

ARA-DAC Weekly Analysis Result: 2347 (GFA)

Technical Report

GPS Week: 2347 (GFA)

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

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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

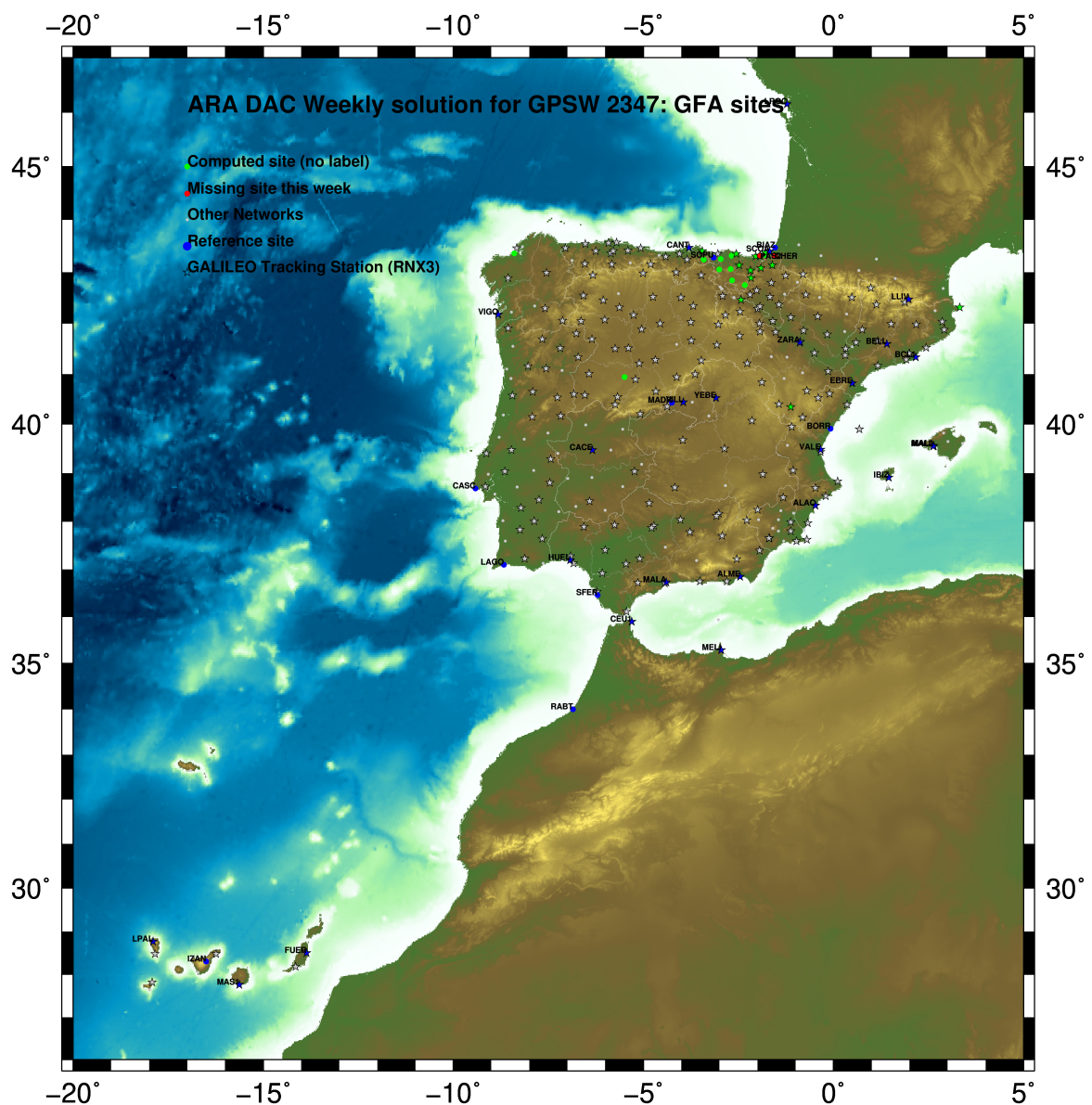


Fig.1: Computed Sites for GPS Week2347 (GFA)

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						20-JAN-25 04:33
LOCAL GEODETIC DATUM: IGS20			EPOCH: 2025-01-01 11:59:45			
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.48211	-678367.27174	4357066.32360	A	G
39	ALDA 19383M001	4687280.10265	-190876.45986	4308107.02652	A	GR
50	ALSA 19419M001	4677250.77438	-176770.28723	4319079.94039	A	GRE
53	AMUR 19388M001	4661499.39075	-244591.15062	4332269.94513	A	GR
384	BIAZ 10074M002	4634455.98773	-124344.86794	4365785.51948	W	GR
101	BIDA 00000M000	4644177.75645	-145778.21667	4354832.54198	A	GR
113	BRZR 19387M001	4662220.93102	-220769.79131	4333309.50111	A	GR
573	CACE 13447M001	4899866.45326	-544566.92671	4033770.27243	W	GRE
592	CANT 13438M001	4625924.25765	-307096.12900	4365771.62295	W	GRE
908	CREU 13432M001	4715420.06353	273178.16635	4271946.90868	A	GRE
135	EBRE 13410M001	4833519.92736	41537.50009	4147461.78410	W	GRE
180	ELGE 19353S001	4657557.33337	-202241.36365	4338991.94967	A	GRE
182	EMAZ 17001M001	4645924.15140	-276949.76308	4347759.63171	A	GR
209	GERN 19389M001	4642811.25835	-217222.81721	4353278.93814	A	GR
257	HOND 15012M002	4640529.25616	-145675.87860	4358781.81949	A	GRE
235	IGEL 19352S001	4645951.36670	-165574.39646	4352550.48551	A	GRE
240	ISPS 19484M001	4640596.42155	-206963.67197	4356391.98330	A	GRE
245	KAST 19499M001	4646949.01454	-240747.16101	4348015.05563	A	GR
252	LARE 19440M001	4632831.89821	-279026.03693	4360314.49364	A	GRE
256	LAZK 19354S001	4666098.28101	-178186.08529	4330463.73525	A	GRE
261	LEIT 19428M001	4663520.87432	-155858.61197	4334519.94904	A	GRE
334	ORON 19427M001	4659695.71767	-130864.63005	4338948.94733	A	GRE
493	PASA 19351S001	4644908.99972	-156644.96294	4353623.14130	A	GRE
553	RID1 13448M002	4708446.76759	-199490.17480	4284089.79828	A	GRE
558	SALA 13469M001	4803054.42957	-462130.96275	4158379.14302	A	GR
526	SCDA 10088M002	4639940.44468	-136224.83903	4359552.48141	W	GRE
715	SOPU 19386M001	4643997.84829	-255913.80046	4350063.20387	W	GR
443	TERU 13487M001	4867391.25977	-95523.23628	4108341.75005	A	GRE
493	VITO 19385M001	4679397.64178	-218436.39531	4314898.43183	A	GR
616	YEBE 13420M001	4848724.51095	-261631.81995	4123094.39635	W	GRE
655	ZARA 13462M001	4773803.10730	-73505.87908	4215454.15964	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						20-JAN-25 04:33
LOCAL GEODETIC DATUM: ETRF2000			EPOCH: 2025-01-01 11:59:45			
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.83119	-678367.91899	4357065.83643	A	
39	ALDA 19383M001	4687280.51524	-190877.11761	4308106.53814	A	
50	ALSA 19419M001	4677251.18983	-176770.94370	4319079.45310	A	
53	AMUR 19388M001	4661499.79790	-244591.80533	4332269.45828	A	
384	BIAZ 10074M002	4634456.41428	-124345.51898	4365785.03675	W	
101	BIDA 00000M000	4644178.17913	-145778.86897	4354832.05808	A	
113	BRZR 19387M001	4662221.34155	-220770.44605	4333309.01453	A	
573	CACE 13447M001	4899866.79421	-544567.61115	4033769.75995	W	
592	CANT 13438M001	4625924.65890	-307096.77947	4365771.13837	W	
908	CREU 13432M001	4715420.53728	273177.50678	4271946.42433	A	
135	EBRE 13410M001	4833520.35883	41536.82518	4147461.28596	W	
180	ELGE 19353S001	4657557.74693	-202242.01776	4338991.46377	A	
182	EMAZ 17001M001	4645924.55535	-276950.41596	4347759.14578	A	
209	GERN 19389M001	4642811.67102	-217223.46954	4353278.45334	A	
257	HOND 15012M002	4640529.67918	-145676.53045	4358781.33592	A	
235	IGEL 19352S001	4645951.78645	-165575.04904	4352550.00117	A	
240	ISPS 19484M001	4640596.83589	-206964.32400	4356391.49885	A	
245	KAST 19499M001	4646949.42352	-240747.81391	4348014.57013	A	
252	LARE 19440M001	4632832.30290	-279026.68818	4360314.00885	A	
256	LAZK 19354S001	4666098.69720	-178186.74038	4330463.24894	A	
261	LEIT 19428M001	4663521.29393	-155859.26669	4334519.46328	A	
334	ORON 19427M001	4659696.14111	-130865.28422	4338948.46226	A	
493	PASA 19351S001	4644909.42080	-156645.61536	4353622.65718	A	
553	RID1 13448M002	4708447.17701	-199490.83516	4284089.30789	A	
558	SALA 13469M001	4803054.79225	-462131.63530	4158378.64040	A	
526	SCDA 10088M002	4639940.86907	-136225.49078	4359551.99802	W	
715	SOPU 19386M001	4643998.25534	-255914.45304	4350062.71841	W	
443	TERU 13487M001	4867391.66906	-95523.91578	4108341.24694	A	
493	VITO 19385M001	4679398.05112	-218437.05216	4314897.94376	A	
616	YEBE 13420M001	4848724.89848	-261632.49764	4123093.89254	W	
655	ZARA 13462M001	4773803.52849	-73506.54709	4215453.66521	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						20-JAN-25 04:33
LOCAL GEODETIC DATUM: ETRF2014						EPOCH: 2025-01-01 11:59:45
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.79145	-678367.95553	4357065.88925	A	
39	ALDA 19383M001	4687280.47293	-190877.15560	4308106.59083	A	
50	ALSA 19419M001	4677251.14758	-176770.98179	4319079.50583	A	
53	AMUR 19388M001	4661499.75607	-244591.84323	4332269.51102	A	
384	BLAZ 10074M002	4634456.37232	-124345.55746	4365785.08965	W	
101	BIDA 00000M000	4644178.13714	-145778.90733	4354832.11093	A	
113	BRZR 19387M001	4662221.29963	-220770.48404	4333309.06729	A	
573	CACE 13447M001	4899866.75049	-544567.64680	4033769.81190	W	
592	CANT 13438M001	4625924.61768	-307096.81730	4365771.19120	W	
908	CREU 13432M001	4715420.49282	273177.46717	4271946.47728	A	
135	EBRE 13410M001	4833520.31393	41536.78698	4147461.33837	W	
180	ELGE 19353S001	4657557.70500	-202242.05585	4338991.51655	A	
182	EMAZ 17001M001	4645924.51381	-276950.45381	4347759.19856	A	
209	GERN 19389M001	4642811.62930	-217223.50763	4353278.50616	A	
257	HOND 15012M002	4640529.63724	-145676.56882	4358781.38878	A	
235	IGEL 19352S001	4645951.74452	-165575.08731	4352550.05400	A	
240	ISPS 19484M001	4640596.79417	-206964.36214	4356391.55168	A	
245	KAST 19499M001	4646949.38184	-240747.85190	4348014.62292	A	
252	LARE 19440M001	4632832.26151	-279026.72609	4360314.06166	A	
256	LAZK 19354S001	4666098.65508	-178186.77852	4330463.30170	A	
261	LEIT 19428M001	4663521.25177	-155859.30492	4334519.51606	A	
334	ORON 19427M001	4659696.09889	-130865.32256	4338948.51507	A	
493	PASA 19351S001	4644909.37884	-156645.65367	4353622.71002	A	
553	RI01 13448M002	4708447.13448	-199490.87302	4284089.36051	A	
558	SALA 13469M001	4803054.74947	-462131.67171	4158378.69263	A	
526	SC0A 10088M002	4639940.82710	-136225.52919	4359552.05089	W	
715	SOPU 19386M001	4643998.21374	-255914.49097	4350062.77121	W	
443	TERU 13487M001	4867391.62428	-95523.95330	4108341.29916	A	
493	VITO 19385M001	4679398.00899	-218437.09008	4314897.99646	A	
616	YEBE 13420M001	4848724.85451	-261632.53461	4123093.94472	W	
655	ZARA 13462M001	4773803.48474	-73506.58512	4215453.71771	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						20-JAN-25 04:33
LOCAL GEODETIC DATUM: ETRF2020						EPOCH: 2025-01-01 11:59:45
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.78767	-678367.94104	4357065.89719	A	
39	ALDA 19383M001	4687280.46785	-190877.14062	4308106.59902	A	
50	ALSA 19419M001	4677251.14242	-176770.96684	4319079.51401	A	
53	AMUR 19388M001	4661499.75107	-244591.82835	4332269.51916	A	
384	BLAZ 10074M002	4634456.36690	-124345.54262	4365785.09776	W	
101	BIDA 00000M000	4644178.13181	-145778.89247	4354832.11906	A	
113	BRZR 19387M001	4662221.29457	-220770.46915	4333309.07543	A	
573	CACE 13447M001	4899866.74711	-544567.63129	4033769.82036	W	
592	CANT 13438M001	4625924.61279	-307096.80256	4365771.19926	W	
908	CREU 13432M001	4715420.48644	273177.48243	4271946.48560	A	
135	EBRE 13410M001	4833520.30855	41536.80252	4147461.34684	W	
180	ELGE 19353S001	4657557.69987	-202242.04097	4338991.52469	A	
182	EMAZ 17001M001	4645924.50887	-276950.43900	4347759.20666	A	
209	GERN 19389M001	4642811.62417	-217223.49280	4353278.51427	A	
257	HOND 15012M002	4640529.63189	-145676.55398	4358781.39690	A	
235	IGEL 19352S001	4645951.73925	-165575.07245	4352550.06213	A	
240	ISPS 19484M001	4640596.78901	-206964.34732	4356391.55979	A	
245	KAST 19499M001	4646949.37680	-240747.83707	4348014.63104	A	
252	LARE 19440M001	4632832.25655	-279026.71132	4360314.06975	A	
256	LAZK 19354S001	4666098.64990	-178186.76360	4330463.30986	A	
261	LEIT 19428M001	4663521.24651	-155859.29000	4334519.52422	A	
334	ORON 19427M001	4659696.09355	-130865.30765	4338948.52323	A	
493	PASA 19351S001	4644909.37354	-156645.63881	4353622.71815	A	
553	RI01 13448M002	4708447.12948	-199490.85798	4284089.36873	A	
558	SALA 13469M001	4803054.74555	-462131.65648	4158378.70096	A	
526	SC0A 10088M002	4639940.82172	-136225.51434	4359552.05902	W	
715	SOPU 19386M001	4643998.20874	-255914.47616	4350062.77932	W	
443	TERU 13487M001	4867391.61940	-95523.93771	4108341.30766	A	
493	VITO 19385M001	4679398.00397	-218437.07514	4314898.00463	A	
616	YEBE 13420M001	4848724.85008	-261632.51915	4123093.95316	W	
655	ZARA 13462M001	4773803.47953	-73506.56982	4215453.72606	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						20-JAN-25 04:33			
Station	#Days	Weekday 0123456	Repeatability (mm)						
			N	E	U				
ACOR 13434M001	7	XXXXXXX	2.42	0.95	5.40				
ALDA 19383M001	7	XXXXXXX	0.73	0.74	3.82				
ALSA 19419M001	7	XXXXXXX	1.44	0.78	4.01				
AMUR 19388M001	7	XXXXXXX	1.40	1.38	3.57				
BIAZ 10074M002	7	XXXXXXX	0.75	0.88	5.78				
BIDA 00000M000	5	XXXXX	1.04	0.82	4.02				
BRZR 19387M001	7	XXXXXXX	1.29	0.50	5.62				
CACE 13447M001	7	XXXXXXX	0.80	0.47	1.99				
CANT 13438M001	7	XXXXXXX	0.55	0.33	2.86				
CREU 13432M001	7	XXXXXXX	0.82	0.78	3.45				
EBRE 13410M001	6	XXXXX X	1.03	0.62	2.91				
ELGE 19353S001	6	XXXXXX	0.98	0.61	3.23				
EMAZ 17001M001	7	XXXXXXX	1.03	0.86	4.36				
GERN 19389M001	7	XXXXXXX	1.78	1.29	4.21				
HOND 15012M002	7	XXXXXXX	0.72	0.47	2.87				
IGEL 19352S001	7	XXXXXXX	1.25	0.48	3.73				
ISPS 19484M001	7	XXXXXXX	0.94	1.36	3.64				
KAST 19499M001	7	XXXXXXX	0.72	0.72	4.48				
LARE 19440M001	7	XXXXXXX	1.24	0.54	2.38				
LAZK 19354S001	7	XXXXXXX	1.53	0.50	4.47				
LEIT 19428M001	7	XXXXXXX	0.71	0.92	3.53				
ORON 19427M001	1	X	0.44	0.50	1.34				
PASA 19351S001	7	XXXXXXX	1.16	0.42	3.08				
RI01 13448M002	7	XXXXXXX	0.88	0.64	1.94				
SALA 13469M001	7	XXXXXXX	0.54	0.27	1.96				
SCOA 10088M002	7	XXXXXXX	0.93	0.85	2.99				
SOPU 19386M001	7	XXXXXXX	0.99	0.64	6.77				
TERU 13487M001	7	XXXXXXX	0.73	0.42	2.42				
VITO 19385M001	7	XXXXXXX	1.20	0.85	2.72				
YEBE 13420M001	7	XXXXXXX	0.44	0.47	2.03				
ZARA 13462M001	7	XXXXXXX	1.18	0.79	3.56				
Comparison of individual solutions:									
ACOR 13434M001	N	2.42	-0.99	-1.66	-0.46	-0.07	-0.05	-1.81	5.29
ACOR 13434M001	E	0.95	1.45	1.31	-0.85	-0.02	-0.29	-0.73	0.53
ACOR 13434M001	U	5.40	3.37	0.36	-5.05	1.54	-4.63	4.66	9.62
ALDA 19383M001	N	0.73	-0.34	1.47	-0.14	0.39	0.81	-0.25	0.22
ALDA 19383M001	E	0.74	-0.11	-0.58	-0.86	0.33	0.67	-1.29	0.09
ALDA 19383M001	U	3.82	-1.74	5.51	-1.13	0.63	1.70	5.43	-4.50
ALSA 19419M001	N	1.44	1.07	2.90	-0.37	-1.45	-0.64	0.37	0.08
ALSA 19419M001	E	0.78	-0.30	-0.67	-0.56	-0.79	-0.62	-0.19	1.32
ALSA 19419M001	U	4.01	-3.75	1.96	-0.96	-4.31	5.24	4.67	3.15
AMUR 19388M001	N	1.40	0.07	-0.36	-0.26	-1.81	-0.50	0.74	2.72
AMUR 19388M001	E	1.38	0.57	0.34	-0.39	-2.79	-0.44	1.66	0.33
AMUR 19388M001	U	3.57	-3.30	3.41	-1.30	-1.02	-4.18	4.01	4.23
BIAZ 10074M002	N	0.75	0.06	1.03	-0.75	0.60	0.52	-0.79	0.67
BIAZ 10074M002	E	0.88	-0.72	-0.62	-0.34	-1.04	-0.65	1.01	1.07
BIAZ 10074M002	U	5.78	-8.00	-3.55	-1.32	3.28	1.21	9.06	5.30
BIDA 00000M000	N	1.04			-0.43	-0.46	1.77	-0.84	0.23
BIDA 00000M000	E	0.82			-0.76	-0.45	-1.16	0.44	0.61
BIDA 00000M000	U	4.02			-0.63	-0.32	1.35	7.65	-1.98
BRZR 19387M001	N	1.29	0.67	1.94	0.01	-1.87	0.88	-1.17	0.29
BRZR 19387M001	E	0.50	-0.45	-0.00	0.22	0.03	-0.04	-1.08	0.26
BRZR 19387M001	U	5.62	-2.93	0.51	-0.85	-1.46	0.27	12.79	-3.75
CACE 13447M001	N	0.80	0.05	-1.51	0.30	-0.45	-0.24	0.13	-1.10
CACE 13447M001	E	0.47	0.21	-0.62	0.32	0.39	0.39	-0.53	0.47
CACE 13447M001	U	1.99	1.65	-1.16	0.54	-1.03	0.48	-4.09	1.16
CANT 13438M001	N	0.55	-0.25	-0.64	-0.08	0.50	0.93	-0.41	0.22
CANT 13438M001	E	0.33	-0.18	-0.17	-0.03	0.24	0.27	-0.66	-0.05
CANT 13438M001	U	2.86	-1.36	2.84	-4.47	-1.37	1.16	3.96	-0.62
CREU 13432M001	N	0.82	0.15	1.24	-0.75	0.69	0.69	0.13	0.94
CREU 13432M001	E	0.78	-0.35	-0.95	-0.66	-0.79	0.21	0.14	1.23
CREU 13432M001	U	3.45	-1.16	3.61	-1.36	1.46	4.27	5.31	-2.58
EBRE 13410M001	N	1.03	0.57	1.81	-0.61	0.46	0.76		0.73
EBRE 13410M001	E	0.62	0.41	-0.84	0.06	-0.14	-0.66		0.78
EBRE 13410M001	U	2.91	-1.42	2.96	-1.36	3.51	3.95		-1.31
ELGE 19353S001	N	0.98			0.52	-0.70	1.64	0.23	-1.13
ELGE 19353S001	E	0.61			-0.02	-0.85	0.37	-0.98	0.21
ELGE 19353S001	U	3.23			4.99	-3.32	-0.41	2.30	3.29
EMAZ 17001M001	N	1.03	1.51	-0.01	0.38	0.31	0.70	-1.76	0.55
EMAZ 17001M001	E	0.86	1.43	0.45	-0.05	0.29	-0.57	-1.09	0.78
EMAZ 17001M001	U	4.36	-4.50	0.26	-4.64	0.05	0.78	7.30	-4.31
GERN 19389M001	N	1.78	0.47	1.48	0.11	2.17	-1.21	-3.11	0.84
GERN 19389M001	E	1.29	-0.16	0.42	0.38	1.50	-0.44	-2.68	-0.09
GERN 19389M001	U	4.21	-3.69	2.37	-2.01	2.66	-3.26	8.08	0.51
HOND 15012M002	N	0.72	-0.07	1.19	-0.65	-0.16	0.67	-0.25	0.85
HOND 15012M002	E	0.47	0.30	-0.10	-0.41	-0.73	-0.19	-0.53	0.44
HOND 15012M002	U	2.87	-0.32	4.55	0.19	0.53	0.02	4.37	-3.05
IGEL 19352S001	N	1.25	-0.49	0.85	-0.74	1.50	-0.62	-0.95	2.09
IGEL 19352S001	E	0.48	0.08	-0.09	-0.16	-0.74	0.17	-0.80	0.36
IGEL 19352S001	U	3.73	-0.86	5.26	-2.40	1.41	0.90	5.64	-3.84
ISPS 19484M001	N	0.94	0.62	0.99	-0.95	-1.22	0.29	-0.08	1.22
ISPS 19484M001	E	1.36	0.34	0.83	1.33	-1.92	0.92	-1.69	-1.08
ISPS 19484M001	U	3.64	-0.09	7.71	1.88	-2.04	-0.34	0.06	-3.49
KAST 19499M001	N	0.72	0.06	0.25	-0.09	0.25	-0.20	-0.94	1.45
KAST 19499M001	E	0.72	-0.13	-0.75	-0.40	0.27	-0.23	-0.99	1.13
KAST 19499M001	U	4.48	-2.51	4.75	-0.41	-2.26	0.78	8.36	-3.95
LARE 19440M001	N	1.24	1.32	0.39	0.76	1.33	-0.84	-2.07	0.08
LARE 19440M001	E	0.54	-0.24	-0.14	0.51	0.41	0.88	-0.47	-0.46
LARE 19440M001	U	2.38	-1.78	2.72	-2.19	0.85	0.18	1.18	-4.04
LAZK 19354S001	N	1.53	0.72	2.71	-0.02	-2.26	-0.54	0.58	0.71
LAZK 19354S001	E	0.50	-0.21	-0.49	-0.50	-0.31	-0.71	0.57	-0.21
LAZK 19354S001	U	4.47	-2.65	5.04	-0.29	0.56	3.81	5.73	-6.31

LEIT 19428M001	N	0.71	1.07	0.54	-0.43	-0.64	0.38	0.39	0.83
LEIT 19428M001	E	0.92	-0.47	-0.21	-0.48	1.06	-0.66	-1.42	1.02
LEIT 19428M001	U	3.53	-0.06	4.61	2.48	0.49	1.98	2.91	-5.89
ORON 19427M001	N	0.44			-0.44				
ORON 19427M001	E	0.50			-0.50				
ORON 19427M001	U	1.34			-1.34				
PASA 19351S001	N	1.16	-0.13	1.31	-0.45	0.02	-0.19	-1.13	2.18
PASA 19351S001	E	0.42	0.02	-0.37	-0.45	-0.12	-0.42	-0.42	0.58
PASA 19351S001	U	3.08	-2.83	3.68	-2.35	0.39	2.70	4.72	0.09
RI01 13448M002	N	0.88	-0.08	1.52	-0.28	0.13	0.23	-0.70	1.28
RI01 13448M002	E	0.64	-0.65	-0.13	-0.78	-0.01	0.14	-0.96	0.69
RI01 13448M002	U	1.94	-0.61	3.05	-1.32	-0.36	1.23	2.68	1.50
SALA 13469M001	N	0.54	0.39	-1.07	-0.54	0.03	0.17	-0.00	-0.39
SALA 13469M001	E	0.27	0.26	0.01	0.28	0.47	0.21	-0.16	0.08
SALA 13469M001	U	1.96	-0.01	-2.85	-1.65	-2.17	1.93	1.87	-0.56
SCDA 10088M002	N	0.93	0.41	0.99	-0.81	0.25	0.58	-0.97	1.43
SCDA 10088M002	E	0.85	0.97	0.51	-0.10	0.12	-0.82	-1.36	-0.79
SCDA 10088M002	U	2.99	-2.56	3.20	-0.90	0.86	2.62	5.00	-1.81
SOPU 19386M001	N	0.99	0.47	0.32	-0.94	1.92	-1.00	-0.02	-0.03
SOPU 19386M001	E	0.64	0.46	-0.30	0.56	-0.83	-0.68	-0.73	0.43
SOPU 19386M001	U	6.77	-3.54	4.00	-1.97	-4.70	-2.04	14.61	-1.70
TERU 13487M001	N	0.73	0.74	-0.80	0.04	0.71	-0.09	-0.40	1.18
TERU 13487M001	E	0.42	-0.22	0.22	-0.72	-0.43	0.33	-0.34	0.10
TERU 13487M001	U	2.42	-1.31	1.90	-2.60	1.00	-0.98	4.13	-2.04
VITO 19385M001	N	1.20	0.40	1.31	-1.23	-0.12	0.40	-0.84	2.09
VITO 19385M001	E	0.85	-1.18	-1.12	0.43	-0.59	0.06	-0.27	1.02
VITO 19385M001	U	2.72	-1.05	3.81	-2.46	-0.28	3.65	3.02	-0.45
YEBE 13420M001	N	0.44	0.27	-0.97	0.06	0.06	-0.01	-0.16	-0.34
YEBE 13420M001	E	0.47	0.31	0.24	0.17	0.30	-0.02	-0.63	0.82
YEBE 13420M001	U	2.03	2.34	-0.74	-2.63	-2.58	-0.86	1.87	-0.92
ZARA 13462M001	N	1.18	-0.59	1.08	-0.59	-0.07	0.75	-0.72	2.32
ZARA 13462M001	E	0.79	-0.29	-0.74	-1.33	-0.49	-0.46	0.36	0.85
ZARA 13462M001	U	3.56	-2.32	3.93	-3.30	-0.49	3.17	5.77	-0.87

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	-0.22	0.01	0.14		
3	ALME 13437M001	I W	-1.14	-1.32	-0.16		
4	BCL1 19482M001	I W	-1.02	0.77	5.30		
5	BELL 13431M001	I W	3.36	1.94	5.14		
6	BIAZ 10074M002	I W	2.11	0.09	-3.18		
7	BORR 13480M001	I W	-2.43	-0.90	3.52		
8	BRST 10004M004	I W	0.98	-2.00	4.19		
9	CACE 13447M001	I W	1.51	-0.37	4.45		
10	CANT 13438M001	I W	1.83	0.19	0.51		
11	CASC 13909S001	I W	0.97	-1.40	0.98		
12	CEU1 13449M002	I W	0.04	0.16	-5.42		
14	EBRE 13410M001	I W	-2.16	1.94	1.48		
16	FLRS 31907M001	I W	-2.55	-5.43	-8.76		
17	FUER 31330M001	I W	-0.66	-1.34	-1.16		
19	HUEL 13451M001	I W	1.20	1.90	-5.54		
20	IBIZ 13454S001	I W	-1.25	1.22	0.06		
21	IZAN 31309M002	I W	-2.23	-2.48	-3.55		
22	LAGO 13903M001	I W	-0.55	-1.83	1.00		
23	LLIV 13436M001	I W	-3.26	2.11	7.29		
24	LPAL 81701M001	I W	0.41	0.17	-6.20		
25	LROC 10023M001	I W	-0.12	0.54	5.60		
26	MADR 13407S012	I W	-3.03	-0.14	-3.08		
27	MAL1 13444M002	I W	1.13	0.08	-6.07		
28	MALA 13443M001	I W	0.69	0.13	4.35		
29	MALL 13444M001	I W	-1.93	0.73	1.19		
30	MAS1 31303M002	I W	-2.25	-3.39	-0.60		
31	MELI 19379M001	I W	-1.29	0.28	-0.15		
32	PDEL 31906M004	I W	-1.44	-2.03	-5.58		
33	RABT 35001M002	I W	0.68	-2.53	-5.79		
34	SCOA 10088M002	I W	3.35	2.47	-6.44		
35	SFER 13402M004	I W	-0.06	-4.36	3.59		
36	SOPU 19386M001	I W	0.84	0.75	1.82		
37	VALE 13439M001	I W	-0.06	3.23	-4.50		
38	VIGO 13450M001	I W	1.62	1.25	1.55		
39	VILL 13406M001	I W	-0.49	-0.81	3.90		
40	YEBE 13420M001	I W	-1.15	0.14	4.85		
41	ZARA 13462M001	I W	0.16	1.94	1.00		
42	ZIMM 14001M004	I W	-1.08	-1.07	9.68		
RMS / COMPONENT			1.67	1.90	4.47		
IQR			2.26	2.11	7.45		
MEAN			-0.25	-0.25	0.14		
MEDIAN			-0.17	0.11	0.74		
MIN			-3.26	-5.43	-8.76		
MAX			3.36	3.23	9.68		
OVERALL RMS/IQR/MAX(3D)			2.96	2.69	10.62	FLRS 31907M001	#SUM
ALL	RMS / COMPONENT		1.67	1.90	4.47		
ALL	IQR		2.26	2.11	7.45		
ALL	MEAN		-0.25	-0.25	0.14		
ALL	MEDIAN		-0.17	0.11	0.74		
ALL	MIN		-3.26	-5.43	-8.76		
ALL	MAX		3.36	3.23	9.68		
ALL	OVERALL RMS/IQR/MAX(3D)		2.96	2.69	10.62	FLRS 31907M001	#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 : 0.01 +- 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              19760199
NUMBER OF UNKNOWNNS                  195641
NUMBER OF DEGREES OF FREEDOM         19564358
PHASE MEASUREMENTS SIGMA              0.00100
SAMPLING INTERVAL (SECONDS)           180
VARIANCE FACTOR                      2.905531676357309
```

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 24:364:00000 25:004:86370 LEICA GR50 -----
ALDA A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
ALSA A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
AMUR A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
BIAZ A 1 P 24:364:00000 25:004:86370 SPECTRA SP90M -----
BIDA A 1 P 24:366:00000 25:004:86370 LEICA GR10 -----
BRZR A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
CACE A 1 P 24:364:00000 25:004:86370 TRIMBLE NETR9 -----
CANT A 1 P 24:364:00000 25:004:86370 LEICA GR10 -----
CREU A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
EBRE A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
ELGE A 1 P 24:365:00000 25:004:86370 LEICA GR30 -----
EMAZ A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
GERN A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
HOND A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
IGEL A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
ISPS A 1 P 24:364:00000 25:004:86370 LEICA GR10 -----
KAST A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
LARE A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
LAZK A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
LEIT A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
ORON A 1 P 24:366:00000 24:366:86370 LEICA GR50 -----
PASA A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
RI01 A 1 P 24:364:00000 25:004:86370 LEICA GR25 -----
SALA A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
SCOA A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
SOPU A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
TERU A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
VITO A 1 P 24:364:00000 25:004:86370 LEICA GR30 -----
YEBE A 1 P 24:364:00000 25:004:86370 LEICA GR50 -----
ZARA A 1 P 24:364:00000 25:004:86370 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 24:364:00000 25:004:86370 LEIAT504 LEIS -----
ALDA A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
ALSA A 1 P 24:364:00000 25:004:86370 LEIAR10 NONE -----
AMUR A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
BIAZ A 1 P 24:364:00000 25:004:86370 LEIAR25 LEIT -----
BIDA A 1 P 24:366:00000 25:004:86370 LEIAS10 NONE -----
BRZR A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
CACE A 1 P 24:364:00000 25:004:86370 TRM29659.00 NONE -----
CANT A 1 P 24:364:00000 25:004:86370 LEIAR25.R4 LEIT -----
CREU A 1 P 24:364:00000 25:004:86370 LEIAR25.R4 NONE -----
EBRE A 1 P 24:364:00000 25:004:86370 LEIAR25.R4 NONE -----
ELGE A 1 P 24:365:00000 25:004:86370 LEIAR25.R4 LEIT -----
EMAZ A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
GERN A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
HOND A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
IGEL A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
ISPS A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
KAST A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
LARE A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
LAZK A 1 P 24:364:00000 25:004:86370 LEIAR25.R4 LEIT -----
LEIT A 1 P 24:364:00000 25:004:86370 LEIAR10 NONE -----
ORON A 1 P 24:366:00000 24:366:86370 LEIAR10 NONE -----
PASA A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
RI01 A 1 P 24:364:00000 25:004:86370 LEIAR25.R4 LEIT -----
SALA A 1 P 24:364:00000 25:004:86370 LEIAR25 NONE -----
SCOA A 1 P 24:364:00000 25:004:86370 TRM55971.00 NONE -----
SOPU A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
TERU A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
VITO A 1 P 24:364:00000 25:004:86370 LEIAS10 NONE -----
YEBE A 1 P 24:364:00000 25:004:86370 LEIAR20 LEIM -----
ZARA A 1 P 24:364:00000 25:004:86370 TRM29659.00 NONE -----
```

7.3 Eccentricities

```

*
*SITE PT SOLN T DATA_START__ DATA_END_____ AXE ARP-->BENCHMARK(M)-----
ACOR A 1 P 24:364:00000 25:004:86370 UNE 3.0460 0.0000 0.0000
ALDA A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
ALSA A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
AMUR A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
BIDA A 1 P 24:366:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
BRZR A 1 P 24:364:00000 25:004:86370 UNE 0.0771 0.0000 0.0000
CACE A 1 P 24:364:00000 25:004:86370 UNE 0.0600 0.0000 0.0000
CANT A 1 P 24:364:00000 25:004:86370 UNE 3.0490 0.0000 0.0000
CREU A 1 P 24:364:00000 25:004:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 24:364:00000 25:004:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 24:365:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
EMAZ A 1 P 24:364:00000 25:004:86370 UNE 0.0350 0.0000 0.0000
GERN A 1 P 24:364:00000 25:004:86370 UNE 0.0771 0.0000 0.0000
HOND A 1 P 24:364:00000 25:004:86370 UNE 0.0771 0.0000 0.0000
IGEL A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
ISPS A 1 P 24:364:00000 25:004:86370 UNE 0.0350 0.0000 0.0000
KAST A 1 P 24:364:00000 25:004:86370 UNE 0.0350 0.0000 0.0000
LARE A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
LAZK A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
LEIT A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
ORON A 1 P 24:366:00000 24:366:86370 UNE 0.0000 0.0000 0.0000
PASA A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
RIO1 A 1 P 24:364:00000 25:004:86370 UNE 0.0606 0.0000 0.0000
SALA A 1 P 24:364:00000 25:004:86370 UNE 0.0600 0.0000 0.0000
SCOA A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
SOPU A 1 P 24:364:00000 25:004:86370 UNE 0.0771 0.0000 0.0000
TERU A 1 P 24:364:00000 25:004:86370 UNE 0.0600 0.0000 0.0000
VITO A 1 P 24:364:00000 25:004:86370 UNE 0.0000 0.0000 0.0000
YEBE A 1 P 24:364:00000 25:004:86370 UNE 0.0600 0.0000 0.0000
ZARA A 1 P 24:364:00000 25:004:86370 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

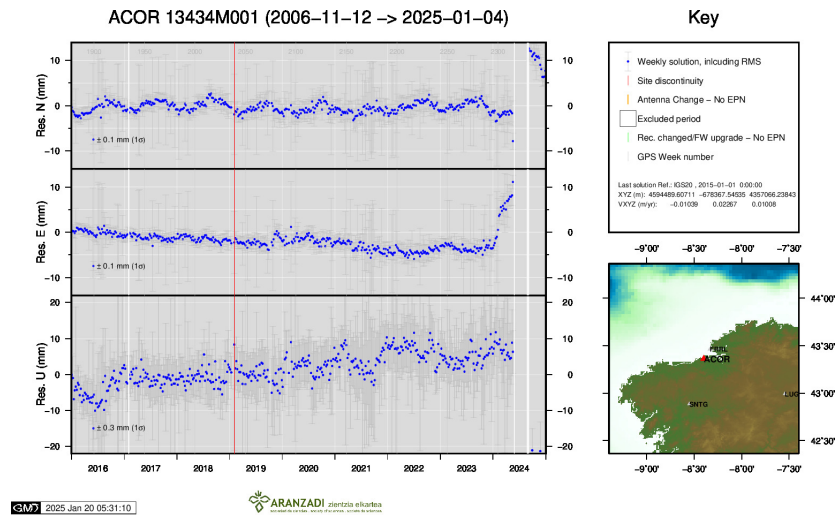
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf

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

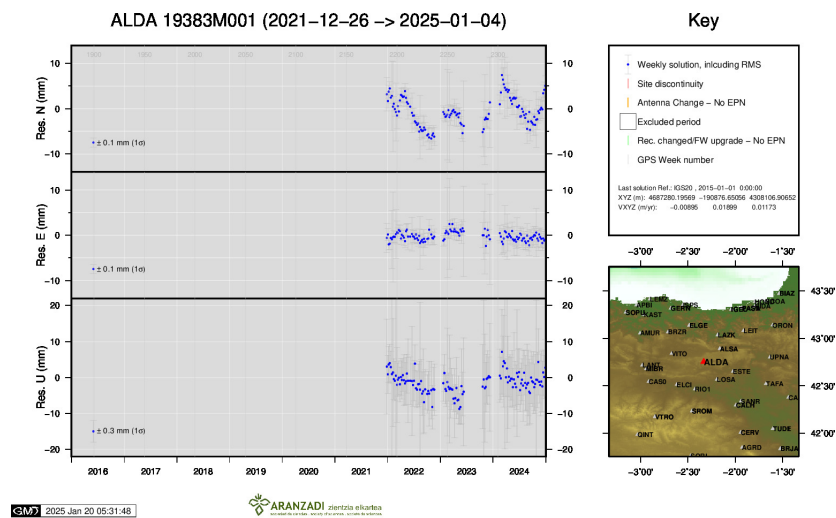
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems*. etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf

9 Cumulative Time Series

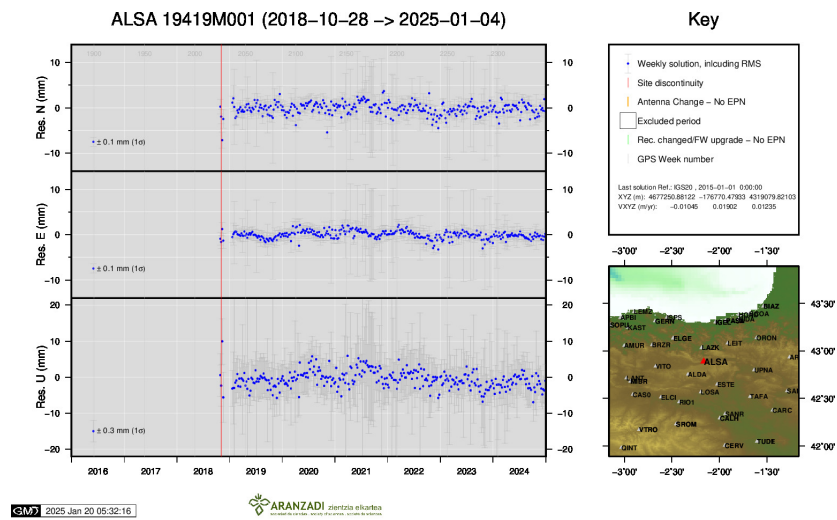
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



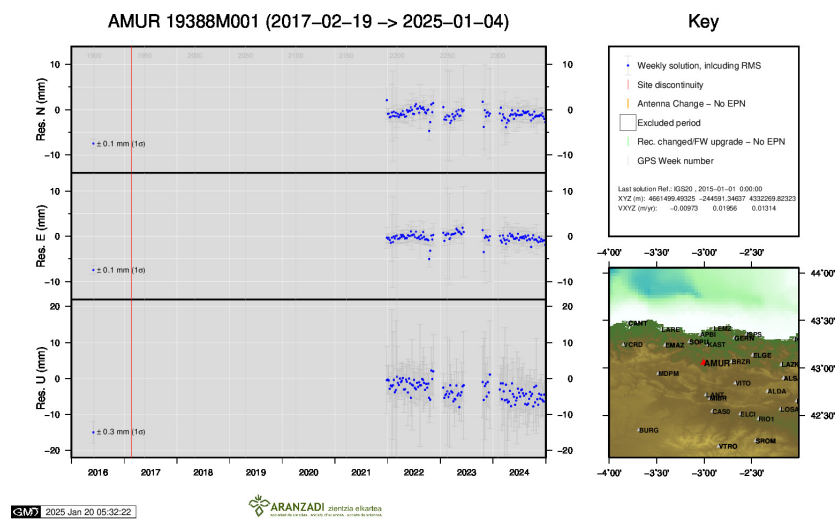
1) ACOR



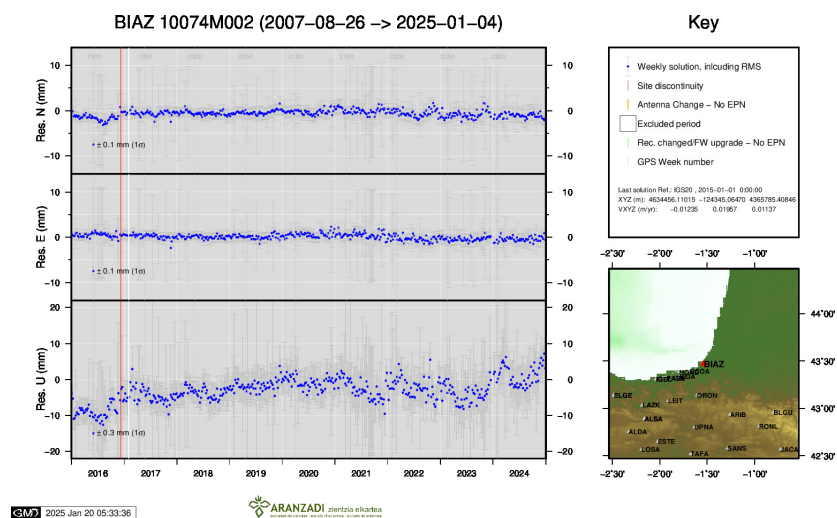
2) ALDA



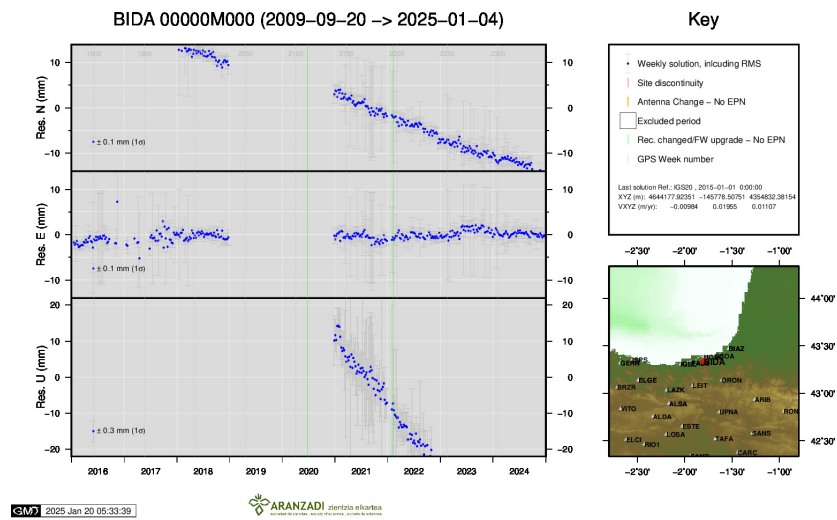
3) ALSA



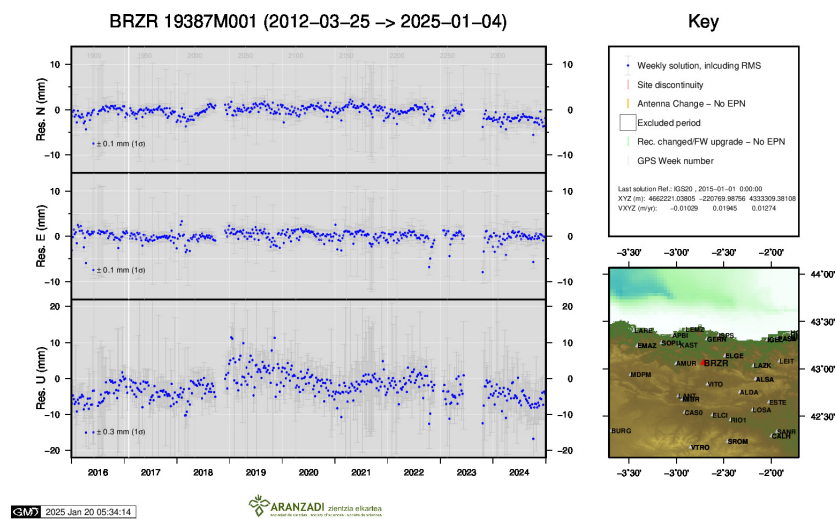
4) AMUR



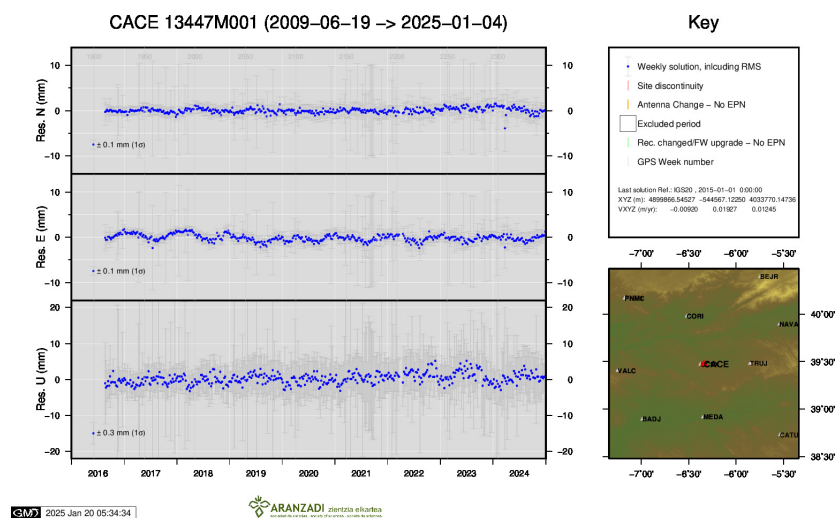
5) BIAZ



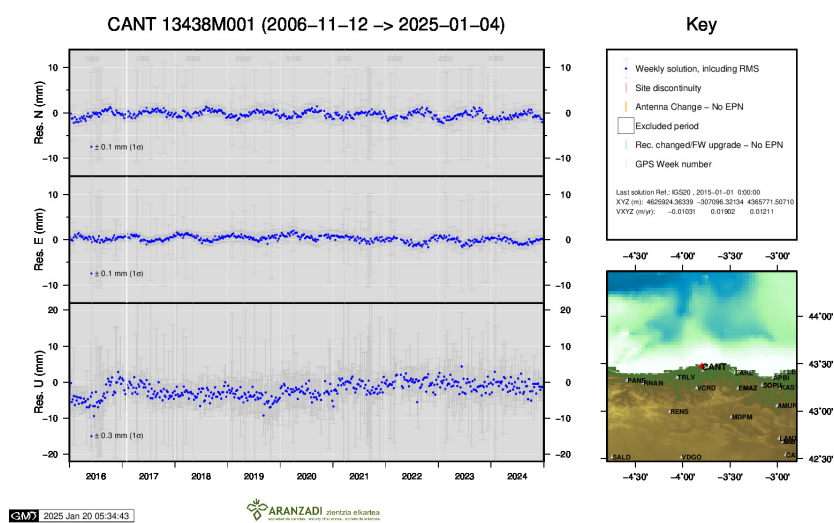
6) BIDA



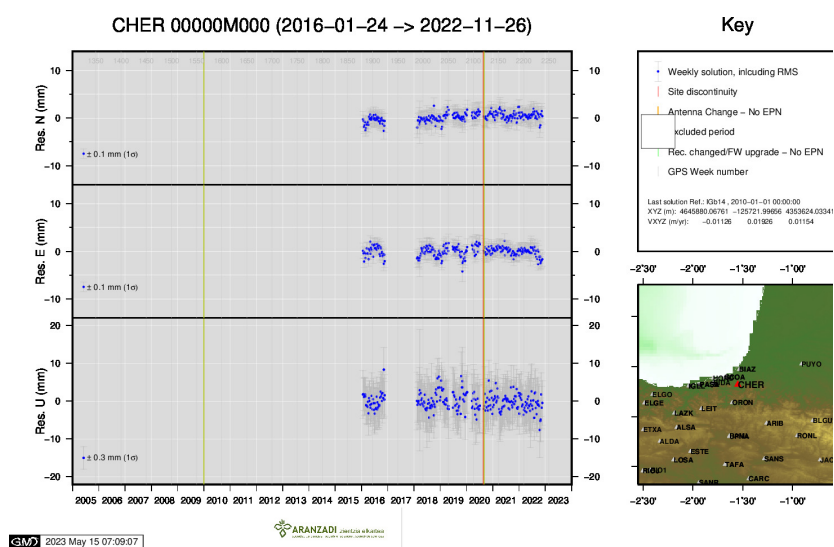
7) BRZR



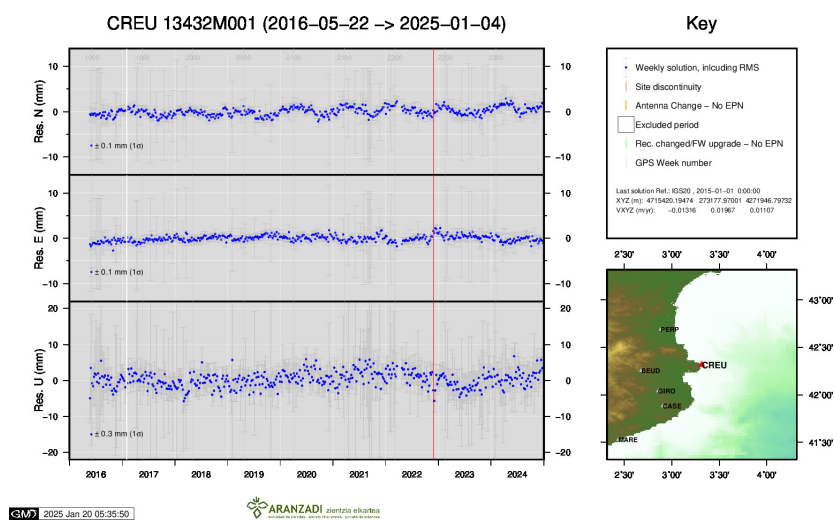
8) CACE



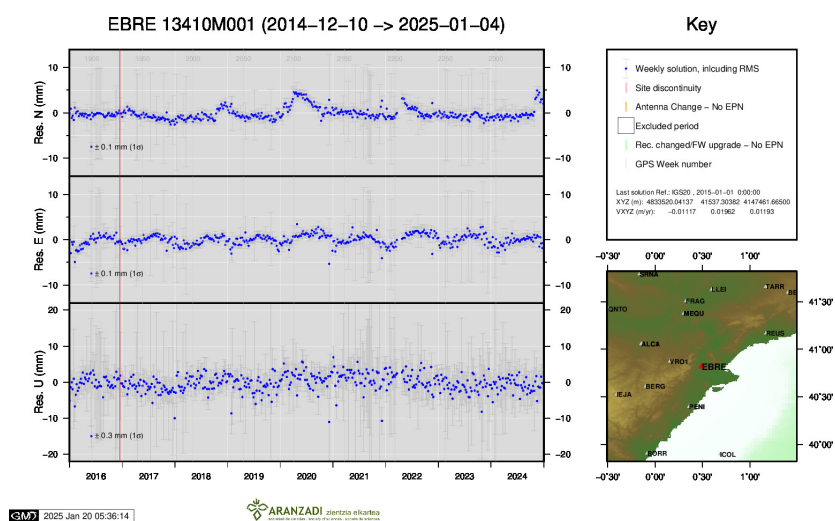
9) CANT



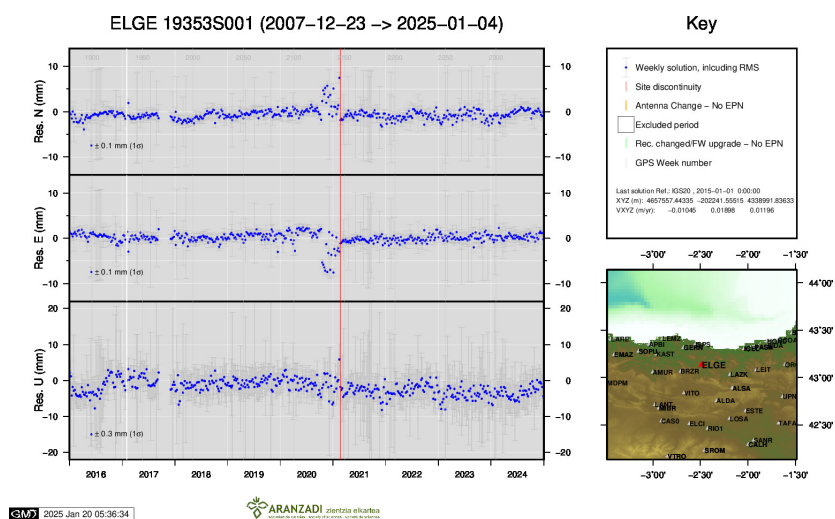
10) CHER



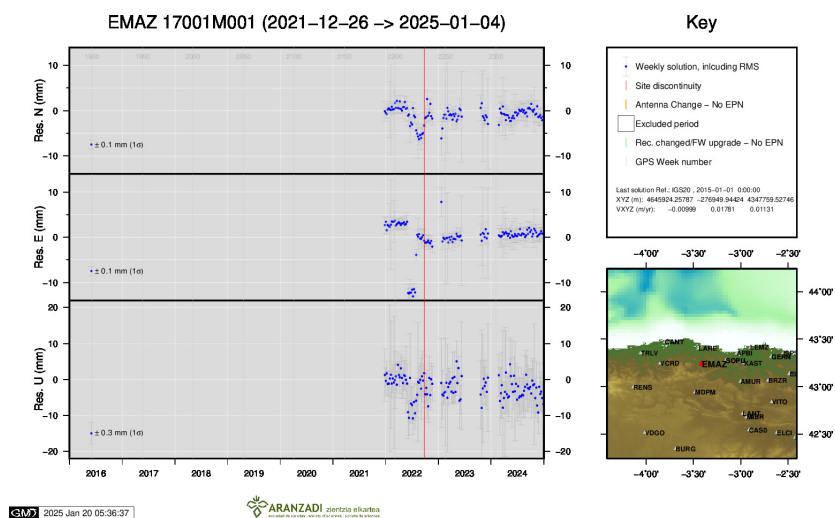
11) CREU



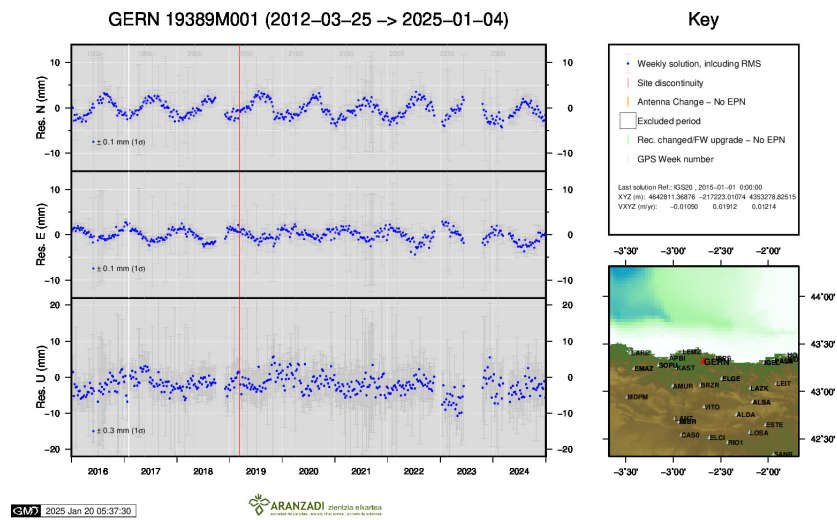
12) EBRE



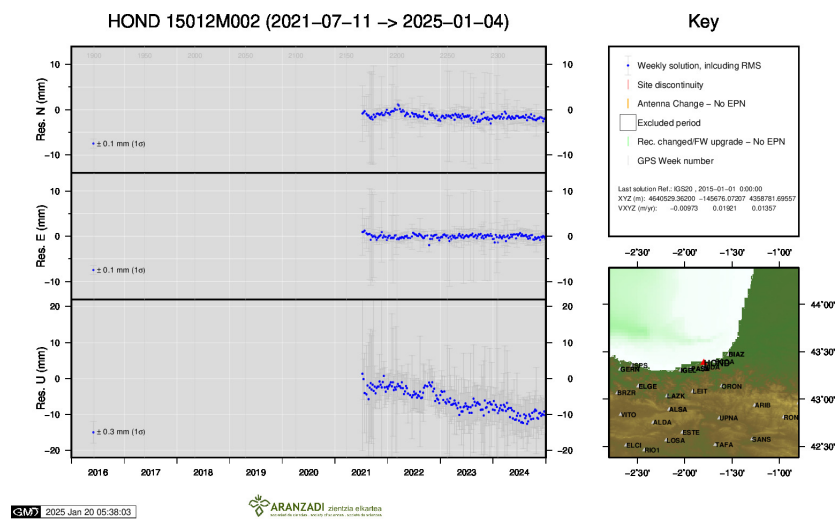
13) ELGE



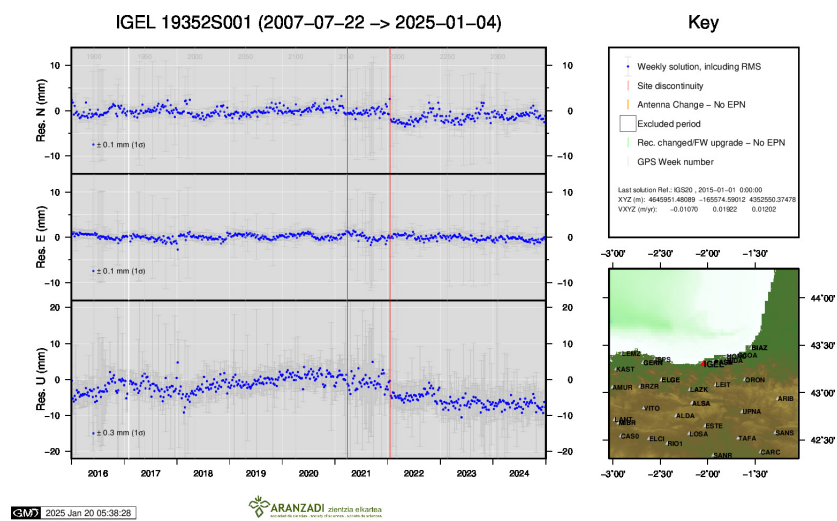
14) EMAZ



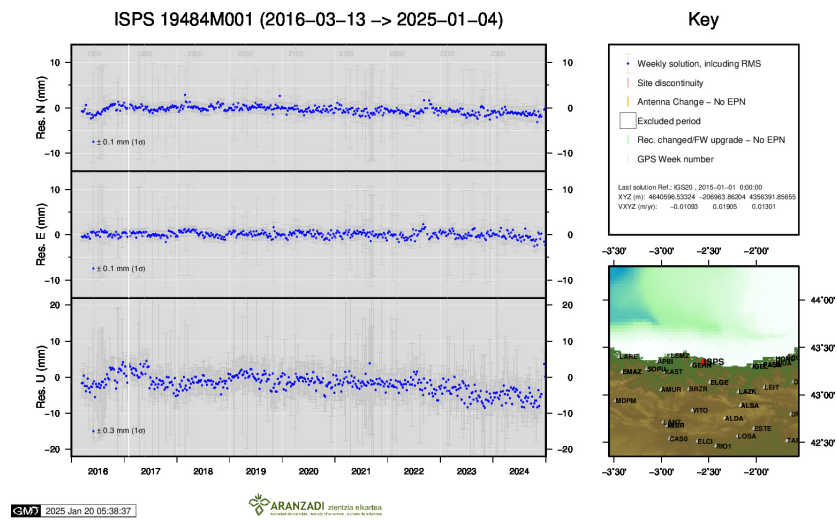
15) GERN



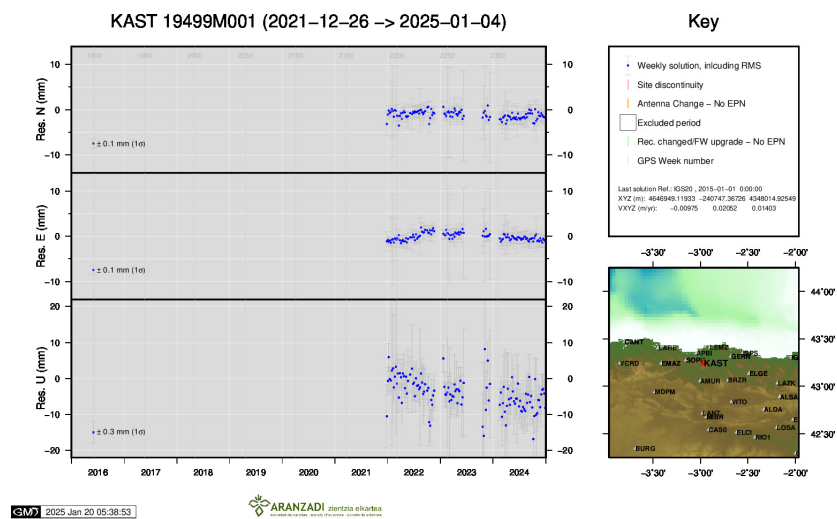
16) HOND



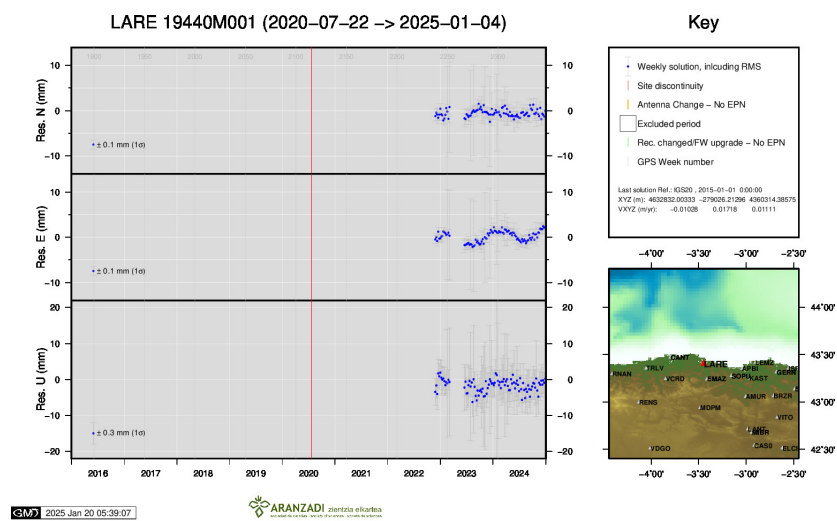
17) IGEL



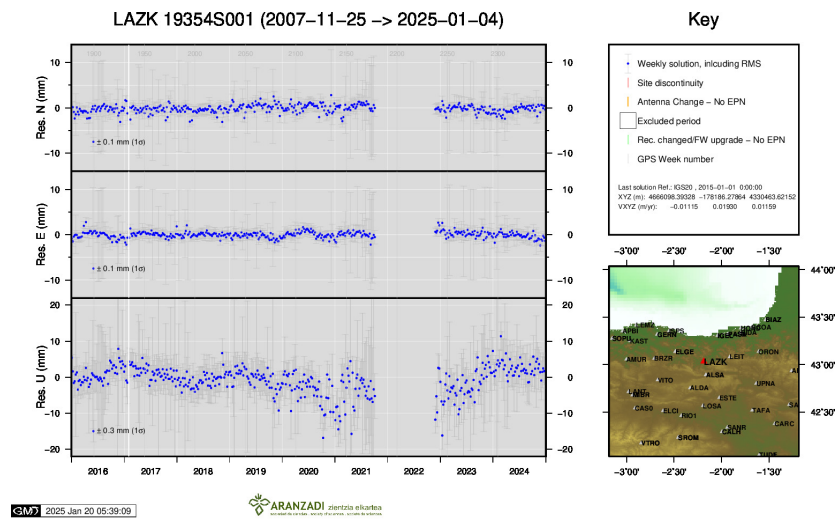
18) ISPS



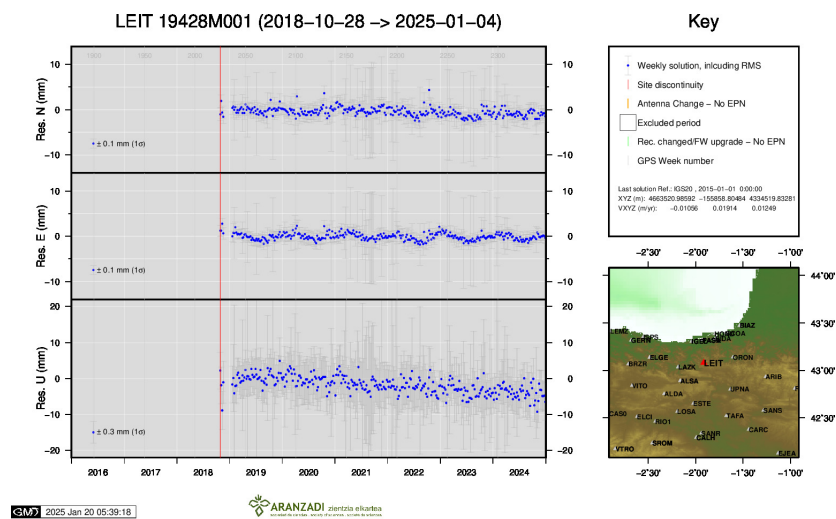
19) KAST



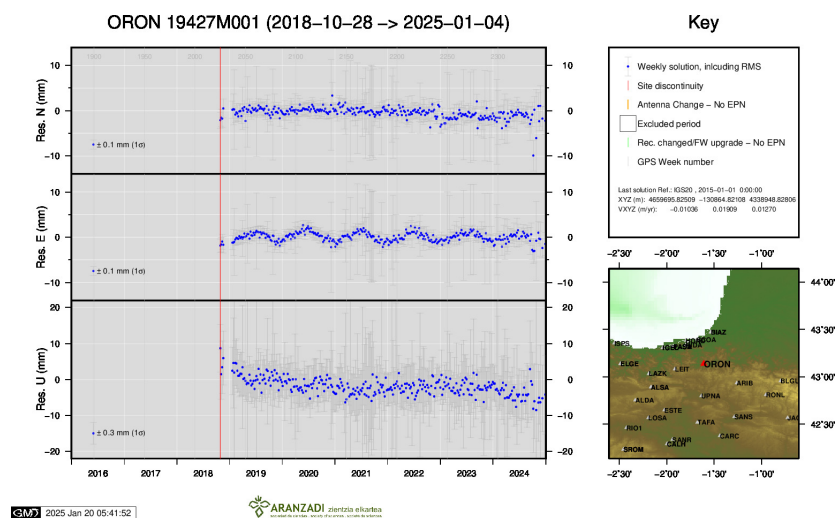
20) LARE



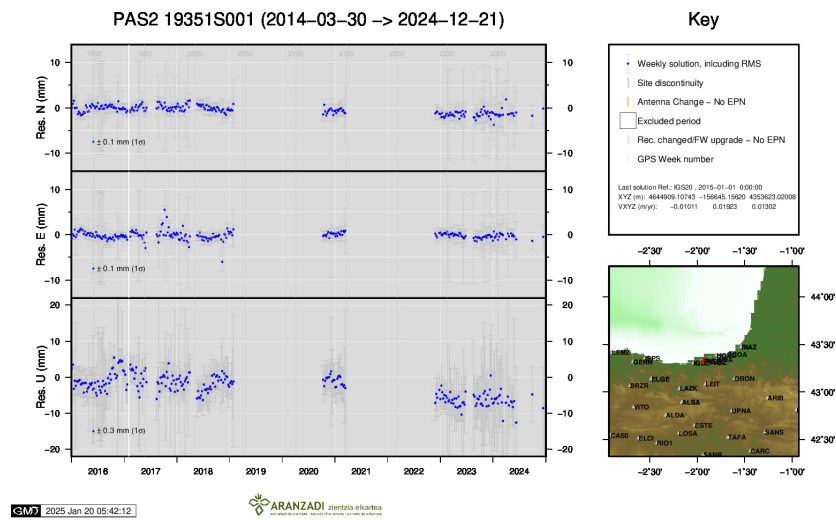
21) LAZK



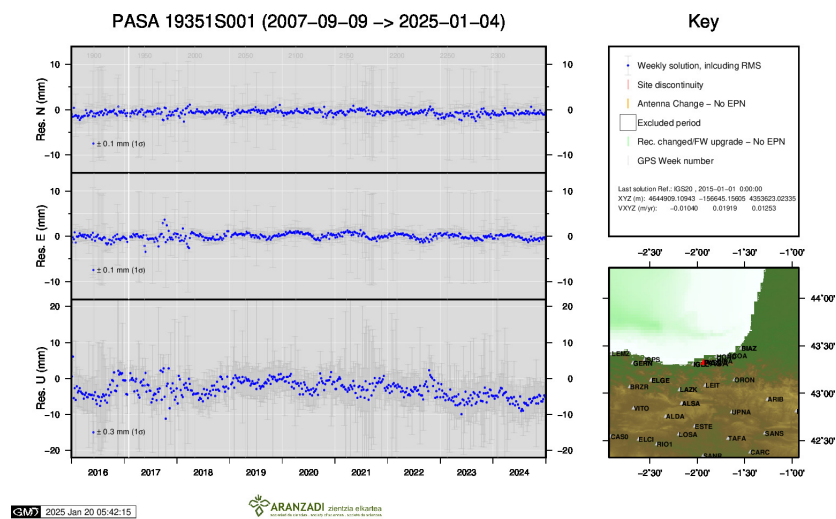
22) LEIT



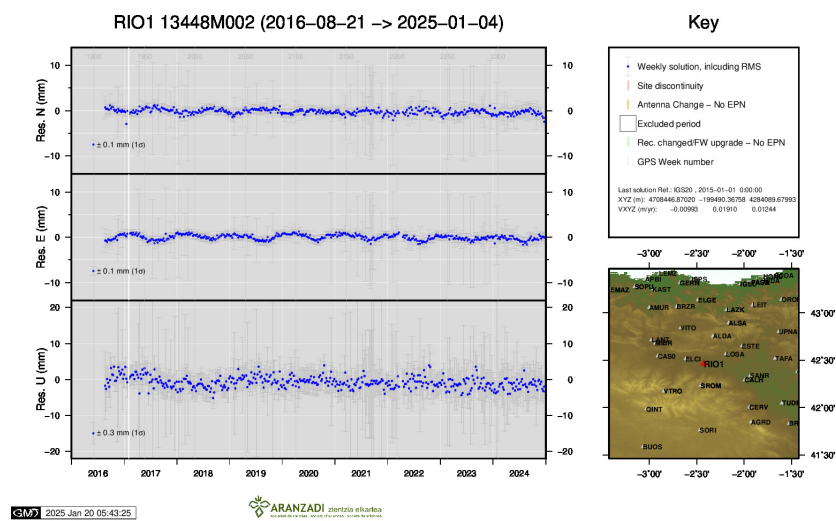
23) ORON



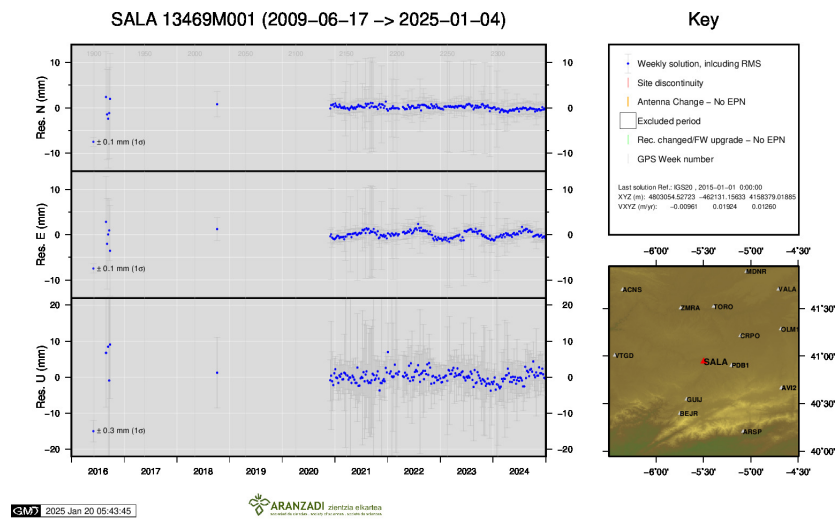
24) PAS2



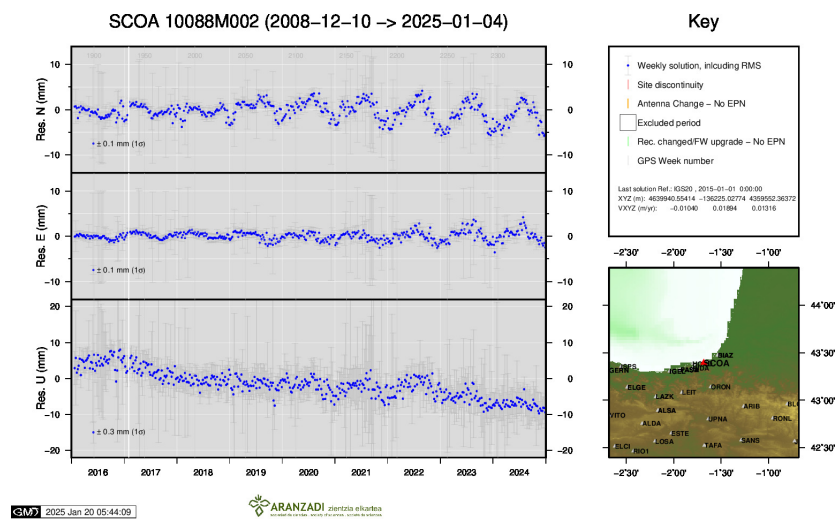
25) PASA



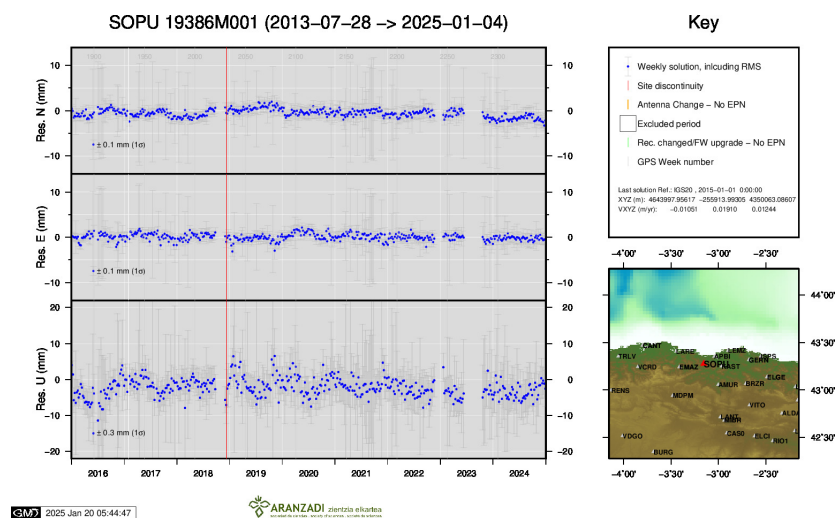
26) RIO1



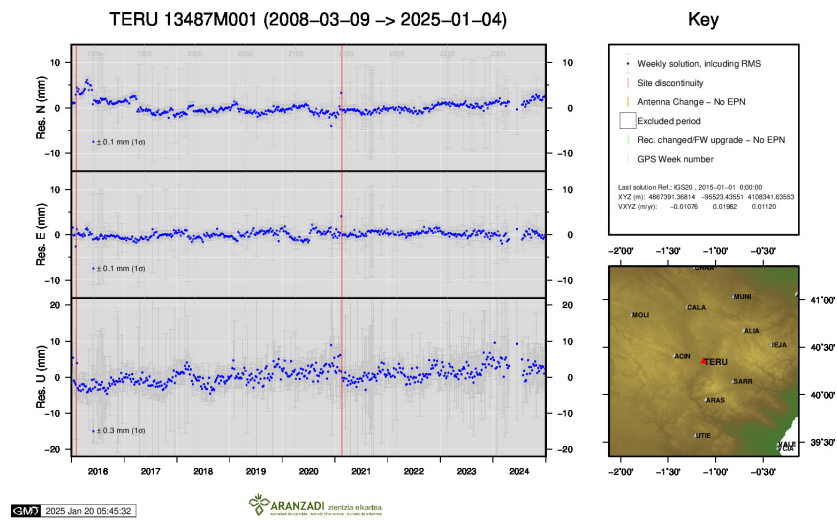
27) SALA



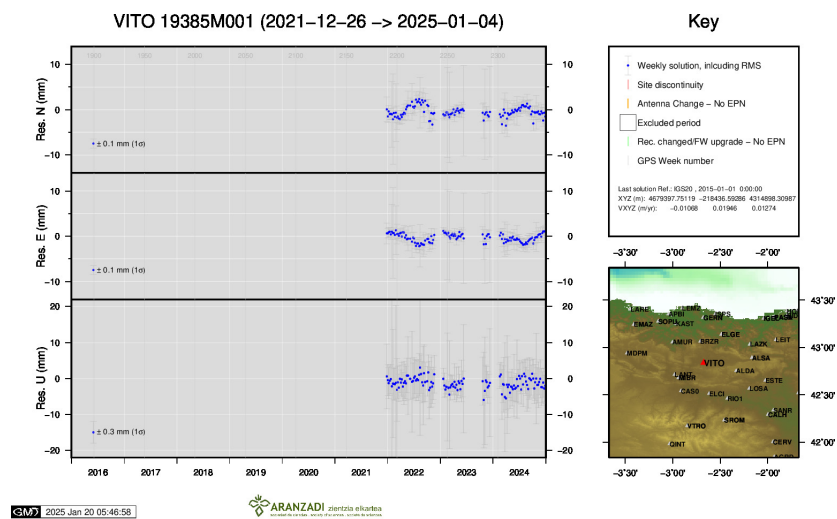
28) SCOA



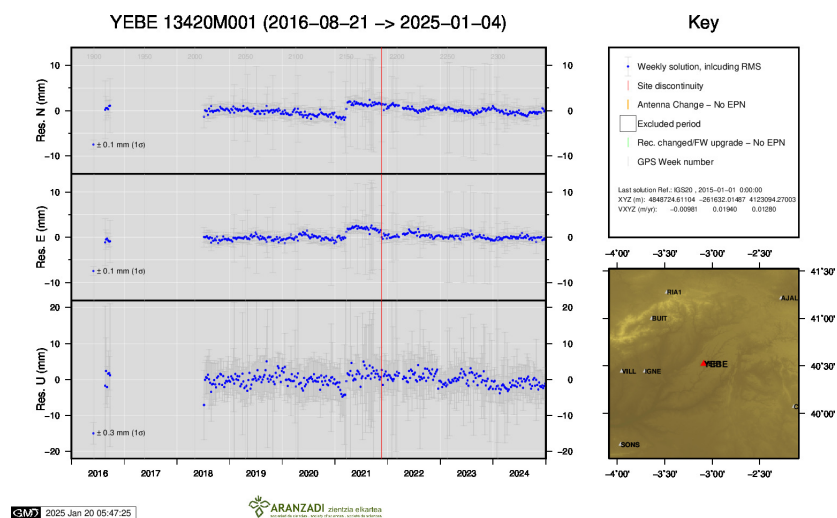
29) SOPU



30) TERU



31) VITO



32) YEBE

