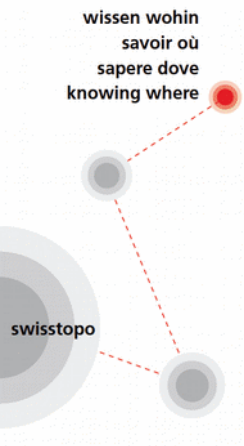




Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Office of Topography swisstopo

wissen wohin
savoir où
sapere dove
knowing where



Reprocessing activities at swisstopo (LPT)

D. Ineichen, E. Brockmann, S. Schaer

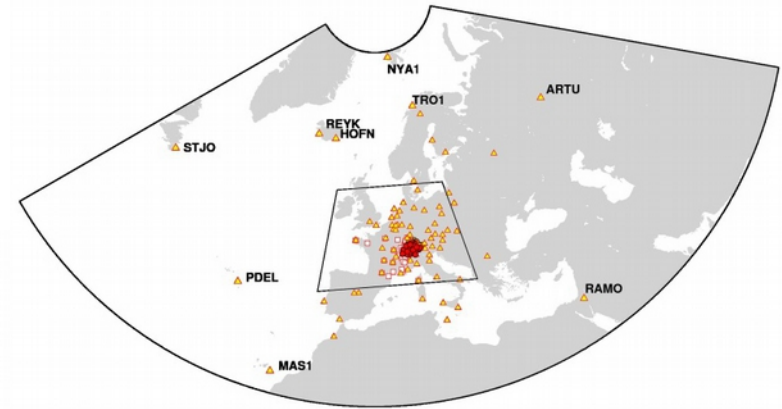
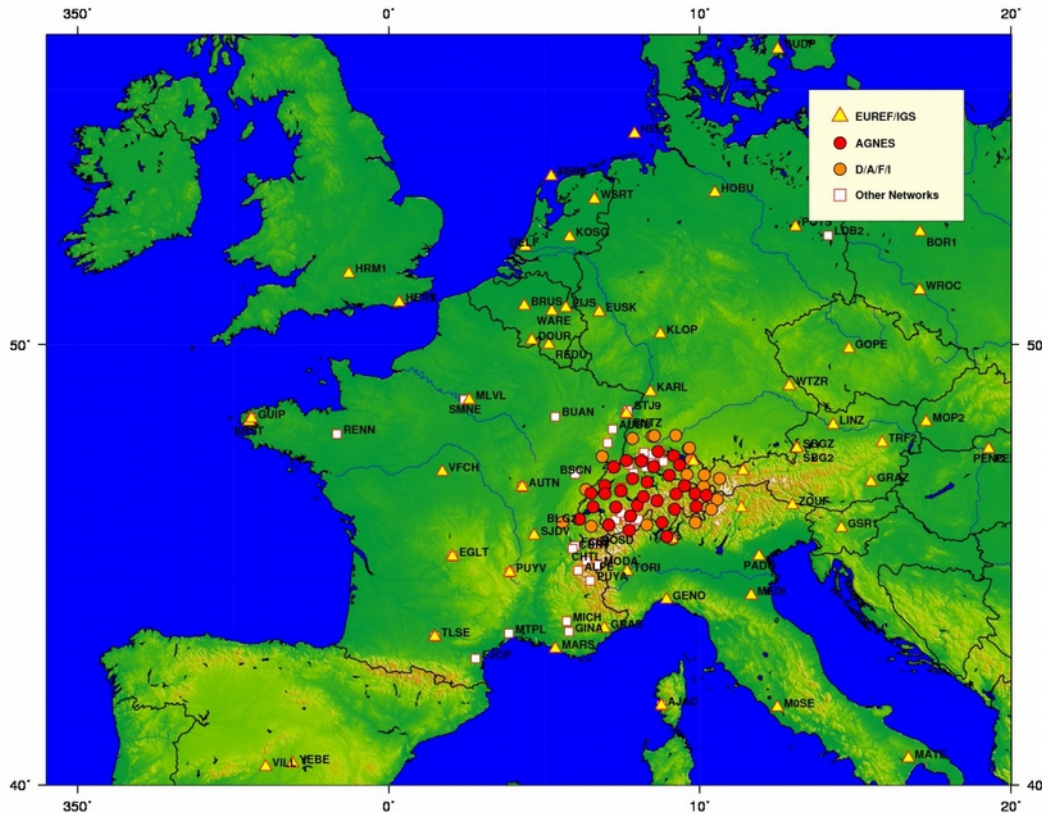


Motivation for Reprocessing

- Achieve homogenous time series
- Benefit from consistent reprocessed input data (orbits and ERPs from CODE reprocessing series 2011)
- Switch to absolute antenna models (so far possible only for test solutions, in order to avoid jumps for the velocity estimation)
- Adopting the newest processing options (Bernese Version 5.2)
- Enhancing the network with valuable sites showing a good performance (seen in retrospect)
- Participating in the reprocessing project of the EPN



Processed Network

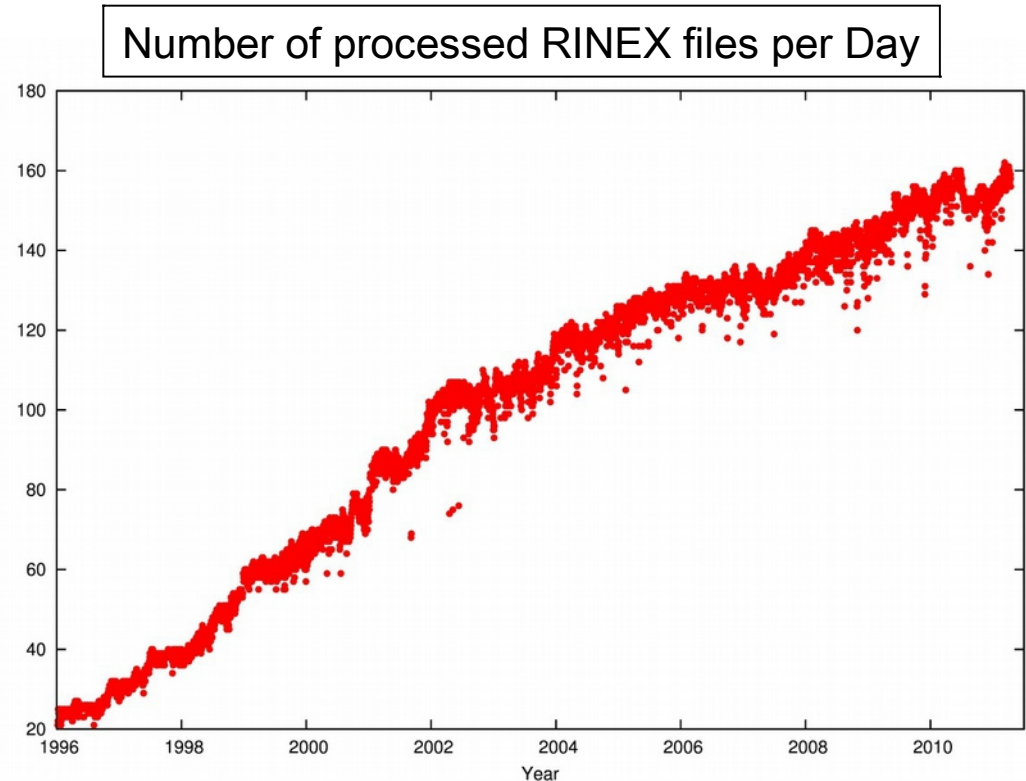


- About 190 sites
- From different types of networks:
 - IGS/EUREF
 - AGNES
 - D/A/F/I
 - Others



Remarks on the Reprocessing

- Time span 1996, DOY 007 till 2011, DOY 106
- Number of sites increased from 20 sites (1996) to 160 sites (2011)
- CODE orbits/ERPs from 2011 reprocessing used
- Alignment to IGB08 reference frame
- Based on RNX2SNX BPE, further developments for reprocessing task





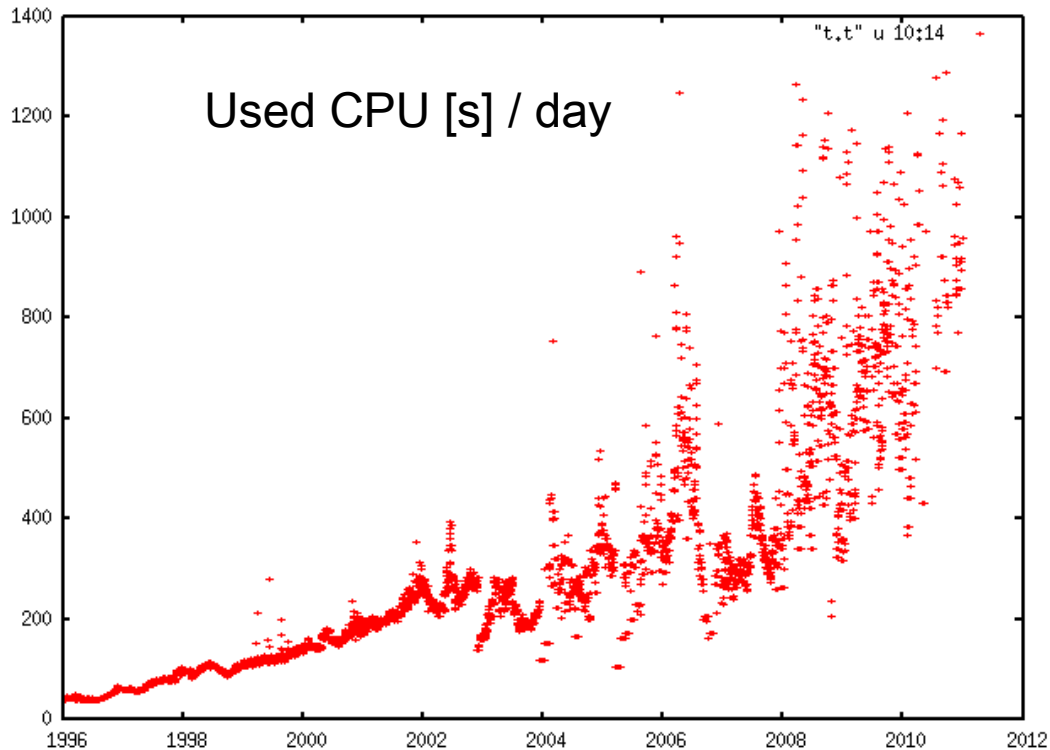
Processing Options

Make use of new Bernese Software (BSW52) options, amongst others:

- Troposphere GMF / Chen Herring for gradients
- Absolute antenna calibration values, specific for GLONASS also
- Following IERS2010 conventions
- Higher order ionosphere
- Intersystem translation parameters and troposphere bias for GLONASS set up, but so far not activated



Processing Times



- **1996:** 20 Stations (24 satellites)
40 sec CPU time / day
- **2011:** 150 stations (55 satellites)
Up to 1300 sec CPU time / day
- **15 years** need
2 weeks of computation time
(on 2 Linux servers with 32
nominal CPUs each)



Principle of Multi-Year Combination

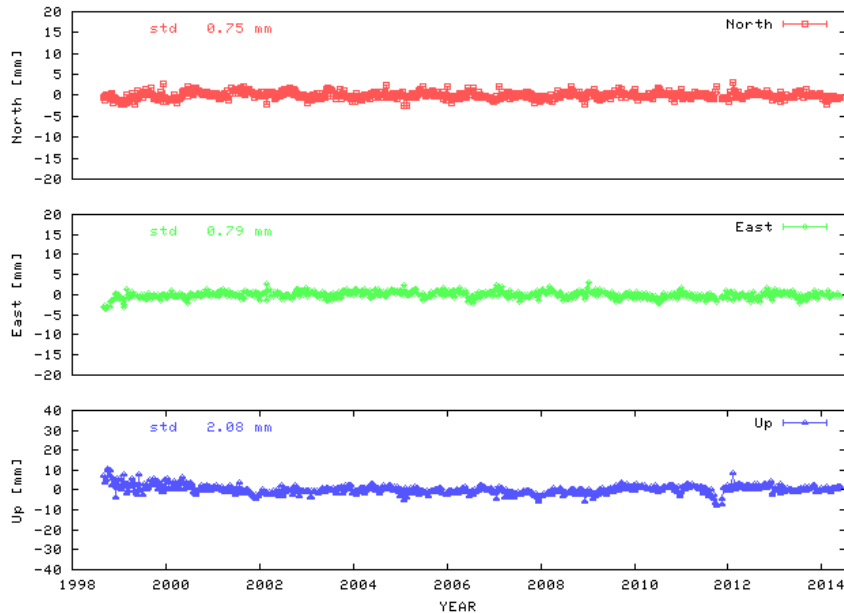
- Done with Bernese program ADDNEQ2
- Using daily solutions (NEQs) from the reprocessing and adding daily solutions from the routine processing after DOY 106, 2011
- **Benefits:**
 - Extension of the reprocessed time series up to current date
 - Update of the combination every week with new data possible
 - Always actual coordinates available (e.g. after equipment change)
- **Difficulties:**
 - Not completely identical networks
 - One part stemming from the routine processing not fully consistent (Slightly different options, BSW50 (17.03.2011 to 10.04.2013))



Multi-Year Solutions

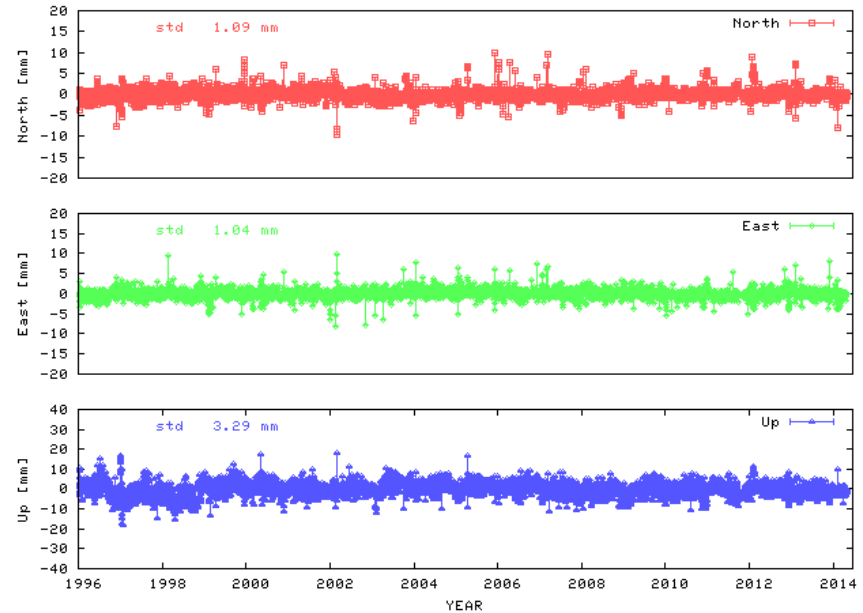
Repeatabilities Old vs. New

Weekly repeatability ZIMM old [mm]



30/05/14 02:58

Daily repeatability ZIMM new [mm]



28/05/14 03:30

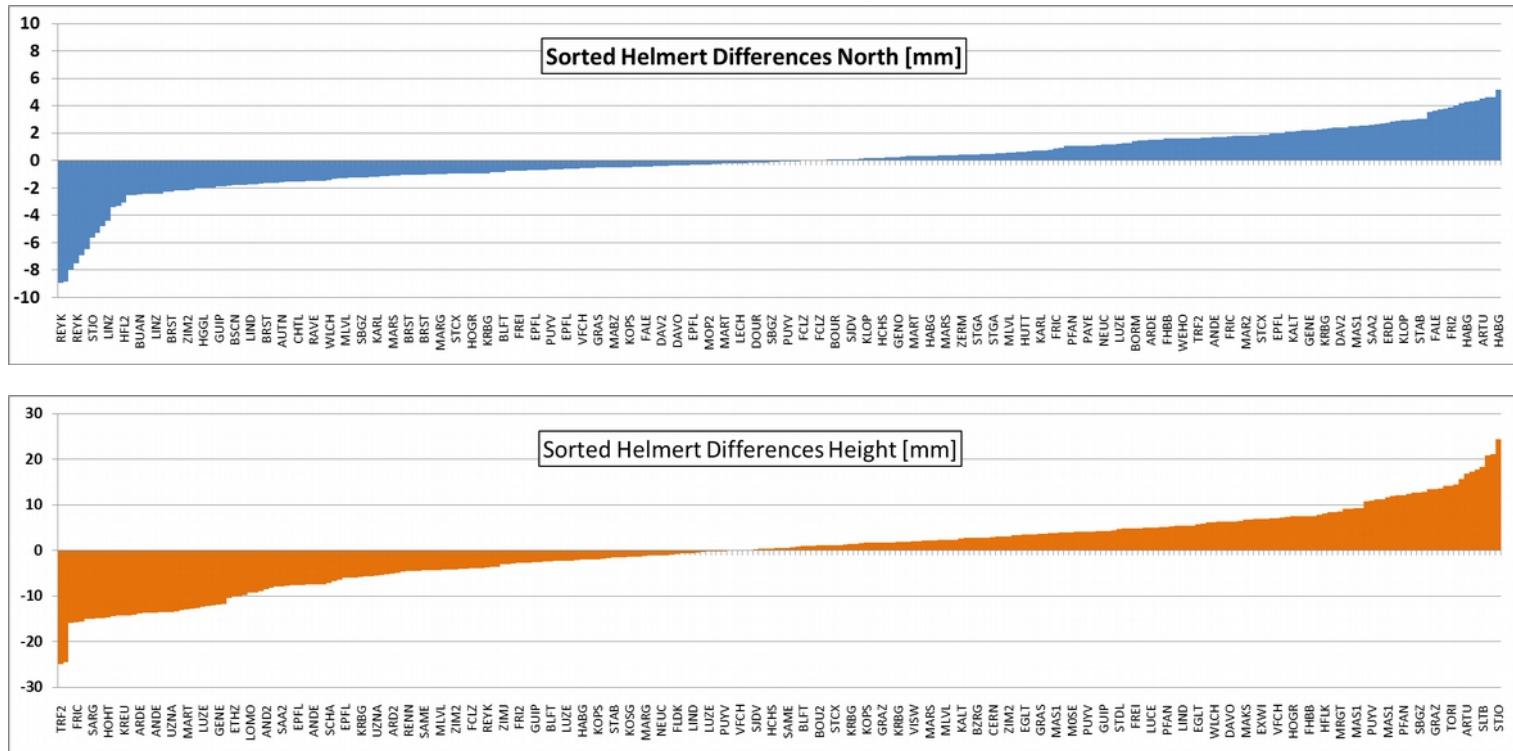
RMS of all sites	North	East	Up
Multi-Year (old)	1.4 mm	1.2 mm	3.5 mm
Multi-Year (new)	1.6 mm	1.4 mm	4.5 mm

New solution shows a nice performance (RMS difference smaller than the expected factor of 2.6 ($\sqrt{7}$), weekly vs. daily)



Helmert Coordinate Differences

Comparison of Old and New Multi-Year Solution

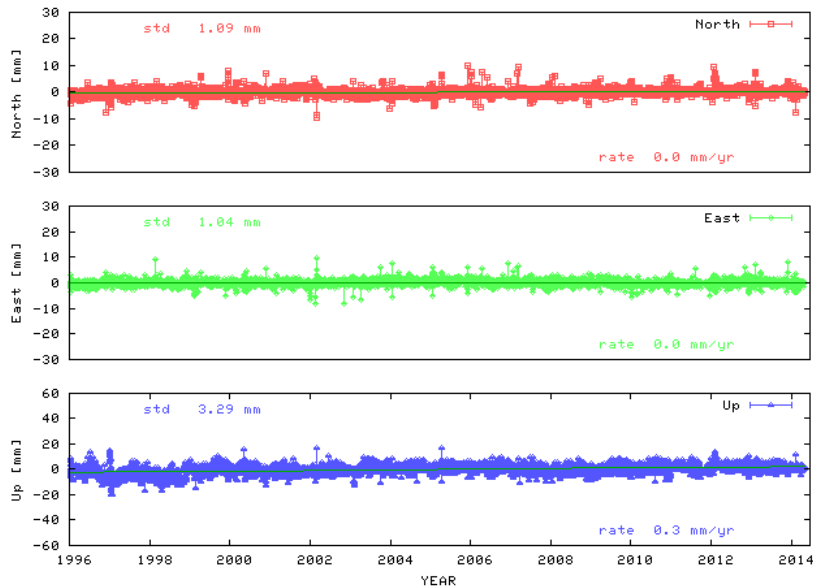


- RMS of all sites: 2.1 mm North / 1.9 mm East / 8.0 mm Up
- Mainly due to different processing options
(especially due to antenna model change from IGS01(rel) to IGS08 (abs))



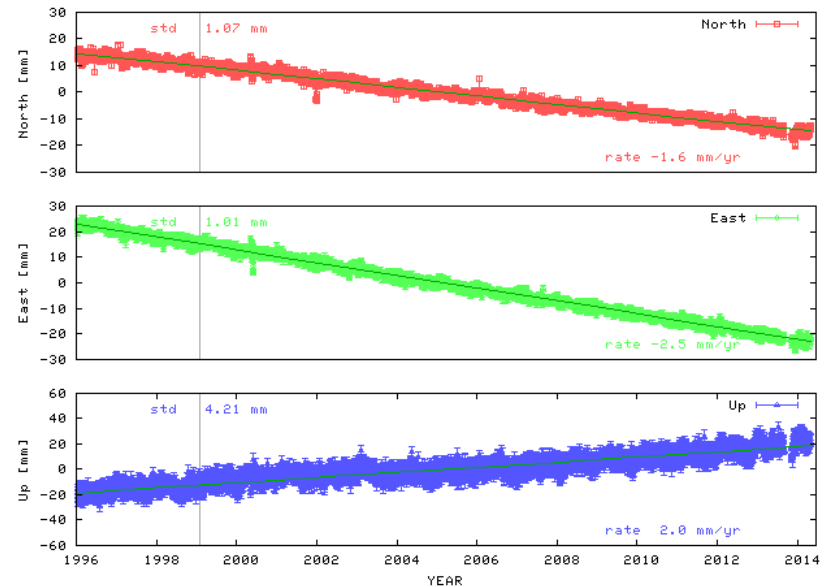
Multi-Year Combination: Time Series Relativ to ZIMM (IGb08)

Coordinate repeatability of Zimmerwald, CH



30/05/14 10:57

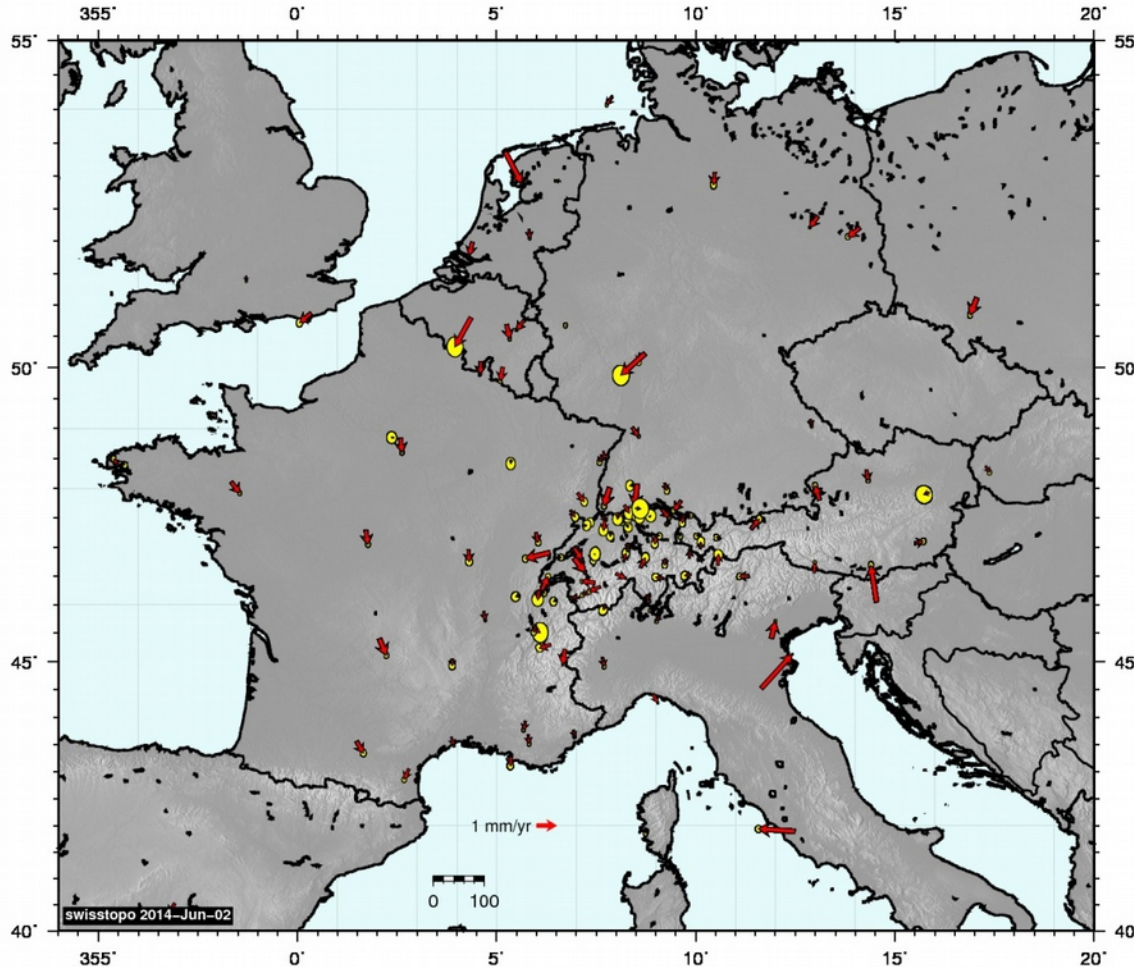
Coordinate repeatability of Onsala, SE



30/05/14 10:56



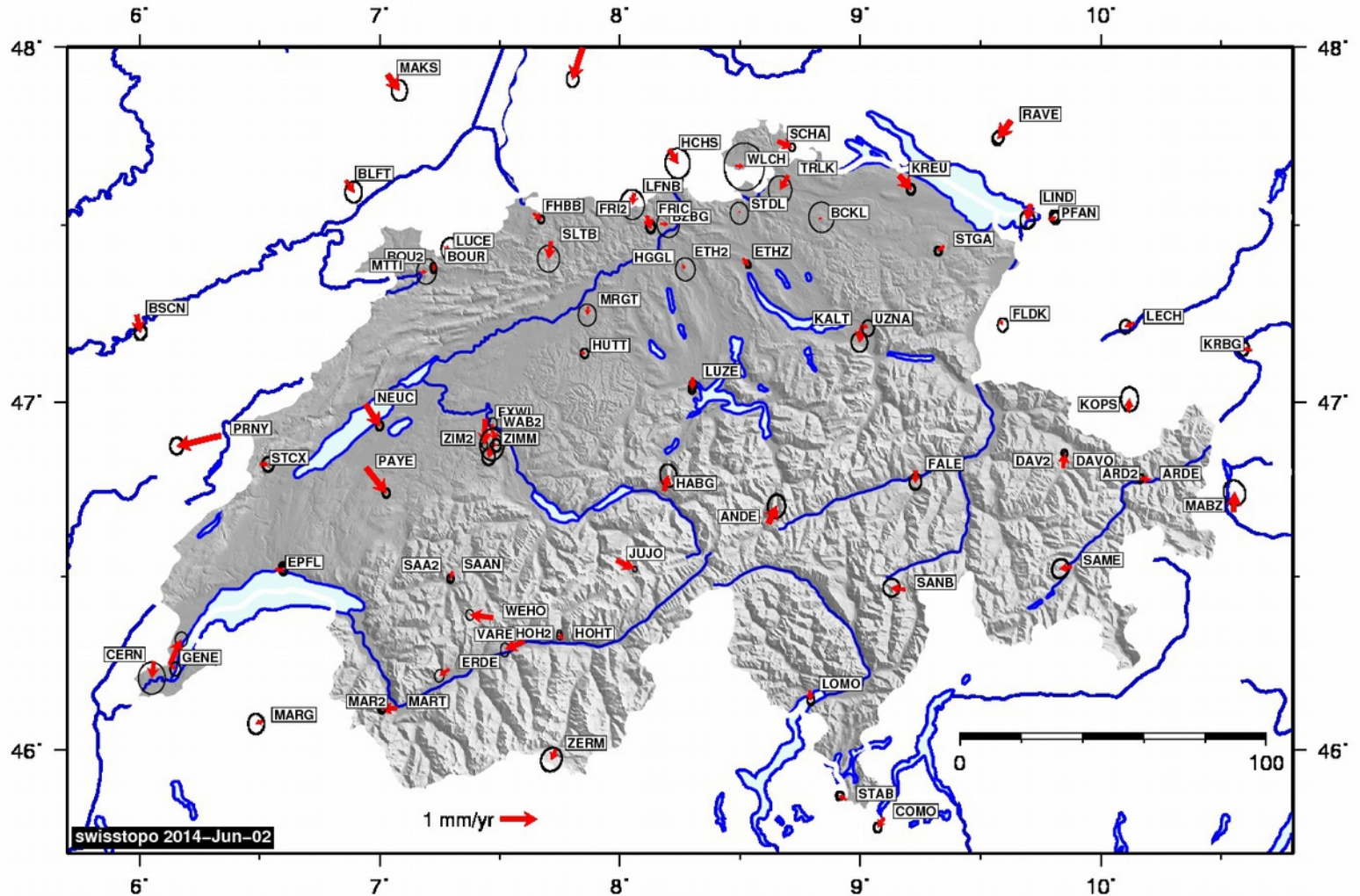
Horizontal Velocity Field (Central Europe)



Relative to APKIM2005
plate motion model
[Drewes, 2009]
and Zimmerwald

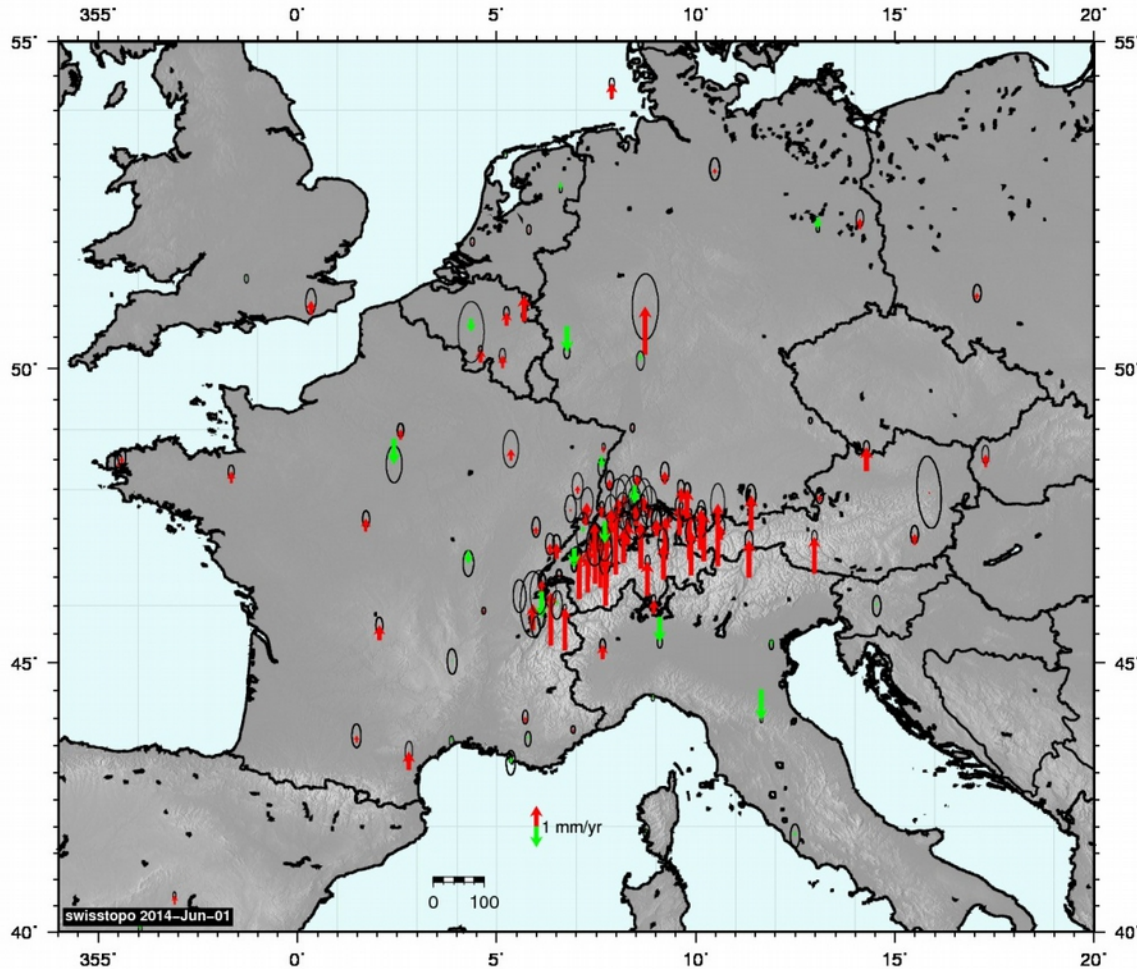


Horizontal Velocity Field (Switzerland)





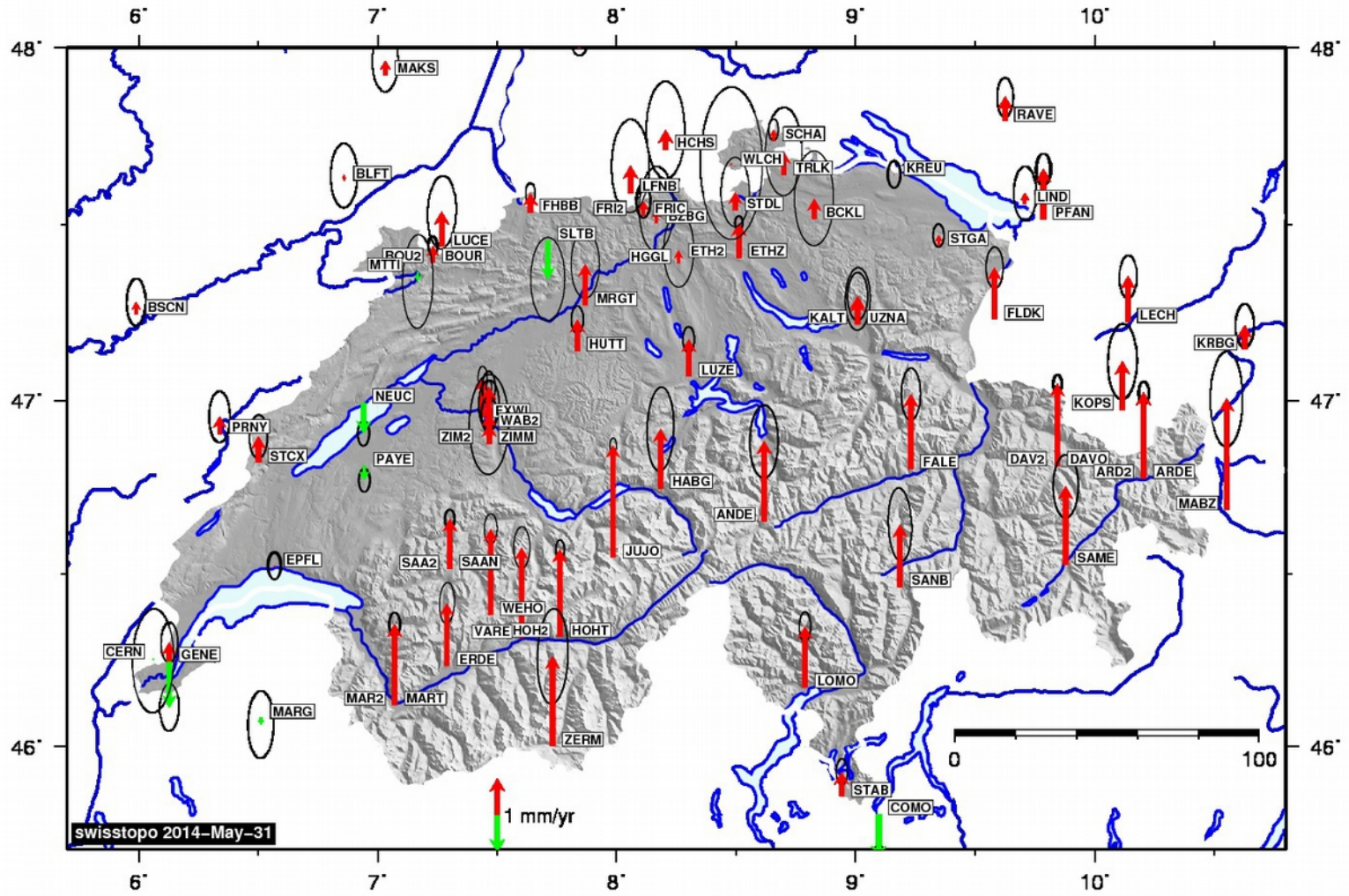
Vertical Velocity Field (Central Europe)



Vertical velocities in
the IGb08 reference
frame



Vertical Velocity Field (Switzerland)





Conclusion/Outlook

- A time series from 1996 to 2011 of about 190 sites is available
- The combination with solutions from routine processing extends the available time span (for velocity estimation) and provides up to date estimates of station coordinates
- Newly available products from CODE (reprocessing series 2013) will allow the extension of our reprocessing series
- Reprocessing is an ongoing task (e.g., new input products, new models and options of the used processing software)
- Follow-up computations will (hopefully) be much easier and faster to do, having solved most problems in the first runs