Donostia - San Sebastian
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EPN Sites Long Term Verification

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Introduction

In this study, we review the process of alignment of the European Frame to IGb08 realized through successive cumulative solutions.

a) Helmert (3T+Sc) comparison of each Cxxxx to IGb08. (xxxx = 1710 : 1875 in steps of 15)
b) Helmert (3T+Sc) comparison of C1875 with the previous realizations.
c) Statistics of the differences of the CRDS/VELS of C1875 with the previous realizations.

We expect that the 4 Helmert parameters (3 translations and the scale factor):

For a) and b) converge to zero.

We expect for c) that the CRDS/VELS of previous realizations tend to coincide to the C1875 realization.

Work with coordinate files, not with SINEX files, as the Cumulative solution SINEX file appears incompatible with the BSW's ADDNQ2

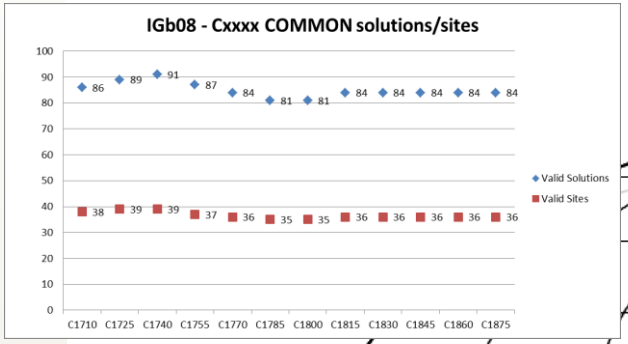
Analysis of the IGb08 Coordinates

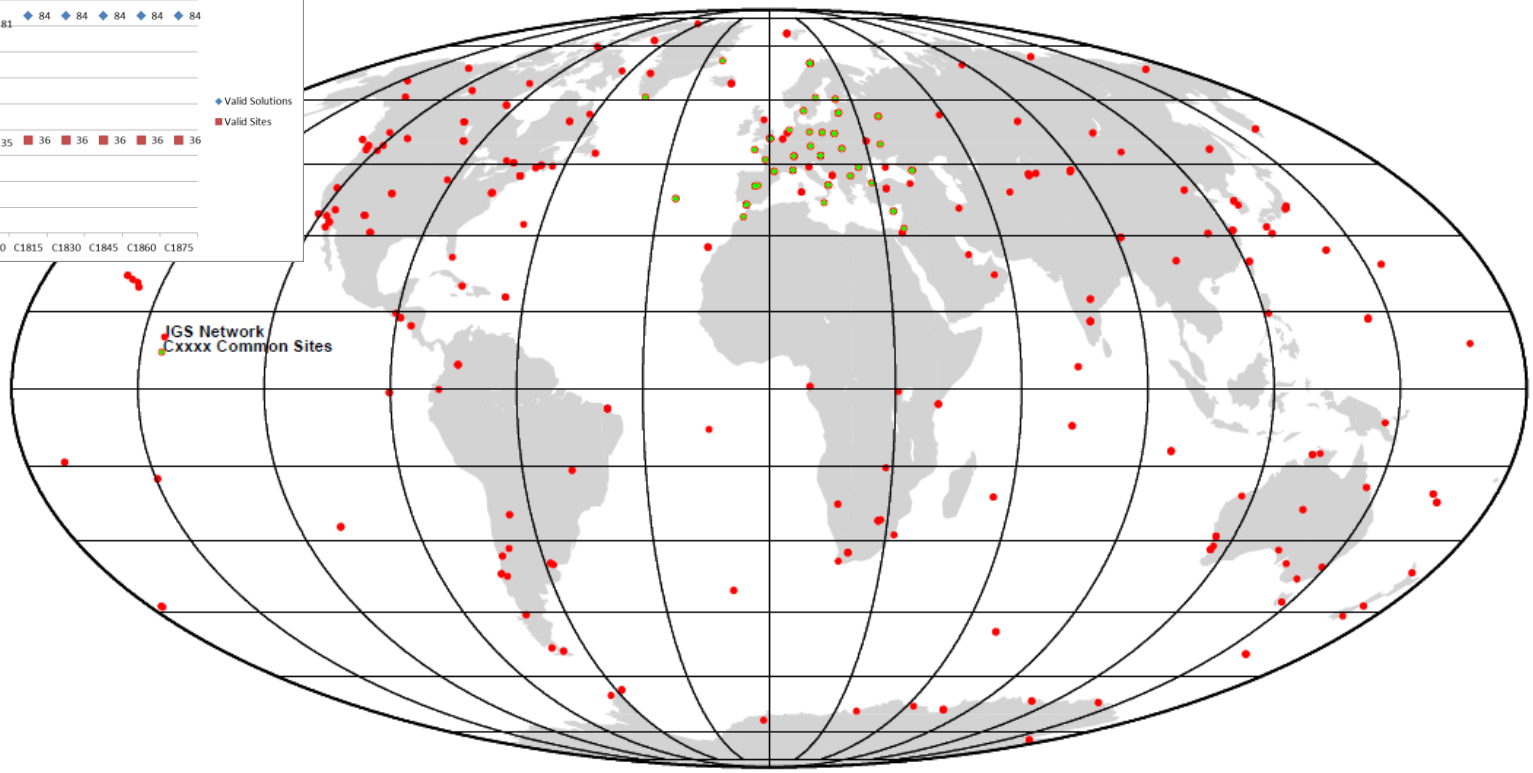
Files available at:

IGb08: ftp://igs-rf.ign.fr/pub/IGb08/IGb08.ssc

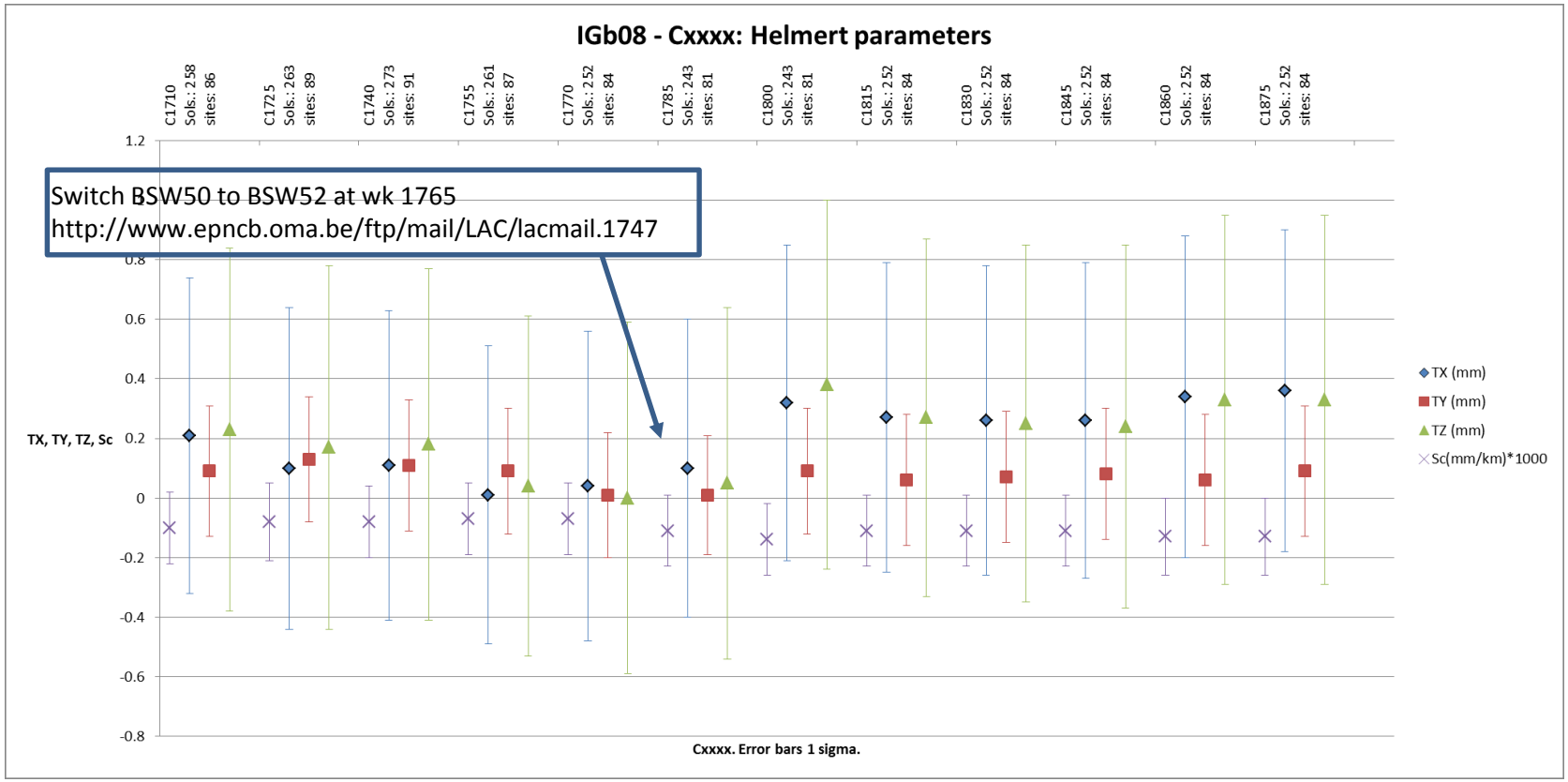
Cxxxx: ftp://epncb.oma.be/epncb/station/coord/EPN/EPN_A_IGb08_Cxxxx.SSC

The number of IGb08 – Cxxxx common sites has been constant since C1815 (36 sites).



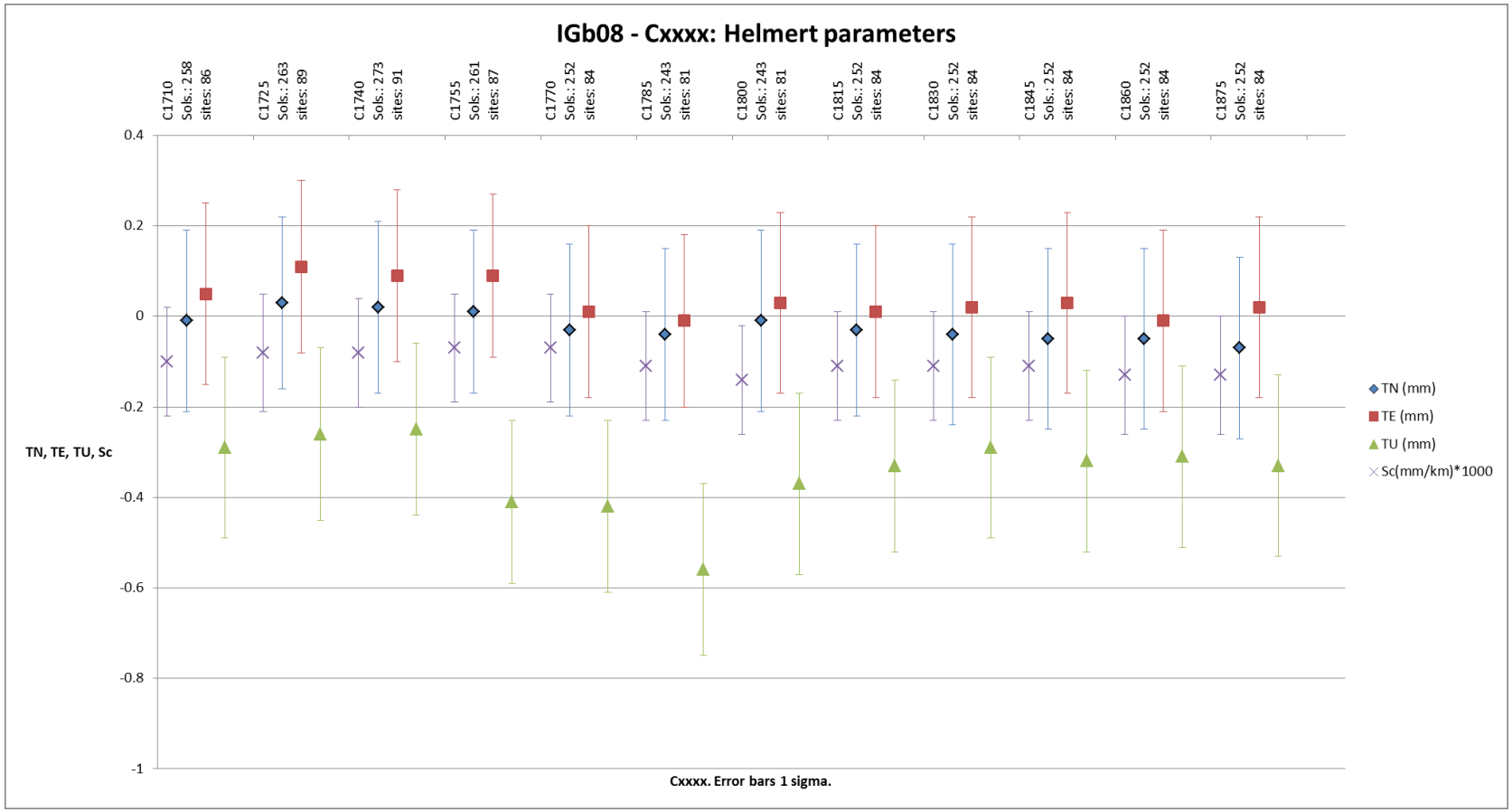


IGb08 and Cxxxx Comparison (XYZ)



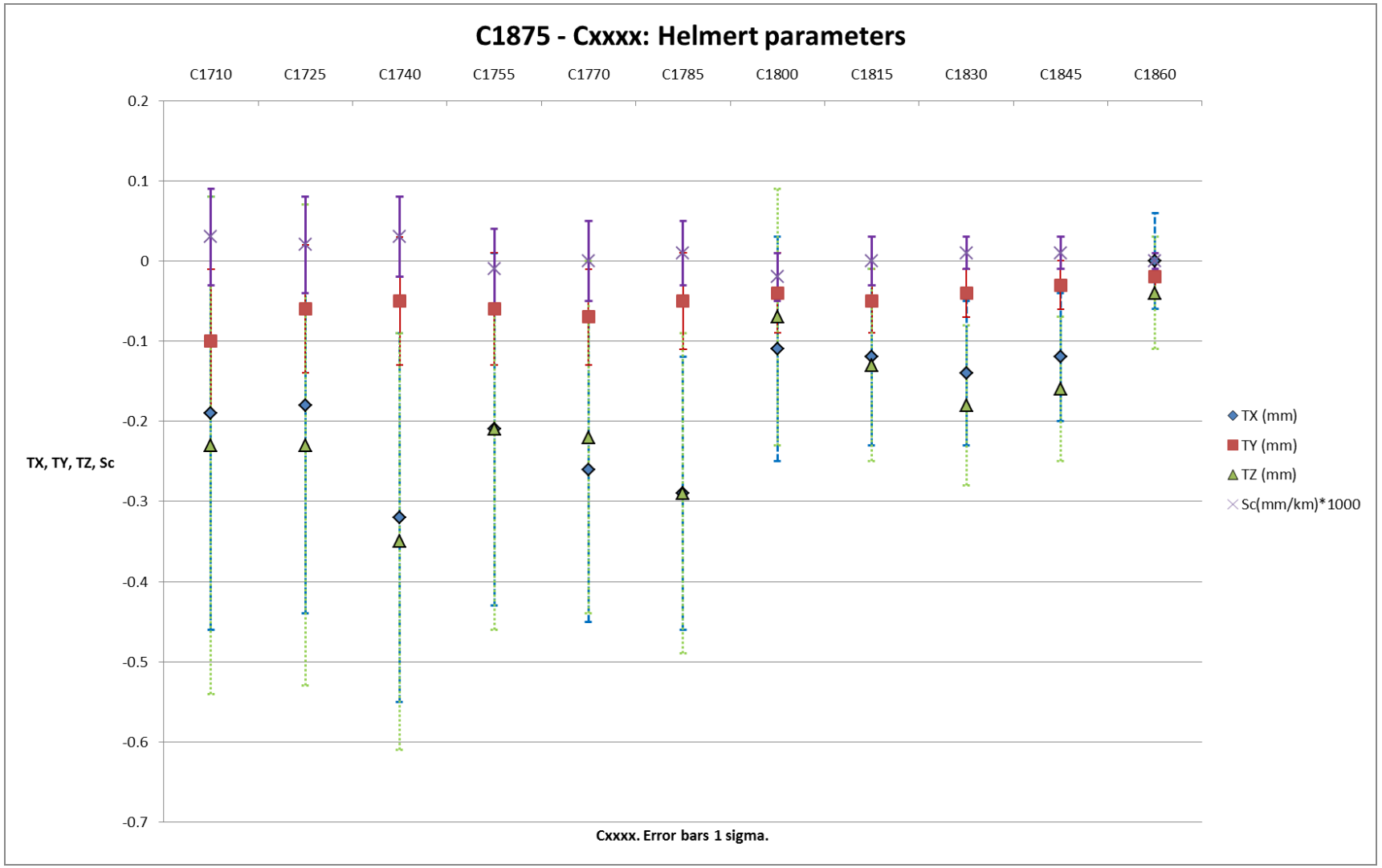
Sudden increase in TX, TZ between C1785 and C1800

IGb08 and Cxxxx Comparision (NEU)

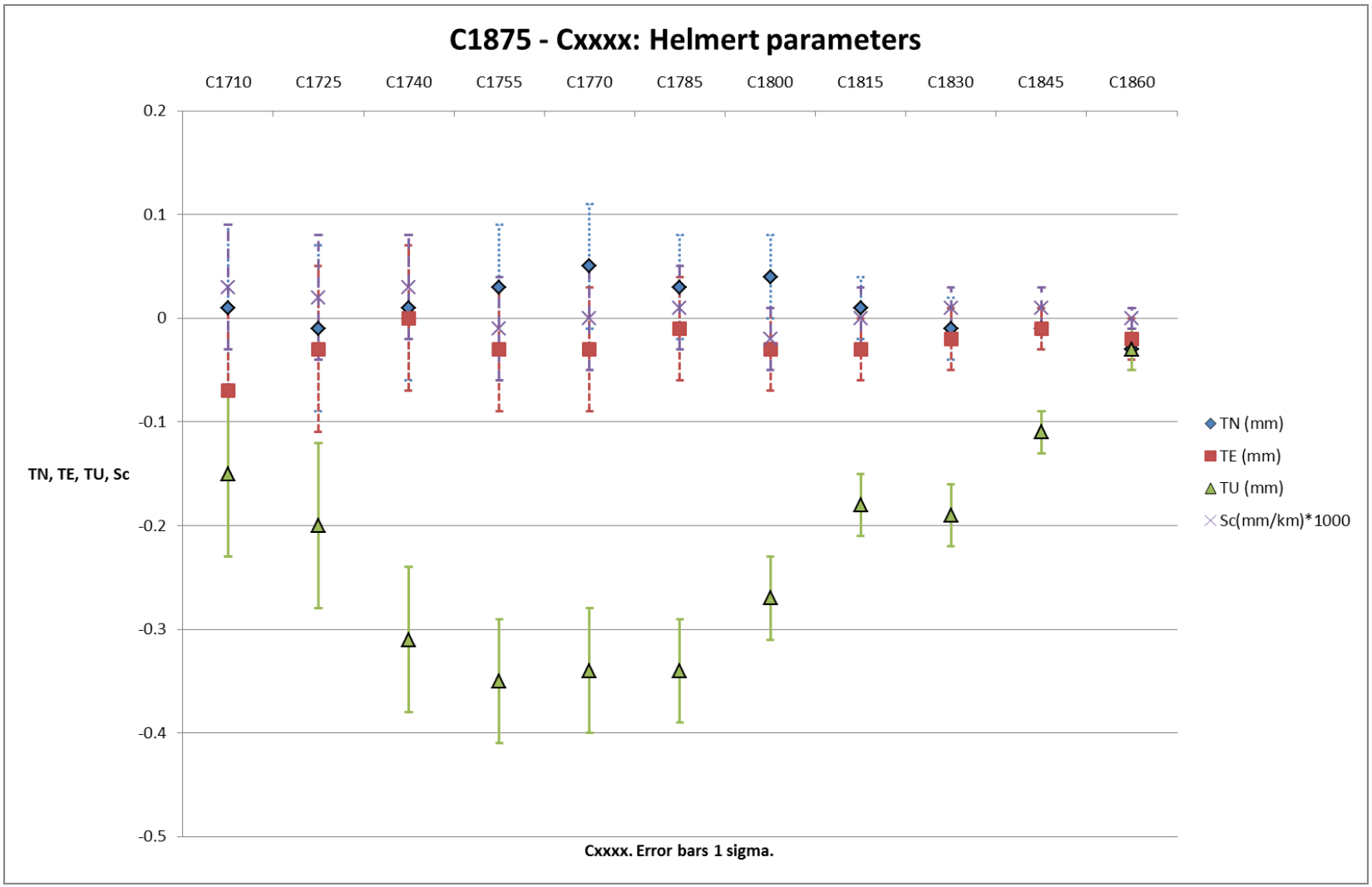


Conclusion: Cxxxx tracks IGb08 within 1 std. Only the Tu component appears marginal. A small but detectable jump in Tx, Tz is observed

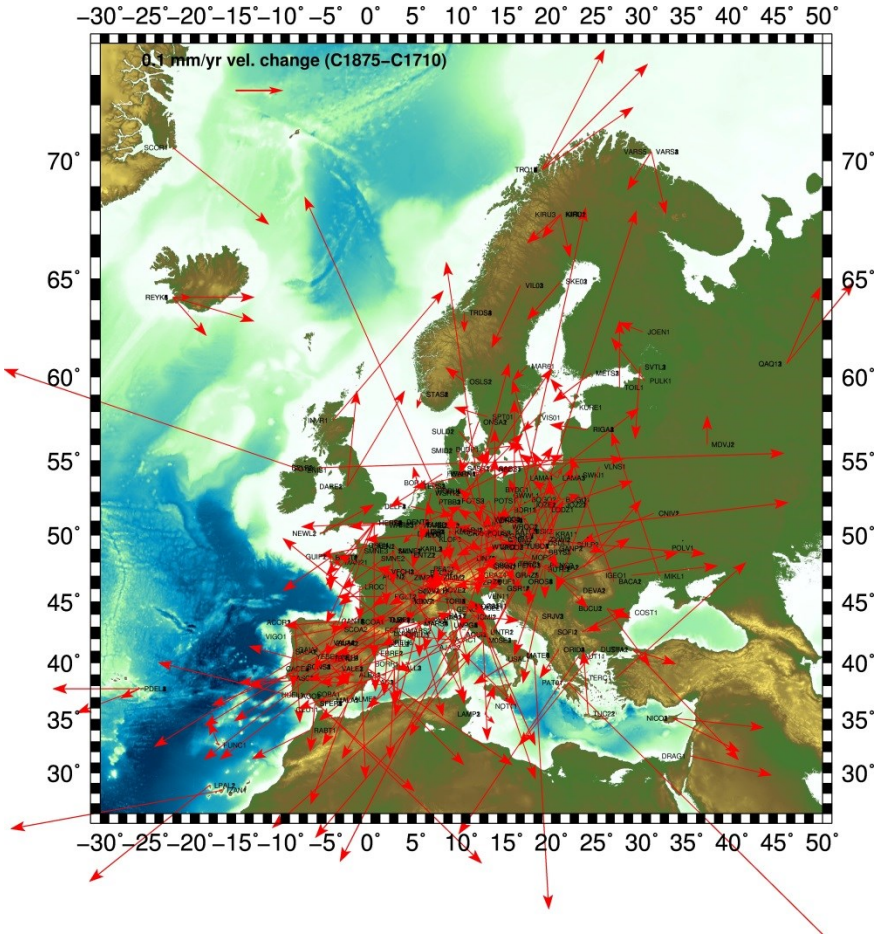
Convergence of Translations (TXYZ) and Scale factor

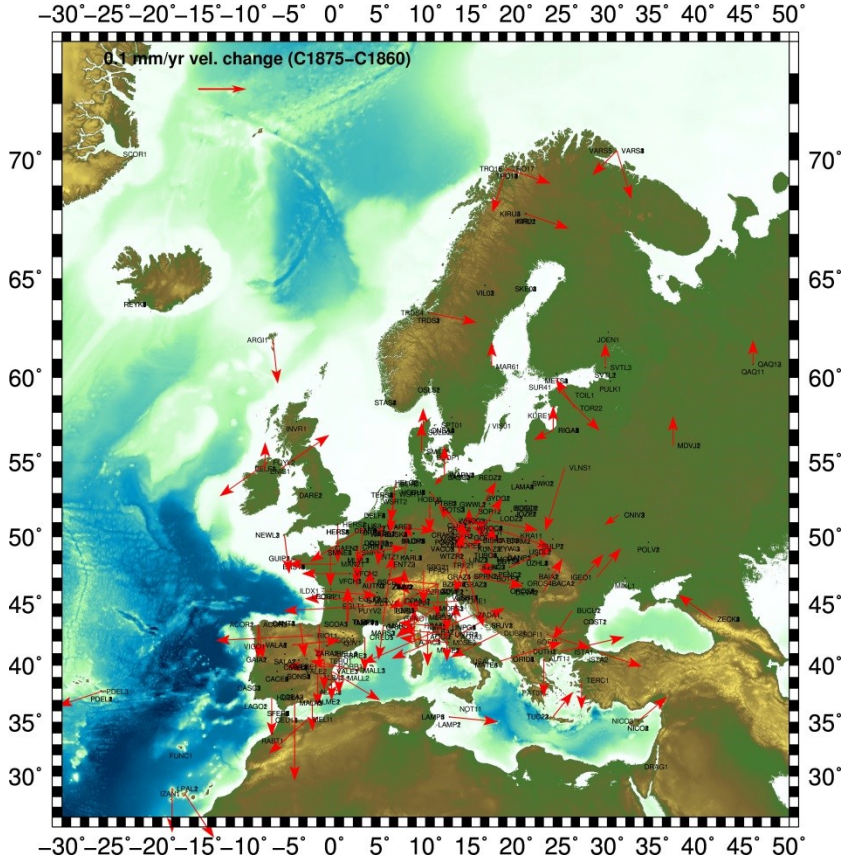


Convergence of Translations (NEU) and Scale factor

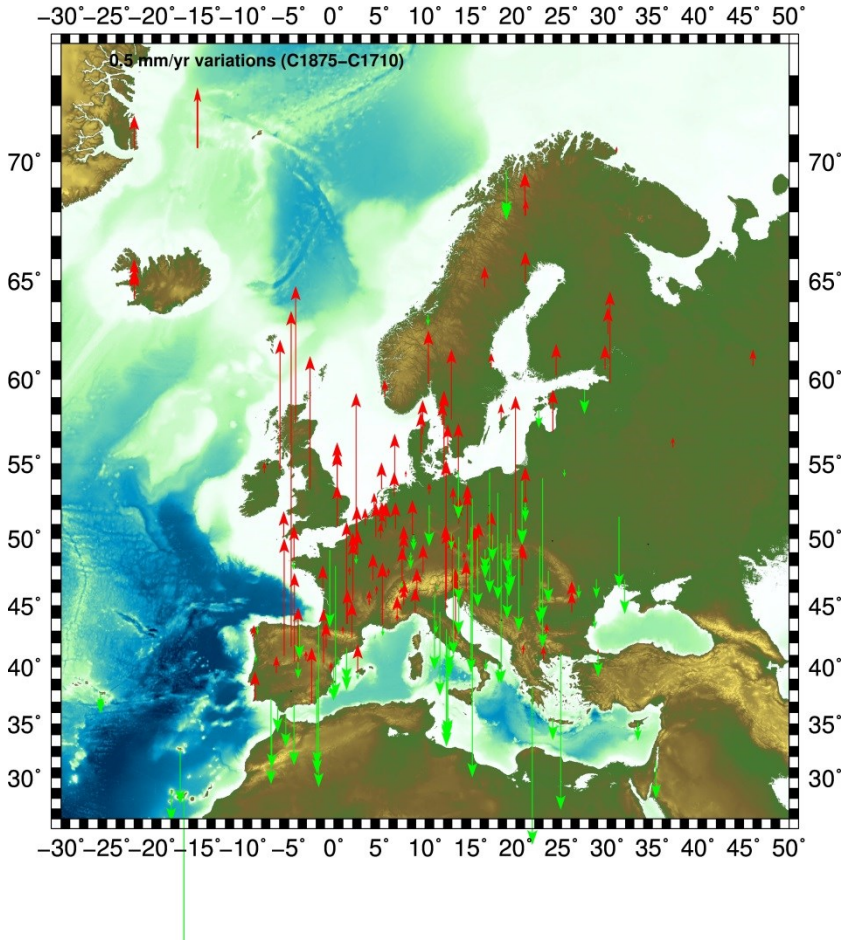


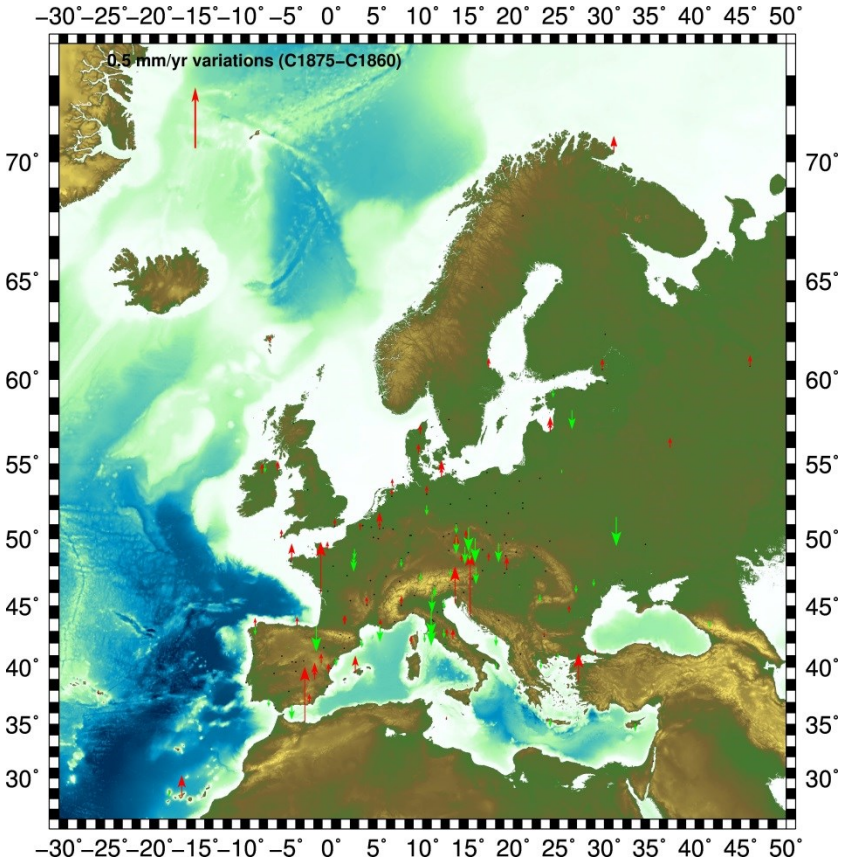
Differences in 2D VELs (C1875 compared to C1710 and C1860):





Differences in vertical velocities (C1875 compared to C1710 and C1860):





Analysis of the Coordinates

Major differences found (From C1875 to Cxxxx):

SITE ID	N	E	U	W/R Release
GWWL112225M001	-1.75	-0.93	-13.04	1710
GWWL112225M001	-2.72	-0.23	-10.89	1725
GWWL112225M001	-2.14	-0.35	-8.74	1740
GWWL112225M001	-0.83	-0.37	-7.22	1755
GWWL112225M001	-0.91	-0.53	-5.82	1770
GWWL112225M001	-1.21	0.15	-2.92	1785
GWWL112225M001	-0.56	0.15	-2.16	1800
GWWL112225M001	0.75	0.16	-0.65	1815
GWWL112225M001	0.00	0.00	0.00	1830
GWWL112225M001	0.00	0.00	0.00	1845
GWWL112225M001	0.00	0.00	0.00	1860
SMNE310001M007	-4.94	-7.48	18.83	1710
SMNE310001M007	-4.88	-7.53	18.83	1725
SMNE310001M007	0.88	2.75	-6.06	1755
SMNE310001M007	1.01	1.75	-6.16	1770
SMNE310001M007	1.78	1.89	-6.80	1785
SMNE310001M007	1.04	0.61	-4.85	1800
SMNE310001M007	0.28	0.47	-4.21	1815
SMNE310001M007	0.27	0.47	-4.21	1830
SMNE310001M007	0.18	0.31	-2.81	1845
SMNE310001M007	-0.77	0.99	-0.65	1860
SMNE410001M007	0.86	3.89	-7.36	1755
SMNE410001M007	1.74	3.04	-8.11	1770
SMNE410001M007	1.88	2.05	-8.20	1785
SMNE410001M007	1.88	0.91	-6.90	1800
SMNE410001M007	1.03	0.62	-4.85	1815
SMNE410001M007	0.27	0.47	-4.21	1830
SMNE410001M007	0.81	1.45	-3.35	1845
SMNE410001M007	-0.03	1.14	-1.30	1860

Statistics (including 0s, 5414 elements):

	N (mm)	E (mm)	U(mm)
Mean	0.01	-0.02	-0.22
Min	-4.94	-7.53	-13.04
Max	5.56	4.55	18.83
Std	0.66	0.62	1.71

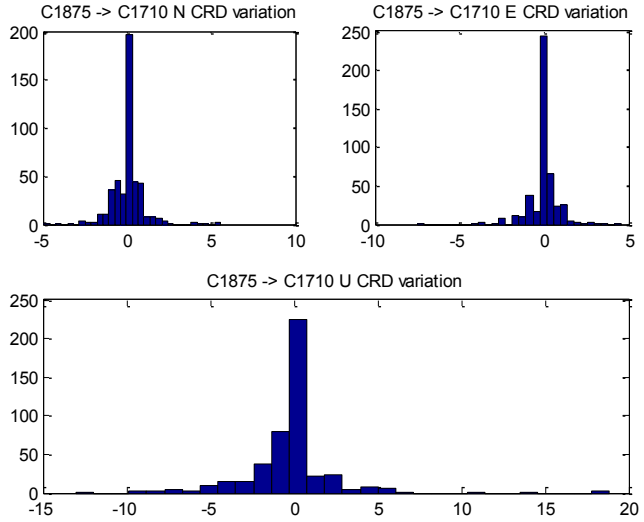
Statistics (no 0s, 2722 elements):

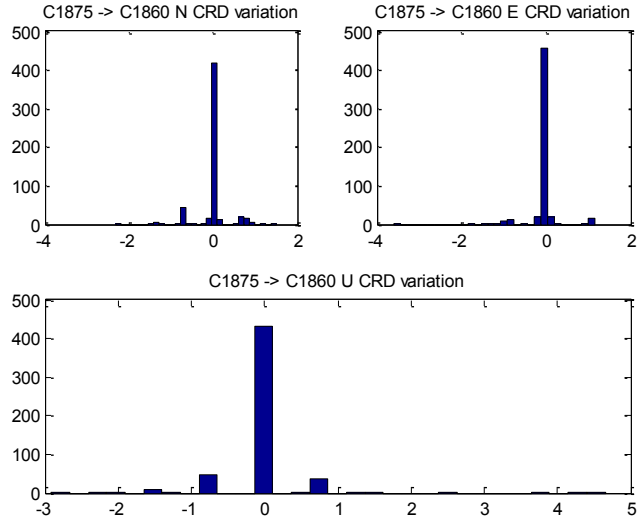
	N (mm)	E (mm)	U(mm)
Mean	0.02	-0.05	-0.44
Min	-4.94	-7.53	-13.04
Max	5.56	4.55	18.83
Std	0.63	0.59	1.63

Statistics of the first and last differences (in mm):

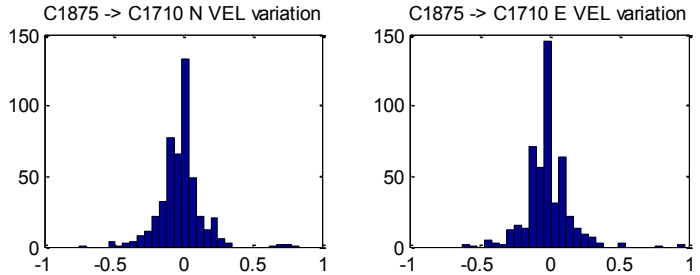
C1710	N (mm)	E (mm)	U (mm)
Mean	0.01	-0.07	-0.15
Min.	-4.94	-7.48	-13.04
Max.	5.56	4.55	18.83
STD.	0.97	0.90	2.62

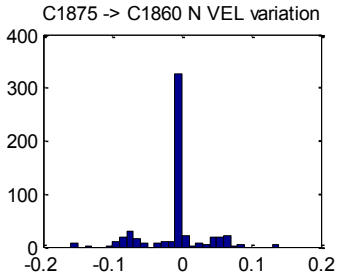
C1860	N (mm)	E (mm)	U (mm)
Mean	-0.03	-0.02	-0.03
Min.	-2.30	-3.59	-2.91
Max.	1.49	1.14	4.65
STD.	0.34	0.32	0.56

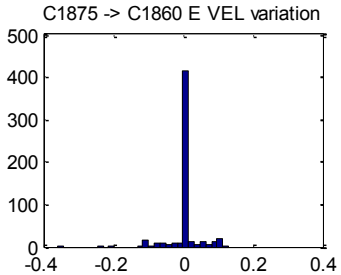


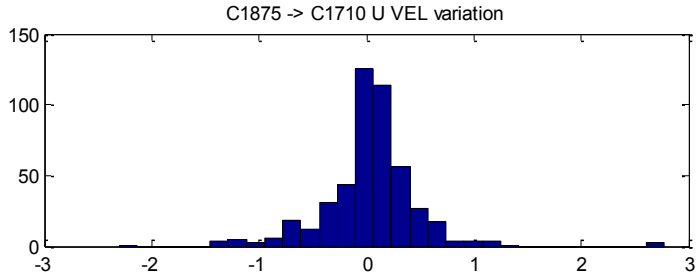


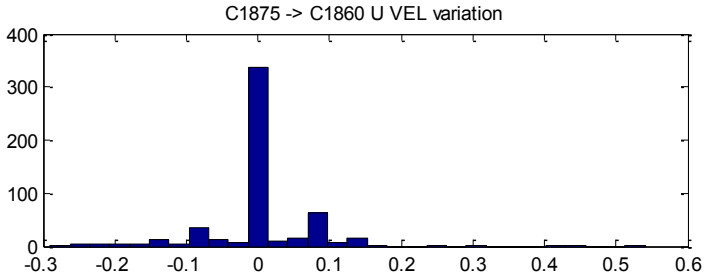
Differences for the NEU velocities (in mm/yr)



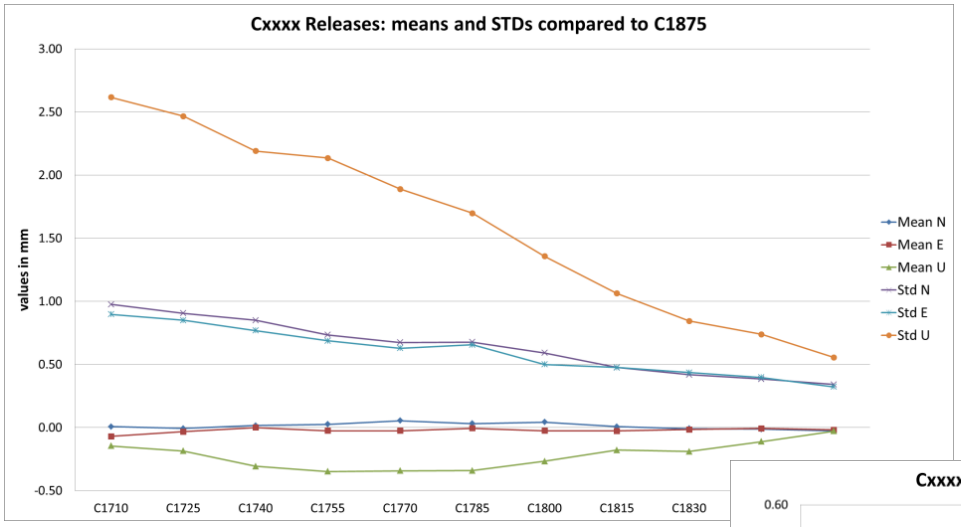


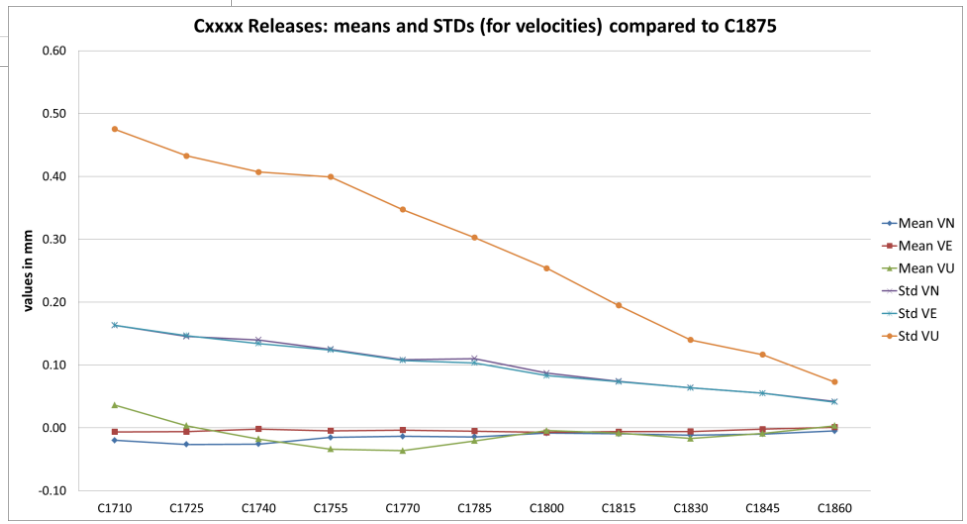




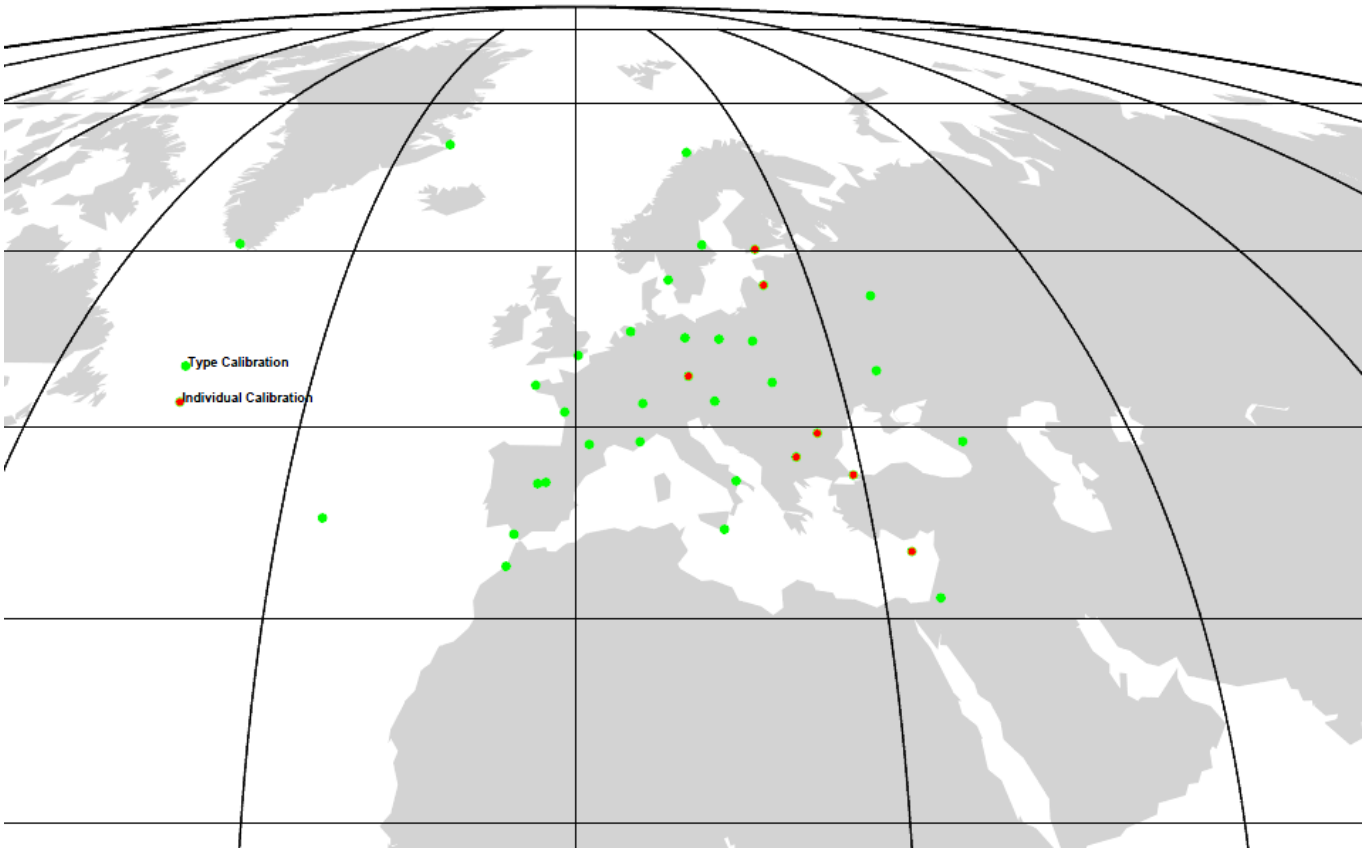


Statistics of the Full set differences (agreement with C1875, CRDs and VELs):

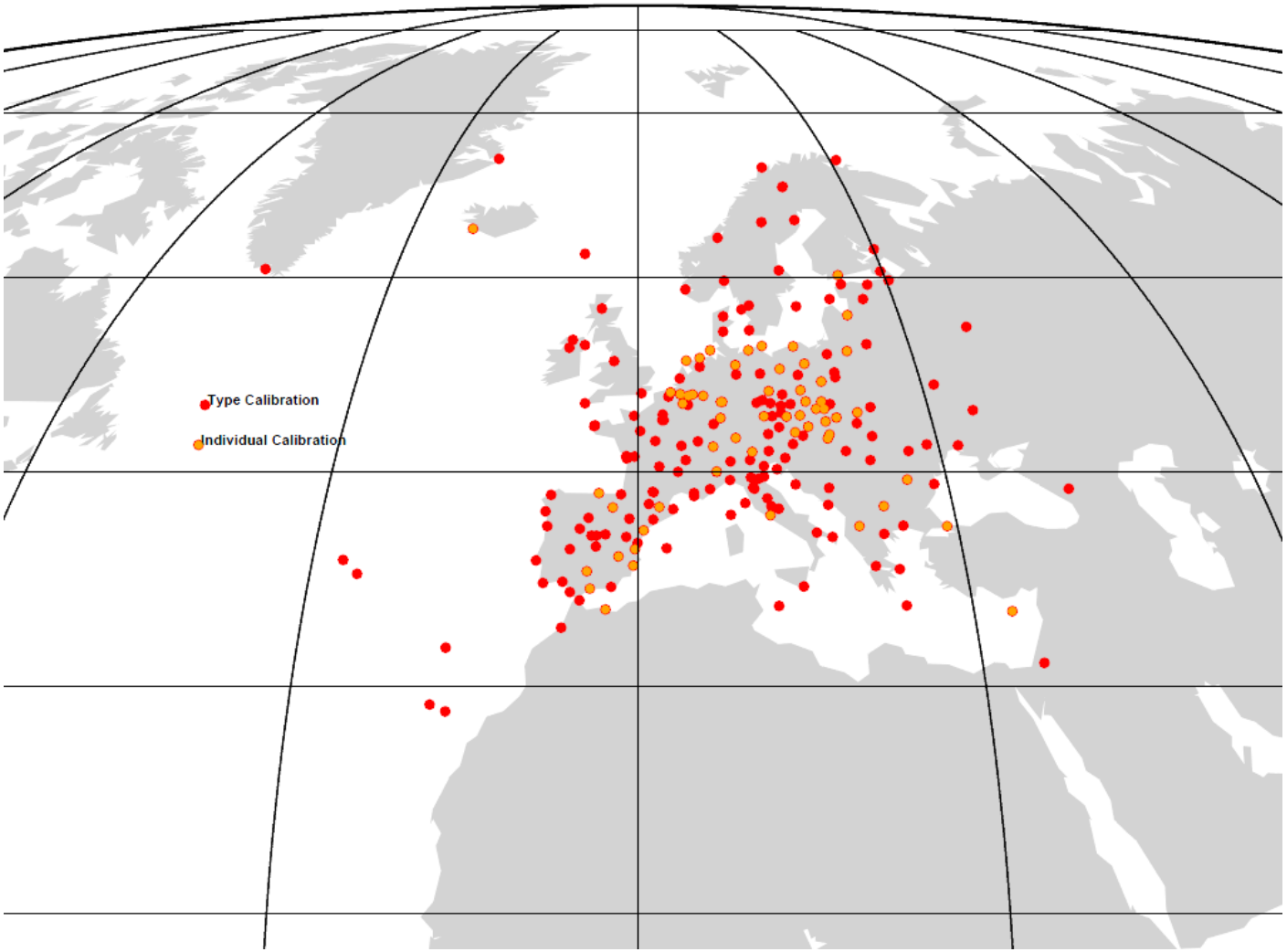




IGb08 and Cxxxx: TYPE(green)/Individual (red) calibration sites: common IGb08/EPN_A sites are processed in the IGb08 and EPN with different antenna models



Cxxxx: TYPE/Individual calibration sites



IGb08 and Cxxxx: TYPE/Individual calibration sites

C1710:

NAME	NEU RESIDUALS IN MILLIMETERS		
ANKR420805M002	1.32	0.20	-1.98
ANKR520805M002	0.06	0.60	0.71
ANKR620805M002	0.03	-1.55	-1.65
BUCU111401M001	0.09	-0.35	1.40
BUCU211401M001	-1.22	3.95	-1.98
ISTA220807M001	-0.07	-0.55	-0.22
METS110503S011	-0.08	0.22	0.09
NICO114302M001	-1.41	0.49	2.59
NICO214302M001	0.17	1.15	3.21
NICO314302M001	2.56	0.28	-0.19
RIGA112302M002	-1.27	0.22	-5.26
RIGA212302M002	-0.30	0.66	-2.00
RIGA312302M002	-0.11	-0.25	-0.96
RIGA412302M002	0.26	0.34	-0.36
SOFI111101M002	-0.17	0.66	2.66
SOFI211101M002	1.52	-1.29	8.87
WTZR114201M010	0.21	-0.64	-1.18
WTZR214201M010	-0.51	-0.11	-2.94

C1875:

NAME	NEU RESIDUALS IN MILLIMETERS		
BUCU111401M001	-0.78	0.50	2.19
BUCU211401M001	-1.84	4.02	-2.68
ISTA220807M001	0.61	-0.47	0.57
METS110503S011	0.01	0.28	0.13
NICO114302M001	-1.58	1.54	2.74
NICO214302M001	0.14	1.23	3.24
NICO314302M001	1.92	0.40	-0.90
RIGA112302M002	-1.14	0.30	-5.23
RIGA212302M002	-0.05	-0.25	-2.08
RIGA312302M002	-0.02	-0.19	-0.93
RIGA412302M002	0.34	0.40	-0.32
SOFI111101M002	-0.17	0.71	2.70
SOFI211101M002	0.84	-1.27	8.15
WTZR114201M010	0.28	-0.59	-1.14
WTZR214201M010	-0.43	-0.06	-2.91

The impact of the type/individual antenna calibrations is below 10 mm in the U component and below 1 mm in the N component reaching to 4 mm for the E component. In all cases, these differences are below our threshold (10 mm in any component).

Source to get the individual calibration sites: epncb website.

Conclusions and Recommendations

- IGb08 vs Cxxxx: TN TE Sc within 0.1mm, 0.1 mm, 0.1 ppb; TU shows systematics
- C1875 vs previous Cxxxx: TN TE Sc converge to zero difference, TU has a bell shaped behavior with a peak about C1785, then converges.
- CRD/VEL: evident increase in stability/repeatibility of the most recent solutions relative to the earlier solutions.

- Recommendations
  - Check agreement between Igb and Cxxxx solution numbers (e.g. BRST has a mismatch)
  - Make the Cxxxx Sinex usable with e.g. ADDNQ2, so that the analysis can be based on fully populated varcov matrices, rather than on coordinates.