Name of research institute or organization:

Bundesamt für Landestopografie / Swiss Federal Office of Topography (swisstopo)

Title of project:

Automated GPS Network Switzerland (AGNES)

Project leader and team:

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Dominique Andrey, Daniel Ineichen, Leïla Kislig, Christian Misslin, Dr. Stefan Schaer, Dr. Urs Wild

Project description:

The permanently observing GPS (Global Positioning System) station at Jungfraujoch has been operating since autumn 1998.

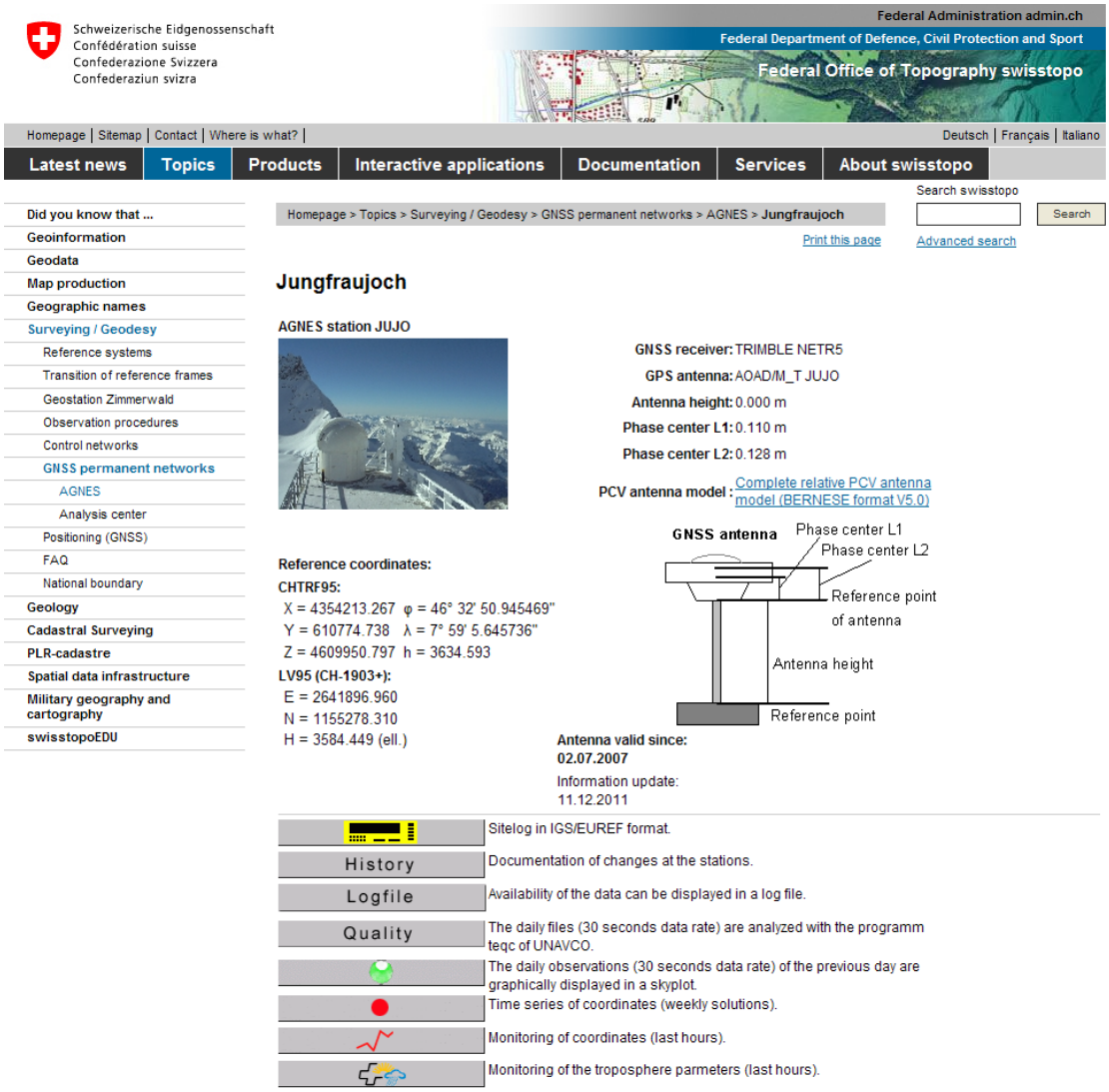

***Figure 1**. Web page for station permanent station JUJO*
(http://www.swisstopo.admin.ch/internet/swisstopo/en/home/topics/survey/permnet/agnes/jujo.html)

The station is part of the Automated GNSS Network of Switzerland (AGNES) consisting presently of 31 sites, partly equipped with GPS and GPS-GLONASS (the Russian equivalent of GPS) combined receivers and antennas. Due to the extreme weather conditions a special antenna is installed at Jungfraujoch. This antenna is unfortunately not capable of receiving the Russian GLONASS satellite data.

This year, we give in our report plots and information for the station available from our web http://www.swisstopo.ch/pnac. The web system displays important information concerning meta data (equipment installed) for all stations and gives access to plots concerning data completeness, quality, and results (coordinates and troposphere parameters).

Fig 1 shows the station page for JUJO, available in 4 languages. At the top of the page general information and information concerning the recently installed equipment can be found. The lower part of the web page contains several buttons that lead to more detailed information. Clicking on  (Sitelog in IGS/EUREF format) displays a log file that lists all relevant equipment changes for the station in the past. Another button accesses a plot showing the completeness of the observations for the complete time series (see Fig.2). Since the beginning, JUJO provides data without greater interruptions.

The plot shown in Fig. 3 is available when clicking on  .

As an example, Fig. 4 shows a plot derived from analyzing the GPS data. Based on daily analyses, weekly averaged coordinates are derived and combined. A repeatability of about 2 mm in the horizontal component and 6 mm in the vertical is reached. This is, compared to other stations of the network, one of the worst performances. Nevertheless, due to the long time span, interesting conclusions can be drawn, such as vertical velocities. Switzerland and especially the Alps are still rising compared to the European tectonic plate (Fig 5). According to our present results, stations of the Swiss midlands (such as Zimmerwald geostation) are rising with about 1.3 mm/year compared to the European plate. Jungfraujoch is rising 3.3 mm/year (2 mm/year relative to ZIMM).

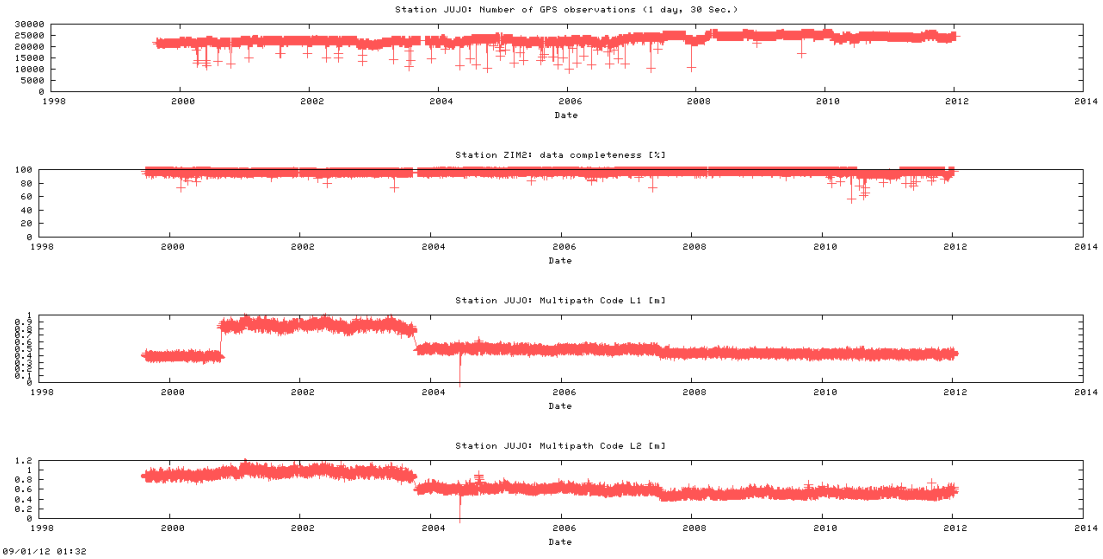

***Figure 2**. Quality values, derived with the program "teqc", indicating the number of GPS observations per day, the completeness and noise values for multipath on pseudo-code observations on the frequencies L1 and L2.*

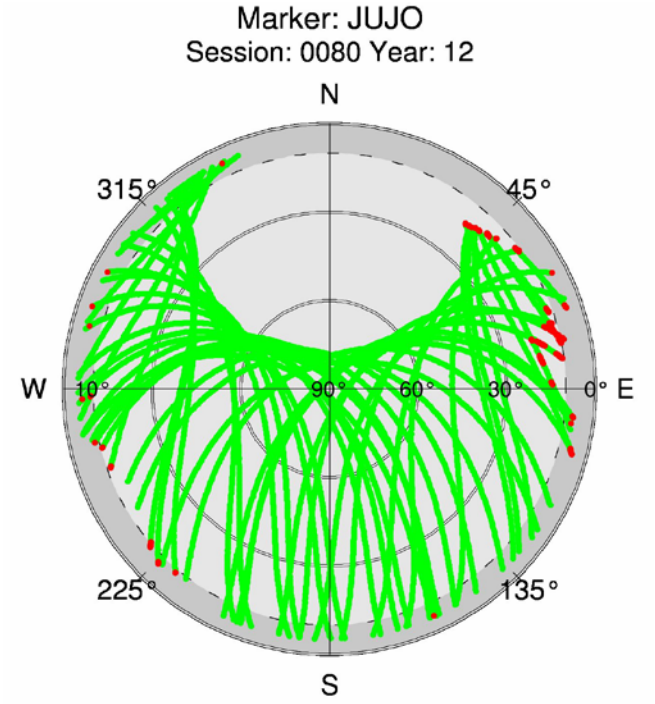

***Figure 3**. Skyplot of the GPS observation collected at the station on the previous day. Red points indicate missing observations on the second frequency.*

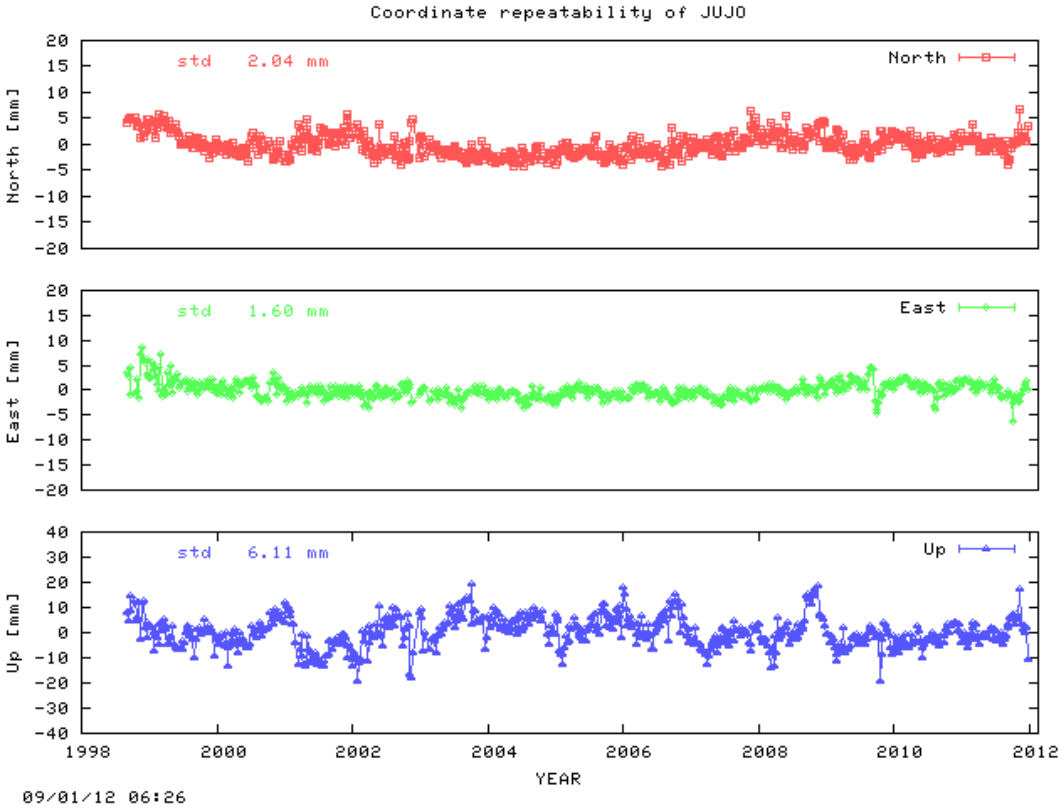

***Figure 4.** Coordinate repeatability derived from weekly solutions.*

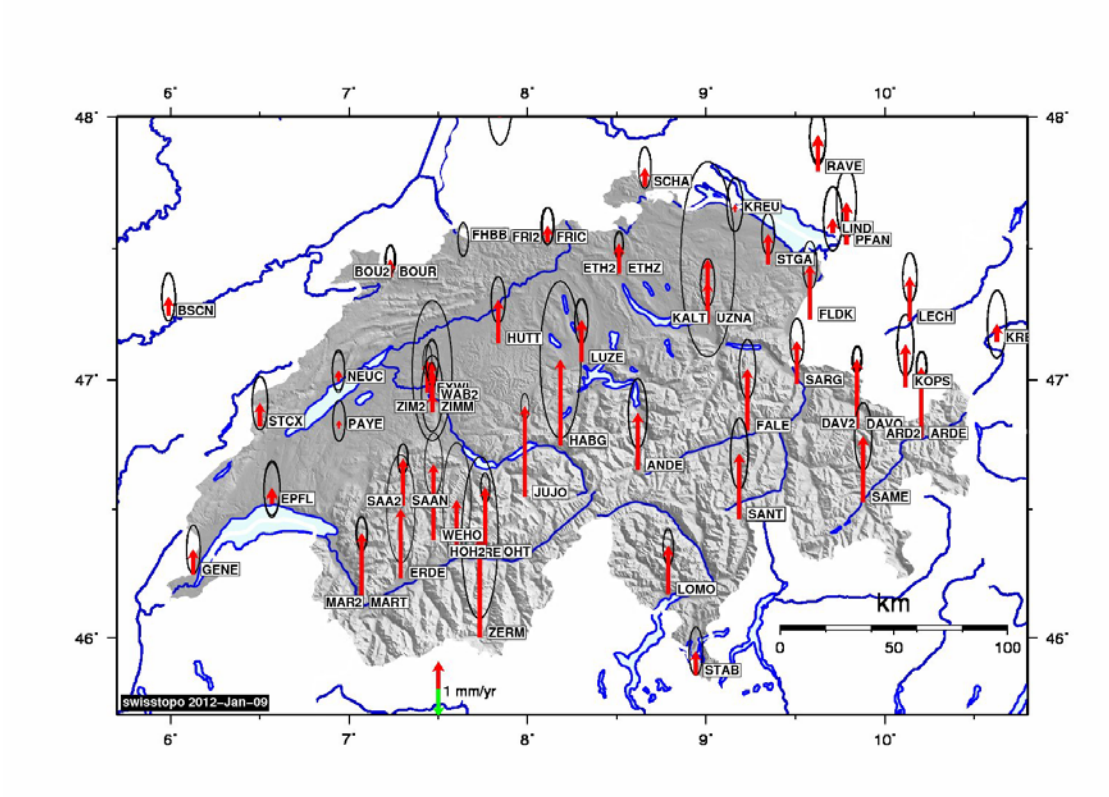

Figure 5. *Vertical velocities derived for the permanent stations of the AGNES network. European stations of the stable part of the European tectonic plate (located in Germany, Poland, France) are assumed to have zero velocities.*

Key words:

GPS, GLONASS, GNSS, Meteorology, Positioning, Integrated Water Vapour, Zenith Path Delay, GPS Tomography, Geotectonics

Internet data bases:

http://www.swisstopo.ch/pnac; http://egvap.dmi.dk/;
http://www.iapmw.unibe.ch/research/projects/STARTWAVE/

Collaborating partners/networks:

Astronomical Institute (AIUB), University of Bern
MeteoSwiss, Zurich and Payerne
Institute of Applied Physics (IAP), University of Bern
Institute of Geodesy and Photogrammetry, ETH Zürich
E-GVAP II (EUMETNET GPS Water Vapor Programme)

Scientific publications and public outreach 2011:

Conference papers

Brockmann E., D. Ineichen, M. Kistler, U. Marti, S. Schaer, A. Schlatter, B. Vogel, A. Wiget, U. Wild (2011): Geodetic activities at swisstopo presented to the EUREF2011 Symposium. Subcommission for the European Reference Frame (EUREF), Chisinau, May 25-28, 2011.

Brockmann E., A. Schlatter (2011): 20 years of maintaining the Swiss terrestrial reference frame CHTRF. Subcommission for the European Reference Frame (EUREF), Chisinau, May 25-28, 2011.

Ihde J., Z. Altamimi, E. Brockmann, C. Bruyninx, A. Caporali, J. Dousa, R. Fernandes, H. Habrich, H. Hornik, A. Kenyeres, M. Lidberg, J. Mäkinen, M. Poutanen, M. Sacher, W. Söhne, G. Stangl, J. Torres, C. Völksen (2011): EUREF's Contribution to a National, European and Global Geodetic Infrastructure. Proceedings of the IUGG symposium in Melbourne, June 27 – July 08, 2011.

Schaer S., M. Meindl (2011): Consideration of Station-Specific Intersystem Translation Parameters at CODE. Subcommission for the European Reference Frame (EUREF), Chisinau, May 25-28, 2011.

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