

EPN Densification Project: Report of the Main Astronomical Observatory NAS of Ukraine

Oleg Khoda

*Main Astronomical Observatory
National Academy of Sciences of Ukraine
(Kiev, Ukraine)*

oleg@mao.kiev.ua



GNSS Data Analysis Centre

Operated: since 1995

Staff: 1-2 persons

Hardware: 2 cluster test nodes + 2 PCs

Software:

- Bernese GPS Software v.3.5 (1995-1999)
- Bernese GPS Software v.4.0 (1999)
- Bernese GPS Software v.4.2 (1999-2007)
- Bernese GPS Software v.5.0 (2008-2013)
- Bernese GNSS Software v.5.2 (2013-)
- GAMIT/GLOBK

Main Tasks

- Regular processing data of permanent GNSS stations located in the Eastern Europe
- Reprocessing archive data
- Rapid daily analysis
- Processing data of regional and local GNSS campaigns

Regular Processing and Reprocessing

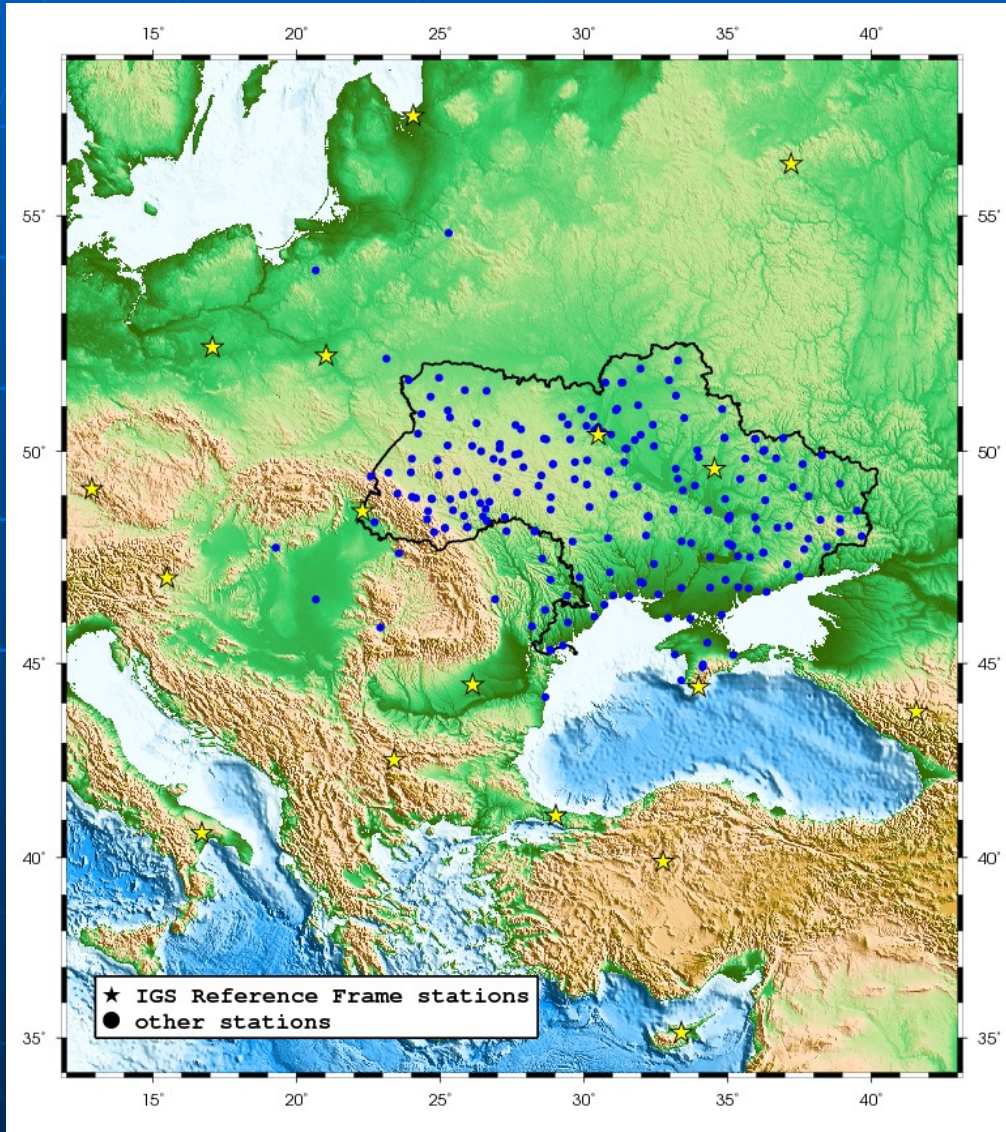
Regular Processing (MAO):

- IGS00b (GPS wks 1236-1399, BSW 4.2)
- IGS05 (GPS wks 1400-1631, BSW 5.0)
- IGS08 (GPS wks 1632-1708, BSW 5.0)
- IGb08 (GPS wks 1709-1933, BSW 5.2)
- IGS14 (GPS wks 1934-..., BSW 5.2)

Reprocessing Campaigns:

- MA1: IGS05 (GPS wks 935-1399, BSW 5.0)
- MA2: IGb08 (GPS wks 935-1708, BSW 5.2)

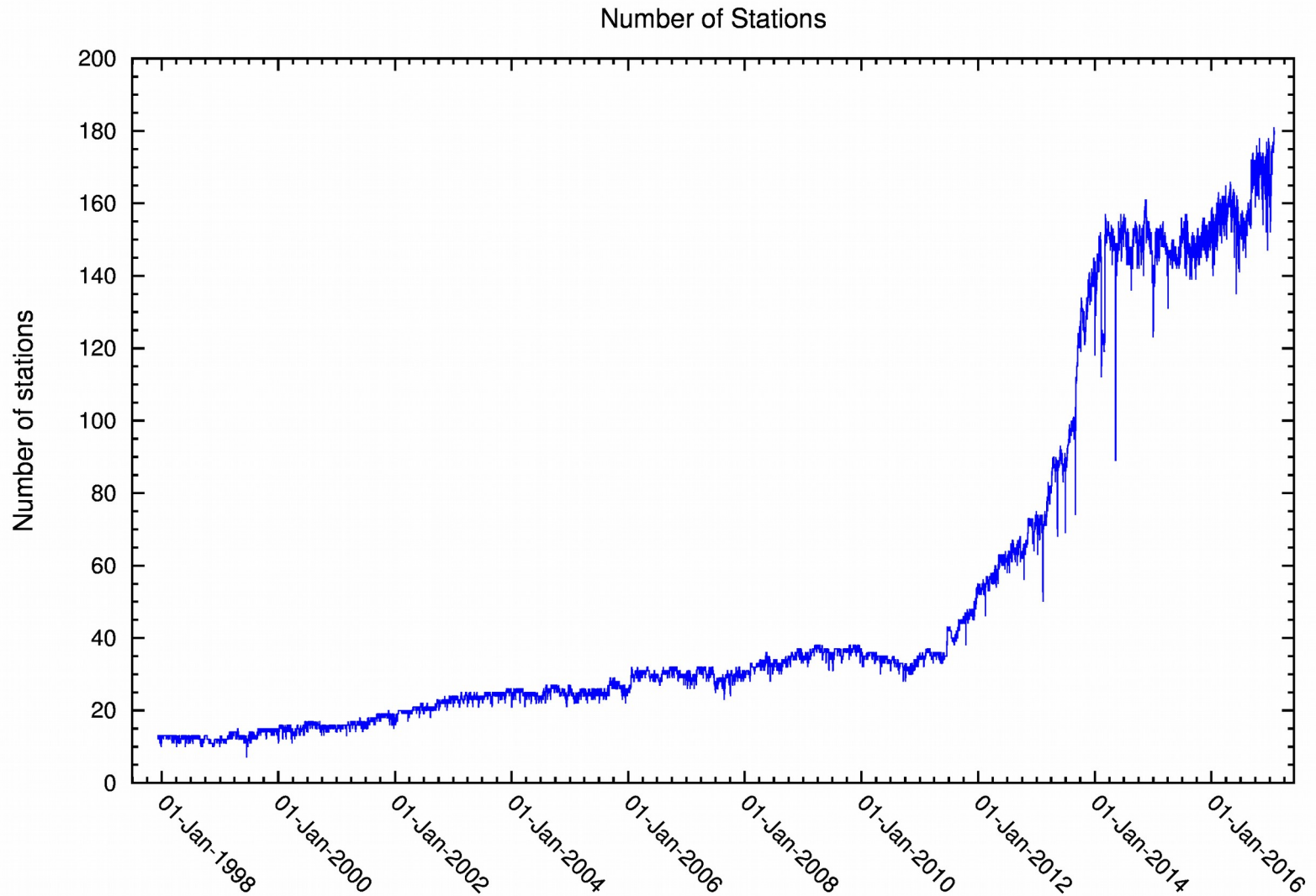
MAO & MA2 (IGb08)



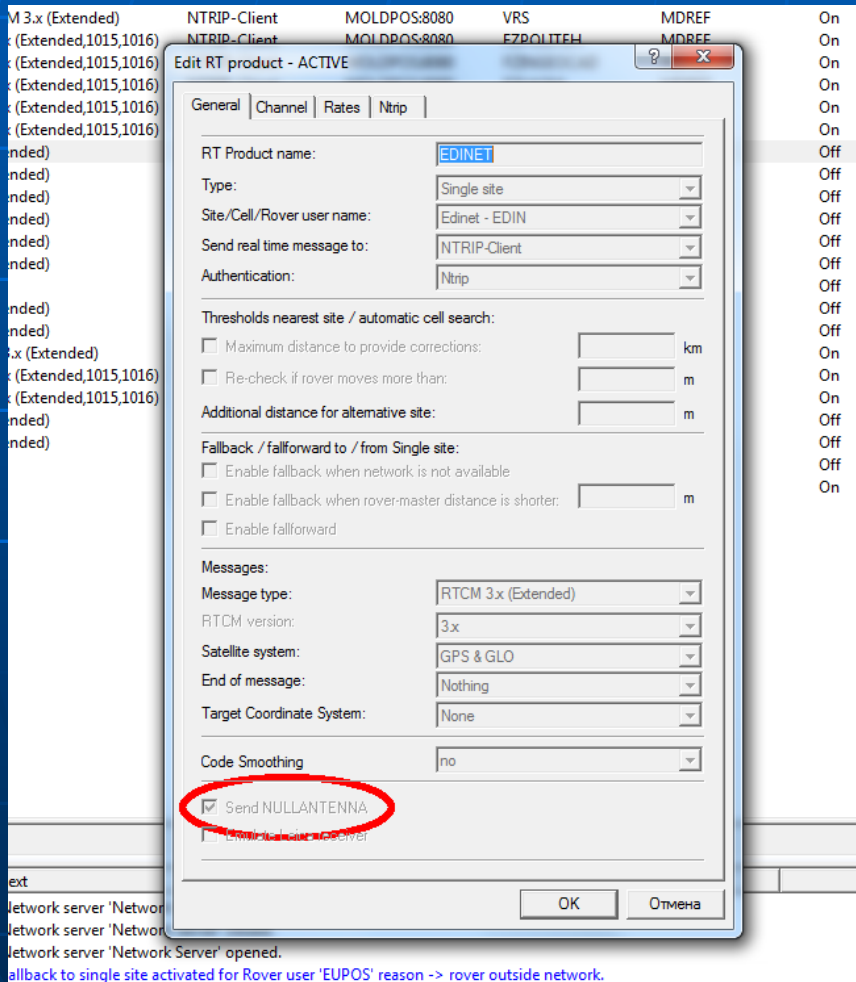
Total 233 stations:

- 24 non-Ukrainian EPN
- 11 Ukrainian EPN
- 191 Ukrainian non-EPN
- 7 Moldavian non-EPN

MAO & MA2 (IGb08)



MAO & MA2 (IGb08)

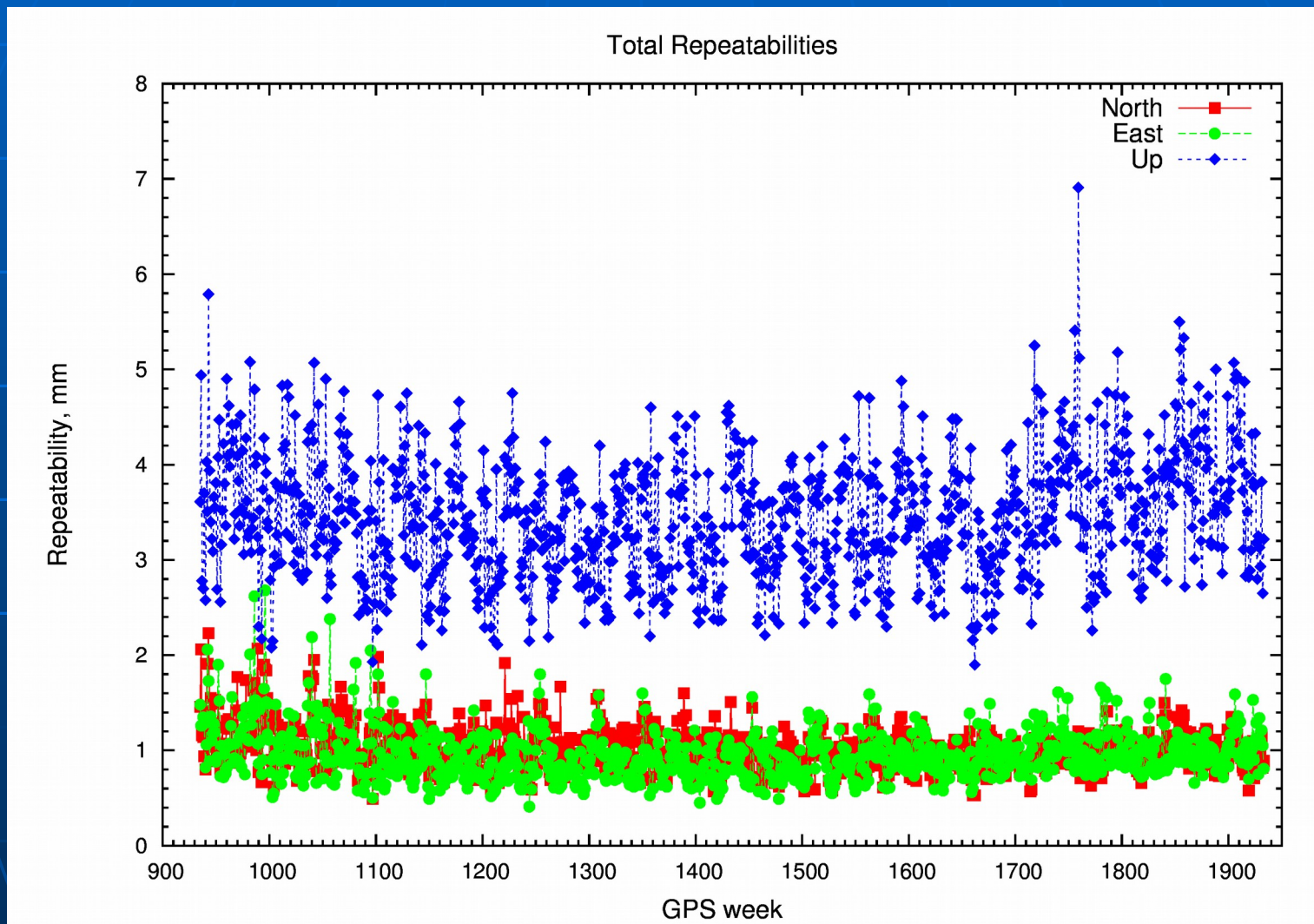


Data for all Moldavian non-EPN stations were received from streams with active *NULLANTENNA* option but processed as equipped with *LEIAR10* antenna without radome.

MAO & MA2 (IGb08)

Satellite systems:	GPS+GLONASS
Ephemerides:	CODE
Earth rotation parameters:	CODE
Ocean tidal loading:	FES2004
Atmospheric tidal loading:	applied
Ionosphere model:	CODE
Troposphere model:	GMF

MAO & MA2 (IGb08)



Mean (N/E/U): 1.01 mm / 0.95 mm / 3.45 mm

MAO & MA2 (IGb08)

Products:

- MA[O2]www7.SNX – weekly SINEX file (NEQ)
- MA[O2]www7C.SNX – weekly SINEX file (COV)
- MA[O2]www7.SUM – weekly summary
- MA[O2]www7d.TRO – daily troposphere solution

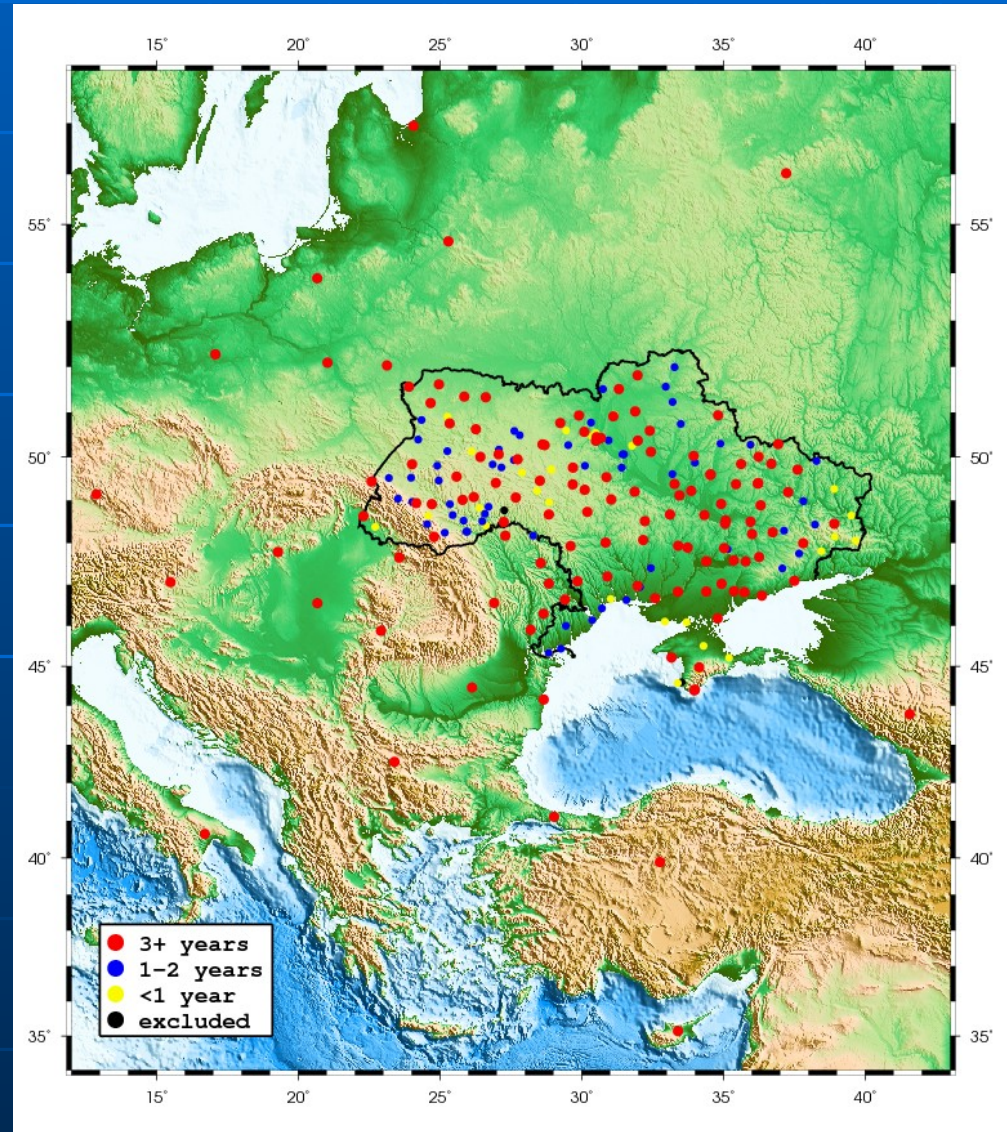
Available at

<ftp://ftp.mao.kiev.ua/pub/gnss/products/IGb08/>

Velocities Estimation (IGb08)

233 stations:

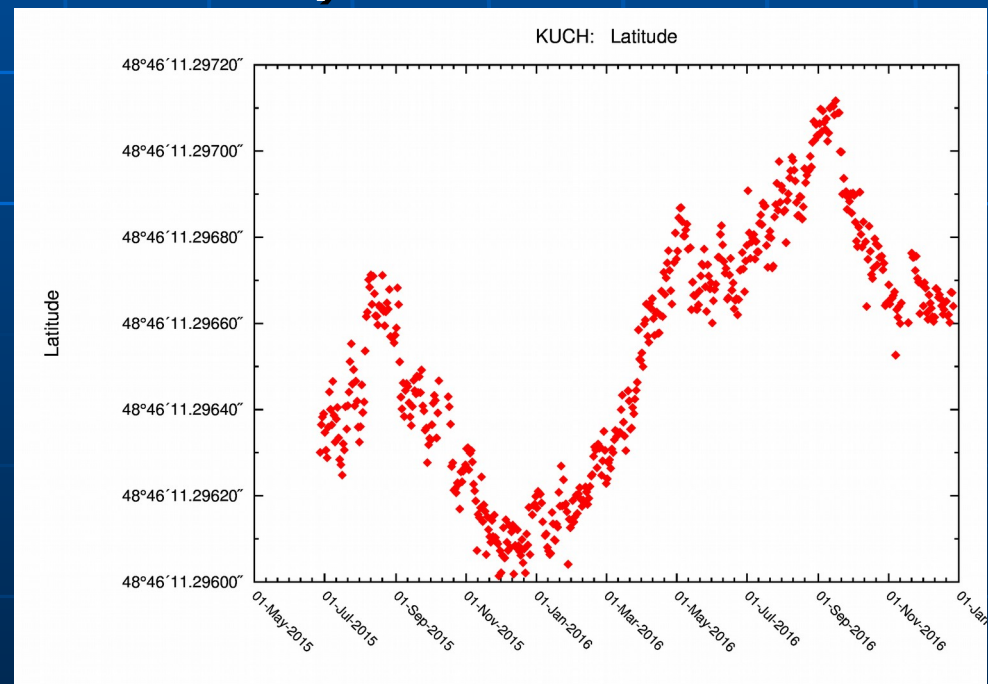
- 352 coordinates sets (3+ years: 166 sets, 1-2 years: 92 sets, <1 year: 94 sets)
- 4 coordinates sets excluded
- 242 velocities sets



Velocities Estimation (IGb08)

Excluded sets:

- KUCH 00000M000 (strange behaviour)
- LAMA212209M001 (EPN_discontinuities.snx)
- ORH2 00000M000 (only 2 days)
- SVRS 00000M000 (<3 weeks)



Velocities Estimation (IGb08)

Number of weeks: 999

(GPS weeks 935-1933)

Number of days: 6993

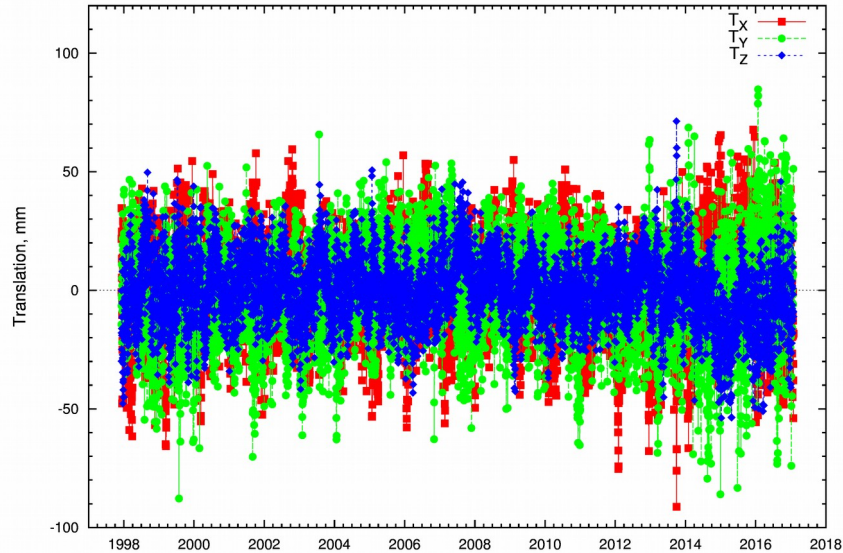
(07-DEC-1997 — 28-JAN-2017)

Total repeatability (N/E/U):

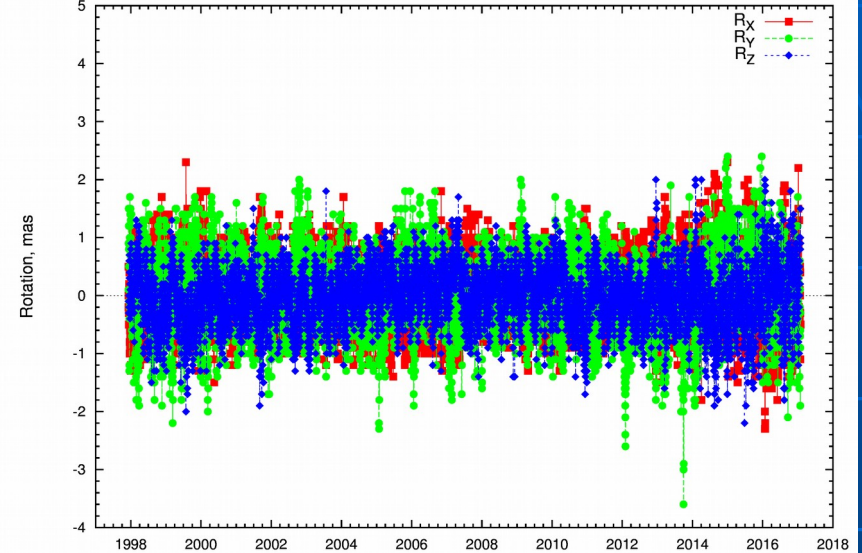
1.69 mm / 1.40 mm / 3.63 mm

Velocities Estimation (IGb08)

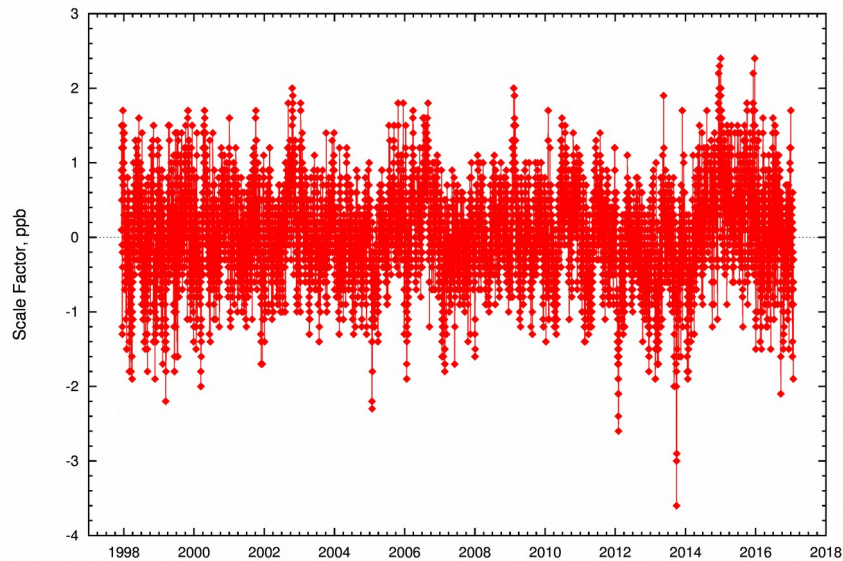
Helmert Transformation Parameters With Respect to Combined Solution: Translation



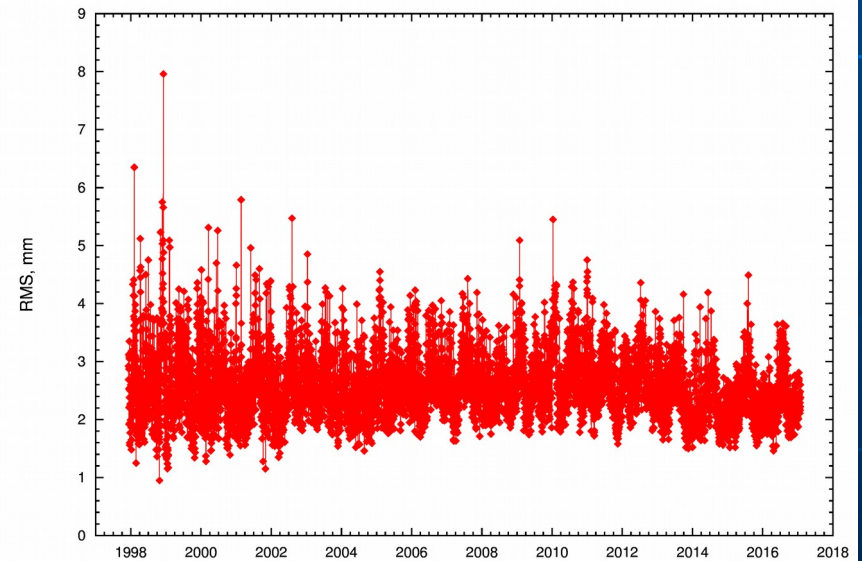
Helmert Transformation Parameters With Respect to Combined Solution: Rotation



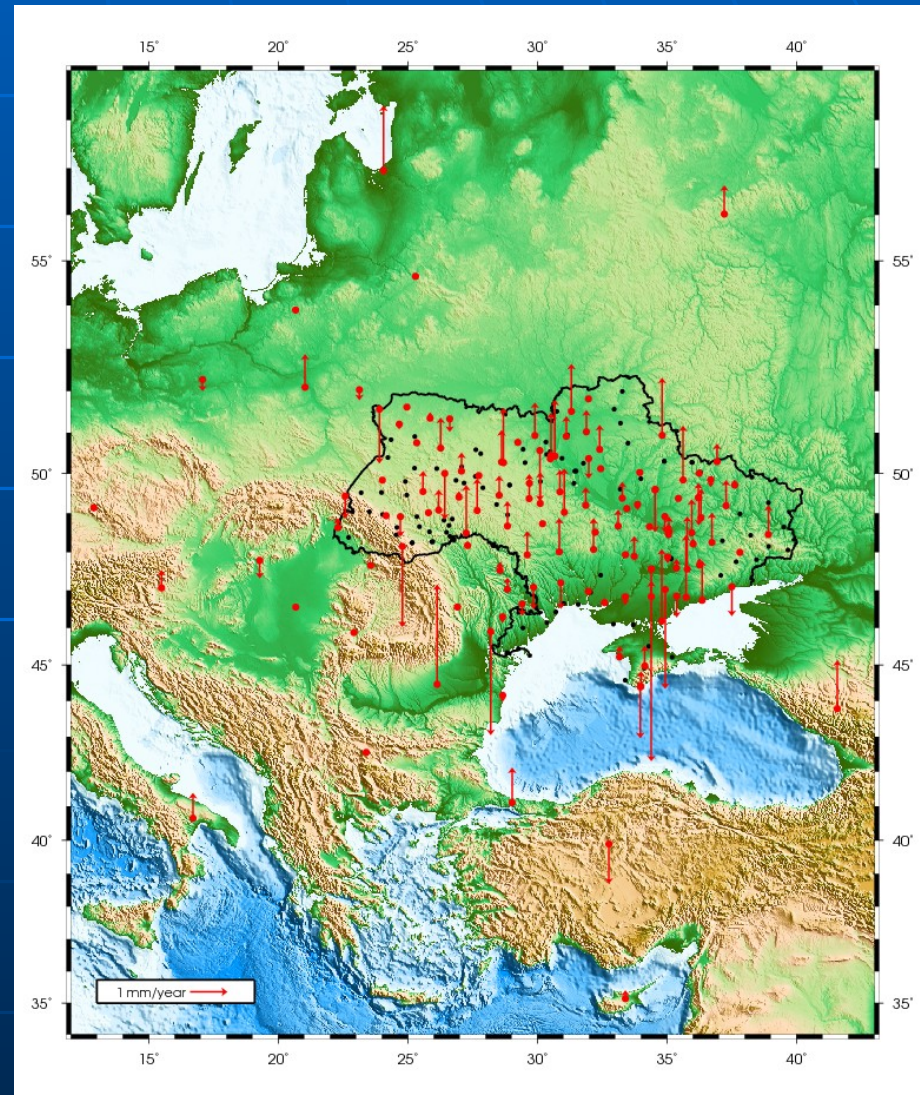
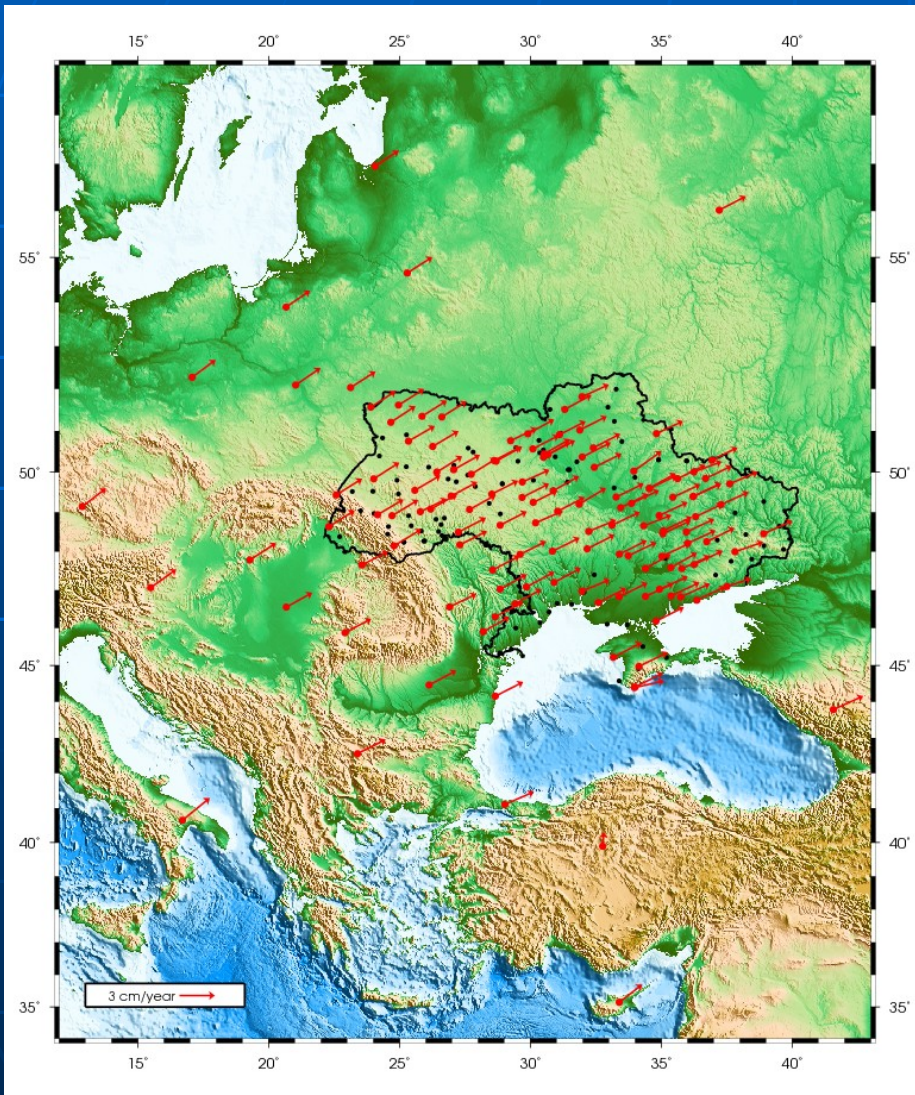
Helmert Transformation Parameters With Respect to Combined Solution: Scale Factor



Helmert Transformation Parameters With Respect to Combined Solution: RMS of Transformation



Velocities Estimation (IGb08)



Rapid daily processing

Bernese GNSS software:

5.0 (GPS weeks 1741-1851),

5.2 (GPS weeks 1852-...)

Reference frame:

IGb08 (GPS weeks 1741-1933),

IGS14 (GPS weeks 1934-...)

Ephemerides: IGV

Earth rotation parameters: IGU

Ionosphere model: COD.ION_U

Rapid daily processing

http://gnss.org.ua → TridentQC

The screenshot shows a web browser window displaying the System.NET website. The page features a navigation menu on the left, a main content area with a 'SINEX Data Analysis Summary' table, and a login form. The table lists various sites with their status, names, codes, and analysis results for the last 1 month and 2 years.

System Solutions

SpiderWeb

Home

- Site overview
- Register
- Forgotten Password
- Spider Business Center
- System.NET sites status
- TridentQC**

Login

User Name: *

Password: *

Remember me

*Required field

EN | UA

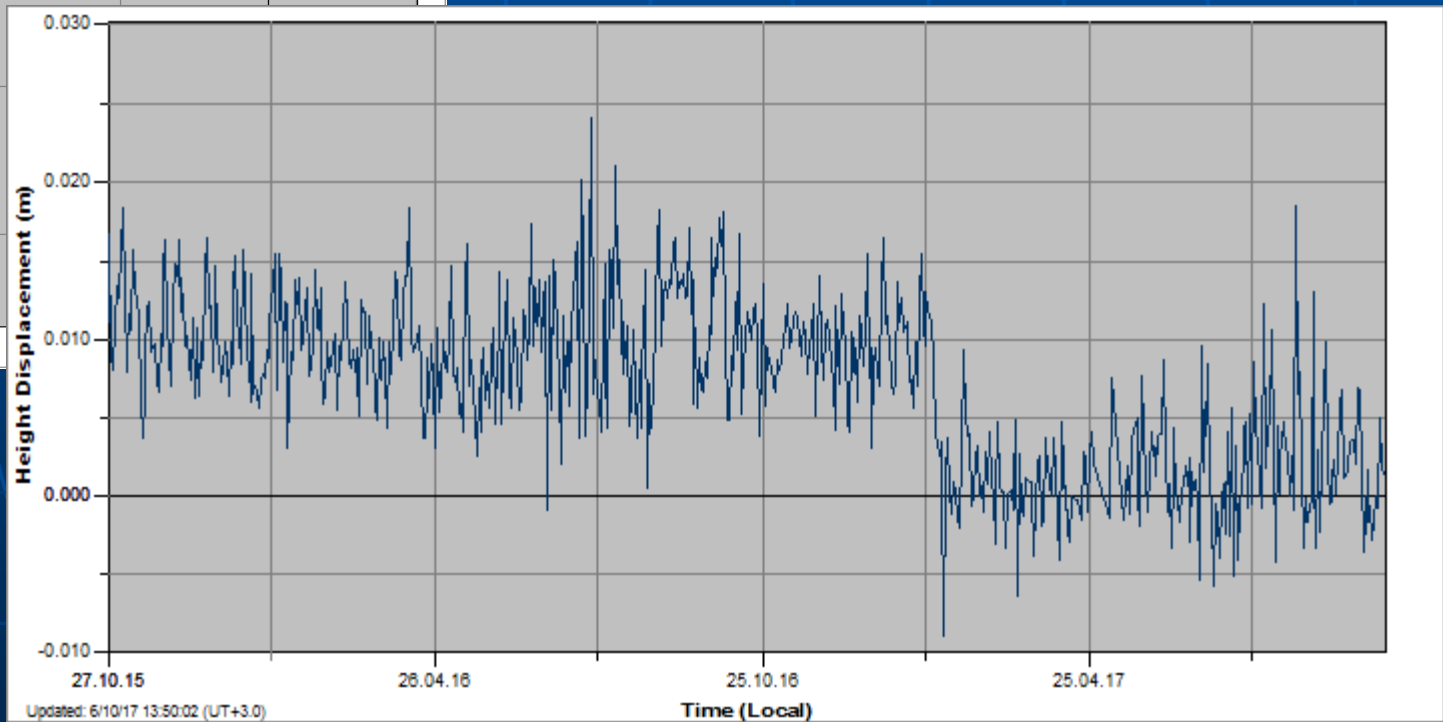
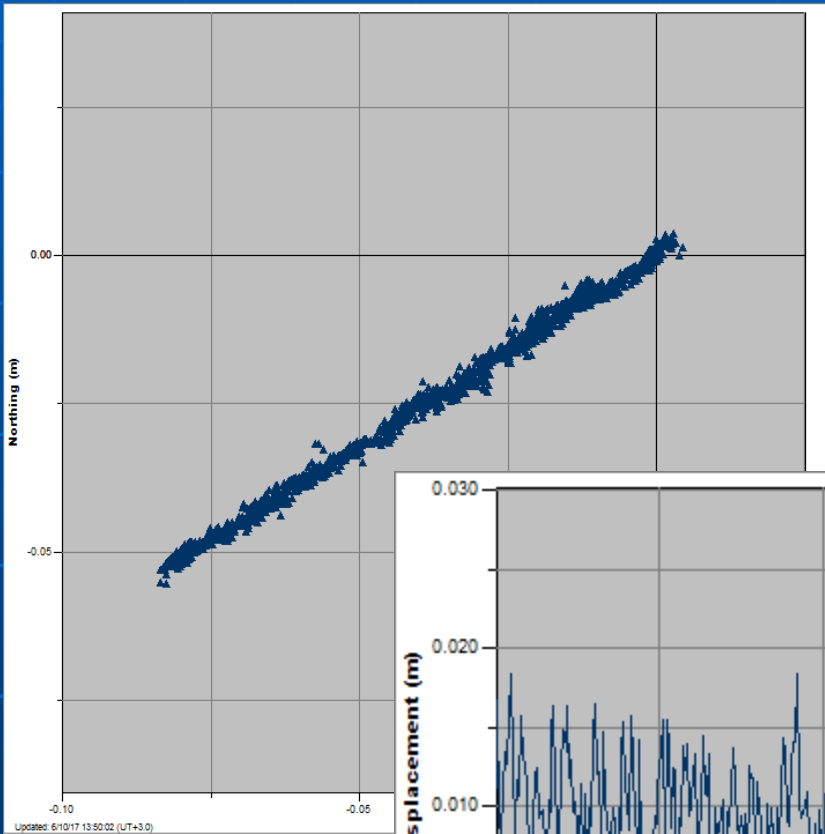
SINEX Data Analysis Summary

[Site Map \(2D Vector\)](#) | [Site Map \(Height Vector\)](#)

Status	Site Name	Site Code	Site Info	Solution Epoch	Δ Up	Δ North	Δ East	Results (1 Months)	Results (2 Years)
●	ALXN	ALXN (A)	i	2017/10/05 15:00:00	+0.002	+0.005	+0.003		
●	BALT	BALT (A)	i	2017/10/05 15:00:00	-0.006	+0.001	+0.005		
●	BAR9	BAR9 (A)	i	2017/10/05 15:00:00	-0.004	+0.002	+0.006		
●	BASH	BASH (A)	i	2017/10/05 15:00:00	+0.011	+0.002	+0.007		
●	BERZ	BERZ (A)	i	2017/10/05 15:00:00	-0.011	+0.004	+0.005		
●	BLGR	BLGR (A)	i	2017/10/05 15:00:00	-0.007	+0.003	+0.009		
●	BRGN	BRGN (A)	i	2017/10/05 15:00:00	-0.005	+0.004	+0.002		
●	BTRY	BTRY (A)	i	2017/10/05 15:00:00	+0.001	+0.005	+0.004		
●	BUCH	BUCH (A)	i	2017/10/05 15:00:00	-0.000	+0.001	+0.002		
●	CAHU	CAHU (A)	i	2017/10/05 15:00:00	-0.009	+0.002	+0.002		
●	CAUS	CAUS (A)	i	2017/10/05 15:00:00	-0.000	+0.002	+0.004		
●	CHNT	CHNT (A)	i	2017/10/05 15:00:00	-0.007	+0.003	+0.002		
●	CHRS	CHRS (A)	i	2017/10/05 15:00:00	+0.002	+0.003	+0.013		
●	CHUC	CHUC (A)	i	2017/10/05 15:00:00	-0.003	-0.004	-0.004		

Rapid daily processing

RIVN time series
(2 years)



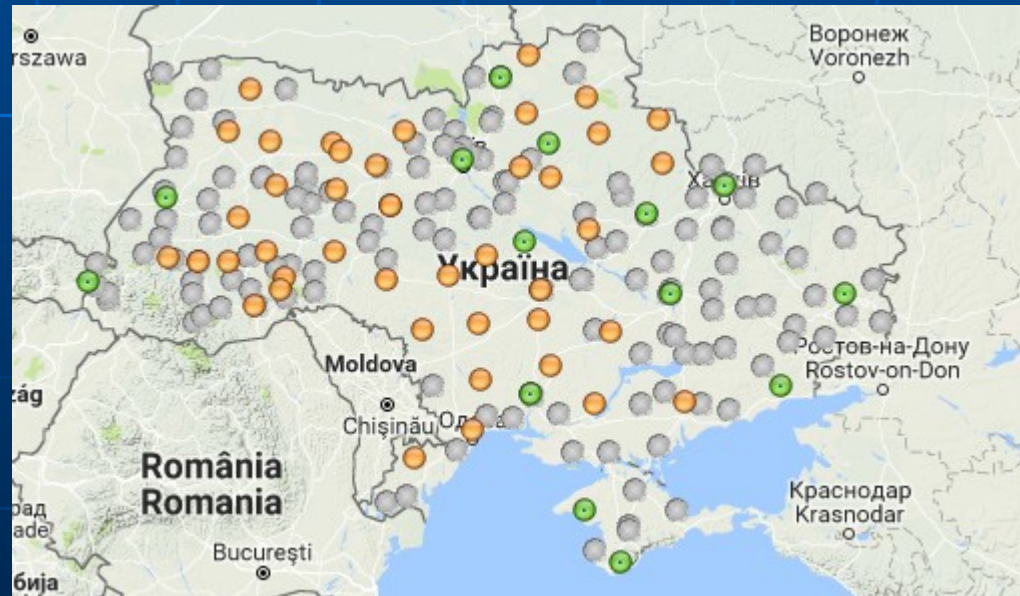
Regional and Local GNSS Campaigns

- GEODUC'95
- Simeiz/Katzively Test Area
 - 1994, -2001, -2004, -2009
- MAO Test Area-1997
- Vernadsky Research Base-2002
- CEGRN-2001, -2003, -2005, -2007,
-2009, -2011, -2013, -2015, -2017
- other

Other activity

Metadata collecting for Ukrainian stations:

- System.NET
- State Space Agency of Ukraine
- other (?)



Thank you!