

# ARA-DAC Weekly Analysis Result: 2319 (GFA)

## Technical Report

**GPS Week: 2319 (GFA)**

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

**ARA-DAC details:**

Contact person: J. Zurutuza

Contact mail: [geodesia@aranzadi.eus](mailto:geodesia@aranzadi.eus)

Report generated on 2024/07/09 at 22:20:23

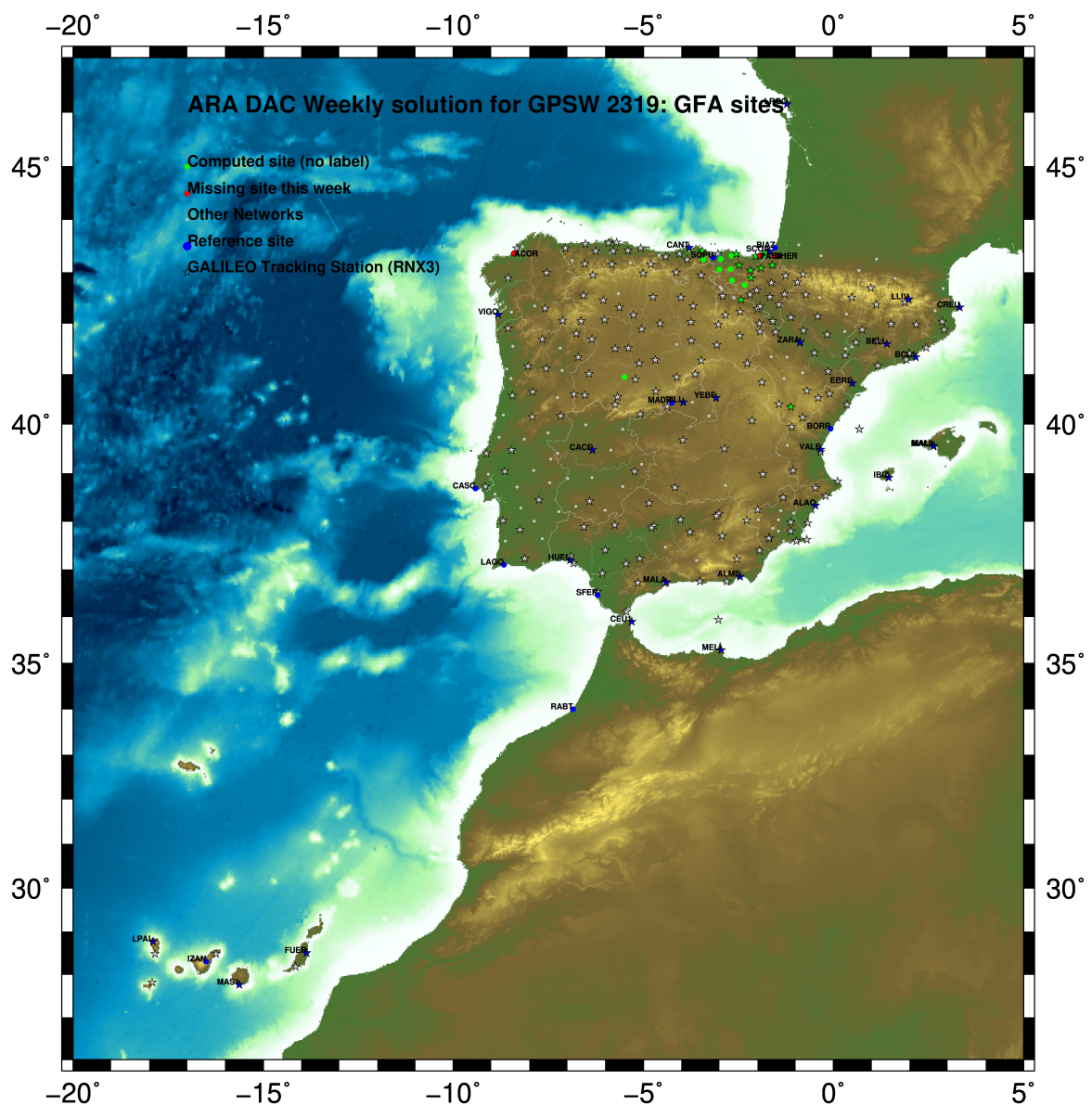


**ARANZADI** zientzia elkartea  
sociedad de ciencias . society of sciences . société de sciences

# 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 Jul 09 22:20:18

Fig.1: Computed Sites for GPS Week2319 (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                                09-JUL-24 20:53
-----
LOCAL GEODETIC DATUM: IGS20                EPOCH: 2024-06-19 11:59:45
-----
NUM STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
-----
 39 ALDA 19383M001    4687280.10968  -190876.47035  4308107.01713  A   GR
 50 ALSA 19419M001    4677250.78041  -176770.29862  4319079.93637  A   GR
 53 AMUR 19388M001    4661499.39583  -244591.16059  4332269.94139  A   GR
 384 BIAZ 10074M002    4634455.99089  -124344.87858  4365785.51290  W   GR
 101 BIDA 00000M000    4644177.76206  -145778.22697  4354832.53702  A   GR
 113 BRZR 19387M001    4662220.93585  -220769.80225  4333309.49493  A   GR
 573 CACE 13447M001    4899866.45596  -544566.93971  4033770.26440  W   GRE
 592 CANT 13438M001    4625924.26356  -307096.14082  4365771.61935  W   GRE
 908 CREU 13432M001    4715420.06974  273178.15597  4271946.90168  W   GRE
 135 EBRE 13410M001    4833519.93596  41537.48964  4147461.77635  W   GRE
 180 ELGE 19353S001    4657557.33777  -202241.37453  4338991.94412  A   GRE
 182 EMAZ 17001M001    4645924.15887  -276949.77387  4347759.63011  A   GR
 209 GERN 19389M001    4642811.26527  -217222.83061  4353278.93676  A   GR
 257 HOND 15012M002    4640529.26120  -145675.88866  4358781.81405  A   GRE
 235 IGEL 19352S001    4645951.37211  -165574.40738  4352550.48074  A   GRE
 240 ISPS 19484M001    4640596.42584  -206963.68179  4356391.97428  A   GRE
 245 KAST 19499M001    4646949.02222  -240747.17280  4348015.05090  A   GR
 252 LARE 19440M001    4632831.90392  -279026.04994  4360314.48811  A   GRE
 256 LAZK 19354S001    4666098.28772  -178186.09449  4330463.73104  A   GRE
 261 LEIT 19428M001    4663520.88136  -155858.62315  4334519.94638  A   GRE
 334 ORDN 19427M001    4659695.72256  -130864.63841  4338948.94301  A   GRE
 553 RI01 13448M002    4708446.77513  -199490.18633  4284089.79561  A   GRE
 558 SALA 13469M001    4803054.43437  -462130.97320  4158379.13683  A   GR
 526 SCDA 10088M002    4639940.44891  -136224.84633  4359552.48369  W   GRE
 715 SOPU 19386M001    4643997.85327  -255913.81126  4350063.19785  W   GR
 443 TERU 13487M001    4867391.27344  -95523.24636  4108341.74716  A   GRE
 493 VITO 19385M001    4679397.64813  -218436.40824  4314898.42851  A   GR
 616 YEBE 13420M001    4848724.51609  -261631.83052  4123094.38939  W   GRE
 655 ZARA 13462M001    4773803.11472  -73505.88805  4215454.15555  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                                                    09-JUL-24 20:53
-----
LOCAL GEODETIC DATUM: ETRF2000                EPOCH: 2024-06-19 11:59:45
-----
NUM STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
-----
 39 ALDA 19383M001    4687280.51685  -190877.11752  4308106.53542  A
 50 ALSA 19419M001    4677251.19039  -176770.94453  4319079.45574  A
 53 AMUR 19388M001    4661499.79763  -244591.80476  4332269.46119  A
 384 BIAZ 10074M002    4634456.41180  -124345.51914  4365785.03676  W
 101 BIDA 00000M000    4644178.17916  -145778.86877  4354832.05973  A
 113 BRZR 19387M001    4662221.34099  -220770.44646  4333309.01500  A
 573 CACE 13447M001    4899866.79254  -544567.61318  4033769.75895  W
 592 CANT 13438M001    4625924.65955  -307096.78082  4365771.14138  W
 908 CREU 13432M001    4715420.53715  273177.50700  4271946.42395  W
 135 EBRE 13410M001    4833520.36172  41536.82556  4147461.28503  W
 180 ELGE 19353S001    4657557.74589  -202242.01812  4338991.46486  A
 182 EMAZ 17001M001    4645924.55752  -276950.41624  4347759.15082  A
 209 GERN 19389M001    4642811.67251  -217223.47244  4353278.45858  A
 257 HOND 15012M002    4640529.67864  -145676.53002  4358781.33708  A
 235 IGEL 19352S001    4645951.78633  -165575.04946  4352550.00301  A
 240 ISPS 19484M001    4640596.83473  -206964.32333  4356391.49644  A
 245 KAST 19499M001    4646949.42582  -240747.81520  4348014.57203  A
 252 LARE 19440M001    4632832.30330  -279026.69071  4360314.00993  A
 256 LAZK 19354S001    4666098.69843  -178186.73905  4330463.25137  A
 261 LEIT 19428M001    4663521.29544  -155859.26734  4334519.46725  A
 334 ORDN 19427M001    4659696.14041  -130865.28206  4338948.46456  A
 553 RI01 13448M002    4708447.17917  -199490.83608  4284089.31192  A
 558 SALA 13469M001    4803054.79236  -462131.63495  4158378.64110  A
 526 SCDA 10088M002    4639940.86770  -136225.48759  4359552.00690  W
 715 SOPU 19386M001    4643998.25497  -255914.45332  4350062.71902  W
 443 TERU 13487M001    4867391.67735  -95523.91496  4108341.25095  A
 493 VITO 19385M001    4679398.05209  -218437.05452  4314897.94711  A
 616 YEBE 13420M001    4848724.89856  -261632.49733  4123093.89249  W
 655 ZARA 13462M001    4773803.53035  -73506.54533  4215453.66788  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		09-JUL-24 20:53				
LOCAL GEODETIC DATUM: ETRF2014		EPOCH: 2024-06-19 11:59:45				
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
39	ALDA 19383M001	4687280.47440	-190877.15569	4308106.58785	A	
50	ALSA 19419M001	4677251.14800	-176770.98280	4319079.50820	A	
53	AMUR 19388M001	4661499.75565	-244591.84285	4332269.51367	A	
384	BIAZ 10074M002	4634456.36970	-124345.55780	4365785.08939	W	
101	BIDA 00000M000	4644178.13703	-145778.90731	4354832.11231	A	
113	BRZR 19387M001	4662221.29892	-220770.48463	4333309.06749	A	
573	CACE 13447M001	4899866.74871	-544567.64904	4033769.81065	W	
592	CANT 13438M001	4625924.61818	-307096.81883	4365771.19395	W	
908	CREU 13432M001	4715420.49258	273177.46724	4271946.47663	W	
135	EBRE 13410M001	4833520.31672	41536.78719	4147461.33718	W	
180	ELGE 19353S001	4657557.70381	-202242.05638	4338991.51737	A	
182	EMAZ 17001M001	4645924.51583	-276950.45428	4347759.20333	A	
209	GERN 19389M001	4642811.63064	-217223.51071	4353278.51113	A	
257	HOND 15012M002	4640529.63655	-145676.56857	4358781.38968	A	
235	IGEL 19352S001	4645951.74425	-165875.08791	4352550.05558	A	
240	ISPS 19484M001	4640596.79285	-206964.36165	4356391.54900	A	
245	KAST 19499M001	4646949.38399	-240747.85336	4348014.62455	A	
252	LARE 19440M001	4632832.26175	-279026.72880	4360314.06249	A	
256	LAZK 19354S001	4666098.65617	-178186.77736	4330463.30387	A	
261	LEIT 19428M001	4663521.25313	-155859.30575	4334519.51977	A	
334	ORON 19427M001	4659696.09805	-130865.32057	4338948.51711	A	
553	RI01 13448M002	4708447.13650	-199490.87412	4284089.36428	A	
558	SALA 13469M001	4803054.74945	-462131.67157	4158378.69307	A	
526	SOA 10088M002	4639940.82558	-136225.52618	4359552.05951	W	
715	SOPU 19386M001	4643998.21322	-255914.49145	4350062.77155	W	
443	TERU 13487M001	4867391.63246	-95523.95267	4108341.30291	A	
493	VITO 19385M001	4679398.00982	-218437.09262	4314897.99954	A	
616	YEBE 13420M001	4848724.85448	-261632.53450	4123093.94441	W	
655	ZARA 13462M001	4773803.48648	-73506.58354	4215453.72012	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 09-JUL-24 20:53

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ALDA 19383M001	6	XXXX XX	1.31	2.08	3.42
ALSA 19419M001	6	XXXX XX	0.89	0.81	2.55
AMUR 19388M001	6	XXXX XX	1.61	0.89	4.24
BIAZ 10074M002	6	XX X XX	0.76	1.17	2.34
BIDA 00000M000	6	XXXX XX	1.10	0.72	4.62
BRZR 19387M001	6	XXXX XX	1.16	0.57	4.53
CACE 13447M001	6	XXXX XX	1.29	1.05	3.74
CANT 13438M001	6	XXXX XX	1.11	0.51	3.52
CREU 13432M001	7	XXXXXX	2.54	0.83	2.65
EBRE 13410M001	7	XXXXXX	2.67	1.27	3.50
ELGE 19353S001	6	XXXX XX	0.85	0.77	2.29
EMAZ 17001M001	6	XXXX XX	1.17	0.96	4.38
GERN 19389M001	6	XXXX XX	1.04	3.26	4.67
HOND 15012M002	6	XXXX XX	0.54	0.77	2.92
IGEL 19352S001	6	XXXX XX	1.28	0.45	2.70
ISPS 19484M001	6	XXXX XX	0.71	1.96	3.14
KAST 19499M001	6	XXXX XX	0.78	0.76	3.32
LARE 19440M001	6	XXXX XX	1.27	0.57	2.00
LAZK 19354S001	6	XXXX XX	0.77	0.78	1.98
LEIT 19428M001	6	XXXX XX	1.00	1.22	3.11
ORDN 19427M001	6	XXXX XX	0.82	1.29	3.96
RI01 13448M002	6	XXXX XX	0.53	0.42	3.77
SALA 13469M001	6	XXXX XX	0.63	0.39	3.08
SCDA 10088M002	6	XXXX XX	2.19	1.80	3.72
SOPU 19386M001	6	XXXX XX	0.77	0.85	5.94
TERU 13487M001	1	X	0.64	0.26	2.98
VITO 19385M001	6	XXXX XX	1.05	0.74	1.50
YEBE 13420M001	6	XXXX XX	0.74	0.32	2.39
ZARA 13462M001	6	XXXX XX	0.76	1.11	2.42

Comparison of individual solutions:

ALDA 19383M001	N	1.31	0.09	0.80	-2.04	1.86	-0.44	0.30	
ALDA 19383M001	E	2.08	-0.87	2.22	2.67	-0.72	0.06	-2.90	
ALDA 19383M001	U	3.42	-4.54	1.68	3.11	3.63	-3.50	-0.06	
ALSA 19419M001	N	0.89	-0.25	-0.24	0.16	1.93	-0.09	-0.19	
ALSA 19419M001	E	0.81	-0.81	0.15	0.47	-1.28	0.72	-0.46	
ALSA 19419M001	U	2.55	-0.49	0.24	4.23	0.82	-2.61	-2.59	
AMUR 19388M001	N	1.61	-0.85	3.16	-1.18	0.39	-0.81	0.05	
AMUR 19388M001	E	0.89	-0.70	1.49	-0.58	-0.27	0.17	-0.91	
AMUR 19388M001	U	4.24	-3.23	-4.96	6.10	-2.83	0.12	3.10	
BIAZ 10074M002	N	0.76	-0.48	-0.74	0.69		-1.01	0.14	
BIAZ 10074M002	E	1.17	-1.51	-0.27	2.29	1.42	0.55	-0.91	
BIAZ 10074M002	U	2.34	-1.82	2.48		-2.99	1.79	-0.60	
BIDA 00000M000	N	1.10	-0.77	0.06	-0.82	1.53	-1.55	0.19	
BIDA 00000M000	E	0.72	0.05	-0.25	0.48	0.62	-0.54	-1.28	
BIDA 00000M000	U	4.62	-0.68	4.75	6.03	1.64	-1.86	-6.40	
BRZR 19387M001	N	1.16	-0.20	-1.16	0.25	0.97	-1.92	0.78	
BRZR 19387M001	E	0.57	0.09	-0.96	-0.29	0.61	-0.43	0.23	
BRZR 19387M001	U	4.53	-5.16	-3.52	1.31	7.70	0.61	1.51	
CACE 13447M001	N	1.29	0.61	-0.84	-1.22	-1.99	0.57	1.19	
CACE 13447M001	E	1.05	0.93	-0.93	-0.71	-0.85	1.07	1.18	
CACE 13447M001	U	3.74	-5.66	2.89	4.96	0.65	-1.71	-1.21	
CANT 13438M001	N	1.11	-1.46	0.35	-0.65	0.15	-0.54	-1.78	
CANT 13438M001	E	0.51	-0.44	0.40	-0.86	0.01	0.43	-0.14	
CANT 13438M001	U	3.52	4.54	4.69	-0.69	-1.95	-3.79	0.93	
CREU 13432M001	N	2.54	0.16	2.18	0.29	0.10	-5.71	0.87	0.71
CREU 13432M001	E	0.83	-1.39	-0.50	0.16	0.20	-1.18	-0.01	-0.69
CREU 13432M001	U	2.65	-0.57	2.51	-4.66	0.57	-3.30	-1.30	0.93
EBRE 13410M001	N	2.67	1.53	1.27	0.96	-1.18	-5.89	0.75	1.17
EBRE 13410M001	E	1.27	0.06	0.63	-1.51	-1.52	1.54	-1.29	-0.78
EBRE 13410M001	U	3.50	-2.07	-1.27	-6.36	-1.03	4.89	0.74	1.21
ELGE 19353S001	N	0.85	0.16	0.89	0.03	-0.76		-1.49	-0.07
ELGE 19353S001	E	0.77	-1.07	-0.39	-0.69	0.48		0.94	-0.28
ELGE 19353S001	U	2.29	-2.04	1.82	4.13	-1.26		0.21	0.01
EMAZ 17001M001	N	1.17	0.40	0.51	-0.75	0.37		-2.11	-1.13
EMAZ 17001M001	E	0.96	-1.42	0.31	-0.85	-0.43		0.10	1.25
EMAZ 17001M001	U	4.38	-6.07	-1.97	6.30	-1.88		1.05	3.28
GERN 19389M001	N	1.04	0.94	-0.45	-0.52	0.31		-1.97	0.21
GERN 19389M001	E	3.26	-6.53	1.75	2.59	0.14		0.26	0.88
GERN 19389M001	U	4.67	-4.02	-3.46	8.23	3.13		1.11	-1.48
HOND 15012M002	N	0.54	0.03	-0.16	-0.09	0.21		-1.17	-0.01
HOND 15012M002	E	0.77	-0.62	0.91	-0.02	0.31		-0.24	-1.28
HOND 15012M002	U	2.92	-1.69	3.19	4.92	-1.74		-1.51	0.39
IGEL 19352S001	N	1.28	-0.27	1.63	-0.16	-0.90		-2.05	0.67
IGEL 19352S001	E	0.45	-0.84	0.28	-0.29	0.03		-0.37	0.17
IGEL 19352S001	U	2.70	-1.31	2.07	5.07	-1.73		-1.18	0.64
ISPS 19484M001	N	0.71	0.39	-0.11	-0.20	0.24		-1.49	-0.17
ISPS 19484M001	E	1.96	-3.51	1.30	0.60	-1.57		1.36	0.76
ISPS 19484M001	U	3.14	0.24	2.99	5.10	-0.91		-3.66	-0.39
KAST 19499M001	N	0.78	-0.14	0.26	-1.07	0.89		-0.86	-0.52
KAST 19499M001	E	0.76	-0.89	-0.94	0.03	0.55		0.77	-0.53
KAST 19499M001	U	3.32	-2.88	-0.87	6.17	-1.82		1.87	1.05
LARE 19440M001	N	1.27	-1.86	-0.05	-0.42	1.10		-1.36	-1.16
LARE 19440M001	E	0.57	-0.45	-0.33	0.02	-0.89		0.66	0.31
LARE 19440M001	U	2.00	-2.59	3.00	1.45	-0.29		-0.23	1.42
LAZK 19354S001	N	0.77	0.10	1.32	-0.06	0.29		-0.88	0.59
LAZK 19354S001	E	0.78	-1.13	0.85	0.15	0.23		-0.48	-0.89
LAZK 19354S001	U	1.98	-1.55	3.22	-0.03	0.22		-2.60	0.07
LEIT 19428M001	N	1.00	-0.88	-0.77	0.36	1.47		-1.14	-0.21
LEIT 19428M001	E	1.22	-0.57	2.40	-0.16	-0.96		-0.36	-0.57
LEIT 19428M001	U	3.11	1.33	1.06	6.31	-1.06		-1.93	-1.01
ORDN 19427M001	N	0.82	-0.98	0.88	-0.92	0.43		-0.53	-0.51
ORDN 19427M001	E	1.29	-0.90	1.68	-0.11	0.93		-1.30	-1.44

ORDN	19427M001	U	3.96	-3.80	2.23	4.92	1.63			-5.31	2.04
RIO1	13448M002	N	0.53	-0.27	0.29	0.86	0.64			0.31	-0.04
RIO1	13448M002	E	0.42	-0.08	0.01	-0.58	-0.19			0.32	-0.64
RIO1	13448M002	U	3.77	1.36	3.02	3.17	0.29			-6.03	-3.70
SALA	13469M001	N	0.63	-0.64	-0.92	0.30	-0.70			0.11	0.35
SALA	13469M001	E	0.39	-0.14	-0.00	-0.53	-0.29			0.46	0.39
SALA	13469M001	U	3.08	-2.07	4.06	1.87	-2.78			-1.17	3.77
SCDA	10088M002	N	2.19	0.38	2.98	0.94	-0.51			-2.89	-2.33
SCDA	10088M002	E	1.80	0.57	2.73	-0.89	0.56			-1.00	-2.50
SCDA	10088M002	U	3.72	-3.36	2.45	6.90	0.32			-1.86	-0.93
SOPU	19386M001	N	0.77	0.86	-0.22	-0.55	0.06			-0.79	-1.12
SOPU	19386M001	E	0.85	-0.44	-0.77	0.85	0.98			-0.61	-0.86
SOPU	19386M001	U	5.94	-6.16	2.65	9.44	-4.02			-2.61	4.43
TERU	13487M001	N	0.64			0.64					
TERU	13487M001	E	0.26			0.26					
TERU	13487M001	U	2.98			-2.98					
VITO	19385M001	N	1.05	-0.38	1.38	1.45	1.13			-0.24	-0.05
VITO	19385M001	E	0.74	-0.92	0.23	-0.98	0.54			0.58	-0.53
VITO	19385M001	U	1.50	0.78	-0.95	0.88	-0.28			-2.79	-1.07
YEBE	13420M001	N	0.74	-1.08	-0.28	-0.80	-0.50			0.23	0.75
YEBE	13420M001	E	0.32	0.22	-0.10	0.34	0.09			-0.56	-0.14
YEBE	13420M001	U	2.39	-1.26	-1.00	4.72	-0.64			0.58	1.70
ZARA	13462M001	N	0.76	0.14	0.96	0.90	-0.06			1.04	0.23
ZARA	13462M001	E	1.11	0.72	1.58	-1.07	-0.57			-0.08	-1.31
ZARA	13462M001	U	2.42	0.24	0.22	4.33	-2.34			-0.90	-2.04



## 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       -2.96   -19.92   -35.14

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS			
1	ALAC 13433M001	I W	-0.50	-0.60	3.56	
2	ALME 13437M001	I W	-0.02	0.58	2.95	
3	BCL1 19482M001	I W	-0.24	-1.20	2.97	
4	BELL 13431M001	I W	-0.19	-0.36	3.52	
5	BIAZ 10074M002	I W	0.01	-0.26	-1.00	
6	BORR 13480M001	I W	-2.28	1.25	0.08	
7	BRST 10004M004	I W	-1.30	-1.85	6.34	
8	CACE 13447M001	I W	0.98	1.72	5.66	
9	CANT 13438M001	I W	-0.03	1.10	-2.44	
10	CASC 13909S001	I W	0.96	-0.50	8.83	
11	CEU1 13449M002	I W	1.09	0.47	-3.85	
12	CREU 13432M001	A W	-3.04	-20.45	-36.06	
13	EBRE 13410M001	I W	0.52	1.24	-0.54	
15	FLRS 31907M001	I W	-0.93	-2.82	-8.28	
16	FUER 31330M001	I W	0.41	-0.57	-0.86	
18	HUEL 13451M001	I W	1.94	3.41	-9.64	
19	IBIZ 13454S001	I W	-0.56	0.63	1.70	
20	IZAN 31309M002	I W	-0.69	-0.15	-5.56	
21	LAGO 13903M001	I W	0.70	-0.47	0.27	
22	LLIV 13436M001	I W	-2.96	0.96	1.56	
23	LPAL 81701M001	I W	2.46	-0.17	-6.71	
24	LROC 10023M001	I W	0.03	0.05	-0.21	
25	MADR 13407S012	I W	-0.89	2.47	-2.06	
26	MAL1 13444M002	I W	3.10	-2.44	-3.04	
27	MALA 13443M001	I W	2.39	-1.71	4.18	
28	MALL 13444M001	I W	-1.23	-1.46	3.61	
29	MAS1 31303M002	I W	-0.31	-1.57	-0.72	
30	MELI 19379M001	I W	0.18	0.17	1.44	
31	PDEL 31906M004	I W	0.01	-0.81	1.39	
32	RABT 35001M002	I W	0.89	-1.35	-3.88	
33	SCOA 10088M002	I W	-4.21	-0.97	-11.13	
34	SFER 13402M004	I W	-1.68	-4.11	-0.14	
35	SOPU 19386M001	I W	0.05	0.64	1.33	
36	VALE 13439M001	I W	-0.43	1.30	-3.61	
37	VIGO 13450M001	I W	0.72	1.46	3.39	
38	VILL 13406M001	I W	-1.16	-0.63	0.64	
39	YEBE 13420M001	I W	-1.05	-0.28	4.21	
40	ZARA 13462M001	I W	-0.55	-0.03	-2.46	
41	ZIMM 14001M004	I W	-0.21	-0.40	7.73	
	RMS / COMPONENT		1.42	1.47	4.52	
	IQR		1.60	1.62	5.85	
	MEAN		-0.13	-0.19	-0.02	
	MEDIAN		-0.11	-0.27	0.17	
	MIN		-4.21	-4.11	-11.13	
	MAX		3.10	3.41	8.83	
	OVERALL RMS/IQR/MAX(3D)		2.86	2.15	11.94	
					SCOA 10088M002	#SUM
ALL	RMS / COMPONENT		1.48	3.62	7.36	
ALL	IQR		1.63	1.85	6.43	
ALL	MEAN		-0.21	-0.71	-0.94	
ALL	MEDIAN		-0.19	-0.28	0.08	
ALL	MIN		-4.21	-20.45	-36.06	
ALL	MAX		3.10	3.41	8.83	
	OVERALL RMS/IQR/MAX(3D)		4.81	2.29	41.57	
					CREU 13432M001	#SUM_ALL

NUMBER OF PARAMETERS : 3  
NUMBER OF STATIONS : 38  
NUMBER OF COORDINATES : 114  
RMS OF TRANSFORMATION : 2.86 MM

PARAMETERS:

TRANSLATION IN X : 0.57 +- 0.46 MM  
TRANSLATION IN Y : 0.55 +- 0.46 MM  
TRANSLATION IN Z : 0.71 +- 0.46 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          19087977
NUMBER OF UNKNOWN               201108
NUMBER OF DEGREES OF FREEDOM    18886869
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
VARIANCE FACTOR                 14.508604352050639
```

## 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 24:168:00000 24:174:86370 LEICA GR30 -----
ALSA A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
AMUR A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
BIAZ A 1 P 24:168:00000 24:174:86370 SPECTRA SP90M -----
BIDA A 1 P 24:168:00000 24:174:86370 LEICA GR10 -----
BRZR A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
CACE A 1 P 24:168:00000 24:174:86370 TRIMBLE NETR9 -----
CANT A 1 P 24:168:00000 24:174:86370 LEICA GR10 -----
CREU A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
EBRE A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
ELGE A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
EMAZ A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
GERN A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
HOND A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
IGEL A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
ISPS A 1 P 24:168:00000 24:174:86370 TRIMBLE NETR9 -----
KAST A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
LARE A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
LAZK A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
LEIT A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
ORON A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
RIO1 A 1 P 24:168:00000 24:174:86370 LEICA GR25 -----
SALA A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
SCDA A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
SOPU A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
TERU A 1 P 24:170:00000 24:170:86370 LEICA GR50 -----
VITO A 1 P 24:168:00000 24:174:86370 LEICA GR30 -----
YEBE A 1 P 24:168:00000 24:174:86370 LEICA GR50 -----
ZARA A 1 P 24:168:00000 24:174:86370 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 24:168:00000 24:174:86370 LEIAS10 NONE ----
ALSA A 1 P 24:168:00000 24:174:86370 LEIAR10 NONE ----
AMUR A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
BIAZ A 1 P 24:168:00000 24:174:86370 LEIAR25 LEIT ----
BIDA A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
BRZR A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
CACE A 1 P 24:168:00000 24:174:86370 TRM29659.00 NONE ----
CANT A 1 P 24:168:00000 24:174:86370 LEIAR25.R4 LEIT ----
CREU A 1 P 24:168:00000 24:174:86370 LEIAR25.R4 NONE ----
EBRE A 1 P 24:168:00000 24:174:86370 LEIAR25.R4 NONE ----
ELGE A 1 P 24:168:00000 24:174:86370 LEIAR25.R4 LEIT ----
EMAZ A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
GERN A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
HOND A 1 P 24:168:00000 24:174:86370 LEIAR20 LEIM ----
IGEL A 1 P 24:168:00000 24:174:86370 LEIAR20 LEIM ----
ISPS A 1 P 24:168:00000 24:174:86370 TRM59900.00 SCIS ----
KAST A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
LARE A 1 P 24:168:00000 24:174:86370 LEIAR20 LEIM ----
LAZK A 1 P 24:168:00000 24:174:86370 LEIAR25.R4 LEIT ----
LEIT A 1 P 24:168:00000 24:174:86370 LEIAR10 NONE ----
ORON A 1 P 24:168:00000 24:174:86370 LEIAR10 NONE ----
RIO1 A 1 P 24:168:00000 24:174:86370 LEIAR25.R4 LEIT ----
SALA A 1 P 24:168:00000 24:174:86370 LEIAR25 NONE ----
SCDA A 1 P 24:168:00000 24:174:86370 TRM55971.00 NONE ----
SOPU A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
TERU A 1 P 24:170:00000 24:170:86370 LEIAR20 LEIM ----
VITO A 1 P 24:168:00000 24:174:86370 LEIAS10 NONE ----
YEBE A 1 P 24:168:00000 24:174:86370 LEIAR20 LEIM ----
ZARA A 1 P 24:168:00000 24:174:86370 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	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
ALSA	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
AMUR	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
BIAZ	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
BIDA	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
BRZR	A	1	P	24:168:00000	24:174:86370	UNE	0.0771	0.0000 0.0000
CACE	A	1	P	24:168:00000	24:174:86370	UNE	0.0600	0.0000 0.0000
CANT	A	1	P	24:168:00000	24:174:86370	UNE	3.0490	0.0000 0.0000
CREU	A	1	P	24:168:00000	24:174:86370	UNE	0.0770	0.0000 0.0000
EBRE	A	1	P	24:168:00000	24:174:86370	UNE	0.0770	0.0000 0.0000
ELGE	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
EMAZ	A	1	P	24:168:00000	24:174:86370	UNE	0.0350	0.0000 0.0000
GERN	A	1	P	24:168:00000	24:174:86370	UNE	0.0771	0.0000 0.0000
HOND	A	1	P	24:168:00000	24:174:86370	UNE	0.0771	0.0000 0.0000
IGEL	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
ISPS	A	1	P	24:168:00000	24:174:86370	UNE	0.0350	0.0000 0.0000
KAST	A	1	P	24:168:00000	24:174:86370	UNE	0.0350	0.0000 0.0000
LARE	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
LAZK	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
LEIT	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
ORDN	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
RID1	A	1	P	24:168:00000	24:174:86370	UNE	0.0606	0.0000 0.0000
SALA	A	1	P	24:168:00000	24:174:86370	UNE	0.0600	0.0000 0.0000
SCDA	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
SOPU	A	1	P	24:168:00000	24:174:86370	UNE	0.0771	0.0000 0.0000
TERU	A	1	P	24:170:00000	24:170:86370	UNE	0.0600	0.0000 0.0000
VITO	A	1	P	24:168:00000	24:174:86370	UNE	0.0000	0.0000 0.0000
YEBE	A	1	P	24:168:00000	24:174:86370	UNE	0.0600	0.0000 0.0000
ZARA	A	1	P	24:168:00000	24:174:86370	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)

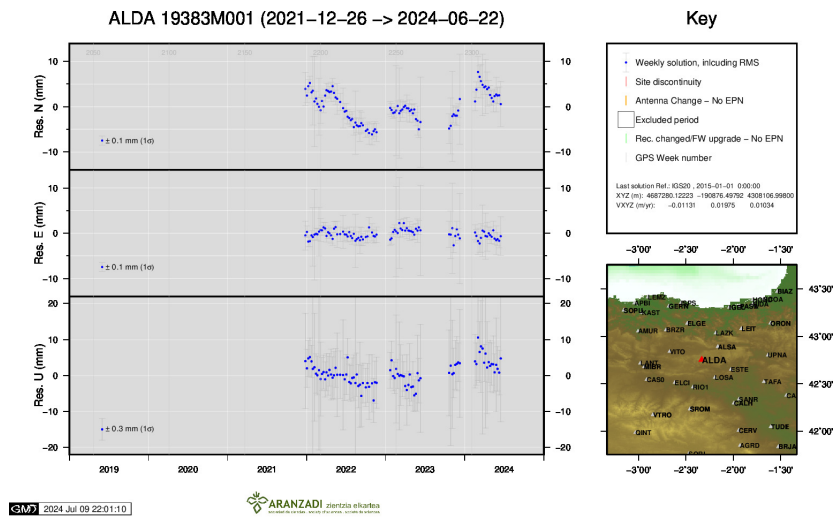
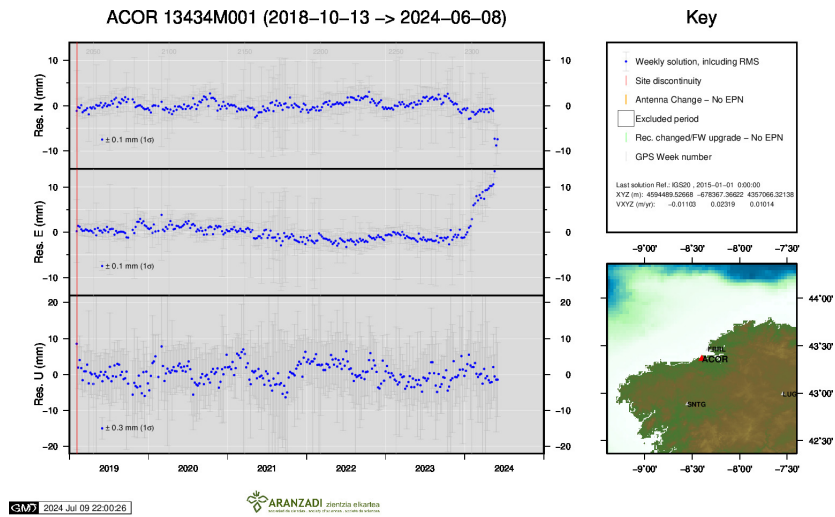
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](https://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

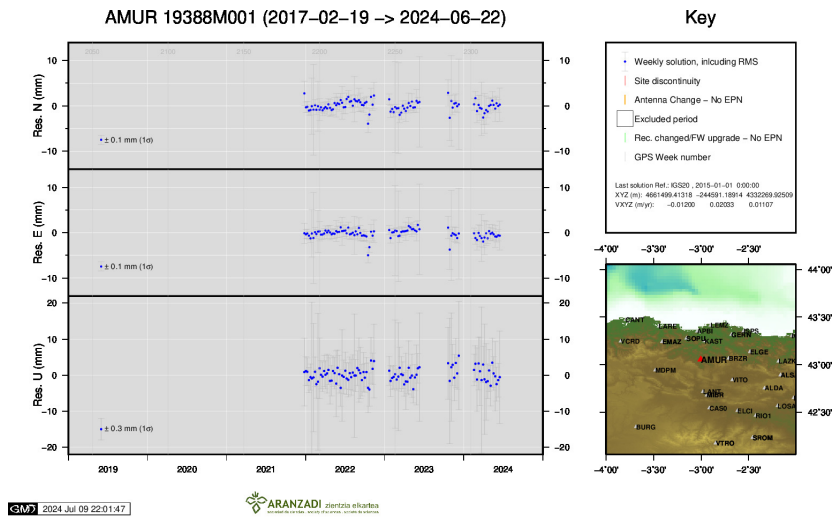
Johnston, G., Riddell, A., Hausler, G. (2017). The International GNSS Service. Teunissen, Peter J.G., Montenbruck, O. (Eds.), Springer Handbook of Global Navigation Satellite Systems (1st ed., pp. 967-982). Cham, Switzerland: Springer International Publishing. DOI: 10.1007/978-3-319-42928-1

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)

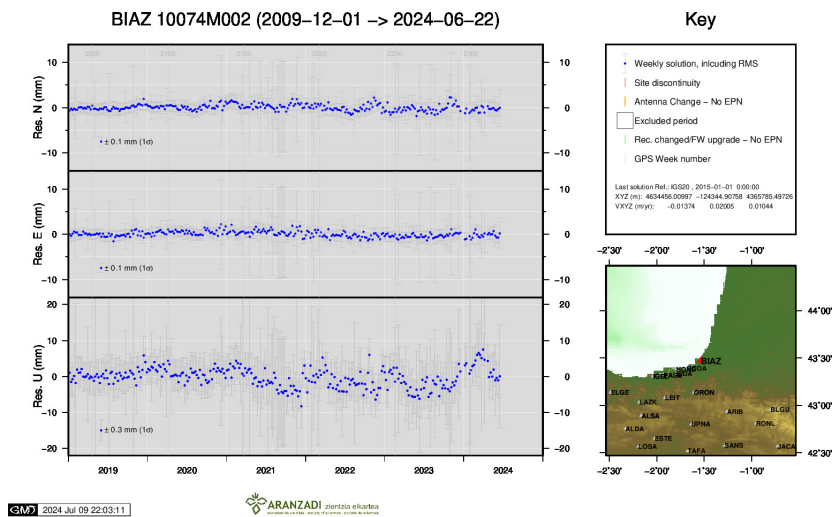
## 9 Cumulative Time Series

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

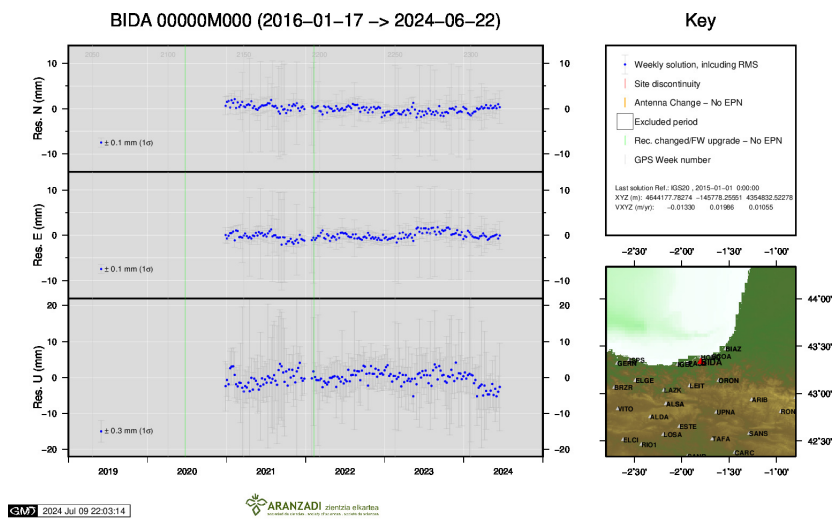




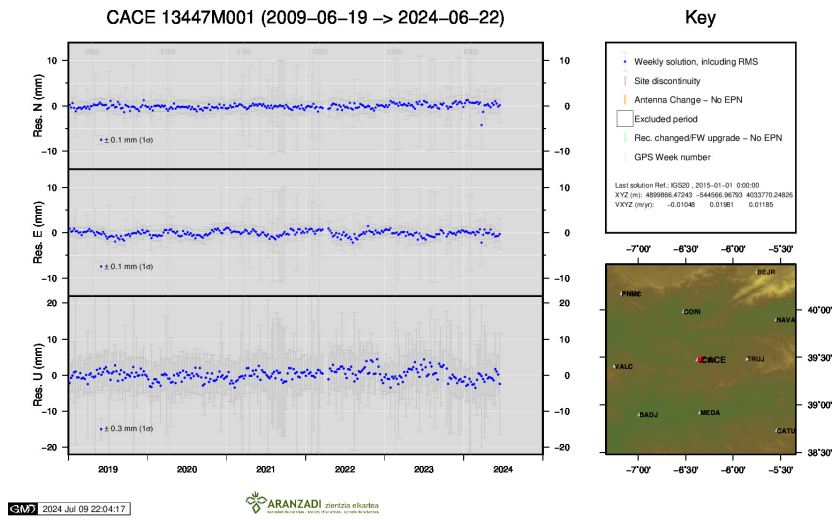
3 ) AMUR



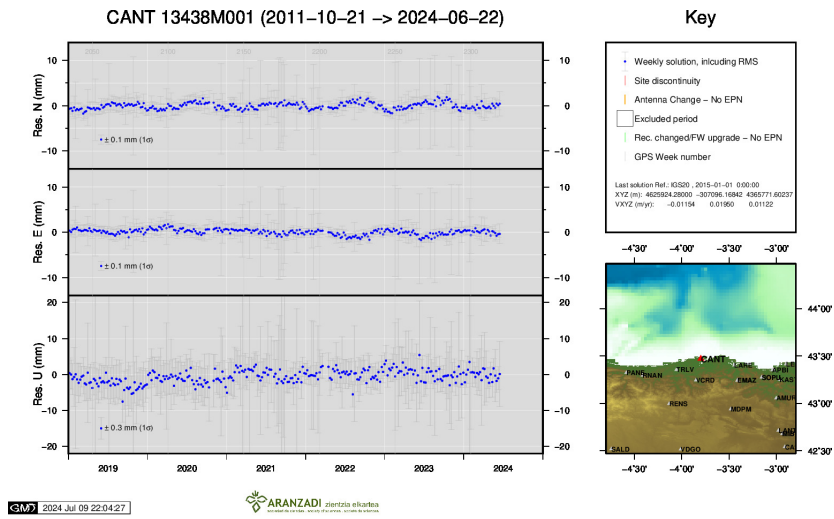
4 ) BIAZ



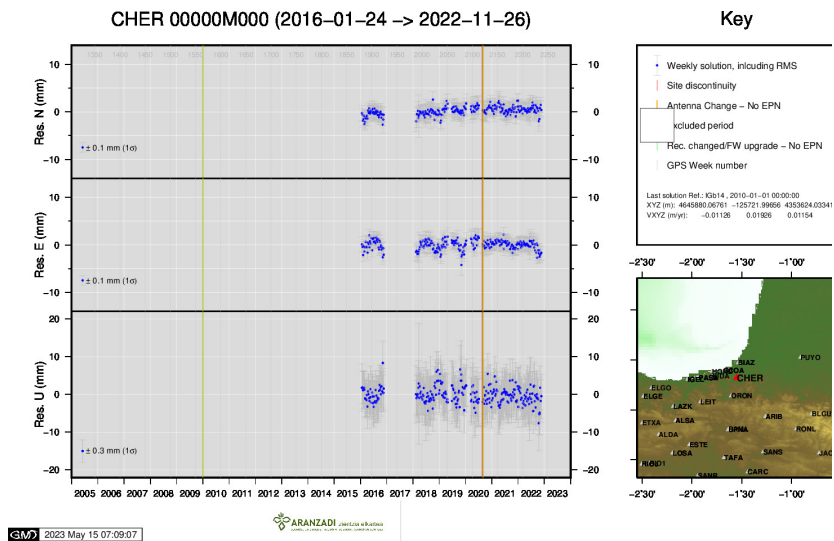
5 ) BIDA



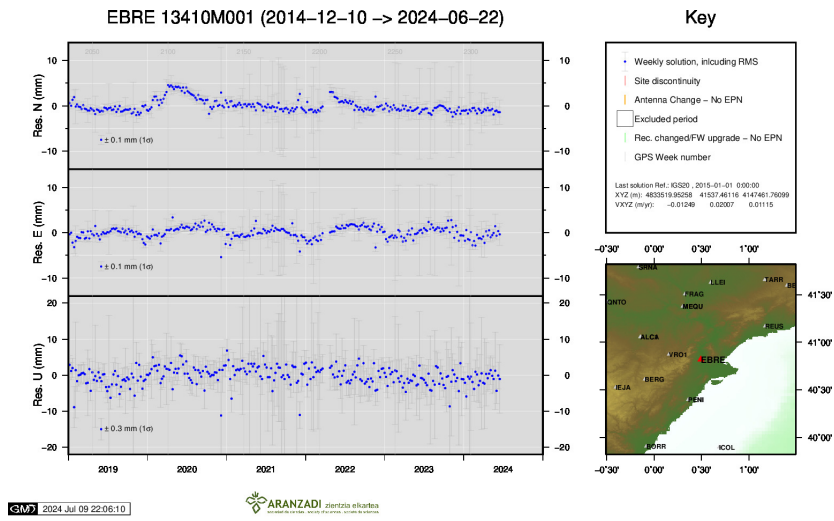
6 ) CACE



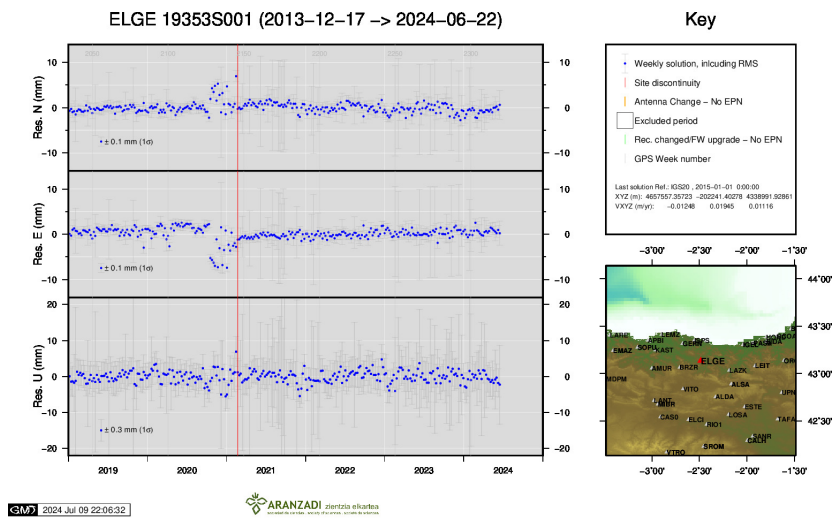
7 ) CANT



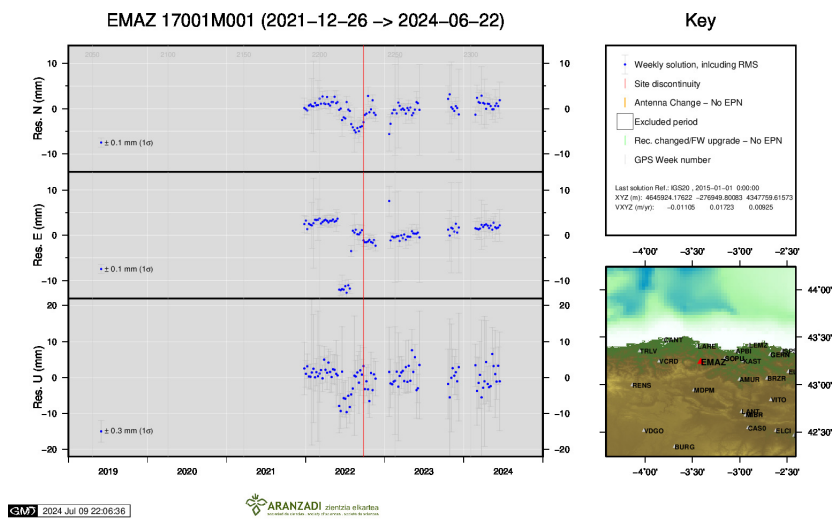
8 ) CHER



9 ) EBRE

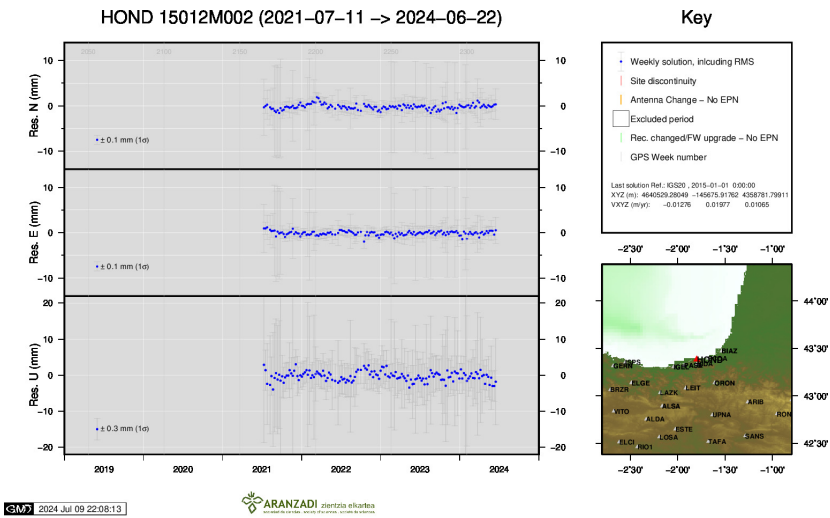


10 ) ELGE

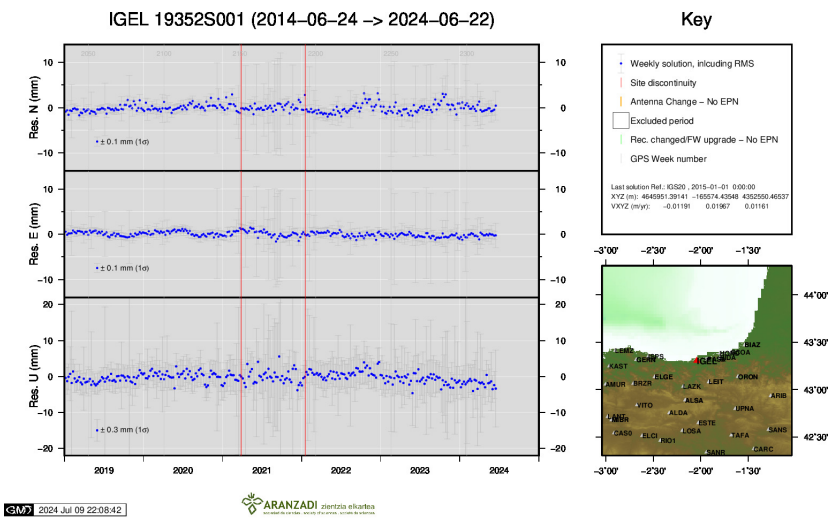


11 ) EMAZ

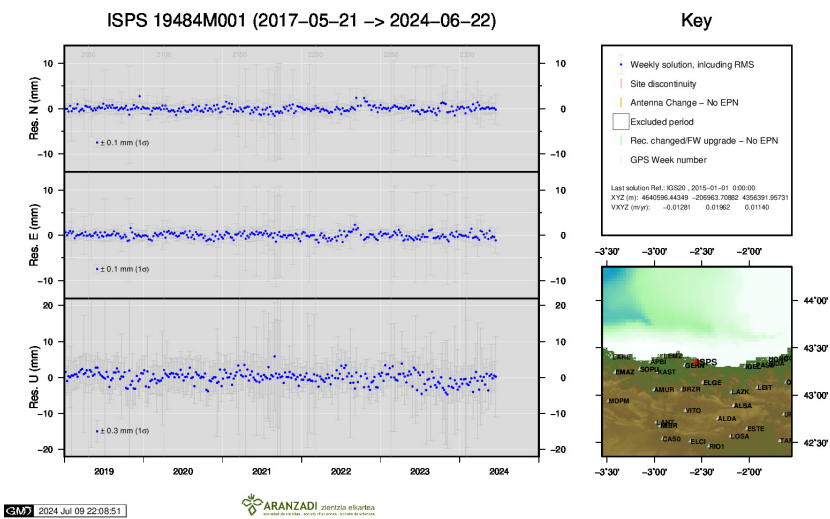




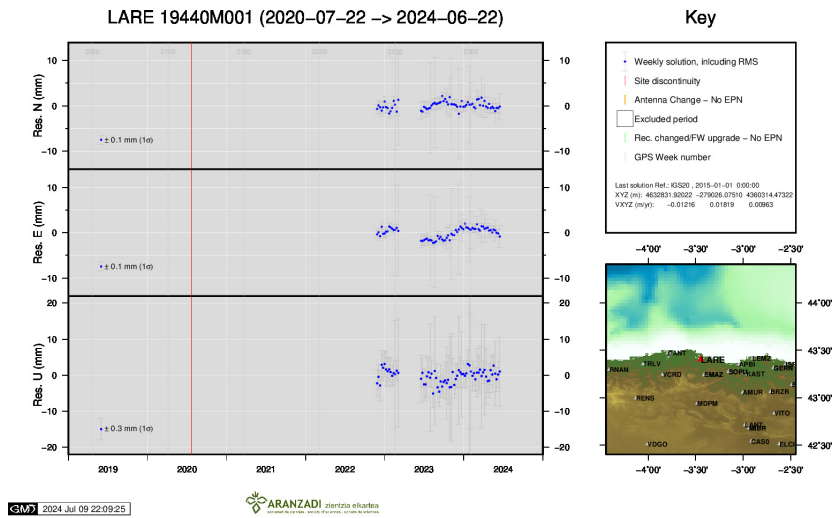
12 ) HOND



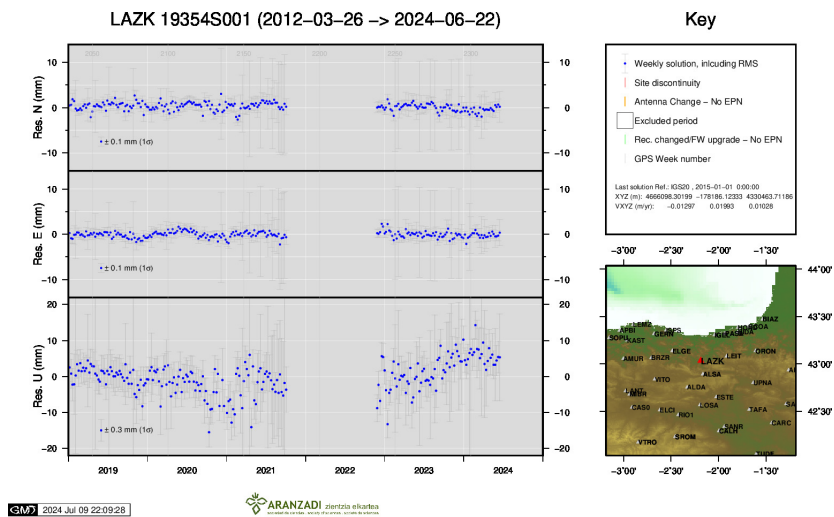
13 ) IGEL



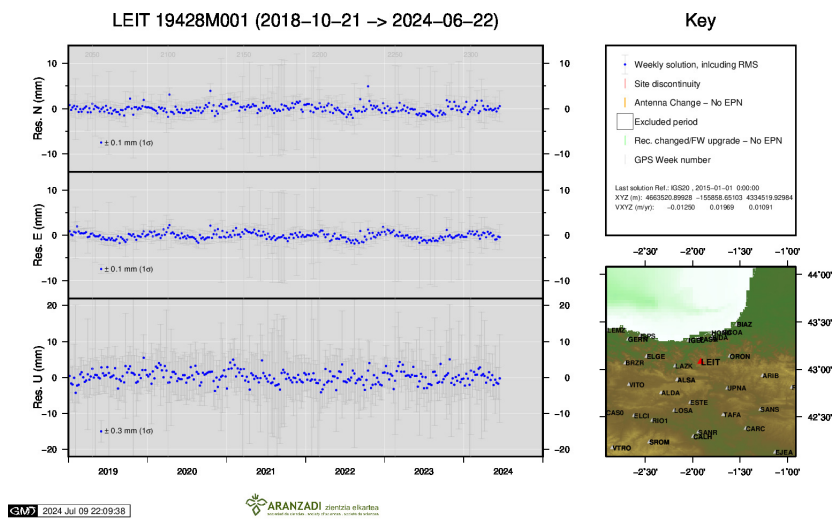
14 ) ISPS



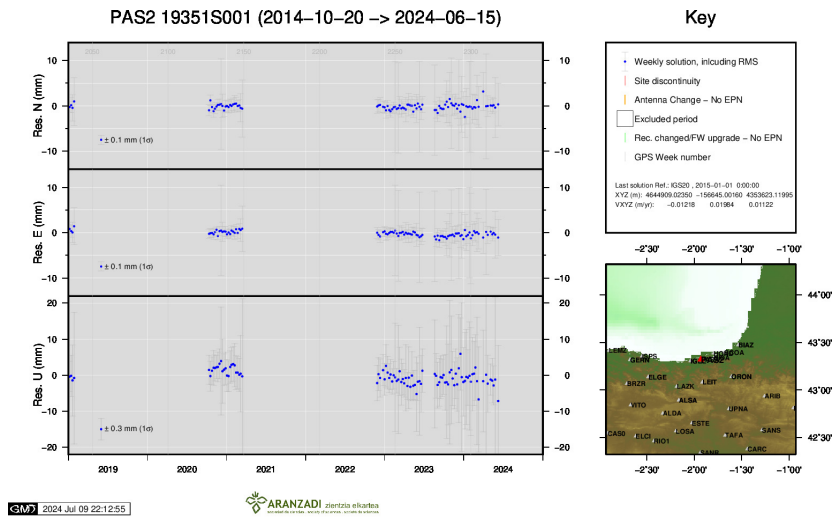
15 ) LARE



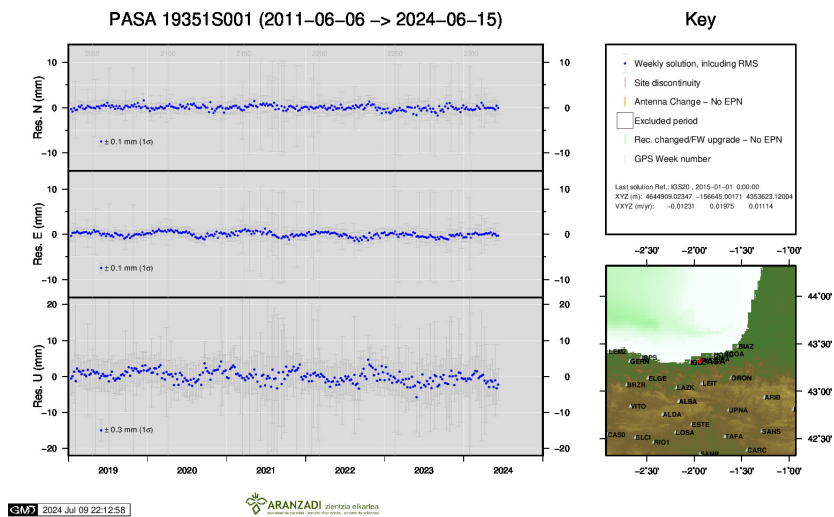
16 ) LAZK



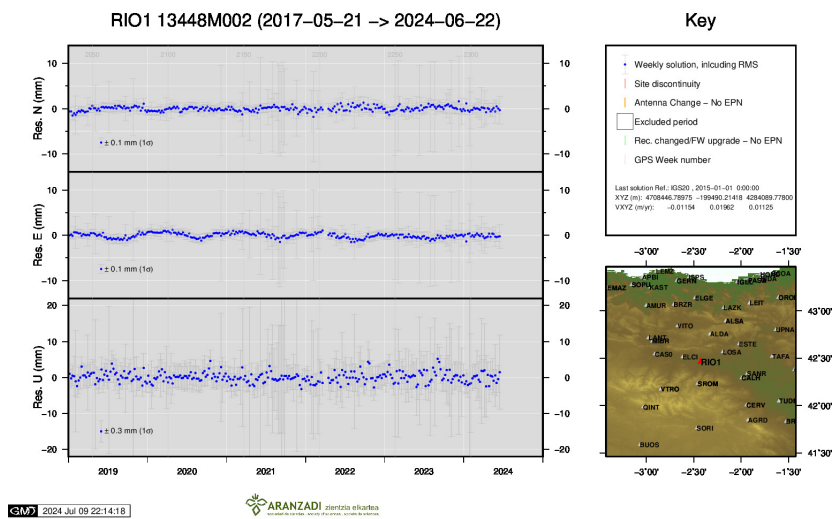
17 ) LEIT



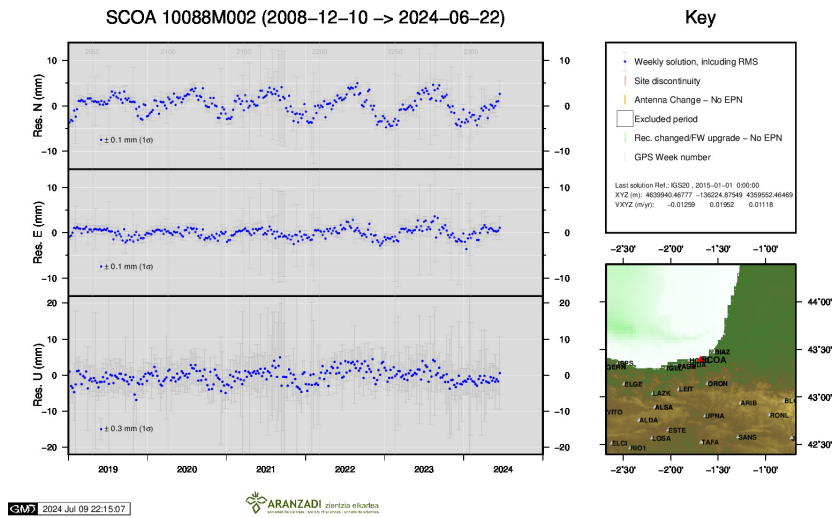
18 ) PAS2



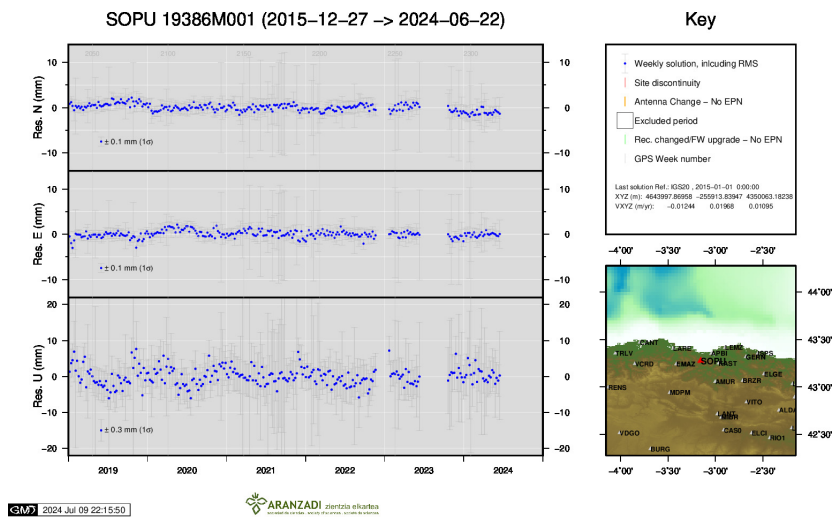
19 ) PASA



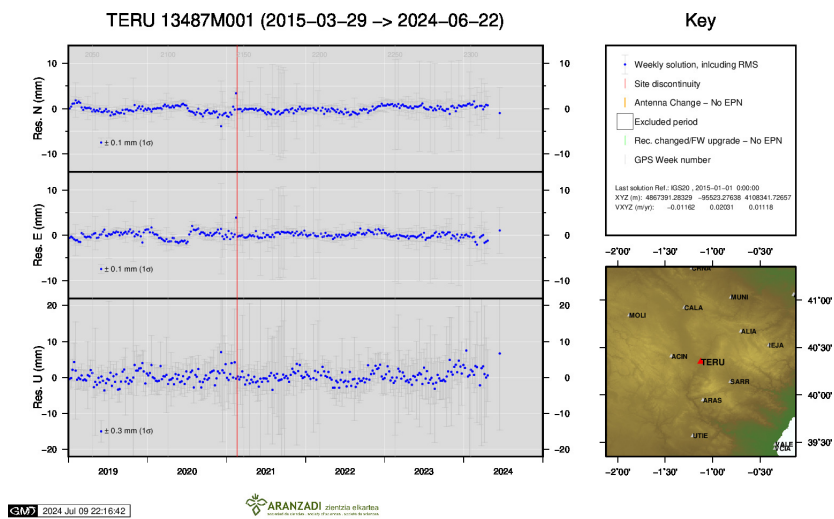
20 ) RIO1



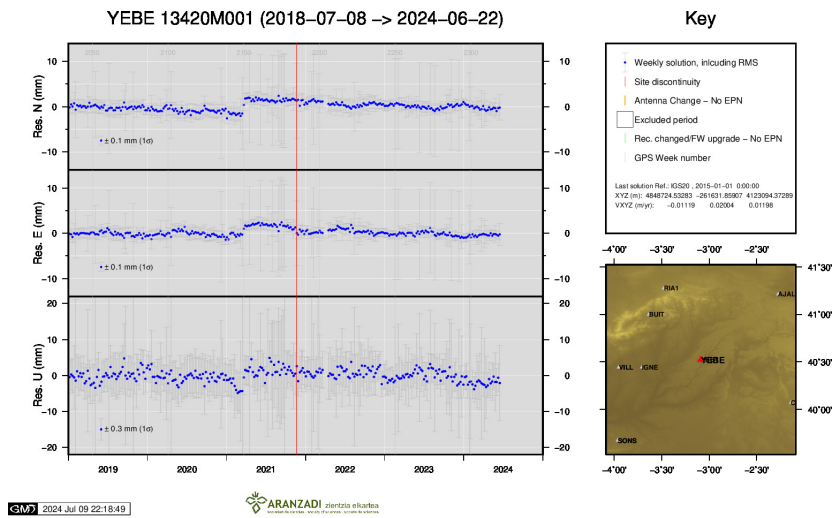
21 ) SCOA



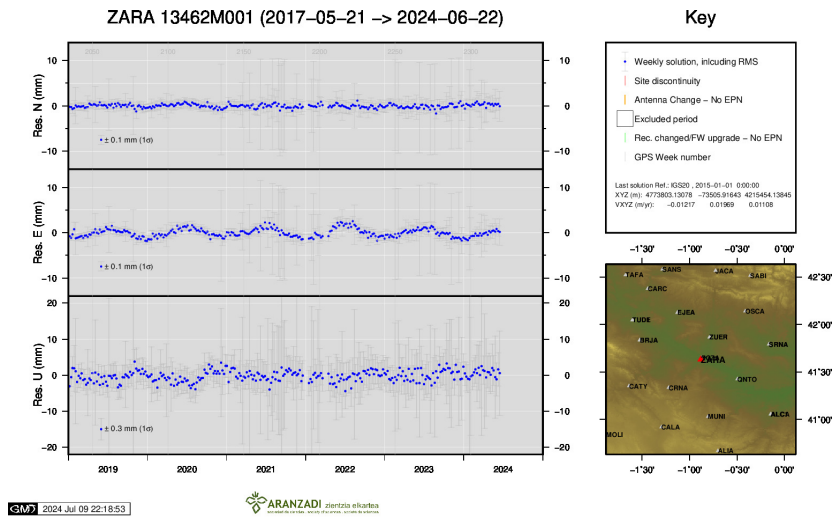
22 ) SOPU



23 ) TERU



24 ) YEBE



25 ) ZARA