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EUREF Related Activities in the Czech Republic 2003 -2004 National Report

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1. Densification of EUREF in the Czech Republic

The densification process is reported and described in *(Kostelecký et al., 2003)*. The beginning of the ETRF89 in the Czech Republic dates back to 1991 (campaign EUREF CS-H/91), its full realization in 1991 - 1994 and implementation in 1995. The national reference EUREF89 frame is represented by 174 sites of the national GPS reference network DOPNUL. The coordinates of the DOPNUL stations were determined by a combined processing based on the data from several national densification campaigns.

Since 1995 this national reference frame has been densified in two parallel ways. The first densification, carried out by the Land Survey Office, is called ”selective maintenance” and is aimed to GPS user community. It is based on the national GPS reference network DOPNUL. After the work is finished the total number of the new GPS stations will be 3,500 and the final density will be 1 station/24 km sq with an average spacing below 5 km. All these stations are identical with the triangulation stations of the national terrestrial triangulation network but they are equipped with a new monumentation and a special protection against damage. Until the end of 2003 the coordinates of 2107 stations were determined. The coordinates are available in ETRF89 and in both the official national user system S-JTSK and an improved user system S-JTSK/95.

Parallel to the “selective maintenance” the other large scale GPS based densification has been running since 1995. It has been carried out by the regional cadastral offices (departments of cadastral mapping) under the headline “Densification”. The project will have been finished by the end of 2004. Unlike the “selective maintenance”, where the GPS campaigns are carried out at existing triangulation stations, in this case it is about establishing a large number of new densification stations by GPS observations. The total number of these new stations should be over 30,000.

After the whole work is accomplished a new stepwise adjustment ”by regions” is supposed to get final ETRF coordinates.

The data from both densifications are archieved in the form of “database” files of the observation vectors and in database of individual points, both with internet access, see http://dataz.cuzk.cz .

2. UELN 2000 and UEGN 2002 Related Activities

New connections between the Czech Republic, the Slovak Republic and Poland is prepared, results will be integrated to the UELN.

In 2003 the relevelling in the 3rd order Czech National Levelling Network (CNLN) was ongoing by the measurement of 650 km levelling lines. Besides, 15 km of levelling lines in the Levelling Network Praha - Karlín,

were observed – see also Fig. 1. The observations were also performed in the Special Levelling Network (SLN) Most and SLN Sokolov – 150 km.

In 2003 a new application was created to make an Internet access to the database of the Czech National Levelling network. The application was tested in a load network and released on the Internet in 2004. The CNLN database holds about 80,000 levelling bench marks of 1st, 2nd and 3rd order levelling lines. The database contains also digitized description sketches and serves for yielding levelling data as well as for keeping correspondance with the cadastral offices, for computations and for providing data for the Fundamental Database of Geographic Data (ZABAGED).

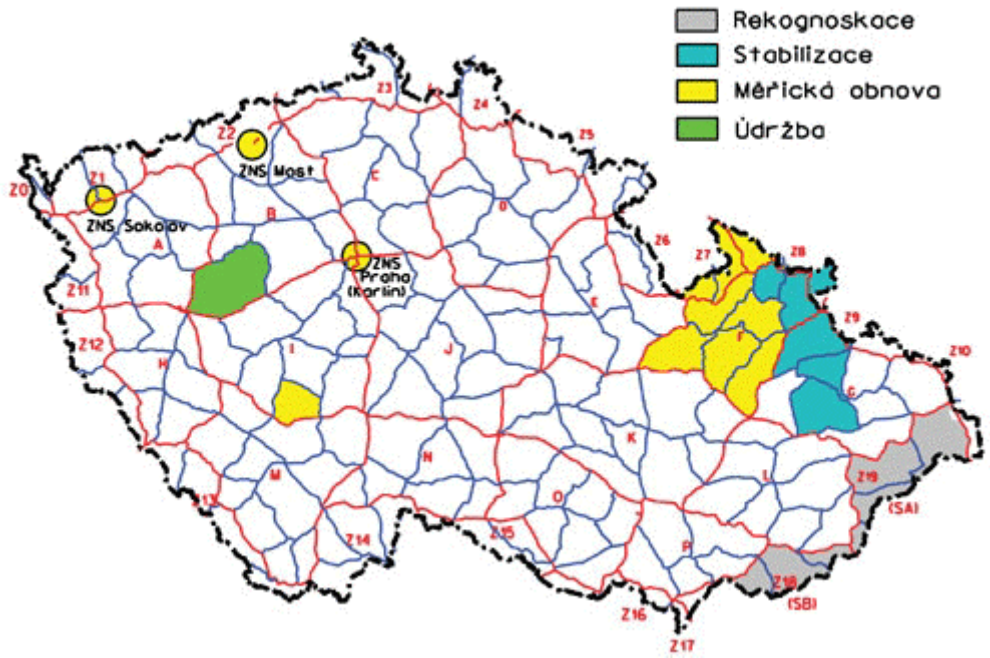

Figure 1 – Levelling in 2003

In cooperation between Land Survey Office and the RIGTC a revision of the Fundamental Geodynamic Network was made and some improvements were proposed namely as for monumentations and forced antenna centerings.

3. Permanent GPS Observations

The two Czech EPN stations GOPE (Geodetic Observatory Pecný) and TUBO (Brno University of Technology), both operated by the RIGTC, have been providing the data from global satellite navigation systems along with meteorological data.

The station GOPE has been involved in IGS, EUREF EPN and LEO projects, TUBO in EUREF EPN, and both stations also in projects oriented to the GPS ground based meteorology (COST716, TOUGH). Since March 2003, the GOP is participating in the EUREF-IP special EPN project. The site GOPE operates as a broadcaster for the RTCM messages (actually 1,3,16,18,19,22,31,36) using the ASHTECH Z-18 receiver including the GLONASS corrections.

A project of a national permanent multifunctional active GPS network was submitted by the RIGTC in 2003. Its realization started in 2004 in cooperation between the Land Survey Office and the RIGTC. The network should cover a broad spectrum of users and their requests for real-time and postprocssing applications.

4. EUREF Local Analysis and Data Center GOP

During the last period, the main effort in the GOP analysis centre was concentrated to developing an efficient and transparent monitoring, archiving and updating system. This should help to manage the grow up of all routine

activities and services provided by the centre and by the analysis centres operated at the Geodetic Observatory Pecný.

The EPN LAC GOP contribution to EPN was extended by 5 stations during the last year: ZYWI (Poland), KATO (Poland), GANP (Slovakia), SKE0 (Sweden), BORK (Germany). The data from altogether 41 stations are being processed, but two stations (MDVO, ZWEN) are inactive at present.

Concerning near real-time troposphere analyses carried out by the GOP, the demonstration campaign of the ending COST-716 project passed smoothly into the TOUGH EU FP5 shared project "Targeting Optimal Use of GPS Humidity for the Measurements in Meteorology" (http://tough.dmi.dk, 2003-2006). The priority of the processing was changed from the strict timelines of 1h 45min to including many as sites as possible in the processing, mainly from the regions sparsely covered by GPS hourly observations.

After the testing period of two months, the GOP near real-time orbit product has been officially accepted since January 2004 as the contribution to the IGS ultra-rapid product. More information of the GOP activities can be found at http://pecny.asu.cas.cz/gop.

5. Gravimetry

The Czech part of the Unified European Gravimetric Network (UEGN) was completed by the new results from absolute and relative measurements performed in 2003. The Research Institute of Geodesy, Topography and Cartography (RIGTC) in cooperation with the Land Survey Office carried out the absolute gravity measurements at the new stations Vyškov and Praha, repeated measurements at Valtice and Polom stations and with Geodetic and Cartgraphic Institute Bratislava (Slovakia) repeated measurements at Gánovce and Bardejov slovakian stations. The measurements were made by the absolute gravimeter FG 5, No.215 of the RIGTC.

Gravity ties of two stations of the UEGN network (Plzeň and Jihlava) to the absolute gravity stations were established. Repeated gravity measurements in the gravity micronetwork around the fundamental station GOPE (Pecný) were carried out.

Gravimetric earth tides have been continuously recorded at GO Pecný by the tidal gravimeter Askania Gs15 No. 228 equipped with the digital feedback and by the upgraded gravimeter LaCoste & Romberg G No. 137 equipped with the MVR feedback. The standard deviation of an hourly ordinate from the tidal analysis was for both gravimeter better than 1 nm s^{-2}. The gravimeter LaCoste & Romberg G No. 137 was also used for detailed measurements of the vertical gravity gradient above the absolute gravity point and for precise calibration of the MVR feedback signal with the help of the measuring screw.

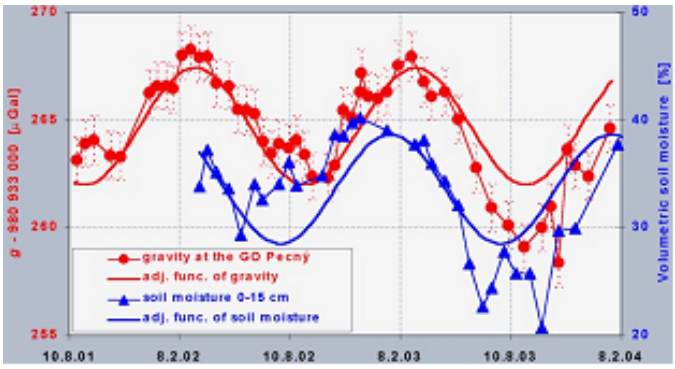

Figure 2 – Absolute gravity at GO Pecný mesured by gravimeter FG5, No 215 of Research Institute of Geodesy, Topography and Cartography (RIGTC)

The absolute gravimeter of the Research Institute of Geodesy, Topography and Cartography FG5 No. 215 was installed at the GO Pecný in August 2001. Since that time the regularly repeated absolute gravity measurements have been carried out at this station in approximately two-week-intervals. More than 50 absolute gravity campaigns were carried out at Pecný untill mid May 2004. The change of gravity at the station can be represented by a harmonic function with the period of 1 year (see Figure 2). The amplitude of this change was estimated to be about

22 nm s^{-2} and the maximum is at turn of February and March. A correlation between the detected variations of gravity and the changes of ground water masses around the observing site can be observed. For evaluation of the hydrological effects on the gravity the height of the ground water level, precipitation and soil moisture have been monitored around the observatory. The FG5 gravimeter took part in the international comparison measurement in Walferdange 2003 (Luxembourg). The comparison was made with respect to other 14 gravimeters.

The results of repeated absolute observation campaigns were used for computing and checking the calibration coefficients of the tidal gravimeters running at the observatory. The calibration coefficients were determined on the accuracy level of 0.05 %.

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