GEONAS - The GEOdynamic Network of the Academy of Sciences of the Czech Republic: Permanent GNSS observations and routine data processing in the IRS operational centre.

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1. Introduction

GEOdynamic Network of the Academy of Sciences (GEONAS) of the Czech Republic was established to make regular geophysical and geodetic observations for geodynamic studies of the Bohemian Massif and the central European area.
The GEONAS network consists at present of the five EPN stations operated by the IRSM – BISK, MARJ, POUS, SNEC and VACO – and twelve more non-EPN permanent geodynamic observatories – BEZD, CHOT, KYNS, LITO, LUBY, PRAG, SECZ, SLUK, STAM, TEME, UPIC and VIDN. Selected mountain observation points are equipped with web cameras to monitor snow coverage at the antennae.

Station	Place	Date	X	Y	Z	Receiver type	Antenna type	Obtions
BEZD	Bezděkov nad Metují	Dec 16,2005	3902726,84	1136008,10	4899383,93	TPS GB-1000	TPSCR3_GGD CONE	
BISK	Biskupská Kupa	Sep 6,2001	3898946,10	1223993,23	4881826,37	ASHTECH Z18	ASH701946.2 SNOW	meteo
CHOT	Chotěboř	Aug 10,2006	3979115,80	1116429,10	4842579,30	TPS GB-1000	TPSCR3_GGD CONE	
KYNS	Kynšperk-Kolová	Dec 19,2005	4000585,39	891012,44	4871283,81	TPS GB-1000	TPSCR3_GGD CONE	
LITO	Litoměřice	Sep 1,2006	3938495,45	992556,38	4901523,11	ASHTECH Z18	ASH701946.2 SNOW	
LUBY	Luby	Dec 21,2005	3991598,58	878173,32	4880936,34	TPS GB-1000	TPSCR3_GGD CONE	
MARJ	Mariánská	May 15,2003	3975132,84	909950,41	4888908,06	ASHTECH Z18	ASH701946.2 SNOW	meteo
POUS	Poustka	Nov 12,2003	4002424,83	872512,90	4873111,70	TPS GB-1000	TPSCR3_GGD CONE	
PRAG	Praha-Holešovice	May 15,2006	3968101,00	1023533,00	4871448,00	TPS GB-1000	TPSCR3_GGD CONE	
SECZ	Seč	Aug 11,2006	3968818,00	1111804,00	4851983,00	TPS GB-1000	TPSCR3_GGD CONE	
SLUK	Šluknov	Aug 17,2006	3894885,10	1004403,30	4933866,40	TPS GB-1000	TPSCR3_GGD CONE	
SNEC	Sněžka	Oct 21,2001	3894162,97	1097514,91	4916279,91	TPS GB-1000	TPSCR3_GGD CONE	meteo+webcam
STAM	Staré Město	Aug 23,2006	3916584,38	1193516,66	4874834,87	TPS GB-1000	TPSCR3_GGD CONE	meteo+webcam
TEME	Temelín	Aug 17,2006	4047280,80	1037654,10	4803655,10	TPS GB-1000	TPSCR3_GGD CONE	
UPIC	Úpice	Dec 21,2005	3907112,24	1121153,23	4899218,36	TPS GB-1000	TPSCR3_GGD CONE	
VACO	Vacov	Oct 20,2004	4062326,02	992104,50	4800911,18	ASHTECH Z18	ASH701946.2 SNOW	
VIDN	Vidnava	Aug 22,2006	3894196,00	1204371,10	4889571,30	TPS GB-1000	TPSCR3_GGD CONE	

2. The GEONAS Network

The observatories are situated at points suitable for investigation of geodynamic movements of structural units of the Bohemian Massif with respect to the situation of the main tectonic structures and earthquake occurrences. The permanent GPS observatories IRSM were built after 2001. The first two observatories are located in the territories of the epoch GPS regional networks. The observatory SNEC is in the area of the West Sudeten network and the observatory BISK is in the area of the East Sudeten network. The observatory MARJ and

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POUS were set up in the Western Bohemian seismoactive region in 2003. The fifth observatory VACO has been operating since October 2004 in Southern Bohemia. Four new permanent observatories started operation in 2005 with the aim of obtaining detailed monitoring of active zones in the Bohemian Massif. They are UPIC, KYNS, BEZD and LUBY. Observatories CHOT, LITO, PRAG, SECZ, SLUK, STAM, TEME, VIDN have operated since summer 2006.

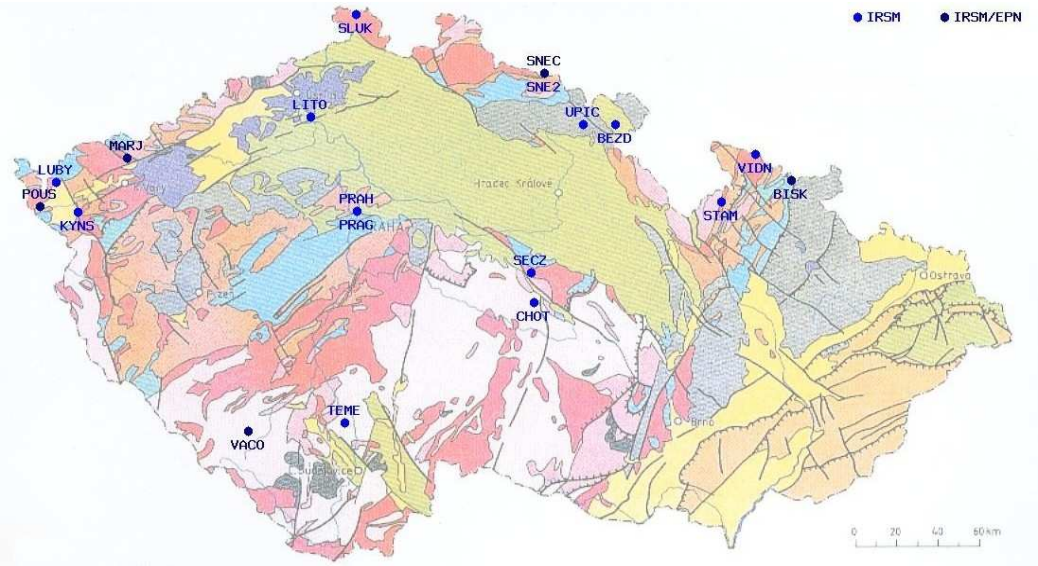

Fig.1 Location of the network GEONAS

3. Observatory equipment and capabilities

Stations BISK, LITO, MARJ and VACO are equipped with the Ashtech Z-18 receivers and the others with Topcon GB-1000 receivers. All stations are equipped with corresponding choke-ring antennas with snow domes and receive both GPS and GLONASS signals (Mantlík et al., 2005). The meteorological data are recorded at the BISK, SNEC MARJ and STAM stations.

Fig.2 *Observatory equipment*

Each receiver is connected to a personal computer to store monitored data and to transmit them by the GPRS or WiFi connection to the operational data centre at the IRSM (OC IRS). The communication between the Ashtech receiver and the station computer uses the original Ashtech Geodetic Base Station Software (GBSS). The receiver is set according to EPN rules for data registration with 5° elevation mask and the recording interval is set to a minimum of 5 seconds. To avoid problems with power failures, each station is equipped with an accumulator, which can power the station equipment independently for at least 24 hours.

4. Operational centre IRS data flow and delivery

After storing on the internal PC hard disk, data are transferred automatically to the data center in the IRSM (IRS) using the Internet. Data delivery from the station to the IRS centre is

provided by the RSYNC protocol (Linux RSYNC command). Every 4 minutes new RSYNC session starts automatically at the IRS server to synchronize the recorded data with the station directories. The RSYNC protocol operates so that only newly monitored data are transmitted from each station and provides an automatic compression of transmitted data. This approach provides very effective use of connection capacity, so that hourly RINEX data are available at the IRS centre within 1-2 minutes after each full hour even if slow GPRS connection is used.

5. Data processing overview in the operational centre IRS

A routine check is performed using standard TEQC procedure when hourly data are delivered to the IRS data centre. In case of any problem, incorrect data are invalidated and new synchronization with a given station takes place. Data files that passed all tests correctly are stored according to the IRS centre rules and registered in the IRS database. Finally hourly data are submitted to the EPN data centers and can be publicly accessed as so called near-real-time data.

Automatic merging procedure combines final daily data and submits them to the EPN data centre after all 24 hourly data files are in place in the IRS data centre. Usually this procedure takes place after 1:00 GMT and the data are publicly available about 5-30 minutes later depending on the procedure at the corresponding EPN data centre.

Thorough data flow monitoring and data quality mapping is available at the IRS data centre too. The operators can have full on-line overview of the data transmission and processing procedures using the user-friendly web interface. Thanks to this any transmission problems as well as problems with data quality at any permanent station can be discovered immediately. The operators can see this web interface easily on the Internet (http://geonas.irsm.cas.cz) and take any action necessary to return to normal operations.

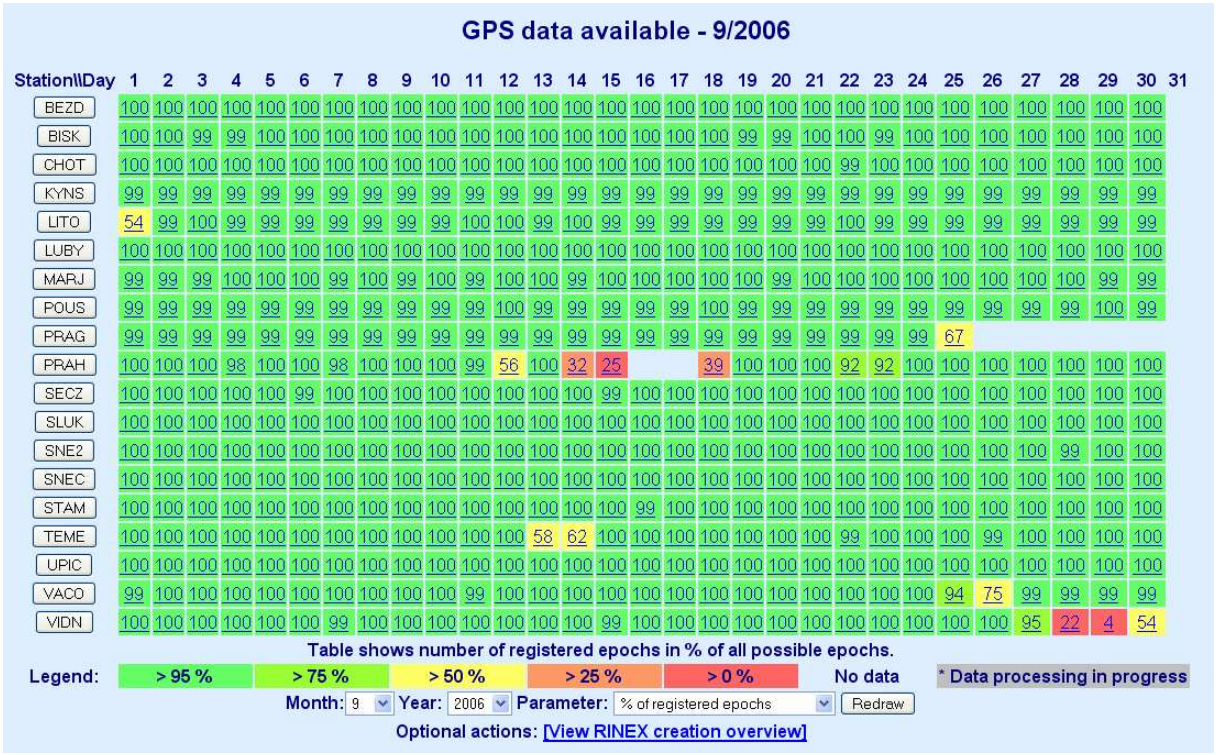

Fig. 3 WWW data quality interface check – sample of quality maps.

6. Outlook

The meteo sensors and webcameras will be installed at the other mountain observatories. Another three permanent observatories are under construction at present.

7. Conclusion

The seventeen permanent GPS stations IRSM AS CR are recording high quality GPS data at well chosen and well built sites. They provide precise reference frame for GPS measurements and especially for geodynamic studies. The data registered by our five EPN observatories are available in the EUREF EPN data centers BKG and OLG mostly within 1-2 minutes past every hour after the registration is completed. Information about all registered data is available on-line at http://geonas.irsm.cas.cz.

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