New Developments in the SWEPOS Network

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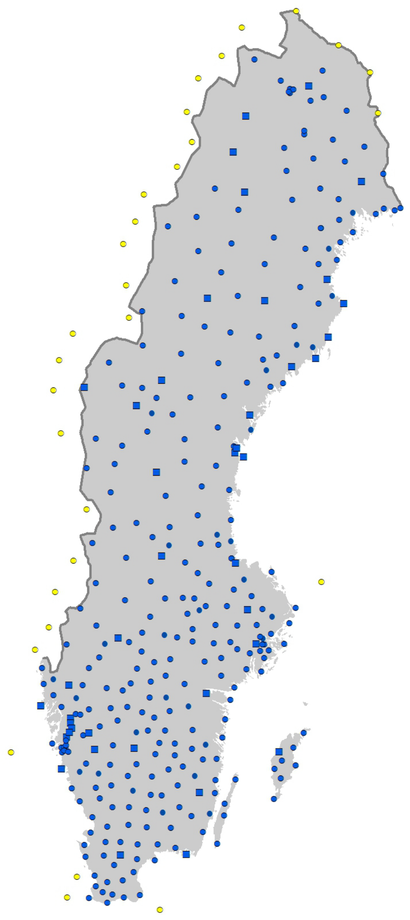
Densification of SWEPOS

In 2009 SWEPOS consisted of 180 permanent reference stations for GNSS in Sweden. In most parts of the country the distances between stations were around 70 kms. In 2008 the CLOSE*) project started as a co-operation between Lantmäteriet, SP Technical Research Institute of Sweden and Onsala Space Observatory. The aims of CLOSE were to investigate the impact of new GNSS's and the impact of a possible densification of SWEPOS on the uncertainty of position estimates. It was found that significant improvements could be made. In 2010 a plan was initiated to densify SWEPOS with 40 stations per year in the years 2011-2015.

*) Emardson R., Jarlemark P., Bergstrand S., Nilsson T. and Johansson J. (2009): Measurement accuracy in Network-RTK, SP Report 2009:23.



41 class A stations

266 class B stations

5 IGS and 24 EPN stations

Dorne-Margolin antennas on all 307 stations

60 Javad Lexon EGGDT
60 Javad TRE_G3TH Delta
80 Leica GRX1200+ GNSS
120 Trimble NetR9

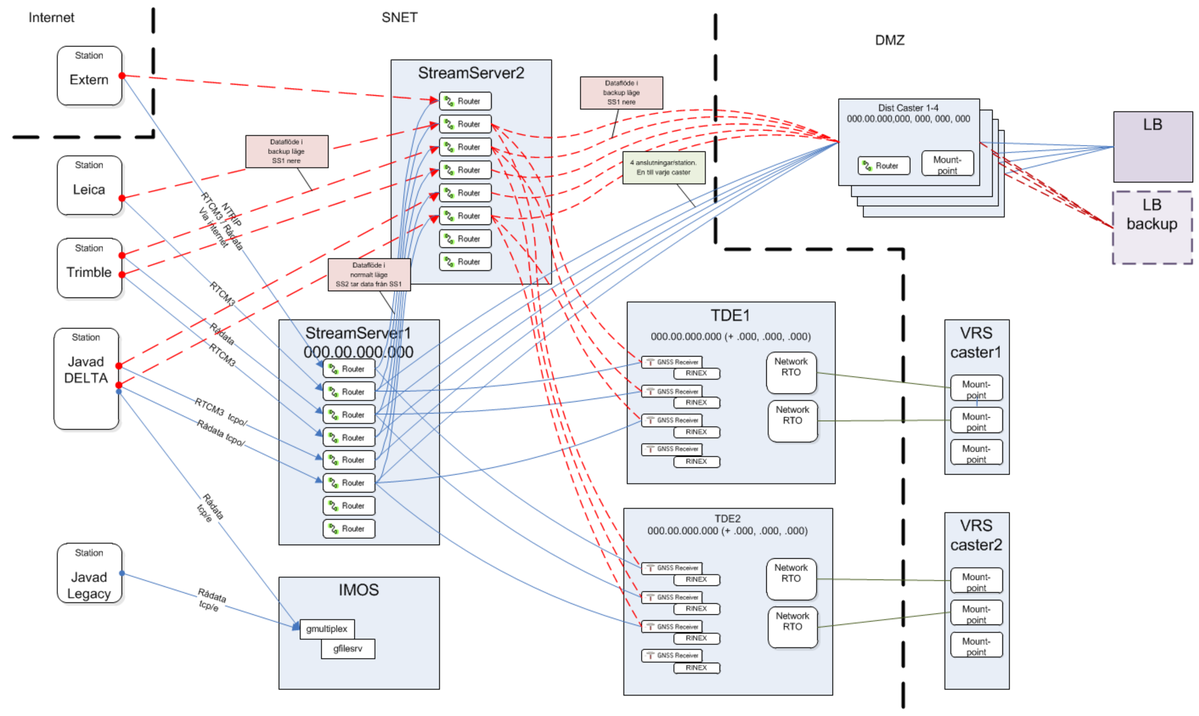
The Javad Lexon receivers don't support Galileo and BeiDou and the Javad Delta don't support the Galileo AltBOC signal.
These receivers will soon be replaced by Javad TRE_G3TH Sigma receivers in order to support GPS, GLONASS, BeiDou and SBAS on all stations.

Visby

New monuments

The antennas on the old SWEPOS pillars are impossible to calibrate together with the radome. The top of the pillar consists of a tribrach on a large steel plate which influences the GNSS measurements with strong near-field multipath ,also the antennas should be lifted as little as possible from the tribrachs.
The old SWEPOS pillars should be left without modification because they are the base for long time-series of GNSS positions.

This made us decide to set up new monuments with truss masts and new calibrated Leica AR25 antennas.
In 2011 the new monuments were erected and put in operation on the 21 main SWEPOS stations. The old and new monuments will be operated in parallel.



New satellite systems and MGEX

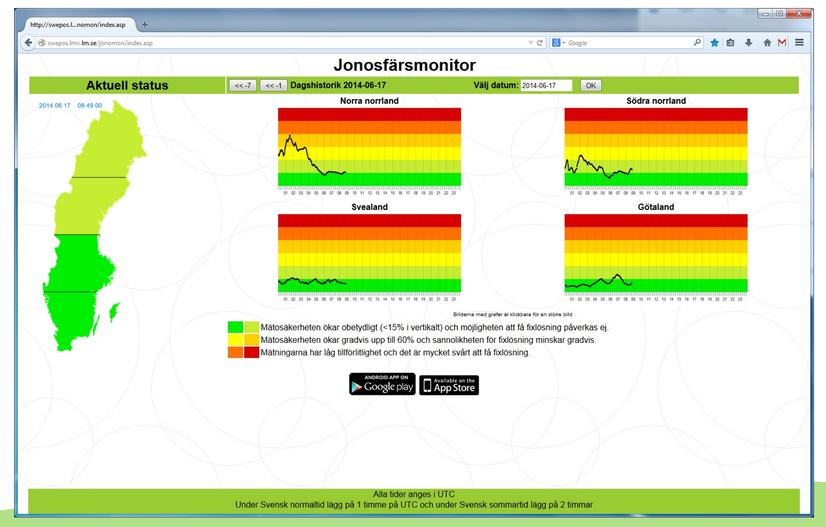
During the last couple of years and for the next couple of years SWEPOS is slowly converted to handle the new GPS and GLONASS signals and the new satellite systems Galileo and. BeiDou. The RTCM MSM (Multiple Signal Message) and Rinex 3.02 formats are crucial for this. In SWEPOS a new dataflow architecture based on Trimbles Pivot Platform has been developed for this purpose. The new architecture also supports the real-time distribution of raw data to many different customers.
Sweden has participated in the MGEX project with 3 stations: Onsala, Mårtsbo and Kiruna. The MGEX data comes from the new monuments and Trimble NetR9 receivers.

Galileo-only code positions (yellow) April 26th 2013 at Mårtsbo with Onsala as base station (RTKLIB 2.4.2 b11).

Ionospheric monitor

As a by-product of the Close II project a web-based ionospheric monitor adapted for network RTK was made. It divides SWEDEN into four parts and estimates the ionospheric variability for each part every 30 second. During the latest solar maximum, ionospheric variability has proved to be strongly correlated with RTK performance and the ionospheric monitor has become a popular tool among Swedish GNSS users.

Emardson R., Jarlemark P., Johansson J. and S. Schäfer (2013): Spatial Variability in the ionosphere measured with GNSS networks, Radio Science, Vol. 48, pp. 646-652.



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