

ARA-DAC Weekly Analysis Result: 2335 (GFA)

Technical Report

GPS Week: 2335 (GFA)

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

ARA-DAC details:

Contact person: J. Zurutuza

Contact mail: geodesia@aranzadi.eus

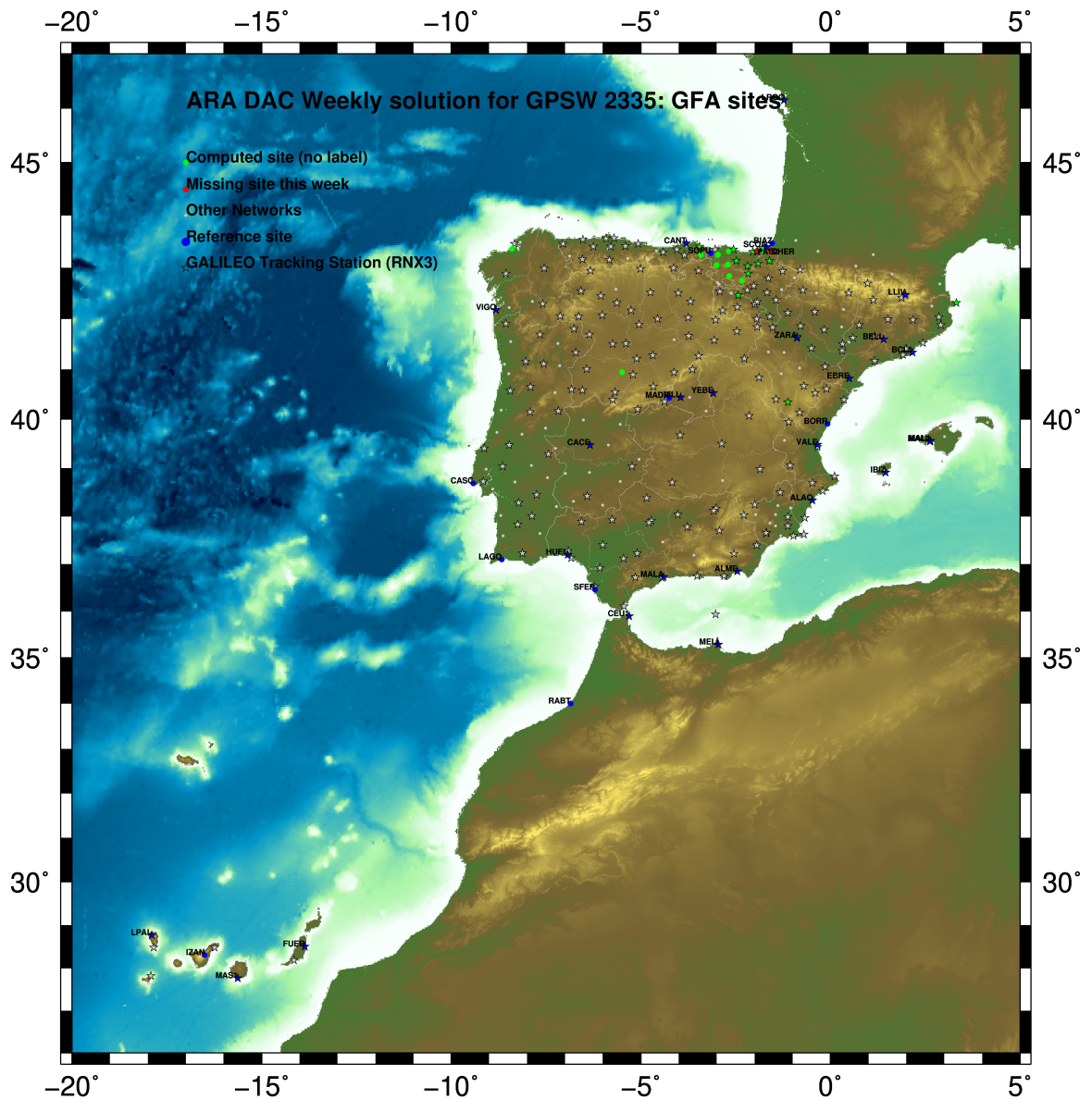
Report generated on 2024/10/28 at 06:26:22



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 2024 Oct 28 06:26:17

Fig.1: Computed Sites for GPS Week2335 (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 is used if available starting GPS week 1986)
- 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.I20 file and individual calibrations from EPNC_20.ATX. In case no calibration values of an antenna/radome pairs are not available for a certain GNSS system at some station, the observation of this/these GNSS/GNSSs are excluded from the analysis of that station.
- Reference sites: the latest IGS cumulative solution is used to align our solution to the latest IGS20 release, regularly updated and available at: IGS0OPSSNX_1994002_00U_00U_CRD.SNX.gz. Following the EUREF guidelines, no other individual calibrations are included in the analysis starting GPSW 2238 (IGS20); also applies to repro3 solutions, which are based on IGS20 standards.
- Troposphere:
 - minimum elevation is 3 deg.; elevation dependent weighting.
 - VMF3 mapping function. ZPD parameters are estimated using the VMF3 mapping function.
 - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2014b (Scherneck).
- Atmospheric loading: not corrected, following the latest recommendations for IGS20 products.
- Tidal displacements:
 - Mean pole model : IERS2010_v1.2.0
 - Subdaily pole model: DESAI2016
 - Nutation model : IAU2000R06

4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria: $3 \times \text{rms}$ of single differences, in the weekly combination of daily normal equations (ADDNEQ)
- Station coordinates: minimum constraints (MC) to IGS 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. DE421 planetary ephemeris and JGM3 Earth geopotential model is used.
- Ambiguity: an advanced ambiguity resolution (AR) scheme is included:
 - Code-Based Widelane (WL) and Narrow Line (NR) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
 - Phase-Based Widelane (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 (IGS cumulative solution) are the ones used in the Minimal Constraints condition.

5.1 IGS20

The Reference Frame considered in this section is the IGS20 (IGS cumulative solution), mapped from 2015.0 to the observation epoch.

ARA FINAL WEEKLY COMBINATION: FINAL ORBITS 28-OCT-24 05:08

LOCAL GEODETIC DATUM: IGS20 EPOCH: 2024-10-09 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.48309	-678367.27808	4357066.32604	A	G
39	ALDA 19383M001	4687280.10934	-190876.46392	4308107.01743	A	GR
50	ALSA 19419M001	4677250.77434	-176770.29280	4319079.93614	A	GRE
53	AMUR 19388M001	4661499.39332	-244591.15331	4332269.94456	A	GR
384	BIAZ 10074M002	4634455.99111	-124344.87346	4365785.52055	W	GR
101	BIDA 00000M000	4644177.76051	-145778.22065	4354832.54119	A	GR
113	BRZR 19387M001	4662220.92841	-220769.80128	4333309.48972	A	GR
573	CACE 13447M001	4899866.45644	-544566.93380	4033770.26948	W	GRE
592	CANT 13438M001	4625924.25762	-307096.13412	4365771.62189	W	GRE
908	CREU 13432M001	4715420.06589	273178.16174	4271946.90469	A	GRE
135	EBRE 13410M001	4833519.93172	41537.49662	4147461.78066	W	GRE
180	ELGE 19353S001	4657557.33930	-202241.36761	4338991.94930	A	GRE
182	EMAZ 17001M001	4645924.15579	-276949.76683	4347759.63597	A	GR
209	GERN 19389M001	4642811.26405	-217222.82413	4353278.94030	A	GR
257	HOND 15012M002	4640529.25988	-145675.88338	4358781.81852	A	GRE
235	IGEL 19352S001	4645951.37216	-165574.40130	4352550.48987	A	GRE
240	ISPS 19484M001	4640596.42073	-206963.67519	4356391.97667	A	GRE
245	KAST 19499M001	4646949.01325	-240747.16594	4348015.04839	A	GR
252	LARE 19440M001	4632831.90055	-279026.04267	4360314.49411	A	GRE
256	LAZK 19354S001	4666098.28771	-178186.08787	4330463.73881	A	GRE
261	LEIT 19428M001	4663520.88241	-155858.61638	4334519.95451	A	GRE
334	ORON 19427M001	4659695.72434	-130864.63615	4338948.93908	A	GRE
493	PASA 19351S001	4644909.00378	-156644.96796	4353623.14113	A	GRE
553	RID1 13448M002	4708446.77300	-199490.18015	4284089.80154	A	GRE
558	SALA 13469M001	4803054.43653	-462130.96775	4158379.14492	A	GR
526	SCDA 10088M002	4639940.44678	-136224.84126	4359552.48903	W	GRE
715	SOPU 19386M001	4643997.84836	-255913.80574	4350063.20186	W	GR
443	TERU 13487M001	4867391.26509	-95523.24008	4108341.75008	A	GRE
493	VITO 19385M001	4679397.64844	-218436.40292	4314898.43183	A	GR
616	YEBE 13420M001	4848724.51577	-261631.82411	4123094.39551	W	GRE
655	ZARA 13462M001	4773803.11422	-73505.88300	4215454.16079	W	GRE

5.2 ETRF2000 (ETRS89) Coordinates

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

CONVERT TO ETRF2000 28-OCT-24 05:08

LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2024-10-09 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.83025	-678367.92086	4357065.84172	A	
39	ALDA 19383M001	4687280.51961	-190877.11713	4308106.53191	A	
50	ALSA 19419M001	4677251.18744	-176770.94474	4319079.45171	A	
53	AMUR 19388M001	4661499.79818	-244591.80350	4332269.46056	A	
384	BIAZ 10074M002	4634456.41524	-124345.52001	4365785.04065	W	
101	BIDA 00000M000	4644178.18080	-145778.86845	4354832.06012	A	
113	BRZR 19387M001	4662221.33663	-220770.45151	4333309.00599	A	
573	CACE 13447M001	4899866.79552	-544567.61354	4033769.76001	W	
592	CANT 13438M001	4625924.65662	-307096.78010	4365771.14014	W	
908	CREU 13432M001	4715420.53692	273177.50671	4271946.42318	A	
135	EBRE 13410M001	4833520.36075	41536.82635	4147461.28544	W	
180	ELGE 19353S001	4657557.75053	-202242.01741	4338991.46625	A	
182	EMAZ 17001M001	4645924.55747	-276950.41521	4347759.15289	A	
209	GERN 19389M001	4642811.67439	-217223.47196	4353278.45834	A	
257	HOND 15012M002	4640529.68051	-145675.53073	4358781.33778	A	
235	IGEL 19352S001	4645951.78954	-165575.04938	4352550.00837	A	
240	ISPS 19484M001	4640596.83274	-206964.32272	4356391.49505	A	
245	KAST 19499M001	4646949.41992	-240747.81434	4348014.56573	A	
252	LARE 19440M001	4632832.30296	-279026.68943	4360314.01215	A	
256	LAZK 19354S001	4666098.70155	-178186.73845	4330463.25534	A	
261	LEIT 19428M001	4663521.29965	-155859.26659	4334519.47159	A	
334	ORON 19427M001	4659696.14538	-130865.28581	4338948.45685	A	
493	PASA 19351S001	4644909.42248	-156645.61588	4353622.65984	A	
553	RID1 13448M002	4708447.18011	-199490.83596	4284089.31402	A	
558	SALA 13469M001	4803054.79720	-462131.63567	4158378.64525	A	
526	SCDA 10088M002	4639940.86877	-136225.48851	4359552.00847	W	
715	SOPU 19386M001	4643998.25312	-255914.45382	4350062.71924	W	
443	TERU 13487M001	4867391.67208	-95523.91491	4108341.24993	A	
493	VITO 19385M001	4679398.05547	-218437.05524	4314897.94661	A	
616	YEBE 13420M001	4848724.90113	-261632.49714	4123093.89466	W	
655	ZARA 13462M001	4773803.53302	-73506.54641	4215453.66926	W	

5.3 ETRF2014 (ETRS89) Coordinates

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

```

CONVERT TO ETRF2014                                     28-OCT-24 05:08
-----
LOCAL GEODETIC DATUM: ETRF2014                       EPOCH: 2024-10-09 11:59:45
NUM STATION NAME      X (M)      Y (M)      Z (M)      FLAG  SYSTEM
111 ACRD 13434M001     4594489.79043 -678367.95749 4357065.89443 A
 39 ALDA 19383M001     4687280.47724 -190877.15520 4308106.58448 A
 50 ALSA 19419M001     4677251.14514 -176770.98291 4319079.50432 A
 53 AMUR 19388M001     4661499.75628 -244591.84148 4332269.51319 A
384 BIAZ 10074M002     4634456.37323 -124345.55857 4365785.09343 W
101 BIDA 00000M000     4644178.13875 -145778.90688 4354832.11286 A
113 BRZR 19387M001     4662221.29465 -220770.48957 4333309.05863 A
573 CACE 13447M001     4899866.75175 -544567.64928 4033769.81186 W
592 CANT 13438M001     4625924.61533 -307096.81801 4365771.19286 W
908 CREU 13432M001     4715420.49242 273177.46704 4271946.47601 A
135 EBRE 13410M001     4833520.31580 41536.78808 4147461.33774 W
180 ELGE 19353S001     4657557.70854 -202242.05557 4338991.51891 A
182 EMAZ 17001M001     4645924.51586 -276950.45314 4347759.20555 A
209 GERN 19389M001     4642811.63261 -217223.51013 4353278.51104 A
257 HOND 15012M002     4640529.63850 -145676.56918 4358781.39052 A
235 IGEL 19352S001     4645951.74755 -165575.08773 4352550.06108 A
240 ISPS 19484M001     4640596.79095 -206964.36094 4356391.54777 A
245 KAST 19499M001     4646949.37818 -240747.85240 4348014.61841 A
252 LARE 19440M001     4632832.26151 -279026.72741 4360314.06486 A
256 LAZK 19354S001     4666098.65937 -178186.77666 4330463.30799 A
261 LEIT 19428M001     4663521.25743 -155859.30489 4334519.52426 A
334 ORDN 19427M001     4659696.10310 -130865.32423 4338948.50955 A
493 PASA 19351S001     4644909.38046 -156645.65427 4353622.71257 A
553 RIO1 13448M002     4708447.13753 -199490.87390 4284089.36653 A
558 SALA 13469M001     4803054.75436 -462131.67217 4158378.69738 A
526 SCOA 10088M002     4639940.82673 -136225.52700 4359552.06123 W
715 SOPU 19386M001     4643998.21145 -255914.49183 4350062.77192 W
443 TERU 13487M001     4867391.62725 -95523.95251 4108341.30204 A
493 VITO 19385M001     4679398.01329 -218437.09324 4314897.99920 A
616 YEBE 13420M001     4848724.85711 -261632.53419 4123093.94673 W
655 ZARA 13462M001     4773803.48922 -73506.58452 4215453.72165 W
    
```

5.4 ETRF2020 (ETRS89) Coordinates

European Terrestrial Reference System, 1989 (ETRS89) is realized by ETRF2020 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

```

CONVERT TO ETRF2020                                     28-OCT-24 05:08
-----
LOCAL GEODETIC DATUM: ETRF2020                       EPOCH: 2024-10-09 11:59:45
NUM STATION NAME      X (M)      Y (M)      Z (M)      FLAG  SYSTEM
111 ACRD 13434M001     4594489.78669 -678367.94310 4357065.90235 A
 39 ALDA 19383M001     4687280.47220 -190877.14033 4308106.59266 A
 50 ALSA 19419M001     4677251.14003 -176770.96806 4319079.51248 A
 53 AMUR 19388M001     4661499.75134 -244591.82671 4332269.52131 A
384 BIAZ 10074M002     4634456.36785 -124345.54383 4365785.10153 W
101 BIDA 00000M000     4644178.13347 -145778.89213 4354832.12097 A
113 BRZR 19387M001     4662221.28964 -220770.47479 4333309.06676 A
573 CACE 13447M001     4899866.74842 -544567.63388 4033769.82030 W
592 CANT 13438M001     4625924.61050 -307096.80338 4365771.20091 W
908 CREU 13432M001     4715420.48610 273177.48219 4271946.48431 A
135 EBRE 13410M001     4833520.31048 41536.80351 4147461.34619 W
180 ELGE 19353S001     4657557.70346 -202242.04080 4338991.52704 A
182 EMAZ 17001M001     4645924.51098 -276950.43843 4347759.21364 A
209 GERN 19389M001     4642811.62754 -217223.49541 4353278.51914 A
257 HOND 15012M002     4640529.63321 -145676.55444 4358781.39863 A
235 IGEL 19352S001     4645951.74233 -165575.07298 4352550.06920 A
240 ISPS 19484M001     4640596.78584 -206964.34622 4356391.55586 A
245 KAST 19499M001     4646949.37319 -240747.83768 4348014.62651 A
252 LARE 19440M001     4632832.25660 -279026.71275 4360314.07293 A
256 LAZK 19354S001     4666098.65424 -178186.76185 4330463.31614 A
261 LEIT 19428M001     4663521.25222 -155859.29008 4334519.53240 A
334 ORDN 19427M001     4659696.09782 -130865.30942 4338948.51769 A
493 PASA 19351S001     4644909.37521 -156645.63952 4353622.72069 A
553 RIO1 13448M002     4708447.13258 -199490.85897 4284089.37474 A
558 SALA 13469M001     4803054.75049 -462131.65705 4158378.70568 A
526 SCOA 10088M002     4639940.82141 -136225.51226 4359552.06934 W
715 SOPU 19386M001     4643998.20651 -255914.47712 4350062.78002 W
443 TERU 13487M001     4867391.62242 -95523.93703 4108341.31052 A
493 VITO 19385M001     4679398.00831 -218437.07840 4314898.00736 A
616 YEBE 13420M001     4848724.85274 -261632.51885 4123093.95515 W
655 ZARA 13462M001     4773803.48407 -73506.56933 4215453.72998 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 IGS20 solution and are given with respect to the Local frame (North-East-Up).

GFA FINAL WEEKLY COMBINATION: FINAL ORBITS 28-OCT-24 05:08

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	7	XXXXXX	1.53	1.94	5.67
ALDA 19383M001	7	XXXXXX	1.77	1.48	3.07
ALSA 19419M001	7	XXXXXX	3.06	1.68	6.48
AMUR 19388M001	5	X X XXX	1.96	1.85	5.37
BIAZ 10074M002	7	XXXXXX	1.49	1.44	7.48
BIDA 00000M000	7	XXXXXX	1.12	2.59	6.82
BRZR 19387M001	7	XXXXXX	3.24	4.85	6.66
CACE 13447M001	7	XXXXXX	3.30	1.51	3.83
CANT 13438M001	7	XXXXXX	1.45	1.56	3.94
CREU 13432M001	7	XXXXXX	3.06	2.97	5.33
EBRE 13410M001	7	XXXXXX	1.85	1.04	4.86
ELGE 19353S001	7	XXXXXX	1.95	1.45	4.48
EMAZ 17001M001	7	XXXXXX	2.59	1.62	8.06
GERN 19389M001	7	XXXXXX	1.11	1.65	7.57
HOND 15012M002	7	XXXXXX	0.83	1.40	5.85
IGEL 19352S001	7	XXXXXX	2.80	1.79	6.62
ISPS 19484M001	7	XXXXXX	2.99	2.56	4.82
KAST 19499M001	7	XXXXXX	1.25	2.02	6.11
LARE 19440M001	7	XXXXXX	1.17	0.79	7.42
LAZK 19354S001	7	XXXXXX	2.52	3.39	6.89
LEIT 19428M001	7	XXXXXX	3.68	1.44	7.10
ORON 19427M001	1	X	0.14	0.94	2.47
PASA 19351S001	6	XX XXXX	1.50	1.45	5.79
RI01 13448M002	7	XXXXXX	1.59	1.42	8.56
SALA 13469M001	7	XXXXXX	1.01	1.14	4.32
SCOA 10088M002	7	XXXXXX	3.21	0.98	3.80
SOPU 19386M001	7	XXXXXX	2.53	1.89	5.64
TERU 13487M001	7	XXXXXX	2.68	2.44	3.29
VITO 19385M001	7	XXXXXX	3.18	0.96	5.17
YEBE 13420M001	7	XXXXXX	2.19	1.27	2.54
ZARA 13462M001	7	XXXXXX	1.87	1.45	4.98

Comparison of individual solutions:

ACOR 13434M001	N	1.53	-1.75	1.26	-0.96	0.90	1.18	2.30	-1.03
ACOR 13434M001	E	1.94	-2.58	0.30	-0.20	1.11	0.58	3.75	0.13
ACOR 13434M001	U	5.67	-0.00	-0.84	-4.16	2.19	-6.11	-10.77	4.11
ALDA 19383M001	N	1.77	0.07	1.60	1.86	-2.31	-1.49	0.94	-2.09
ALDA 19383M001	E	1.48	1.58	1.26	0.87	1.27	-1.94	-1.69	0.18
ALDA 19383M001	U	3.07	-2.04	2.22	2.43	2.89	-0.05	-5.25	-2.35
ALSA 19419M001	N	3.06	-3.07	2.72	3.18	1.87	-2.97	0.82	-4.03
ALSA 19419M001	E	1.68	0.33	2.72	-1.15	2.32	-1.30	-0.57	-0.85
ALSA 19419M001	U	6.48	-7.97	1.41	-9.60	6.59	4.26	-1.87	5.38
AMUR 19388M001	N	1.96	1.73		-1.82		-2.01	1.16	1.92
AMUR 19388M001	E	1.85	-0.44		-0.02		-0.49	0.50	3.60
AMUR 19388M001	U	5.37	7.09		1.54		-5.87	-4.55	2.76
BIAZ 10074M002	N	1.49	-0.57	1.94	0.06	1.62	-2.30	0.06	-1.12
BIAZ 10074M002	E	1.44	-0.39	1.30	-0.15	-2.63	1.77	0.18	-0.69
BIAZ 10074M002	U	7.48	-1.03	7.35	1.82	6.14	7.92	-13.27	0.96
BIDA 00000M000	N	1.12	0.96	-0.34	0.30	-2.04	-0.02	1.14	-0.96
BIDA 00000M000	E	2.59	-0.94	2.77	-0.73	4.10	-3.65	-0.36	-1.01
BIDA 00000M000	U	6.82	-0.47	11.44	-0.61	-1.36	-0.67	-7.40	9.51
BRZR 19387M001	N	3.24	-4.57	0.48	-2.50	4.74	1.47	2.35	-2.35
BRZR 19387M001	E	4.85	-3.49	-5.56	-5.78	1.06	5.89	4.38	3.12
BRZR 19387M001	U	6.66	3.32	7.78	-11.09	8.15	1.58	0.84	-1.35
CACE 13447M001	N	3.30	-1.05	-1.95	-0.42	0.78	7.21	0.04	-2.76
CACE 13447M001	E	1.51	-0.69	-1.70	0.07	-0.11	2.83	1.49	0.29
CACE 13447M001	U	3.83	1.30	-3.52	0.16	2.10	-6.57	0.46	5.12
CANT 13438M001	N	1.45	-0.47	1.27	1.00	-1.42	-2.23	0.32	-1.61
CANT 13438M001	E	1.56	-0.34	1.22	0.26	-3.49	-0.11	-0.83	-0.36
CANT 13438M001	U	3.94	-4.84	0.15	4.96	-2.75	-2.41	-4.56	3.29
CREU 13432M001	N	3.06	0.13	0.97	1.43	-5.92	-3.48	2.35	0.77
CREU 13432M001	E	2.97	3.12	1.28	1.22	-5.65	-1.70	0.77	2.13
CREU 13432M001	U	5.33	-0.62	8.26	0.63	-7.90	6.15	0.12	-1.11
EBRE 13410M001	N	1.85	-0.02	-0.53	2.26	-2.23	-2.90	0.90	-1.02
EBRE 13410M001	E	1.04	1.53	1.19	-0.88	-0.08	-1.14	0.59	0.57
EBRE 13410M001	U	4.86	-0.79	9.78	-2.09	-2.92	3.83	-3.83	1.83
ELGE 19353S001	N	1.95	0.89	-2.10	1.06	-3.22	-0.89	1.95	1.25
ELGE 19353S001	E	1.45	2.22	1.53	-1.37	-0.87	0.32	-0.46	-1.56
ELGE 19353S001	U	4.48	4.89	6.93	2.47	2.11	-3.21	-5.15	1.14
EMAZ 17001M001	N	2.59	1.77	1.85	-0.56	0.10	-1.62	-2.61	-4.90
EMAZ 17001M001	E	1.62	0.02	-0.05	2.43	0.13	1.92	-1.58	-1.92
EMAZ 17001M001	U	8.06	-7.21	8.95	-8.43	3.77	-7.98	-10.22	-2.11
GERN 19389M001	N	1.11	-0.69	1.25	0.08	-1.31	-1.39	1.30	-0.11
GERN 19389M001	E	1.65	0.31	1.26	-1.53	2.90	-1.58	-1.09	0.42
GERN 19389M001	U	7.57	10.42	10.82	-2.60	3.54	0.79	-9.23	-3.60
HOND 15012M002	N	0.83	0.31	0.72	-0.23	0.13	-1.77	0.37	-0.42
HOND 15012M002	E	1.40	0.31	-2.02	-1.17	2.25	-0.26	1.04	-0.15
HOND 15012M002	U	5.85	1.36	11.84	-2.77	3.45	3.53	-5.34	-1.66
IGEL 19352S001	N	2.80	1.34	1.36	1.39	-0.55	-6.12	-0.57	1.80
IGEL 19352S001	E	1.79	0.42	3.09	-1.58	1.50	-0.76	-0.93	-1.83
IGEL 19352S001	U	6.62	1.18	14.70	1.44	0.01	-1.35	-6.43	0.76
ISPS 19484M001	N	2.99	-1.23	4.24	0.70	1.61	-4.26	1.38	-3.30
ISPS 19484M001	E	2.56	-0.61	2.42	-2.37	4.55	0.07	-0.98	-2.39
ISPS 19484M001	U	4.82	4.30	8.89	1.59	-1.23	0.31	-6.06	1.12
KAST 19499M001	N	1.25	0.30	-0.22	1.79	-0.28	-1.81	0.80	-1.43
KAST 19499M001	E	2.02	-1.83	1.58	-0.30	3.16	1.23	-1.17	-2.36
KAST 19499M001	U	6.11	0.93	4.86	-10.33	8.28	3.09	-1.06	3.66
LARE 19440M001	N	1.17	-1.63	0.05	-0.98	-0.63	-0.91	0.43	-1.77
LARE 19440M001	E	0.79	0.45	1.33	-0.13	-0.64	-0.84	-0.80	0.07
LARE 19440M001	U	7.42	-5.40	0.68	-5.32	11.23	-8.63	-8.24	-1.92
LAZK 19354S001	N	2.52	1.06	-2.00	3.50	0.41	-4.51	-0.44	0.40
LAZK 19354S001	E	3.39	4.90	3.96	0.77	0.75	-3.22	-3.89	-1.63
LAZK 19354S001	U	6.89	-4.96	3.65	9.71	-7.35	-4.44	-5.29	7.14

LEIT 19428M001	N	3.68	0.62	5.36	0.22	2.96	-5.26	-2.01	-3.43
LEIT 19428M001	E	1.44	0.78	2.26	0.72	-0.27	-1.68	-1.54	-0.99
LEIT 19428M001	U	7.10	7.59	5.71	3.93	6.83	-9.56	-6.44	-4.15
ORDN 19427M001	N	0.14				-0.14			
ORDN 19427M001	E	0.94				0.94			
ORDN 19427M001	U	2.47				2.47			
PASA 19351S001	N	1.50	1.42	0.24		0.31	-1.75	0.53	-2.41
PASA 19351S001	E	1.45	0.92	-2.54		1.31	0.02	1.17	-0.33
PASA 19351S001	U	5.79	-2.99	12.43		-1.09	0.29	-0.98	1.29
RIO1 13448M002	N	1.59	-0.03	0.11	1.19	0.15	-3.68	0.21	0.25
RIO1 13448M002	E	1.42	0.59	1.27	-0.44	2.68	-1.49	-0.58	-0.30
RIO1 13448M002	U	8.56	-9.58	8.30	-4.02	9.87	-9.16	-3.73	8.24
SALA 13469M001	N	1.01	1.02	1.10	0.31	0.38	1.86	-0.43	0.11
SALA 13469M001	E	1.14	0.14	-2.06	0.40	0.67	1.55	0.75	-0.06
SALA 13469M001	U	4.32	-1.51	-0.66	-2.65	4.72	-7.74	-4.48	0.48
SCDA 10088M002	N	3.21	0.24	0.28	-0.75	1.65	-6.55	0.06	3.93
SCDA 10088M002	E	0.98	0.70	0.58	1.03	-0.21	-1.73	-0.86	0.29
SCDA 10088M002	U	3.80	0.73	8.80	1.00	0.23	0.98	-2.37	1.12
SOPU 19386M001	N	2.53	3.48	1.74	2.17	-1.61	-3.31	-1.48	-1.72
SOPU 19386M001	E	1.89	0.70	2.92	-0.24	-1.97	-2.49	-0.39	1.43
SOPU 19386M001	U	5.64	2.17	4.80	7.66	6.32	-5.39	-5.90	0.63
TERU 13487M001	N	2.68	0.35	-0.40	0.60	0.75	-6.41	0.92	0.10
TERU 13487M001	E	2.44	-0.75	1.01	-3.40	4.14	-2.33	0.16	-0.29
TERU 13487M001	U	3.29	0.31	-5.49	5.33	1.22	-1.15	-0.22	1.82
VITO 19385M001	N	3.18	-1.88	-1.42	-0.93	-5.26	-1.06	3.01	4.06
VITO 19385M001	E	0.96	0.19	-1.19	0.56	0.21	-0.08	1.33	1.40
VITO 19385M001	U	5.17	-3.92	8.67	1.56	-2.29	-1.17	-7.77	-0.60
YEBE 13420M001	N	2.19	0.15	0.33	-0.51	1.27	-5.11	0.70	-0.29
YEBE 13420M001	E	1.27	-0.24	-1.26	1.03	0.72	-2.46	0.45	0.43
YEBE 13420M001	U	2.54	3.05	-1.79	-4.00	0.88	-1.47	0.02	-2.69
ZARA 13462M001	N	1.87	0.29	1.15	0.18	-0.64	-4.09	1.57	0.25
ZARA 13462M001	E	1.45	2.25	0.14	-0.10	2.32	-1.35	0.53	-0.08
ZARA 13462M001	U	4.98	-3.05	3.01	-1.66	9.95	-1.91	-4.89	1.16

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.

TRANSFORMATION IN EQUATORIAL SYSTEM (X, Y, Z):
RESIDUALS IN LOCAL SYSTEM (NORTH, EAST, UP)

LIST OF REMOVED STATIONS:

OUTLIER CRITERIA: 15.00 15.00 20.00

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
2	ALAC 13433M001	I W	0.86	-1.24	1.29
3	ALME 13437M001	I W	0.81	0.35	2.22
4	BCL1 19482M001	I W	-0.12	-1.93	3.56
5	BELL 13431M001	I W	0.76	-0.88	4.74
6	BIAZ 10074M002	I W	-0.13	1.10	-6.03
7	BORR 13480M001	I W	-2.49	-1.28	1.73
8	BRST 10004M004	I W	-1.02	-0.04	3.45
9	CACE 13447M001	I W	2.40	2.08	3.34
10	CANT 13438M001	I W	-1.00	1.06	1.14
11	CASC 13909S001	I W	1.32	-1.27	1.31
12	CEU1 13449M002	I W	1.22	0.60	-6.51
14	EBRE 13410M001	I W	-0.39	0.88	0.56
16	FLRS 31907M001	I W	-0.56	1.60	-1.03
17	FUER 31330M001	I W	1.22	-1.68	0.68
19	HUEL 13451M001	I W	3.11	3.45	-10.60
20	IBIZ 13454S001	I W	0.31	1.49	5.04
21	IZAN 31309M002	I W	-0.69	-2.44	0.73
22	LAGO 13903M001	I W	-0.25	-0.53	1.90
23	LLIV 13436M001	I W	-2.76	0.76	0.35
24	LPAL 81701M001	I W	2.74	-0.53	-3.17
25	LROC 10023M001	I W	-0.31	1.72	-1.59
26	MADR 13407S012	I W	-3.02	-0.45	-7.46
27	MAL1 13444M002	I W	3.15	-0.90	0.18
28	MALA 13443M001	I W	2.41	-2.35	2.01
29	MALL 13444M001	I W	-0.68	0.90	5.97
30	MAS1 31303M002	I W	-0.14	-2.80	4.78
31	MELI 19379M001	I W	0.53	0.12	2.51
32	PDEL 31906M004	I W	-2.00	0.15	-0.00
33	RABT 35001M002	I W	1.74	-2.01	-7.15
34	SCOA 10088M002	I W	-4.46	0.34	-12.82
35	SFER 13402M004	I W	1.21	-4.66	-3.17
36	SOPU 19386M001	I W	-1.22	1.73	3.07
37	VALE 13439M001	I W	-0.14	1.83	-2.68
38	VIGO 13450M001	I W	-0.45	3.06	5.63
39	VILL 13406M001	I W	-1.48	-0.74	4.64
40	YEBE 13420M001	I W	-0.95	-0.30	1.58
41	ZARA 13462M001	I W	0.25	1.36	-4.82
42	ZIMM 14001M004	I W	-0.95	-0.45	3.19
RMS / COMPONENT			1.70	1.69	4.54
IQR			2.16	2.33	5.87
MEAN			-0.03	-0.05	-0.04
MEDIAN			-0.14	0.04	1.22
MIN			-4.46	-4.66	-12.82
MAX			3.15	3.45	5.97
OVERALL RMS/IQR/MAX(3D)			2.96	2.63	13.58
SCOA 10088M002	#SUM				
ALL	RMS / COMPONENT		1.70	1.69	4.54
ALL	IQR		2.16	2.33	5.87
ALL	MEAN		-0.03	-0.05	-0.04
ALL	MEDIAN		-0.14	0.04	1.22
ALL	MIN		-4.46	-4.66	-12.82
ALL	MAX		3.15	3.45	5.97
ALL	OVERALL RMS/IQR/MAX(3D)		2.96	2.63	13.58
SCOA 10088M002	#SUM_ALL				

NUMBER OF PARAMETERS : 3
NUMBER OF STATIONS : 38
NUMBER OF COORDINATES : 114
RMS OF TRANSFORMATION : 2.96 MM

PARAMETERS:

TRANSLATION IN X : 0.01 +- 0.48 MM
TRANSLATION IN Y : -0.00 +- 0.48 MM
TRANSLATION IN Z : -0.01 +- 0.48 MM

NUMBER OF ITERATIONS : 1

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 to the daily solutions are shown.

```
* STATISTICAL PARAMETER-----VALUE(S)-----
NUMBER OF OBSERVATIONS          18666329
NUMBER OF UNKNOWN(S)            236122
NUMBER OF DEGREES OF FREEDOM    18630207
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
VARIANCE FACTOR                  3.309680603309525
```

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 24:280:00000 24:286:86370 LEICA GR50 -----
ALDA A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
ALSA A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
AMUR A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
BIAZ A 1 P 24:280:00000 24:286:86370 SPECTRA SP90M -----
BIDA A 1 P 24:280:00000 24:286:86370 LEICA GR10 -----
BRZR A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
CACE A 1 P 24:280:00000 24:286:86370 TRIMBLE NETR9 -----
CANT A 1 P 24:280:00000 24:286:86370 LEICA GR10 -----
CREU A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
EBRE A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
ELGE A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
EMAZ A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
GERN A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
HOND A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
IGEL A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
ISPS A 1 P 24:280:00000 24:286:86370 TRIMBLE NETR9 -----
KAST A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
LARE A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
LAZK A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
LEIT A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
ORON A 1 P 24:283:00000 24:283:86370 LEICA GR50 -----
PASA A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
RIO1 A 1 P 24:280:00000 24:286:86370 LEICA GR25 -----
SALA A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
SCDA A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
SOPU A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
TERU A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
VITO A 1 P 24:280:00000 24:286:86370 LEICA GR30 -----
YEBE A 1 P 24:280:00000 24:286:86370 LEICA GR50 -----
ZARA A 1 P 24:280:00000 24:286:86370 TRIMBLE NETR9 -----
```

7.2 Antennas

Serial number ONLY provided in case individual calibrations are used.

```
*SITE PT SOLN T DATA_START_ DATA_END_ DESCRIPTION----- S/N_ DAZI
ACOR A 1 P 24:280:00000 24:286:86370 LEIAT504 LEIS ----
ALDA A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
ALSA A 1 P 24:280:00000 24:286:86370 LEIAR10 NONE ----
AMUR A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
BIAZ A 1 P 24:280:00000 24:286:86370 LEIAR25 LEIT ----
BIDA A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
BRZR A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
CACE A 1 P 24:280:00000 24:286:86370 TRM29659.00 NONE ----
CANT A 1 P 24:280:00000 24:286:86370 LEIAR25_R4 LEIT ----
CREU A 1 P 24:280:00000 24:286:86370 LEIAR25_R4 NONE ----
EBRE A 1 P 24:280:00000 24:286:86370 LEIAR25_R4 NONE ----
ELGE A 1 P 24:280:00000 24:286:86370 LEIAR25_R4 LEIT ----
EMAZ A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
GERN A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
HOND A 1 P 24:280:00000 24:286:86370 LEIAR20 LEIM ----
IGEL A 1 P 24:280:00000 24:286:86370 LEIAR20 LEIM ----
ISPS A 1 P 24:280:00000 24:286:86370 TRM59900.00 SCIS ----
KAST A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
LARE A 1 P 24:280:00000 24:286:86370 LEIAR20 LEIM ----
LAZK A 1 P 24:280:00000 24:286:86370 LEIAR25_R4 LEIT ----
LEIT A 1 P 24:280:00000 24:286:86370 LEIAR10 NONE ----
ORON A 1 P 24:283:00000 24:283:86370 LEIAR10 NONE ----
PASA A 1 P 24:280:00000 24:286:86370 LEIAR20 LEIM ----
RIO1 A 1 P 24:280:00000 24:286:86370 LEIAR25_R4 LEIT ----
SALA A 1 P 24:280:00000 24:286:86370 LEIAR25 NONE ----
SCDA A 1 P 24:280:00000 24:286:86370 TRM55971.00 NONE ----
SOPU A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
TERU A 1 P 24:280:00000 24:286:86370 LEIAR20 LEIM ----
VITO A 1 P 24:280:00000 24:286:86370 LEIAS10 NONE ----
YEBE A 1 P 24:280:00000 24:286:86370 LEIAR20 LEIM ----
ZARA A 1 P 24:280:00000 24:286:86370 TRM29659.00 NONE ----
```

7.3 Eccentricities

```

*
UP----- NORTH----- EAST-----
*SITE PT SOLN T DATA_START__ DATA_END_____ AXE ARP->BENCHMARK(M)-----
ACOR A 1 P 24:280:00000 24:286:86370 UNE 3.0460 0.0000 0.0000
ALDA A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
ALSA A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
AMUR A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
BIDA A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
BRZR A 1 P 24:280:00000 24:286:86370 UNE 0.0771 0.0000 0.0000
CACE A 1 P 24:280:00000 24:286:86370 UNE 0.0600 0.0000 0.0000
CANT A 1 P 24:280:00000 24:286:86370 UNE 3.0490 0.0000 0.0000
CREU A 1 P 24:280:00000 24:286:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 24:280:00000 24:286:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
EMAZ A 1 P 24:280:00000 24:286:86370 UNE 0.0350 0.0000 0.0000
GERN A 1 P 24:280:00000 24:286:86370 UNE 0.0771 0.0000 0.0000
HOND A 1 P 24:280:00000 24:286:86370 UNE 0.0771 0.0000 0.0000
IGEL A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
ISPS A 1 P 24:280:00000 24:286:86370 UNE 0.0350 0.0000 0.0000
KAST A 1 P 24:280:00000 24:286:86370 UNE 0.0350 0.0000 0.0000
LARE A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
LAZK A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
LEIT A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
ORDN A 1 P 24:283:00000 24:283:86370 UNE 0.0000 0.0000 0.0000
PASA A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
RI01 A 1 P 24:280:00000 24:286:86370 UNE 0.0606 0.0000 0.0000
SALA A 1 P 24:280:00000 24:286:86370 UNE 0.0600 0.0000 0.0000
SCDA A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
SOPU A 1 P 24:280:00000 24:286:86370 UNE 0.0771 0.0000 0.0000
TERU A 1 P 24:280:00000 24:286:86370 UNE 0.0600 0.0000 0.0000
VITO A 1 P 24:280:00000 24:286:86370 UNE 0.0000 0.0000 0.0000
YEBE A 1 P 24:280:00000 24:286:86370 UNE 0.0600 0.0000 0.0000
ZARA A 1 P 24:280:00000 24:286:86370 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

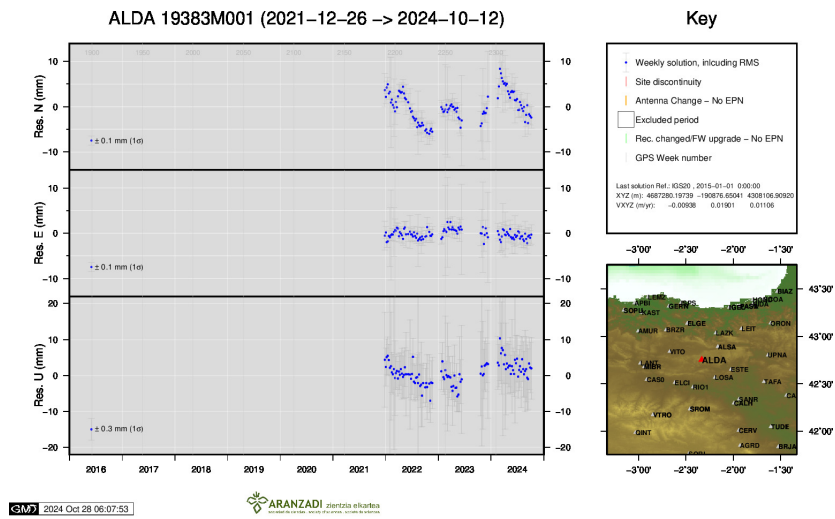
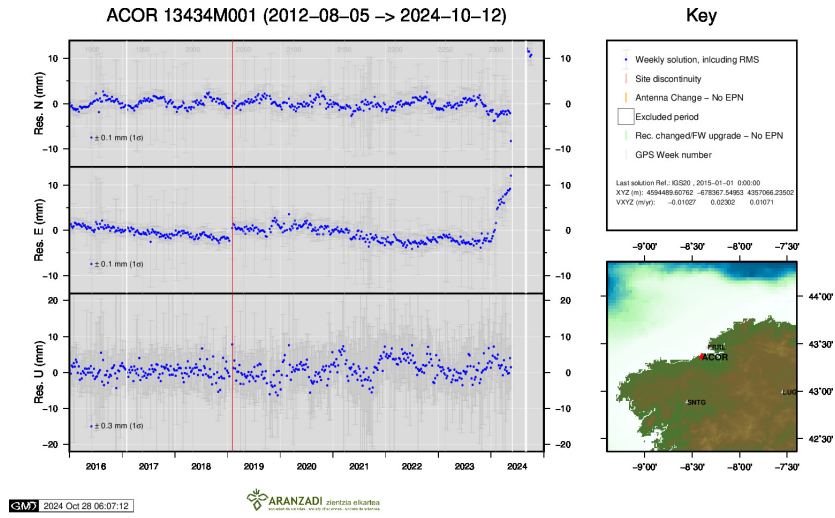
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf

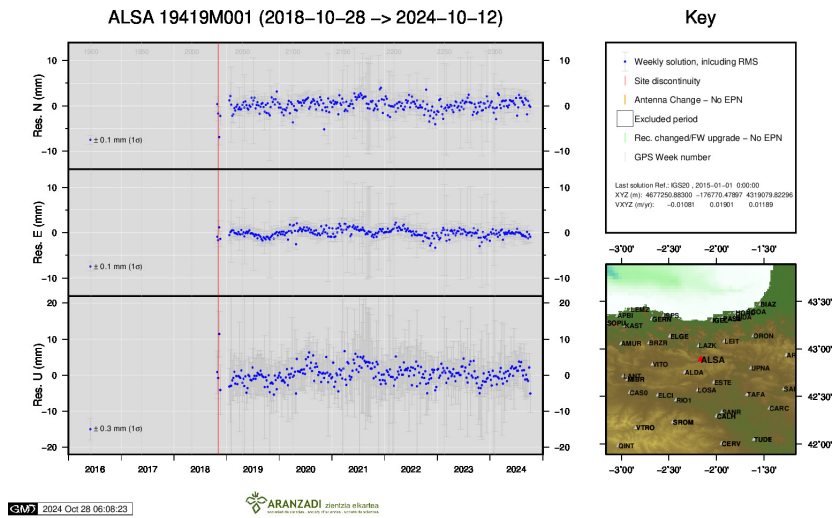
Johnston, G., Riddell, A., Hausler, G. (2017). The International GNSS Service. Teunissen, Peter J.G., Montenbruck, O. (Eds.), Springer Handbook of Global Navigation Satellite Systems (1st ed., pp. 967-982). Cham, Switzerland: Springer International Publishing. DOI: 10.1007/978-3-319-42928-1

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

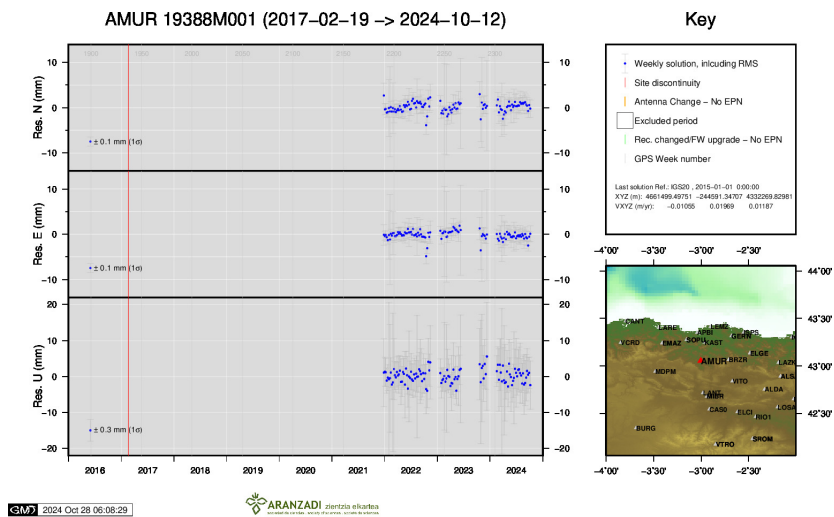
9 Cumulative Time Series

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

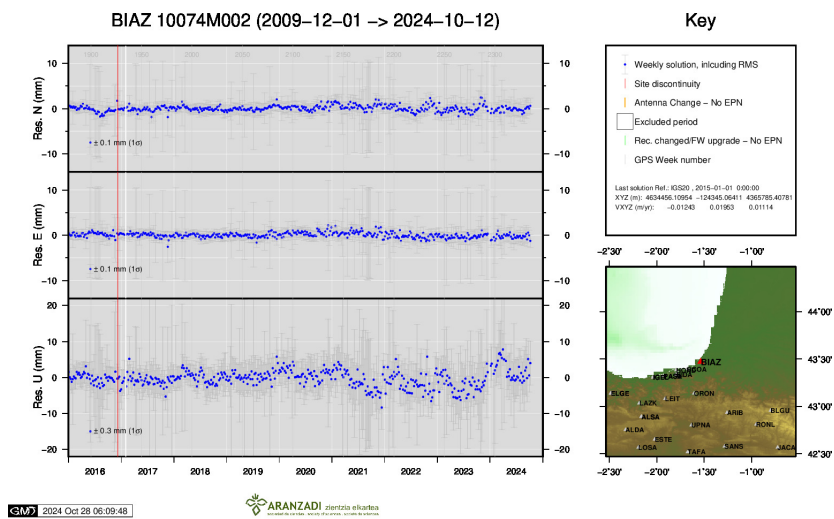




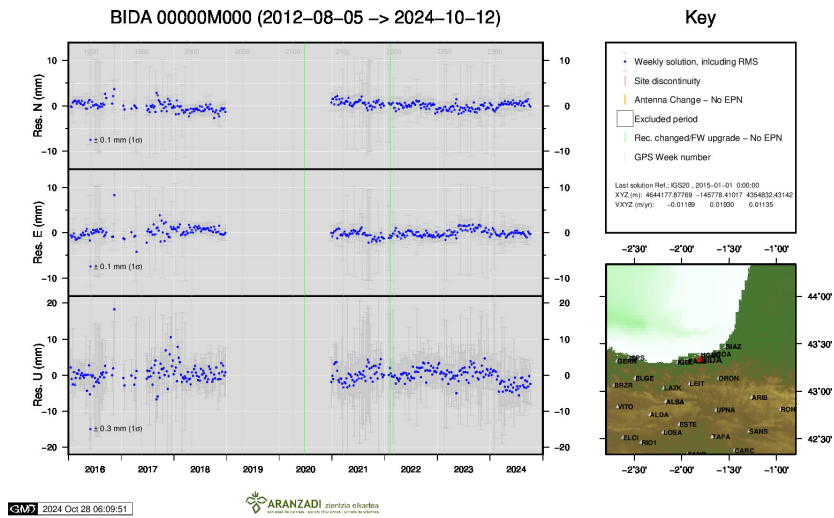
3) ALSA



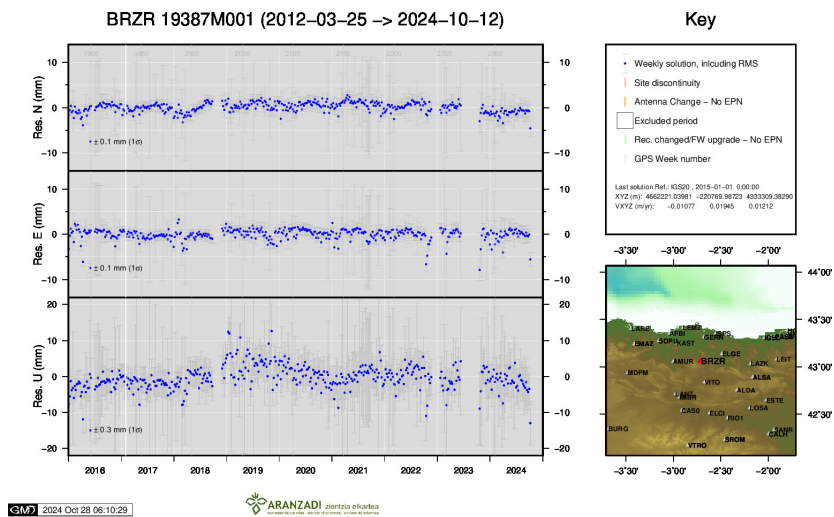
4) AMUR



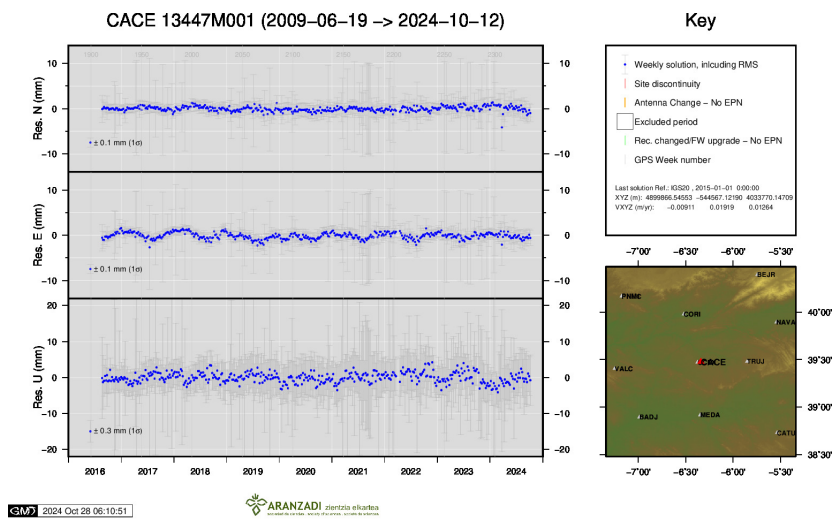
5) BIAZ



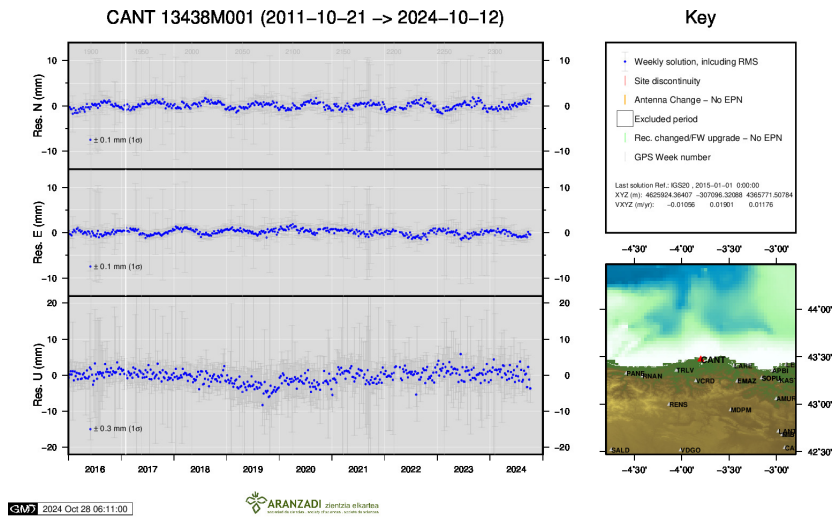
6) BIDA



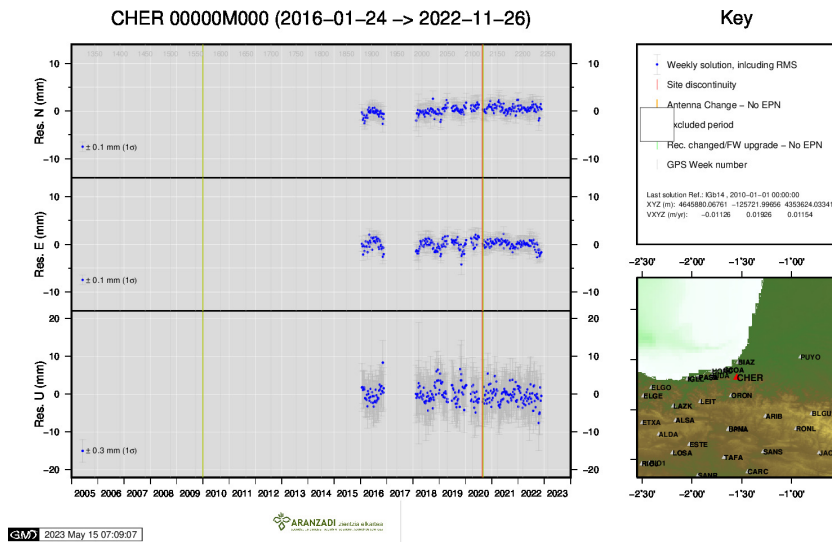
7) BRZR



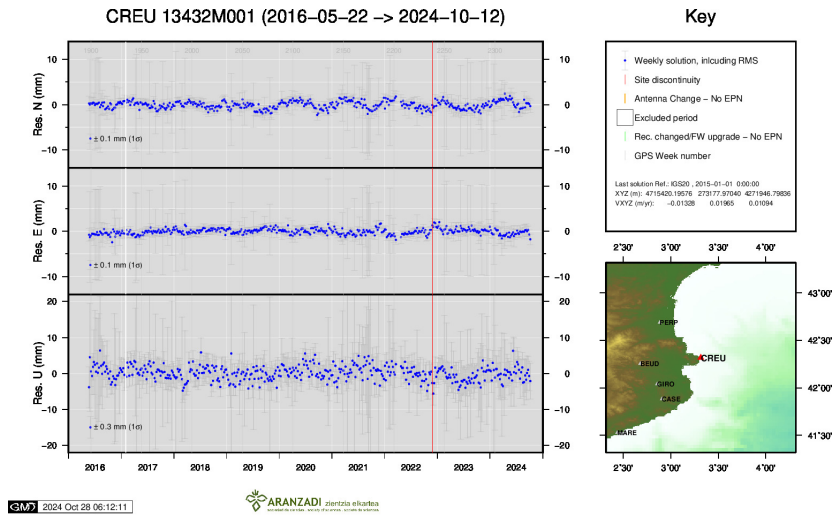
8) CACE



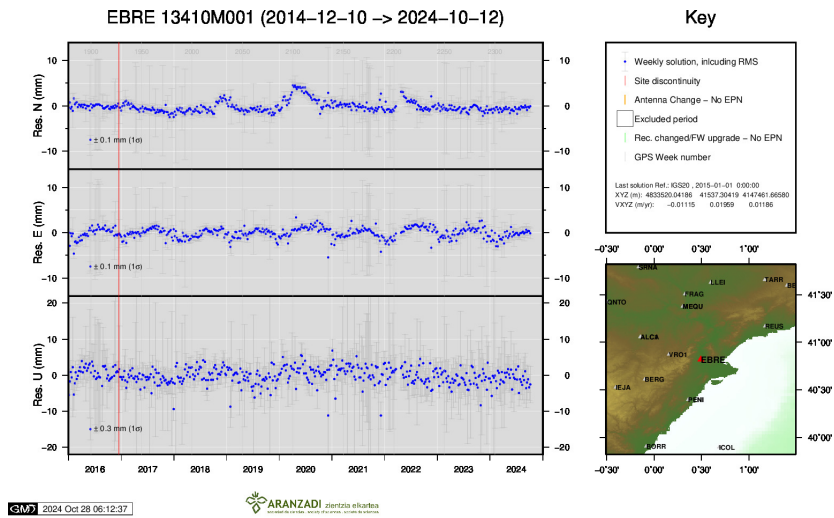
9) CANT



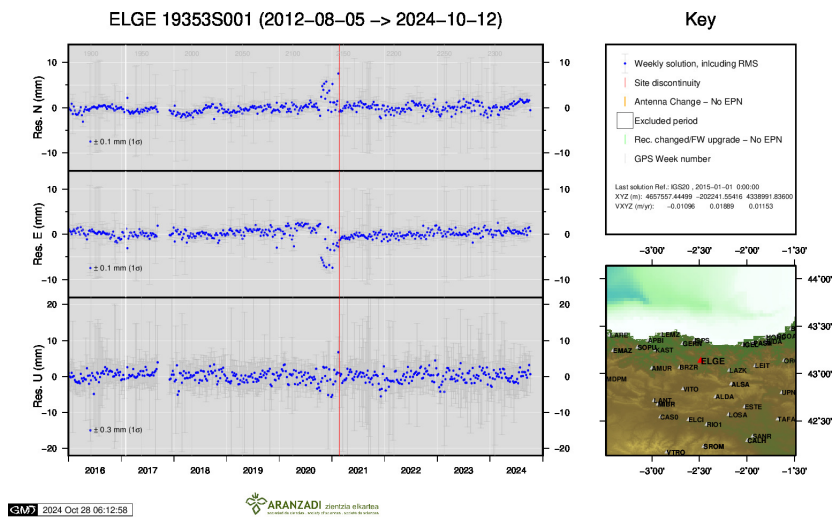
10) CHER



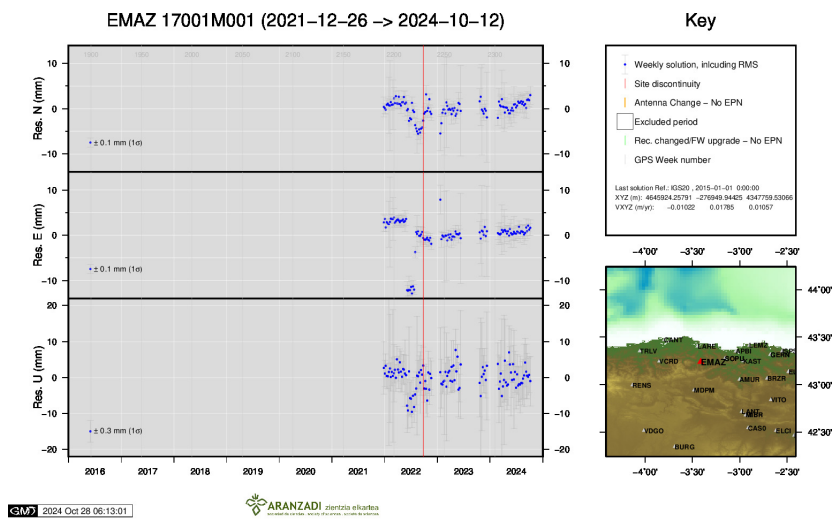
11) CREU



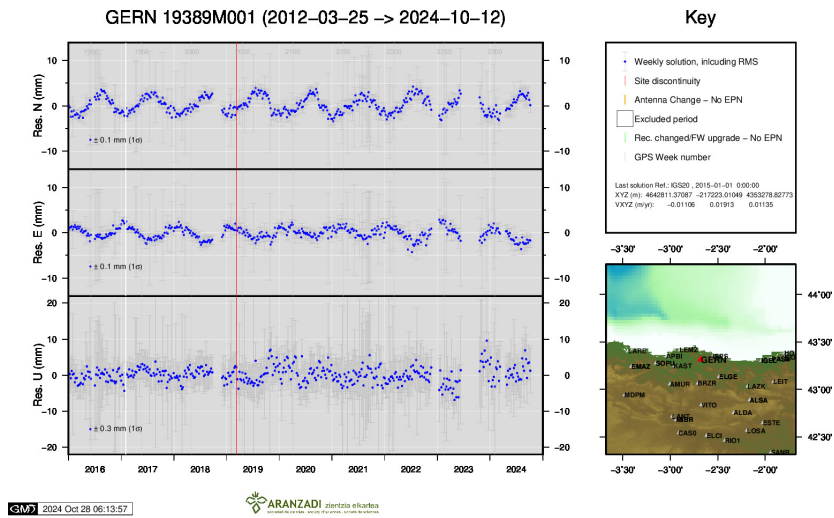
12) EBRE



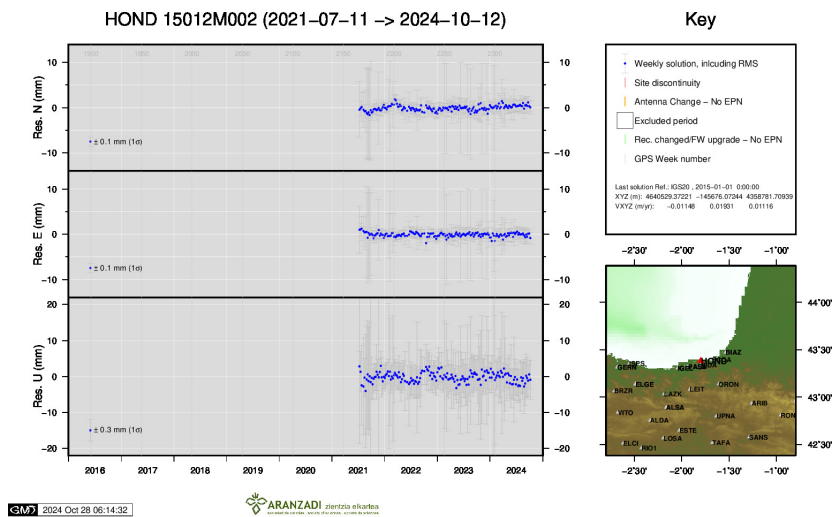
13) ELGE



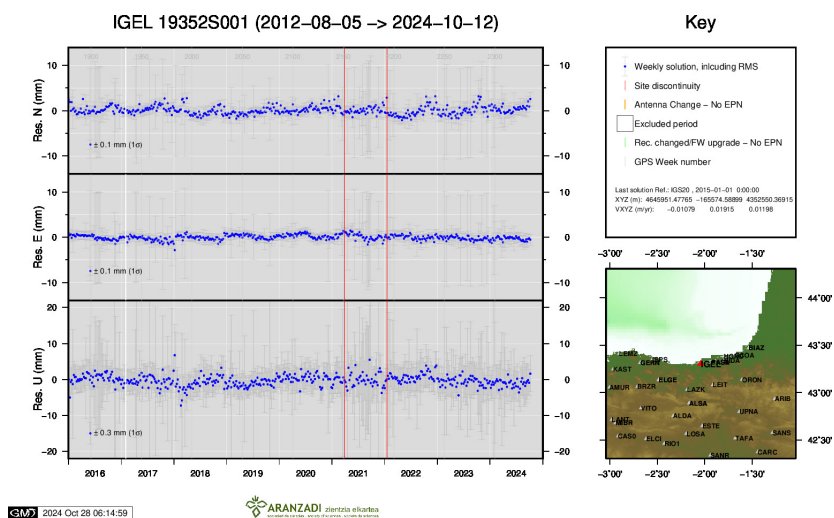
14) EMAZ



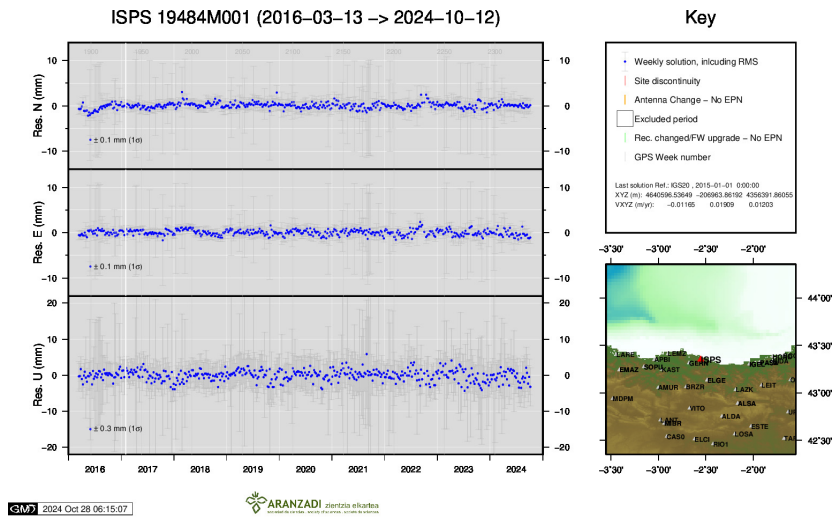
15) GERN



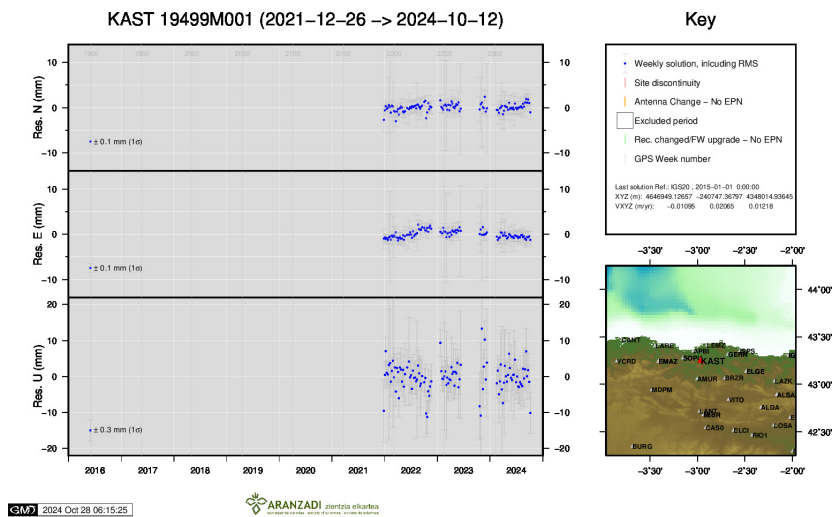
16) HOND



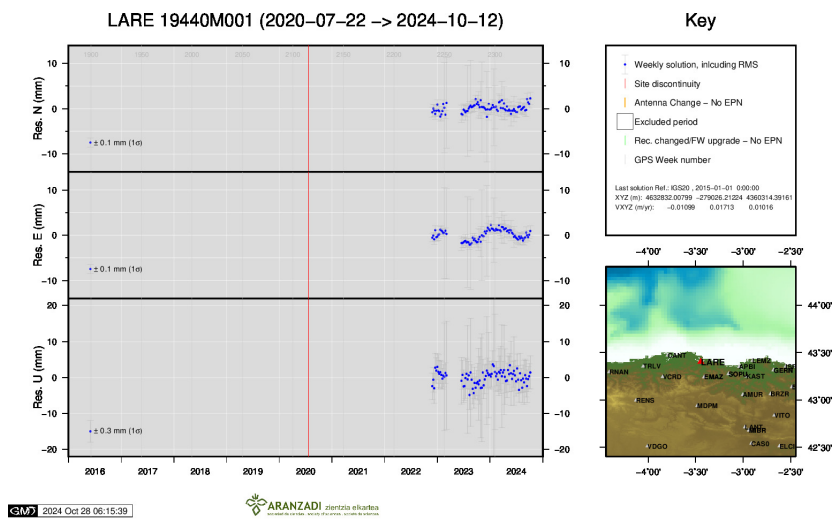
17) IGEL



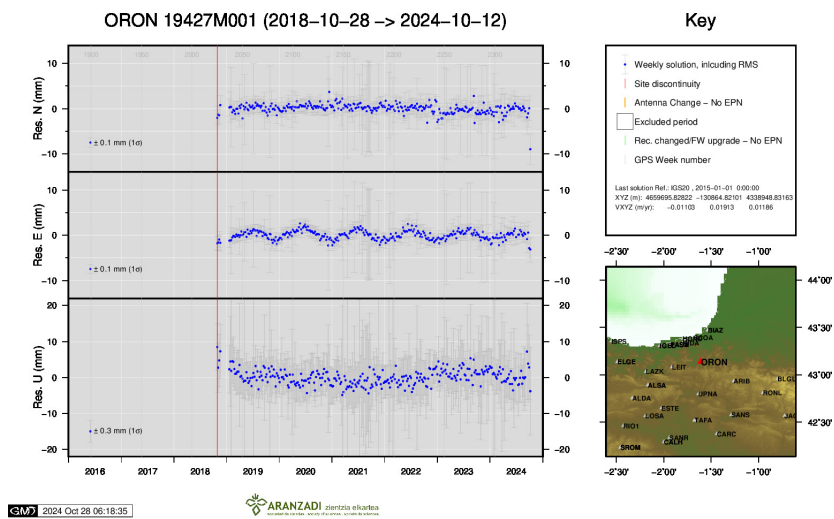
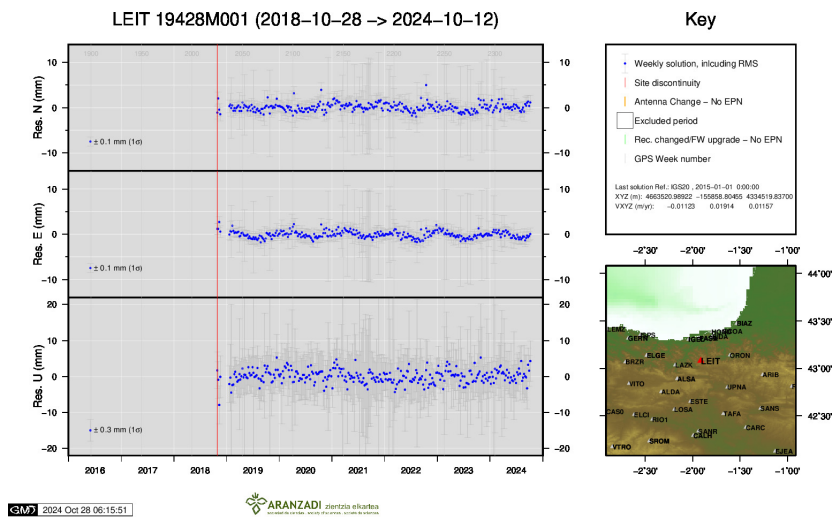
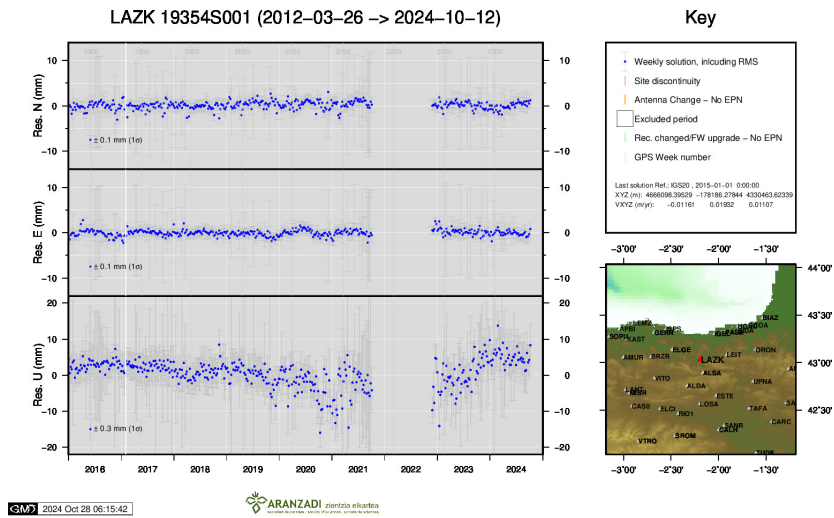
18) ISPS

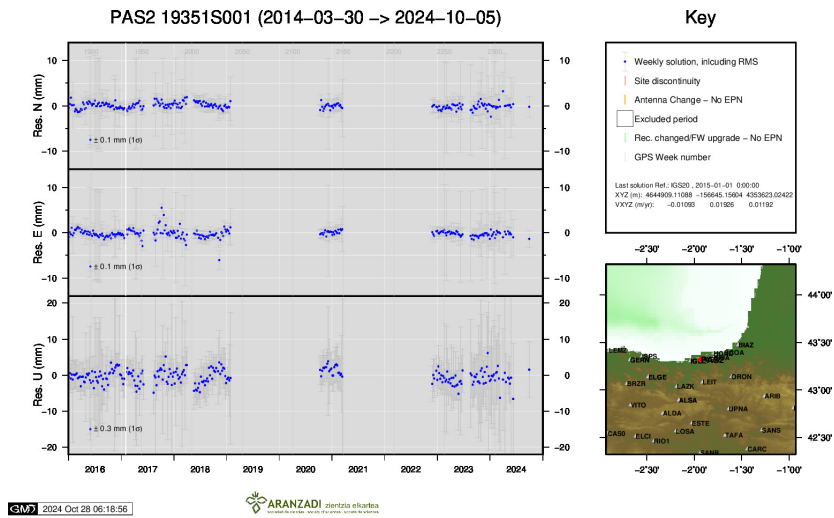


19) KAST

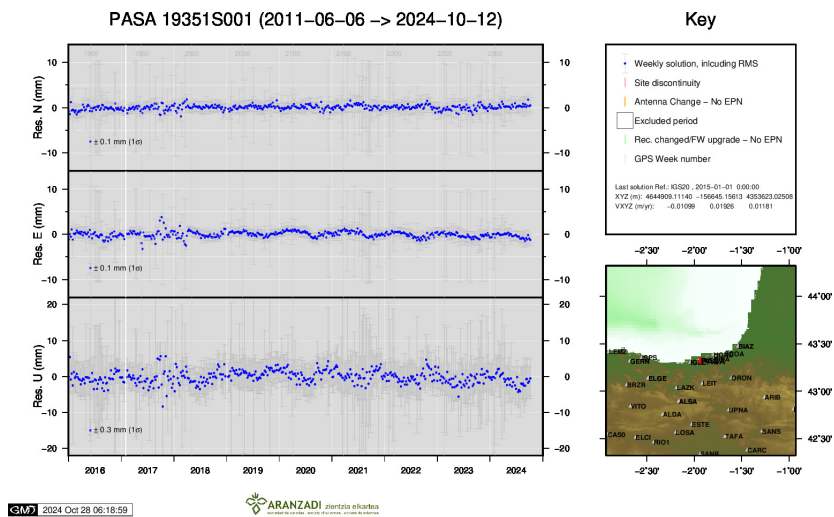


20) LARE

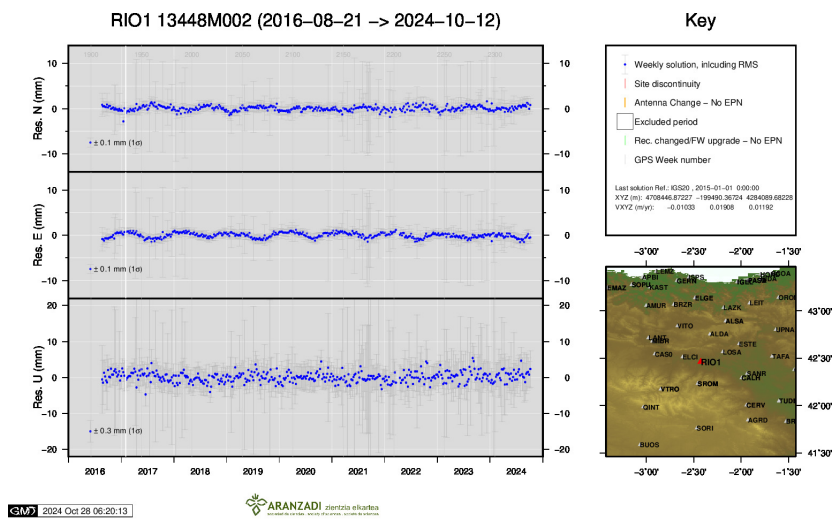




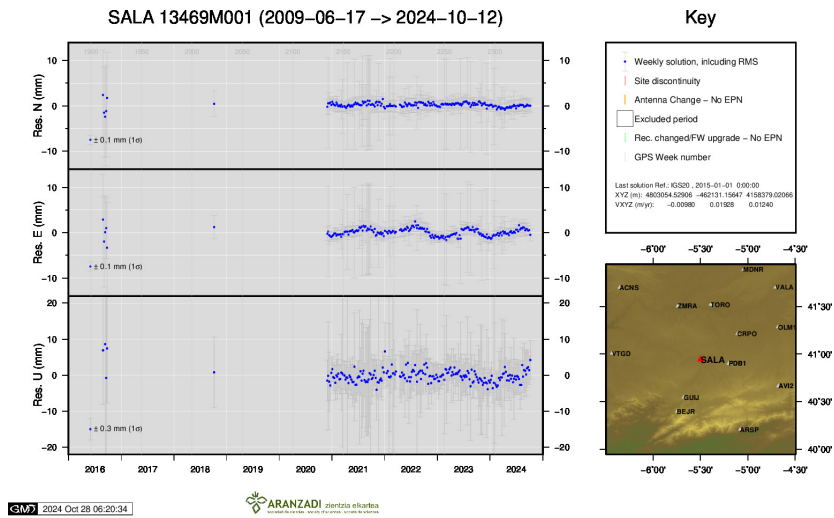
24) PAS2



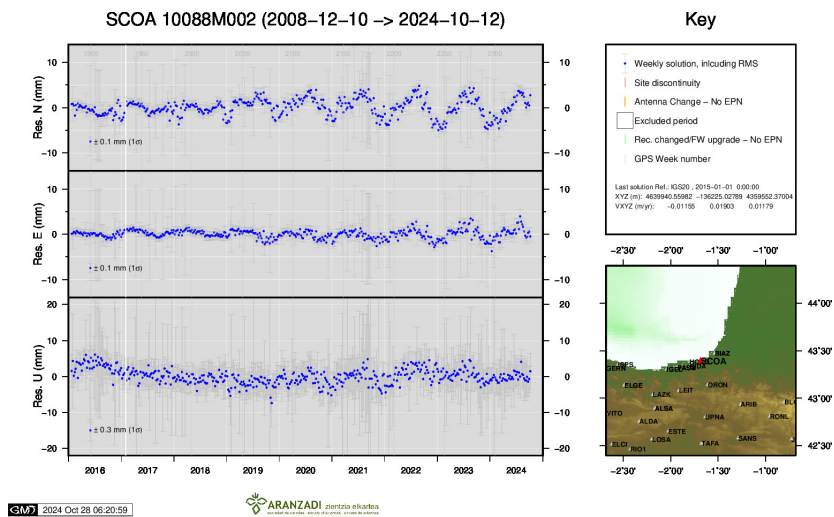
25) PASA



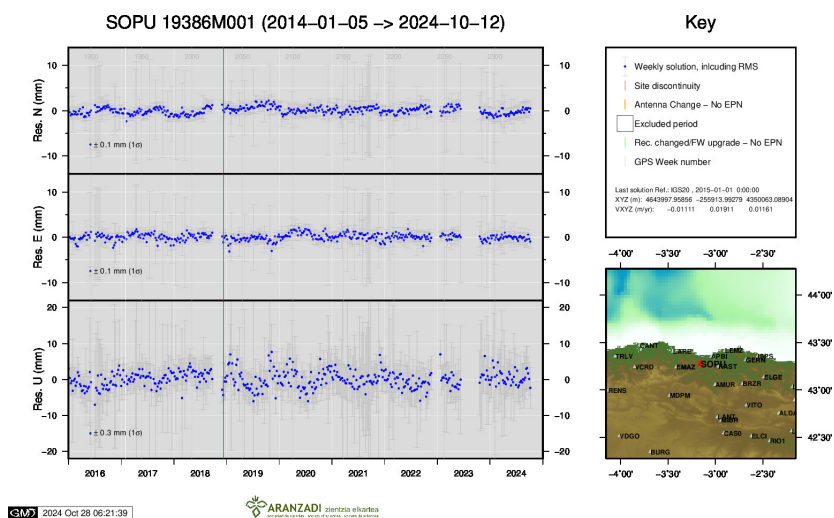
26) RIO1



27) SALA



28) SCOA



29) SOPU

