

GOP EUREF permanent network reprocessing using IGS05 and IGS08 models

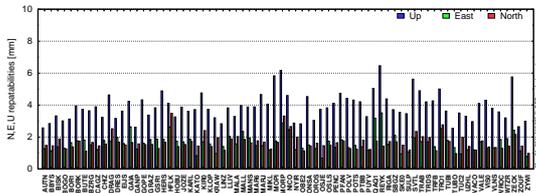
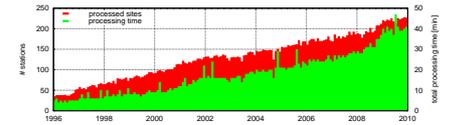
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Introduction

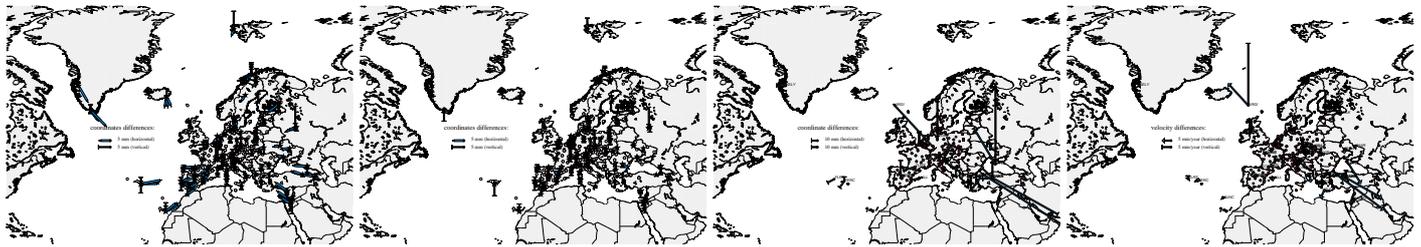
The EUREF reprocessing has followed the IGS repro1 while keeping IGS repro1 products fixed in regional solution. The EUREF ITRF2008 densification is based partly on the EUREF reprocessed solutions and partly on operational solutions (since GPS week 1408) so that the consistent set of adopted models is provided. By the setup, the EUREF ITRF2008 densifications is a mixture of various ACs' contributions, software and reprocessed and operational solutions.



Firstly, GOP contributed to the EPN repro1 with its sub-network of about 70 stations and provided multi-year combination via detecting outliers, discontinuities and estimating velocities (plot of repeatabilities is at the left plot). Secondly, GOP provided an independent re-processing of the whole EPN (see the top right figure for processing time dependency on number of stations) from GPS week 0836 to 1631 using both IGS05 and IGS08 reference frames (RF) and antenna phase centre offsets and variations (PCO+PCV) models. The combination was done for both solution over 1996-2011 for the velocity and discontinuity estimation. The daily, weekly and combined processing was done by Bernese Software [Dach et al, 2007]. The GOP IGS05 solution was used to independently evaluate an official EUREF ITRF2008 densification, while helping to identify some issues with the EUREF repro1 campaign and providing recommendations for future repro2. The comparisons of IGS05 and IGS08 solutions resulted in a very good agreement for all coordinates and velocities, however, a scale change of about 1ppb was identified, which partly reduced 2ppb scale between the ITRF2008 and its EUREF densification (GNSS-based only). Fortunately, no significant rotation observed. Some specific data and individual AC's solution problems were identified (see below), however, significant improvement in new ITRF2008 European densification was achieved.

GOP combination 0836-1631 and comparison with EUREF ITRF2008 densification

Two left plots below shows the selection of 86 fiducial stations (159 solution numbers) and their residuals after 3- or 7-parameter Helmert transformation. The right plot shows the GOP repro1+ and EUREF ITRF2008 densification coordinate and velocities differences at central epoch 2005.0. The discontinuities were maximally kept as in EUREF ITRF2008 densification. Only few stations' velocities are significantly different mainly due to different data time-span or some the discontinuity redefinition.



Helmert residuals for fiducials (TRANSLATION only)

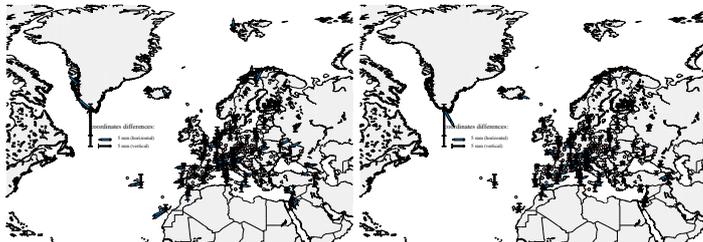
Helmert residuals for fiducials (TRA+ROT+SCALE)

CRD differences to EUREF ITRF2008 densification

VEL differences to EUREF ITRF2008 densification

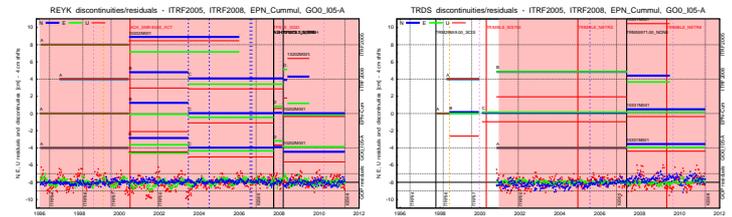
GOP Repro1+ using IGS05 and IGS08 PCV+PCO models

Comparison of two solutions based on different IGS models shows scale factor of 1ppb and some remaining station-wise individual differences. Left figure below shows Helmert residuals with translation only, while the right applying all 7 parameters.



GOP Repro1+ assessing ITRF2008 EPN stations

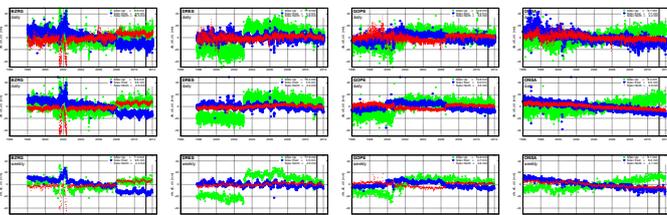
Examples of two stations (REYK and TRDS) from the EUREF Permanent network where significant discontinuities were observed. In other cases, different velocities/coordinates are due to e.g. different data time-span used in IGS-repro1 and EPN-repro1.



Problems in data, various solutions

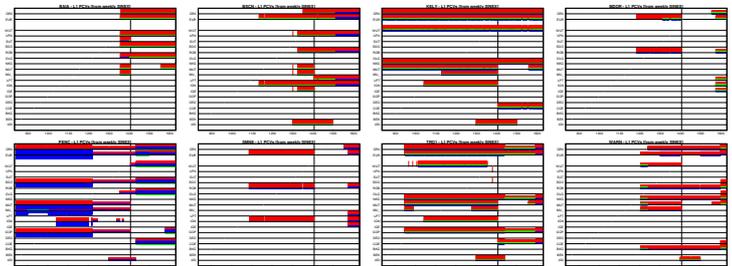
- ITRF2008 - total 38 EPN stations with shorten periods (9 significantly)
- ITRF2008 densification - 22 EPN stations with shorten periods (3 significantly)
- GOP Repro1 - 35 EPN stations with shorten periods (20 significantly from EPN archive)
- some data gaps not well handled or different discontinuity definitions

Below is examples for 4 EPN stations from top to bottom - a) raw daily, b) daily from weekly solution (with daily outlier elimination) and weekly N,E,U coordinates.



Problems in EUREF LACs' SINEX, EPN combination

- incorrect PCO+PCV in individual SINEX
- combination sometimes based on 1-2 stations only (for a most of the period)
- various data time span in individual contributions
- some non-EUREF stations, some former EPN stations missing



Conclusion, experience and recommendations

Besides that GOP full EPN repro1+ provided the assessment of ITRF2008, its densifications in Europe, additional information about historical data quality of EPN stations, the work provide some suggestions for both EPN and IGS repro2 in future:

- EPN - should revise stations validity interval (add and remove), provide information of data problems - see item below
- EPN - should maintain a unique historical data archive with full data and meta-data content monitoring and historical modification logs (to be used uniquely for any reprocessing purpose, climate study etc.)
- EPN-repro2 - stations should be strictly synchronized with respect to revised EPN validity interval by all ACs
- EPN-repro2 - individual ACs' SINEXs should be checked for PCV+PCO and other metadata as it is done in an operational mode
- EPN-repro2 - promote various software packages and probably less ACs providing full EPN network
- EPN-repro2 - avoid combination of repro and operational solutions
- IGS-repro2 - should use the EPN historical data archive for EPN stations

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