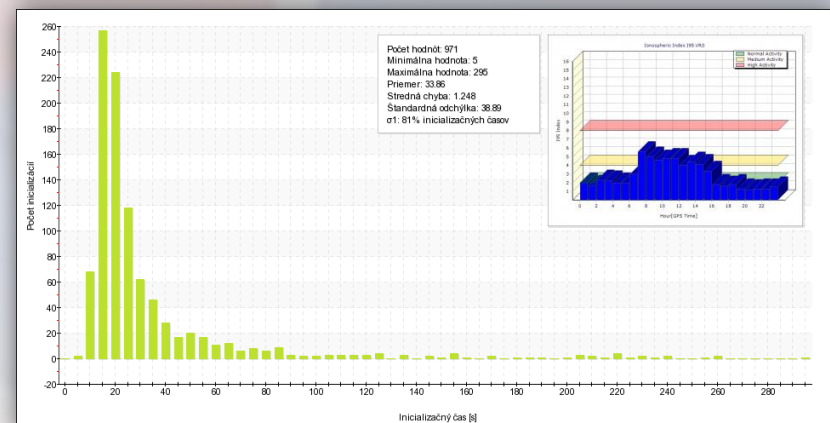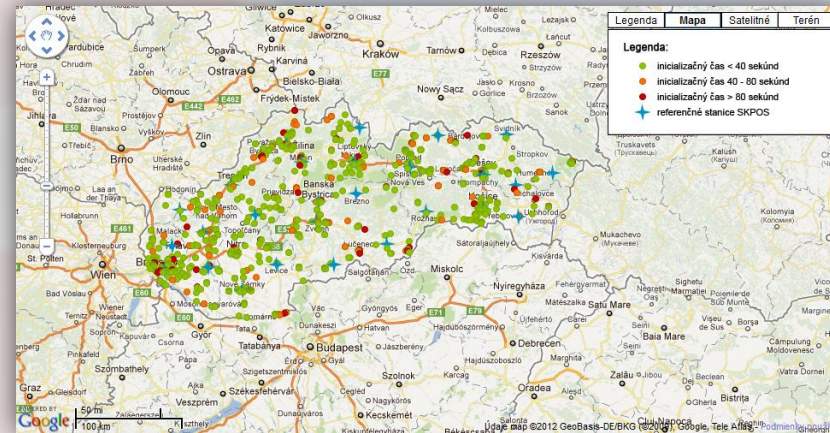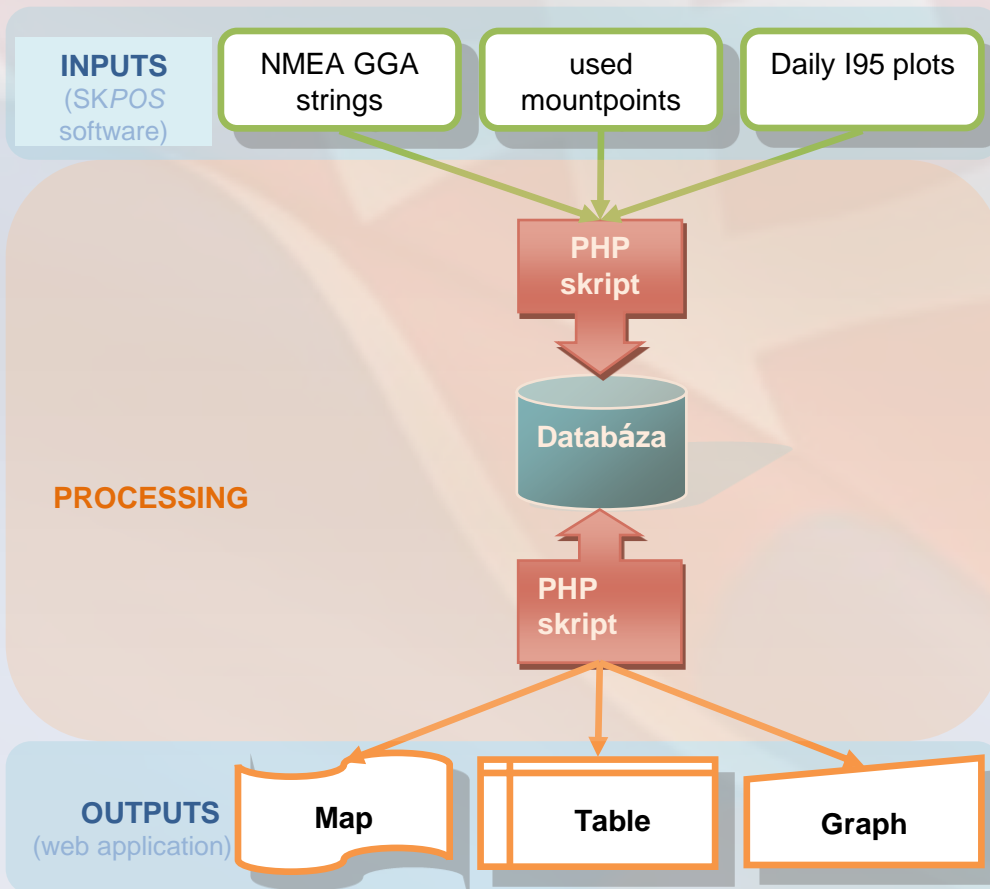- **30 permanent stations** all GPS+GLONASS

- Trimble GPSNet

    - Former SK*POS* software

    - Replaced in 11.11.2011

- **Trimble VRS³Net**

    - Successfully tested

    - Introduced into routine operation in 11.11.2011

- Formats:

    - RTK – RTCM2.3, RTCM3.1, CMR+ and CMRx

    - DGPS – RTCM2.1, RTCM2.3(+Glonass)

- RTCM 3.1 format contain also:

    - Message 1021 =7 Helmert transformation parameters (**ETRS89->JTSK03**)

    - Message 1023 =geoid undulation corrections (DVRM – Bpv vertical datum)
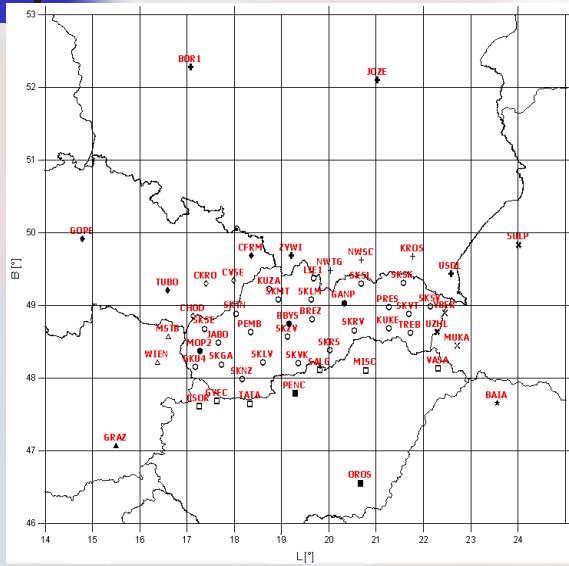
users, field of applications, charges

- Number of users (registrations)
  - **750 users** - status in May 2012
  - 650 users – status in November 2011

- Field of applications
  - 98% - surveying, cadastral, cartography geodesy and GIS
  - 2% - precise farming etc.

- <u>RTK service - charges</u>
  - flat rate **90 EUR** per technical year (365 days from the date of registration)
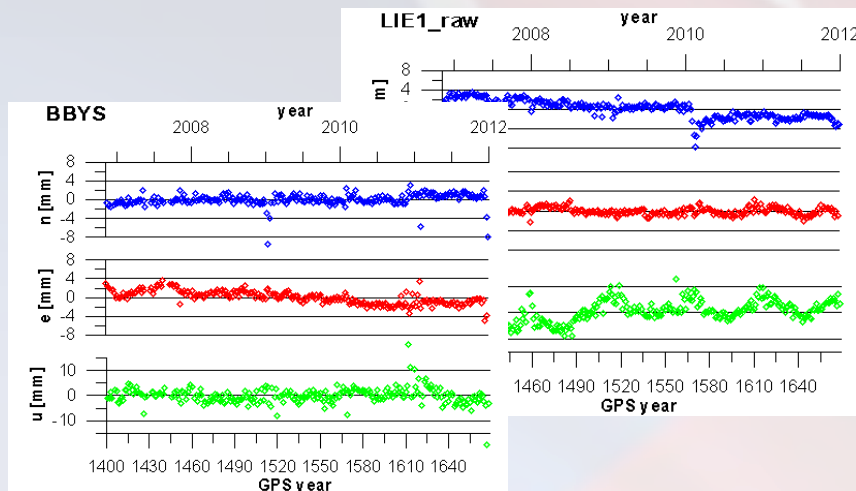
New application for SK*POS* users monitoring

- serve for administrator to monitor RTK users performance e.g. we can monitor users performance and its dependence on Ionosphere

Computations, data processing, time series

- Daily solution + weekly combination in Bernese 5.0

- 60 permanent stations processed together (SK*POS* + EPN + border stations)

- IGS08 ephemeris (from GPS week 1632)

- ETRF2000 coordinates
  - *Memo* document - transformation parameters from ITRF2008 to ETRF2000
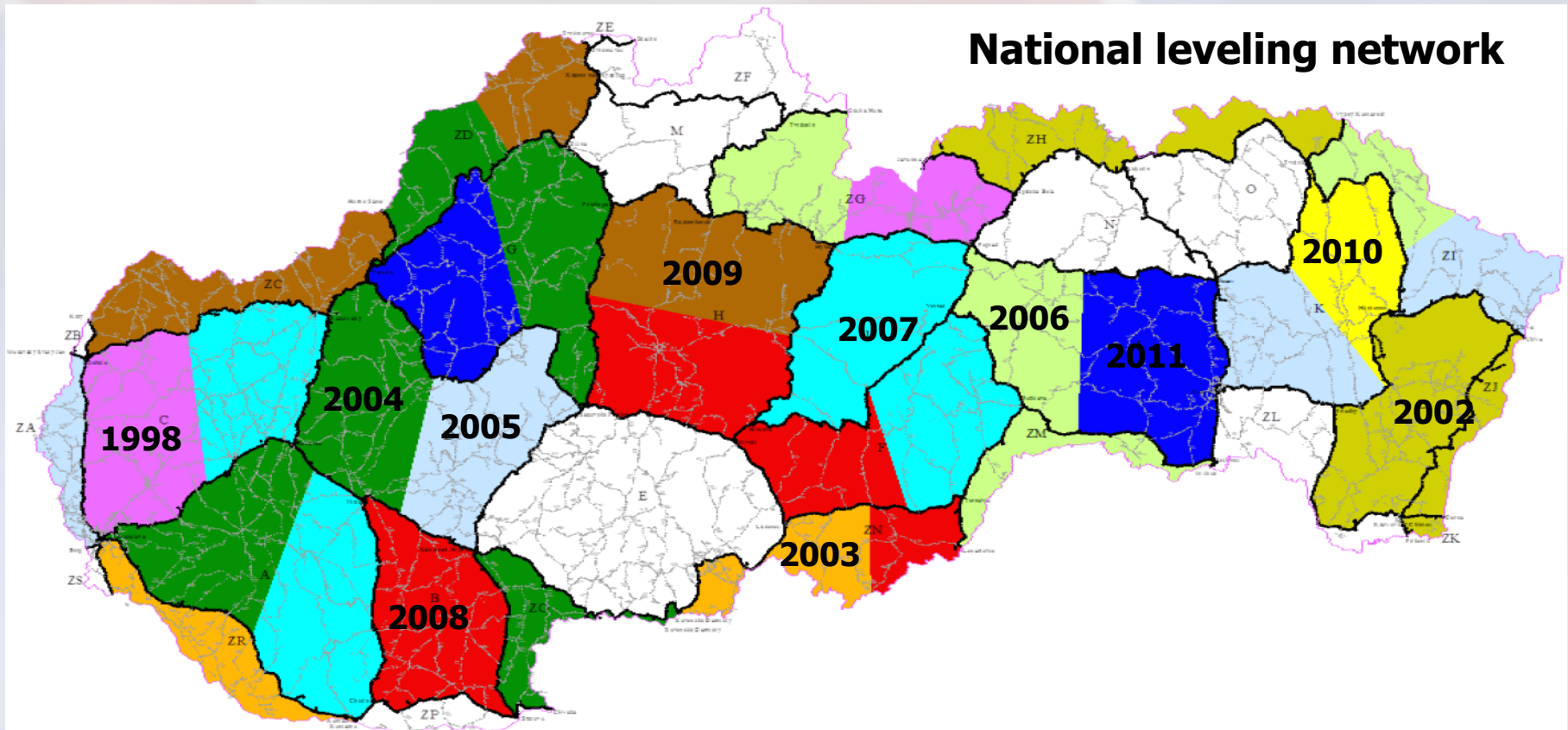- Time series
  - raw
  - clean (without jumps)

- National Height system is **Balt** with <u>Bpv realization</u> (Balt after adjustment)

- New Challenge for future = **new Bpv*yy* realization** & **new national EVRS realization**
  - Measurement:
    - remeasuring of all leveling lines of National Leveling Network
    - 1st order lines measured during 1997-2003
    - 2nd order leveling lines measured 2003-2015
  - Adjustment:
    - 1st order leveling lines separate adjustment
    - 2nd order tied to 1st order results

2nd order leveling lines measurement graphics

- In 2011 - Totally measured – 577 km
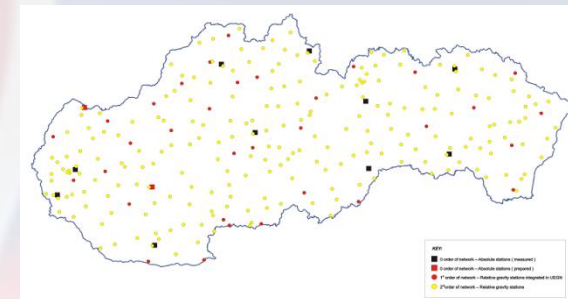- 60% of all 2nd order leveling lines done now

National leveling network

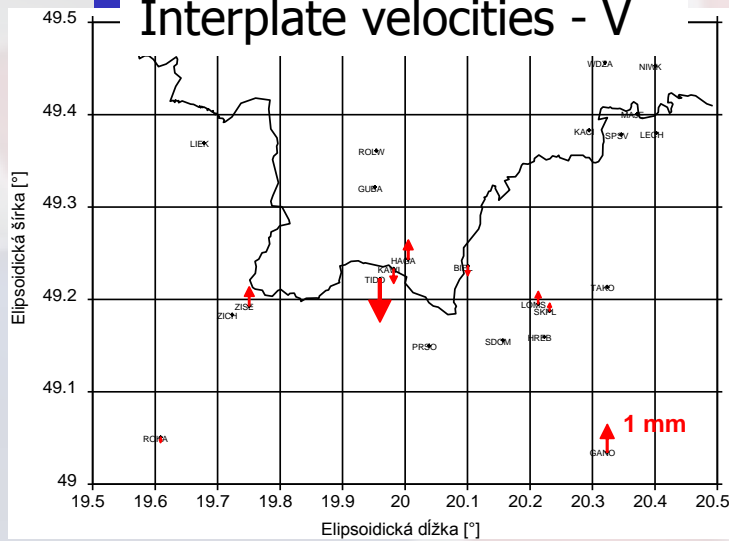# National gravity network (ŠGS)

Status in 2012

- 0.order ŠGS
  - 11 points (absolute measurement)
- 1.order ŠGS
  - 30 points
- 2.order ŠGS
  - 246 points
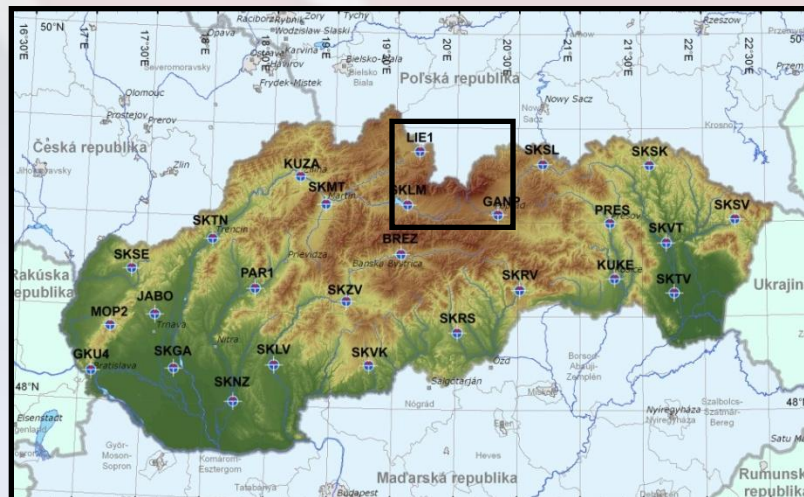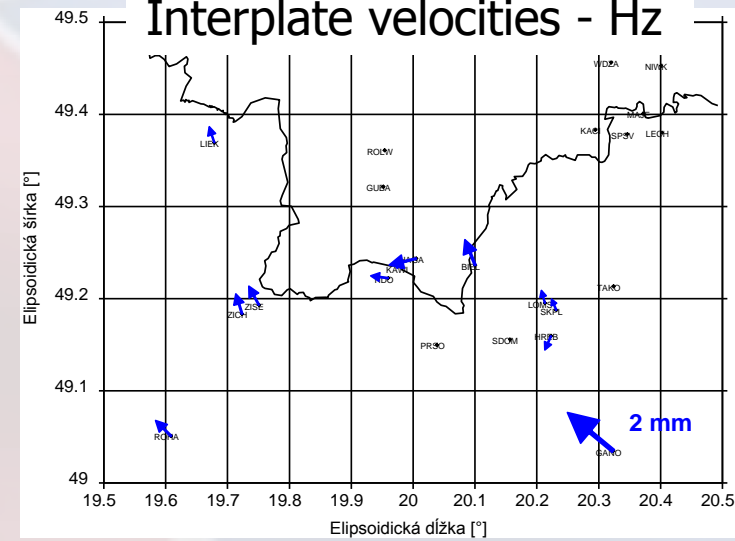- 3.order ŠGS
  - over 1500 points

Geodynamics
Local geodynamic network **TATRY**

Interplate velocities - V

- campaign measurement (96 hours)
- every year from 1998
- 1998-2011
- cooperation with Poland

Interplate velocities - Hz

Thank you
for your attention