

# ARA-DAC Weekly Analysis Result: 2102 (GFA)

## Technical Report

**GPS Week: 2102 (GFA)**

<http://geolabpasaia.org/gnss/ARA-euref/>

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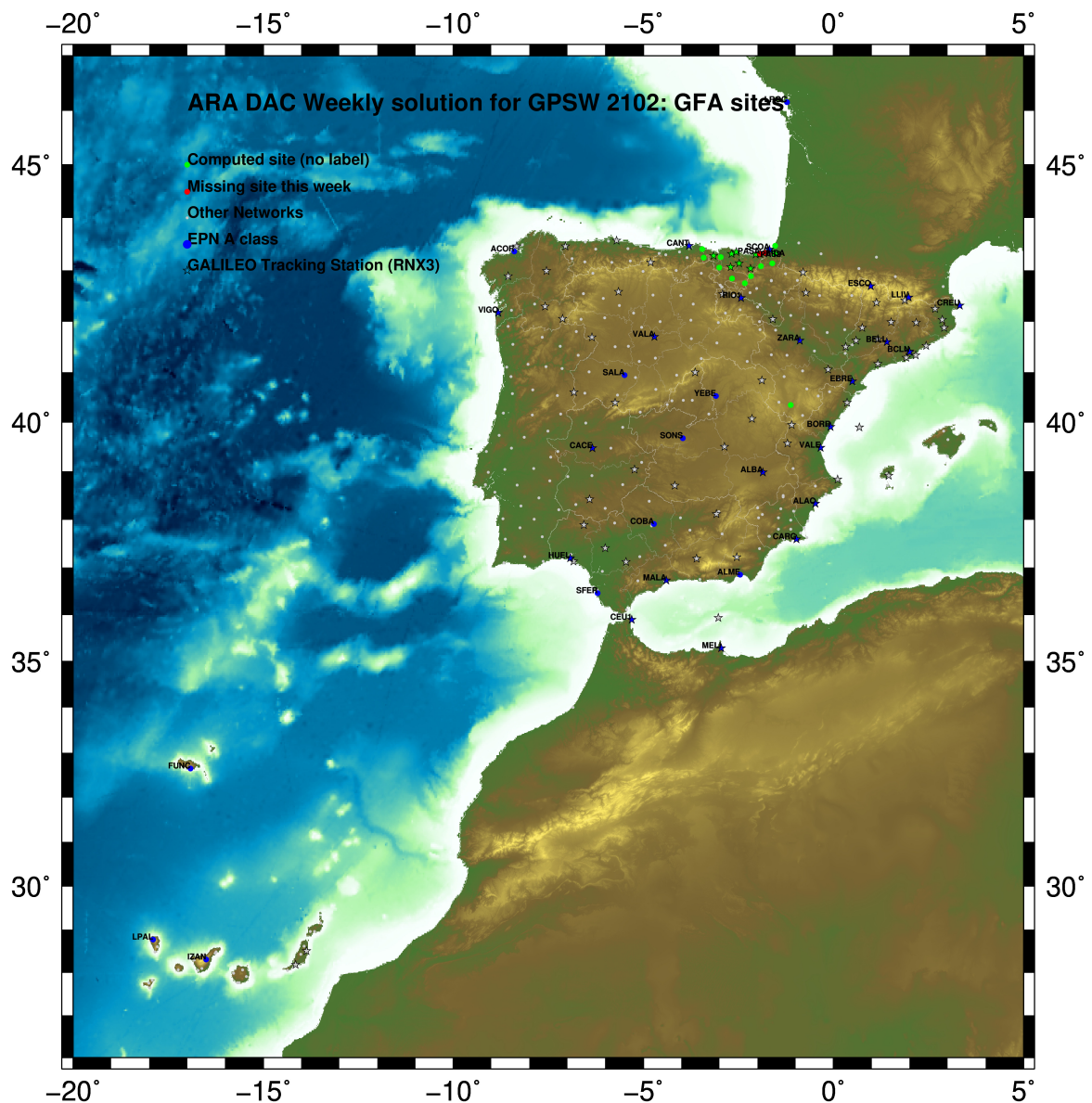
Report generated on 2020/05/10 at 03:09:31



# 1 Introduction

In may 2015 ARA (EUREF's acronym of the ARANZADI's Department of Applied Geodesy), kicks off as a EUREF's Operational Center. In July 2015, the Densification solutions ARA computes routinely in a weekly basis start being submitted to the EUREF's EPN Densification Project.

# 2 Map of Computed Sites



GM 2020 May 10 03:09:23

Fig.1: Computed Sites for GPS Week2102 (GFA)

### 3 Main Computation Parameters

The main parameters considered in the ARA analysis follow strictly the EPN recommendations.

- Preprocessing: Independent baselines are defined by the criterion of maximum common observations. Cycle slips are fixed with the MAUPRP program, analysing triple phase differences for each independent baseline. If MAUPRP does not fix all slips for one station, that station is edited out.
- Basic Observable : Carrier phase,  $L_1$  and  $L_2$ ; a priori sigma of single differences:0.002 m.
  - sampling (for ambiguity resolution): 30 s
  - sampling (for final processing): 180 s
  - Systems: GPS+GLONASS observations are used (Galileo also used if available from GPSW 1986 on)
- Modelled observable: Double differences of carrier phase using different combinations based on the distance.
- Ground antenna phase center calibrations: Group APCV used from the PCV\_COD.I14 file and individual calibrations from EPNC\_14.ATX. EPN\_A class sites (CRD + VEL) IGS14 used to define the reference frame (from GPSW 1934). If individual calibrations, other from these, are available, they are also included in the analysis.
- Troposphere:
  - 3 deg elev. cutoff; elevation dependent weighting
  - VMF1 mapping function. ZPD parameters are estimated using the VMF1 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2004 (Scherneck).
- Atmosph. Loading: computed from a global grid using the GRDS1S2 program of Bernese 5.2.

### 4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria: 3\*rms of single differences, in the weekly combination of daily normal equations (ADDNEQ)
- Station coordinates: minimum constraints (MC) to EPN A class sites (only translations).
- Troposphere: 3 deg. After having obtained coordinates valid for the entire week, tropospheric zenith delay is solved at each site at intervals of 1 hour throughout the week, holding the coordinates constrained at the weekly values.
- Ionospheric: second and third "High Order Ionosphere (HOI)" corrections used, using CODE files, to improve Ambiguity Resolution.
- Satellite clock bias: not estimated because are eliminated by double differencing the phase data.
- Receiver clock bias: not estimated because are eliminated by double differencing the phase data.
- Orbits and ERPs: CODE's orbits and ERP for both rapid and final solutions. DE405 planetary ephemeris and JGM3 Earth geopotential model is used.
- Tidal displacements: according to IERS2010 Conventions. Atmospheric loading corrections used.

- Ambiguity: an advanced ambiguity resolution (AR) scheme is included:
  - Code-Based Wideline (WL) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
  - Phase-Based Wideline ( $L_5$ ) AR for baselines shorter than 200km, the code-based wide-lane AR is replaced by a phase-only wide-lane with a subsequent narrow-lane AR.
  - Quasi-Ionosphere-Free (QIF)AR for the remaining real-valued ambiguities for baselines shorter than 2000km.
  - Direct  $L_1/L_2$  AR for baselines shorter than 20km
- AR Verification: Each baseline is processed by introducing the resolved integer ambiguities and checking the residuals. If there is any problem, the ambiguities are re-initialized.



## 5 Computed Coordinates

In this section the adjusted coordinates are summarized. Note that the sites with an A flag are the computed ones, whereas sites flagged as W are the ones used in the Minimal Constraints condition.

### 5.1 IGS14

The Reference Frame considered in this section is IGS14, release C2055.

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ARA LAC 2102 WEEK FINAL COMBINATION: PRECISE ORBITS          09-MAY-20 23:02
-----
LOCAL GEODETIC DATUM: IGS14          EPOCH: 2020-04-22 12:00:00
-----
NUM STATION NAME          X (M)          Y (M)          Z (M)          FLAG
-----
 1 ACRD 13434M001          4594489.54999          -678367.42661          4357066.29344          W
34 ALDA 19383M001          4687280.14456          -190876.55006          4308106.96910          A
43 ALSA 19419M001          4677250.82170          -176770.37712          4319079.88501          A
45 AMUR 19388M001          4661499.43622          -244591.24319          4332269.89427          A
81 BIAZ 10074M002          4634456.03998          -124344.96062          4365785.46976          A
92 BRZR 19387M001          4662220.97933          -220769.88338          4333309.45227          A
 9 CACE 13447M001          4899866.49124          -544567.01913          4033770.21450          W
10 CANT 13438M001          4625924.30020          -307096.21784          4365771.56607          W
118 CHER 00000M000          4645880.31058          -125721.91109          4353624.38528          A
15 CREU 13432M001          4715420.11638          273178.07488          4271946.85105          W
17 EBRE 13410M001          4833519.97889          41537.40767          4147461.73282          W
139 ELGE 19353S001          4657557.38913          -202241.45875          4338991.87839          A
141 EMAZ 17001M001          4645924.19409          -276949.85002          4347759.58819          A
209 GERN 19389M001          4642811.30923          -217222.90971          4353278.89113          A
183 IGEL 19352S001          4645951.41523          -165574.48823          4352550.42852          A
188 ISPS 19484M001          4640596.46530          -206963.76178          4356391.92328          A
193 KAST 19499M001          4646949.06945          -240747.25905          4348015.00320          A
198 LARE 19440M001          4632831.93759          -279026.12284          4360314.43606          A
199 LAZK 19354S001          4666098.32163          -178186.17532          4330463.67785          A
203 LEIT 19428M001          4663520.92299          -155858.70158          4334519.89446          A
260 ORDN 19427M001          4659695.76471          -130864.71864          4338948.89256          A
 33 PASA 19351S001          4644909.04417          -156645.05228          4353623.08630          W
 36 RID1 13448M002          4708446.81339          -199490.26817          4284089.74728          W
 37 SALA 13469M001          4803054.47152          -462131.05489          4158379.08744          W
 38 SCDA 10088M002          4639940.48559          -136224.92617          4359552.42529          W
321 SOPU 19386M001          4643997.89531          -255913.89080          4350063.15359          A
342 TERU 13487M001          4867391.31119          -95523.33741          4108341.69330          A
375 VITO 19385M001          4679397.68956          -218436.48969          4314898.37770          A
 49 YEBE 13420M001          4848724.55387          -261631.91397          4123094.33942          W
 50 ZARA 13462M001          4773803.15198          -73505.96756          4215454.10433          W
    
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### 5.2 ETRF2000 (ETRS89) Coordinates

European Terrestrial Reference System, 1989 (ETRS89) is realized by ETRF2000 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

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ETRF2000 FINAL COORD. wk 2102          09-MAY-20 23:02
-----
LOCAL GEODETIC DATUM: ETRF2000        EPOCH: 2020-04-22 12:00:00
-----
NUM STATION NAME          X (M)          Y (M)          Z (M)          FLAG
-----
 1 ACRD 13434M001          4594489.86414          -678367.98158          4357065.86556          W
34 ALDA 19383M001          4687280.51400          -190877.11386          4308106.54014          A
43 ALSA 19419M001          4677251.19362          -176770.93980          4319079.45700          A
45 AMUR 19388M001          4661499.80091          -244591.80438          4332269.46665          A
81 BIAZ 10074M002          4634456.42152          -124345.51854          4365785.04575          A
92 BRZR 19387M001          4662221.34696          -220770.44458          4333309.02489          A
 9 CACE 13447M001          4899866.79851          -544567.60636          4033769.76441          W
10 CANT 13438M001          4625924.65974          -307096.77538          4365771.14044          W
118 CHER 00000M000          4645880.69109          -125722.47024          4353623.96036          A
15 CREU 13432M001          4715420.53902          273177.50978          4271946.42557          W
17 EBRE 13410M001          4833520.36484          41536.82908          4147461.29527          W
139 ELGE 19353S001          4657557.75940          -202242.01940          4338991.45161          A
141 EMAZ 17001M001          4645924.55598          -276950.40964          4347759.16138          A
209 GERN 19389M001          4642811.67870          -217223.46881          4353278.46531          A
183 IGEL 19352S001          4645951.79087          -165575.04752          4352550.00310          A
188 ISPS 19484M001          4640596.83623          -206964.32062          4356391.49776          A
193 KAST 19499M001          4646949.43272          -240747.81867          4348014.57676          A
198 LARE 19440M001          4632832.30012          -279026.68105          4360314.01025          A
199 LAZK 19354S001          4666098.69418          -178186.73680          4330463.25070          A
203 LEIT 19428M001          4663521.29852          -155859.26272          4334519.46779          A
260 ORDN 19427M001          4659696.14356          -130865.27929          4338948.46649          A
 33 PASA 19351S001          4644909.42096          -156645.61142          4353622.66107          W
 36 RID1 13448M002          4708447.18008          -199490.83425          4284089.31655          W
 37 SALA 13469M001          4803054.79762          -462131.63172          4158378.64600          W
 38 SCDA 10088M002          4639940.86526          -136225.48472          4359552.00070          W
321 SOPU 19386M001          4643998.25990          -255914.45014          4350062.72719          A
342 TERU 13487M001          4867391.67787          -95523.92007          4108341.25141          A
375 VITO 19385M001          4679398.05516          -218437.05272          4314897.94901          A
 49 YEBE 13420M001          4848724.90161          -261632.49515          4123093.89693          W
 50 ZARA 13462M001          4773803.52894          -73506.54021          4215453.67005          W
    
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### 5.3 ETRF2014 (ETRS89) Coordinates

European Terrestrial Reference System, 1989 (ETRS89) is realized by ETRF2014 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

ETRF2014 FINAL COORD. wk 2102		09-MAY-20 23:02			
LOCAL GEODETIC DATUM: ETRF2014		EPOCH: 2020-04-22 12:00:00			
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACDR 13434M001	4594489.82188	-678368.01982	4357065.91437	W
34	ALDA 19383M001	4687280.46948	-190877.15348	4308106.58884	A
43	ALSA 19419M001	4677251.14916	-176770.97951	4319079.50574	A
45	AMUR 19388M001	4661499.75681	-244591.84391	4332269.51540	A
81	BLAZ 10074M002	4634456.37733	-124345.55861	4365785.09462	A
92	BRZR 19387M001	4662221.30279	-220770.48420	4333309.07365	A
9	CACE 13447M001	4899866.75271	-544567.64386	4033769.81255	W
10	CANT 13438M001	4625924.61619	-307096.81483	4365771.18926	W
118	CHER 00000M000	4645880.64679	-125722.51026	4353624.00920	A
15	CREU 13432M001	4715420.49263	273177.46864	4271946.47451	W
17	EBRE 13410M001	4833520.31803	41536.78923	4147461.34377	W
139	ELGE 19353S001	4657557.71521	-202242.05910	4338991.50038	A
141	EMAZ 17001M001	4645924.51215	-276950.44912	4347759.21016	A
209	GERN 19389M001	4642811.63472	-217223.50852	4353278.51412	A
183	IGEL 19352S001	4645951.74669	-165575.08739	4352550.05192	A
188	ISPS 19484M001	4640596.79224	-206964.36037	4356391.54658	A
193	KAST 19499M001	4646949.38876	-240747.85827	4348014.62555	A
198	LARE 19440M001	4632832.25642	-279026.72057	4360314.05905	A
199	LAZK 19354S001	4666098.64984	-178186.77655	4330463.29946	A
203	LEIT 19428M001	4663521.25414	-155859.30256	4334519.51657	A
260	ORON 19427M001	4659696.09913	-130865.31923	4338948.51530	A
33	PASA 19351S001	4644909.37676	-156645.65134	4353622.70990	W
36	RI01 13448M002	4708447.13537	-199490.87375	4284089.36521	W
37	SALA 13469M001	4803054.75267	-462131.66991	4158378.69435	W
38	SOA 10088M002	4639940.82105	-136225.52472	4359552.04955	W
321	SOPU 19386M001	4643998.21601	-255914.48970	4350062.77598	A
342	TERU 13487M001	4867391.63116	-95523.95930	4108341.29976	A
375	VITO 19385M001	4679398.01081	-218437.09228	4314897.99772	A
49	YEBE 13420M001	4848724.85561	-261632.53387	4123093.94524	W
50	ZARA 13462M001	4773803.48315	-73506.57990	4215453.71861	W

## 6 Quality Control

### 6.1 Mean and Daily Repeatabilities

In this section, the mean and daily repeatabilities of the sites are shown. Repeatabilities refer to the IGS14 solution and are given with respect the Local frame (North-East-Up).

ARA LAC 2102 WEEK FINAL COMBINATION: PRECISE ORBITS 09-MAY-20 23:02

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	7	XXXXXX	0.71	0.74	2.31
ALDA 19383M001	7	XXXXXX	1.05	0.82	3.01
ALSA 19419M001	7	XXXXXX	1.98	0.99	2.24
AMUR 19388M001	6	XX XXXX	0.82	0.84	1.18
BLAZ 10074M002	7	XXXXXX	0.72	0.73	3.34
BRZR 19387M001	7	XXXXXX	0.66	1.09	7.37
CACE 13447M001	7	XXXXXX	0.58	0.77	2.27
CANT 13438M001	7	XXXXXX	0.81	0.32	3.39
CHER 00000M000	7	XXXXXX	0.73	1.38	3.67
CREU 13432M001	7	XXXXXX	0.88	1.26	5.74
EBRE 13410M001	7	XXXXXX	0.88	0.40	3.69
ELGE 19353S001	7	XXXXXX	0.58	0.57	2.09
EMAZ 17001M001	7	XXXXXX	0.82	0.38	3.38
GERN 19389M001	7	XXXXXX	0.54	1.03	5.87
IGEL 19352S001	3	XX X	0.54	1.11	2.64
ISPS 19484M001	7	XXXXXX	0.77	0.63	3.93
KAST 19499M001	7	XXXXXX	0.37	0.59	3.40
LARE 19440M001	7	XXXXXX	1.11	1.32	2.24
LAZK 19354S001	7	XXXXXX	0.62	0.57	6.75
LEIT 19428M001	7	XXXXXX	0.93	0.49	2.01
ORDN 19427M001	7	XXXXXX	0.61	0.75	2.62
PASA 19351S001	7	XXXXXX	0.37	0.48	2.43
RI01 13448M002	7	XXXXXX	0.64	0.72	3.29
SALA 13469M001	2	X X	0.83	0.68	0.60
SCDA 10088M002	7	XXXXXX	1.16	0.79	4.42
SOPU 19386M001	7	XXXXXX	0.67	0.85	3.94
TERU 13487M001	7	XXXXXX	0.65	0.42	1.99
VITO 19385M001	7	XXXXXX	1.40	1.40	2.02
YEBE 13420M001	6	X XXXXX	0.92	0.91	2.46
ZARA 13462M001	7	XXXXXX	0.56	0.50	2.97

Comparison of individual solutions:

ACOR 13434M001	N	0.71	0.94	-0.48	0.37	-0.91	0.67	-0.17	-0.72
ACOR 13434M001	E	0.74	0.52	-0.12	0.27	0.90	-1.31	-0.32	0.55
ACOR 13434M001	U	2.31	-3.19	0.30	2.06	3.35	2.36	0.64	0.45
ALDA 19383M001	N	1.05	0.38	1.17	0.30	0.46	-1.58	-1.53	0.11
ALDA 19383M001	E	0.82	-0.43	0.77	1.00	-0.47	-1.34	0.54	-0.02
ALDA 19383M001	U	3.01	2.12	-1.69	5.08	-0.21	0.60	-4.52	0.58
ALSA 19419M001	N	1.98	0.53	0.37	0.57	0.40	-0.95	-4.53	1.07
ALSA 19419M001	E	0.99	-0.24	0.71	-0.23	0.31	0.33	0.90	-2.07
ALSA 19419M001	U	2.24	2.60	-2.89	-1.88	-1.86	-0.02	-1.18	2.56
AMUR 19388M001	N	0.82	-0.53	-0.33		-0.79	-1.03	-0.27	1.10
AMUR 19388M001	E	0.84	0.56	0.56		-0.04	-0.62	-1.26	-0.96
AMUR 19388M001	U	1.18	0.62	-0.01		1.13	1.73	0.09	-1.51
BLAZ 10074M002	N	0.72	-0.83	-0.54	1.10	-0.08	-0.66	0.66	0.22
BLAZ 10074M002	E	0.73	0.29	0.43	1.54	0.39	-0.33	0.49	-0.19
BLAZ 10074M002	U	3.34	-3.86	-3.04	-2.56	-2.73	-3.63	-2.68	-2.88
BRZR 19387M001	N	0.66	-0.96	0.03	0.57	-0.53	-0.26	0.05	1.03
BRZR 19387M001	E	1.09	1.61	0.30	0.50	-0.44	-1.58	0.81	-0.93
BRZR 19387M001	U	7.37	13.49	-2.99	8.39	-3.61	-1.75	-5.02	-4.80
CACE 13447M001	N	0.58	0.86	-0.82	0.66	-0.23	0.02	0.15	-0.33
CACE 13447M001	E	0.77	-0.69	-0.18	-0.12	1.26	0.49	0.49	-0.97
CACE 13447M001	U	2.27	1.85	-2.17	0.38	3.21	0.50	2.79	-2.09
CANT 13438M001	N	0.81	-0.54	0.06	-1.00	-0.06	0.27	-0.83	-1.39
CANT 13438M001	E	0.32	-0.26	0.08	0.32	0.39	-0.19	-0.50	-0.10
CANT 13438M001	U	3.39	-3.36	-0.75	-1.09	0.04	7.18	-1.47	1.47
CHER 00000M000	N	0.73	-0.12	0.35	-0.91	-0.48	-0.77	0.34	1.13
CHER 00000M000	E	1.38	0.13	0.71	-0.32	-0.49	-0.36	3.21	-0.21
CHER 00000M000	U	3.67	-5.37	-3.76	-1.30	-1.24	-1.24	-2.53	-5.18
CREU 13432M001	N	0.88	0.51	-0.48	-1.22	-0.36	0.13	1.45	0.65
CREU 13432M001	E	1.26	0.85	0.84	0.76	0.12	0.09	-1.68	-2.15
CREU 13432M001	U	5.74	2.62	4.05	0.42	0.98	-1.85	-10.00	-8.35
EBRE 13410M001	N	0.88	-0.55	-0.05	-0.87	-0.75	0.06	0.63	1.60
EBRE 13410M001	E	0.40	-0.03	0.42	0.09	-0.55	-0.12	-0.63	0.23
EBRE 13410M001	U	3.69	-2.00	4.52	-1.62	0.12	-2.92	-1.80	-6.55
ELGE 19353S001	N	0.58	-0.83	0.04	0.37	-0.46	-0.37	0.60	0.70
ELGE 19353S001	E	0.57	0.44	0.35	0.49	0.42	-0.03	-0.90	-0.66
ELGE 19353S001	U	2.09	-0.86	3.77	-1.03	0.64	2.83	-0.39	-1.26
EMAZ 17001M001	N	0.82	-0.55	-0.14	-0.45	-0.35	1.35	-1.15	-0.55
EMAZ 17001M001	E	0.38	-0.15	-0.40	-0.51	0.48	-0.35	-0.11	0.26
EMAZ 17001M001	U	3.38	-3.53	-0.63	-2.39	-3.50	5.04	3.48	-0.46
GERN 19389M001	N	0.54	-0.22	0.27	0.03	-0.89	-0.33	0.84	0.21
GERN 19389M001	E	1.03	0.56	0.94	-1.89	-0.46	0.32	-0.43	1.04
GERN 19389M001	U	5.87	8.20	-7.19	4.68	5.22	-5.71	1.53	-2.02
IGEL 19352S001	N	0.54	-0.66	0.18					0.33
IGEL 19352S001	E	1.11	1.08	0.57					-0.99
IGEL 19352S001	U	2.64	3.26	-1.70					0.66
ISPS 19484M001	N	0.77	-0.57	0.18	0.36	0.03	-1.71	-0.01	0.36
ISPS 19484M001	E	0.63	0.80	0.17	0.81	0.15	0.17	-0.46	-0.88
ISPS 19484M001	U	3.93	4.52	0.05	-0.84	-0.72	-7.96	1.28	2.40
KAST 19499M001	N	0.37	0.24	-0.02	0.59	-0.50	-0.40	0.03	0.02
KAST 19499M001	E	0.59	0.19	0.20	0.76	-0.79	-0.40	0.70	-0.41
KAST 19499M001	U	3.40	6.74	-1.36	3.14	-0.19	-2.71	0.86	-2.00
LARE 19440M001	N	1.11	-1.64	0.71	-1.31	-1.06	0.87	-0.40	-0.69
LARE 19440M001	E	1.32	0.57	0.62	-0.97	1.66	-1.88	-1.29	-0.88
LARE 19440M001	U	2.24	-0.73	-2.12	-2.78	1.45	1.00	3.59	1.14
LAZK 19354S001	N	0.62	-0.23	-0.37	0.33	-0.40	-1.02	-0.90	-0.03
LAZK 19354S001	E	0.57	-0.79	0.87	-0.08	0.38	-0.50	-0.37	0.11
LAZK 19354S001	U	6.75	-0.97	-2.00	-8.59	-8.42	2.56	8.55	6.65
LEIT 19428M001	N	0.93	-0.25	-0.32	0.23	0.18	-1.05	-1.88	0.57
LEIT 19428M001	E	0.49	-0.14	0.22	-0.30	0.07	-0.66	0.81	-0.42
LEIT 19428M001	U	2.01	1.38	-2.50	-2.81	-1.54	0.79	2.27	-0.36
ORDN 19427M001	N	0.61	-0.36	0.06	0.09	-0.34	-1.28	-0.60	-0.01

ORDN 19427M001	E	0.75	-0.05	0.53	-0.83	-0.31	-1.04	1.09	0.16
ORDN 19427M001	U	2.62	-2.26	-3.55	2.28	-0.10	-1.20	-2.45	3.31
PASA 19351S001	N	0.37	-0.43	-0.19	-0.31	0.50	-0.17	0.39	0.25
PASA 19351S001	E	0.48	0.33	0.19	0.09	0.65	-0.11	-0.76	-0.45
PASA 19351S001	U	2.43	-0.30	-1.87	4.55	-0.62	-2.04	2.20	1.35
RID1 13448M002	N	0.64	-0.86	-0.06	-0.52	-0.43	-0.61	0.58	-0.77
RID1 13448M002	E	0.72	0.04	1.04	-0.33	0.33	-0.82	0.09	-1.08
RID1 13448M002	U	3.29	-2.25	-1.70	-4.61	0.18	0.80	-3.26	4.93
SALA 13469M001	N	0.83	-0.49						0.66
SALA 13469M001	E	0.68	0.68						0.02
SALA 13469M001	U	0.60	-0.14						0.58
SCDA 10088M002	N	1.16	-0.80	0.54	-0.85	-0.22	-1.49	1.63	1.23
SCDA 10088M002	E	0.79	-0.05	0.83	0.87	0.42	-0.33	1.32	-0.46
SCDA 10088M002	U	4.42	-4.15	-3.42	-3.85	-5.69	2.47	-1.37	-5.77
SOPU 19386M001	N	0.67	-0.79	-0.22	1.23	-0.41	-0.22	-0.21	0.46
SOPU 19386M001	E	0.85	0.38	1.05	-0.78	0.65	-1.06	-0.68	0.69
SOPU 19386M001	U	3.94	7.48	-1.77	-1.86	4.28	-2.49	1.22	-2.08
TERU 13487M001	N	0.65	-0.00	-0.16	0.11	-0.68	-0.43	1.31	-0.33
TERU 13487M001	E	0.42	0.06	0.18	-0.12	-0.64	0.22	0.11	-0.71
TERU 13487M001	U	1.99	-2.36	0.81	1.01	-1.48	-2.43	-2.27	-1.83
VITO 19385M001	N	1.40	-1.33	-0.35	-0.15	-1.14	-1.29	-0.87	2.48
VITO 19385M001	E	1.40	0.07	0.19	2.09	-0.54	-1.87	-1.62	0.93
VITO 19385M001	U	2.02	-0.85	-2.23	-0.12	-1.64	-0.70	1.68	3.58
YEBE 13420M001	N	0.92	-1.10		-0.01	0.58	0.34	-0.19	1.59
YEBE 13420M001	E	0.91	-0.95		1.16	0.40	1.12	-0.43	-0.56
YEBE 13420M001	U	2.46	2.48		0.37	3.69	-0.99	-0.98	2.91
ZARA 13462M001	N	0.56	-0.50	-0.07	-0.61	-0.23	-1.08	-0.15	-0.01
ZARA 13462M001	E	0.50	-0.37	0.25	-0.82	0.22	-0.52	0.54	-0.11
ZARA 13462M001	U	2.97	-2.20	-5.39	-1.22	0.18	2.05	-1.01	-3.48

## 6.2 Datum verification

In this section, the datum verification is shown. A 3 parameter Helmert 3D (3 translations) is computed to the minimally constrained sites.

LOCAL GEODETIC DATUM: IGS14  
RESIDUALS IN LOCAL SYSTEM (NORTH, EAST, UP)

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
1	ACOR 13434M001	I W	-0.54	-0.40	-1.01
2	ALAC 13433M001	I W	0.63	-0.11	0.82
3	ALBA 13452M001	I W	-0.15	-1.88	-0.78
4	ALME 13437M001	I W	-1.82	0.82	1.78
5	BCLN 13412M001	I W	-0.46	-1.04	-0.62
6	BELL 13431M001	I W	1.00	1.12	-0.26
7	BORR 13480M001	I W	-0.12	-0.63	-0.44
8	BRST 10004M004	I W	-1.35	-0.90	1.53
9	CACE 13447M001	I W	-0.06	0.29	4.25
10	CANT 13438M001	I W	-1.13	0.10	1.77
11	CARG 19412M001	I W	0.16	-1.29	-1.47
13	CEU1 13449M002	I W	0.05	0.79	-4.09
14	COBA 13453M001	I W	0.36	0.20	-4.48
15	CREU 13432M001	I W	-0.70	1.88	1.71
17	EBRE 13410M001	I W	-5.00	-0.16	-5.00
18	ESCO 13435M001	I W	0.04	-1.24	1.01
19	FUNC 13911S001	I W	2.97	0.15	-5.15
22	HUEL 13451M001	I W	0.27	2.02	-6.95
23	IZAN 31309M002	I W	0.89	-1.66	-4.35
25	LLIV 13436M001	I W	0.12	0.53	1.54
26	LPAL 81701M001	I W	-0.82	0.57	-4.24
27	LRDC 10023M001	I W	0.44	-0.75	2.32
28	MALA 13443M001	I W	-0.01	-1.20	-1.15
32	MELI 19379M001	I W	0.75	1.18	1.82
33	PASA 19351S001	I W	-0.94	0.57	3.39
34	PDEL 31906M004	I W	3.96	-1.00	1.31
36	RID1 13448M002	I W	-1.78	0.63	-0.31
37	SALA 13469M001	I W	0.33	2.21	-0.04
38	SCOA 10088M002	I W	-2.22	0.86	-1.32
39	SFER 13402M004	I W	-0.44	-1.37	2.51
42	SONS 13446M001	I W	0.49	1.05	-2.90
44	TERC 31909M001	I W	5.87	-5.06	-4.78
46	VALA 13463M002	I W	-0.89	0.51	1.56
47	VALE 13439M001	I W	-0.48	1.35	0.68
48	VIGO 13450M001	I W	0.81	0.47	7.12
49	YEBE 13420M001	I W	0.02	1.08	6.57
50	ZARA 13462M001	I W	-0.33	-0.27	5.19
51	ZIMM 14001M004	I W	0.07	0.57	2.48
	RMS / COMPONENT		1.70	1.34	3.30
	MEAN		0.00	-0.00	-0.00
	MIN		-5.00	-5.06	-6.95
	MAX		5.87	2.21	7.12

NUMBER OF PARAMETERS : 3  
NUMBER OF COORDINATES : 114  
RMS OF TRANSFORMATION : 2.28 MM

BARYCENTER COORDINATES:

LATITUDE : 40 1 0.61  
LONGITUDE : - 4 56 37.74  
HEIGHT : -46.825 KM

PARAMETERS:

TRANSLATION IN N : 0.00 +- 0.37 MM  
TRANSLATION IN E : 0.01 +- 0.37 MM  
TRANSLATION IN U : -0.00 +- 0.37 MM

### 6.3 Adjustment Statistics

In this section, the summary of the global adjustment and not subnetworks are shown. Also, the Helmert parameters of the combined solution with respect the daily solutions are shown.

```
* STATISTICAL PARAMETER-----VALUE(S)-----
NUMBER OF OBSERVATIONS          15727218
NUMBER OF UNKNOWN               185102
NUMBER OF DEGREES OF FREEDOM    15542116
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
VARIANCE FACTOR                  1.884487190315439

Helmert Transformation Parameters With Respect to Combined Solution:
-----
Sol  Rms (m)      Translation (m)      Rotation (")
      X          Y          Z          X          Y          Z      Scale (ppm)
-----
  1  0.00197    -0.0008 -0.0080 -0.0037  0.0001  0.0001 -0.0002  0.00038
  2  0.00212     0.0062 -0.0017  0.0043 -0.0001  0.0000 -0.0001  -0.00127
  3  0.00190     0.0053 -0.0138  0.0001  0.0003  0.0001 -0.0003  -0.00079
  4  0.00214    -0.0086 -0.0202  0.0094  0.0004 -0.0004 -0.0005  -0.00003
  5  0.00207    -0.0085 -0.0085  0.0079  0.0002 -0.0004 -0.0002  0.00029
  6  0.00214    -0.0084 -0.0159  0.0100  0.0002 -0.0004 -0.0005  -0.00011
  7  0.00210    -0.0033 -0.0107  0.0133  0.0001 -0.0004 -0.0003  -0.00117
```

```
Statistics of individual solutions:
-----
File  RMS (m)      DOF  Chi**2/DOF  #Observations authentic / pseudo  #Parameters explicit / implicit / singular
-----
  1  0.00142     2431038      2.01           2460887      3           963      28889      0
  2  0.00139     2392035      1.92           2422799      3           954      29813      0
  3  0.00136     2142015      1.86           2168454      3           840      25602      0
  4  0.00132     2183386      1.75           2208954      3           855      24716      0
  5  0.00131     2093636      1.73           2118365      3           849      23883      0
  6  0.00142     2101182      2.01           2127494      3           858      25457      0
  7  0.00136     2193637      1.85           2220265      3           864      25767      0
```

## 7 Equipment

### 7.1 Receiver List

Serial numbers not shown.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__ FIRMWARE____
ACOR  A   1 P 20:110:00000 20:116:86370 LEICA GR50      -----
ALDA  A   1 P 20:110:00000 20:116:86370 LEICA GR10      -----
ALSA  A   1 P 20:110:00000 20:116:86370 LEICA GR50      -----
AMUR  A   1 P 20:110:00000 20:116:86370 LEICA GR10      -----
BIAZ  A   1 P 20:110:00000 20:116:86370 TRI SP90M      -----
BRZR  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
CACE  A   1 P 20:110:00000 20:116:86370 TRIMBLE NETR9  -----
CANT  A   1 P 20:110:00000 20:116:86370 LEICA GR10      -----
CHER  A   1 P 20:110:00000 20:116:86370 LEICA GRX1200+GNSS -----
CREU  A   1 P 20:110:00000 20:116:86370 LEICA GR50      -----
EBRE  A   1 P 20:110:00000 20:116:86370 LEICA GR50      -----
ELGE  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
EMAZ  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
GERN  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
IGEL  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
ISPS  A   1 P 20:110:00000 20:116:86370 TRIMBLE NETR9  -----
KAST  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
LARE  A   1 P 20:110:00000 20:116:86370 LEICA GRX1200GGPRO -----
LAZK  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
LEIT  A   1 P 20:110:00000 20:116:86370 LEICA GR50      -----
ORON  A   1 P 20:110:00000 20:116:86370 LEICA GR50      -----
PASA  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
RIO1  A   1 P 20:110:00000 20:116:86370 LEICA GR25      -----
SALA  A   1 P 20:110:00000 20:116:86370 LEICA GRX1200+GNSS -----
SCOA  A   1 P 20:110:00000 20:116:86370 LEICA GR25      -----
SOPU  A   1 P 20:110:00000 20:116:86370 LEICA GR30      -----
TERU  A   1 P 20:110:00000 20:116:86370 LEICA GRX1200GGPRO -----
VITO  A   1 P 20:110:00000 20:116:86370 LEICA GR10      -----
YEBE  A   1 P 20:110:00000 20:116:86370 TRIMBLE NETR9  -----
ZARA  A   1 P 20:110:00000 20:116:86370 TRIMBLE NETR9  -----
```

### 7.2 Antennas

Serial number ONLY provided in case individual calibrations are available.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__
ACOR  A   1 P 20:110:00000 20:116:86370 LEIAT504      LEIS -----
ALDA  A   1 P 20:110:00000 20:116:86370 LEIAS10      NONE -----
ALSA  A   1 P 20:110:00000 20:116:86370 LEIAR10      NONE -----
AMUR  A   1 P 20:110:00000 20:116:86370 LEIAS10      NONE -----
BIAZ  A   1 P 20:110:00000 20:116:86370 LEIAR25      LEIT -----
BRZR  A   1 P 20:110:00000 20:116:86370 LEIAS10      NONE -----
```

```

CACE A 1 P 20:110:00000 20:116:86370 TRM29659.00 NONE -----
CANT A 1 P 20:110:00000 20:116:86370 LEIAR25_R4 LEIT 25066
CHER A 1 P 20:110:00000 20:116:86370 LEIAX1203+GNSS NONE -----
CREU A 1 P 20:110:00000 20:116:86370 LEIAR25_R4 NONE 26357
EBRE A 1 P 20:110:00000 20:116:86370 LEIAR25_R4 NONE 26359
ELGE A 1 P 20:110:00000 20:116:86370 LEIAR25_R4 LEIT -----
EMAZ A 1 P 20:110:00000 20:116:86370 LEIAS10 NONE -----
GERN A 1 P 20:110:00000 20:116:86370 LEIAS10 NONE -----
IGEL A 1 P 20:110:00000 20:116:86370 LEIAR20 LEIM -----
ISPS A 1 P 20:110:00000 20:116:86370 TRM59900.00 SCIS -----
KAST A 1 P 20:110:00000 20:116:86370 LEIAS10 NONE -----
LARE A 1 P 20:110:00000 20:116:86370 LEIAT504 NONE -----
LAZK A 1 P 20:110:00000 20:116:86370 LEIAR25_R4 LEIT -----
LEIT A 1 P 20:110:00000 20:116:86370 LEIAR10 NONE -----
ORDN A 1 P 20:110:00000 20:116:86370 LEIAR10 NONE -----
PASA A 1 P 20:110:00000 20:116:86370 LEIAR20 LEIM 73034
RID1 A 1 P 20:110:00000 20:116:86370 LEIAR25_R4 LEIT 25138
SALA A 1 P 20:110:00000 20:116:86370 LEIAR25 NONE -----
SCDA A 1 P 20:110:00000 20:116:86370 TRM55971.00 NONE -----
SOPU A 1 P 20:110:00000 20:116:86370 LEIAS10 NONE -----
TERU A 1 P 20:110:00000 20:116:86370 LEIAT504GG LEIS -----
VITO A 1 P 20:110:00000 20:116:86370 LEIAS10 NONE -----
YEBE A 1 P 20:110:00000 20:116:86370 TRM29659.00 NONE -----
ZARA A 1 P 20:110:00000 20:116:86370 TRM29659.00 NONE -----

```

### 7.3 Eccentricities

```

*
*SITE PT SOLN T DATA_START_ DATA_END_ AXE ARP->BENCHMARK(M) UP_ NORTH_ EAST_
ACOR A 1 P 20:110:00000 20:116:86370 UNE 3.0460 0.0000 0.0000
ALDA A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
ALSA A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
AMUR A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
BRZR A 1 P 20:110:00000 20:116:86370 UNE 0.0771 0.0000 0.0000
CACE A 1 P 20:110:00000 20:116:86370 UNE 0.0600 0.0000 0.0000
CANT A 1 P 20:110:00000 20:116:86370 UNE 3.0490 0.0000 0.0000
CHER A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
CREU A 1 P 20:110:00000 20:116:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 20:110:00000 20:116:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
EMAZ A 1 P 20:110:00000 20:116:86370 UNE 0.0350 0.0000 0.0000
GERN A 1 P 20:110:00000 20:116:86370 UNE 0.0771 0.0000 0.0000
IGEL A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
ISPS A 1 P 20:110:00000 20:116:86370 UNE 0.0350 0.0000 0.0000
KAST A 1 P 20:110:00000 20:116:86370 UNE 0.0350 0.0000 0.0000
LARE A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
LAZK A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
LEIT A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
ORDN A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
PASA A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
RID1 A 1 P 20:110:00000 20:116:86370 UNE 0.0606 0.0000 0.0000
SALA A 1 P 20:110:00000 20:116:86370 UNE 0.0600 0.0000 0.0000
SCDA A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
SOPU A 1 P 20:110:00000 20:116:86370 UNE 0.0771 0.0000 0.0000
TERU A 1 P 20:110:00000 20:116:86370 UNE 0.0600 0.0000 0.0000
VITO A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
YEBE A 1 P 20:110:00000 20:116:86370 UNE 0.0000 0.0000 0.0000
ZARA A 1 P 20:110:00000 20:116:86370 UNE 3.2590 0.0000 0.0000

```

## 8 References

C. Boucher and Z. Altamimi (2011): *Specifications for reference frame fixing in the analysis of a EUREF GPS campaign*. [etrs89.ensg.ign.fr/memo-V8.pdf](https://etrs89.ensg.ign.fr/memo-V8.pdf)

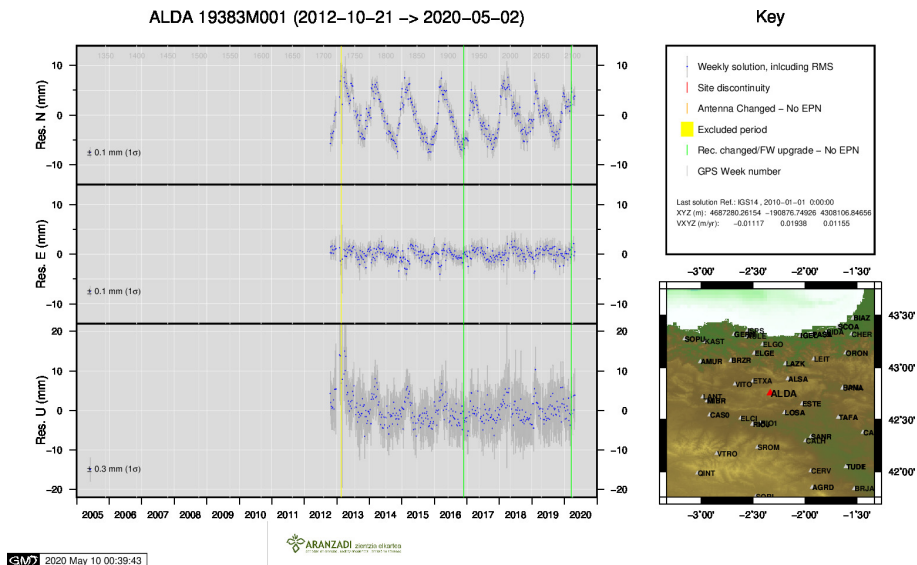
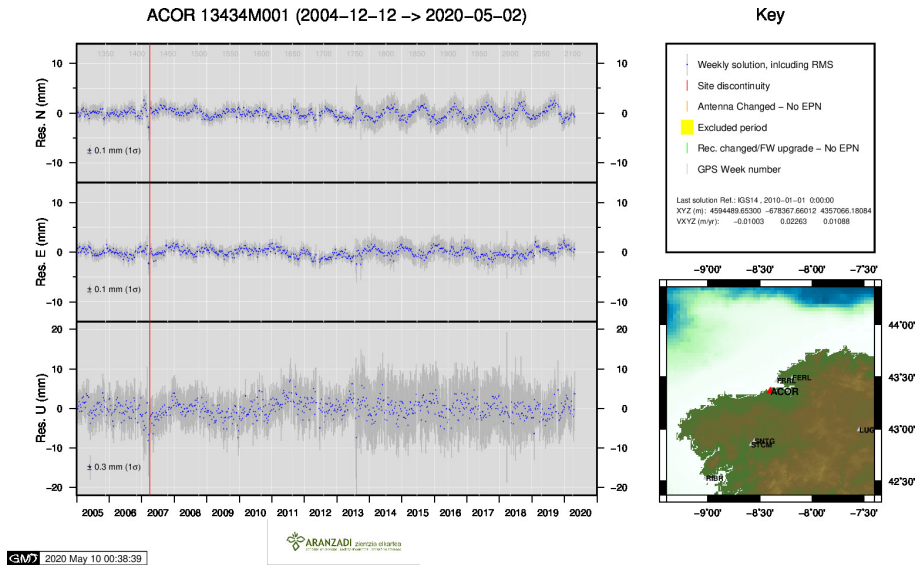
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](https://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

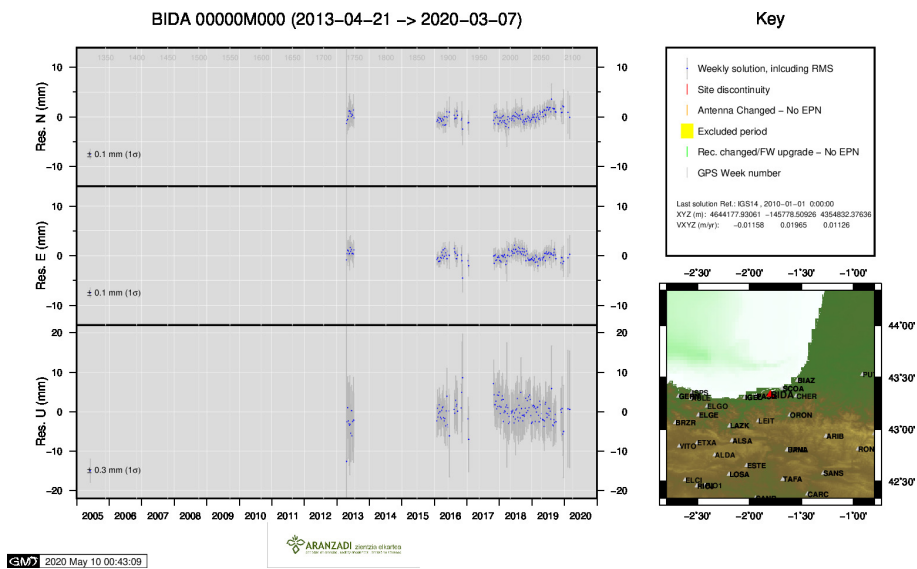
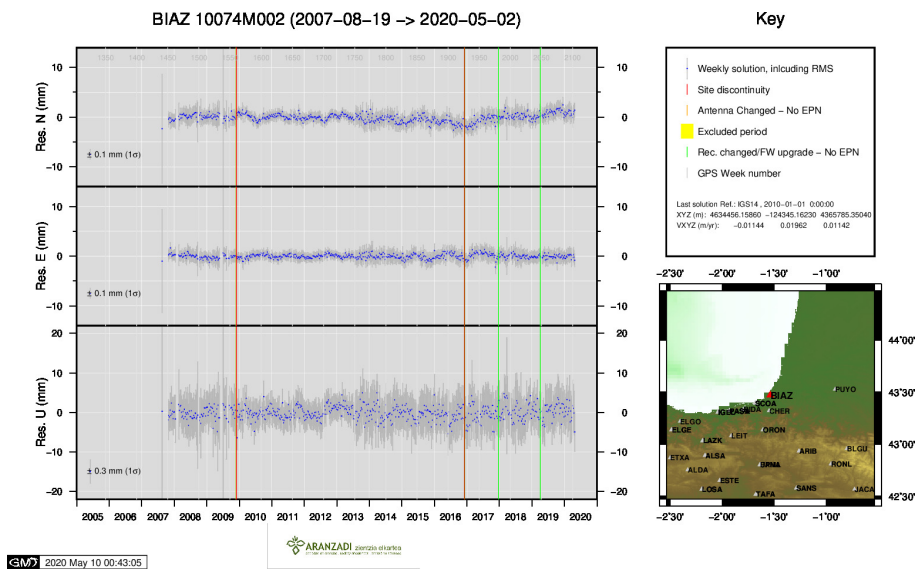
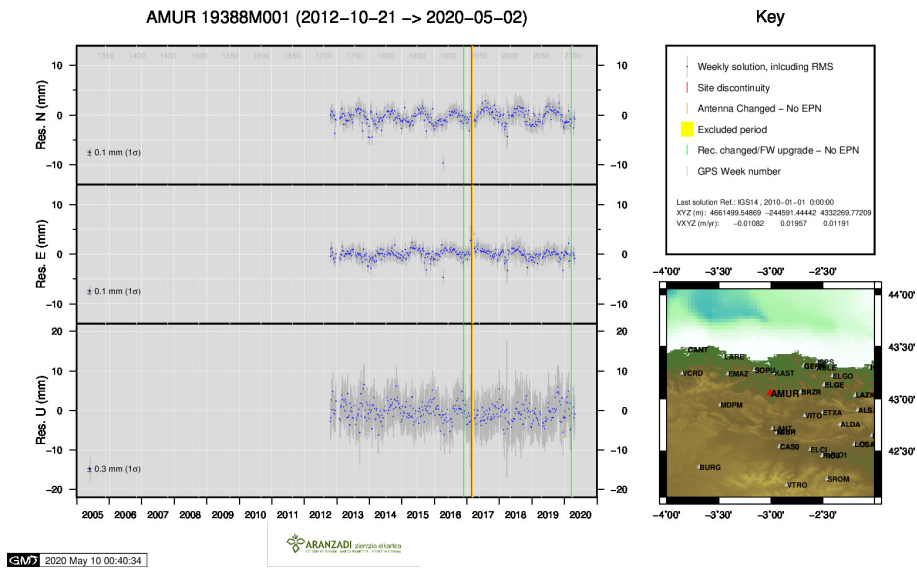
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems*. [etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf](https://etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf)

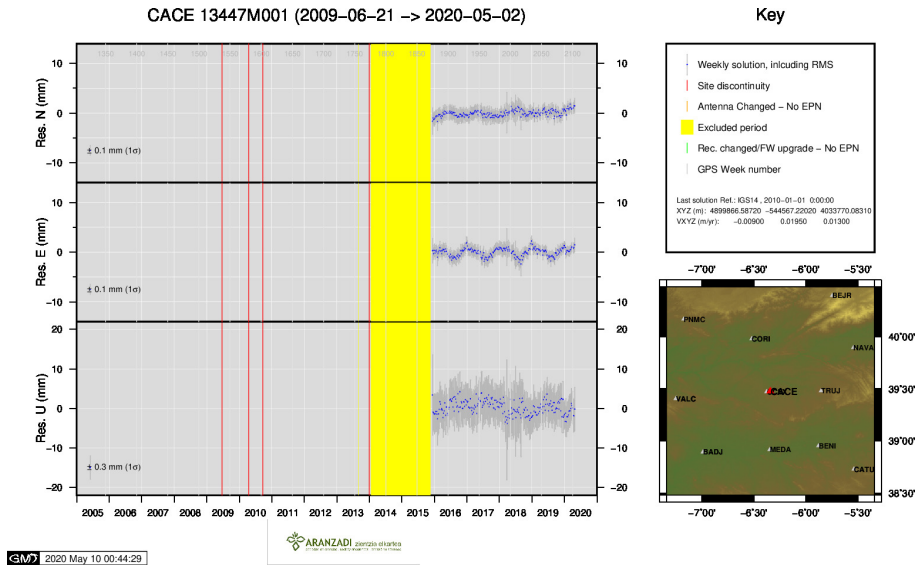


## 9 Cumulative Time Series

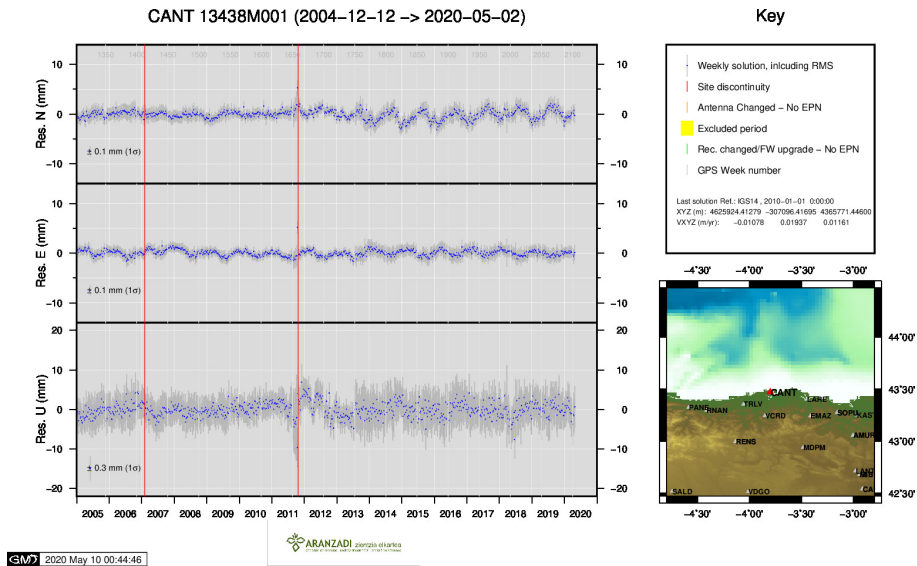
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



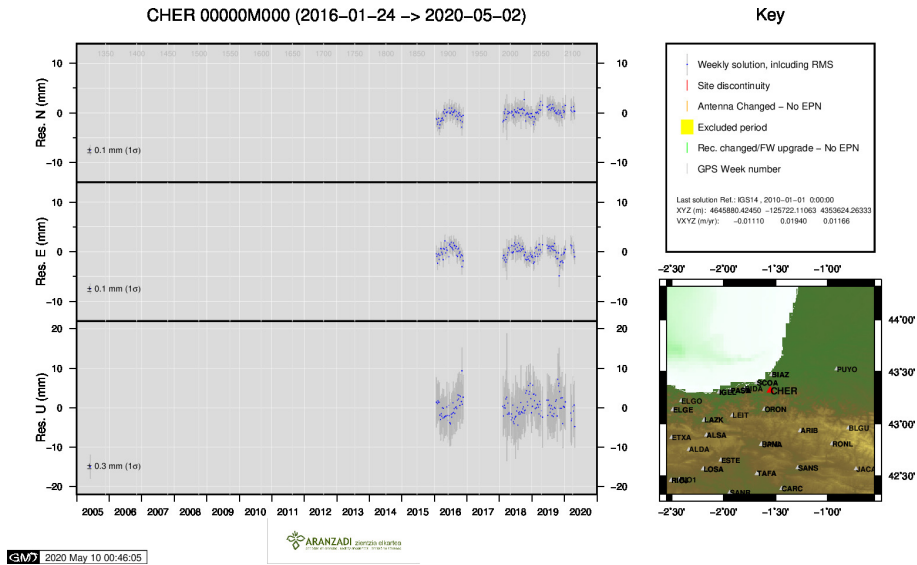




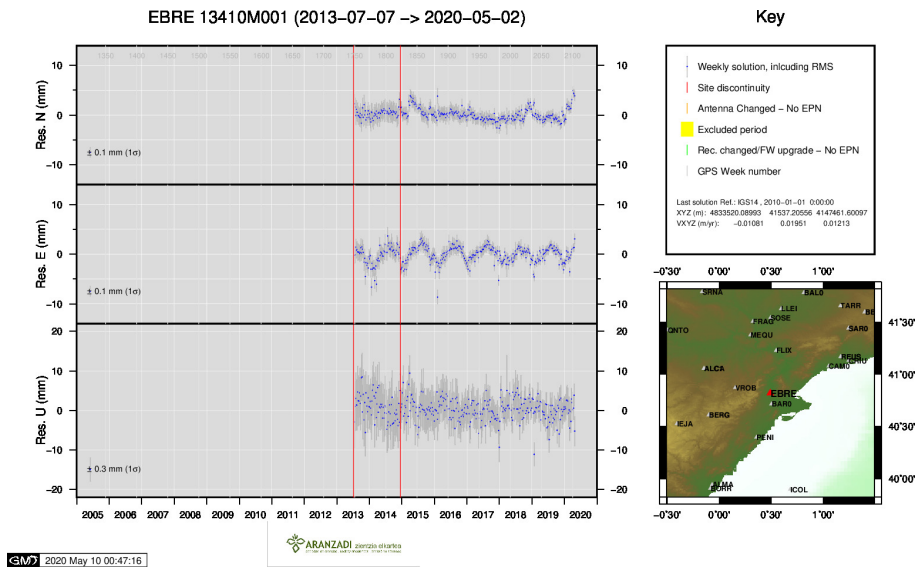
6 ) CACE



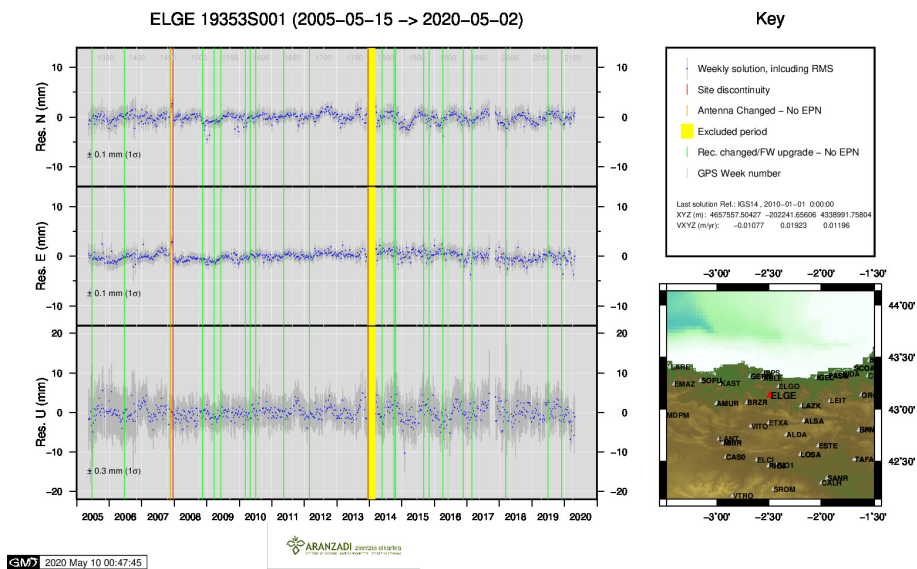
7 ) CANT



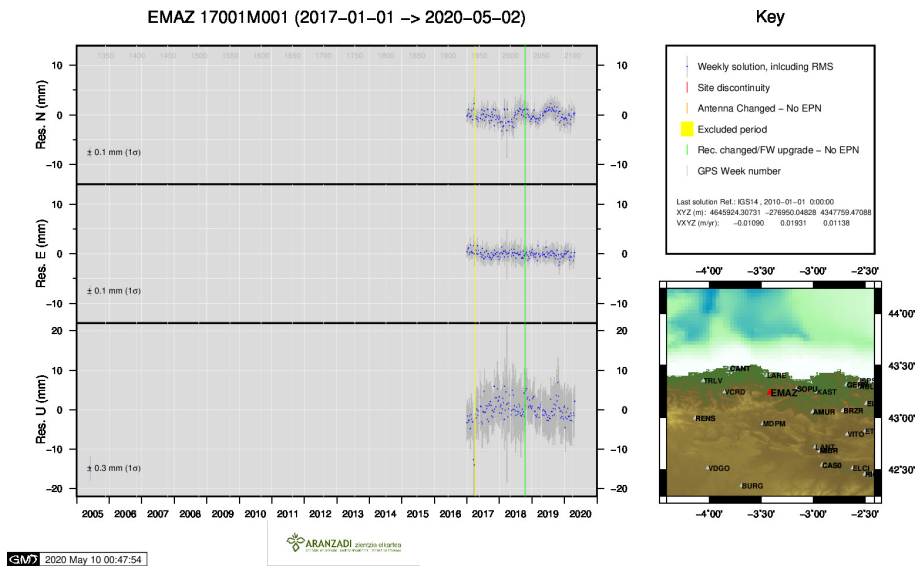
8 ) CHER



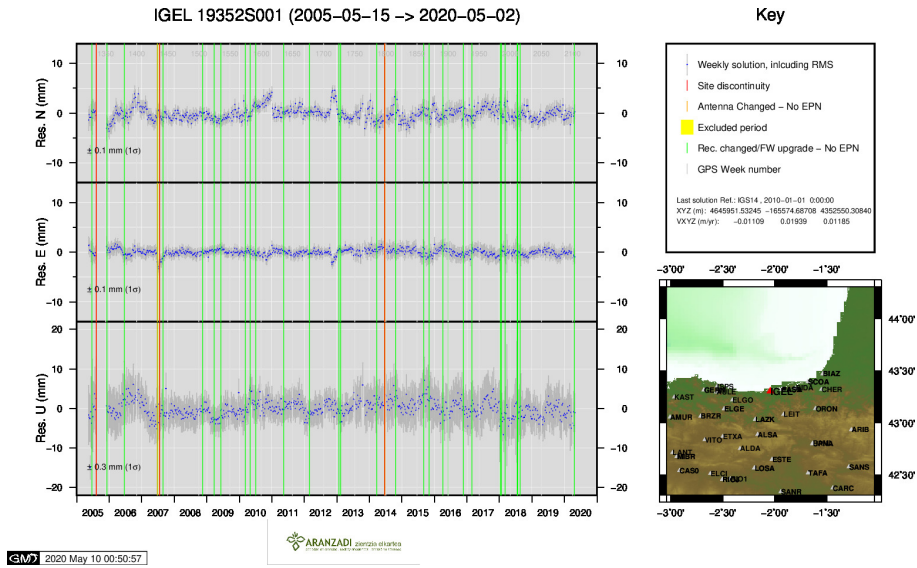
9 ) EBRE



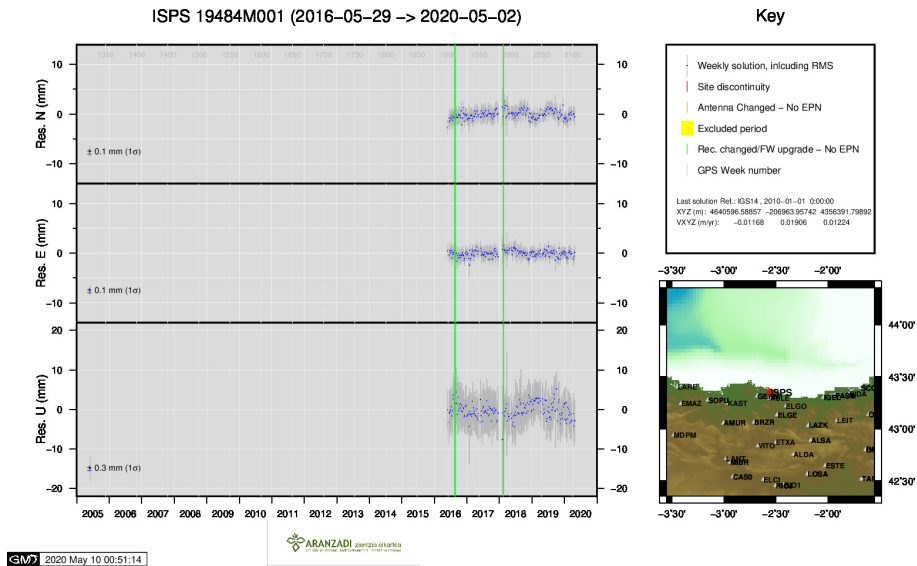
10 ) ELGE



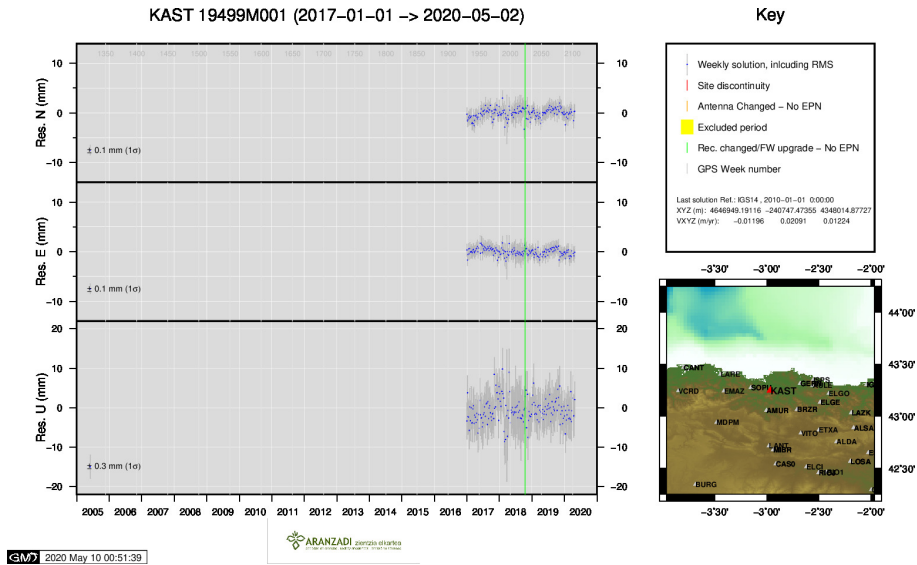
11 ) EMAZ



12 ) IGEL

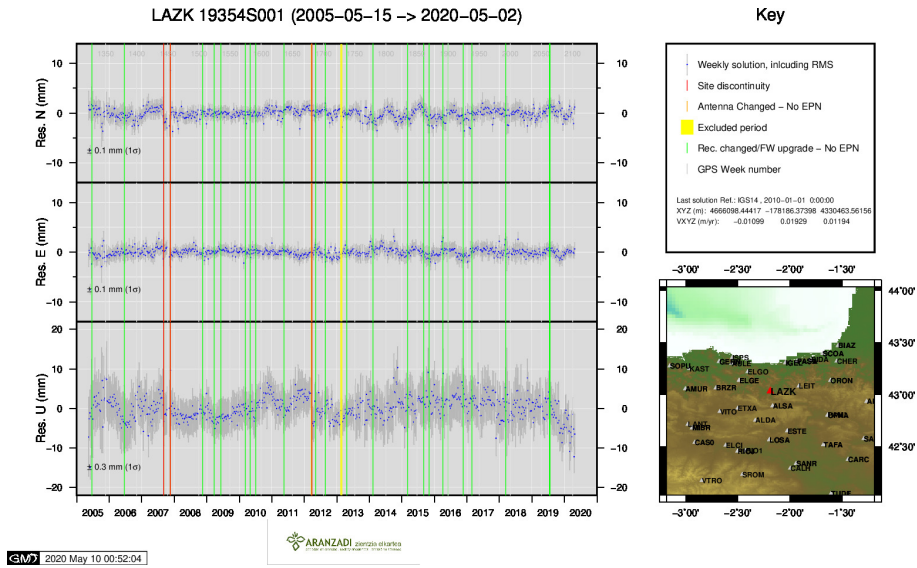


13 ) ISPS

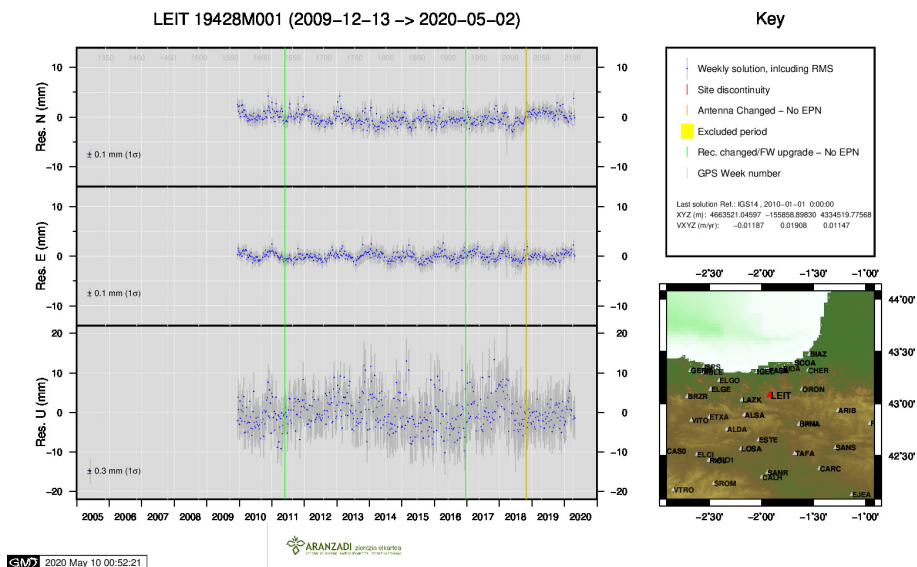


14 ) KAST

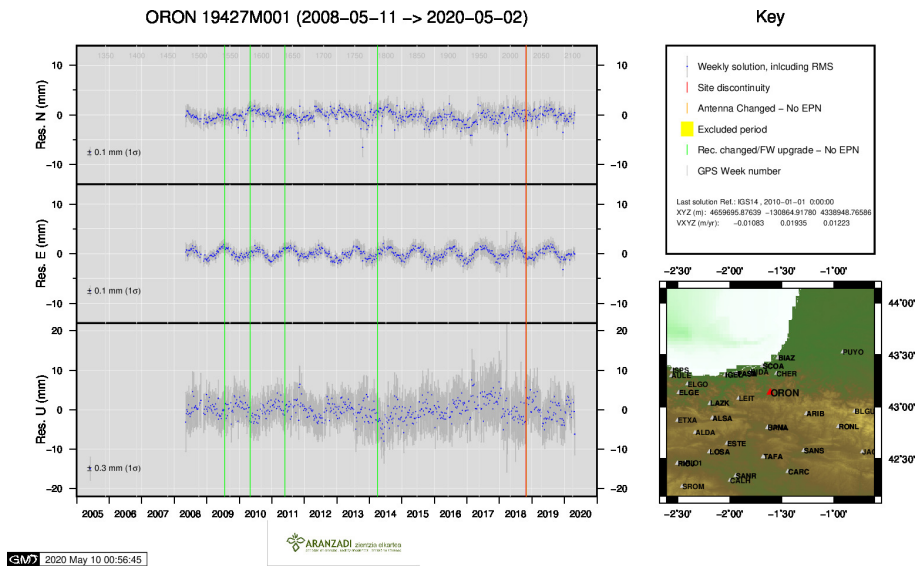




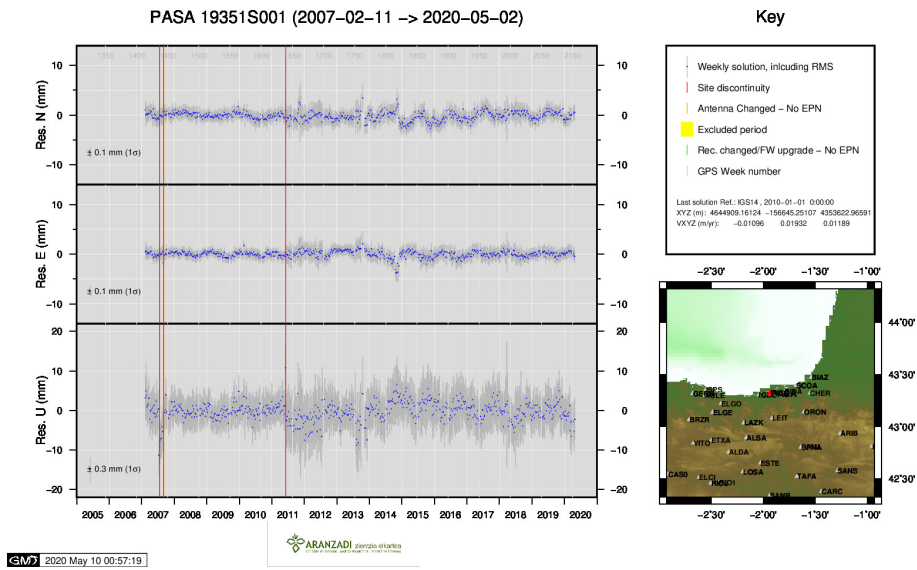
15 ) LAZK



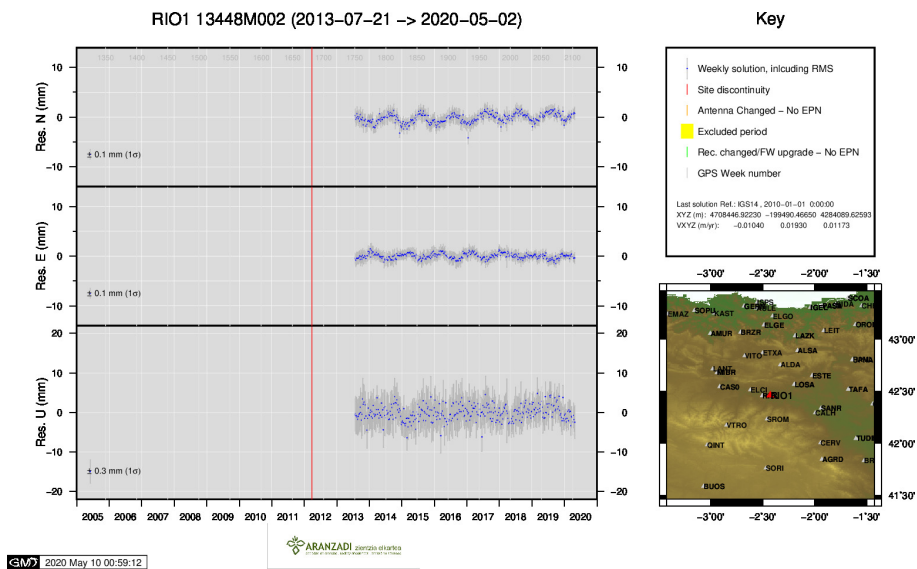
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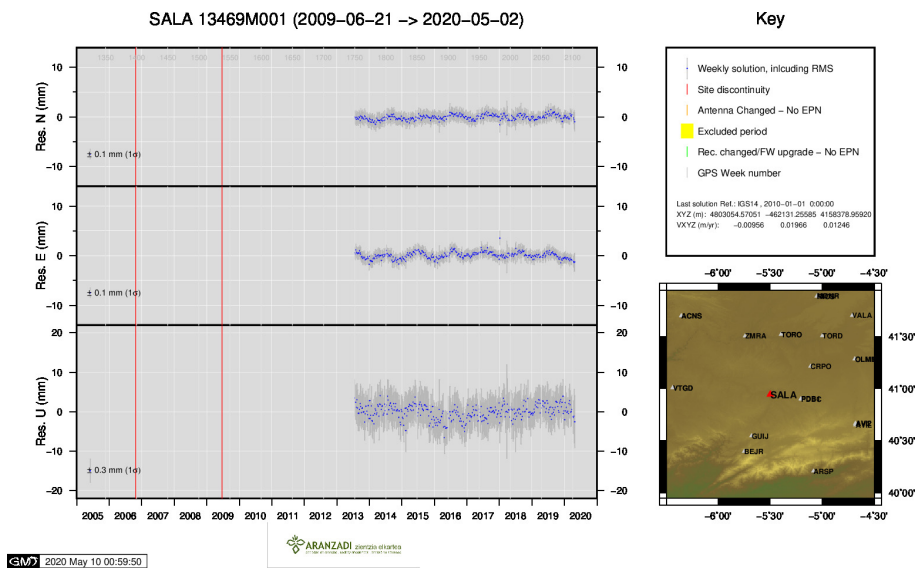
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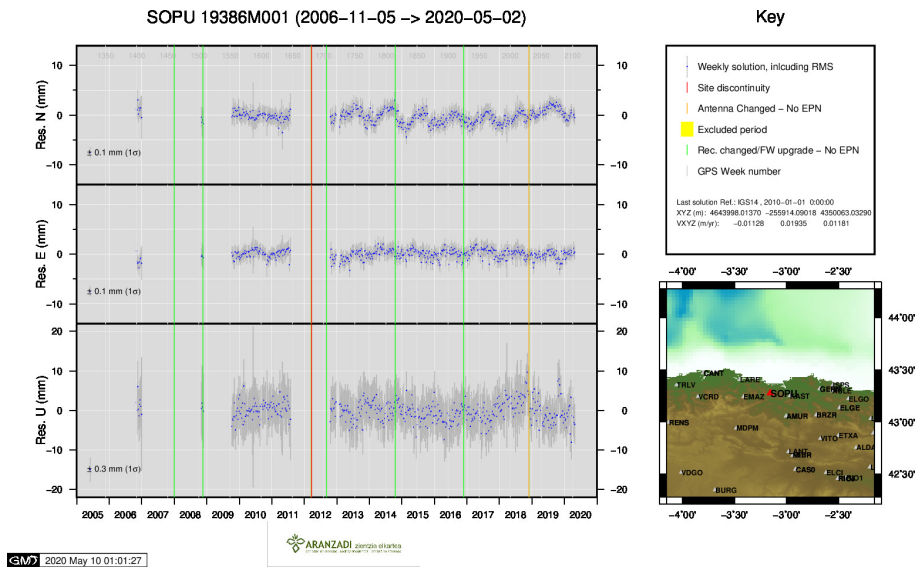
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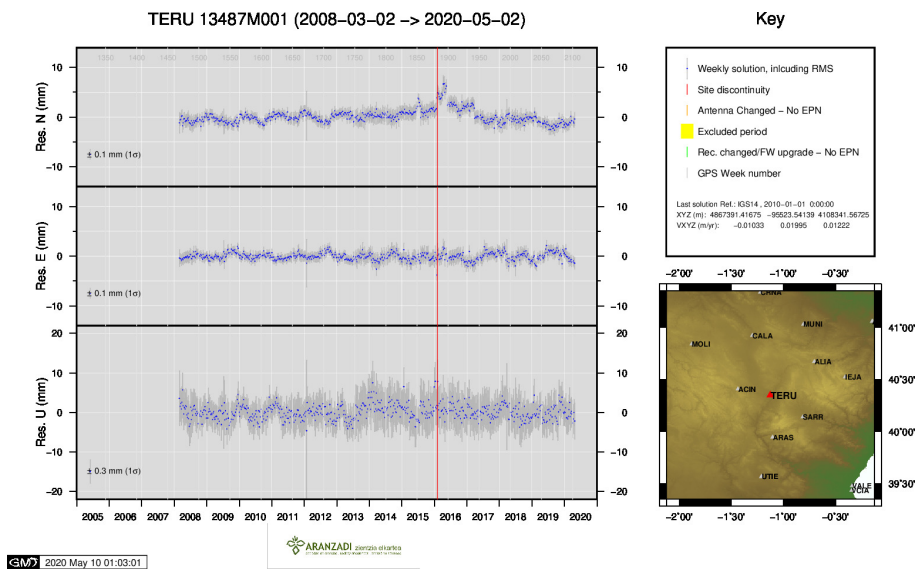
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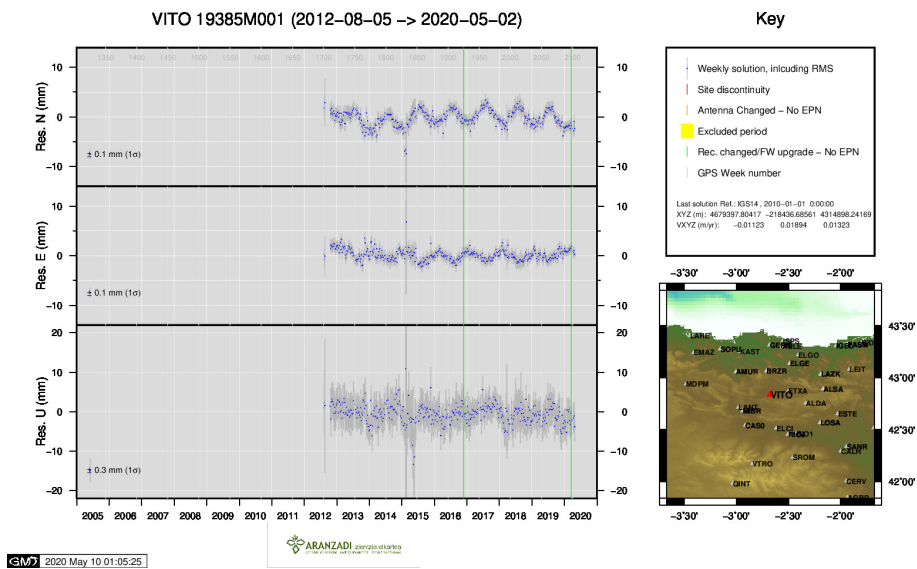
20 ) SALA



21 ) SOPU

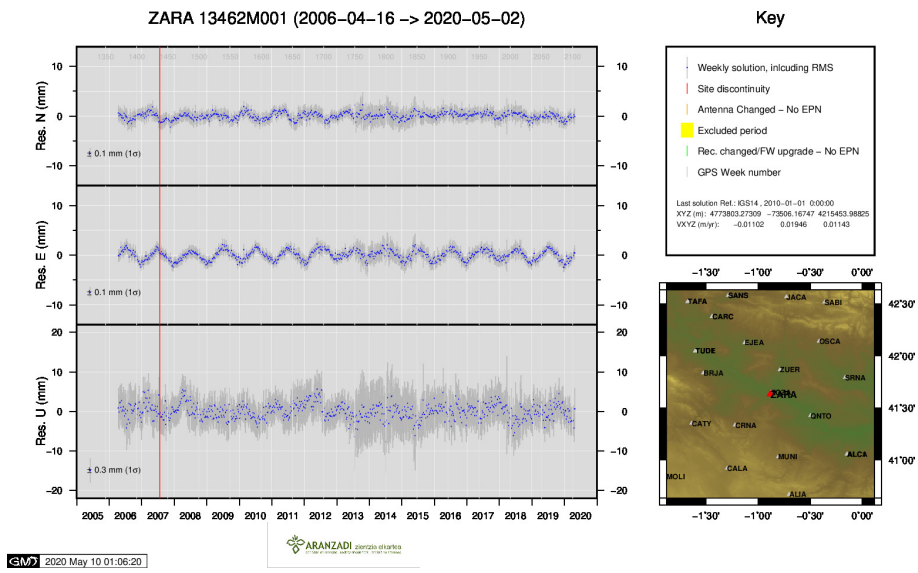


22 ) TERU



23 ) VITO





24 ) ZARA