

Name of research institute or organization:

Bundesamt für Landestopographie / Swiss Federal Office of Topography

Title of project:

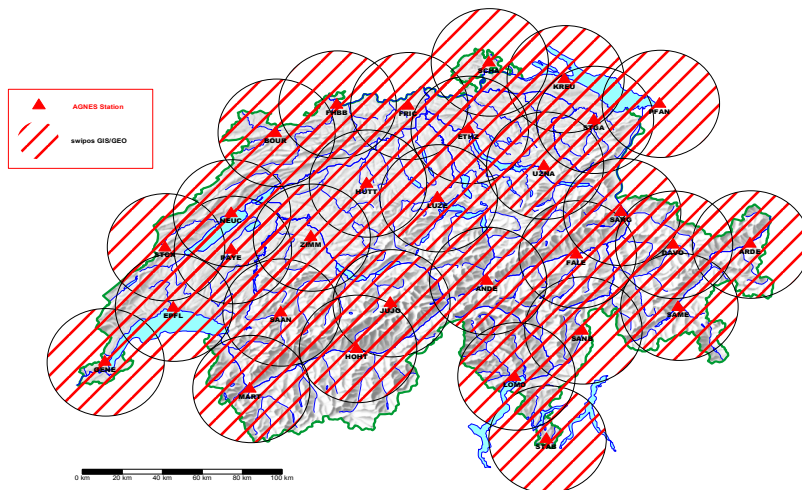
Automated GPS Network in Switzerland (AGNES)

Project leader and team:

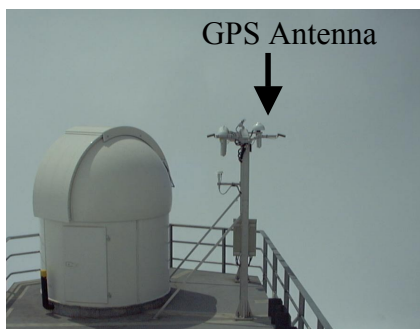
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Dr. Urs Wild, Daniel Ineichen, Simon Grünig

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.

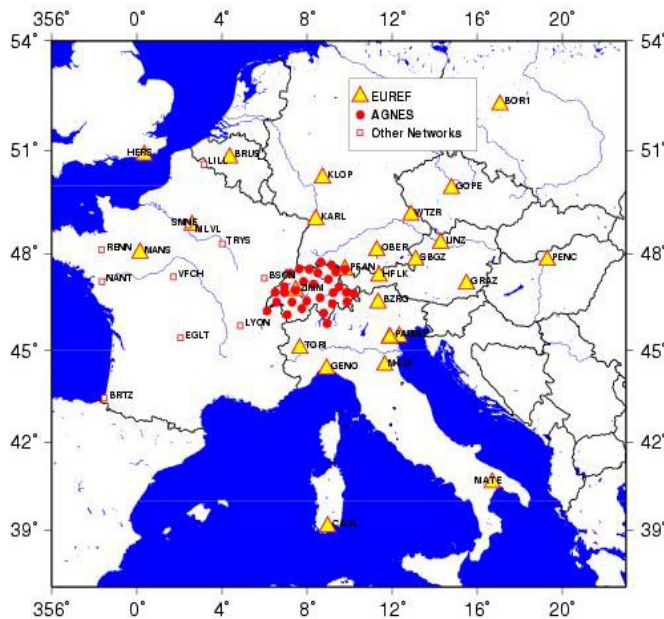
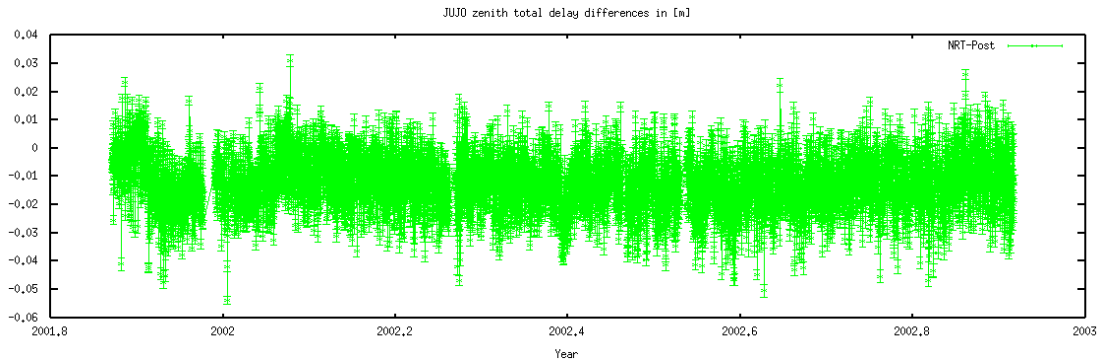


Since 2002 an operational service called *swipos-GIS/GEO*® (Swiss positioning service for GIS and geodetic applications) is in place. The service allows a navigation in the field with cm accuracy in real time in the new Swiss geodetic reference frame CHTRF95. The GPS data of all sites are transferred every second via the federal network KOMBV to Bern and from there after data processing via GSM to the user in the field.



The station Jungfrauoch (Sphinx) is one of the AGNES sites. The GPS antenna is heated in order to avoid snow coverage. The construction is identical to the one of the measurement instruments of Meteo Swiss. In summer 2002 the relative position of the antenna with respect to several other local markers was determined with classical geodetic measurements.

The data of the AGNES sites are being monitored since the end of 1998 on a daily basis (for geotectonics; see annual report 2001) and since Dec. 2001 on an hourly basis (near real-time) as an additional information to numerical weather prediction (Meteo Swiss). As a result of the GPS data processing zenith total delay (ZTD) parameters are estimated every hour for every station. These values can be converted to integrated water vapor (IVW) with known pressure and temperature values. A comparison of ZTD values for Jungfraujoch achieved in near real-time compared with postprocessed values is given below. The agreement is of the order of 1 cm ZTD (rms), which roughly corresponds to 1/6 cm IVW.



Since 1999 the Swiss Federal Office of Topography has been active in the European project COST 716 (exploitation of ground-based GPS for climate and numerical weather prediction application). 63 European sites are hourly processed by swisstopo. The web site <http://www.knmi.nl/samenw/cost716/> nicely shows the contribution of totally 7 European analyses centers. The project will be finished in 2003.

In Switzerland (collaboration of Meteo Swiss, Institute of Applied physics of the University of Bern and swisstopo) 3 time periods (Sept. 2001, Jan 2002, June 2002) were selected in order to analyze the impact of GPS derived ZTD parameters to numerical weather prediction. The results were promising. More details can be found in [Guerova et al, 2002b].

Key words:

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

Internet data bases:

<http://www.swisstopo.ch>; <http://www.knmi.nl/samenw/cost716/>

Collaborating partners/networks:

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

Scientific publications and public outreach 2002:

Brockmann E., R. Hug and Th. Signer (2002a): *Geotectonics in the Swiss Alps using GPS*. In: Torres J.A. and H. Hornik (Eds): Subcommission for the European Reference Frame (EUREF). EUREF Publication No. 11 (in prep.).

Brockmann, E. and M. Troller (2002b): *GPS Meteorology in the Swiss Alps: Interpolation Accuracy for different Alpine Areas and Near Real-time Results*, COST-716 workshop Potsdam, Jan. 28-29 2002.

Brockmann, E., S. Grünig, D. Schneider, A. Wiget and U. Wild (2002c): *Applications of the real-time Swiss GPS permanent network AGNES*. In Proceedings of the EGS XXVII General Assembly Nice, 21 - 26 April 2002, Session 9 on Evolving Space Geodesy Techniques, Physics and Chemistry of the Earth (in prep.)

Guerova G., J.-M. Bettems, E. Brockmann and Ch. Matzler (2002a): *Assimilation of GPS in the Alpine Model: sensitivity experiment*. Proceedings of the COST-716 workshop Potsdam, Jan. 28-29 2002.

Guerova, G., Bettems, J.-M., Brockmann, E., Matzler, Ch. (2002b). *Assimilation of the GPS-derived Integrated Water Vapour (IWV) in the MeteoSwiss Numerical Weather Prediction model - a first experiment*. In Proceedings of the EGS XXVII General Assembly Nice, 21 - 26 April 2002, Session 9 on Evolving Space Geodesy Techniques, Physics and Chemistry of the Earth (in prep.)

Troller M., Brockmann E., Cocard M. and Geiger A. (2002): *GPS Derived Pathdelays Versus Four-Dimensional Meteorological Modelling*; COST-716 workshop Potsdam, Jan. 28-29 2002.

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