

# ARA-DAC Weekly Analysis Result: 2321 (GFA)

## Technical Report

**GPS Week: 2321 (GFA)**

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

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Report generated on 2024/08/18 at 21:06:22

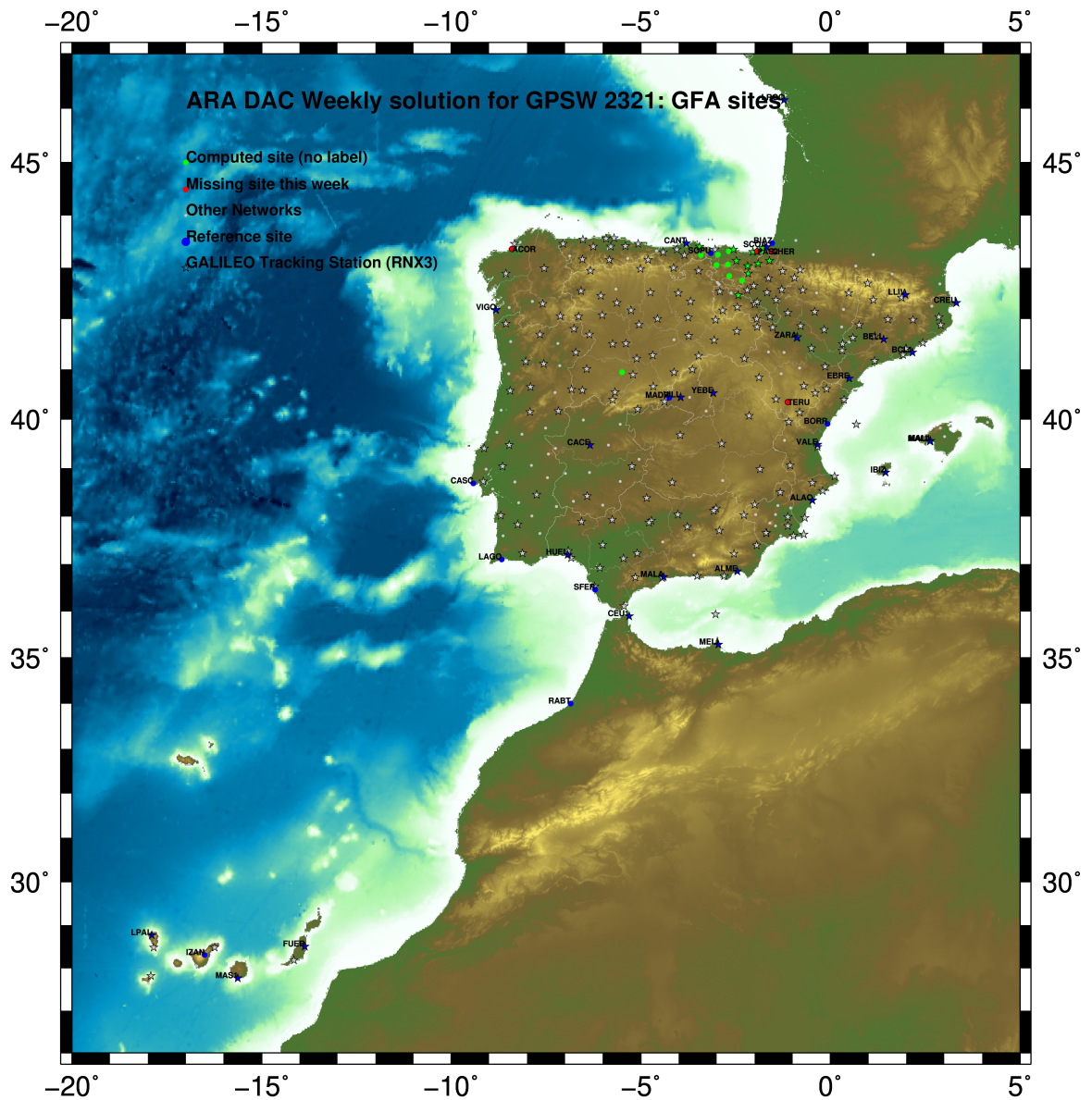


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# 1 Introduction

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



GM 2024 Aug 18 21:06:16

Fig.1: Computed Sites for GPS Week2321 (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:  $3\sigma$  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 18-AUG-24 19:51

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LOCAL GEODETIC DATUM: IGS20 EPOCH: 2024-07-03 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.10912	-190876.46969	4308107.01796	A	GR
50	ALSA 19419M001	4677250.77924	-176770.29749	4319079.93793	A	GRE
53	AMUR 19388M001	4661499.39612	-244591.16007	4332269.94282	A	GR
384	BLAZ 10074M002	4634455.98951	-124344.87638	4365785.51250	W	GR
101	BIDA 00000M000	4644177.75980	-145778.22594	4354832.53614	A	GR
113	BRZR 19387M001	4662220.93475	-220769.80046	4333309.49404	A	GR
573	CACE 13447M001	4899866.45811	-544566.93963	4033770.26752	W	GRE
592	CANT 13438M001	4625924.26182	-307096.13999	4365771.61851	W	GRE
908	CREU 13432M001	4715420.06953	273178.15752	4271946.90163	W	GRE
135	EBRE 13410M001	4833519.93698	41537.49106	4147461.77876	W	GRE
180	ELGE 19353S001	4657557.33764	-202241.37345	4338991.94436	A	GRE
182	EMAZ 17001M001	4645924.15685	-276949.77345	4347759.62843	A	GR
209	GERN 19389M001	4642811.26231	-217222.82892	4353278.93412	A	GR
257	HOND 15012M002	4640529.25987	-145675.88772	4358781.81331	A	GRE
235	IGEL 19352S001	4645951.37206	-165574.40606	4352550.48113	A	GRE
240	ISPS 19484M001	4640596.42366	-206963.67985	4356391.97359	A	GRE
245	KAST 19499M001	4646949.01971	-240747.17135	4348015.05023	A	GR
252	LARE 19440M001	4632831.90148	-279026.04925	4360314.48599	A	GRE
256	LAZK 19354S001	4666098.28518	-178186.09413	4330463.73020	A	GRE
261	LEIT 19428M001	4663520.87927	-155858.62290	4334519.94540	A	GRE
334	ORON 19427M001	4659695.72153	-130864.63887	4338948.94389	A	GRE
493	PASA 19351S001	4644909.00290	-156644.97240	4353623.13416	A	GRE
553	RIDI 13448M002	4708446.77344	-199490.18577	4284089.79562	A	GRE
558	SALA 13469M001	4803054.43410	-462130.97209	4158379.13651	A	GR
526	SCDA 10088M002	4639940.44799	-136224.84616	4359552.48257	W	GRE
715	SOPU 19386M001	4643997.85043	-255913.81043	4350063.19723	W	GR
493	VITO 19385M001	4679397.64768	-218436.40759	4314898.43009	A	GR
616	YEBE 13420M001	4848724.51717	-261631.82978	4123094.39165	W	GRE
655	ZARA 13462M001	4773803.11341	-73505.88737	4215454.15606	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 18-AUG-24 19:51

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LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2024-07-03 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.51667	-190877.11762	4308106.53578	A	
50	ALSA 19419M001	4677251.18961	-176770.94416	4319079.45683	A	
53	AMUR 19388M001	4661499.79830	-244591.80500	4332269.46214	A	
384	BLAZ 10074M002	4634456.41082	-124345.51969	4365785.03589	W	
101	BIDA 00000M000	4644178.17730	-145778.86849	4354832.05837	A	
113	BRZR 19387M001	4662221.34027	-220770.44542	4333309.01364	A	
573	CACE 13447M001	4899866.79500	-544567.61388	4033769.76157	W	
592	CANT 13438M001	4625924.65819	-307096.78074	4365771.14007	W	
908	CREU 13432M001	4715420.53739	273177.50779	4271946.42342	W	
135	EBRE 13410M001	4833520.36315	41536.82620	4147461.28695	W	
180	ELGE 19353S001	4657557.74615	-202242.01779	4338991.46463	A	
182	EMAZ 17001M001	4645924.55588	-276950.41657	4347759.14867	A	
209	GERN 19389M001	4642811.66993	-217223.47150	4353278.45547	A	
257	HOND 15012M002	4640529.67771	-145676.52983	4358781.33587	A	
235	IGEL 19352S001	4645951.78667	-165575.04889	4352550.00293	A	
240	ISPS 19484M001	4640596.83294	-206964.32214	4356391.49528	A	
245	KAST 19499M001	4646949.42370	-240747.81450	4348014.57088	A	
252	LARE 19440M001	4632832.30124	-279026.69077	4360314.00734	A	
256	LAZK 19354S001	4666098.69628	-178186.73944	4330463.25005	A	
261	LEIT 19428M001	4663521.29375	-155859.26784	4334519.46580	A	
334	ORON 19427M001	4659696.13978	-130865.28327	4338948.46497	A	
493	PASA 19351S001	4644909.41882	-156645.61507	4353622.65618	A	
553	RIDI 13448M002	4708447.17786	-199490.83628	4284089.31145	A	
558	SALA 13469M001	4803054.79242	-462131.63461	4158378.64029	A	
526	SCDA 10088M002	4639940.86718	-136225.48817	4359552.00531	W	
715	SOPU 19386M001	4643998.25251	-255914.45325	4350062.71793	W	
493	VITO 19385M001	4679398.05202	-218437.05463	4314897.94821	A	
616	YEBE 13420M001	4848724.90000	-261632.49737	4123093.89425	W	
655	ZARA 13462M001	4773803.52943	-73506.54541	4215453.66791	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		18-AUG-24 19:51				
LOCAL GEODETIC DATUM: ETRF2014		EPOCH: 2024-07-03 11:59:45				
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.47423	-190877.15577	4308106.58822	A	
50	ALSA 19419M001	4677251.14723	-176770.98241	4319079.50931	A	
53	AMUR 19388M001	4661499.75633	-244591.84307	4332269.51464	A	
384	BIAZ 10074M002	4634456.36874	-124345.55833	4365785.08854	W	
101	BIDA 00000M000	4644178.13518	-145778.90701	4354832.11098	A	
113	BRZR 19387M001	4662221.29822	-220770.48358	4333309.06614	A	
573	CACE 13447M001	4899866.75118	-544567.64973	4033769.81329	W	
592	CANT 13438M001	4625924.61683	-307096.81874	4365771.19265	W	
908	CREU 13432M001	4715420.49283	273177.46804	4271946.47612	W	
135	EBRE 13410M001	4833520.31815	41536.78785	4147461.33912	W	
180	ELGE 19353S001	4657557.70408	-202242.05604	4338991.51716	A	
182	EMAZ 17001M001	4645924.51420	-276950.45460	4347759.20119	A	
209	GERN 19389M001	4642811.62808	-217223.50976	4353278.50804	A	
257	HOND 15012M002	4640529.63563	-145676.56837	4358781.38848	A	
235	IGEL 19352S001	4645951.74461	-165575.08733	4352550.05552	A	
240	ISPS 19484M001	4640596.79107	-206964.36045	4356391.54786	A	
245	KAST 19499M001	4646949.38188	-240747.85265	4348014.62343	A	
252	LARE 19440M001	4632832.25970	-279026.72884	4360314.05991	A	
256	LAZK 19354S001	4666098.65403	-178186.77774	4330463.30257	A	
261	LEIT 19428M001	4663521.25145	-155859.30624	4334519.51833	A	
334	ORON 19427M001	4659696.09743	-130865.32177	4338948.51754	A	
493	PASA 19351S001	4644909.37673	-156645.65355	4353622.70877	A	
553	RI01 13448M002	4708447.13521	-199490.87430	4284089.36383	A	
558	SALA 13469M001	4803054.74953	-462131.67121	4158378.69228	A	
526	SOA 10088M002	4639940.82507	-136225.52674	4359552.05793	W	
715	SOPU 19386M001	4643998.21078	-255914.49136	4350062.77048	W	
493	VITO 19385M001	4679398.00976	-218437.09272	4314898.00066	A	
616	YEBE 13420M001	4848724.85593	-261632.53453	4123093.94620	W	
655	ZARA 13462M001	4773803.48557	-73506.58362	4215453.72017	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 18-AUG-24 19:51

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ALDA 19383M001	7	XXXXXX	1.80	1.19	5.53
ALSA 19419M001	6	XXXX X	1.05	1.11	1.19
AMUR 19388M001	2	XX	0.61	0.68	4.76
BLAZ 10074M002	6	XX XXX	1.03	0.80	3.20
BIDA 00000M000	7	XXXXXX	0.68	0.84	2.69
BRZR 19387M001	7	XXXXXX	0.76	0.64	3.10
CACE 13447M001	7	XXXXXX	0.76	0.73	3.41
CANT 13438M001	7	XXXXXX	0.65	0.48	5.27
CREU 13432M001	7	XXXXXX	2.07	1.74	4.32
EBRE 13410M001	7	XXXXXX	1.17	0.96	2.23
ELGE 19353S001	7	XXXXXX	0.65	0.64	2.63
EMAZ 17001M001	7	XXXXXX	0.87	0.96	3.01
GERN 19389M001	7	XXXXXX	0.66	0.68	3.62
HOND 15012M002	7	XXXXXX	1.03	0.56	1.52
IGEL 19352S001	7	XXXXXX	1.30	0.75	2.23
ISPS 19484M001	7	XXXXXX	0.88	0.95	2.72
KAST 19499M001	7	XXXXXX	0.79	0.91	1.62
LARE 19440M001	7	XXXXXX	0.88	1.05	2.75
LAZK 19354S001	7	XXXXXX	0.99	0.79	3.33
LEIT 19428M001	6	XXXX X	0.35	0.76	3.32
ORDN 19427M001	4	X XX X	1.91	0.94	5.44
PASA 19351S001	7	XXXXXX	0.70	0.51	1.88
RI01 13448M002	7	XXXXXX	0.54	0.70	3.37
SALA 13469M001	7	XXXXXX	0.74	0.58	5.58
SCDA 10088M002	7	XXXXXX	1.64	1.27	2.30
SOPU 19386M001	7	XXXXXX	0.80	0.50	3.41
VITO 19385M001	7	XXXXXX	0.79	0.49	2.74
YEBE 13420M001	7	XXXXXX	0.48	0.49	3.41
ZARA 13462M001	7	XXXXXX	1.04	0.95	4.00

Comparison of individual solutions:

ALDA 19383M001	N	1.80	-1.80	0.24	1.18	3.09	0.48	-2.16	-0.47
ALDA 19383M001	E	1.19	1.00	-0.37	-1.28	-1.87	0.08	1.41	0.45
ALDA 19383M001	U	5.53	2.15	4.63	10.55	-4.03	-2.30	-4.71	-1.61
ALSA 19419M001	N	1.05	-0.68	-0.57	0.26	1.95	-0.84		-0.44
ALSA 19419M001	E	1.11	-0.50	-0.02	-1.58	1.13	1.26		-0.74
ALSA 19419M001	U	1.19	-1.04	-0.15	0.41	1.55	-1.84		-0.17
AMUR 19388M001	N	0.61						-0.42	0.44
AMUR 19388M001	E	0.68						0.63	0.27
AMUR 19388M001	U	4.76						-3.07	-3.65
BLAZ 10074M002	N	1.03	1.89	-0.38		-0.64	-0.66	0.86	-0.24
BLAZ 10074M002	E	0.80	-0.79	-0.62		-0.11	-0.14	-0.96	1.10
BLAZ 10074M002	U	3.20	-3.52	-0.15		3.70	3.10	-3.37	2.03
BIDA 00000M000	N	0.68	1.30	0.14	0.16	-0.15	0.12	-0.90	-0.44
BIDA 00000M000	E	0.84	-0.47	-1.18	0.09	-1.48	0.10	0.41	0.49
BIDA 00000M000	U	2.69	-2.32	-1.70	1.30	4.00	3.14	-2.72	0.53
BRZR 19387M001	N	0.76	1.42	-0.01	-0.23	-0.69	0.93	0.25	-0.06
BRZR 19387M001	E	0.64	-0.80	0.53	0.17	-0.28	-1.13	-0.32	0.16
BRZR 19387M001	U	3.10	-4.47	3.44	0.09	2.17	-0.89	-0.72	4.45
CACE 13447M001	N	0.76	-0.18	-0.20	-0.69	-0.62	-0.77	-1.01	0.95
CACE 13447M001	E	0.73	-0.48	0.26	0.93	0.44	0.88	-0.71	0.75
CACE 13447M001	U	3.41	2.79	-0.82	0.86	0.78	0.63	7.62	-1.21
CANT 13438M001	N	0.65	0.91	-0.86	0.36	-0.11	-0.60	-0.23	0.61
CANT 13438M001	E	0.48	-0.29	0.22	0.11	-0.90	-0.29	0.55	-0.24
CANT 13438M001	U	5.27	2.22	-3.57	1.27	0.72	1.70	11.55	-3.26
CREU 13432M001	N	2.07	0.85	-2.04	2.93	0.87	2.34	0.11	-2.42
CREU 13432M001	E	1.74	-0.51	-0.41	-0.37	-2.25	-1.45	0.50	3.18
CREU 13432M001	U	4.32	1.88	1.91	-7.61	-5.36	-4.06	0.91	0.90
EBRE 13410M001	N	1.17	2.21	0.36	-0.61	1.48	-0.46	-0.64	-0.26
EBRE 13410M001	E	0.96	-1.08	0.05	0.83	-0.58	-0.64	-1.36	1.04
EBRE 13410M001	U	2.23	-0.27	-1.02	-0.93	-0.98	-0.62	-4.90	-1.59
ELGE 19353S001	N	0.65	1.50	-0.25	0.20	0.08	-0.02	-0.23	0.33
ELGE 19353S001	E	0.64	-0.73	-0.28	0.93	-0.83	-0.50	-0.19	-0.03
ELGE 19353S001	U	2.63	2.48	-3.12	0.47	3.42	1.23	2.36	-2.54
EMAZ 17001M001	N	0.87	-0.32	-1.06	-0.55	-0.12	1.12	1.31	-0.04
EMAZ 17001M001	E	0.96	-0.26	1.34	1.04	-0.29	1.51	-0.50	-0.08
EMAZ 17001M001	U	3.01	4.58	-0.96	2.11	0.70	1.71	-3.56	3.44
GERN 19389M001	N	0.66	0.67	-0.06	-0.29	0.27	-0.17	0.92	-1.06
GERN 19389M001	E	0.68	-0.97	-0.36	0.86	-0.79	-0.22	-0.27	-0.42
GERN 19389M001	U	3.62	-1.78	6.73	-1.18	-0.63	3.79	-3.09	-2.13
HOND 15012M002	N	1.03	1.92	-0.20	-0.85	-1.22	0.25	0.61	-0.23
HOND 15012M002	E	0.56	-0.15	-0.97	-0.21	-0.42	-0.28	0.54	-0.60
HOND 15012M002	U	1.52	0.94	-1.63	0.06	0.40	3.13	-0.64	-0.06
IGEL 19352S001	N	1.30	2.42	-1.37	-0.28	-0.26	0.82	0.19	-1.27
IGEL 19352S001	E	0.75	-0.96	-0.69	0.48	-1.02	-0.22	0.66	-0.44
IGEL 19352S001	U	2.23	-1.14	0.99	1.51	2.50	2.93	-3.12	-0.86
ISPS 19484M001	N	0.88	1.98	-0.13	-0.62	-0.35	-0.37	-0.22	-0.04
ISPS 19484M001	E	0.95	-1.75	-0.06	0.18	-1.35	0.30	0.59	-0.00
ISPS 19484M001	U	2.72	-4.07	2.08	0.80	-0.32	4.54	0.49	-1.42
KAST 19499M001	N	0.79	1.40	-0.42	-0.25	0.29	-0.76	0.66	-0.66
KAST 19499M001	E	0.91	-1.91	0.94	-0.43	0.07	-0.15	-0.28	-0.42
KAST 19499M001	U	1.62	-1.03	3.78	0.05	0.28	-0.39	0.19	-0.33
LARE 19440M001	N	0.88	1.54	-0.53	0.65	0.30	0.10	-0.46	-1.11
LARE 19440M001	E	1.05	-0.62	0.47	1.30	0.73	0.04	-1.62	1.10
LARE 19440M001	U	2.75	5.57	0.51	1.41	2.17	-1.06	1.15	-2.25
LAZK 19354S001	N	0.99	-0.27	0.04	-1.05	0.64	-0.46	1.84	-0.86
LAZK 19354S001	E	0.79	0.27	-0.98	1.34	-0.80	-0.25	-0.32	0.30
LAZK 19354S001	U	3.33	4.87	-3.94	1.44	-2.80	-2.12	2.56	-2.51
LEIT 19428M001	N	0.35	0.00	-0.56	0.11	0.17	0.17	-0.40	0.29
LEIT 19428M001	E	0.76	-0.46	1.21	0.09	-0.94	0.21		-0.53
LEIT 19428M001	U	3.32	3.50	-3.72	3.27	0.47	-0.66		-4.18
ORDN 19427M001	N	1.91	1.68			-1.79	-1.83		1.29
ORDN 19427M001	E	0.94	-0.27			1.16	1.06		-0.32

ORDN	19427M001	U	5.44	0.58			-7.03	4.49		-4.36
PASA	19351S001	N	0.70	1.17	-0.08	-0.05	-0.44	0.52	0.13	-1.05
PASA	19351S001	E	0.51	-0.64	-0.94	0.22	-0.30	-0.22	-0.06	-0.21
PASA	19351S001	U	1.88	0.57	0.63	1.04	3.03	1.22	-1.14	-2.71
RIDI	13448M002	N	0.54	1.10	-0.39	-0.44	-0.09	0.25	0.07	-0.29
RIDI	13448M002	E	0.70	-1.00	-0.49	0.87	-0.49	0.32	-0.31	0.72
RIDI	13448M002	U	3.37	-2.91	0.54	0.34	3.19	-1.72	1.91	-6.53
SALA	13469M001	N	0.74	-0.12	0.52	0.29	-0.28	0.22	-1.59	-0.47
SALA	13469M001	E	0.58	-0.09	-0.46	0.71	0.48	-0.24	0.99	0.03
SALA	13469M001	U	5.58	0.43	2.04	1.27	-4.15	-5.02	11.54	2.36
SCDA	10088M002	N	1.64	2.22	-0.70	-0.61	0.33	0.38	0.90	-3.04
SCDA	10088M002	E	1.27	-0.91	-0.94	-1.22	0.99	0.81	0.95	-2.00
SCDA	10088M002	U	2.30	-2.93	1.23	1.93	1.22	2.93	-2.33	-1.50
SOPU	19386M001	N	0.80	-0.38	-0.52	-0.86	0.93	0.99	0.69	-0.57
SOPU	19386M001	E	0.50	0.38	-0.32	-0.23	-0.73	-0.26	-0.35	-0.70
SOPU	19386M001	U	3.41	4.75	3.27	0.19	-3.13	1.85	0.20	-4.80
VITO	19385M001	N	0.79	-0.96	-0.69	-0.14	0.50	-0.72	0.83	0.92
VITO	19385M001	E	0.49	0.57	-0.64	0.20	-0.61	0.51	-0.10	-0.20
VITO	19385M001	U	2.74	1.99	-2.94	-0.94	1.41	-1.05	-5.05	-1.70
YEBE	13420M001	N	0.48	-0.55	0.24	-0.71	-0.28	-0.15	-0.31	0.55
YEBE	13420M001	E	0.49	0.50	-0.22	0.43	-0.11	-0.00	0.97	0.05
YEBE	13420M001	U	3.41	2.68	1.96	1.95	-2.23	-3.64	5.39	2.79
ZARA	13462M001	N	1.04	0.84	-0.86	0.84	0.60	0.44	0.67	-1.84
ZARA	13462M001	E	0.95	-1.08	-0.08	1.53	-0.34	0.18	0.99	-0.87
ZARA	13462M001	U	4.00	4.86	-6.52	-4.66	0.80	1.62	-1.25	-1.79



## 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       -2.54   -22.41   -37.86

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
1	ALAC 13433M001	I W	0.27	-0.43	0.28
2	ALME 13437M001	I W	-0.45	0.11	2.17
3	BCL1 19482M001	I W	-0.35	-1.61	2.67
4	BELL 13431M001	I W	-1.37	-0.71	3.32
5	BIAZ 10074M002	I W	0.04	0.24	0.14
6	BORR 13480M001	I W	-2.75	1.42	2.00
7	BRST 10004M004	I W	-1.77	-1.45	2.74
8	CACE 13447M001	I W	0.60	2.02	1.96
9	CANT 13438M001	I W	0.02	1.01	-0.65
10	CASC 13909S001	I W	0.20	-0.86	10.50
11	CEU1 13449M002	I W	1.86	0.09	-3.38
12	CREU 13432M001	A W	-2.61	-23.00	-38.86
13	EBRE 13410M001	I W	0.03	0.51	-2.99
15	FLRS 31907M001	I W	-0.51	-2.41	-9.41
16	FUER 31330M001	I W	0.99	-0.04	-2.87
18	HUEL 13451M001	I W	2.43	3.45	-9.88
19	IBIZ 13454S001	I W	-0.59	0.50	1.57
20	IZAN 31309M002	I W	-0.03	-0.32	-3.88
21	LAGO 13903M001	I W	0.91	-0.10	-0.84
22	LLIV 13436M001	I W	-3.45	0.50	3.53
23	LPAL 81701M001	I W	2.01	0.53	-7.19
24	LROC 10023M001	I W	0.58	-0.59	0.98
25	MADR 13407S012	I W	0.22	2.65	-2.23
26	MAL1 13444M002	I W	3.54	-2.94	-5.20
27	MALA 13443M001	I W	1.76	-1.75	5.20
28	MALL 13444M001	I W	-0.78	-1.21	1.49
29	MAS1 31303M002	I W	-0.38	-1.35	-2.11
30	MELI 19379M001	I W	0.59	-0.98	2.71
31	PDEL 31906M004	I W	-0.13	-0.38	2.02
32	RABT 35001M002	I W	1.27	-1.27	-4.08
33	SCOA 10088M002	I W	-3.36	-0.48	-9.83
34	SFER 13402M004	I W	-1.29	-3.32	2.14
35	SOPU 19386M001	I W	-0.80	0.62	3.77
36	VALE 13439M001	I W	-0.52	1.05	-3.99
37	VIGO 13450M001	I W	1.47	1.58	4.50
38	VILL 13406M001	I W	-1.50	-0.40	1.41
39	YEBE 13420M001	I W	-1.44	-0.44	1.88
40	ZARA 13462M001	I W	-1.16	-0.04	-1.91
41	ZIMM 14001M004	I W	-1.28	-1.43	11.31
RMS / COMPONENT			1.50	1.42	4.73
IQR			1.76	1.73	5.65
MEAN			-0.13	-0.22	-0.06
MEDIAN			-0.08	-0.35	1.20
MIN			-3.45	-3.32	-9.88
MAX			3.54	3.45	11.31
OVERALL RMS/IQR/MAX(3D)			2.98	2.77	11.47
ZIMM 14001M004	#SUM				
ALL RMS / COMPONENT			1.54	3.99	7.85
ALL IQR			1.88	1.79	6.05
ALL MEAN			-0.20	-0.80	-1.05
ALL MEDIAN			-0.13	-0.38	0.98
ALL MIN			-3.45	-23.00	-38.86
ALL MAX			3.54	3.45	11.31
ALL OVERALL RMS/IQR/MAX(3D)			5.16	2.84	45.23
CREU 13432M001	#SUM_ALL				

NUMBER OF PARAMETERS : 3  
NUMBER OF STATIONS : 38  
NUMBER OF COORDINATES : 114  
RMS OF TRANSFORMATION : 2.98 MM

PARAMETERS:

TRANSLATION IN X : 0.65 +- 0.48 MM  
TRANSLATION IN Y : 0.63 +- 0.48 MM  
TRANSLATION IN Z : 0.72 +- 0.48 MM

NUMBER OF ITERATIONS : 3

ACCEPTED STATIONS : 38 97.44 %  
VERIFIED STATIONS : 0 0.00 %  
REJECTED STATIONS : 1 2.56 %

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          18907446
NUMBER OF UNKNOWN                198521
NUMBER OF DEGREES OF FREEDOM     18708925
PHASE MEASUREMENTS SIGMA         0.00100
SAMPLING INTERVAL (SECONDS)      180
VARIANCE FACTOR                  2.593223716727905
```

## 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 24:182:00000 24:188:86370 LEICA GR30 -----
ALSA A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
AMUR A 1 P 24:187:00000 24:188:86370 LEICA GR30 -----
BIAZ A 1 P 24:182:00000 24:188:86370 SPECTRA SP90M -----
BIDA A 1 P 24:182:00000 24:188:86370 LEICA GR10 -----
BRZR A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
CACE A 1 P 24:182:00000 24:188:86370 TRIMBLE NETR9 -----
CANT A 1 P 24:182:00000 24:188:86370 LEICA GR10 -----
CREU A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
EBRE A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
ELGE A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
EMAZ A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
GERN A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
HOND A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
IGEL A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
ISPS A 1 P 24:182:00000 24:188:86370 TRIMBLE NETR9 -----
KAST A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
LARE A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
LAZK A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
LEIT A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
ORON A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
PASA A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
RIO1 A 1 P 24:182:00000 24:188:86370 LEICA GR25 -----
SALA A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
SCDA A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
SOPU A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
VITO A 1 P 24:182:00000 24:188:86370 LEICA GR30 -----
YEBE A 1 P 24:182:00000 24:188:86370 LEICA GR50 -----
ZARA A 1 P 24:182:00000 24:188:86370 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 24:182:00000 24:188:86370 LEIAS10 NONE ----
ALSA A 1 P 24:182:00000 24:188:86370 LEIAR10 NONE ----
AMUR A 1 P 24:187:00000 24:188:86370 LEIAS10 NONE ----
BIAZ A 1 P 24:182:00000 24:188:86370 LEIAR25 LEIT ----
BIDA A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
BRZR A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
CACE A 1 P 24:182:00000 24:188:86370 TRM29659.00 NONE ----
CANT A 1 P 24:182:00000 24:188:86370 LEIAR25.R4 LEIT ----
CREU A 1 P 24:182:00000 24:188:86370 LEIAR25.R4 NONE ----
EBRE A 1 P 24:182:00000 24:188:86370 LEIAR25.R4 NONE ----
ELGE A 1 P 24:182:00000 24:188:86370 LEIAR25.R4 LEIT ----
EMAZ A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
GERN A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
HOND A 1 P 24:182:00000 24:188:86370 LEIAR20 LEIM ----
IGEL A 1 P 24:182:00000 24:188:86370 LEIAR20 LEIM ----
ISPS A 1 P 24:182:00000 24:188:86370 TRM59900.00 SCIS ----
KAST A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
LARE A 1 P 24:182:00000 24:188:86370 LEIAR20 LEIM ----
LAZK A 1 P 24:182:00000 24:188:86370 LEIAR25.R4 LEIT ----
LEIT A 1 P 24:182:00000 24:188:86370 LEIAR10 NONE ----
ORON A 1 P 24:182:00000 24:188:86370 LEIAR10 NONE ----
PASA A 1 P 24:182:00000 24:188:86370 LEIAR20 LEIM ----
RIO1 A 1 P 24:182:00000 24:188:86370 LEIAR25.R4 LEIT ----
SALA A 1 P 24:182:00000 24:188:86370 LEIAR25 NONE ----
SCDA A 1 P 24:182:00000 24:188:86370 TRM55971.00 NONE ----
SOPU A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
VITO A 1 P 24:182:00000 24:188:86370 LEIAS10 NONE ----
YEBE A 1 P 24:182:00000 24:188:86370 LEIAR20 LEIM ----
ZARA A 1 P 24:182:00000 24:188:86370 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	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
ALSA	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
AMUR	A	1	P	24:187:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
BIAZ	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
BIDA	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
BRZR	A	1	P	24:182:00000	24:188:86370	UNE	0.0771	0.0000	0.0000
CACE	A	1	P	24:182:00000	24:188:86370	UNE	0.0600	0.0000	0.0000
CANT	A	1	P	24:182:00000	24:188:86370	UNE	3.0490	0.0000	0.0000
CREU	A	1	P	24:182:00000	24:188:86370	UNE	0.0770	0.0000	0.0000
EBRE	A	1	P	24:182:00000	24:188:86370	UNE	0.0770	0.0000	0.0000
ELGE	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
EMAZ	A	1	P	24:182:00000	24:188:86370	UNE	0.0350	0.0000	0.0000
GERN	A	1	P	24:182:00000	24:188:86370	UNE	0.0771	0.0000	0.0000
HOND	A	1	P	24:182:00000	24:188:86370	UNE	0.0771	0.0000	0.0000
IGEL	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
ISPS	A	1	P	24:182:00000	24:188:86370	UNE	0.0350	0.0000	0.0000
KAST	A	1	P	24:182:00000	24:188:86370	UNE	0.0350	0.0000	0.0000
LARE	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
LAZK	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
LEIT	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
ORDN	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
PASA	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
RID1	A	1	P	24:182:00000	24:188:86370	UNE	0.0606	0.0000	0.0000
SALA	A	1	P	24:182:00000	24:188:86370	UNE	0.0600	0.0000	0.0000
SCDA	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
SOPU	A	1	P	24:182:00000	24:188:86370	UNE	0.0771	0.0000	0.0000
VITO	A	1	P	24:182:00000	24:188:86370	UNE	0.0000	0.0000	0.0000
YEBE	A	1	P	24:182:00000	24:188:86370	UNE	0.0600	0.0000	0.0000
ZARA	A	1	P	24:182:00000	24:188:86370	UNE	3.2590	0.0000	0.0000

## 8 References

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

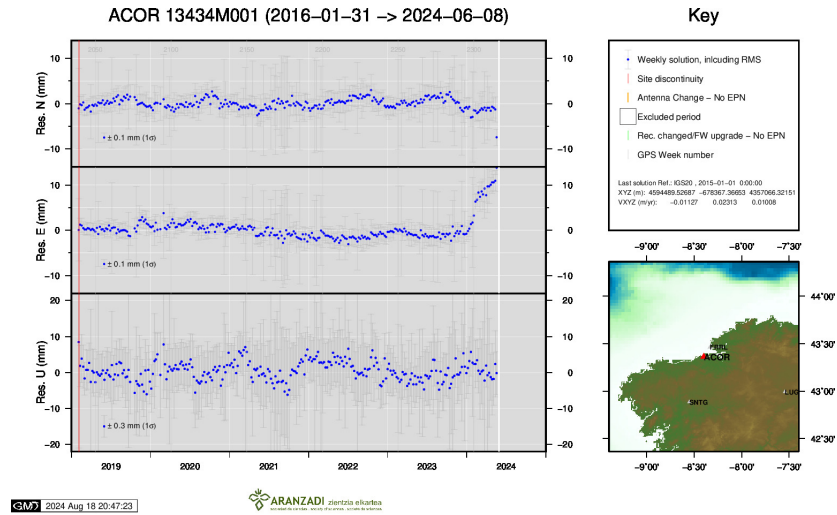
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](https://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

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

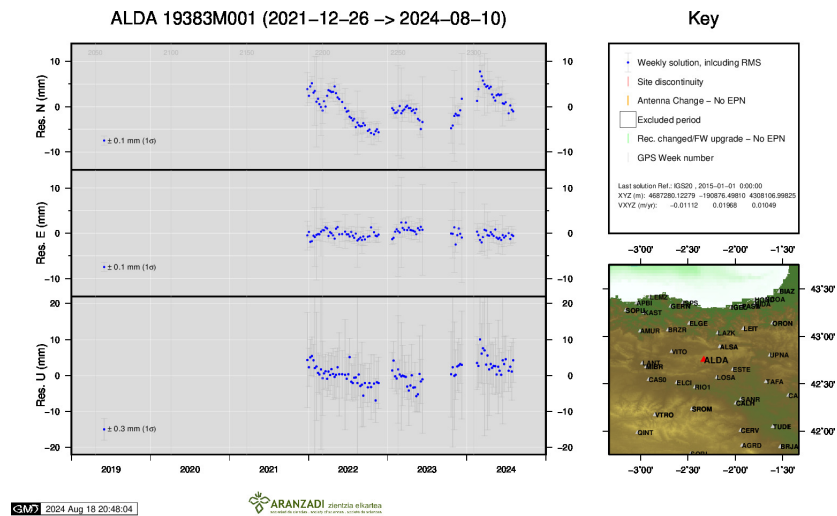
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems*. [etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf](https://etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf)

## 9 Cumulative Time Series

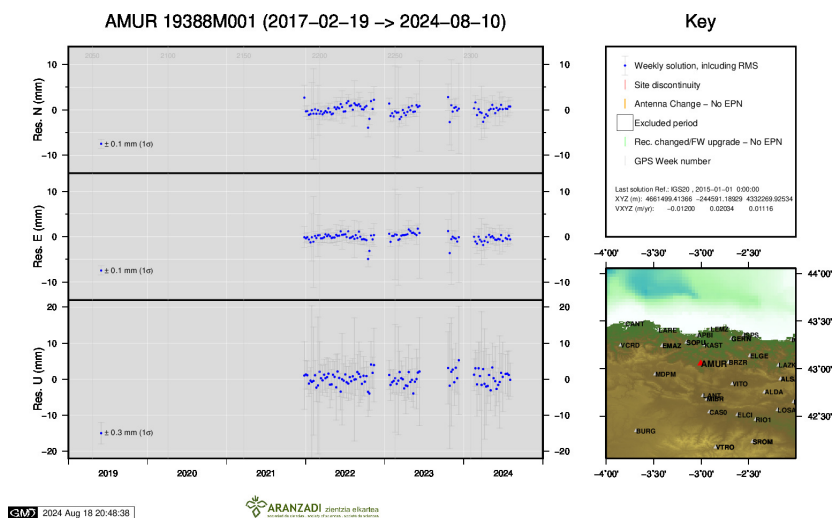
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



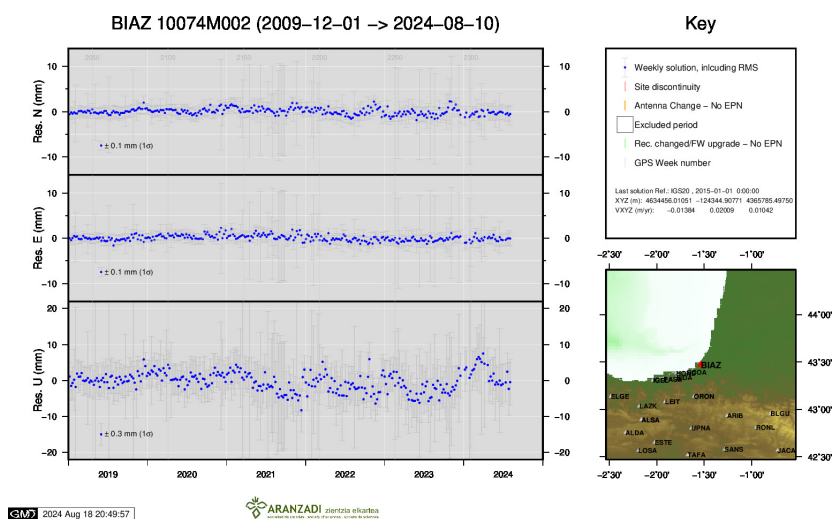
1 ) ACOR



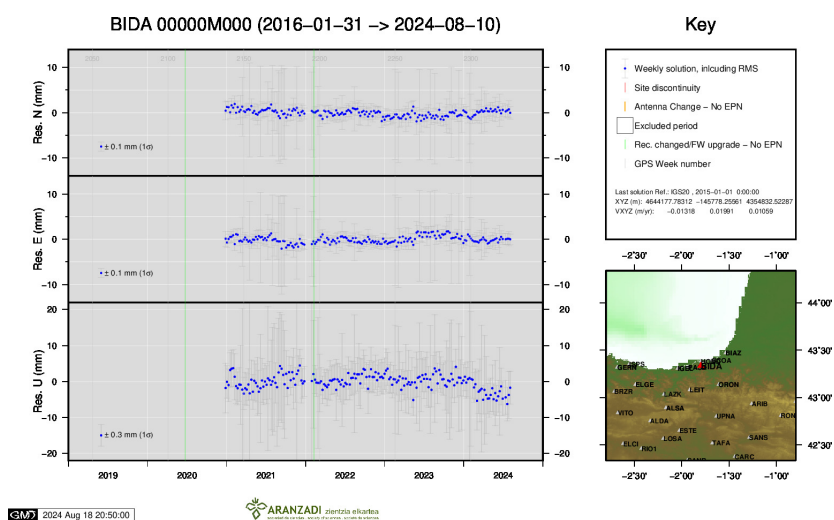
2 ) ALDA



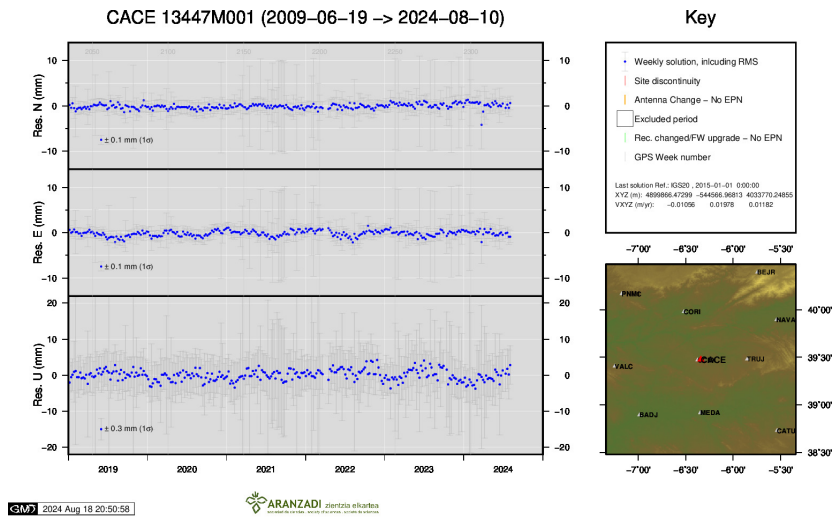
### 3 ) AMUR



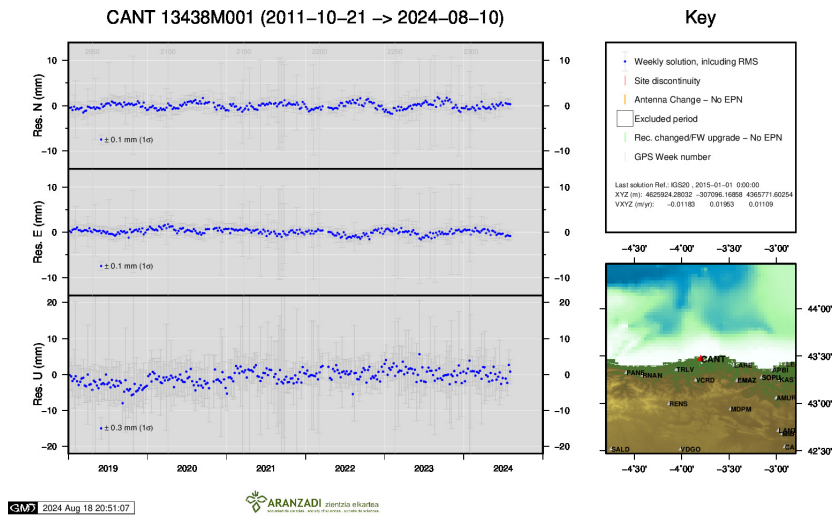
### 4 ) BLAZ



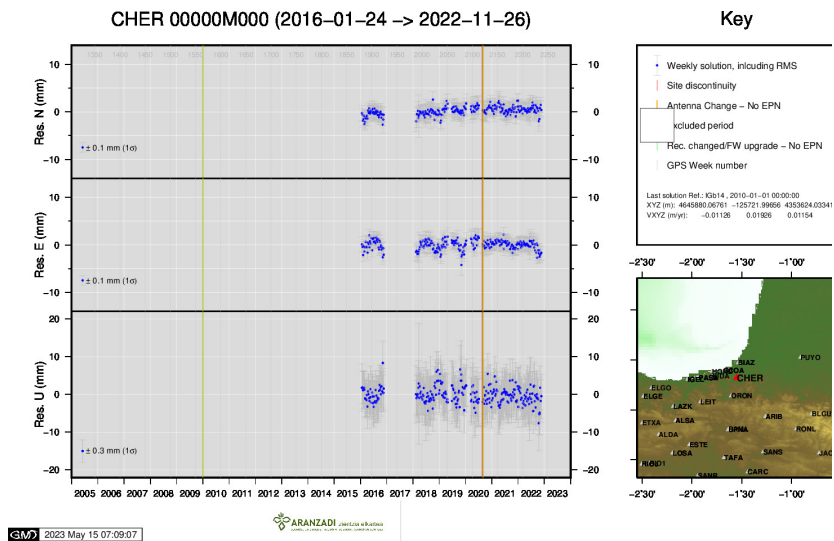
### 5 ) BIDA



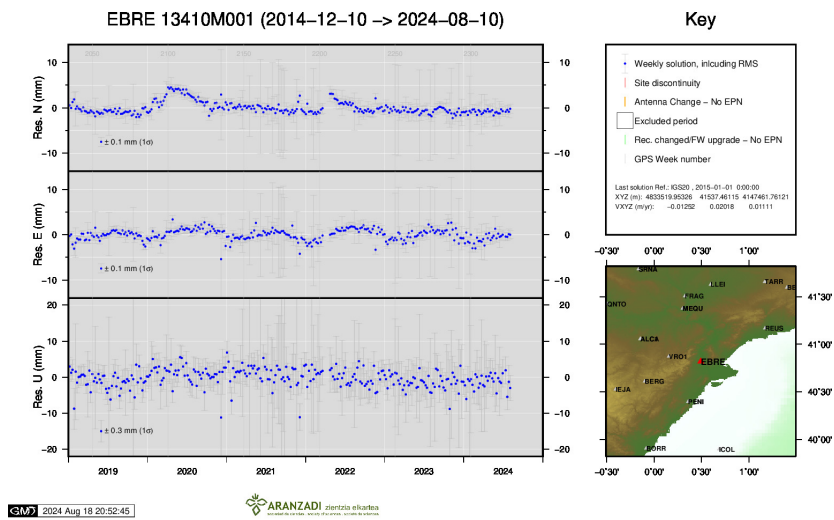
6 ) CACE



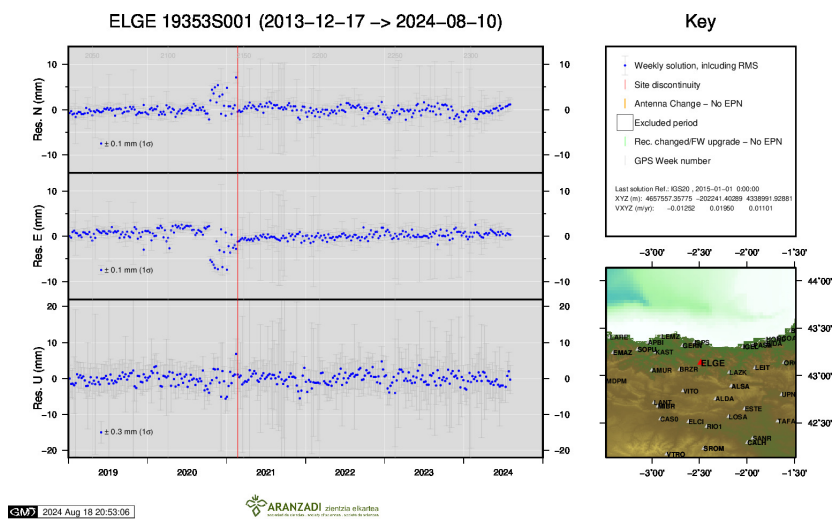
7 ) CANT



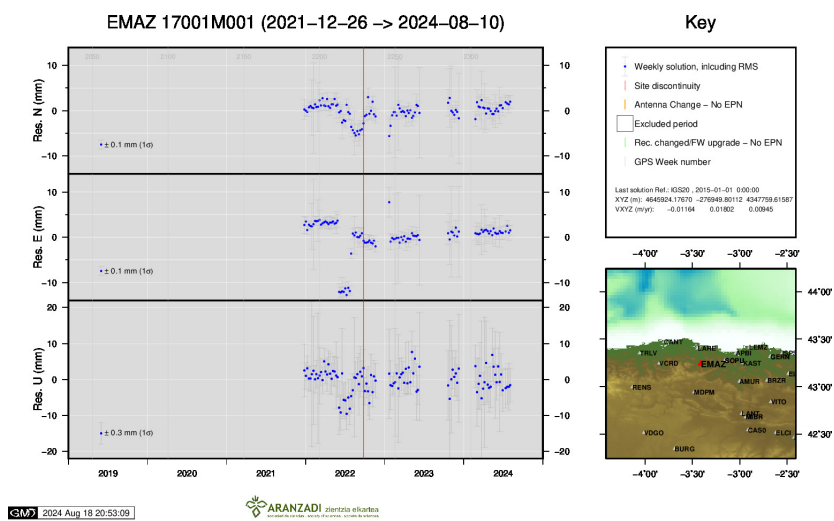
8 ) CHER



9 ) EBRE

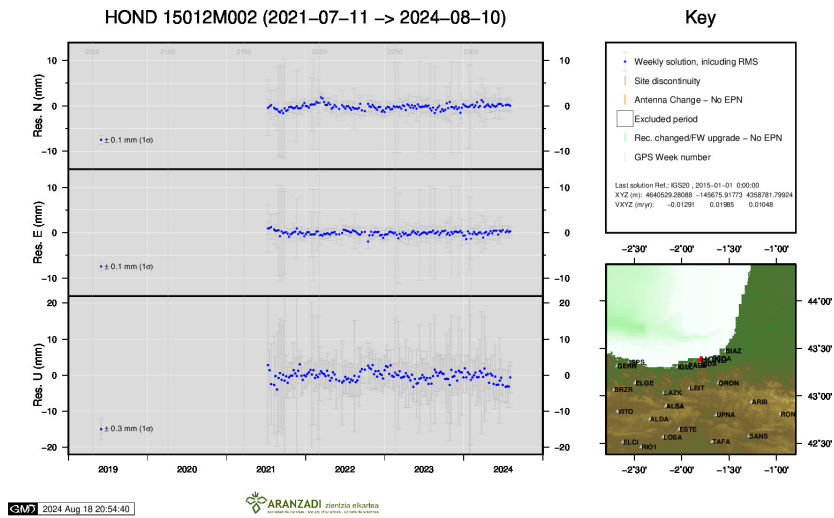


10 ) ELGE

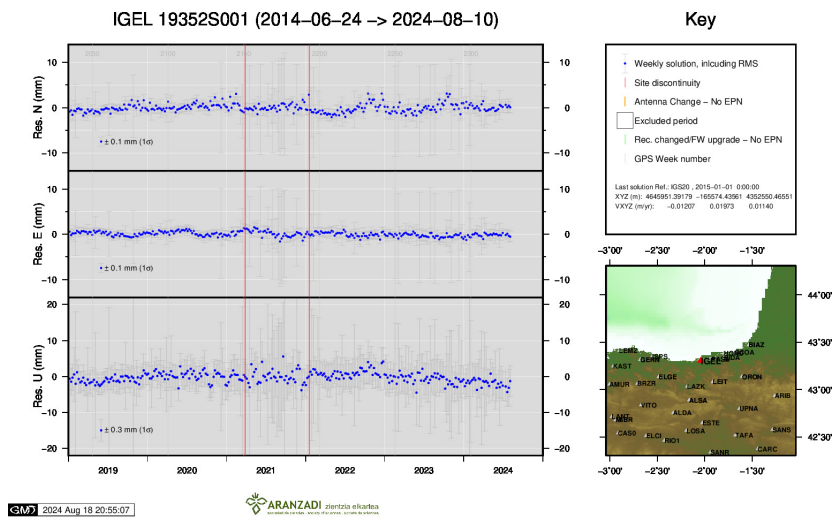


11 ) EMAZ

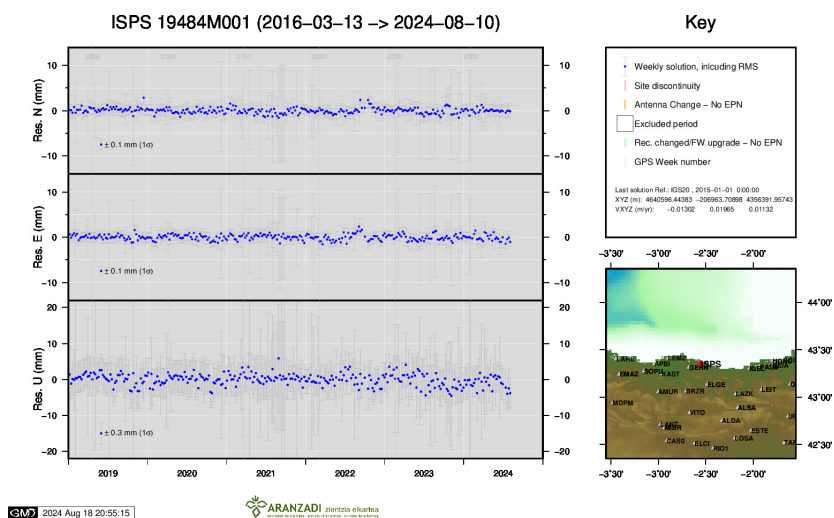




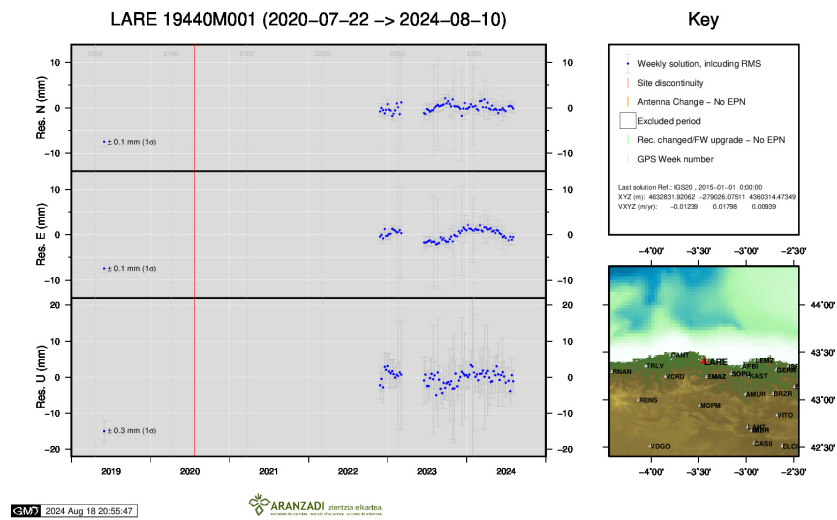
12 ) HOND



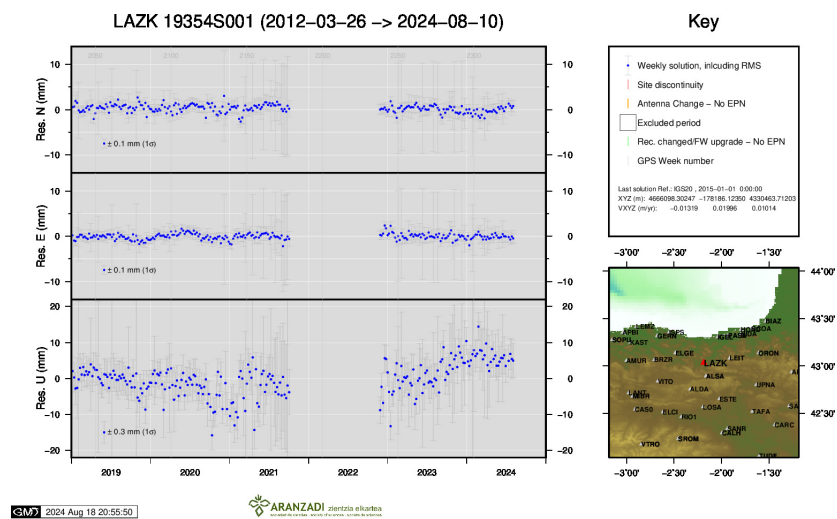
13 ) IGEL



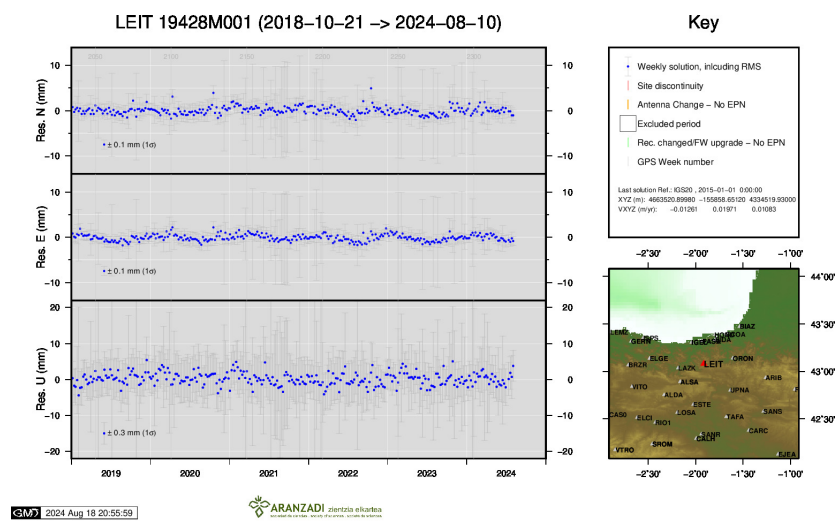
14 ) ISPS



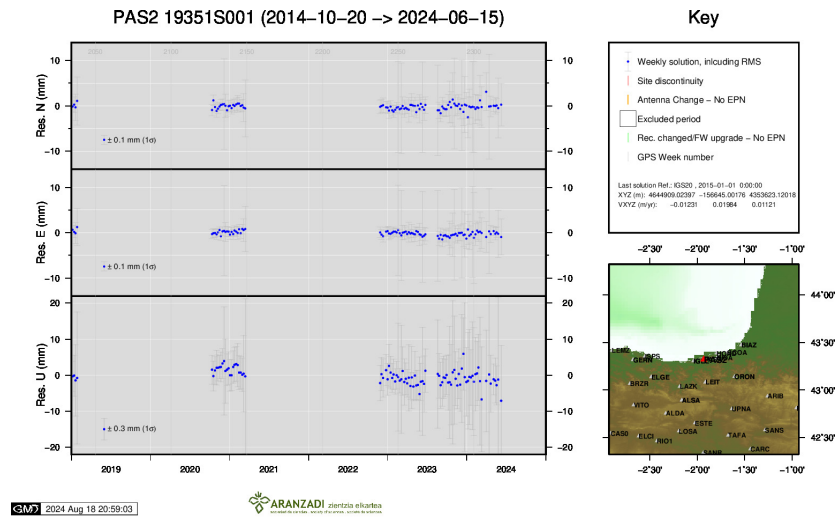
15 ) LARE



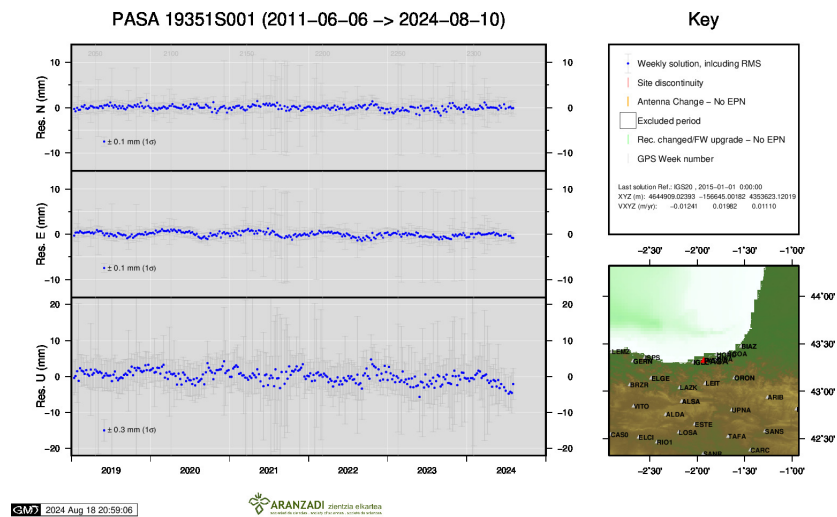
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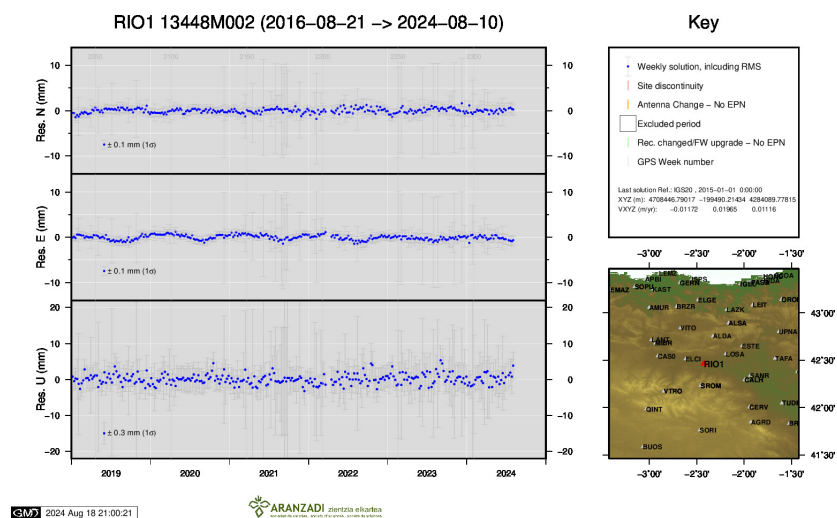
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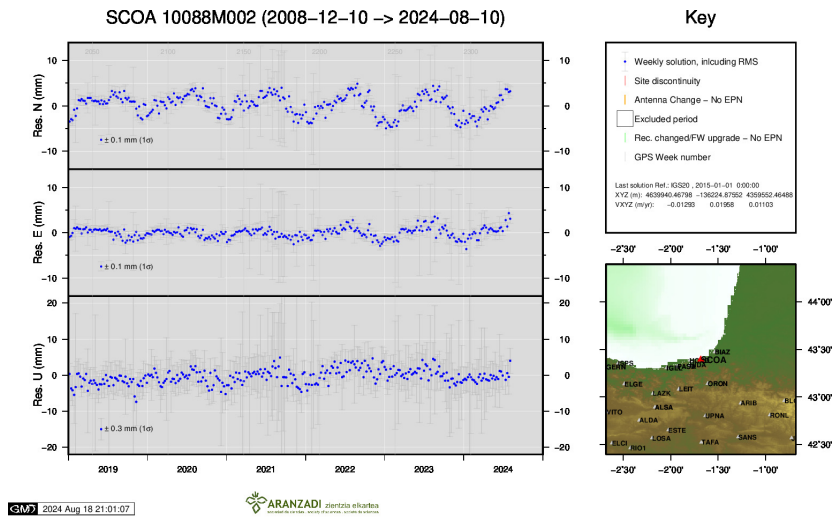
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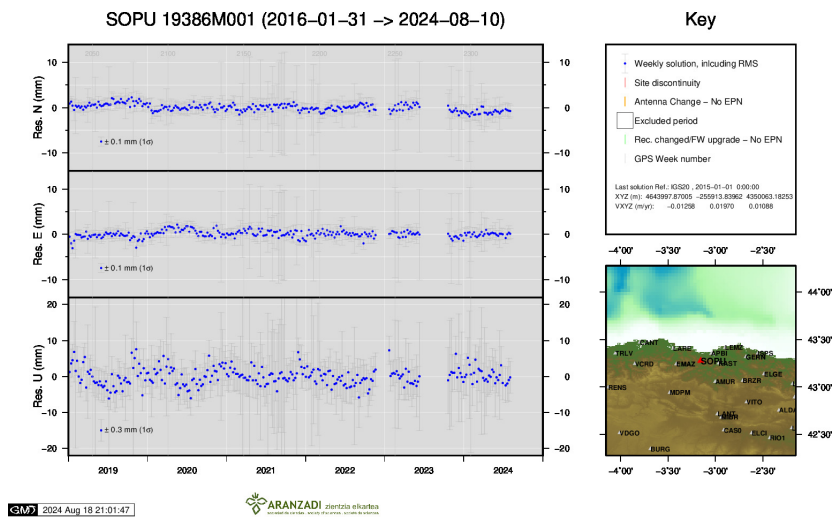
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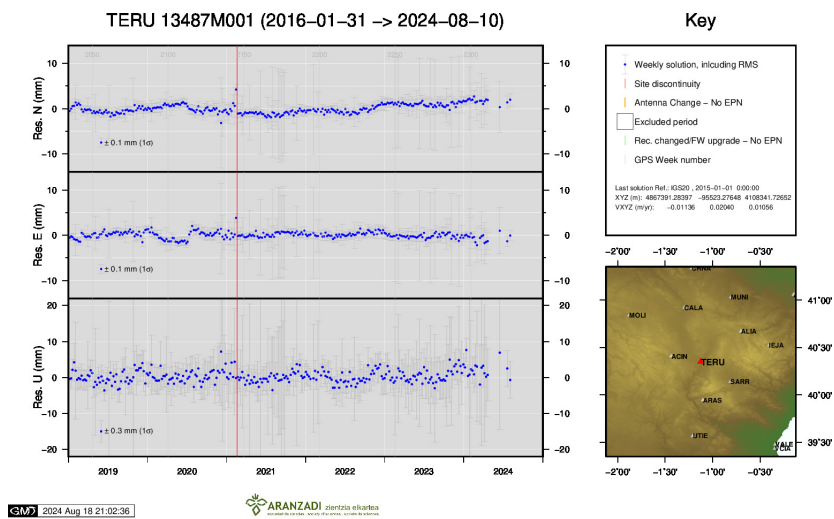
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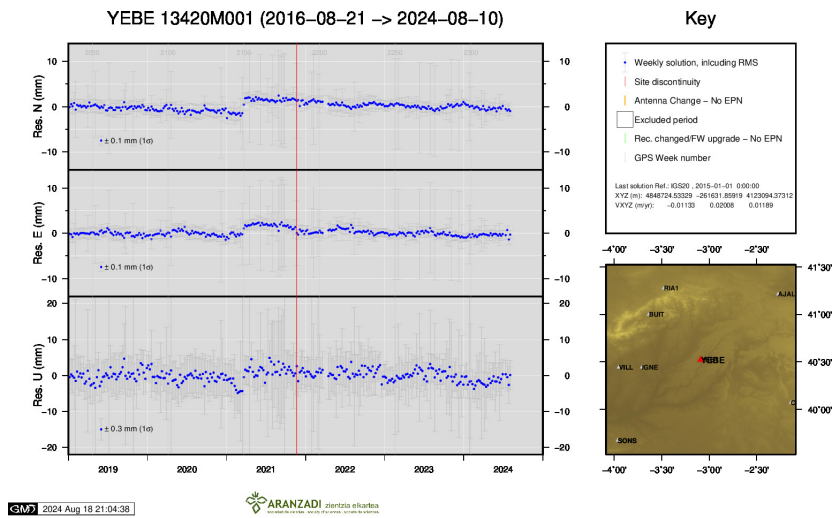
21 ) SCOA



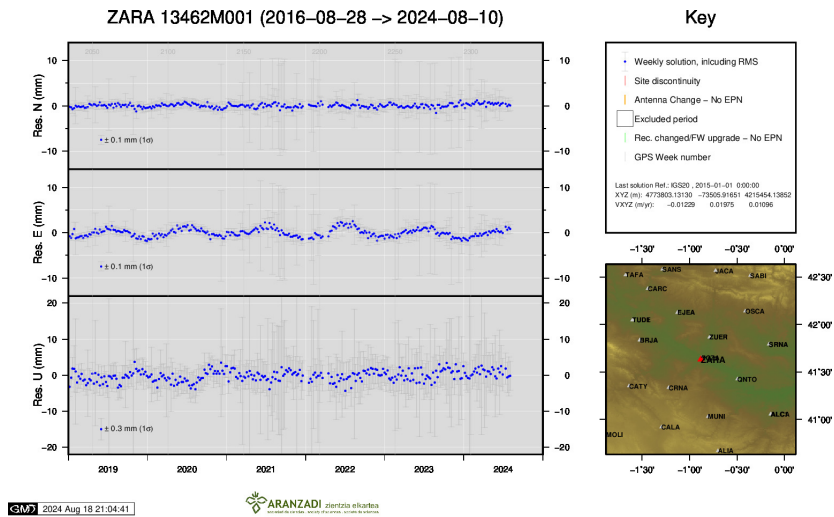
22 ) SOPU



23 ) TERU



24 ) YEBE



25 ) ZARA