Name of research institute or organization:

Bundesamt für Landestopographie

Title of project:

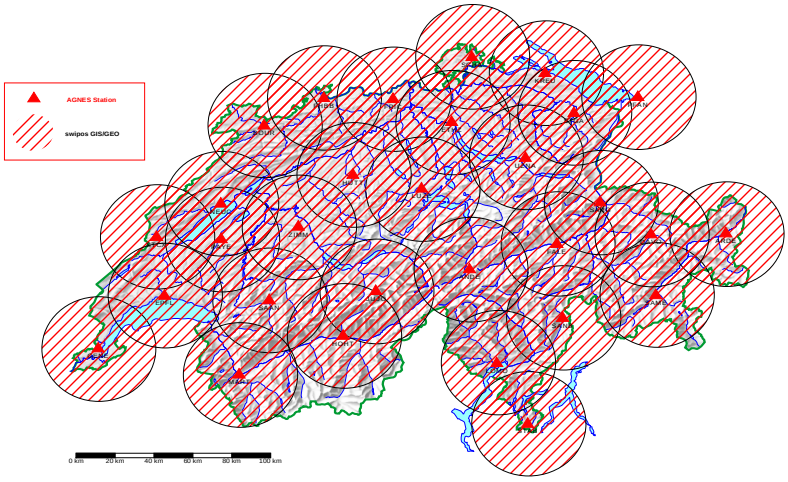
Automated GPS Network in Switzerland (AGNES)

Project leader and team:

Dr. Urs Wild, Project manager
Dr. Elmar Brockmann, Simon Grünig, René Hug,

Project description:

The Swiss Federal Office of Topography (*swisstopo*) has been building up and operating the Automated GPS Network for Switzerland (AGNES) since 1998. The final expansion of 29 permanently operating GPS tracking stations was reached at the end of 2001. AGNES is a multipurpose network which serves as reference for surveying, real-time positioning services and for scientific applications.



The spatial distribution of the 29 AGNES stations over Switzerland had to fulfil to the largest possible extent the requirements of all these three applications. The mean distance between two AGNES stations is about 50-60 km, in order to keep the maximum distance between the user and the reference station below 30 km (maximum distance for high-precision real-time differential positioning). Where possible, the AGNES stations are collocated with meteo stations (ANETZ) of *MeteoSwiss* (such as the station Jungfraujoch).

AGNES is the new on-line realisation of the GPS-based geodetic reference frame CHTRF95 in Switzerland, which will replace the existing triangulation networks in the mean term. Surveyors may use the AGNES data for post-processing applications as well as for real-time positioning (accuracy 0.01 - 0.1 m), using GSM as the data channel between the reference stations and the rover.

The data of the AGNES stations are analysed on a daily basis to validate the stability of the reference frame. An example of the coordinate time series of the Jungfraujoch GPS receiver is given in Figure 2. Monitoring sites over a long time interval will

allow the detection of possible tectonic movements in the Swiss Alps with an accuracy of approximately 2-3 mm/year.

Since Dec. 2001 the GPS data are additionally processed on an hourly basis. So-called zenith total delay estimates (ZTD) are derived every hour with a time delay of about 1:15 hours: With known surface pressure and temperature these values can be converted to integrated water vapour (IWV). The ZTD values are submitted to the European COST-716 project (Exploitation of Ground Based GPS for Climate and Numerical Weather Prediction). A web site (http://www.knmi.nl/samenw/cost716) displays the actual situation in terms of ZTD and IVW in Europe derived from presently 4 processing centres. In collaboration with *MeteoSwiss* and the Institute of Applied Physics (Univ. Bern), an attempt was made (Dec. 2002) to use this information for numerical weather prediction. Comparisons of the GPS-derived ZTD values with values from the weather prediction model (local model LM of *MeteoSwiss*) already prooved the potential of GPS in the field of meteorology.

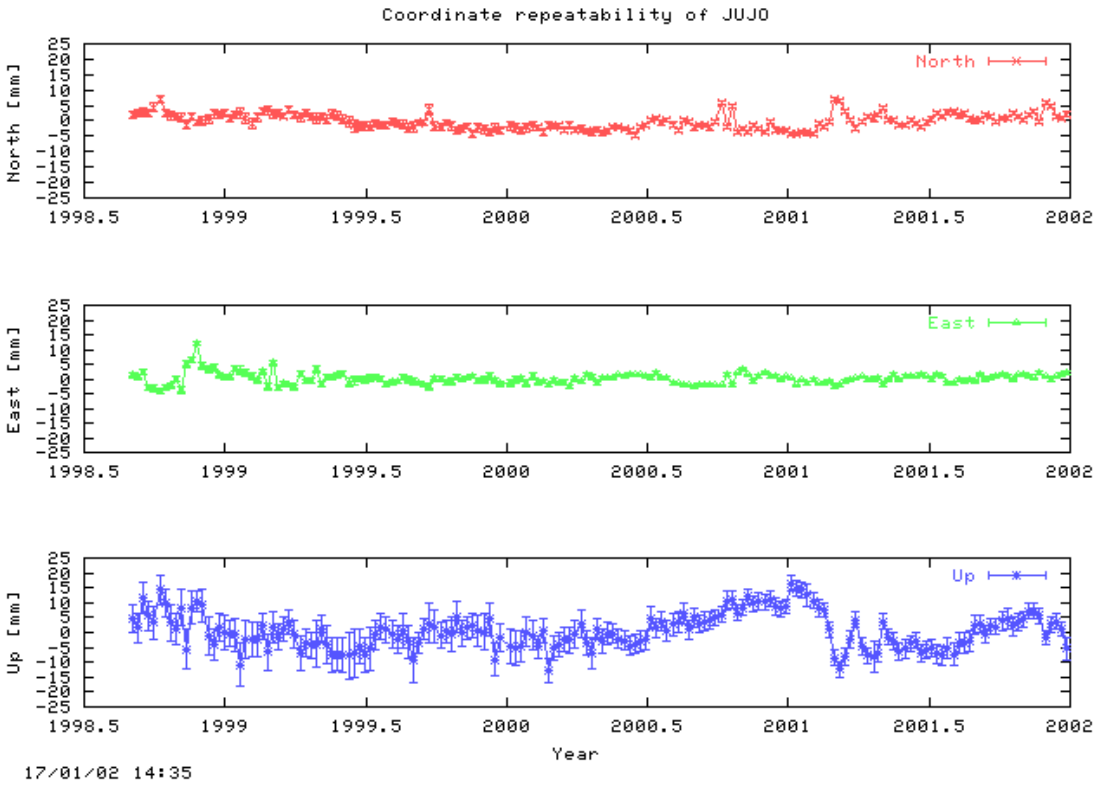


Fig. 2: Coordinate time series (North, East, Up) of the Jungfraujoch GPS receiver (from mid of 1998 till end of 2001). This information is updated weekly at http://www.swisstopo.ch/de/geo/pnac_results.htm.

Key words

GPS, Meteorology, Positioning, Intergrated Water Vapour, Zenith Path Delay, Geodynamics

Collaborating partners/networks:

Astronomical Institute (AIUB), University of Berne
MeteoSwiss, Zurich
Institute of Applied Physics (IAP), University of Berne

Scientific publications and public outreach 2001:

Brockmann E., Schlatter A., Schneider D., Signer Th. and Wiget A. (2000): *Leveling using GPS in the Swiss Alps: The impact of Meteorology*. Proceedings of the COST 716 workshop in Oslo, 12-14 July 2000.

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Address:

Bundesamt für Landestopographie
Seftigenstrasse 264
CH-3084 Wabern

Contacts:

Elmar Brockmann Tel. +41 31 963 2111 e-mail: elmar.brockmann@lt.admin.ch
URL: www.swisstopo.ch