

# ARA-DAC Weekly Analysis Result: 2322 (GFA)

## Technical Report

**GPS Week: 2322 (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 2024/08/20 at 12:38:12

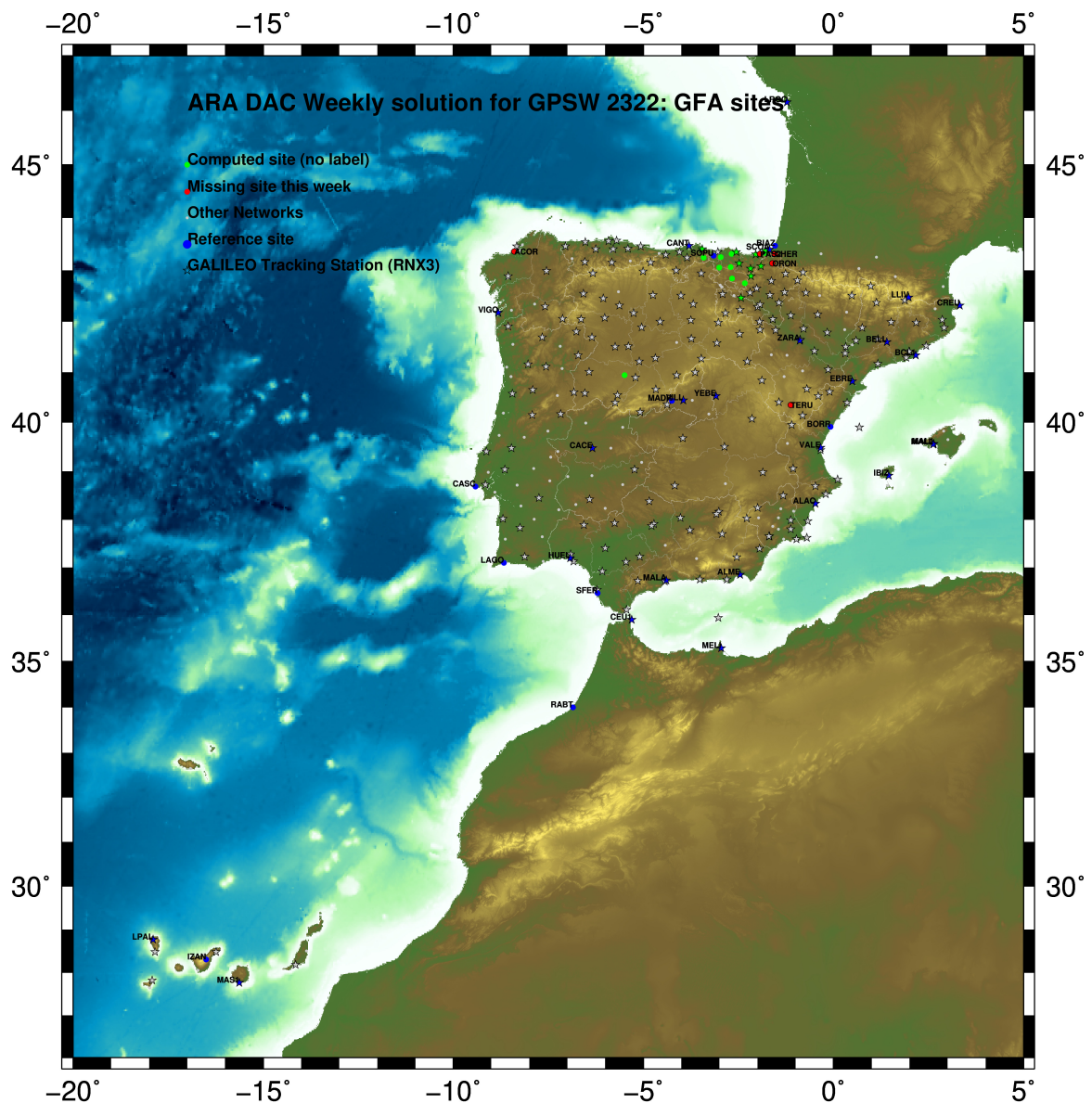


**ARANZADI** zientzia elkartea  
sociedad de ciencias . society of sciences . société de sciences

# 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 Aug 20 12:38:06

Fig.1: Computed Sites for GPS Week2322 (GFA)

### 3 Main Computation Parameters

The main parameters considered in the ARA analysis follow strictly the EPN recommendations.

- Preprocessing: Independent baselines are defined by the criterion of maximum common observations. Cycle slips are fixed with the MAUPRP program, analysing triple phase differences for each independent baseline. If MAUPRP does not fix all slips for one station, that station is edited out.
- Basic Observable : Carrier phase,  $L_1$  and  $L_2$ ; a priori sigma of single differences: 0.002 m.
  - sampling (for ambiguity resolution): 30 s
  - sampling (for final processing): 180 s
  - Systems: GPS+GLONASS observations are used (Galileo is used if available starting GPS week 1986)
- Modelled observable: Double differences of carrier phase using different combinations based on the distance.
- Ground antenna phase center calibrations: Group APCV used from the PCV\_COD.I20 file and individual calibrations from EPNC\_20.ATX. In case no calibration values of an antenna/radome pairs are not available for a certain GNSS system at some station, the observation of this/these GNSS/GNSSs are excluded from the analysis of that station.
- Reference sites: the latest IGS cumulative solution is used to align our solution to the latest IGS20 release, regularly updated and available at: IGS0OPSSNX\_1994002\_00U\_00U\_CRD.SNX.gz. Following the EUREF guidelines, no other individual calibrations are included in the analysis starting GPSW 2238 (IGS20); also applies to repro3 solutions, which are based on IGS20 standards.
- Troposphere:
  - minimum elevation is 3 deg.; elevation dependent weighting.
  - VMF3 mapping function. ZPD parameters are estimated using the VMF3 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2014b (Scherneck).
- Atmospheric loading: not corrected, following the latest recommendations for IGS20 products.
- Tidal displacements:
  - Mean pole model : IERS2010\_v1.2.0
  - Subdaily pole model: DESAI2016
  - Nutation model : IAU2000R06

### 4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria:  $3 \times \text{rms}$  of single differences, in the weekly combination of daily normal equations (ADDNEQ)
- Station coordinates: minimum constraints (MC) to IGS sites (only translations).
- Troposphere: 3 deg. After having obtained coordinates valid for the entire week, tropospheric zenith delay is solved at each site at intervals of 1 hour throughout the week, holding the coordinates constrained at the weekly values.

- Ionospheric: second and third "High Order Ionosphere (HOI)" corrections used, using CODE files, to improve Ambiguity Resolution.
- Satellite clock bias: not estimated because are eliminated by double differencing the phase data.
- Receiver clock bias: not estimated because are eliminated by double differencing the phase data.
- Orbits and ERPs: CODE's orbits and ERP for both rapid and final solutions. DE421 planetary ephemeris and JGM3 Earth geopotential model is used.
- Ambiguity: an advanced ambiguity resolution (AR) scheme is included:
  - Code-Based Widelane (WL) and Narrow Line (NR) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
  - Phase-Based Widelane ( $L_5$ ) AR for baselines shorter than 200km, the code-based wide-lane AR is replaced by a phase-only wide-lane with a subsequent narrow-lane AR.
  - Quasi-Ionosphere-Free (QIF) AR for the remaining real-valued ambiguities for baselines shorter than 2000km.
  - Direct  $L_1/L_2$  AR for baselines shorter than 20km
- AR Verification: Each baseline is processed by introducing the resolved integer ambiguities and checking the residuals. If there is any problem, the ambiguities are re-initialized.

## 5 Computed Coordinates

In this section the adjusted coordinates are summarized. Note that the sites with an A flag are the computed ones, whereas sites flagged as W (IGS cumulative solution) are the ones used in the Minimal Constraints condition.

### 5.1 IGS20

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

```

ARA FINAL WEEKLY COMBINATION: FINAL ORBITS                                20-AUG-24 11:19
-----
LOCAL GEODETIC DATUM: IGS20                EPOCH: 2024-07-10 11:59:45
-----
NUM STATION NAME          X (M)          Y (M)          Z (M)    FLAG  SYSTEM
-----
 39 ALDA 19383M001      4687280.10738    -190876.46861    4308107.01337    A    GR
 50 ALSA 19419M001      4677250.78146    -176770.29673    4319079.93607    A    GRE
 53 AMUR 19388M001      4661499.39880    -244591.15955    4332269.94272    A    GR
 384 BIAZ 10074M002      4634455.99057    -124344.87785    4365785.51347    W    GR
 101 BIDA 00000M000      4644177.76099    -145778.22539    4354832.53730    A    GR
 113 BRZR 19387M001      4662220.93514    -220769.80138    4333309.49525    A    GR
 573 CACE 13447M001      4899866.45693    -544566.93923    4033770.26643    W    GRE
 592 CANT 13438M001      4625924.26426    -307096.14050    4365771.62092    W    GRE
 908 CREU 13432M001      4715420.07106    273178.15850    4271946.90459    W    GRE
 135 EBRE 13410M001      4833519.93534    41537.49121    4147461.77640    W    GRE
 180 ELGE 19353S001      4657557.33843    -202241.37322    4338991.94570    A    GRE
 182 EMAZ 17001M001      4645924.15967    -276949.77307    4347759.63198    A    GR
 209 GERN 19389M001      4642811.26390    -217222.83036    4353278.93681    A    GR
 257 HOND 15012M002      4640529.26107    -145675.88745    4358781.81498    A    GRE
 235 IGEL 19352S001      4645951.37383    -165574.40638    4352550.48326    A    GRE
 240 ISPS 19484M001      4640596.42483    -206963.68042    4356391.97510    A    GRE
 245 KAST 19499M001      4646949.02141    -240747.17140    4348015.05185    A    GR
 252 LARE 19440M001      4632831.90446    -279026.04962    4360314.48919    A    GRE
 256 LAZK 19354S001      4666098.28919    -178186.09450    4330463.73442    A    GRE
 261 LEIT 19428M001      4663520.88194    -155858.62198    4334519.94778    A    GRE
 493 PASA 19351S001      4644909.00532    -156644.97271    4353623.13727    A    GRE
 553 RID1 13448M002      4708446.77257    -199490.18596    4284089.79508    A    GRE
 558 SALA 13469M001      4803054.43466    -462130.97197    4158379.13815    A    GR
 526 SCDA 10088M002      4639940.44801    -136224.84370    4359552.48485    W    GRE
 715 SOPU 19386M001      4643997.85379    -255913.81091    4350063.20048    W    GR
 493 VITO 19385M001      4679397.64774    -218436.40795    4314898.42983    A    GR
 616 YEBE 13420M001      4848724.51622    -261631.82922    4123094.39016    W    GRE
 655 ZARA 13462M001      4773803.11268    -73505.88660    4215454.15564    W    GRE
    
```

### 5.2 ETRF2000 (ETRS89) Coordinates

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

```

CONVERT TO ETRF2000                                                    20-AUG-24 11:19
-----
LOCAL GEODETIC DATUM: ETRF2000                EPOCH: 2024-07-10 11:59:45
-----
NUM STATION NAME          X (M)          Y (M)          Z (M)    FLAG  SYSTEM
-----
 39 ALDA 19383M001      4687280.51513    -190877.11691    4308106.53095    A
 50 ALSA 19419M001      4677251.19202    -176770.94377    4319079.45373    A
 53 AMUR 19388M001      4661499.79817    -244591.80485    4332269.46180    A
 384 BIAZ 10074M002      4634456.41209    -124345.51953    4365785.03662    W
 101 BIDA 00000M000      4644178.17869    -145778.86832    4354832.05930    A
 113 BRZR 19387M001      4662221.34085    -220770.44672    4333309.01461    A
 573 CACE 13447M001      4899866.79398    -544567.61387    4033769.76023    W
 592 CANT 13438M001      4625924.66082    -307096.78162    4365771.14224    W
 908 CREU 13432M001      4715420.53915    273177.50839    4271946.42615    W
 135 EBRE 13410M001      4833520.36171    41536.82597    4147461.28435    W
 180 ELGE 19353S001      4657557.74714    -202242.01794    4338991.46573    A
 182 EMAZ 17001M001      4645924.55889    -276950.41657    4347759.15198    A
 209 GERN 19389M001      4642811.67172    -217223.47332    4353278.45792    A
 257 HOND 15012M002      4640529.67910    -145676.52993    4358781.33730    A
 235 IGEL 19352S001      4645951.78864    -165575.04958    4352550.00483    A
 240 ISPS 19484M001      4640596.83430    -206964.32308    4356391.49655    A
 245 KAST 19499M001      4646949.42559    -240747.81492    4348014.57227    A
 252 LARE 19440M001      4632832.30441    -279026.69152    4360314.01031    A
 256 LAZK 19354S001      4666098.70048    -178186.74018    4330463.25404    A
 261 LEIT 19428M001      4663521.29661    -155859.26730    4334519.46794    A
 493 PASA 19351S001      4644909.42144    -156645.61576    4353622.65905    A
 553 RID1 13448M002      4708447.17718    -199490.83684    4284089.31067    A
 558 SALA 13469M001      4803054.79315    -462131.63487    4158378.64168    A
 526 SCDA 10088M002      4639940.86740    -136225.48608    4359552.00736    W
 715 SOPU 19386M001      4643998.25606    -255914.45411    4350062.72094    W
 493 VITO 19385M001      4679398.05227    -218437.05536    4314897.94771    A
 616 YEBE 13420M001      4848724.89923    -261632.49720    4123093.89252    W
 655 ZARA 13462M001      4773803.52890    -73506.54503    4215453.66725    W
    
```

### 5.3 ETRF2014 (ETRS89) Coordinates

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

```

CONVERT TO ETRF2014                                20-AUG-24 11:19
-----
LOCAL GEODETIC DATUM: ETRF2014                    EPOCH: 2024-07-10 11:59:45
NUM  STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
39  ALDA 19383M001     4687280.47269 -190877.15506 4308106.58340  A
50  ALSA 19419M001     4677251.14965 -176770.98202 4319079.50622  A
53  AMUR 19388M001     4661499.75621 -244591.84292 4332269.51431  A
384 BIAZ 10074M002     4634456.37000 -124345.55817 4365785.08928  W
101 BIDA 00000M000     4644178.13657 -145778.90683 4354832.11191  A
113 BRZR 19387M001     4662221.29880 -220770.48487 4333309.06712  A
573 CACE 13447M001     4899866.75016 -544567.64971 4033769.81196  W
592 CANT 13438M001     4625924.61946 -307096.81961 4365771.19484  W
908 CREU 13432M001     4715420.49459 273177.46865 4271946.47886  W
135 EBRE 13410M001     4833520.31672 41536.78762 4147461.33653  W
180 ELGE 19353S001     4657557.70507 -202242.05618 4338991.51827  A
182 EMAZ 17001M001     4645924.51721 -276950.45458 4347759.20452  A
209 GERN 19389M001     4642811.62987 -217223.51157 4353278.51050  A
257 HOND 15012M002     4640529.63703 -145676.56847 4358781.38993  A
235 IGEL 19352S001     4645951.74658 -165575.08801 4352550.05742  A
240 ISPS 19484M001     4640596.79244 -206964.36138 4356391.54914  A
245 KAST 19499M001     4646949.38377 -240747.85307 4348014.62482  A
252 LARE 19440M001     4632832.26288 -279026.72958 4360314.06289  A
256 LAZK 19354S001     4666098.65824 -178186.77848 4330463.30656  A
261 LEIT 19428M001     4663521.25432 -155859.30569 4334519.52048  A
493 PASA 19351S001     4644909.37935 -156645.65423 4353622.71166  A
553 RIO1 13448M002     4708447.13453 -199490.87487 4284089.36306  A
558 SALA 13469M001     4803054.75026 -462131.67147 4158378.69368  A
526 SOGA 10088M002     4639940.82529 -136225.52465 4359552.05999  W
715 SOPU 19386M001     4643998.21433 -255914.49221 4350062.77350  W
493 VITO 19385M001     4679398.01002 -218437.09345 4314898.00018  A
616 YEBE 13420M001     4848724.85516 -261632.53435 4123093.94447  W
655 ZARA 13462M001     4773803.48505 -73506.58322 4215453.71951  W

```

## 6 Quality Control

### 6.1 Mean and Daily Repeatabilities

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

GFA FINAL WEEKLY COMBINATION: FINAL ORBITS		20-AUG-24 11:19			
Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ALDA 19383M001	7	XXXXXX	1.56	1.27	3.55
ALSA 19419M001	6	XXXXX X	4.83	1.29	4.75
AMUR 19388M001	7	XXXXXX	1.37	0.89	4.75
BLAZ 10074M002	6	XXXX XX	1.18	0.99	5.36
BIDA 00000M000	7	XXXXXX	1.24	1.33	3.75
BRZR 19387M001	7	XXXXXX	0.91	1.49	2.70
CACE 13447M001	7	XXXXXX	2.57	1.42	4.17
CANT 13438M001	7	XXXXXX	1.07	0.76	2.98
CREU 13432M001	7	XXXXXX	1.70	0.89	6.70
EBRE 13410M001	7	XXXXXX	1.38	0.68	5.68
ELGE 19353S001	7	XXXXXX	1.06	0.79	2.01
EMAZ 17001M001	7	XXXXXX	0.72	0.68	5.82
GERN 19389M001	7	XXXXXX	0.87	1.59	3.95
HOND 15012M002	7	XXXXXX	1.12	1.16	2.11
IGEL 19352S001	7	XXXXXX	1.20	1.19	4.10
ISPS 19484M001	7	XXXXXX	1.54	2.01	4.26
KAST 19499M001	7	XXXXXX	1.33	0.95	6.20
LARE 19440M001	7	XXXXXX	1.04	1.15	4.29
LAZK 19354S001	7	XXXXXX	1.40	1.20	3.63
LEIT 19428M001	6	XXXX X	1.05	1.50	3.10
PASA 19351S001	7	XXXXXX	1.43	1.39	3.48
RI01 13448M002	7	XXXXXX	0.85	0.93	4.08
SALA 13469M001	7	XXXXXX	1.68	0.75	2.41
SCDA 10088M002	7	XXXXXX	1.14	1.08	1.73
SOPU 19386M001	7	XXXXXX	0.75	0.91	3.96
VITO 19385M001	7	XXXXXX	1.04	0.90	3.08
YEBE 13420M001	7	XXXXXX	1.24	0.66	4.16
ZARA 13462M001	7	XXXXXX	0.64	1.15	2.08

Comparison of individual solutions:

ALDA 19383M001	N	1.56	2.54	-0.31	-1.49	0.87	1.97	0.98	0.41
ALDA 19383M001	E	1.27	-0.64	1.26	0.43	-0.72	-1.81	-1.91	0.15
ALDA 19383M001	U	3.55	-0.63	4.29	-1.30	0.19	-6.73	-3.12	-0.03
ALSA 19419M001	N	4.83	4.14	-5.36	-6.00	2.99	3.97		3.20
ALSA 19419M001	E	1.29	-1.31	0.50	2.13	-0.64	-1.18		0.03
ALSA 19419M001	U	4.75	-4.65	3.75	-8.07	2.45	-1.87		1.54
AMUR 19388M001	N	1.37	1.13	-0.59	-0.50	-0.09	2.96	0.28	0.72
AMUR 19388M001	E	0.89	-0.34	-0.19	0.93	0.68	0.19	-1.64	-0.75
AMUR 19388M001	U	4.75	-5.64	-5.15	3.40	3.45	-5.30	0.59	-5.02
BLAZ 10074M002	N	1.18	2.45	0.16	0.57	-0.50		-0.45	0.37
BLAZ 10074M002	E	0.99	1.80	0.69	-0.54	-0.20		-0.32	-0.87
BLAZ 10074M002	U	5.36	-9.42	-4.09	-2.39	4.66		2.19	-2.45
BIDA 00000M000	N	1.24	1.86	0.49	-0.89	0.03	-1.28	1.44	0.99
BIDA 00000M000	E	1.33	1.83	1.16	-0.61	0.55	-0.59	-2.15	-0.47
BIDA 00000M000	U	3.75	-4.59	-2.26	-2.25	-0.12	4.64	-5.63	0.00
BRZR 19387M001	N	0.91	0.19	0.89	-1.04	1.32	-0.57	0.74	0.66
BRZR 19387M001	E	1.49	-0.04	-1.11	-0.95	1.83	-2.78	0.45	0.05
BRZR 19387M001	U	2.70	-1.81	3.20	-2.06	-3.80	-0.20	3.39	-0.35
CACE 13447M001	N	2.57	-0.25	-0.81	-1.08	0.25	0.66	-6.11	0.27
CACE 13447M001	E	1.42	-1.02	-1.00	1.64	1.29	2.40	0.06	0.08
CACE 13447M001	U	4.17	0.88	0.27	5.46	7.40	0.28	-1.65	4.04
CANT 13438M001	N	1.07	2.04	0.08	0.24	1.09	-0.09	0.20	-1.18
CANT 13438M001	E	0.76	1.38	0.07	-0.59	-0.80	0.48	-0.23	-0.54
CANT 13438M001	U	2.98	-4.80	-2.91	-1.65	-1.01	-4.20	-0.32	0.58
CREU 13432M001	N	1.70	2.33	0.20	0.04	-0.47	0.14	3.27	-0.91
CREU 13432M001	E	0.89	0.82	-0.43	-1.50	-1.03	0.17	0.33	0.65
CREU 13432M001	U	6.70	-14.17	-3.23	1.84	-3.91	3.64	3.45	-3.73
EBRE 13410M001	N	1.38	1.36	0.32	1.01	1.51	-0.46	1.94	-1.45
EBRE 13410M001	E	0.68	-0.10	-1.17	0.74	-0.56	-0.55	-0.42	0.32
EBRE 13410M001	U	5.68	1.85	-9.92	-4.02	-7.16	4.88	-0.33	0.11
ELGE 19353S001	N	1.06	0.42	1.38	-0.91	-1.09	1.18	0.01	1.11
ELGE 19353S001	E	0.79	-1.18	-0.33	-0.98	0.07	0.51	0.14	-0.97
ELGE 19353S001	U	2.01	-1.10	-0.11	2.30	1.02	-3.69	0.87	-1.49
EMAZ 17001M001	N	0.72	1.23	0.21	-0.33	0.71	-0.12	-0.49	0.85
EMAZ 17001M001	E	0.68	1.33	-0.47	-0.57	-0.16	0.44	0.10	-0.44
EMAZ 17001M001	U	5.82	-8.95	-3.75	4.31	0.48	-0.49	3.83	-8.66
GERN 19389M001	N	0.87	1.57	-0.22	-0.21	-0.40	0.89	0.07	1.01
GERN 19389M001	E	1.59	1.71	0.22	1.21	-3.17	-0.62	-0.39	0.51
GERN 19389M001	U	3.95	-7.58	-4.84	-0.53	-1.50	2.94	-0.19	1.21
HOND 15012M002	N	1.12	2.30	-0.41	-0.88	0.18	0.93	0.61	0.08
HOND 15012M002	E	1.16	2.17	-0.06	0.12	0.18	-0.84	-1.57	-0.31
HOND 15012M002	U	2.11	-2.47	-0.99	0.59	-0.20	-1.58	-2.29	-3.38
IGEL 19352S001	N	1.20	1.87	1.40	-0.58	0.95	-0.94	-0.71	0.76
IGEL 19352S001	E	1.19	2.38	-0.25	-1.25	0.23	-0.85	-0.61	0.00
IGEL 19352S001	U	4.10	-6.94	0.28	3.17	-1.72	2.26	-1.29	-5.74
ISPS 19484M001	N	1.54	2.97	1.74	-0.69	-1.05	-0.40	-0.43	0.65
ISPS 19484M001	E	2.01	2.52	2.20	-0.85	-3.43	-0.18	-0.65	-0.18
ISPS 19484M001	U	4.26	-6.51	-6.72	2.05	-1.03	2.75	1.53	-2.46
KAST 19499M001	N	1.33	1.73	0.64	-0.19	-1.13	-0.97	2.15	0.58
KAST 19499M001	E	0.95	-0.21	-0.31	-0.25	1.83	-1.06	0.16	-0.81
KAST 19499M001	U	6.20	-7.98	-6.22	2.56	-0.15	-2.88	9.40	-4.98
LARE 19440M001	N	1.04	0.60	0.90	-0.00	0.73	0.49	-1.82	1.12
LARE 19440M001	E	1.15	2.04	0.48	-0.63	-0.07	-1.74	0.15	-0.40
LARE 19440M001	U	4.29	-3.87	5.97	-0.26	-1.82	-2.05	-5.54	-4.67
LAZK 19354S001	N	1.40	0.25	-1.55	-0.67	1.26	2.40	0.45	1.13
LAZK 19354S001	E	1.20	-0.43	-1.54	0.53	0.99	1.49	-0.76	-1.40
LAZK 19354S001	U	3.63	-2.99	3.99	-5.01	1.26	-5.11	-0.04	-1.20
LEIT 19428M001	N	1.05	1.76	0.13	1.30	-0.43	0.71		0.11
LEIT 19428M001	E	1.50	1.47	1.32	-2.18	1.00	-1.20		-0.26
LEIT 19428M001	U	3.10	-5.74	-3.30	-1.43	1.36	-0.38		-0.49
PASA 19351S001	N	1.43	2.63	-1.55	0.23	-0.58	1.30	-0.14	0.90
PASA 19351S001	E	1.39	2.85	0.03	-0.66	0.09	-0.93	-1.43	-0.29
PASA 19351S001	U	3.48	-6.87	1.50	-1.25	-1.00	1.98	-0.39	-4.09

RID1	13448M002	N	0.85	0.33	-0.14	1.67	1.14	0.38	0.15	-0.06
RID1	13448M002	E	0.93	-0.26	0.70	0.55	-1.11	0.82	-1.52	-0.40
RID1	13448M002	U	4.08	2.42	3.11	-1.96	1.38	-6.95	-5.38	1.23
SALA	13469M001	N	1.68	0.62	-0.81	-0.69	0.21	-0.96	-3.73	0.70
SALA	13469M001	E	0.75	0.18	-0.73	1.48	0.42	0.22	0.55	-0.38
SALA	13469M001	U	2.41	2.08	3.66	2.50	-0.80	-1.09	-0.92	2.88
SCDA	10088M002	N	1.14	1.04	-0.92	-0.38	0.02	0.15	2.36	-0.39
SCDA	10088M002	E	1.08	0.57	1.54	-0.55	0.70	0.52	-1.18	-1.37
SCDA	10088M002	U	1.73	-1.03	0.23	-0.54	-3.02	0.46	-2.69	-0.34
SOPU	19386M001	N	0.75	0.94	1.29	0.10	-0.32	0.37	0.70	-0.30
SOPU	19386M001	E	0.91	0.66	-0.28	0.73	0.75	-1.01	-1.55	0.02
SOPU	19386M001	U	3.96	-5.10	-1.65	3.17	3.16	-3.13	-5.72	-1.69
VITO	19385M001	N	1.04	0.69	-0.13	-0.87	0.87	1.99	0.43	0.58
VITO	19385M001	E	0.90	0.83	0.94	-1.03	-0.41	-1.18	-0.79	-0.31
VITO	19385M001	U	3.08	-5.55	-2.34	-2.19	-0.50	-0.21	0.53	-3.89
YEBE	13420M001	N	1.24	0.49	-0.93	-0.41	0.02	-2.03	-1.80	0.78
YEBE	13420M001	E	0.66	0.64	0.30	0.42	0.91	0.61	-0.61	-0.63
YEBE	13420M001	U	4.16	6.21	3.80	3.10	4.67	-2.47	-2.64	-2.51
ZARA	13462M001	N	0.64	0.69	-0.46	0.28	0.47	0.82	0.68	0.60
ZARA	13462M001	E	1.15	0.40	-0.30	0.24	1.15	0.49	-2.44	-0.38
ZARA	13462M001	U	2.08	-2.70	-2.68	1.18	-2.00	2.26	0.06	0.94



## 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       -3.44   -23.76   -42.45

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS			
1	ALAC 13433M001	I W	-0.30	-0.41	1.23	
2	ALME 13437M001	I W	0.36	0.63	4.13	
3	BCL1 19482M001	I W	-0.24	-2.59	1.65	
4	BELL 13431M001	I W	-1.70	-0.56	3.96	
5	BIAZ 10074M002	I W	0.35	-0.01	-1.47	
6	BORR 13480M001	I W	-2.93	2.04	-3.60	
7	BRST 10004M004	I W	-1.52	-1.11	7.51	
8	CACE 13447M001	I W	0.96	2.05	3.45	
9	CANT 13438M001	I W	0.26	1.66	-4.26	
10	CASC 13909S001	I W	0.35	-0.57	8.94	
11	CEU1 13449M002	I W	1.29	-0.51	-8.01	
12	CREU 13432M001	A W	-3.54	-24.40	-43.60	
13	EBRE 13410M001	I W	1.02	0.68	-0.36	
15	FLRS 31907M001	I W	0.01	-1.44	-5.30	
17	HUEL 13451M001	I W	2.17	3.25	-7.31	
18	IBIZ 13454S001	I W	-1.43	0.84	1.12	
19	IZAN 31309M002	I W	0.01	0.63	-4.18	
20	LAGO 13903M001	I W	1.12	-0.24	1.75	
21	LLIV 13436M001	I W	-3.57	0.24	6.92	
22	LPAL 81701M001	I W	2.63	0.75	-6.60	
23	LROC 10023M001	I W	0.72	-0.29	-0.06	
24	MADR 13407S012	I W	0.33	3.77	-3.08	
25	MAL1 13444M002	I W	3.99	-2.33	-4.79	
26	MALA 13443M001	I W	1.56	-2.08	3.94	
27	MALL 13444M001	I W	-1.28	-0.66	2.17	
28	MAS1 31303M002	I W	-0.55	-1.16	0.37	
29	MELI 19379M001	I W	0.61	-1.08	0.04	
30	PDEL 31906M004	I W	1.76	0.89	5.49	
31	RABT 35001M002	I W	1.54	-1.58	-3.26	
32	SCOA 10088M002	I W	-4.77	-2.63	-11.54	
33	SFER 13402M004	I W	-1.93	-4.81	3.38	
34	SOPU 19386M001	I W	-0.56	1.21	-1.08	
35	VALE 13439M001	I W	-1.26	1.11	-4.78	
36	VIGO 13450M001	I W	1.24	1.81	0.34	
37	VILL 13406M001	I W	-0.77	-0.15	0.03	
38	YEBE 13420M001	I W	-0.66	-0.64	3.45	
39	ZARA 13462M001	I W	-1.06	-0.48	-1.24	
40	ZIMM 14001M004	I W	-0.86	-1.10	8.70	
RMS / COMPONENT			1.71	1.70	4.80	
IQR			2.07	1.94	7.04	
MEAN			-0.08	-0.13	-0.06	
MEDIAN			0.01	-0.29	0.04	
MIN			-4.77	-4.81	-11.54	
MAX			3.99	3.77	8.94	
OVERALL RMS/IQR/MAX(3D)			3.10	2.52	12.76	
					SCOA 10088M002	#SUM
ALL RMS / COMPONENT			1.78	4.35	8.59	
ALL IQR			2.27	1.95	7.62	
ALL MEAN			-0.17	-0.77	-1.21	
ALL MEDIAN			0.01	-0.35	0.03	
ALL MIN			-4.77	-24.40	-43.60	
ALL MAX			3.99	3.77	8.94	
ALL OVERALL RMS/IQR/MAX(3D)			5.65	2.67	50.09	
					CREU 13432M001	#SUM_ALL

NUMBER OF PARAMETERS : 3  
NUMBER OF STATIONS : 37  
NUMBER OF COORDINATES : 111  
RMS OF TRANSFORMATION : 3.10 MM

PARAMETERS:

TRANSLATION IN X : 0.74 +- 0.51 MM  
TRANSLATION IN Y : 0.68 +- 0.51 MM  
TRANSLATION IN Z : 0.84 +- 0.51 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          18998978
NUMBER OF UNKNOWN(S)            197573
NUMBER OF DEGREES OF FREEDOM    18801405
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)      180
VARIANCE FACTOR                  2.756700624670251
```

## 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 24:189:00000 24:195:86370 LEICA GR30 -----
ALSA A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
AMUR A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
BIAZ A 1 P 24:189:00000 24:195:86370 SPECTRA SP90M -----
BIDA A 1 P 24:189:00000 24:195:86370 LEICA GR10 -----
BRZR A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
CACE A 1 P 24:189:00000 24:195:86370 TRIMBLE NETR9 -----
CANT A 1 P 24:189:00000 24:195:86370 LEICA GR10 -----
CREU A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
EBRE A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
ELGE A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
EMAZ A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
GERN A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
HOND A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
IGEL A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
ISPS A 1 P 24:189:00000 24:195:86370 TRIMBLE NETR9 -----
KAST A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
LARE A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
LAZK A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
LEIT A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
PASA A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
RI01 A 1 P 24:189:00000 24:195:86370 LEICA GR25 -----
SALA A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
SCDA A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
SOPU A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
VITO A 1 P 24:189:00000 24:195:86370 LEICA GR30 -----
YEBE A 1 P 24:189:00000 24:195:86370 LEICA GR50 -----
ZARA A 1 P 24:189:00000 24:195:86370 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 24:189:00000 24:195:86370 LEIAS10 NONE ----
ALSA A 1 P 24:189:00000 24:195:86370 LEIAR10 NONE ----
AMUR A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
BIAZ A 1 P 24:189:00000 24:195:86370 LEIAR25 LEIT ----
BIDA A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
BRZR A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
CACE A 1 P 24:189:00000 24:195:86370 TRM29659.00 NONE ----
CANT A 1 P 24:189:00000 24:195:86370 LEIAR25.R4 LEIT ----
CREU A 1 P 24:189:00000 24:195:86370 LEIAR25.R4 NONE ----
EBRE A 1 P 24:189:00000 24:195:86370 LEIAR25.R4 NONE ----
ELGE A 1 P 24:189:00000 24:195:86370 LEIAR25.R4 LEIT ----
EMAZ A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
GERN A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
HOND A 1 P 24:189:00000 24:195:86370 LEIAR20 LEIM ----
IGEL A 1 P 24:189:00000 24:195:86370 LEIAR20 LEIM ----
ISPS A 1 P 24:189:00000 24:195:86370 TRM59900.00 SCIS ----
KAST A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
LARE A 1 P 24:189:00000 24:195:86370 LEIAR20 LEIM ----
LAZK A 1 P 24:189:00000 24:195:86370 LEIAR25.R4 LEIT ----
LEIT A 1 P 24:189:00000 24:195:86370 LEIAR10 NONE ----
PASA A 1 P 24:189:00000 24:195:86370 LEIAR20 LEIM ----
RI01 A 1 P 24:189:00000 24:195:86370 LEIAR25.R4 LEIT ----
SALA A 1 P 24:189:00000 24:195:86370 LEIAR25 NONE ----
SCDA A 1 P 24:189:00000 24:195:86370 TRM5971.00 NONE ----
SOPU A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
VITO A 1 P 24:189:00000 24:195:86370 LEIAS10 NONE ----
YEBE A 1 P 24:189:00000 24:195:86370 LEIAR20 LEIM ----
ZARA A 1 P 24:189:00000 24:195:86370 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	24:189:00000	24:195:86370	UNE	0.0000	0.0000
ALSA	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
AMUR	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
BIAZ	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
BIDA	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
BRZR	A	1	P	24:189:00000	24:195:86370	UNE	0.0771	0.0000
CACE	A	1	P	24:189:00000	24:195:86370	UNE	0.0600	0.0000
CANT	A	1	P	24:189:00000	24:195:86370	UNE	3.0490	0.0000
CREU	A	1	P	24:189:00000	24:195:86370	UNE	0.0770	0.0000
EBRE	A	1	P	24:189:00000	24:195:86370	UNE	0.0770	0.0000
ELGE	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
EMAZ	A	1	P	24:189:00000	24:195:86370	UNE	0.0350	0.0000
GERN	A	1	P	24:189:00000	24:195:86370	UNE	0.0771	0.0000
HOND	A	1	P	24:189:00000	24:195:86370	UNE	0.0771	0.0000
IGEL	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
ISPS	A	1	P	24:189:00000	24:195:86370	UNE	0.0350	0.0000
KAST	A	1	P	24:189:00000	24:195:86370	UNE	0.0350	0.0000
LARE	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
LAZK	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
LEIT	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
PASA	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
RID1	A	1	P	24:189:00000	24:195:86370	UNE	0.0606	0.0000
SALA	A	1	P	24:189:00000	24:195:86370	UNE	0.0600	0.0000
SCDA	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
SOPU	A	1	P	24:189:00000	24:195:86370	UNE	0.0771	0.0000
VITO	A	1	P	24:189:00000	24:195:86370	UNE	0.0000	0.0000
YEBE	A	1	P	24:189:00000	24:195:86370	UNE	0.0600	0.0000
ZARA	A	1	P	24:189:00000	24:195:86370	UNE	3.2590	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)

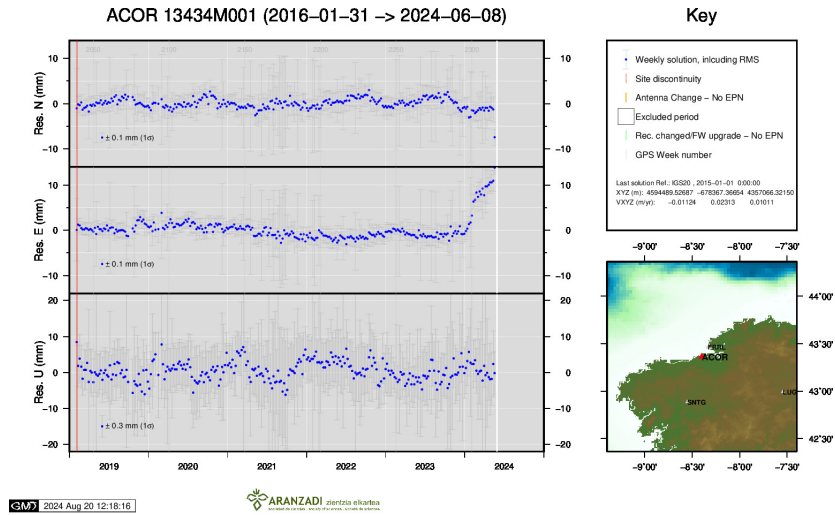
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](https://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

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

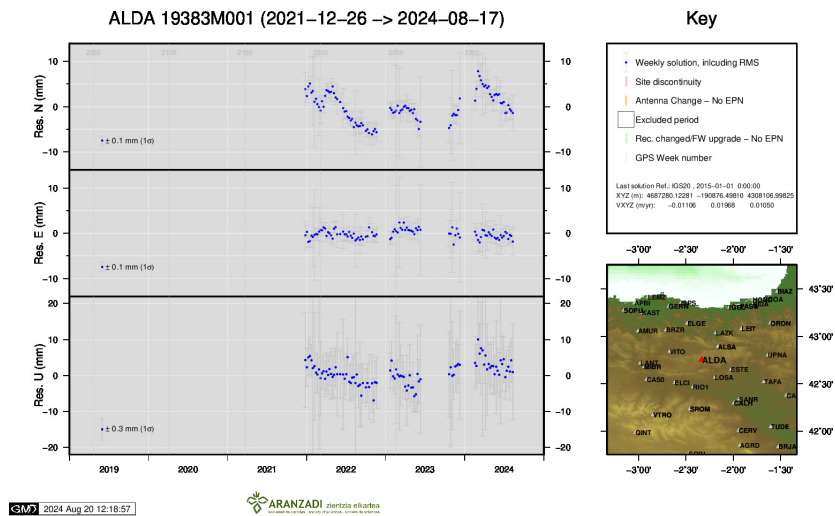
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems*. [etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf](https://etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf)

## 9 Cumulative Time Series

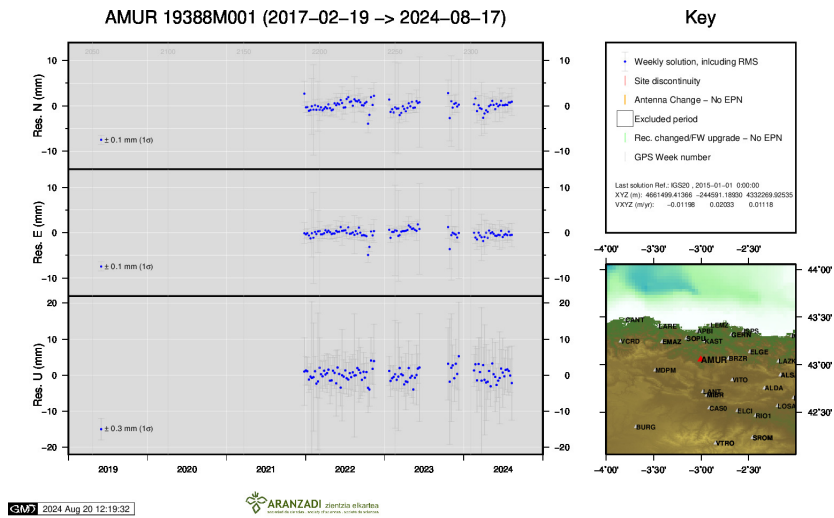
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



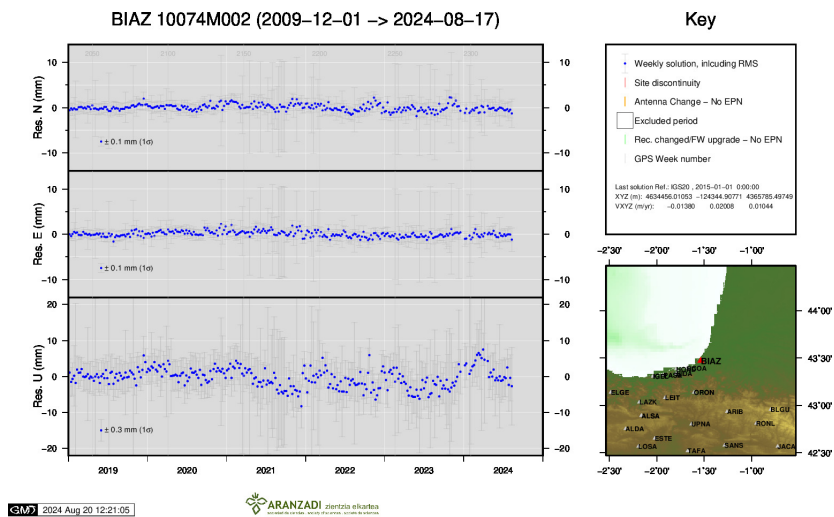
1 ) ACOR



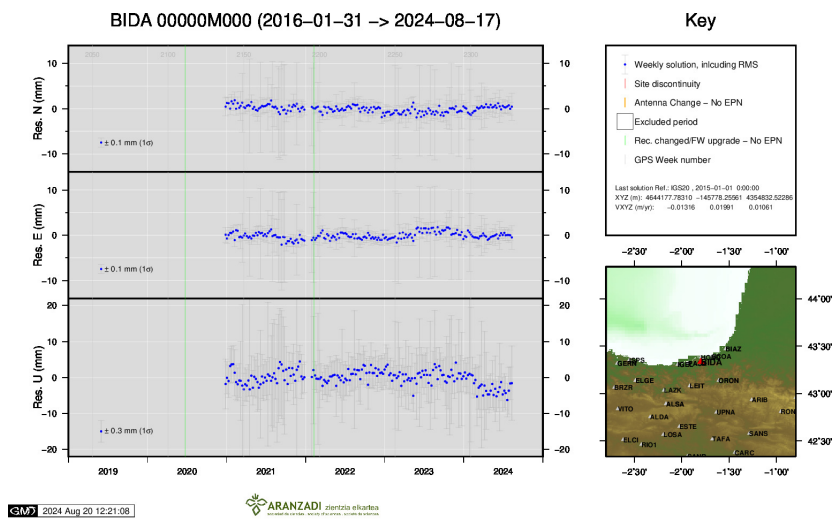
2 ) ALDA



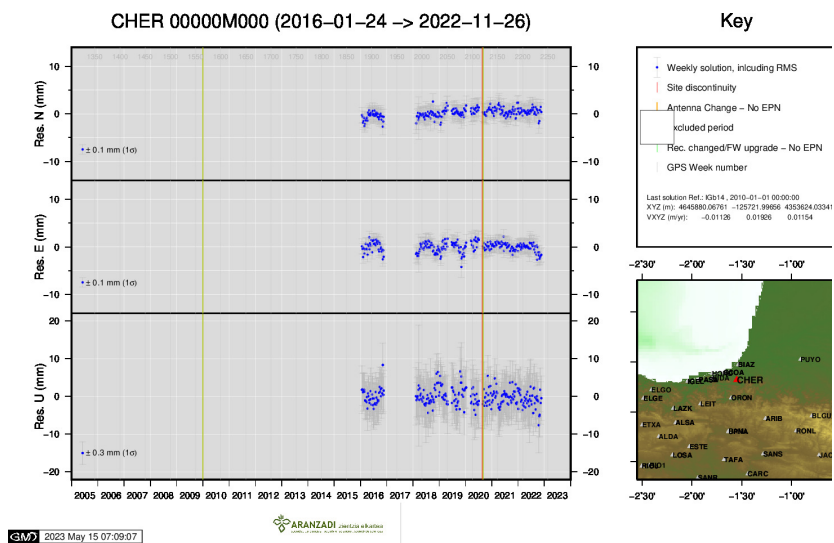
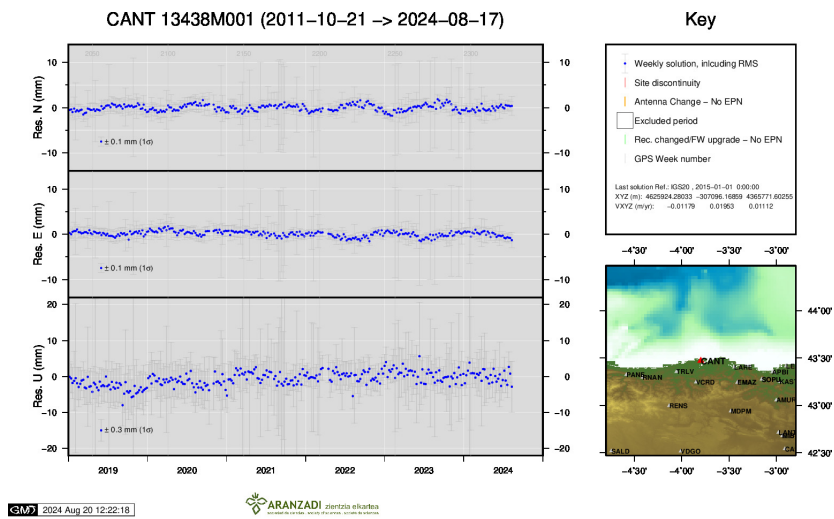
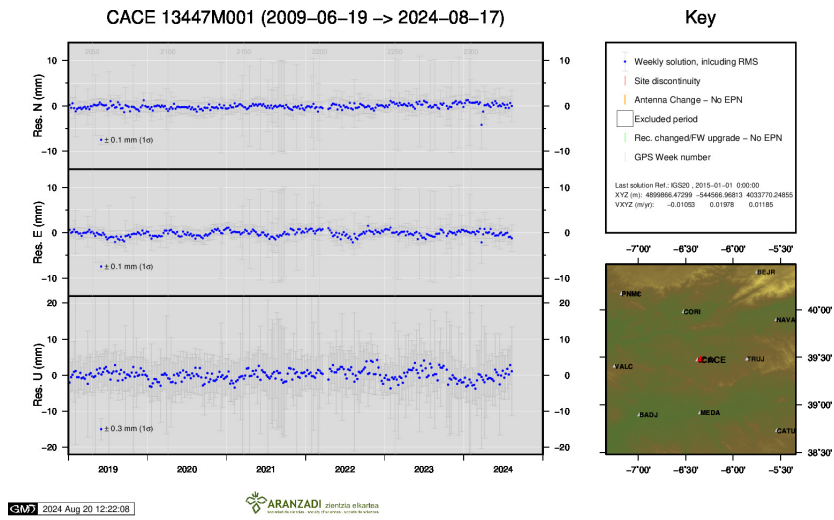
3 ) AMUR

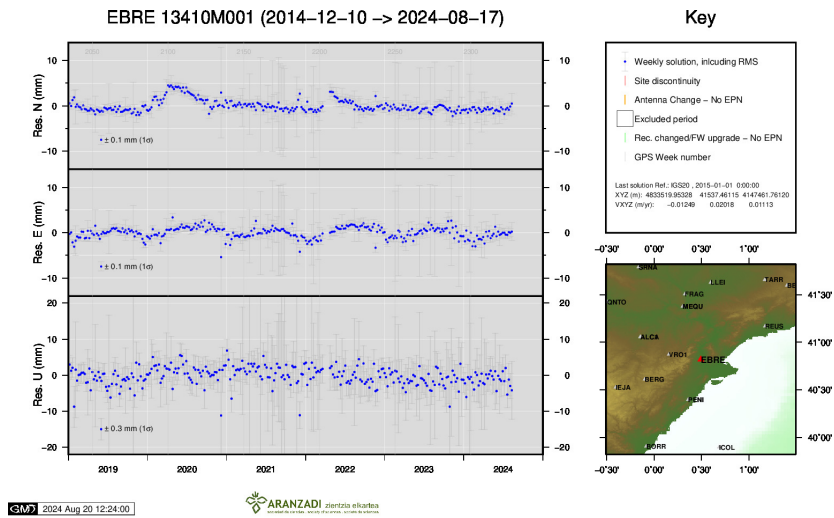


4 ) BIAZ

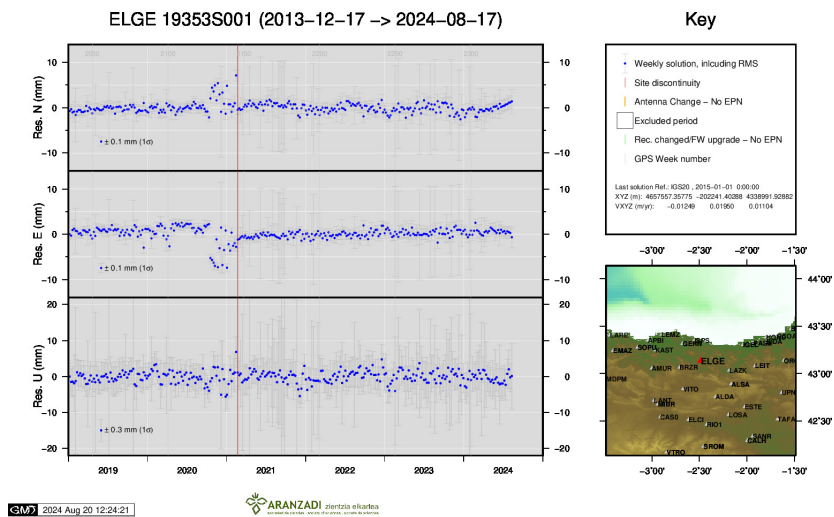


5 ) BIDA

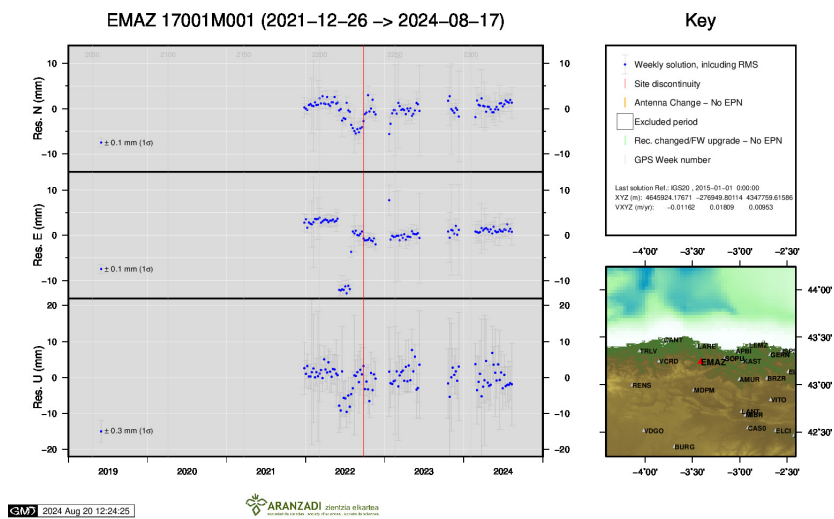




9 ) EBRE

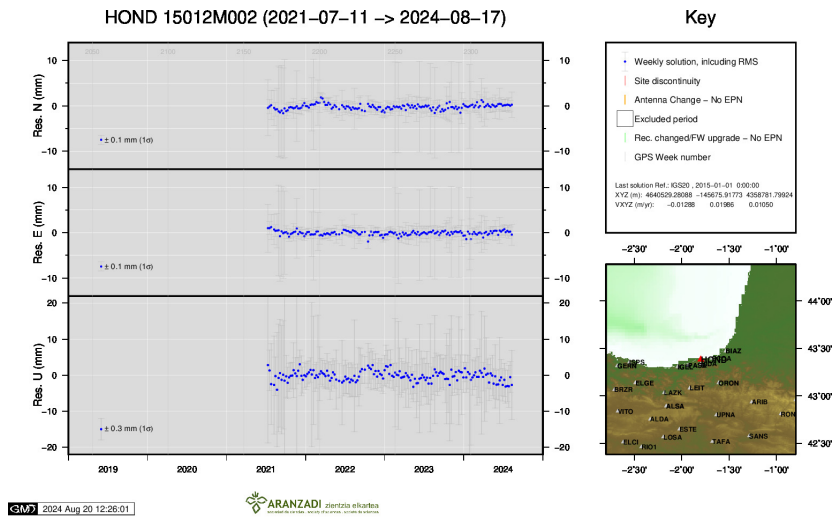


10 ) ELGE

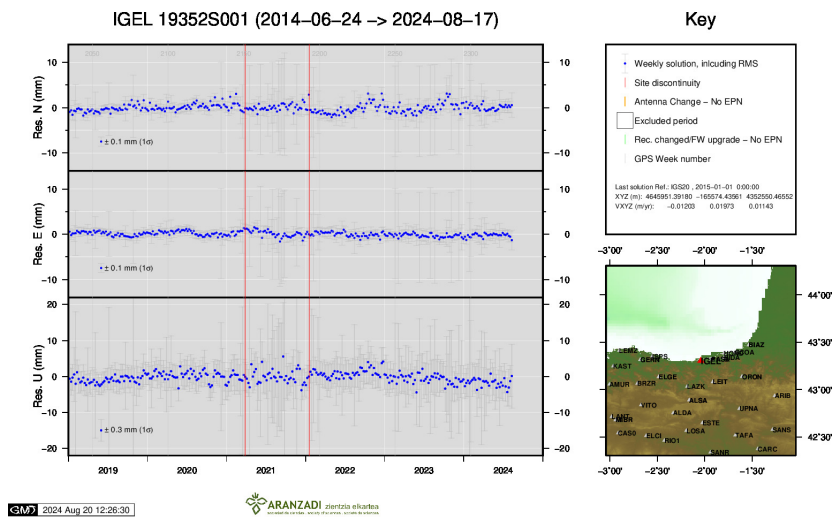


11 ) EMAZ

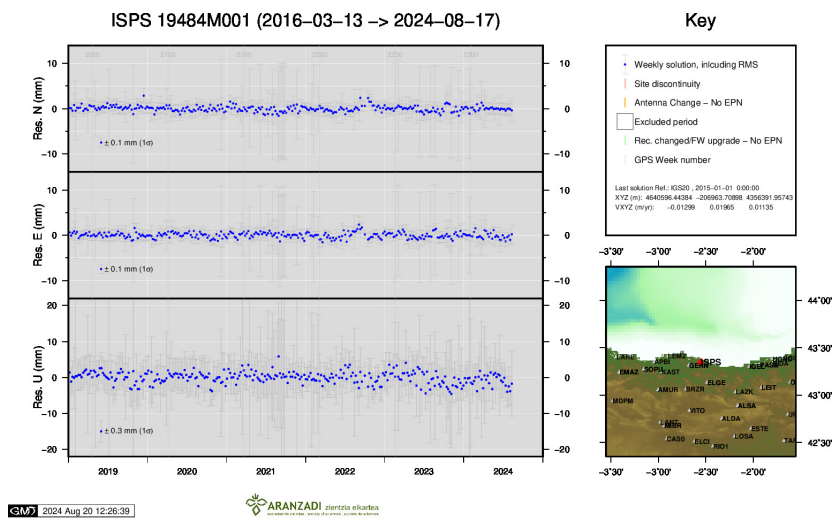




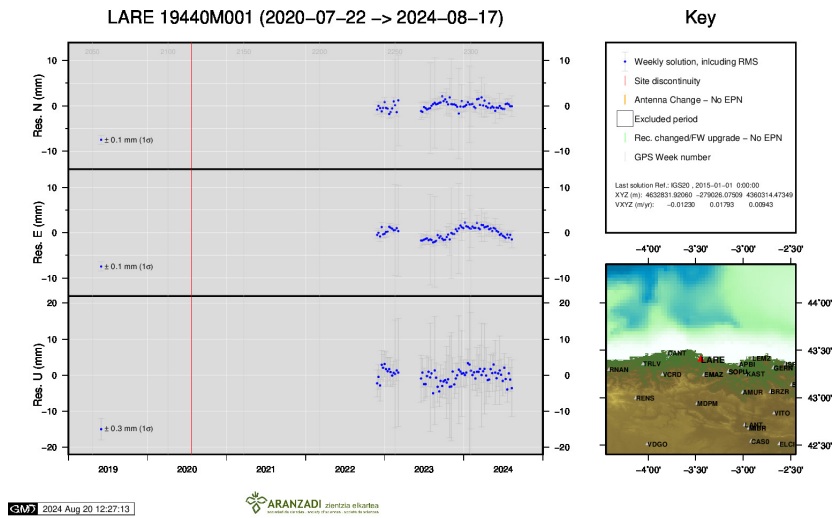
12 ) HOND



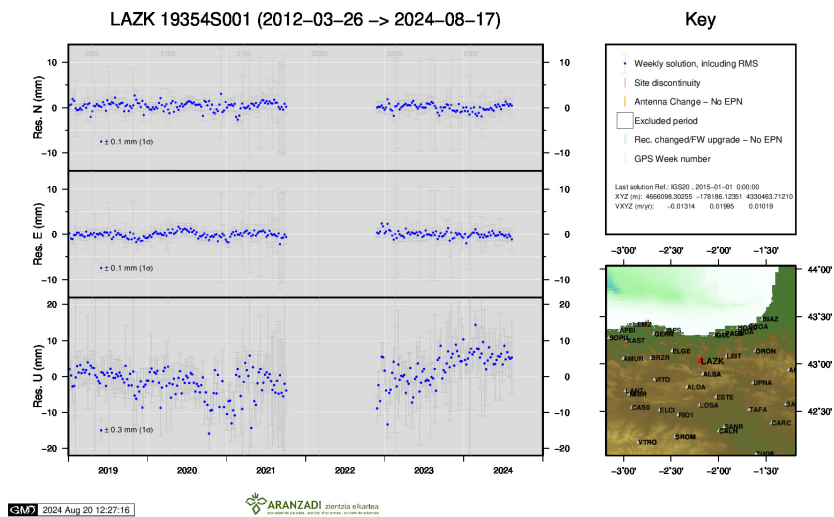
13 ) IGEL



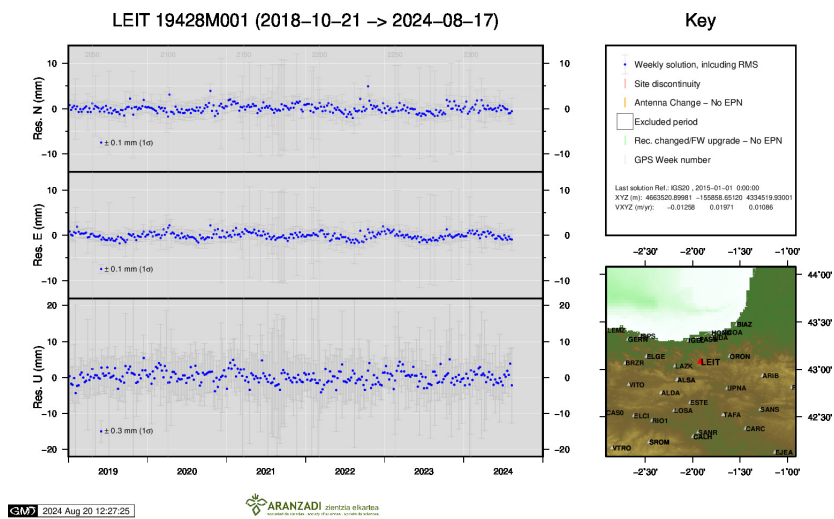
14 ) ISPS



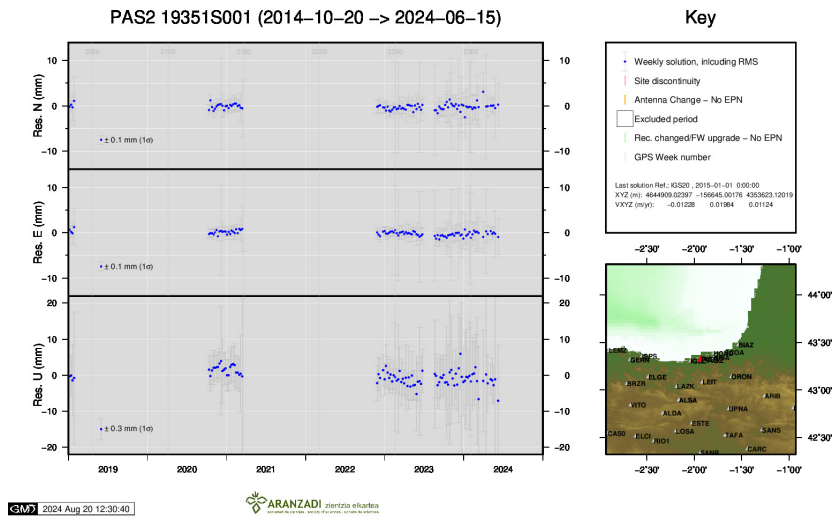
15 ) LARE



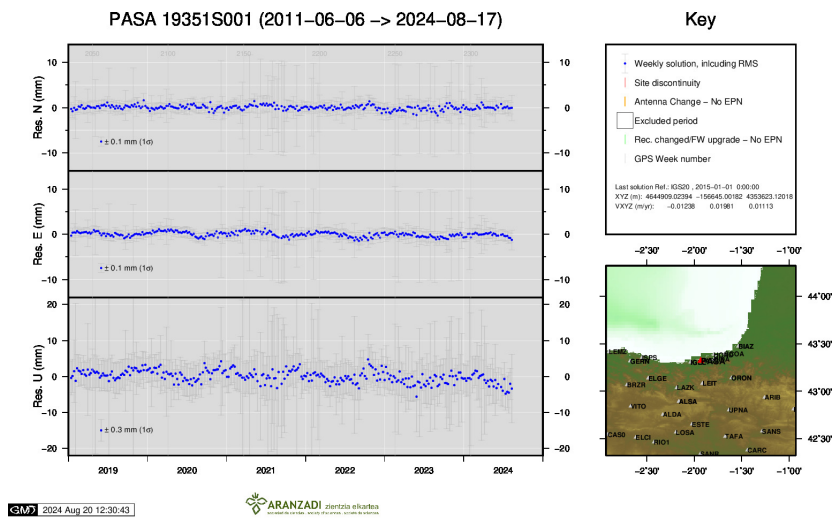
16 ) LAZK



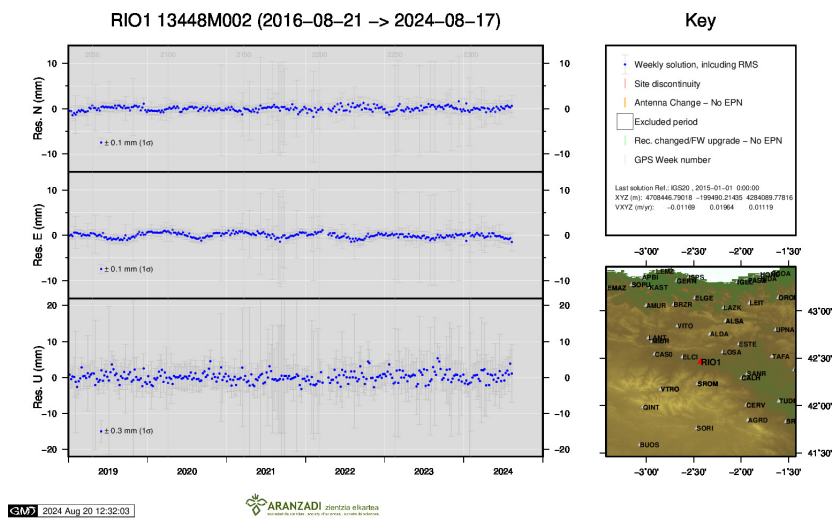
17 ) LEIT



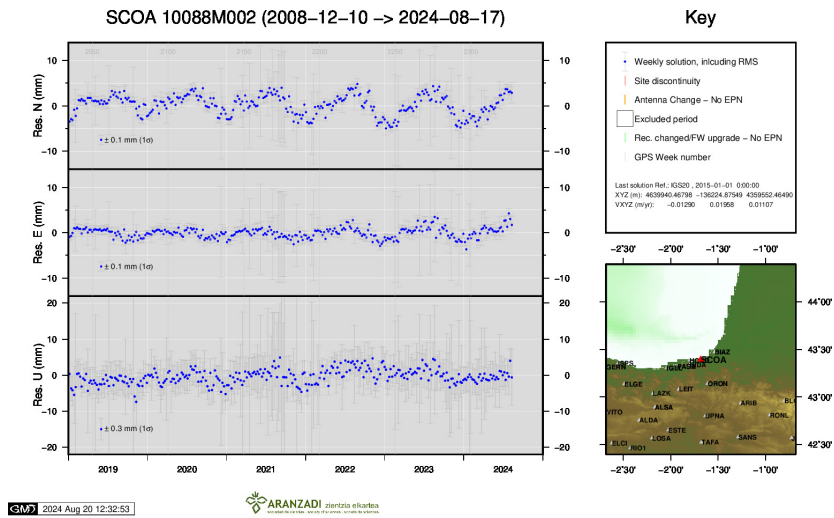
18 ) PAS2



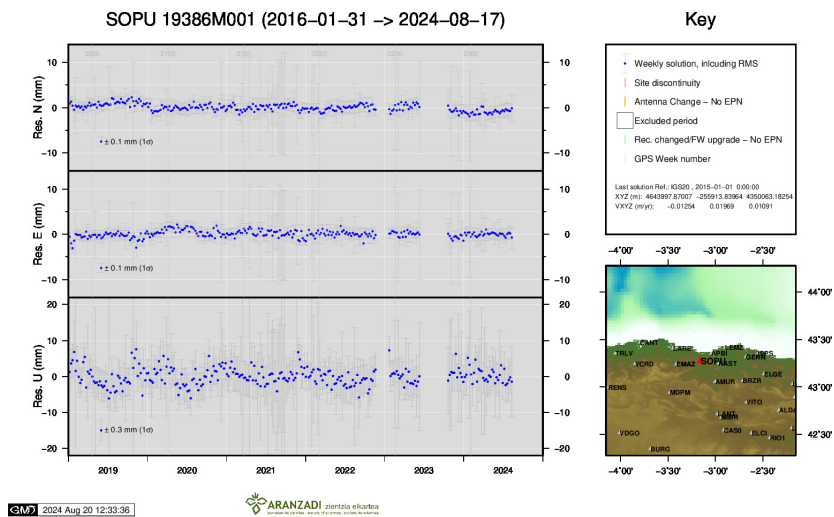
19 ) PASA



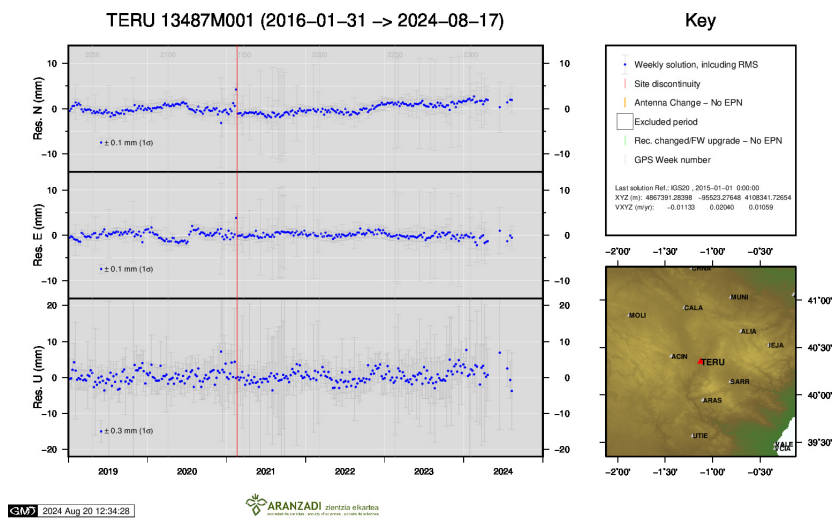
20 ) RIO1



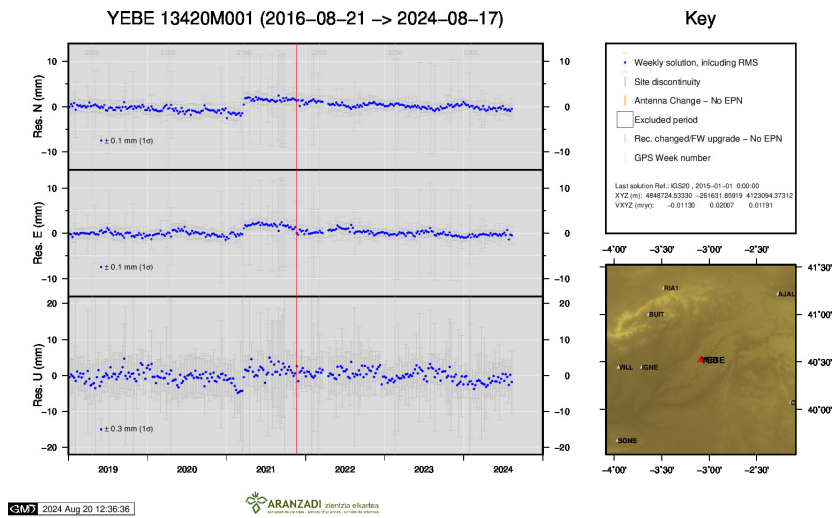
21 ) SCOA



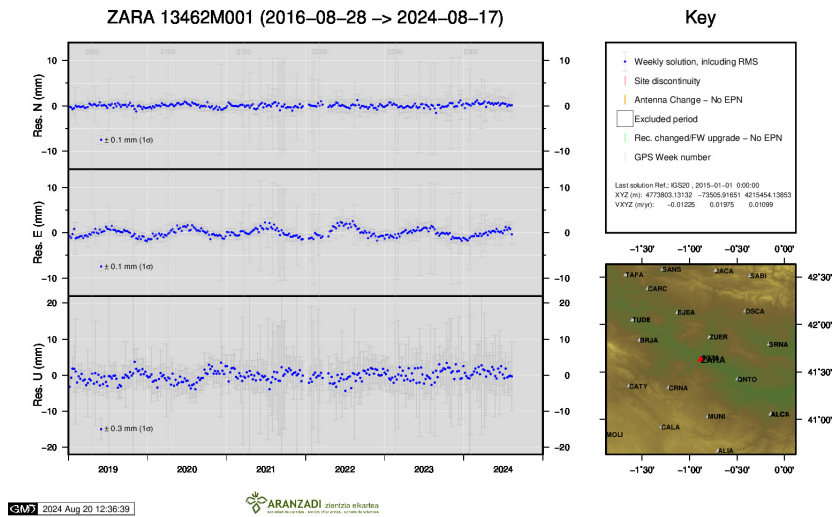
22 ) SOPU



23 ) TERU



24 ) YEBE



25 ) ZARA