ARA-DAC Weekly Analysis Result: 2323 (GFA)

Technical Report

GPS Week: 2323 (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

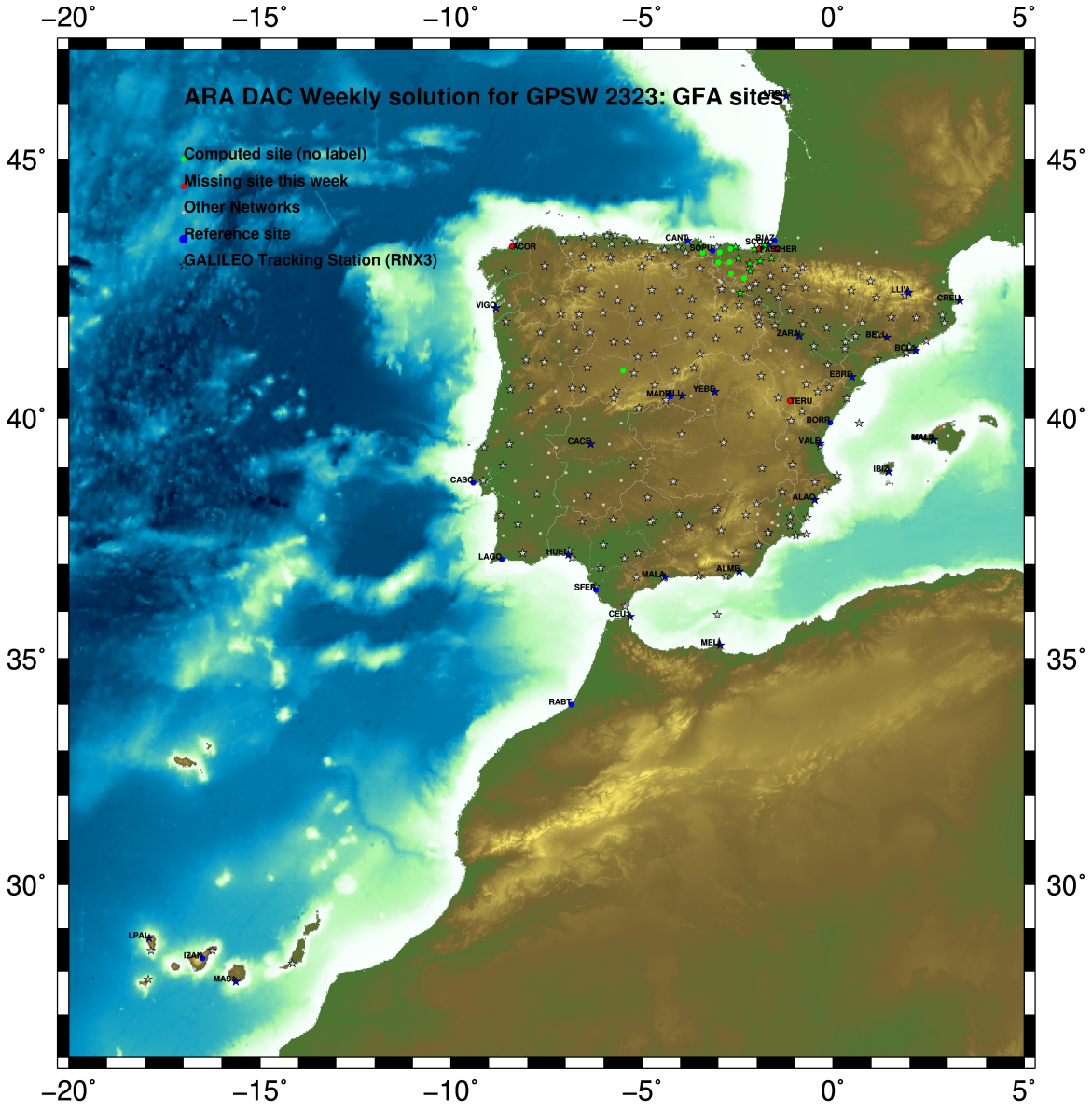


Fig.1: Computed Sites for GPS Week2323 (GFA)

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 observatione 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*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 05-AUG-24 05:04

LOCAL GEODETIC DATUM: IGS20 EPOCH: 2024-07-17 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.10772	-190876.46845	4308107.01445	A	GR
50	ALSA 19419M001	4677250.77922	-176770.29706	4319079.93627	A	GRE
53	AMUR 19388M001	4661499.39610	-244591.15903	4332269.94388	A	GR
384	BIAZ 10074M002	4634455.98931	-124344.87778	4365785.51302	W	GR
101	BIDA 00000M000	4644177.75953	-145778.22549	4354832.53658	A	GR
113	BRZR 19387M001	4662220.93280	-220769.80158	4333309.49465	A	GR
573	CACE 13447M001	4899866.45741	-544566.93858	4033770.26649	W	GRE
592	CANT 13438M001	4625924.26092	-307096.14007	4365771.61939	W	GRE
908	CREU 13432M001	4715420.06911	273178.15834	4271946.90394	W	GRE
135	EBRE 13410M001	4833519.93623	41537.49134	4147461.77921	W	GRE
180	ELGE 19353S001	4657557.33643	-202241.37328	4338991.94488	A	GRE
182	EMAZ 17001M001	4645924.15589	-276949.77265	4347759.63029	A	GR
209	GERN 19389M001	4642811.26187	-217222.83003	4353278.93640	A	GR
257	HOND 15012M002	4640529.25868	-145675.88764	4358781.81355	A	GRE
235	IGEL 19352S001	4645951.37086	-165574.40602	4352550.48183	A	GRE
240	ISPS 19484M001	4640596.42247	-206963.68075	4356391.97321	A	GRE
245	KAST 19499M001	4646949.01819	-240747.17118	4348015.04999	A	GR
252	LARE 19440M001	4632831.90056	-279026.04932	4360314.48766	A	GRE
256	LAZK 19354S001	4666098.28489	-178186.09374	4330463.73216	A	GRE
261	LEIT 19428M001	4663520.88066	-155858.62210	4334519.94693	A	GRE
334	ORON 19427M001	4659695.71935	-130864.63765	4338948.94299	A	GRE
493	PASA 19351S001	4644909.00140	-156644.97229	4353623.13425	A	GRE
553	RIO1 13448M002	4708446.77276	-199490.18542	4284089.79669	A	GRE
558	SALA 13469M001	4803054.43362	-462130.97183	4158379.13781	A	GR
526	SCOA 10088M002	4639940.44475	-136224.84316	4359552.48395	W	GRE
715	SOPU 19386M001	4643997.84914	-255913.81074	4350063.19756	W	GR
493	VITO 19385M001	4679397.64400	-218436.40769	4314898.42802	A	GR
616	YEBE 13420M001	4848724.51659	-261631.82931	4123094.39132	W	GRE
655	ZARA 13462M001	4773803.11365	-73505.88540	4215454.15718	W	GRE

5.2 ETRF2000 (ETRS89) Coordinates

European **T**errestrial **R**eference **S**ystem, **1989** (**ETRS89**) is realized by ETRF2000 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

CONVERT TO ETRF2000 05-AUG-24 05:04

LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2024-07-17 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.51566	-190877.11713	4308106.53179	A	
50	ALSA 19419M001	4677251.18998	-176770.94448	4319079.45469	A	
53	AMUR 19388M001	4661499.79866	-244591.80471	4332269.46273	A	
384	BIAZ 10074M002	4634456.41103	-124345.51984	4365785.03594	W	
101	BIDA 00000M000	4644178.17743	-145778.86879	4354832.05834	A	
113	BRZR 19387M001	4662221.33871	-220770.44729	4333309.01377	A	
573	CACE 13447M001	4899866.79462	-544567.61361	4033769.76004	W	
592	CANT 13438M001	4625924.65767	-307096.78157	4365771.14048	W	
908	CREU 13432M001	4715420.53742	273177.50785	4271946.42526	W	
135	EBRE 13410M001	4833520.36281	41536.82571	4147461.28692	W	
180	ELGE 19353S001	4657557.74533	-202242.01837	4338991.46467	A	
182	EMAZ 17001M001	4645924.55530	-276950.41653	4347759.15005	A	
209	GERN 19389M001	4642811.66988	-217223.47336	4353278.45728	A	
257	HOND 15012M002	4640529.67691	-145676.53050	4358781.33564	A	
235	IGEL 19352S001	4645951.78587	-165575.04960	4352550.00316	A	
240	ISPS 19484M001	4640596.83214	-206964.32379	4356391.49443	A	
245	KAST 19499M001	4646949.42256	-240747.81508	4348014.57017	A	
252	LARE 19440M001	4632832.30070	-279026.69159	4360314.00854	A	
256	LAZK 19354S001	4666098.69638	-178186.73980	4330463.25154	A	
261	LEIT 19428M001	4663521.29553	-155859.26779	4334519.46685	A	
334	ORON 19427M001	4659696.13799	-130865.28280	4338948.46360	A	
493	PASA 19351S001	4644909.41772	-156645.61571	4353622.65580	A	
553	RIO1 13448M002	4708447.17757	-199490.83668	4284089.31204	A	
558	SALA 13469M001	4803054.79228	-462131.63512	4158378.64109	A	
526	SCOA 10088M002	4639940.86434	-136225.48592	4359552.00622	W	
715	SOPU 19386M001	4643998.25160	-255914.45431	4350062.71778	W	
493	VITO 19385M001	4679398.04873	-218437.05548	4314897.94566	A	
616	YEBE 13420M001	4848724.89978	-261632.49768	4123093.89343	W	
655	ZARA 13462M001	4773803.53007	-73506.54421	4215453.66855	W	

5.3 ETRF2014 (ETRS89) Coordinates

European **T**errestrial **R**eference **S**ystem, **1989** (**ETRS89**) is realized by ETRF2014 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

CONVERT TO ETRF2014 05-AUG-24 05:04

LOCAL GEODETIC DATUM: ETRF2014 EPOCH: 2024-07-17 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.47323	-190877.15528	4308106.58425	A	
50	ALSA 19419M001	4677251.14761	-176770.98272	4319079.50719	A	
53	AMUR 19388M001	4661499.75671	-244591.84277	4332269.51524	A	
384	BIAZ 10074M002	4634456.36895	-124345.55847	4365785.08861	W	
101	BIDA 00000M000	4644178.13532	-145778.90730	4354832.11097	A	
113	BRZR 19387M001	4662221.29666	-220770.48544	4333309.06630	A	
573	CACE 13447M001	4899866.75080	-544567.64945	4033769.81177	W	
592	CANT 13438M001	4625924.61631	-307096.81955	4365771.19308	W	
908	CREU 13432M001	4715420.49288	273177.46812	4271946.47798	W	
135	EBRE 13410M001	4833520.31782	41536.78737	4147461.33910	W	
180	ELGE 19353S001	4657557.70327	-202242.05661	4338991.51722	A	
182	EMAZ 17001M001	4645924.51363	-276950.45453	4347759.20260	A	
209	GERN 19389M001	4642811.62804	-217223.51161	4353278.50987	A	
257	HOND 15012M002	4640529.63485	-145676.56902	4358781.38827	A	
235	IGEL 19352S001	4645951.74381	-165575.08802	4352550.05577	A	
240	ISPS 19484M001	4640596.79028	-206964.36208	4356391.54703	A	
245	KAST 19499M001	4646949.38075	-240747.85322	4348014.62273	A	
252	LARE 19440M001	4632832.25917	-279026.72965	4360314.06113	A	
256	LAZK 19354S001	4666098.65414	-178186.77809	4330463.30408	A	
261	LEIT 19428M001	4663521.25324	-155859.30617	4334519.51941	A	
334	ORON 19427M001	4659696.09566	-130865.32129	4338948.51618	A	
493	PASA 19351S001	4644909.37564	-156645.65417	4353622.70841	A	
553	RIO1 13448M002	4708447.13492	-199490.87470	4284089.36444	A	
558	SALA 13469M001	4803054.74939	-462131.67171	4158378.69311	A	
526	SCOA 10088M002	4639940.82224	-136225.52448	4359552.05886	W	
715	SOPU 19386M001	4643998.20988	-255914.49241	4350062.77035	W	
493	VITO 19385M001	4679398.00648	-218437.09356	4314897.99814	A	
616	YEBE 13420M001	4848724.85572	-261632.53482	4123093.94539	W	
655	ZARA 13462M001	4773803.48622	-73506.58240	4215453.72082	W	

6 Quality Control

6.1 Mean and Daily Repeatabilities

In this section, the mean and daily repeatabilities of the sites are shown. Repatabilities refer to the IGS20 solution and are given with respect to the Local frame (North-East-Up).

GFA FINAL WEEKLY COMBINATION: FINAL ORBITS 05-AUG-24 05:04

Station	#Days	Weekday 0123456	Repeatability (mm) N	E	U
ALDA 19383M001	7	XXXXXXX	2.49	1.34	4.69
ALSA 19419M001	7	XXXXXXX	3.18	1.51	3.83
AMUR 19388M001	7	XXXXXXX	1.52	1.40	4.46
BIAZ 10074M002	7	XXXXXXX	1.13	0.49	5.01
BIDA 00000M000	7	XXXXXXX	1.12	0.64	5.31
BRZR 19387M001	7	XXXXXXX	1.69	2.24	4.70
CACE 13447M001	7	XXXXXXX	0.75	0.69	4.47
CANT 13438M001	7	XXXXXXX	0.34	0.80	3.80
CREU 13432M001	7	XXXXXXX	1.74	0.90	3.19
EBRE 13410M001	6	XXX XXX	1.10	1.05	5.90
ELGE 19353S001	7	XXXXXXX	0.96	0.73	4.01
EMAZ 17001M001	7	XXXXXXX	1.61	1.40	3.10
GERN 19389M001	7	XXXXXXX	0.72	2.02	4.54
HOND 15012M002	7	XXXXXXX	1.06	0.70	5.89
IGEL 19352S001	7	XXXXXXX	1.06	0.54	3.52
ISPS 19484M001	7	XXXXXXX	0.53	2.25	5.16
KAST 19499M001	7	XXXXXXX	1.08	1.12	4.49
LARE 19440M001	7	XXXXXXX	1.33	1.39	4.06
LAZK 19354S001	7	XXXXXXX	1.73	1.14	2.68
LEIT 19428M001	7	XXXXXXX	1.31	0.96	3.36
ORON 19427M001	2	XX	1.58	0.96	0.99
PASA 19351S001	7	XXXXXXX	1.02	0.30	3.30
RIO1 13448M002	7	XXXXXXX	0.55	0.94	2.39
SALA 13469M001	7	XXXXXXX	1.03	0.85	4.89
SCOA 10088M002	7	XXXXXXX	2.20	1.20	4.58
SOPU 19386M001	7	XXXXXXX	0.82	0.87	5.25
VITO 19385M001	7	XXXXXXX	1.01	0.80	5.22
YEBE 13420M001	7	XXXXXXX	0.55	0.60	1.68
ZARA 13462M001	7	XXXXXXX	0.86	0.92	3.69

Comparison of individual solutions:

ALDA 19383M001	N	2.49	-1.82	0.95	0.47	-3.73	-1.51	0.98	3.94
ALDA 19383M001	E	1.34	1.74	-0.95	1.01	0.94	0.39	-1.40	-1.66
ALDA 19383M001	U	4.69	5.12	-0.74	2.33	2.53	6.51	1.27	-7.04
ALSA 19419M001	N	3.18	-5.05	1.02	1.90	-1.16	-2.91	4.32	1.45
ALSA 19419M001	E	1.51	2.60	-1.92	0.11	1.09	0.54	-1.18	-0.53
ALSA 19419M001	U	3.83	-1.59	-6.70	2.49	2.82	0.77	5.01	-0.75
AMUR 19388M001	N	1.52	-0.24	-3.08	0.27	-1.04	-1.18	1.21	-0.56
AMUR 19388M001	E	1.40	1.11	-0.76	-0.31	0.62	2.70	-1.49	0.09
AMUR 19388M001	U	4.46	7.51	-4.98	0.82	-0.34	-5.36	-0.45	2.88
BIAZ 10074M002	N	1.13	-2.03	0.89	0.42	-0.90	0.03	0.89	0.98
BIAZ 10074M002	E	0.49	0.69	0.63	-0.54	0.07	-0.38	-0.32	-0.12
BIAZ 10074M002	U	5.01	6.23	-8.54	2.68	1.19	-2.50	2.28	4.33
BIDA 00000M000	N	1.12	-1.67	1.06	0.98	-1.39	0.52	-0.05	0.65
BIDA 00000M000	E	0.64	0.07	-1.01	0.18	-0.13	-0.39	0.52	0.98
BIDA 00000M000	U	5.31	8.14	-8.66	1.88	-1.62	4.03	0.01	2.39
BRZR 19387M001	N	1.69	0.16	-3.37	0.38	0.19	2.17	0.43	0.82
BRZR 19387M001	E	2.24	1.50	-4.57	1.14	1.01	1.76	0.62	1.09
BRZR 19387M001	U	4.70	1.09	-8.44	2.20	3.31	1.43	6.49	0.36
CACE 13447M001	N	0.75	0.07	0.52	-0.01	0.70	-0.34	0.20	-1.56
CACE 13447M001	E	0.69	0.65	-0.17	-0.35	1.13	-0.04	-0.64	-0.80
CACE 13447M001	U	4.47	2.19	-6.63	0.69	3.48	4.81	-2.40	5.42
CANT 13438M001	N	0.34	0.04	-0.24	-0.17	-0.47	-0.37	-0.03	0.48
CANT 13438M001	E	0.80	0.59	0.51	0.04	-0.42	1.19	1.06	-0.70
CANT 13438M001	U	3.80	-2.30	2.17	3.77	-1.40	-4.16	3.27	5.68
CREU 13432M001	N	1.74	1.35	-1.50	-0.24	1.70	-1.18	2.57	-1.75
CREU 13432M001	E	0.90	-0.52	-1.25	-0.06	0.15	0.93	1.44	0.17
CREU 13432M001	U	3.19	-2.94	3.95	-2.26	-2.16	-1.77	1.29	-4.71
EBRE 13410M001	N	1.10	-0.82	1.20	-0.60		-0.34	1.86	0.13
EBRE 13410M001	E	1.05	0.32	-0.58	-0.75		1.53	1.18	-0.89
EBRE 13410M001	U	5.90	-0.69	1.14	-2.50		2.57	-12.01	3.88
ELGE 19353S001	N	0.96	-1.40	-0.26	0.56	0.01	1.22	-0.61	1.16
ELGE 19353S001	E	0.73	0.27	0.82	0.12	-0.29	1.35	-0.35	0.67
ELGE 19353S001	U	4.01	5.01	-4.45	2.58	3.66	-4.44	3.44	-0.37
EMAZ 17001M001	N	1.61	1.27	0.14	-1.91	0.61	1.35	0.38	-2.82
EMAZ 17001M001	E	1.40	-1.40	0.56	-0.36	1.76	0.63	-0.51	2.36
EMAZ 17001M001	U	3.10	3.33	-3.23	5.28	-1.42	-0.41	2.39	-0.44
GERN 19389M001	N	0.72	-0.04	-0.20	-0.24	-0.78	1.38	-0.35	0.61
GERN 19389M001	E	2.02	1.32	-1.79	1.48	-1.91	3.57	-1.02	0.14
GERN 19389M001	U	4.54	7.97	-2.29	2.38	-1.84	-3.51	-3.54	4.59
HOND 15012M002	N	1.06	-1.28	1.03	0.38	-1.51	0.05	0.51	1.16
HOND 15012M002	E	0.70	0.37	-1.44	0.49	0.11	0.03	0.07	0.66
HOND 15012M002	U	5.89	11.94	-7.19	3.41	-0.18	-1.26	-0.29	-0.59
IGEL 19352S001	N	1.06	-1.57	-0.06	0.27	-1.09	0.80	0.48	1.45
IGEL 19352S001	E	0.54	1.03	0.14	0.35	-0.07	-0.57	-0.47	-0.06
IGEL 19352S001	U	3.52	6.20	-2.38	0.54	0.21	0.50	-3.05	4.50
ISPS 19484M001	N	0.53	0.13	-0.58	0.18	0.10	0.96	-0.60	0.07
ISPS 19484M001	E	2.25	1.63	-2.29	1.48	-1.42	4.02	-1.47	-0.00
ISPS 19484M001	U	5.16	7.48	5.06	1.68	-8.31	0.50	-2.39	-0.38
KAST 19499M001	N	1.08	-0.85	-1.99	0.40	-0.58	1.17	-0.36	0.52
KAST 19499M001	E	1.12	0.72	-1.87	0.02	1.04	1.23	0.41	0.86
KAST 19499M001	U	4.49	7.53	-6.30	1.31	-1.80	-0.21	2.80	3.43
LARE 19440M001	N	1.33	1.90	-0.99	-2.26	-0.30	-0.43	0.56	0.61
LARE 19440M001	E	1.39	-0.96	0.50	0.57	3.01	0.40	-0.94	0.04
LARE 19440M001	U	4.06	-2.12	-0.31	-0.10	-3.80	4.77	-0.86	7.51
LAZK 19354S001	N	1.73	-2.02	3.08	-0.73	-0.66	-0.58	1.50	-0.91
LAZK 19354S001	E	1.14	0.59	-0.85	0.47	-0.95	0.88	-1.28	1.79
LAZK 19354S001	U	2.68	5.45	-1.60	-1.42	0.46	-0.93	-1.69	2.24
LEIT 19428M001	N	1.31	-0.70	1.97	0.38	-1.68	-1.70	0.15	0.22
LEIT 19428M001	E	0.96	1.71	0.51	-0.37	-0.02	0.78	-1.02	-0.79
LEIT 19428M001	U	3.36	-2.50	4.25	1.30	2.00	-4.53	1.56	-3.82
ORON 19427M001	N	1.58						1.23	0.98
ORON 19427M001	E	0.96						0.95	0.13

ORON	19427M001	U	0.99						0.72	-0.68
PASA	19351S001	N	1.02	-0.46	-1.05	0.32	-1.33	0.45	1.08	1.32
PASA	19351S001	E	0.30	0.29	0.04	0.33	0.30	-0.27	-0.41	0.01
PASA	19351S001	U	3.30	6.54	-2.49	2.14	0.89	0.31	-2.68	1.92
RIO1	13448M002	N	0.55	-0.21	-0.64	-0.12	-0.51	-0.32	0.78	0.60
RIO1	13448M002	E	0.94	1.03	-1.03	0.15	0.22	1.19	0.20	-1.29
RIO1	13448M002	U	2.39	-1.24	2.62	3.04	-3.68	-0.18	1.55	0.78
SALA	13469M001	N	1.03	-0.50	1.22	-0.12	-0.85	-1.17	1.40	-0.73
SALA	13469M001	E	0.85	0.07	1.19	0.22	0.84	0.75	-1.26	-0.21
SALA	13469M001	U	4.89	8.47	-2.89	-5.60	-1.48	4.43	-0.57	3.09
SCOA	10088M002	N	2.20	-2.90	1.45	-1.92	-2.18	0.03	2.45	2.04
SCOA	10088M002	E	1.20	0.75	-2.03	-0.87	-0.22	-0.01	1.21	1.31
SCOA	10088M002	U	4.58	7.43	-6.80	2.68	2.55	1.36	-2.58	1.51
SOPU	19386M001	N	0.82	0.42	-0.13	-0.96	-0.47	0.91	-0.04	-1.38
SOPU	19386M001	E	0.87	-0.39	-0.43	0.93	1.45	0.86	0.59	-0.36
SOPU	19386M001	U	5.25	9.04	-6.07	3.00	0.46	2.09	3.17	-4.81
VITO	19385M001	N	1.01	-0.34	-2.08	0.43	-0.61	-0.15	0.69	0.78
VITO	19385M001	E	0.80	0.37	0.82	0.28	-0.06	1.15	-1.22	0.44
VITO	19385M001	U	5.22	2.12	-8.30	2.12	-0.87	-3.73	3.16	7.83
YEBE	13420M001	N	0.55	-0.79	-0.41	0.14	-0.71	-0.24	0.57	-0.29
YEBE	13420M001	E	0.60	0.42	0.82	0.48	0.03	0.88	-0.48	0.24
YEBE	13420M001	U	1.68	2.60	-0.43	0.25	-2.11	0.86	1.62	1.44
ZARA	13462M001	N	0.86	-0.63	-0.70	0.05	-1.43	-0.40	0.91	0.69
ZARA	13462M001	E	0.92	1.12	-0.92	0.31	-1.30	0.04	0.76	0.81
ZARA	13462M001	U	3.69	-0.99	3.88	-1.17	3.14	5.37	-4.29	2.70

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

ITERATION   1: CREU 13432M001        -4.05    -24.18    -41.99
```

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS			
1	ALAC 13433M001	I W	0.21	-0.79	3.24	
2	ALME 13437M001	I W	0.04	1.14	1.22	
3	BCL1 19482M001	I W	-0.50	-2.59	3.70	
4	BELL 13431M001	I W	-2.48	-0.18	1.72	
5	BIAZ 10074M002	I W	0.13	0.31	-0.27	
6	BORR 13480M001	I W	-1.00	1.77	-0.46	
7	BRST 10004M004	I W	-1.85	-1.34	6.37	
8	CACE 13447M001	I W	1.48	1.69	3.11	
9	CANT 13438M001	I W	-0.63	1.79	-0.76	
10	CASC 13909S001	I W	1.24	0.06	6.03	
11	CEU1 13449M002	I W	0.81	-0.28	-5.05	
12	CREU 13432M001	A W	-4.16	-24.83	-43.12	*
13	EBRE 13410M001	I W	-0.23	0.93	-2.87	
15	FLRS 31907M001	I W	-1.12	-2.71	-13.85	
17	HUEL 13451M001	I W	2.40	3.24	-9.18	
18	IBIZ 13454S001	I W	-0.12	0.02	1.57	
19	IZAN 31309M002	I W	0.48	-0.33	-1.14	
20	LAGO 13903M001	I W	0.67	-0.55	1.16	
21	LLIV 13436M001	I W	-4.03	1.45	7.42	
22	LPAL 81701M001	I W	2.64	0.19	-4.86	
23	LROC 10023M001	I W	0.66	-0.05	2.62	
24	MADR 13407S012	I W	0.87	2.82	-2.59	
25	MAL1 13444M002	I W	5.01	-2.50	-5.59	
26	MALA 13443M001	I W	2.18	-1.60	2.49	
27	MALL 13444M001	I W	-0.72	-0.91	1.79	
28	MAS1 31303M002	I W	-0.49	-1.39	0.29	
29	MELI 19379M001	I W	0.91	-1.69	-1.98	
30	PDEL 31906M004	I W	0.14	-0.46	-1.19	
31	RABT 35001M002	I W	1.92	-2.13	-6.61	
32	SCOA 10088M002	I W	-6.06	-2.73	-8.57	
33	SFER 13402M004	I W	-0.85	-4.54	1.21	
34	SOPU 19386M001	I W	-1.32	1.64	4.31	
35	VALE 13439M001	I W	-1.15	0.91	-4.42	
36	VIGO 13450M001	I W	0.70	1.77	4.73	
37	VILL 13406M001	I W	-0.61	-0.10	2.20	
38	YEBE 13420M001	I W	-1.00	-0.22	2.42	
39	ZARA 13462M001	I W	-1.28	-1.34	-2.97	
40	ZIMM 14001M004	I W	-2.24	-0.93	12.33	
	RMS / COMPONENT		1.91	1.71	5.05	
	IQR		1.81	2.27	5.49	
	MEAN		-0.14	-0.26	-0.07	
	MEDIAN		-0.12	-0.22	1.16	
	MIN		-6.06	-4.54	-13.85	
	MAX		5.01	3.24	12.33	

```
        OVERALL RMS/IQR/MAX(3D)       3.27      2.90     14.16       FLRS 31907M001      #SUM
```

ALL	RMS / COMPONENT		2.01	4.42	8.67		
ALL	IQR		1.93	2.31	5.59		
ALL	MEAN		-0.25	-0.91	-1.20		
ALL	MEDIAN		-0.18	-0.25	0.73		
ALL	MIN		-6.06	-24.83	-43.12		
ALL	MAX		5.01	3.24	12.33		

```
  ALL   OVERALL RMS/IQR/MAX(3D)       5.74      2.87     49.94       CREU 13432M001      #SUM_ALL


NUMBER OF PARAMETERS  :     3
NUMBER OF STATIONS    :    37
NUMBER OF COORDINATES :   111
RMS OF TRANSFORMATION :    3.27 MM


PARAMETERS:

TRANSLATION IN  X     :           0.73     +-  0.54    MM
TRANSLATION IN  Y     :           0.70     +-  0.54    MM
TRANSLATION IN  Z     :           0.84     +-  0.54    MM


NUMBER OF ITERATIONS  :     3


ACCEPTED STATIONS     :    37    97.37 %
VERIFIED STATIONS     :     0     0.00 %
REJECTED STATIONS     :     1     2.63 %


LIST OF VERIFIED/REJECTED STATIONS
```

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                       18955005
 NUMBER OF UNKNOWNS                             208814
 NUMBER OF DEGREES OF FREEDOM                 18746191
 PHASE MEASUREMENTS SIGMA                      0.00100
 SAMPLING INTERVAL (SECONDS)                       180
 VARIANCE FACTOR                  2.358589557458179
```

7 Equipment

7.1 Receiver List

Serial numbers not shown.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ FIRMWARE___
 ALDA  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 ALSA  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 AMUR  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 BIAZ  A    1 P 24:196:00000 24:202:86370 SPECTRA SP90M        ----- -----------
 BIDA  A    1 P 24:196:00000 24:202:86370 LEICA GR10           ----- -----------
 BRZR  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 CACE  A    1 P 24:196:00000 24:202:86370 TRIMBLE NETR9        ----- -----------
 CANT  A    1 P 24:196:00000 24:202:86370 LEICA GR10           ----- -----------
 CREU  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 EBRE  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 ELGE  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 EMAZ  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 GERN  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 HOND  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 IGEL  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 ISPS  A    1 P 24:196:00000 24:202:86370 TRIMBLE NETR9        ----- -----------
 KAST  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 LARE  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 LAZK  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 LEIT  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 ORON  A    1 P 24:201:00000 24:202:86370 LEICA GR50           ----- -----------
 PASA  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 RIO1  A    1 P 24:196:00000 24:202:86370 LEICA GR25           ----- -----------
 SALA  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 SCOA  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 SOPU  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 VITO  A    1 P 24:196:00000 24:202:86370 LEICA GR30           ----- -----------
 YEBE  A    1 P 24:196:00000 24:202:86370 LEICA GR50           ----- -----------
 ZARA  A    1 P 24:196:00000 24:202:86370 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
 ALDA  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 ALSA  A    1 P 24:196:00000 24:202:86370 LEIAR10             NONE -----
 AMUR  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 BIAZ  A    1 P 24:196:00000 24:202:86370 LEIAR25             LEIT -----
 BIDA  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 BRZR  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 CACE  A    1 P 24:196:00000 24:202:86370 TRM29659.00         NONE -----
 CANT  A    1 P 24:196:00000 24:202:86370 LEIAR25.R4          LEIT -----
 CREU  A    1 P 24:196:00000 24:202:86370 LEIAR25.R4          NONE -----
 EBRE  A    1 P 24:196:00000 24:202:86370 LEIAR25.R4          NONE -----
 ELGE  A    1 P 24:196:00000 24:202:86370 LEIAR25.R4          LEIT -----
 EMAZ  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 GERN  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 HOND  A    1 P 24:196:00000 24:202:86370 LEIAR20             LEIM -----
 IGEL  A    1 P 24:196:00000 24:202:86370 LEIAR20             LEIM -----
 ISPS  A    1 P 24:196:00000 24:202:86370 TRM59900.00         SCIS -----
 KAST  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 LARE  A    1 P 24:196:00000 24:202:86370 LEIAR20             LEIM -----
 LAZK  A    1 P 24:196:00000 24:202:86370 LEIAR25.R4          LEIT -----
 LEIT  A    1 P 24:196:00000 24:202:86370 LEIAR10             NONE -----
 ORON  A    1 P 24:201:00000 24:202:86370 LEIAR10             NONE -----
 PASA  A    1 P 24:196:00000 24:202:86370 LEIAR20             LEIM -----
 RIO1  A    1 P 24:196:00000 24:202:86370 LEIAR25.R4          LEIT -----
 SALA  A    1 P 24:196:00000 24:202:86370 LEIAR25             NONE -----
 SCOA  A    1 P 24:196:00000 24:202:86370 TRM55971.00         NONE -----
 SOPU  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 VITO  A    1 P 24:196:00000 24:202:86370 LEIAS10             NONE -----
 YEBE  A    1 P 24:196:00000 24:202:86370 LEIAR20             LEIM -----
 ZARA  A    1 P 24:196:00000 24:202:86370 TRM29659.00         NONE -----
```

7.3 Eccentricities

```
*                                       UP______ NORTH___ EAST____
```

*SITE	PT	SOLN	T	DATA_START__	DATA_END____	AXE	ARP->BENCHMARK(M)_____		
ALDA	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
ALSA	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
AMUR	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
BIAZ	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
BIDA	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
BRZR	A	1	P	24:196:00000	24:202:86370	UNE	0.0771	0.0000	0.0000
CACE	A	1	P	24:196:00000	24:202:86370	UNE	0.0600	0.0000	0.0000
CANT	A	1	P	24:196:00000	24:202:86370	UNE	3.0490	0.0000	0.0000
CREU	A	1	P	24:196:00000	24:202:86370	UNE	0.0770	0.0000	0.0000
EBRE	A	1	P	24:196:00000	24:202:86370	UNE	0.0770	0.0000	0.0000
ELGE	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
EMAZ	A	1	P	24:196:00000	24:202:86370	UNE	0.0350	0.0000	0.0000
GERN	A	1	P	24:196:00000	24:202:86370	UNE	0.0771	0.0000	0.0000
HOND	A	1	P	24:196:00000	24:202:86370	UNE	0.0771	0.0000	0.0000
IGEL	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
ISPS	A	1	P	24:196:00000	24:202:86370	UNE	0.0350	0.0000	0.0000
KAST	A	1	P	24:196:00000	24:202:86370	UNE	0.0350	0.0000	0.0000
LARE	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
LAZK	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
LEIT	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
ORON	A	1	P	24:201:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
PASA	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
RIO1	A	1	P	24:196:00000	24:202:86370	UNE	0.0606	0.0000	0.0000
SALA	A	1	P	24:196:00000	24:202:86370	UNE	0.0600	0.0000	0.0000
SCOA	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
SOPU	A	1	P	24:196:00000	24:202:86370	UNE	0.0771	0.0000	0.0000
VITO	A	1	P	24:196:00000	24:202:86370	UNE	0.0000	0.0000	0.0000
YEBE	A	1	P	24:196:00000	24:202:86370	UNE	0.0600	0.0000	0.0000
ZARA	A	1	P	24:196:00000	24:202:86370	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

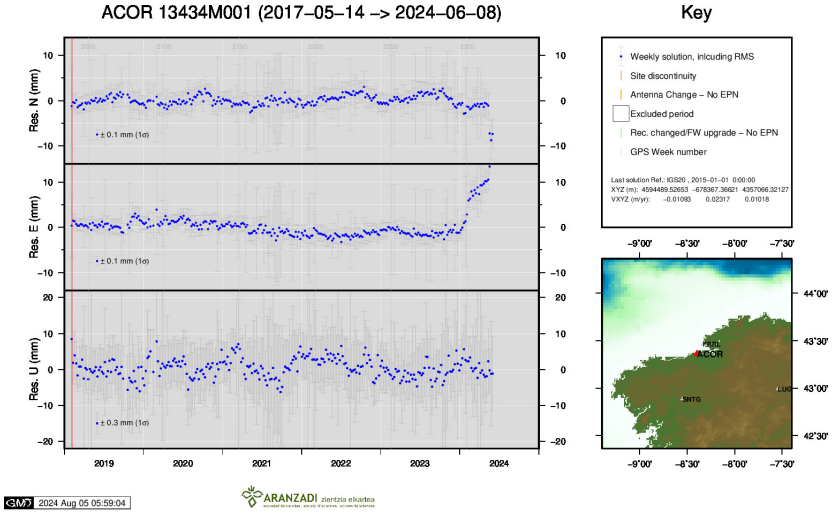
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres.* epncb.oma.be/$_d$*ocumentation/guidelines/guidelines*$_a$*nalysis*$_c$*entres.pdf*

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

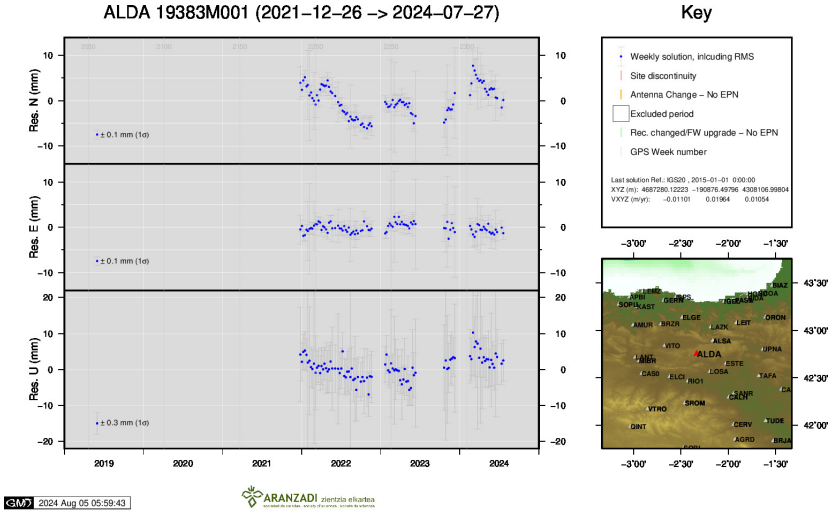
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems.* etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf

9 Cumulative Time Series

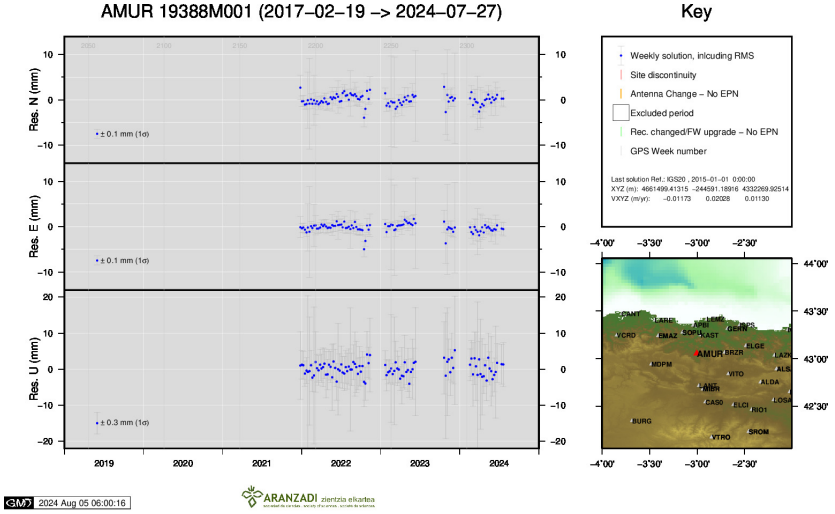
Time series of stations. Latest plots at: http://geolabpasaia.org/gnss/ARA-net/TSeries/, or click on the caption of each image.



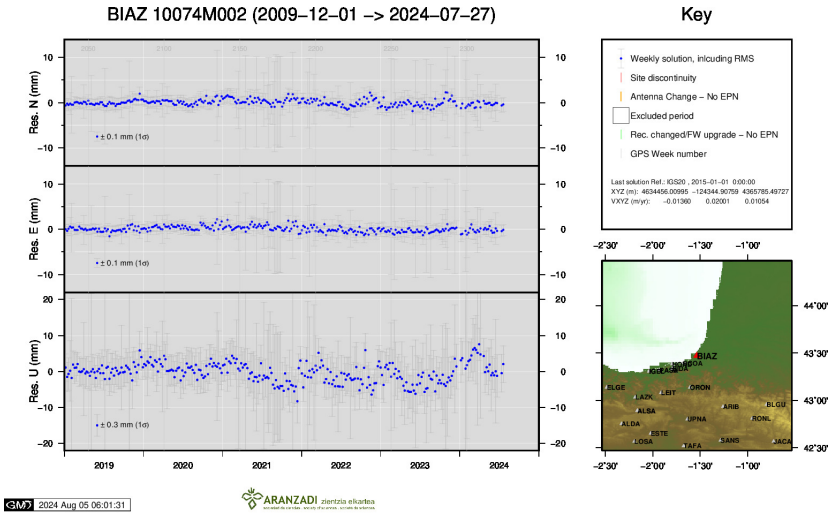
1) ACOR



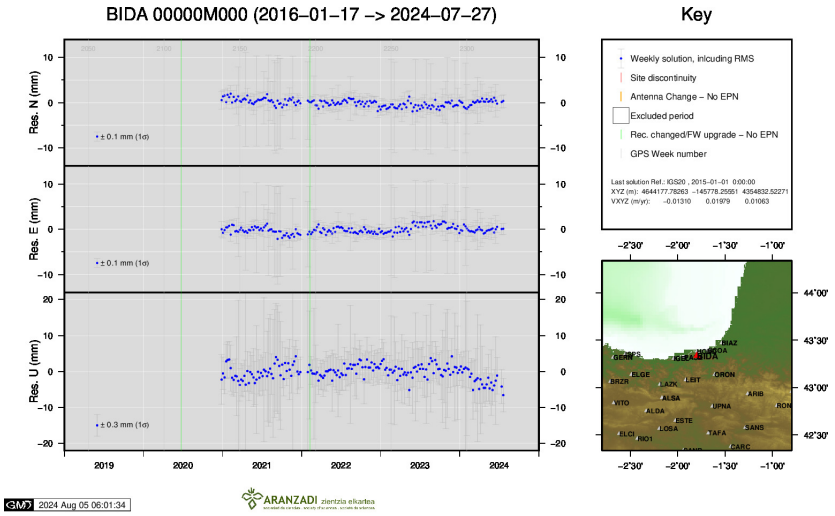
2) ALDA



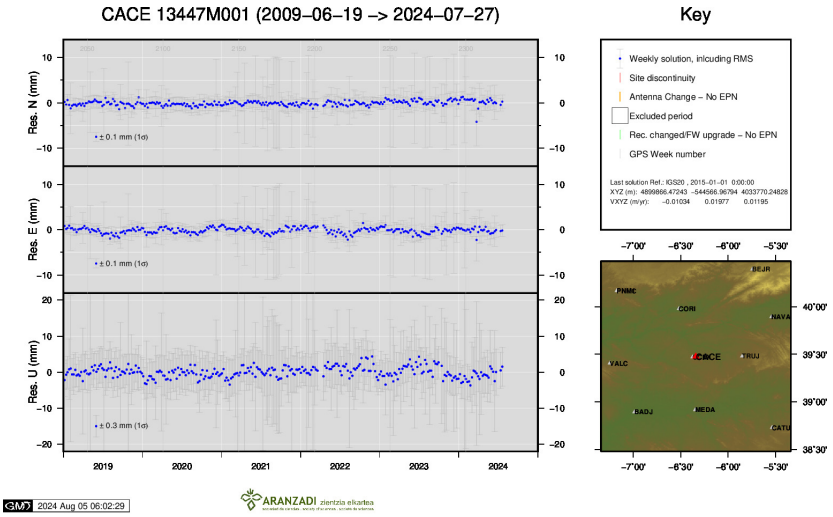
3) AMUR



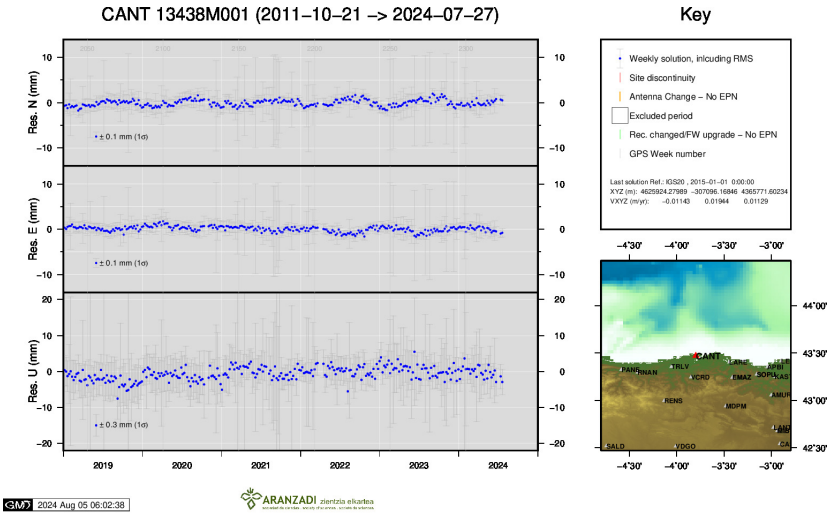
4) BIAZ



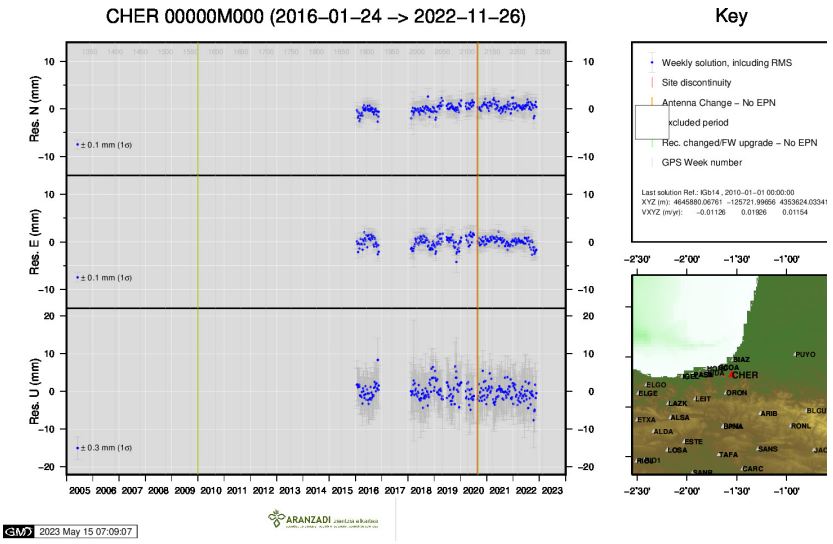
5) BIDA



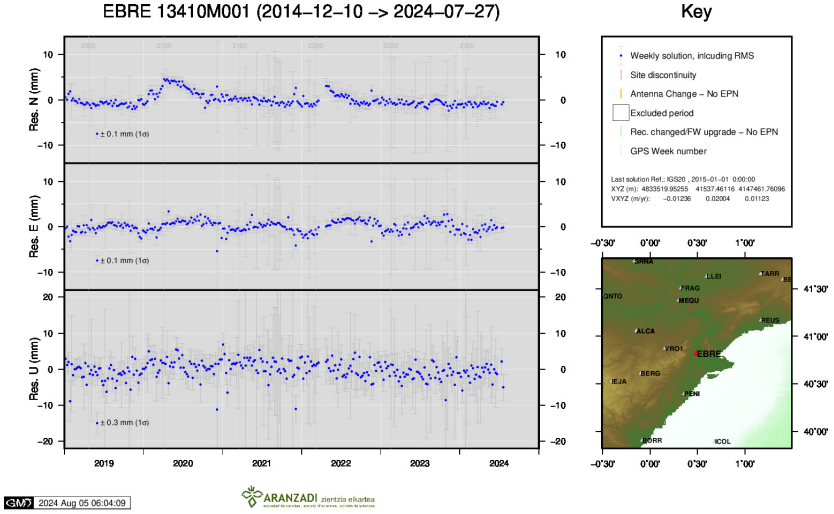
6) CACE



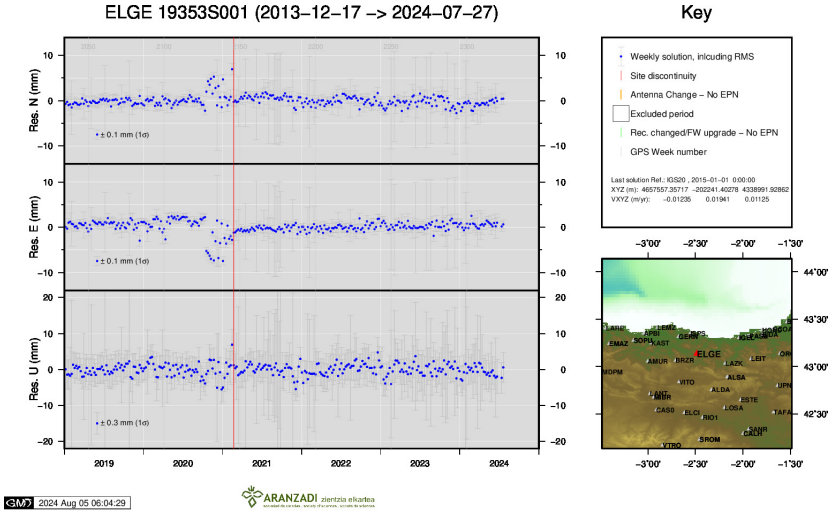
7) CANT



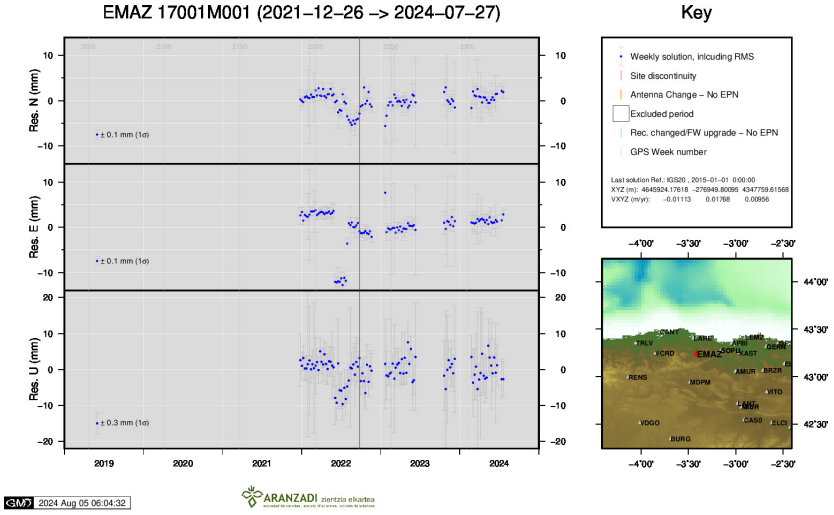
8) CHER



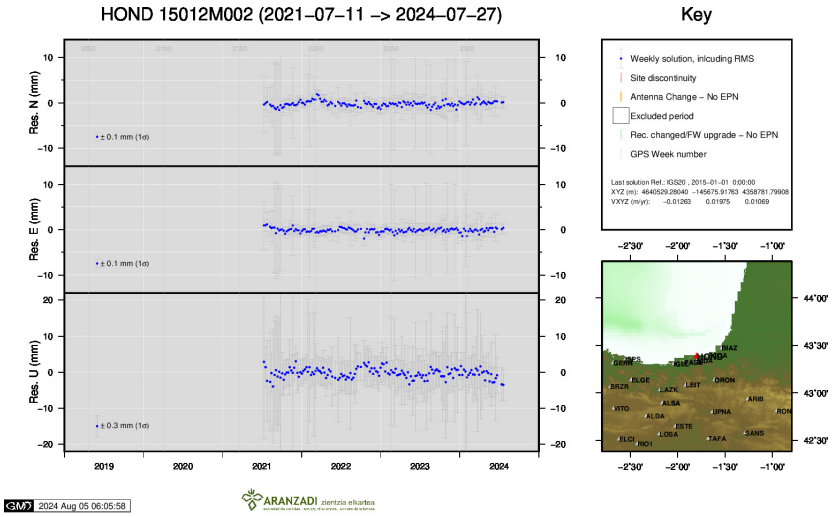
9) EBRE



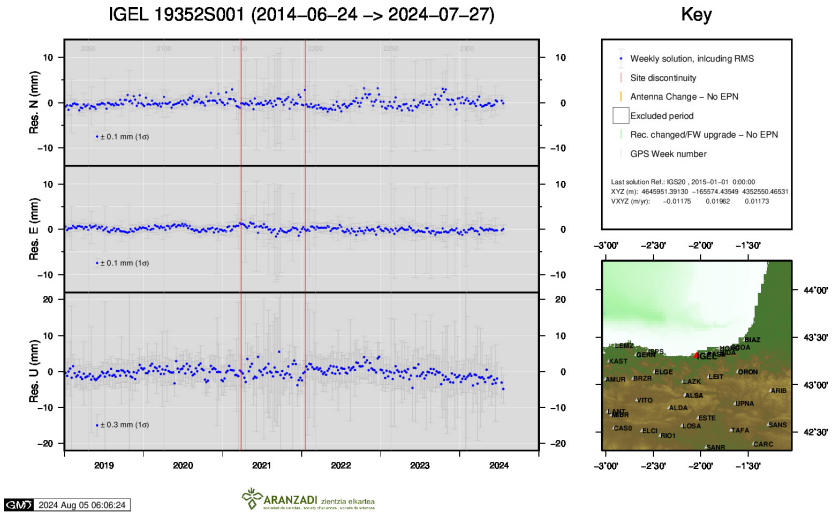
10) ELGE



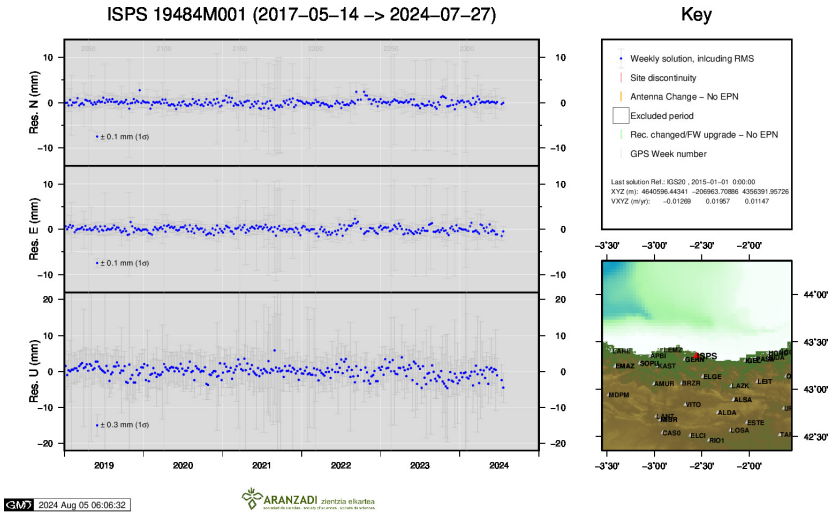
11) EMAZ



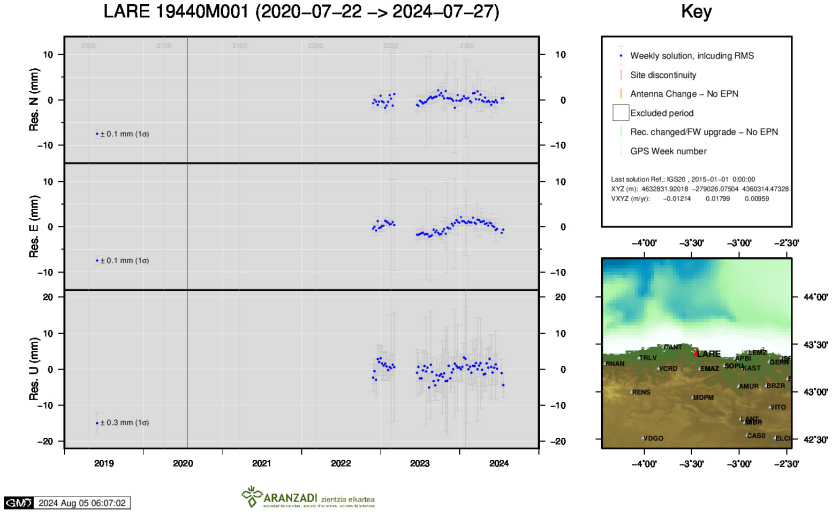
12) HOND



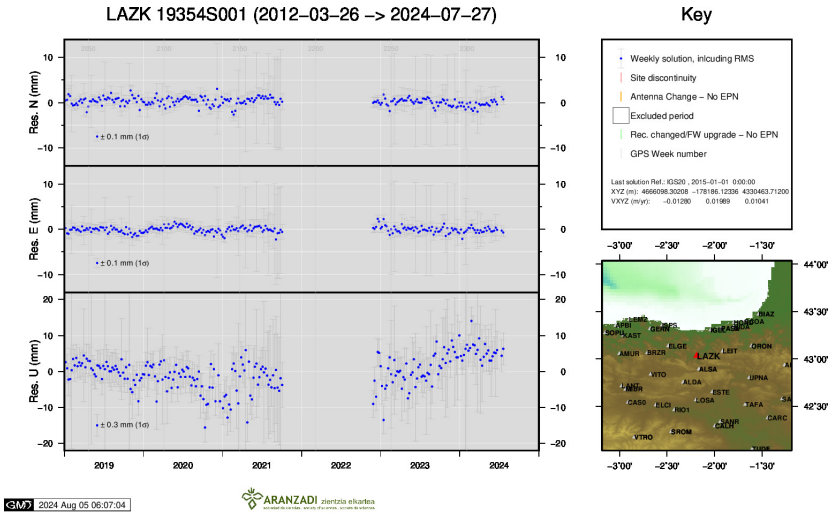
13) IGEL



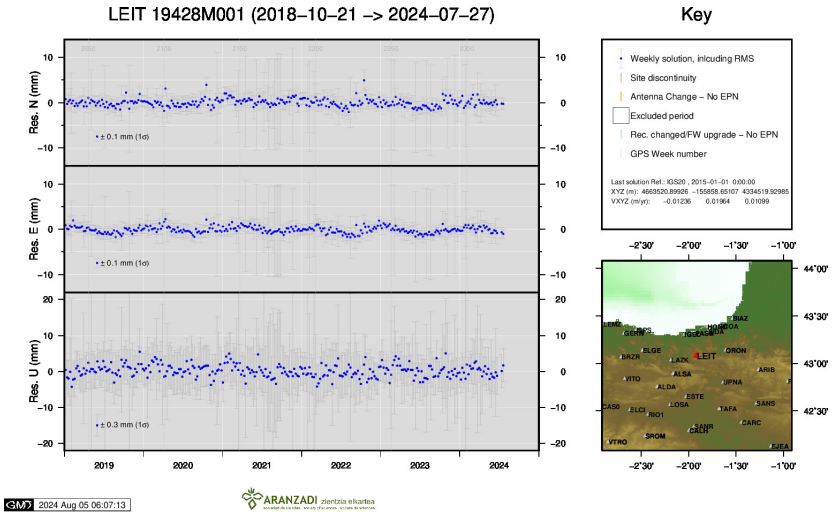
14) ISPS



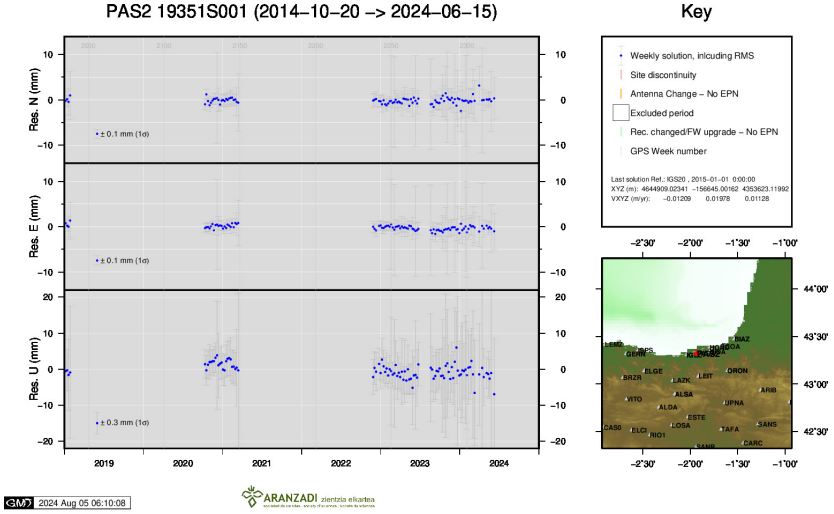
15) LARE



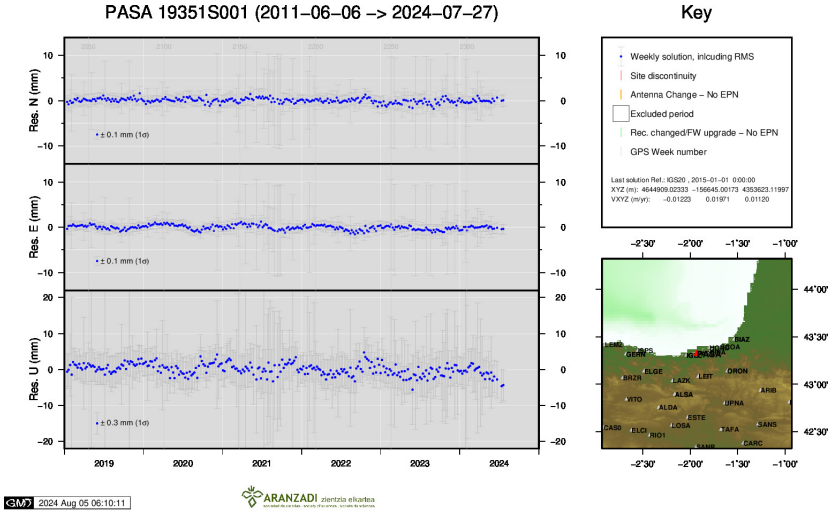
16) LAZK



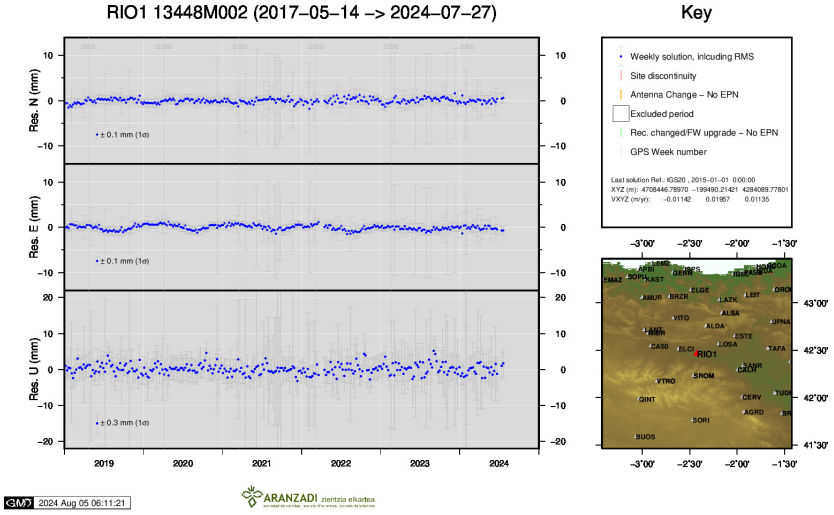
17) LEIT



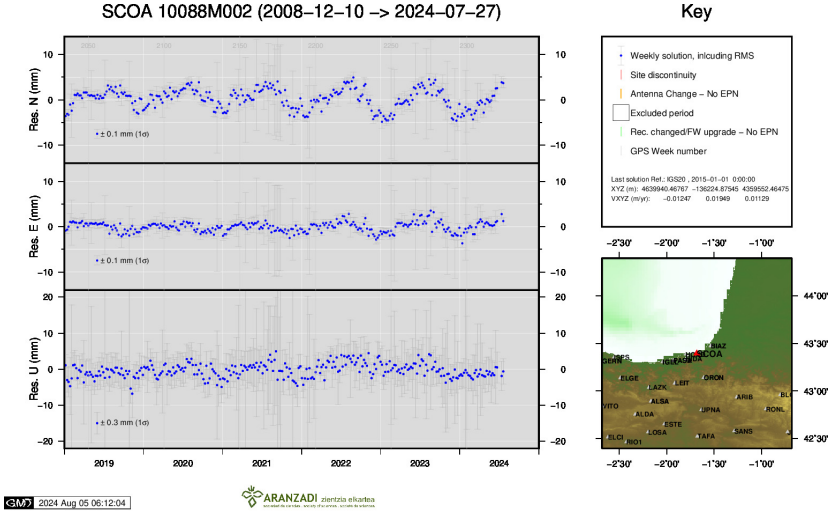
18) PAS2



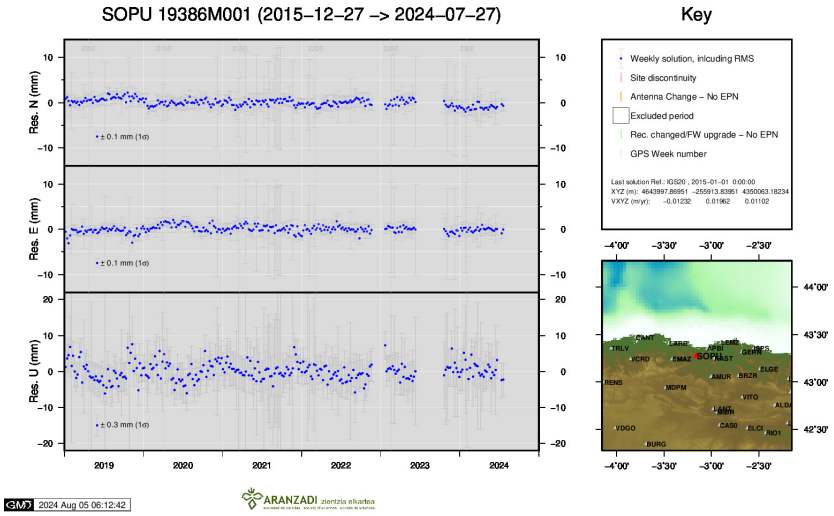
19) PASA



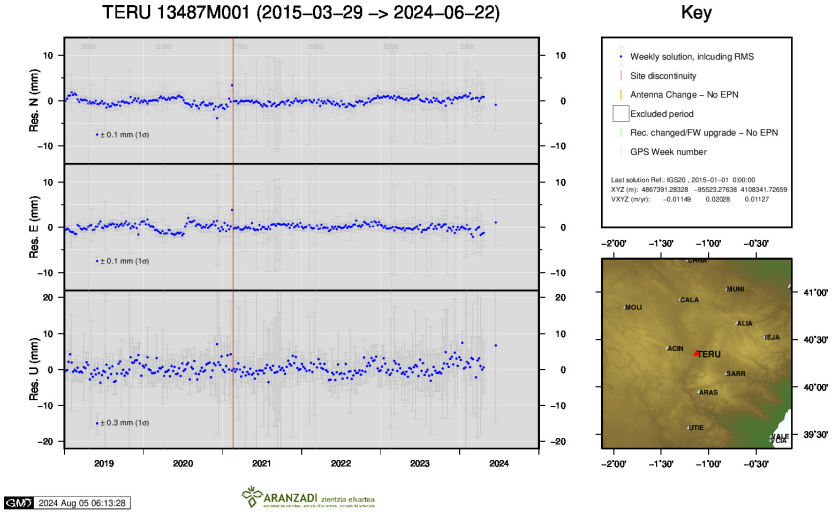
20) RIO1



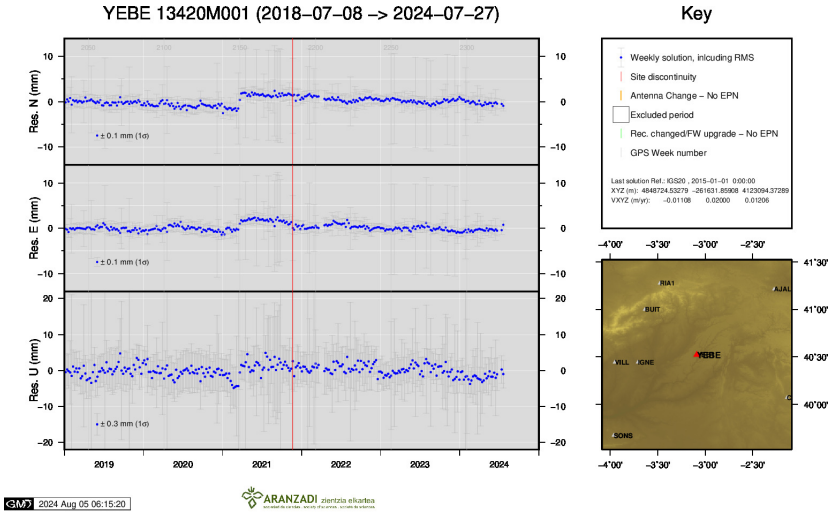
21) SCOA



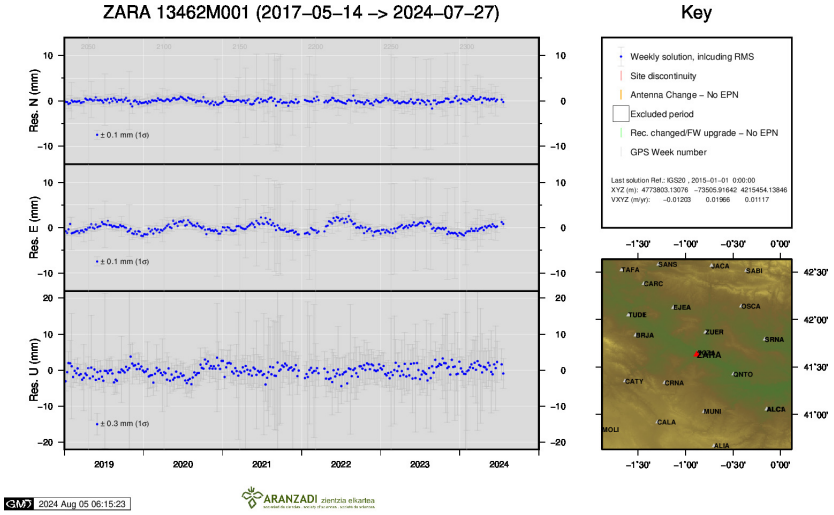
22) SOPU



23) TERU



24) YEBE



25) ZARA