



EPN Re-Processing 1

- Combination of Pilot Solutions -

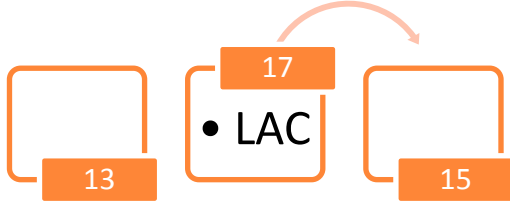
Heinz Habrich, EPN Analysis Coordinator
Federal Agency for Cartography and Geodesy



- Combination of weekly and daily re-processed solutions
- Comparing two series of weekly solutions
- Investigation of datum definition by applying ITRF2005 versus ITRF2008



Summary of Solutions



Selected time window:

First session 2006 - 0010
(Week.d 1356.0)
Last session 2006 - 3650
(Week.d 1408.0)

Solution type: WEEKLY

LAC	#Sol.	#Gaps	Integrity
BE0	53	0	100.0%
GO0	53	0	100.0%
IG0	53	0	100.0%
IN0	52	1	98.1%
LP0	53	0	100.0%
MU0	53	0	100.0%
MU_	52	1	98.1%
NK0	52	1	98.1%
OL0	52	1	98.1%
SG0	51	2	96.2%
SU0	53	0	100.0%
UP0	53	0	100.0%
WU0	53	0	100.0%
EU0	53	0	100.0%

Missing solutions:

IN0	1408	MU_	1408
NK0	1408	SG0	1407 1408
OL0	1408		

Selected time window:

First session 2006 - 0010
(Week.d 1356.0)
Last session 2006 - 3650
(Week.d 1408.0)

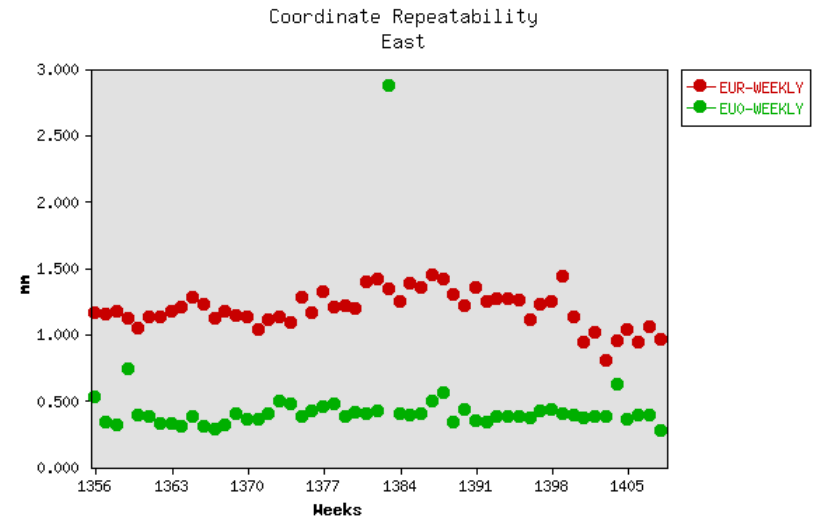
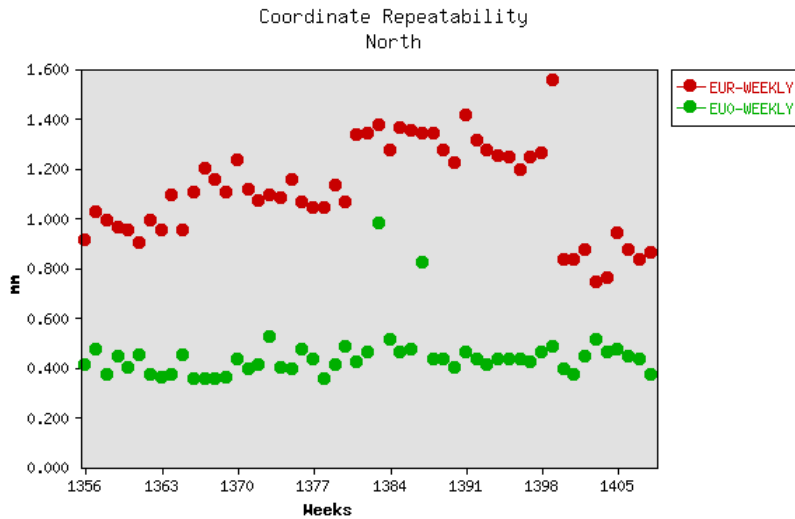
Solution type: DAILY

LAC	#Sol.	#Gaps	Integrity
AS_	365	0	100.0%
BE0	365	0	100.0%
DE0	14	351	3.8%
GO0	365	0	100.0%
IG0	365	0	100.0%
LP0	365	0	100.0%
MU0	364	1	99.7%
MU_	365	0	100.0%
NK0	365	0	100.0%
OL0	364	1	99.7%
RO0	365	0	100.0%
SG0	362	1	99.7%
SU0	365	0	100.0%
UP0	365	0	100.0%
WU0	365	0	100.0%
EU0	364	1	99.7%

Missing solutions: DE0 1358.0-1408.0
MU0 1365.5 SG0 1408.0
OL0 1408.0 EU0 1385.6



Coordinate Comparison LAC vs. Combined Solution (RMS)



Solution: EUR

Type: WEEKLY

Inspected solutions: 53

Median North: 1.10 mm

East: 1.17 mm

Height: 3.68 mm

Solution: EU0

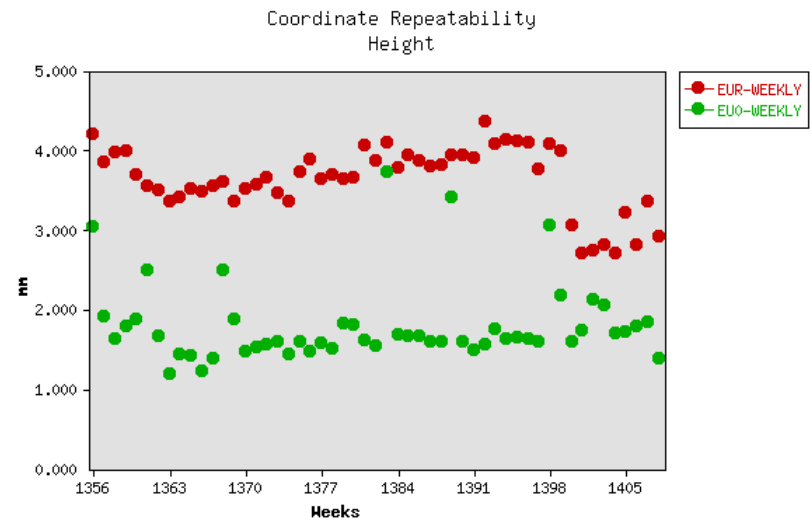
Type: WEEKLY

Inspected solutions: 53

Median North: 0.43 mm

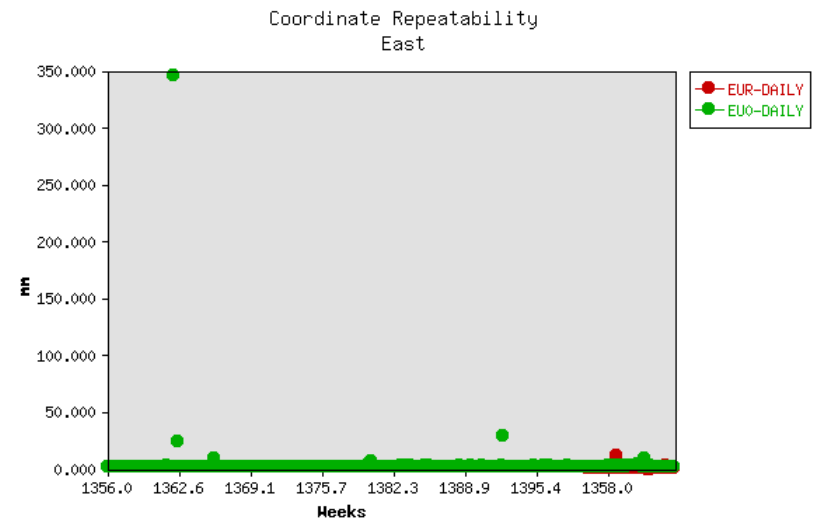
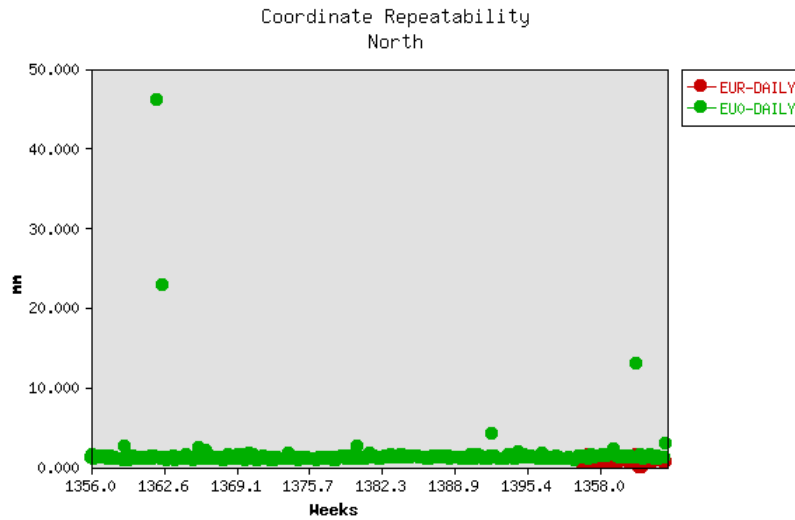
East: 0.39 mm

Height: 1.63 mm





Coordinate Comparison LAC vs. Combined Solution (RMS)



Solution: EUR

Type: DAILY

Inspected solutions: 57

Median North: 0.66 mm

East: 0.68 mm

Height: 3.74 mm

Solution: EU0

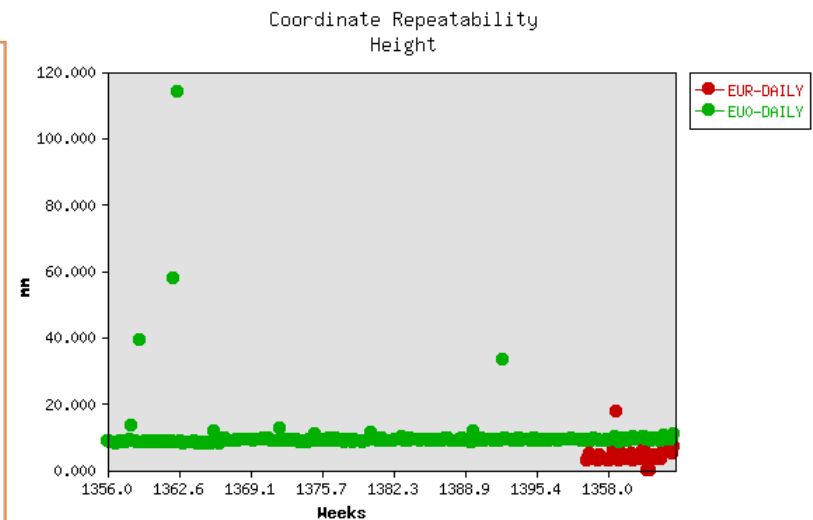
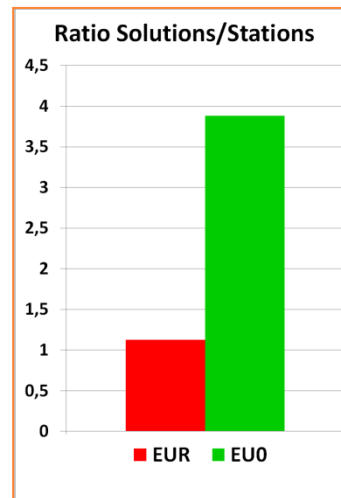
Type: DAILY

Inspected solutions: 365

Median North: 1.11 mm

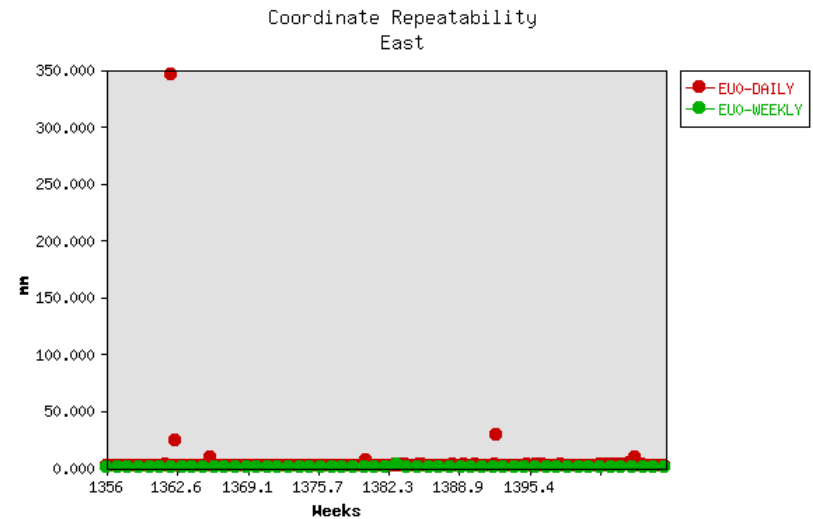
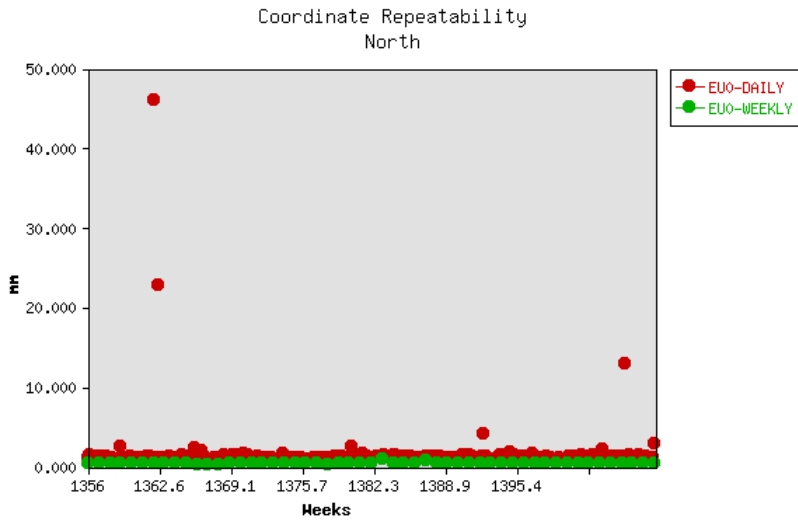
East: 1.89 mm

Height: 8.90 mm





Coordinate Comparison LAC vs. Combined Solution (RMS)



Solution: EU0

Type: DAILY

Inspected solutions: 365

Median North: 1.11 mm

East: 1.89 mm

Height: 8.90 mm

Solution: EU0

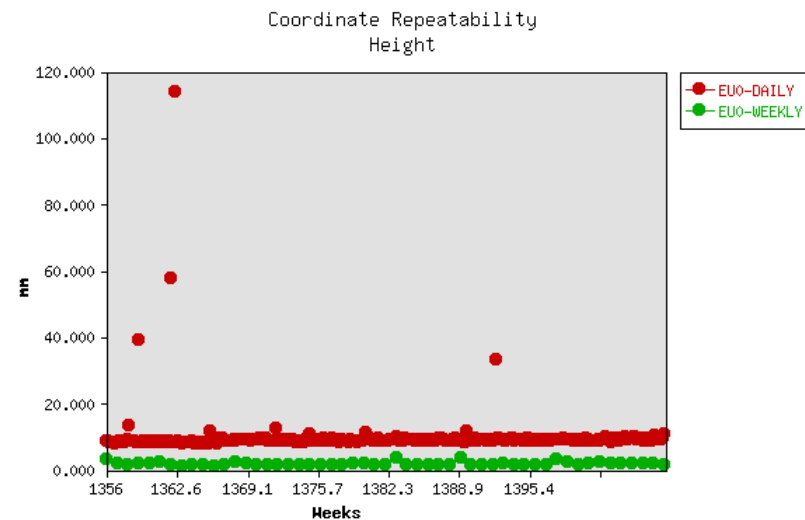
Type: WEEKLY

Inspected solutions: 53

Median North: 0.43 mm

East: 0.39 mm

Height: 1.63 mm



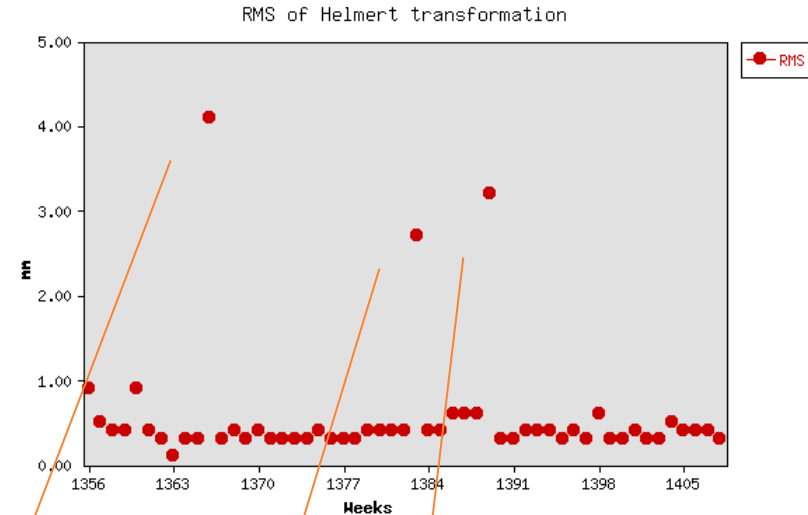
Comparing Two Series of Weekly Solutions

- Comparison of coordinates:

Solution 1: Combination of weekly LAC solutions

Solution 2: Combination of daily LAC solutions and successive combination of 7 days

- Unequal LACs involved for solutions 1 and 2



SNEC 0.1 / 0.0 / **100.1** (N/E/H) mm → antenna change within week

	RMS	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
SNEC U	35.59	29.72	30.40	30.75	24.15	-19.46	-50.30	-36.78

GOPE -0.0 / 0.0 / **64.9** (N/E/H) mm

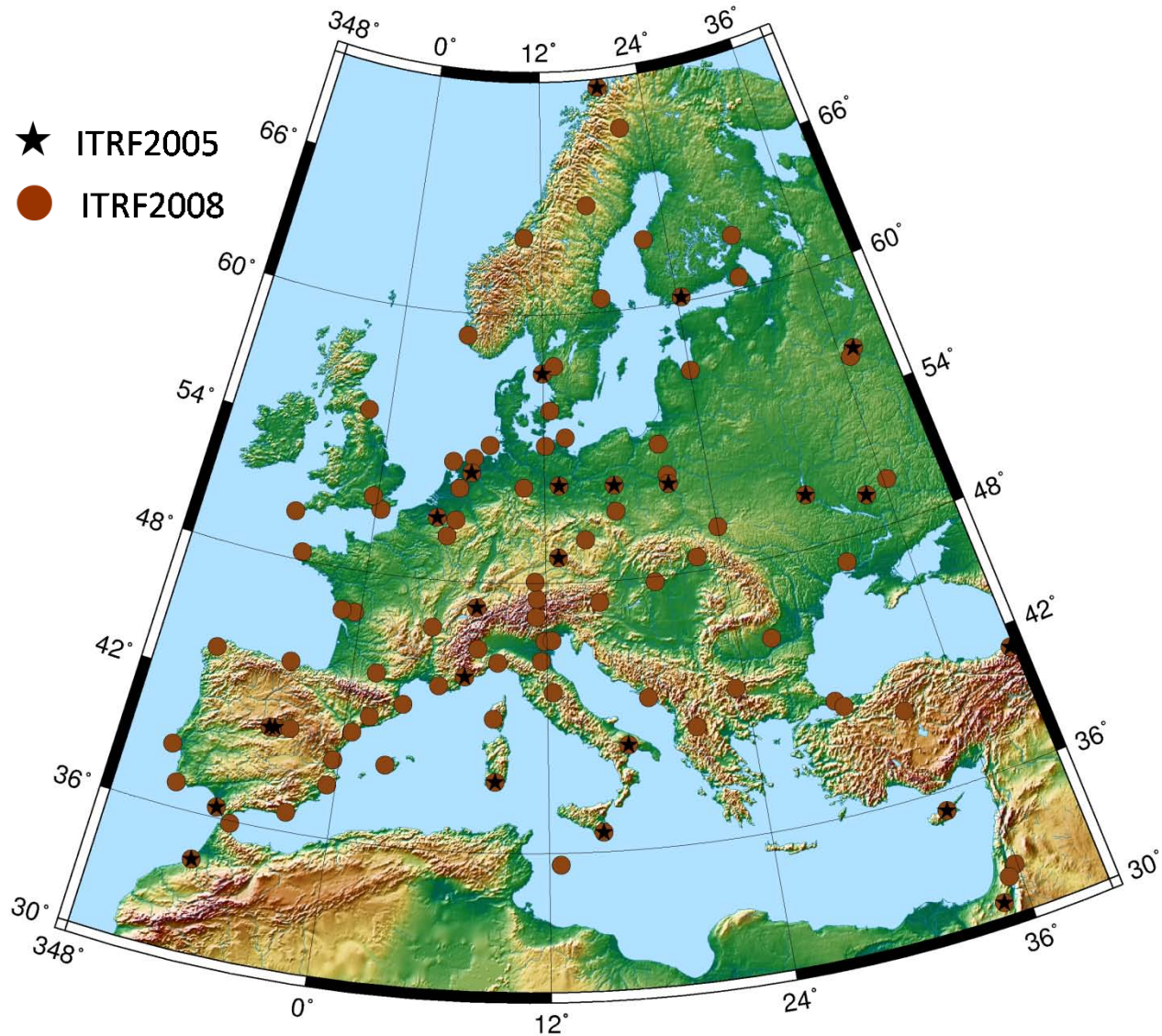
	RMS	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
GOPE U	10.01	-0.51	7.90	3.66	-1.86	8.52	-21.11	-1.84

GANP -0.3 / -0.5 / **76.1** (N/E/H) mm

	RMS	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
GANP U	64.05	20.40	9.33	10.97	13.64	-154.05	-4.13	-7.42



ITRF Stations in Europe

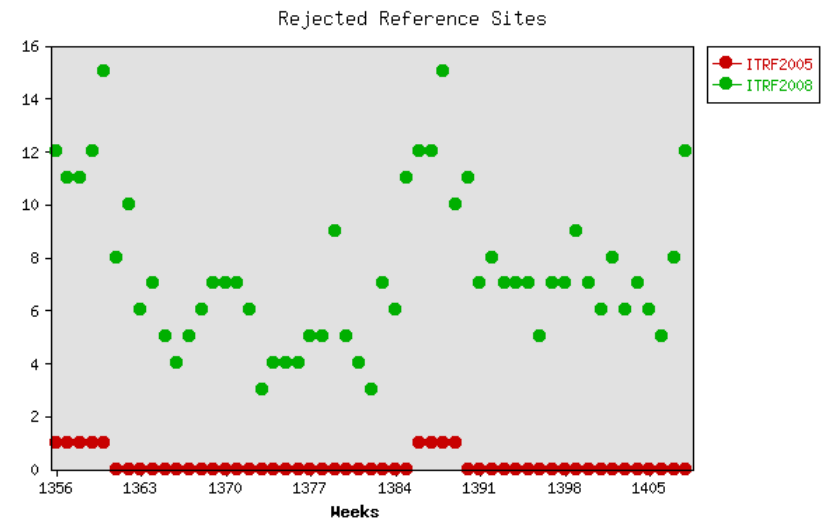
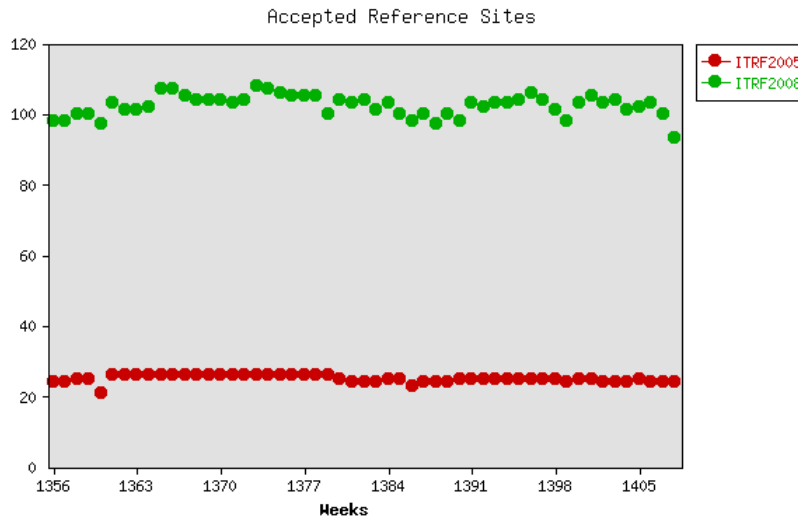




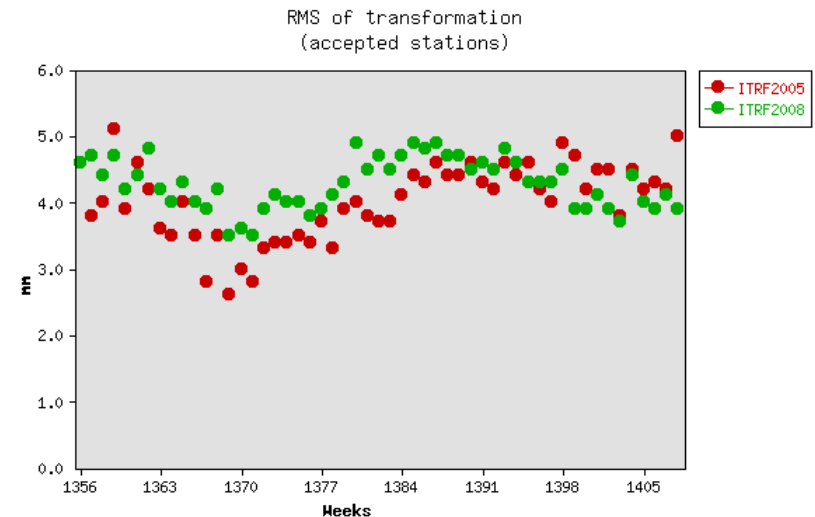
Reference Sites		Solution		ETRS89	
EPN05.CRD EPN05.VEL	→ Solve NEQ system	EU0www7.CRD	→ Transform into ETRF2000	EU0wwwE.CRD	
	→ Check residuals of reference sites, accept/reject sites ←				
	→ Check reference frame stability and validate MCC				
EPN08.CRD EPN08.VEL	→ Solve NEQ system	EU0wwwC.CRD	→ Transform into ETRF2000	EU0wwwF.CRD	
	→ Check residuals of reference sites, accept/reject sites ←				
	→ Check reference frame stability and validate MCC				



Validation of Reference Site Coordinates - ITRF2005 vs. ITRF2008 -

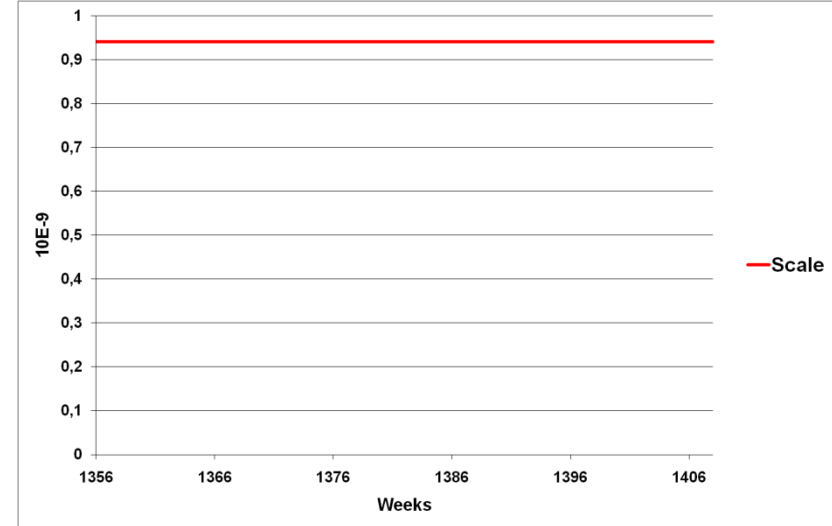
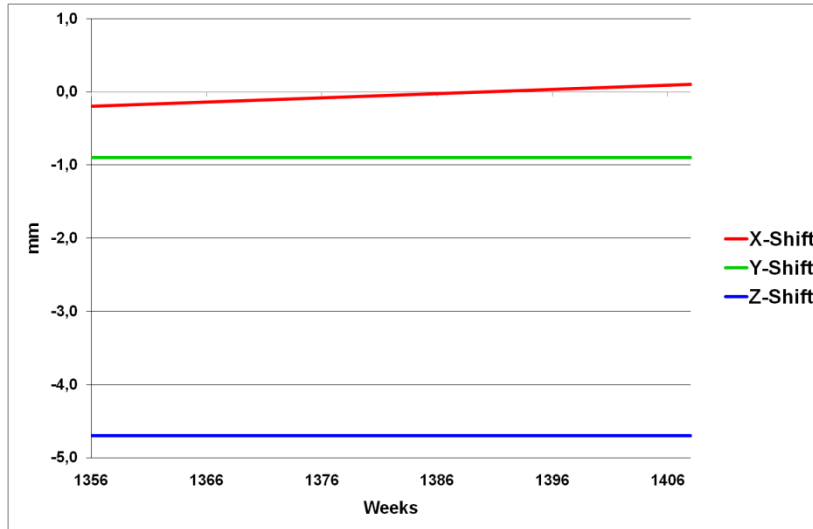


- Solved reference site coordinates of weekly combinations
vs.
ITRF (2005 or 2008) reference
- Rejection criteria:
 - 1 cm for North and East
 - 3 cm for Height





ITRF2005 to ITRF2008 Formal Transformation for Period of 2006



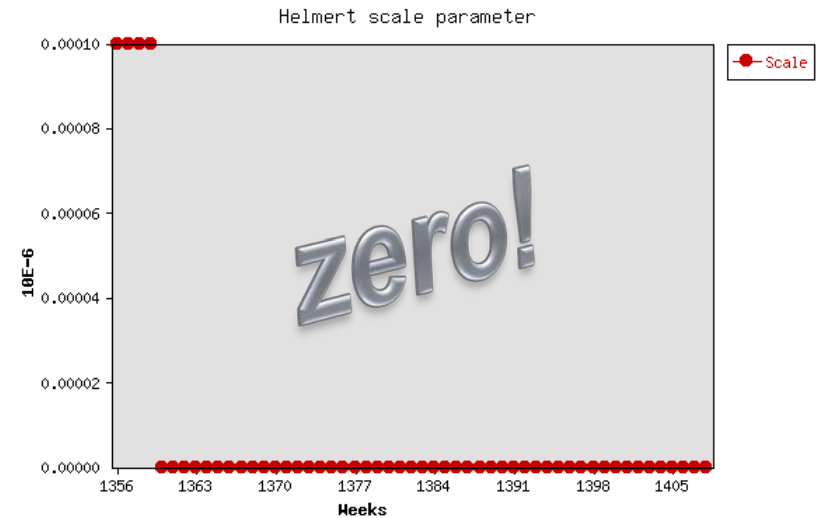
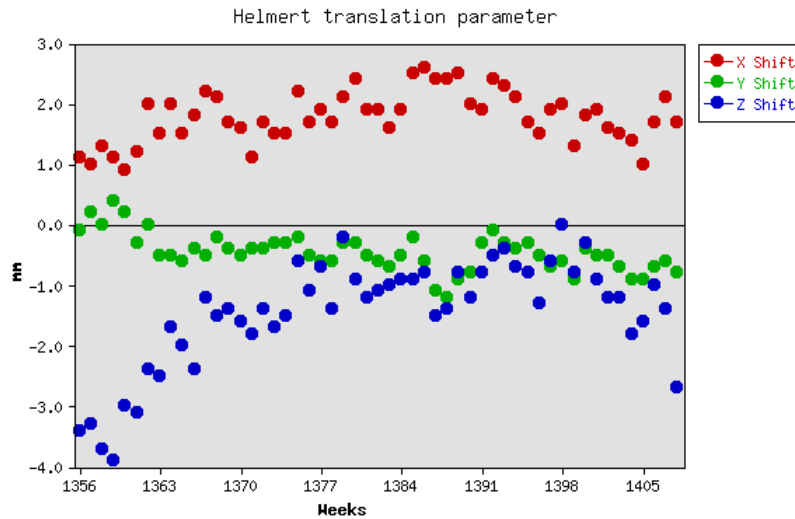
■ Shift and scale parameters from published values

	T1	T2	T3	D	R1	R2	R3	
	mm	mm	mm	10 ⁻⁹	mas	mas	mas	
	-0.5	-0.9	-4.7	0.94	0.000	0.000	0.000	
+/-	0.2	0.2	0.2	0.03	0.008	0.008	0.008	
Rates		0.3	0.0	0.0	0.00	0.000	0.000	0.000
+/-	0.2	0.2	0.2	0.03	0.008	0.008	0.008	0.000

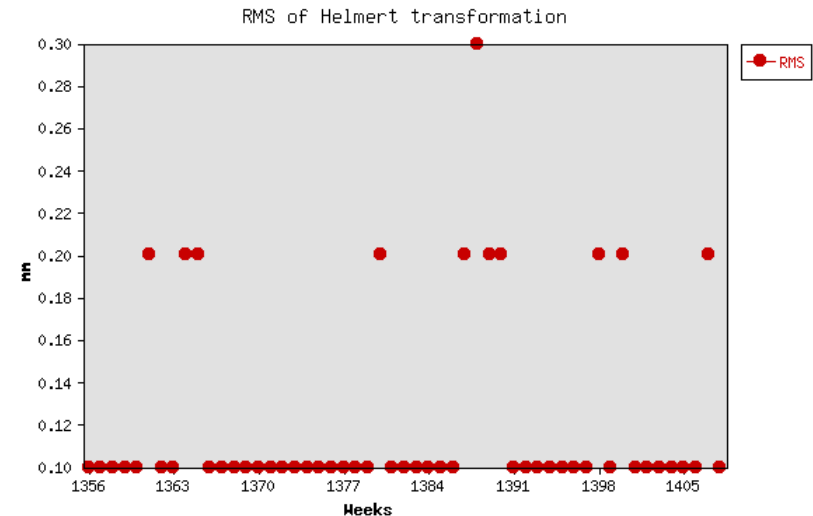
Transformation parameters at epoch 2005.0 and their rates from ITRF2008 to ITRF2005 (ITRF2005 minus ITRF2008) (Reference: http://itrf.ign.fr/ITRF_solutions/2008/)

■ Rotation parameters are zero

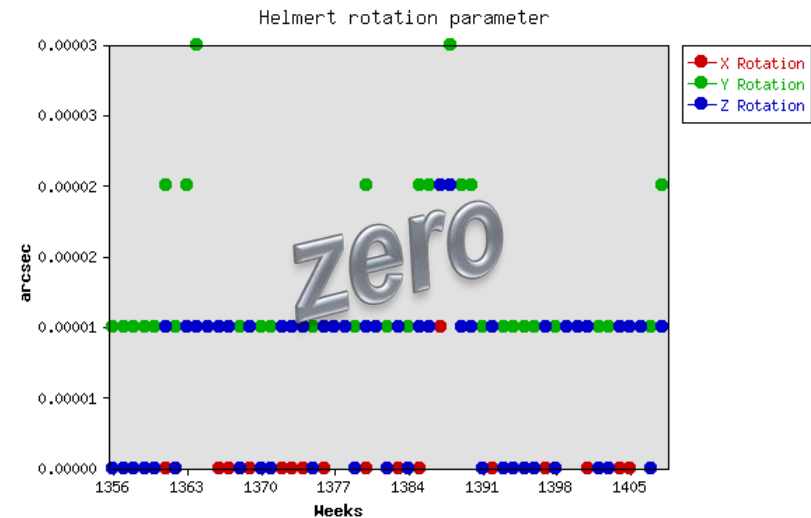
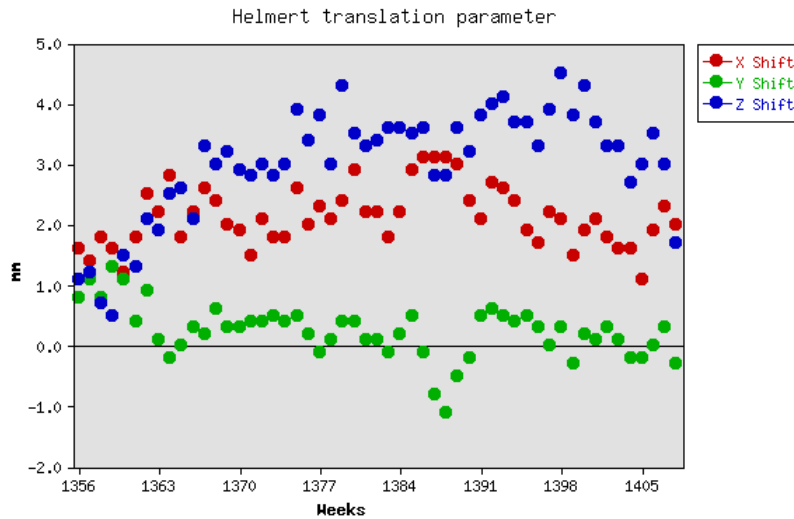
Impact of Reference Stations on Weekly EPN Coordinates (ITRF200X)



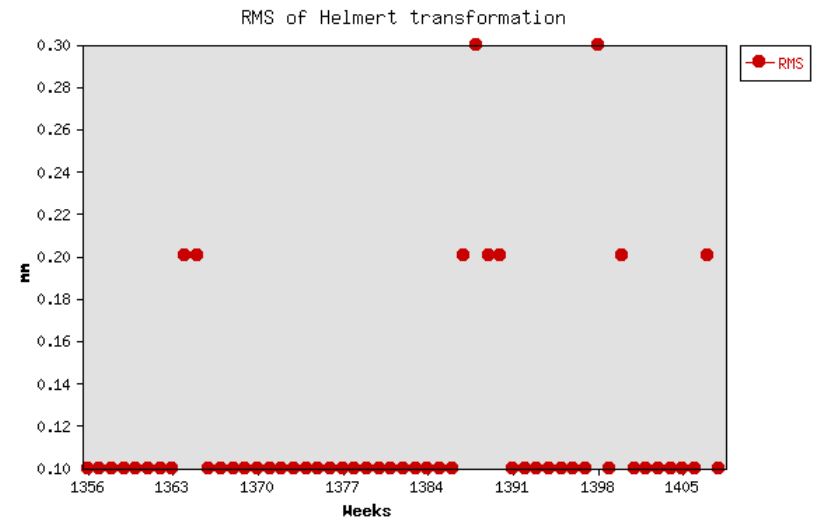
- 4-parameter Helmert transformation (Shift and Scale)
- Formal transformation parameters could not be re-covered
- Published scale parameter of 0.94 ppb is strictly no datum parameter
- Use IGS08 orbit and ANTEX files in processing mandatory



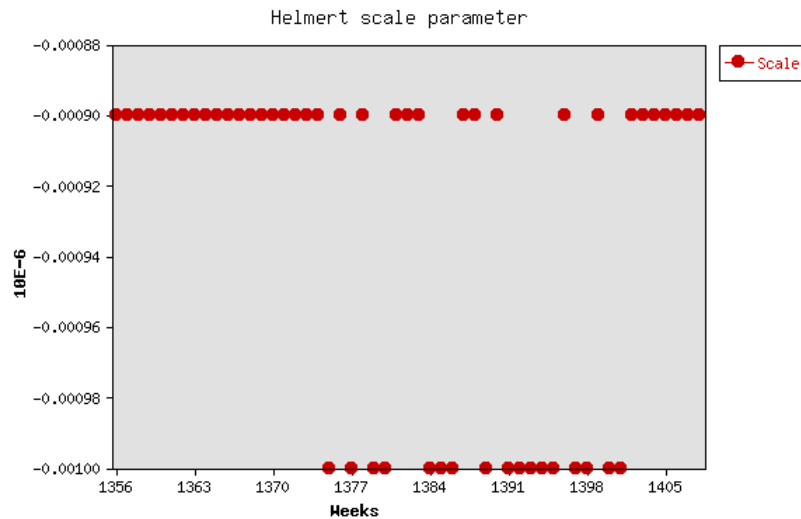
Impact of Reference Stations on Weekly EPN Coordinates (ETRF2000)



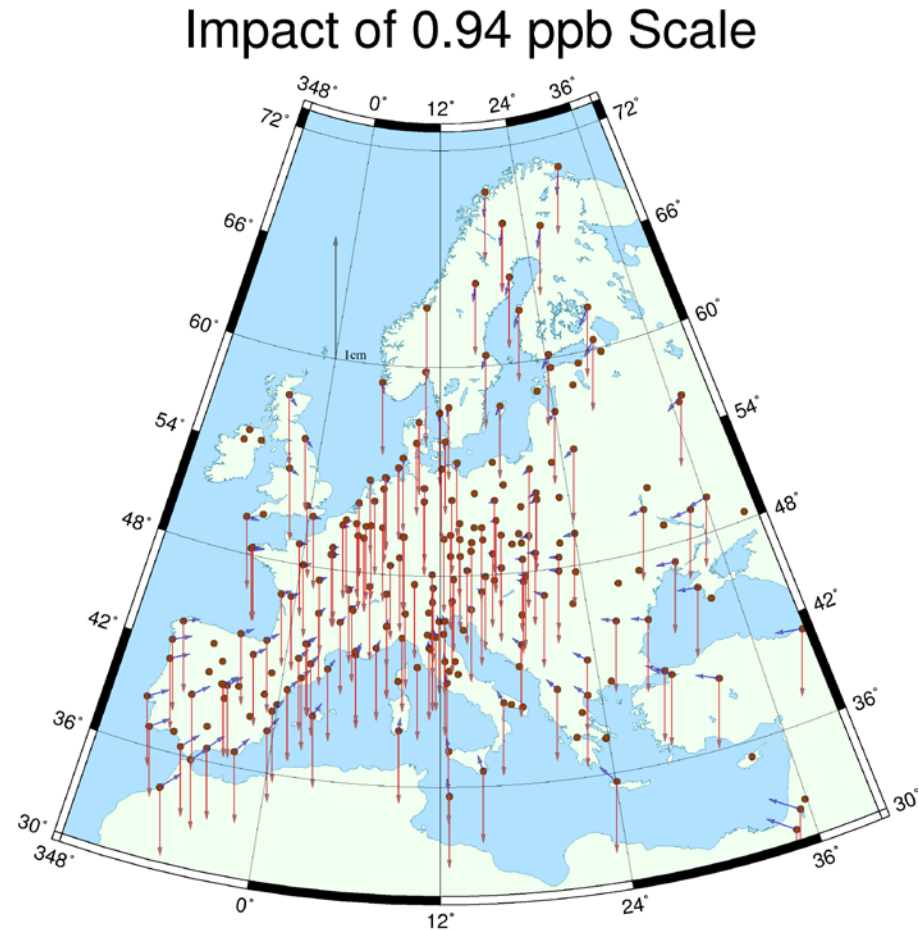
- 7-parameter Helmert transformation
- Weekly solution transformed from ITRF2005 and ITRF2008 into ETRF2000
- Published transformation parameters between ITRF2005 und ITRF2008 applied



Impact of Reference Stations on Weekly EPN Coordinates (ETRF2000)



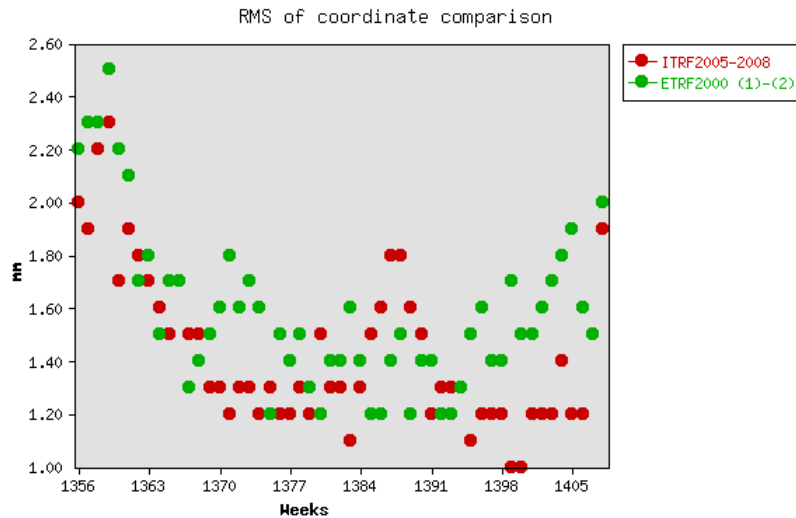
- Applied scale parameter for transformation of ITRF2008 to ITRF2005 recovered, because actually this scale difference was not realized
- Scale impact shown in local system



Mean Height change 5.8 mm
Mean Horizontal component change 1 mm



Coordinate Changes induced by ITRF2008



- Calculated RMS of coordinate differences
- No Helmert transformation applied
- EPN(ITRF2005) – EPN(ITRF2008) and EPN(ETRF2000) (1) – (2)



- Pilot re-processing without model changes demonstrates improvements w.r.t. operational solution
- Generation of weekly from daily solution by AC possible, but weekly LAC solution is useful anymore
- Evaluation of ITRF2008 need to be repeated, when IGS08 orbit and ANTEX files has been used for the data analysis