ARA-DAC Weekly Analysis Result: 2274 (GFA)

Technical Report

GPS Week: 2274 (GFA)

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

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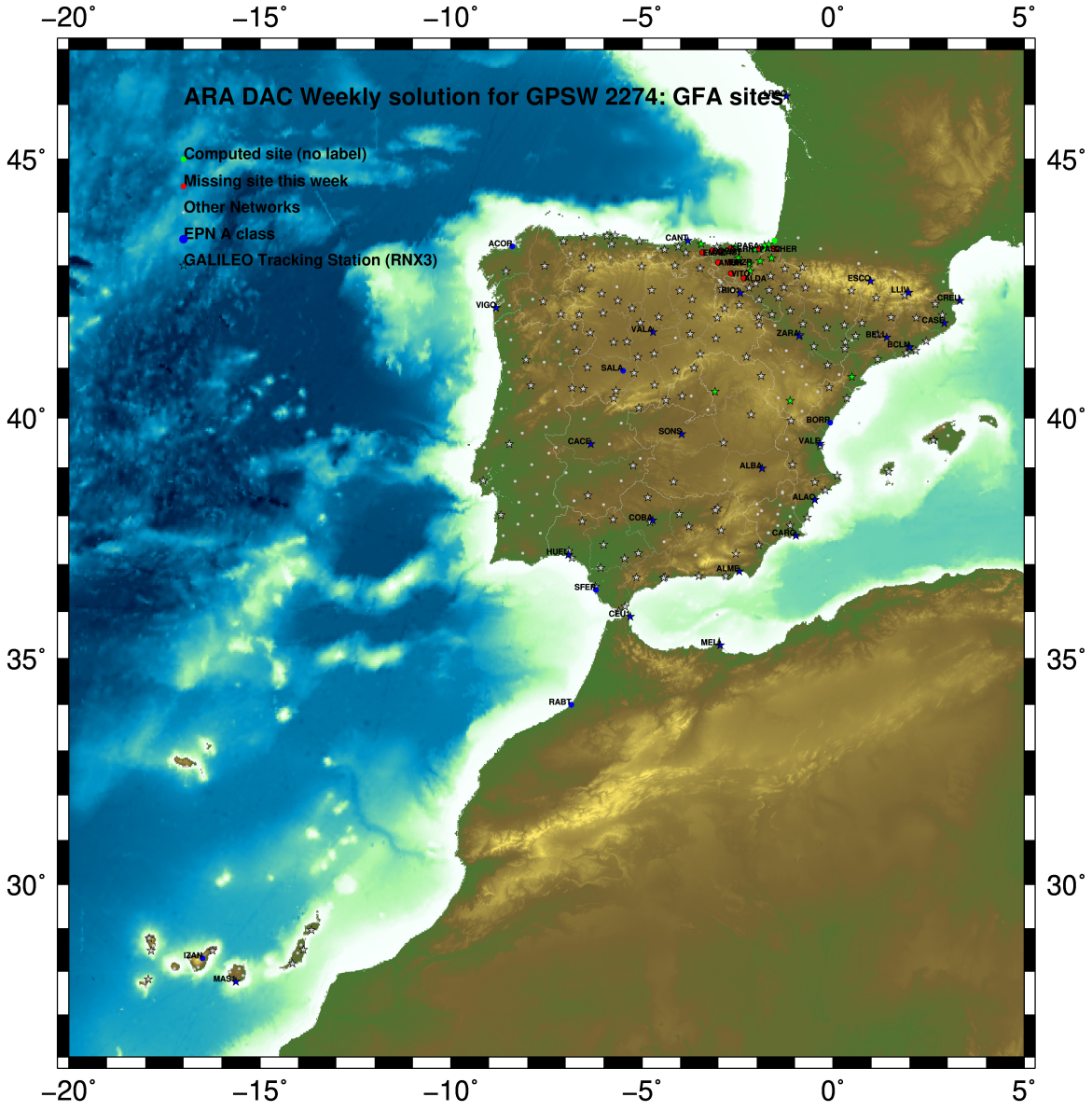
1 Introduction

In may 2015 ARA (EUREF's acronym of the ARANZADI's Department of Applied Geodesy), kicks off as a EUREF's Operational Center. In July 2015, the Densification solutions ARA computes routinely in a weekly basis start being submitted to the EUREF's EPN Densification Project.

2 Map of Computed Sites



GMT 2023 Aug 28 22:08:14

Fig.1: Computed Sites for GPS Week2274 (GFA)

3 Main Computation Parameters

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

- Preprocessing: Independent baselines are defined by the criterion of maximum common observations. Cycle slips are fixed with the MAUPRP program, analysing triple phase differences for each independent baseline. If MAUPRP does not fix all slips for one station, that station is edited out.
- Basic Observable : Carrier phase, L_1 and L_2; a priori sigma of single differences:0.002 m.
  - sampling (for ambiguity resolution): 30 s
  - sampling (for final processing): 180 s
  - Systems: GPS+GLONASS observations are used (Galileo is used if available starting GPS week 1986)
- Modelled observable: Double differences of carrier phase using different combinations based on the distance.
- Ground antenna phase center calibrations: Group APCV used from the PCV_COD.I20 file and individual calibrations from EPNC_20.ATX. In case no calibration values of an antenna/radome pairs are not available for a certain GNSS system at some station, the observatione of this/theese GNSS/GNSSs are excluded from the analysis of that station.
- EPN_A class sites (CRD + VEL) IGS20 used to define the reference frame (no EPN release is available at the time this report is generated). Following the EUREF guidelines, no other individual calibrations are included in the analysis starting GPSW 2238 (IGS20).
- Calibraciones de antena: calibraciones absolutas del IGS, incluidas en el fichero igs20.atx. A partir de la semana GPS 2238 (IGS20) No se incluyen calibraciones absolutas individuales de ninguna otra antena.
- El datum se establece con las estaciones EPN de clase A (coordenadas y velocidades) en datum IGS20 (solución PRELIMINAR, basada en IGb14). En caso de no disponer de datos de calibración de una determinada antena/radomo para cierto sistem GNSS, las observaciones de éste se omiten en el cálculo de la estación.
- Troposphere:
  - minimum elevation is 3 deg.; elevation dependent weighting.
  - VMF3 mapping function. ZPD parameters are estimated using the VMF3 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2014b (Scherneck).
- Atmospheric loading: not corrected, following the latest recommendations for IGS20 products.
- Tidal displacements:
  - Mean pole model : IERS2010_v1.2.0
  - Subdaily pole model: DESAI2016
  - Nutation model : IAU2000R06

4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria: 3*rms of single differences, in the weekly combination of daily normal equations (ADDNEQ)
- Station coordinates: minimum constraints (MC) to EPN A class 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 are the ones used in the Minimal Constraints condition.

5.1 IGS20

The Reference Frame considered in this section is a PRELIMINARY IGS20, based on the previously used IGb14 solution.

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ARA FINAL WEEKLY COMBINATION: FINAL ORBITS                      28-AUG-23 21:22
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LOCAL GEODETIC DATUM: IGS20             EPOCH: 2023-08-09 11:59:45

NUM  STATION NAME           X (M)          Y (M)          Z (M)     FLAG     SYSTEM

  4  ACOR 13434M001    4594489.51612  -678367.35531  4357066.33276    W      G
 50  ALSA 19419M001    4677250.78309  -176770.31552  4319079.92844    A      GRE
100  BIAZ 10074M002    4634455.99450  -124344.89605  4365785.50095    A      GR
101  BIDA 00000M000    4644177.76918  -145778.24258  4354832.52805    A      GR
104  CACE 13447M001    4899866.46261  -544566.95803  4033770.25705    W      GRE
116  CANT 13438M001    4625924.26861  -307096.15895  4365771.61139    W      GRE
162  CREU 13432M001    4715420.07539   273178.14057  4271946.89196    W      GRE
204  EBRE 13410M001    4833519.93791    41537.47452  4147461.76409    A      GRE
180  ELGE 19353S001    4657557.34509  -202241.39193  4338991.93773    A      GRE
257  HOND 15012M002    4640529.26697  -145675.90621  4358781.80445    A      GRE
235  IGEL 19352S001    4645951.37973  -165574.42409  4352550.47329    A      GRE
240  ISPS 19484M001    4640596.43091  -206963.69807  4356391.96475    A      GRE
252  LARE 19440M001    4632831.90829  -279026.06663  4360314.48077    A      GRE
256  LAZK 19354S001    4666098.28840  -178186.11234  4330463.72016    A      GRE
261  LEIT 19428M001    4663520.88615  -155858.64108  4334519.93547    A      GRE
334  ORON 19427M001    4659695.72765  -130864.65527  4338948.93391    A      GRE
493  PASA 19351S001    4644909.00960  -156644.99088  4353623.12527    W      GRE
553  RIO1 13448M002    4708446.77682  -199490.20390  4284089.78607    W      GRE
558  SALA 13469M001    4803054.43907  -462130.98985  4158379.12862    W      GR
566  SCOA 10088M002    4639940.45408  -136224.86201  4359552.47379    A      GRE
443  TERU 13487M001    4867391.27075   -95523.26498  4108341.73399    A      GRE
752  YEBE 13420M001    4848724.52270  -261631.84743  4123094.38190    A      GRE
755  ZARA 13462M001    4773803.11622   -73505.90363  4215454.14422    W      GRE
```

5.2 ETRF2000 (ETRS89) Coordinates

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

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CONVERT TO ETRF2000                                             28-AUG-23 21:22
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LOCAL GEODETIC DATUM: ETRF2000          EPOCH: 2023-08-09 11:59:45

NUM  STATION NAME           X (M)          Y (M)          Z (M)     FLAG     SYSTEM

  4  ACOR 13434M001    4594489.85351  -678367.97538  4357065.86294    W
 50  ALSA 19419M001    4677251.18427  -176770.94446  4319079.45851    A
100  BIAZ 10074M002    4634456.40635  -124345.51977  4365785.03540    A
101  BIDA 00000M000    4644178.17732  -145778.86752  4354832.06137    A
104  CACE 13447M001    4899866.79218  -544567.61385  4033769.76291    W
116  CANT 13438M001    4625924.65615  -307096.78212  4365771.14406    W
162  CREU 13432M001    4715420.53261   273177.50863  4271946.42486    W
204  EBRE 13410M001    4833520.35449    41536.82784  4147461.28373    A
180  ELGE 19353S001    4657557.74446  -202242.01861  4338991.46914    A
257  HOND 15012M002    4640529.67543  -145676.53071  4358781.33809    A
235  IGEL 19352S001    4645951.78505  -165575.04929  4352550.00619    A
240  ISPS 19484M001    4640596.83103  -206964.32275  4356391.49754    A
252  LARE 19440M001    4632832.29914  -279026.69056  4360314.01323    A
256  LAZK 19354S001    4666098.69030  -178186.73996  4330463.25116    A
261  LEIT 19428M001    4663521.29134  -155859.26834  4334519.46700    A
334  ORON 19427M001    4659696.13651  -130865.28200  4338948.46611    A
493  PASA 19351S001    4644909.41619  -156645.61593  4353622.65838    W
553  RIO1 13448M002    4708447.17221  -199490.83659  4284089.31315    W
558  SALA 13469M001    4803054.78953  -462131.63424  4158378.64396    W
566  SCOA 10088M002    4639940.86386  -136225.48642  4359552.00761    A
443  TERU 13487M001    4867391.66601   -95523.91606  4108341.24886    A
752  YEBE 13420M001    4848724.89705  -261632.49677  4123093.89609    A
755  ZARA 13462M001    4773803.52292   -73506.54366  4215453.66742    W
```

5.3 ETRF2014 (ETRS89) Coordinates

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

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CONVERT TO ETRF2014                                             28-AUG-23 21:22
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LOCAL GEODETIC DATUM: ETRF2014          EPOCH: 2023-08-09 11:59:45

NUM  STATION NAME           X (M)          Y (M)          Z (M)     FLAG     SYSTEM
```

4	ACOR	13434M001	4594489.81331	-678368.01245	4357065.91507	W
50	ALSA	19419M001	4677251.14166	-176770.98302	4319079.51055	A
100	BIAZ	10074M002	4634456.36402	-124345.55871	4365785.08760	A
101	BIDA	00000M000	4644178.13495	-145778.90633	4354832.11353	A
104	CACE	13447M001	4899866.74816	-544567.65006	4033769.81420	W
116	CANT	13438M001	4625924.61452	-307096.82043	4365771.19619	W
162	CREU	13432M001	4715420.48787	273177.46862	4271946.47711	W
204	EBRE	13410M001	4833520.30933	41536.78919	4147461.33546	A
180	ELGE	19353S001	4657557.70215	-202242.05716	4338991.52122	A
257	HOND	15012M002	4640529.63311	-145676.56955	4358781.39026	A
235	IGEL	19352S001	4645951.74274	-165575.08803	4352550.05833	A
240	ISPS	19484M001	4640596.78892	-206964.36135	4356391.54968	A
252	LARE	19440M001	4632832.25734	-279026.72894	4360314.06536	A
256	LAZK	19354S001	4666098.64780	-178186.77856	4330463.30324	A
261	LEIT	19428M001	4663521.24880	-155859.30703	4334519.51909	A
334	ORON	19427M001	4659696.09393	-130865.32080	4338948.51823	A
493	PASA	19351S001	4644909.37386	-156645.65470	4353622.71053	W
553	RIO1	13448M002	4708447.12932	-199490.87492	4284089.36509	W
558	SALA	13469M001	4803054.74641	-462131.67119	4158378.69552	W
566	SCOA	10088M002	4639940.82151	-136225.52528	4359552.05978	A
443	TERU	13487M001	4867391.62096	-95523.95407	4108341.30041	A
752	YEBE	13420M001	4848724.85277	-261632.53425	4123093.94761	A
755	ZARA	13462M001	4773803.47886	-73506.58217	4215453.71924	W

6 Quality Control

6.1 Mean and Daily Repeatabilities

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

GFA FINAL WEEKLY COMBINATION: FINAL ORBITS 28-AUG-23 21:22

Station	#Days	Weekday 0123456	Repeatability (mm) N	E	U
ACOR 13434M001	7	XXXXXXX	0.92	1.46	5.96
ALSA 19419M001	7	XXXXXXX	1.38	0.78	2.80
BIAZ 10074M002	7	XXXXXXX	0.92	0.71	5.04
BIDA 00000M000	7	XXXXXXX	1.11	1.08	4.83
CACE 13447M001	7	XXXXXXX	0.72	1.02	3.38
CANT 13438M001	7	XXXXXXX	0.63	0.52	3.75
CREU 13432M001	7	XXXXXXX	0.89	0.80	4.98
EBRE 13410M001	7	XXXXXXX	2.79	3.49	4.97
ELGE 19353S001	7	XXXXXXX	0.86	0.77	3.29
HOND 15012M002	7	XXXXXXX	0.84	0.65	3.87
IGEL 19352S001	7	XXXXXXX	0.75	0.43	3.92
ISPS 19484M001	7	XXXXXXX	0.92	0.94	4.16
LARE 19440M001	7	XXXXXXX	0.92	1.25	5.55
LAZK 19354S001	7	XXXXXXX	0.95	0.84	4.85
LEIT 19428M001	7	XXXXXXX	2.07	0.97	3.84
ORON 19427M001	7	XXXXXXX	0.92	1.03	4.27
PASA 19351S001	7	XXXXXXX	0.74	0.50	4.82
RIO1 13448M002	7	XXXXXXX	0.47	0.44	4.35
SALA 13469M001	7	XXXXXXX	0.70	0.58	3.60
SCOA 10088M002	7	XXXXXXX	1.35	1.91	3.96
TERU 13487M001	7	XXXXXXX	0.85	0.61	3.68
YEBE 13420M001	7	XXXXXXX	0.38	0.75	2.80
ZARA 13462M001	6	XXXXXX	0.83	0.92	4.82

Comparison of individual solutions:

ACOR 13434M001	N	0.92	-1.59	1.02	0.70	-0.81	-0.39	-0.43	-0.10
ACOR 13434M001	E	1.46	0.03	0.31	0.58	1.84	-1.70	0.78	2.36
ACOR 13434M001	U	5.96	4.50	-5.49	-6.96	7.33	4.17	4.52	-4.76
ALSA 19419M001	N	1.38	2.65	0.94	-0.70	-1.71	0.02	-0.02	-0.32
ALSA 19419M001	E	0.78	-1.43	-0.08	0.00	-0.25	0.84	0.77	0.51
ALSA 19419M001	U	2.80	-1.25	0.01	-4.51	3.14	1.36	-0.68	-3.60
BIAZ 10074M002	N	0.92	0.88	1.45	0.74	0.52	-1.00	0.22	0.52
BIAZ 10074M002	E	0.71	-0.87	-0.73	0.19	-0.14	-1.19	0.42	0.25
BIAZ 10074M002	U	5.04	-1.49	-2.22	-2.33	-1.40	7.58	0.75	-8.94
BIDA 00000M000	N	1.11	2.04	0.25	0.03	-1.23	0.49	0.70	0.97
BIDA 00000M000	E	1.08	-2.24	-0.60	-0.02	-0.57	-0.30	0.68	0.85
BIDA 00000M000	U	4.83	-0.32	-3.26	-5.56	5.97	4.30	-2.47	-6.18
CACE 13447M001	N	0.72	-0.95	0.52	-0.68	-1.14	-0.20	-0.24	0.25
CACE 13447M001	E	1.02	0.02	1.46	-0.04	1.08	-0.56	-1.16	1.16
CACE 13447M001	U	3.38	4.31	-3.50	-3.53	3.03	1.49	-0.93	3.58
CANT 13438M001	N	0.63	-1.10	-0.17	0.65	-0.64	-0.05	-0.14	0.56
CANT 13438M001	E	0.52	-0.67	-0.08	-0.81	-0.40	0.54	0.26	-0.04
CANT 13438M001	U	3.75	-0.54	1.75	-7.93	2.54	3.30	0.89	0.15
CREU 13432M001	N	0.89	-1.74	0.53	0.63	0.84	0.07	0.55	0.10
CREU 13432M001	E	0.80	-0.79	0.36	0.52	0.02	1.59	-0.54	-0.21
CREU 13432M001	U	4.98	6.65	-4.98	-1.92	-2.07	2.36	-0.44	-8.13
EBRE 13410M001	N	2.79	-5.69	1.25	2.40	-0.82	1.86	1.68	-0.05
EBRE 13410M001	E	3.49	8.06	-0.92	-0.53	-1.51	-1.27	-0.36	-1.71
EBRE 13410M001	U	4.97	3.71	5.61	1.53	-3.64	-5.12	-2.50	-7.44
ELGE 19353S001	N	0.86	0.37	0.04	1.67	-0.88	0.05	0.88	0.04
ELGE 19353S001	E	0.77	1.25	-0.41	0.30	-0.22	-1.16	0.53	0.20
ELGE 19353S001	U	3.29	-1.84	-2.10	-4.74	-0.93	3.14	0.17	-4.91
HOND 15012M002	N	0.84	1.60	0.73	0.66	-0.07	-0.41	0.10	0.76
HOND 15012M002	E	0.65	-0.11	-0.82	-0.37	-1.09	-0.49	0.27	0.43
HOND 15012M002	U	3.87	-2.11	-3.25	-2.36	2.63	4.38	-0.54	-6.56
IGEL 19352S001	N	0.75	0.75	0.73	1.19	-0.33	-0.05	0.73	0.46
IGEL 19352S001	E	0.43	-0.38	-0.70	-0.05	-0.42	-0.50	-0.03	-0.20
IGEL 19352S001	U	3.92	-0.57	-2.57	-5.93	3.34	3.27	-1.13	-5.19
ISPS 19484M001	N	0.92	0.45	0.40	0.90	-0.53	-0.71	-1.59	0.77
ISPS 19484M001	E	0.94	-0.54	-0.08	-1.75	1.03	0.43	-0.76	-0.36
ISPS 19484M001	U	4.16	1.85	2.33	-6.92	4.08	-2.11	4.02	3.12
LARE 19440M001	N	0.92	-0.39	0.06	1.14	-0.45	-0.67	0.11	-1.73
LARE 19440M001	E	1.25	-0.39	0.43	0.37	-0.75	2.09	-1.10	-1.65
LARE 19440M001	U	5.55	-1.82	-3.50	-9.62	2.70	3.60	6.44	-3.84
LAZK 19354S001	N	0.95	2.14	0.05	0.16	-0.29	-0.82	-0.16	-0.20
LAZK 19354S001	E	0.84	1.27	-1.35	0.33	-0.04	-0.32	-0.14	0.75
LAZK 19354S001	U	4.85	-8.54	0.06	0.21	3.57	5.07	-0.92	-5.38
LEIT 19428M001	N	2.07	4.45	0.30	0.29	-1.97	-1.25	-0.35	-0.20
LEIT 19428M001	E	0.97	-2.03	0.59	0.72	0.48	-0.61	0.11	0.20
LEIT 19428M001	U	3.84	-3.93	-0.31	-1.53	2.52	2.90	2.88	-6.88
ORON 19427M001	N	0.92	1.74	-0.28	-0.16	-1.09	-0.06	-0.59	-0.64
ORON 19427M001	E	1.03	-1.56	-1.44	-0.18	0.11	1.02	0.67	0.56
ORON 19427M001	U	4.27	-7.58	-1.08	-2.66	4.98	2.52	2.64	-2.39
PASA 19351S001	N	0.74	0.15	-0.14	0.74	0.05	0.93	0.48	1.27
PASA 19351S001	E	0.50	-0.35	-0.15	-0.24	-0.70	-0.21	0.21	-0.85
PASA 19351S001	U	4.82	-0.70	-0.47	-6.83	4.02	4.93	-3.02	-6.50
RIO1 13448M002	N	0.47	0.63	0.06	-0.03	-0.42	0.60	-0.55	0.34
RIO1 13448M002	E	0.44	0.34	-0.10	0.24	0.83	-0.39	-0.29	0.15
RIO1 13448M002	U	4.35	1.98	-4.38	-5.94	6.64	-2.05	2.36	-1.15
SALA 13469M001	N	0.70	-0.72	0.61	-1.09	-0.71	-0.50	0.29	0.13
SALA 13469M001	E	0.58	-0.80	0.40	0.40	-0.43	-0.30	-0.12	0.90
SALA 13469M001	U	3.60	4.55	-4.38	-2.98	3.30	0.43	4.19	-0.56
SCOA 10088M002	N	1.35	1.81	-0.08	0.41	-1.41	2.30	-0.27	0.34
SCOA 10088M002	E	1.91	-3.38	-2.23	-0.20	0.81	2.09	0.46	0.48
SCOA 10088M002	U	3.96	-0.72	0.94	-4.59	1.87	4.62	-1.23	-6.72
TERU 13487M001	N	0.85	0.88	0.54	1.11	0.29	-0.29	-0.01	-1.35
TERU 13487M001	E	0.61	-0.48	0.11	1.03	0.35	0.50	-0.44	-0.59
TERU 13487M001	U	3.68	-3.56	-3.92	1.42	1.07	-3.60	0.77	6.04
YEBE 13420M001	N	0.38	-0.80	-0.05	-0.02	-0.28	0.05	-0.35	-0.07
YEBE 13420M001	E	0.75	-1.21	0.51	0.15	-0.42	-0.06	-0.14	1.20
YEBE 13420M001	U	2.80	4.97	-3.75	-1.65	1.70	0.33	0.20	1.56
ZARA 13462M001	N	0.83		-0.57	0.30	-0.44	-1.43	0.44	0.75
ZARA 13462M001	E	0.92		-1.31	-0.11	-0.25	1.54	0.28	-0.16
ZARA 13462M001	U	4.82		2.88	-4.40	8.00	-2.52	1.55	-3.94

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


-------------------------------------------------------------------
| NUM |      NAME        | FLG |     RESIDUALS IN MILLIMETERS   |   |
-------------------------------------------------------------------
|     |                  |     |                                |   |
|   1 | ACOR 13434M001   | I W |      -2.68      2.69     -3.29 |   |
|   2 | ALAC 13433M001   | I W |      -0.91      2.17      2.43 |   |
|   3 | ALBA 13452M001   | I W |       4.81     -1.60     -5.29 |   |
|   4 | ALME 13437M001   | I W |      -1.87     -0.18      6.36 |   |
|   5 | BCLN 13412M001   | I W |       2.22     -2.81      3.67 |   |
|   6 | BELL 13431M001   | I W |       0.44     -1.64      0.12 |   |
|   7 | BORR 13480M001   | I W |      -1.67      1.48     -2.15 |   |
|   8 | BRST 10004M004   | I W |      -2.49      0.84      2.00 |   |
|   9 | CACE 13447M001   | I W |       1.05      2.13      3.12 |   |
|  10 | CANT 13438M001   | I W |      -3.62      3.91     -8.15 |   |
|  11 | CARG 19412M001   | I W |       1.90      3.28     -5.36 |   |
|  12 | CASE 13494M001   | I W |      -3.08     -0.35     -2.70 |   |
|  13 | CEU1 13449M002   | I W |       1.18     -1.10      0.39 |   |
|  14 | COBA 13453M001   | I W |       2.20      1.32     -7.54 |   |
|  15 | CREU 13432M001   | I W |      -2.17     -0.41      0.24 |   |
|  17 | ESCO 13435M001   | I W |      -3.24      0.69     -0.41 |   |
|  18 | HUEL 13451M001   | I W |      10.30     -7.41     10.30 |   |
|  20 | IZAN 31309M002   | I W |       1.34      4.09      3.21 |   |
|  21 | LLIV 13436M001   | I W |      -1.23      1.04      4.60 |   |
|  23 | LROC 10023M001   | I W |       0.75      1.16      5.86 |   |
|  25 | MAS1 31303M002   | I W |       0.27      0.25      1.65 |   |
|  26 | MELI 19379M001   | I W |       5.43     -0.00     -4.92 |   |
|  27 | PASA 19351S001   | I W |       1.49      0.95     -2.92 |   |
|  28 | RABT 35001M002   | I W |       0.97      0.55     -8.46 |   |
|  29 | RIO1 13448M002   | I W |      -3.01     -1.17      0.99 |   |
|  30 | SALA 13469M001   | I W |       1.17      0.27     -1.81 |   |
|  32 | SFER 13402M004   | I W |      -3.37    -11.60      0.29 |   |
|  33 | SONS 13446M001   | I W |      -1.77      1.46      0.06 |   |
|  34 | VALA 13463M002   | I W |       0.89     -0.54     -1.26 |   |
|  35 | VALE 13439M001   | I W |      -4.68      2.69     -7.61 |   |
|  36 | VIGO 13450M001   | I W |       2.37      0.02      5.05 |   |
|  39 | ZARA 13462M001   | I W |      -1.16     -0.79      2.71 |   |
|  40 | ZIMM 14001M004   | I W |      -2.67     -2.56      5.98 |   |
|     |                  |     |                                |   |
-------------------------------------------------------------------
|     | RMS / COMPONENT  |     |       3.07      3.01      4.64 |   |
|     | IQR              |     |       3.83      2.25      6.03 |   |
|     | MEAN             |     |      -0.03     -0.04     -0.09 |   |
|     | MEDIAN           |     |       0.27      0.27      0.24 |   |
|     | MIN              |     |      -4.68    -11.60     -8.46 |   |
|     | MAX              |     |      10.30      4.09     10.30 |   |
-------------------------------------------------------------------
       OVERALL RMS/IQR/MAX(3D)        3.65      4.15     16.34       HUEL 13451M001      #SUM
-------------------------------------------------------------------
| ALL | RMS / COMPONENT  |     |       3.07      3.01      4.64 |   |
| ALL | IQR              |     |       3.83      2.25      6.03 |   |
| ALL | MEAN             |     |      -0.03     -0.04     -0.09 |   |
| ALL | MEDIAN           |     |       0.27      0.27      0.24 |   |
| ALL | MIN              |     |      -4.68    -11.60     -8.46 |   |
| ALL | MAX              |     |      10.30      4.09     10.30 |   |
-------------------------------------------------------------------
  ALL   OVERALL RMS/IQR/MAX(3D)        3.65      4.15     16.34       HUEL 13451M001      #SUM_ALL


NUMBER OF PARAMETERS  :     3
NUMBER OF STATIONS    :    33
NUMBER OF COORDINATES :    99
RMS OF TRANSFORMATION :    3.65 MM


PARAMETERS:

TRANSLATION IN  X     :          -0.00     +-  0.64    MM
TRANSLATION IN  Y     :           0.00     +-  0.64    MM
TRANSLATION IN  Z     :          -0.00     +-  0.64    MM


NUMBER OF ITERATIONS  :     1
```

6.3 Adjustment Statistics

In this section, the summary of the global adjustment and not subnetworks are shown. Also, the Helmert parameters of the combined solution with respect to the daily solutions are shown.

```
*_STATISTICAL PARAMETER________ __VALUE(S)____________
 NUMBER OF OBSERVATIONS                      15665909
 NUMBER OF UNKNOWNS                           172970
 NUMBER OF DEGREES OF FREEDOM                15492939
 PHASE MEASUREMENTS SIGMA                     0.00100
 SAMPLING INTERVAL (SECONDS)                      180
 VARIANCE FACTOR                 2.167849011670203
```

7 Equipment

7.1 Receiver List

Serial numbers not shown.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ FIRMWARE___
 ACOR  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 ALSA  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 BIAZ  A    1 P 23:218:00000 23:224:86370 SPECTRA SP90M        ----- -----------
 BIDA  A    1 P 23:218:00000 23:224:86370 LEICA GR10           ----- -----------
 CACE  A    1 P 23:218:00000 23:224:86370 TRIMBLE NETR9        ----- -----------
 CANT  A    1 P 23:218:00000 23:224:86370 LEICA GR10           ----- -----------
 CREU  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 EBRE  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 ELGE  A    1 P 23:218:00000 23:224:86370 LEICA GR30           ----- -----------
 HOND  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 IGEL  A    1 P 23:218:00000 23:224:86370 LEICA GR30           ----- -----------
 ISPS  A    1 P 23:218:00000 23:224:86370 TRIMBLE NETR9        ----- -----------
 LARE  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 LAZK  A    1 P 23:218:00000 23:224:86370 LEICA GR30           ----- -----------
 LEIT  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 ORON  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 PASA  A    1 P 23:218:00000 23:224:86370 LEICA GR30           ----- -----------
 RIO1  A    1 P 23:218:00000 23:224:86370 LEICA GR25           ----- -----------
 SALA  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 SCOA  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 TERU  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 YEBE  A    1 P 23:218:00000 23:224:86370 LEICA GR50           ----- -----------
 ZARA  A    1 P 23:219:00000 23:224:86370 TRIMBLE NETR9        ----- -----------
```

7.2 Antennas

Serial number ONLY provided in case individual calibrations are used.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ DAZI
 ACOR  A    1 P 23:218:00000 23:224:86370 LEIAT504         LEIS -----
 ALSA  A    1 P 23:218:00000 23:224:86370 LEIAR10          NONE -----
 BIAZ  A    1 P 23:218:00000 23:224:86370 LEIAR25          LEIT -----
 BIDA  A    1 P 23:218:00000 23:224:86370 LEIAS10          NONE -----
 CACE  A    1 P 23:218:00000 23:224:86370 TRM29659.00      NONE -----
 CANT  A    1 P 23:218:00000 23:224:86370 LEIAR25.R4       LEIT -----
 CREU  A    1 P 23:218:00000 23:224:86370 LEIAR25.R4       NONE -----
 EBRE  A    1 P 23:218:00000 23:224:86370 LEIAR25.R4       NONE -----
 ELGE  A    1 P 23:218:00000 23:224:86370 LEIAR25.R4       LEIT -----
 HOND  A    1 P 23:218:00000 23:224:86370 LEIAR20          LEIM -----
 IGEL  A    1 P 23:218:00000 23:224:86370 LEIAR20          LEIM -----
 ISPS  A    1 P 23:218:00000 23:224:86370 TRM59900.00      SCIS -----
 LARE  A    1 P 23:218:00000 23:224:86370 LEIAR20          LEIM -----
 LAZK  A    1 P 23:218:00000 23:224:86370 LEIAR25.R4       LEIT -----
 LEIT  A    1 P 23:218:00000 23:224:86370 LEIAR10          NONE -----
 ORON  A    1 P 23:218:00000 23:224:86370 LEIAR10          NONE -----
 PASA  A    1 P 23:218:00000 23:224:86370 LEIAR20          LEIM -----
 RIO1  A    1 P 23:218:00000 23:224:86370 LEIAR25.R4       LEIT -----
 SALA  A    1 P 23:218:00000 23:224:86370 LEIAR25          NONE -----
 SCOA  A    1 P 23:218:00000 23:224:86370 TRM55971.00      NONE -----
 TERU  A    1 P 23:218:00000 23:224:86370 LEIAR20          LEIM -----
 YEBE  A    1 P 23:218:00000 23:224:86370 LEIAR20          LEIM -----
 ZARA  A    1 P 23:219:00000 23:224:86370 TRM29659.00      NONE -----
```

7.3 Eccentricities

```
*                                          UP______ NORTH___ EAST____
*SITE PT SOLN T DATA_START__ DATA_END____ AXE ARP->BENCHMARK(M)_________
 ACOR  A    1 P 23:218:00000 23:224:86370 UNE   3.0460   0.0000   0.0000
 ALSA  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
 BIAZ  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
 BIDA  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
 CACE  A    1 P 23:218:00000 23:224:86370 UNE   0.0600   0.0000   0.0000
 CANT  A    1 P 23:218:00000 23:224:86370 UNE   3.0490   0.0000   0.0000
 CREU  A    1 P 23:218:00000 23:224:86370 UNE   0.0770   0.0000   0.0000
 EBRE  A    1 P 23:218:00000 23:224:86370 UNE   0.0770   0.0000   0.0000
 ELGE  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
```

```
HOND  A    1 P 23:218:00000 23:224:86370 UNE   0.0771   0.0000   0.0000
IGEL  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
ISPS  A    1 P 23:218:00000 23:224:86370 UNE   0.0350   0.0000   0.0000
LARE  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
LAZK  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
LEIT  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
ORON  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
PASA  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
RIO1  A    1 P 23:218:00000 23:224:86370 UNE   0.0606   0.0000   0.0000
SALA  A    1 P 23:218:00000 23:224:86370 UNE   0.0600   0.0000   0.0000
SCOA  A    1 P 23:218:00000 23:224:86370 UNE   0.0000   0.0000   0.0000
TERU  A    1 P 23:218:00000 23:224:86370 UNE   0.0600   0.0000   0.0000
YEBE  A    1 P 23:218:00000 23:224:86370 UNE   0.0600   0.0000   0.0000
ZARA  A    1 P 23:219:00000 23:224:86370 UNE   3.2590   0.0000   0.0000
```

8 Inconsistencies (logsheet-RINEX metadata)

The following inconsistencies were found comparing the data available in the logsheets and the RINEX headers:

```
2023-08-27 03:34 UTC | BRZR2180.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: brzr00esp_20220408.log
2023-08-27 06:17 UTC | BRZR2190.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: brzr00esp_20220408.log
2023-08-27 09:48 UTC | BRZR2200.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: brzr00esp_20220408.log
2023-08-27 13:01 UTC | BRZR2210.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: brzr00esp_20220408.log
2023-08-27 16:48 UTC | BRZR2220.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: brzr00esp_20220408.log
2023-08-27 19:48 UTC | BRZR2230.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: brzr00esp_20220408.log
2023-08-27 03:34 UTC | GERN2180.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: gern00esp_20220408.log
2023-08-27 06:17 UTC | GERN2190.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: gern00esp_20220408.log
2023-08-27 09:48 UTC | GERN2200.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: gern00esp_20220408.log
2023-08-27 13:01 UTC | GERN2210.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: gern00esp_20220408.log
2023-08-27 16:48 UTC | GERN2220.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: gern00esp_20220408.log
2023-08-27 19:48 UTC | GERN2230.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: gern00esp_20220408.log
2023-08-27 03:34 UTC | ISPS2180.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-27 06:17 UTC | ISPS2190.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-27 09:48 UTC | ISPS2200.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-27 13:01 UTC | ISPS2210.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-27 16:48 UTC | ISPS2220.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-27 19:48 UTC | ISPS2230.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-28 01:12 UTC | ISPS2240.23O | RECEIVER FIRM. VERS. |  5.30 -> 5.22 (source: isps00esp_20220907.log
2023-08-27 03:34 UTC | SOPU2180.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: sopu00esp_20220408.log
2023-08-27 06:17 UTC | SOPU2190.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: sopu00esp_20220408.log
2023-08-27 09:48 UTC | SOPU2200.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: sopu00esp_20220408.log
2023-08-27 13:01 UTC | SOPU2210.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: sopu00esp_20220408.log
2023-08-27 16:48 UTC | SOPU2220.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: sopu00esp_20220408.log
2023-08-27 19:48 UTC | SOPU2230.23O | RECEIVER FIRM. VERS. |  4.61/7.811 -> 4.51/7.710 (source: sopu00esp_20220408.log
```

9 References

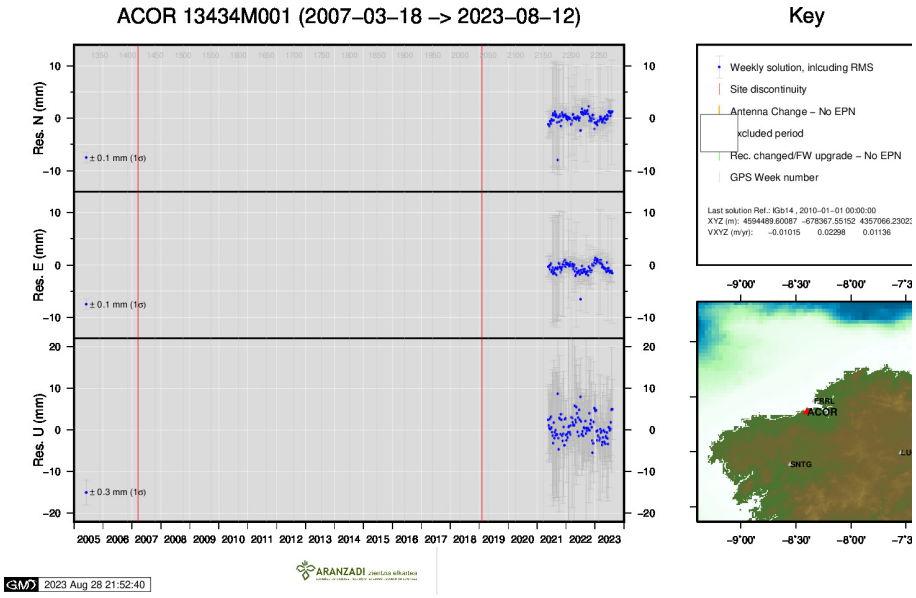
C. Boucher and Z. Altamimi (2011): *Specifications for reference frame fixing in the analysis of a EUREF GPS campaign.* etrs89.ensg.ign.fr/memo-V8.pdf

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

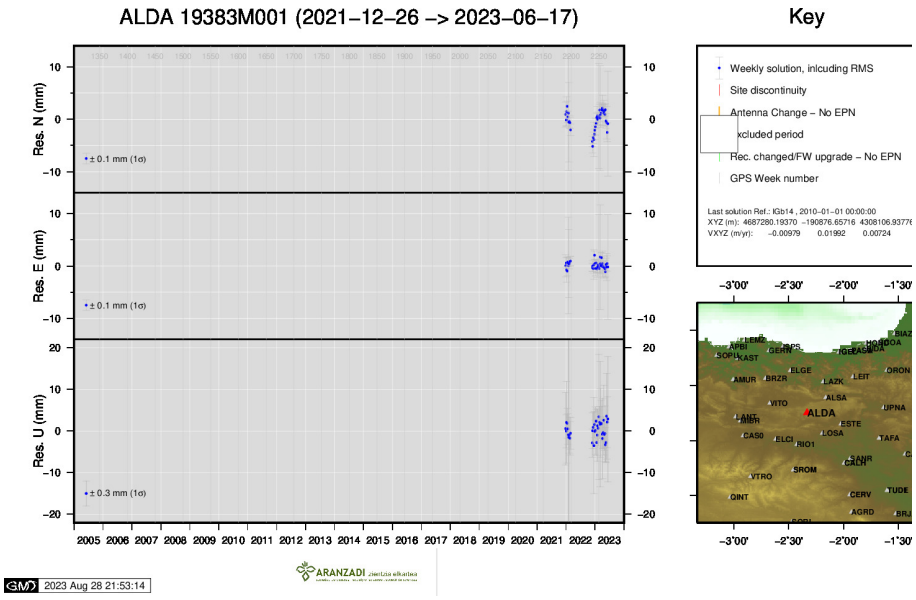
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems.* etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf

10 Cumulative Time Series

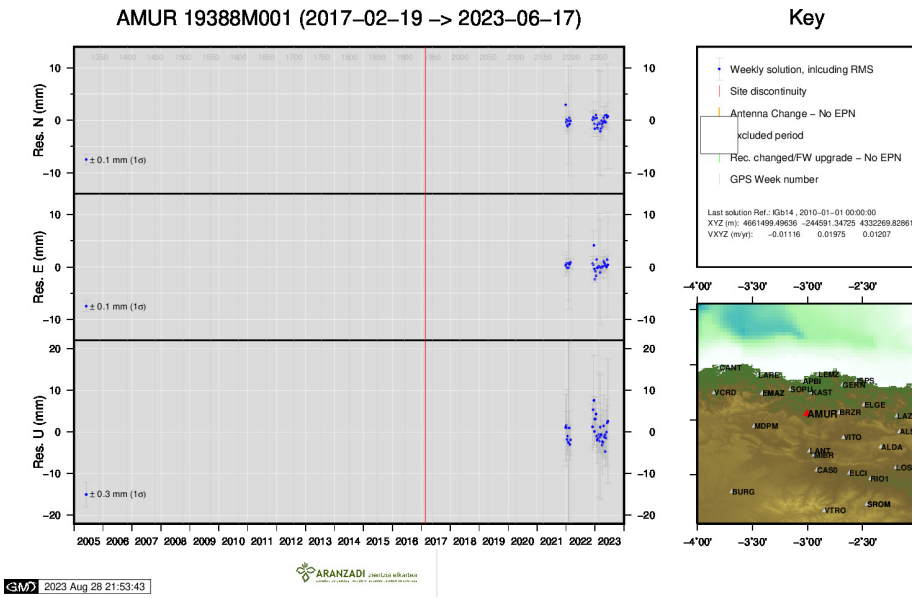
Time series of stations. Latest plots at: http://geolabpasaia.org/gnss/ARA-net/TSeries/, or click on the caption of each image.



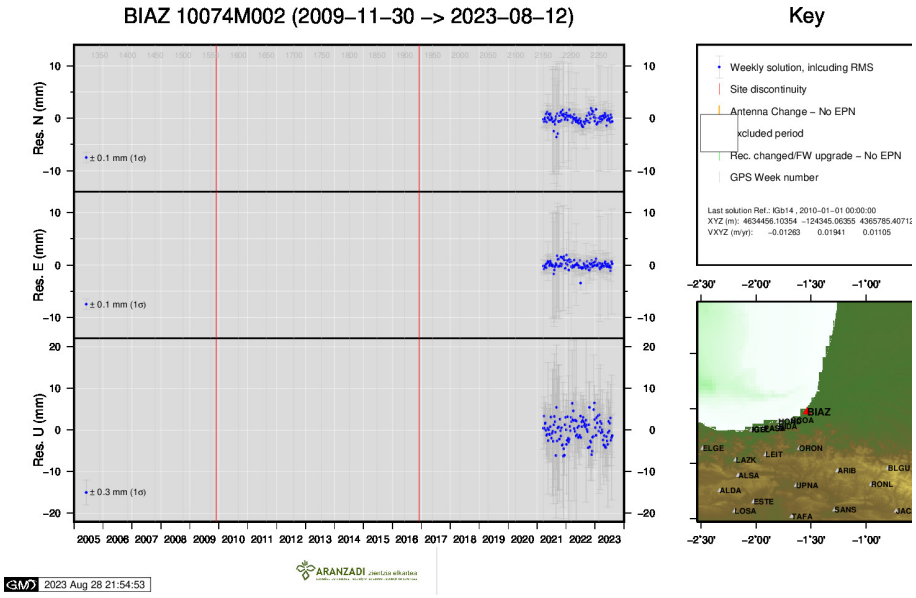
1) ACOR



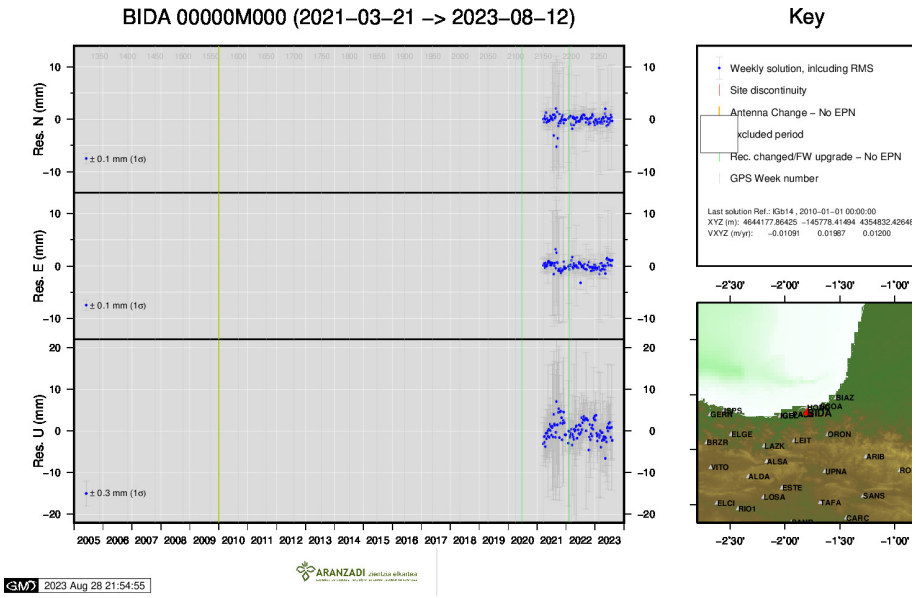
2) ALDA



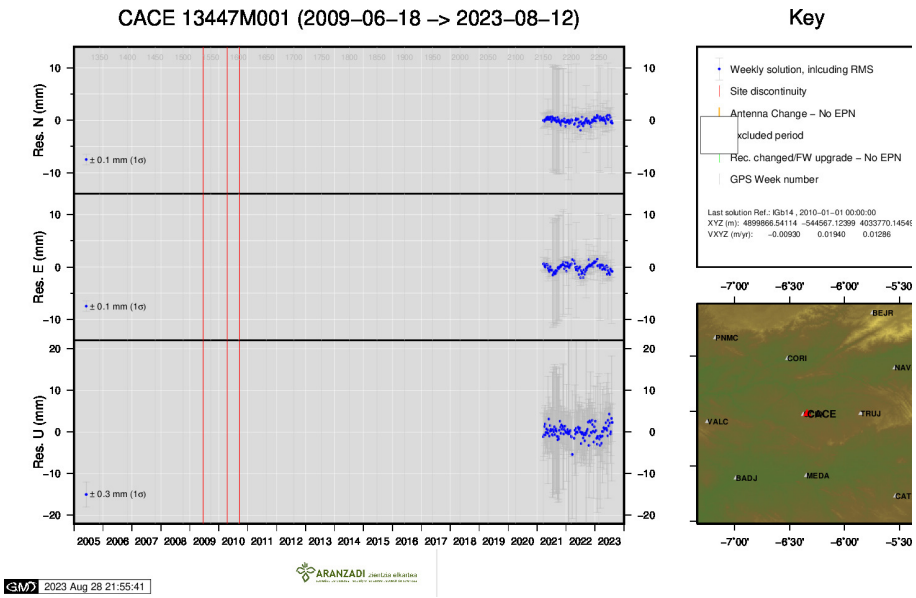
3) AMUR



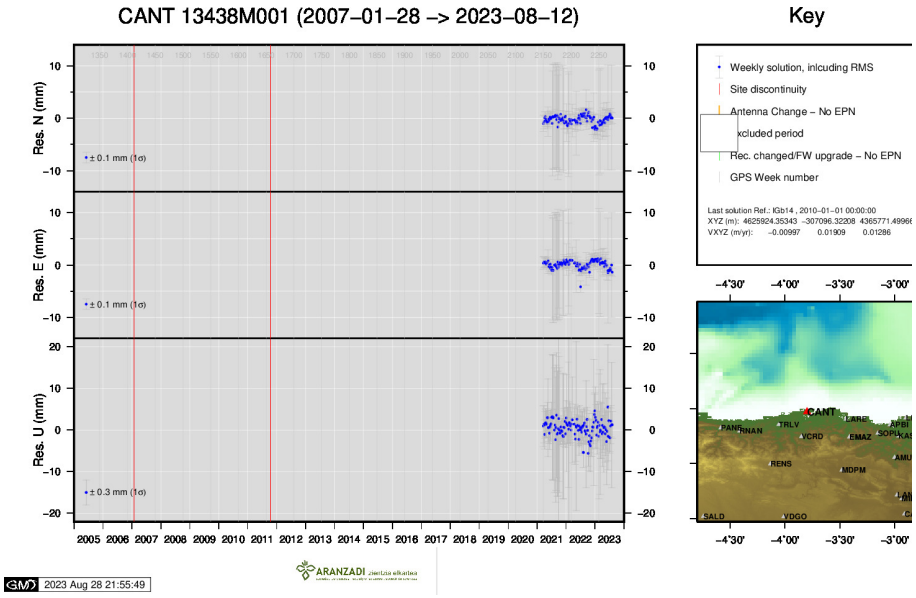
4) BIAZ



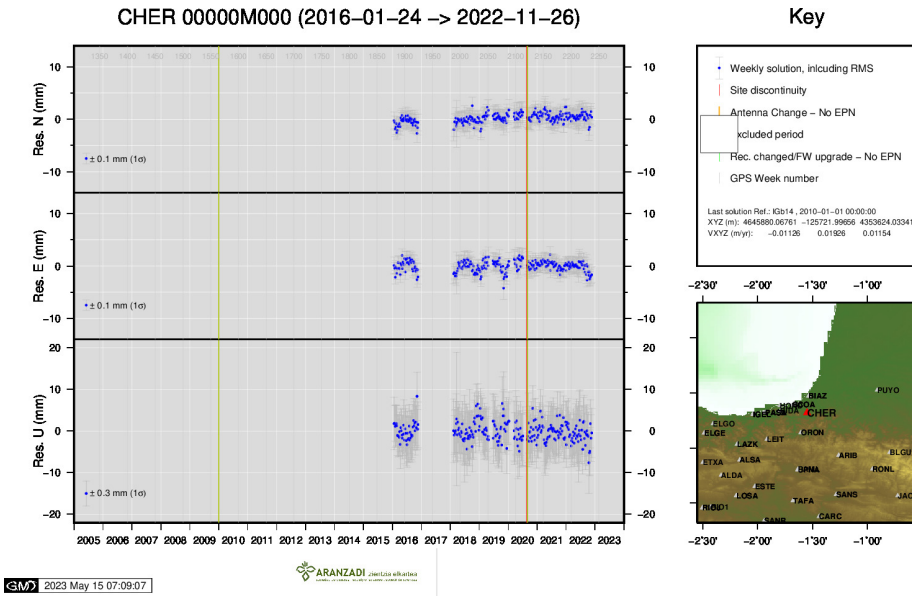
5) BIDA



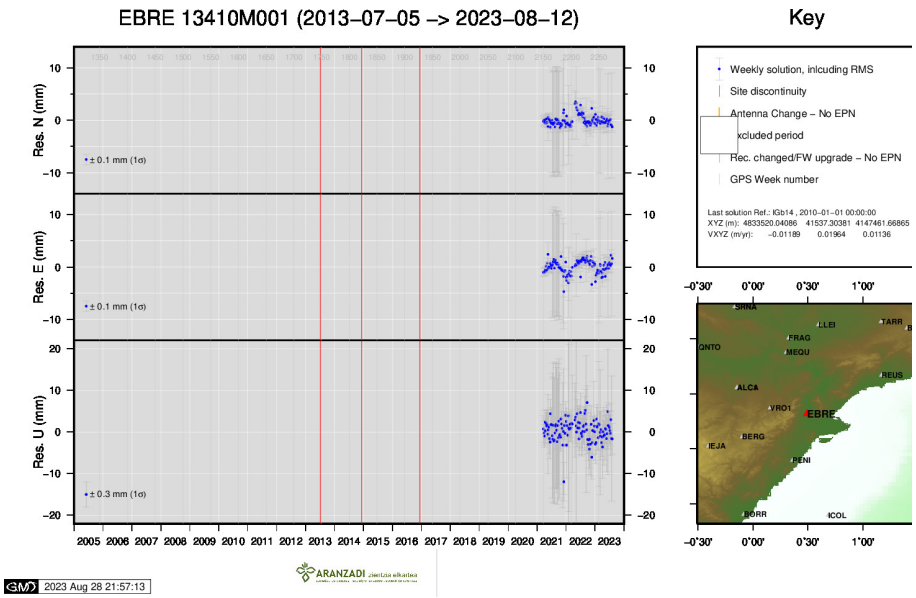
6) CACE



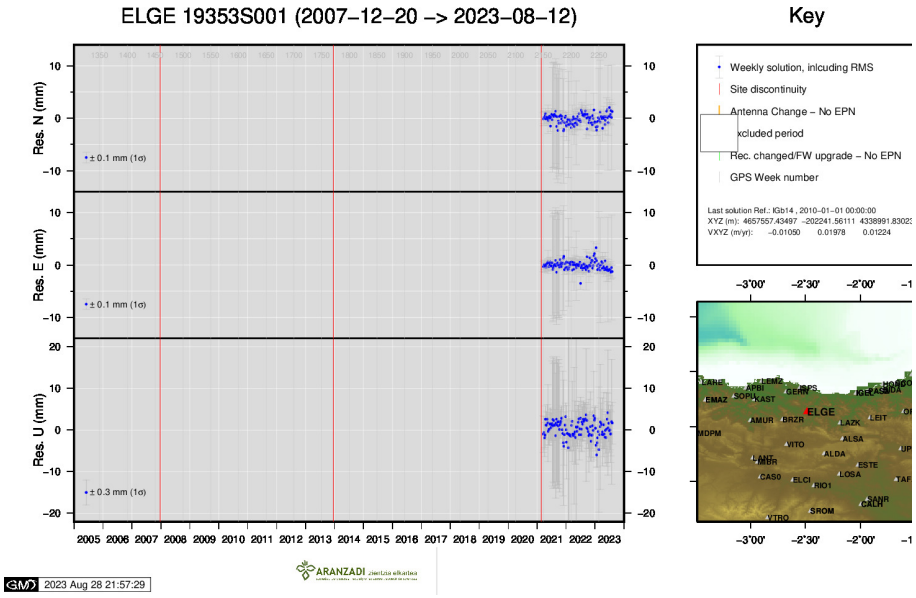
7) CANT



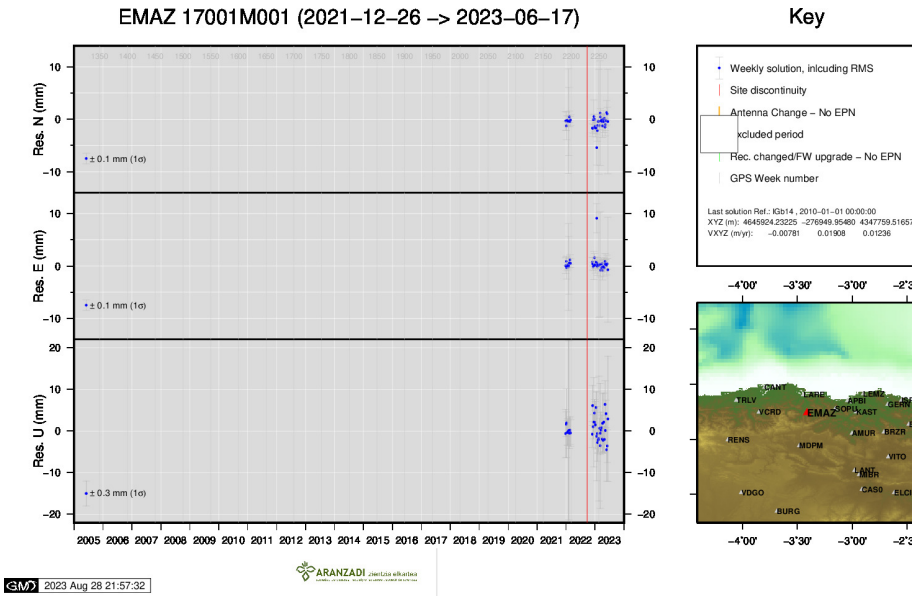
8) CHER



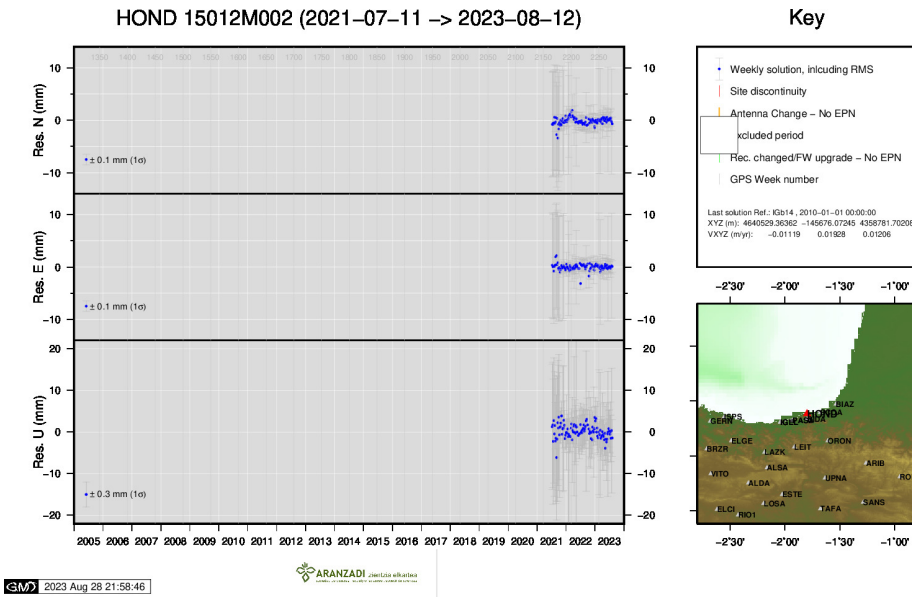
9) EBRE



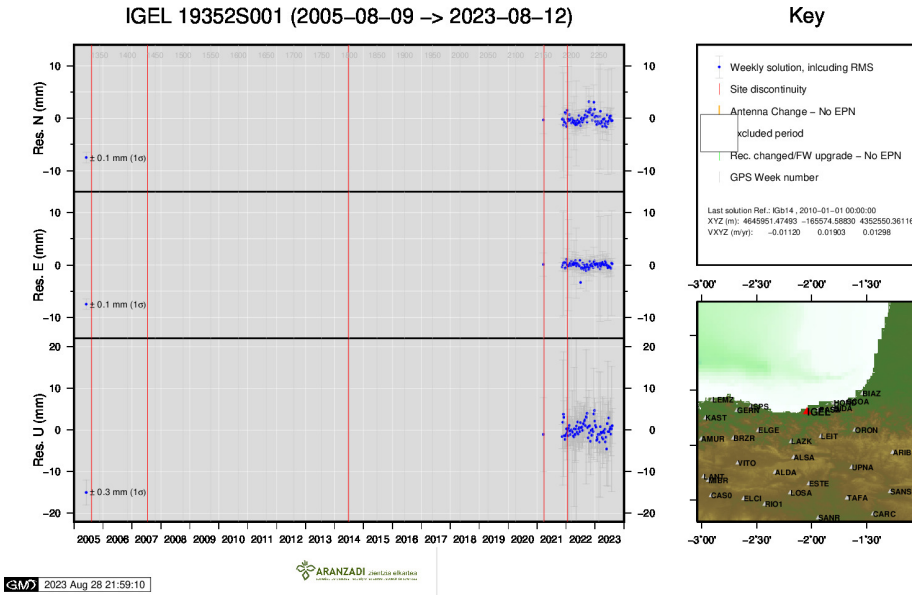
10) ELGE



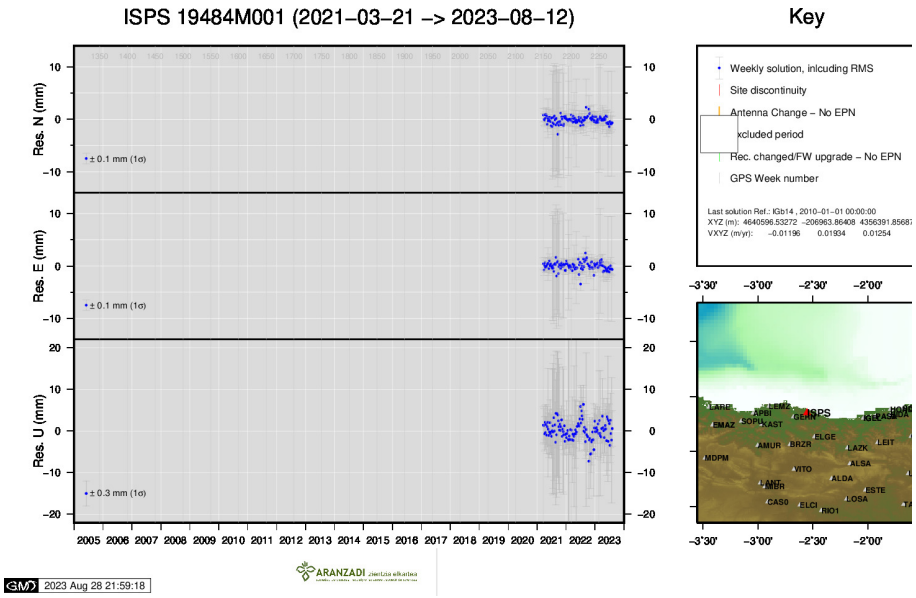
11) EMAZ



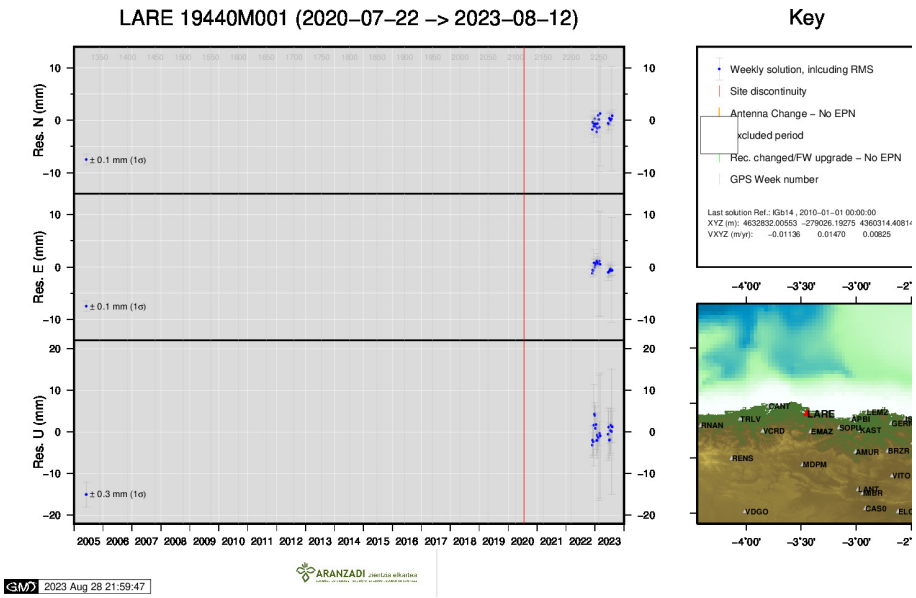
12) HOND



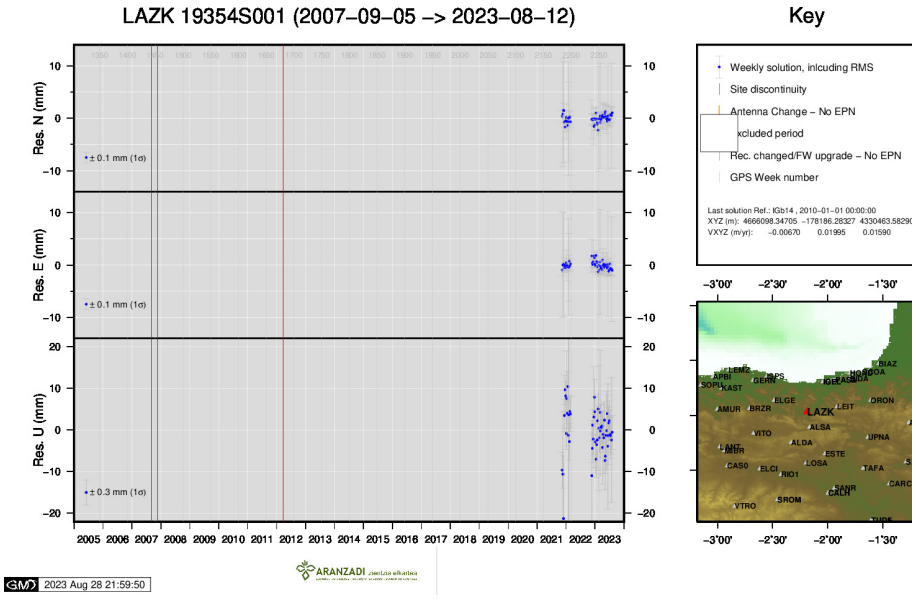
13) IGEL



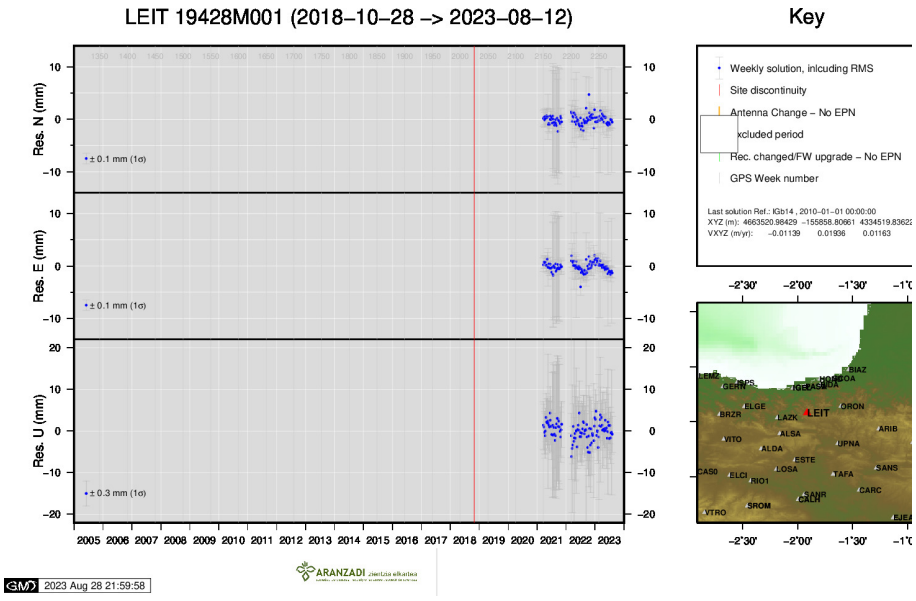
14) ISPS



15) LARE



16) LAZK



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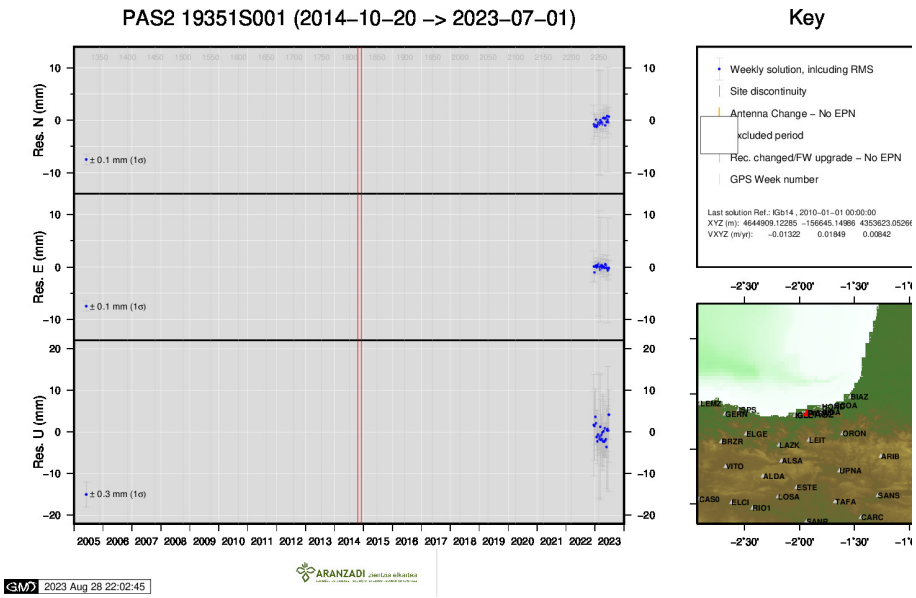

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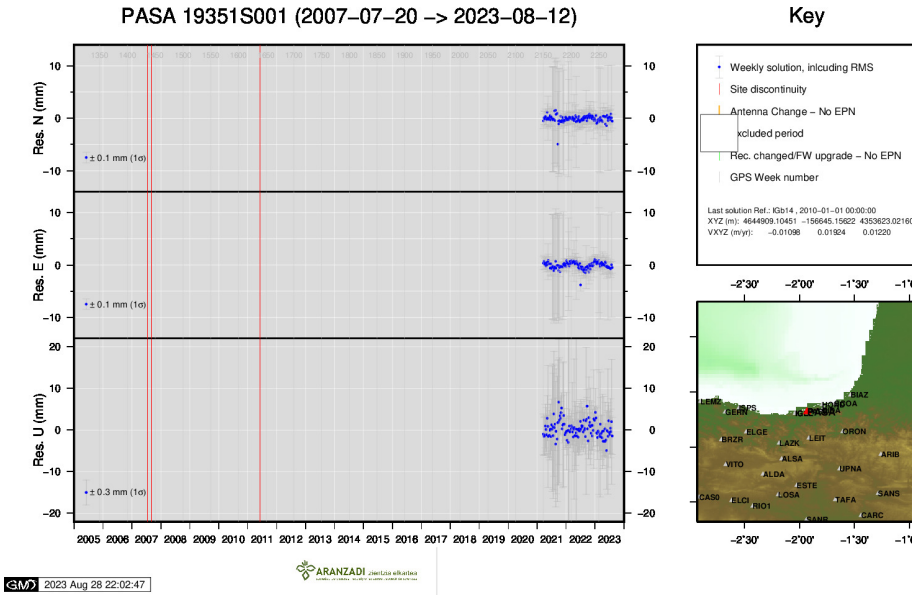
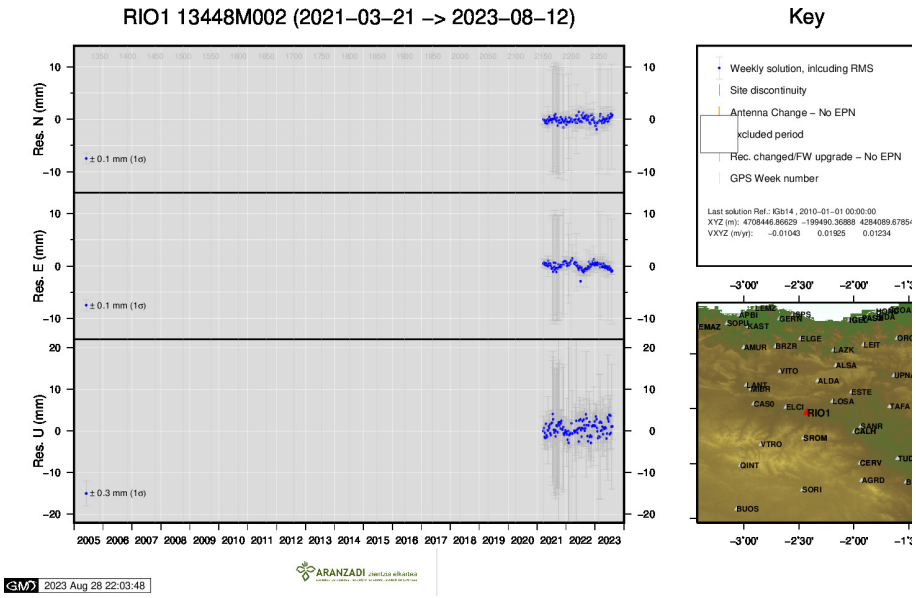


19) PASA



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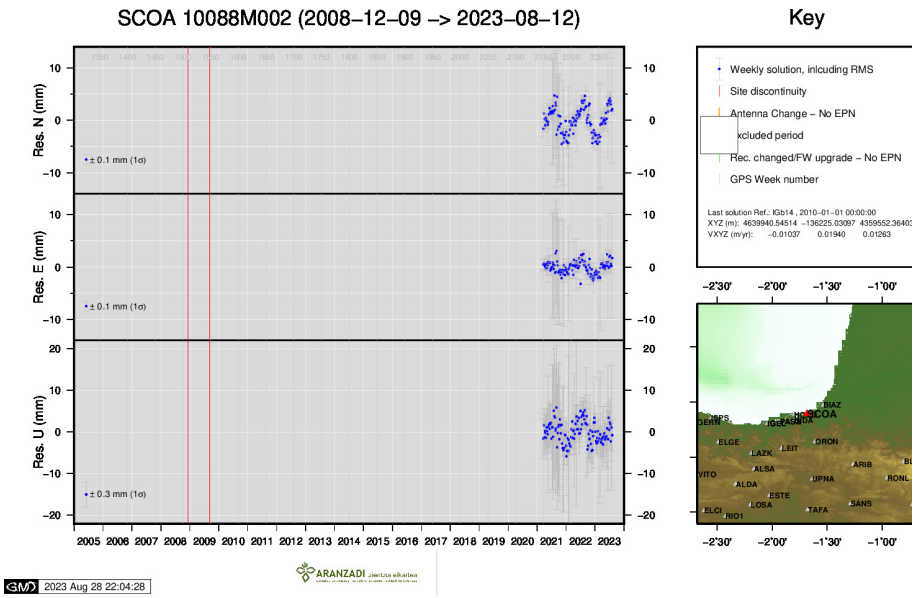
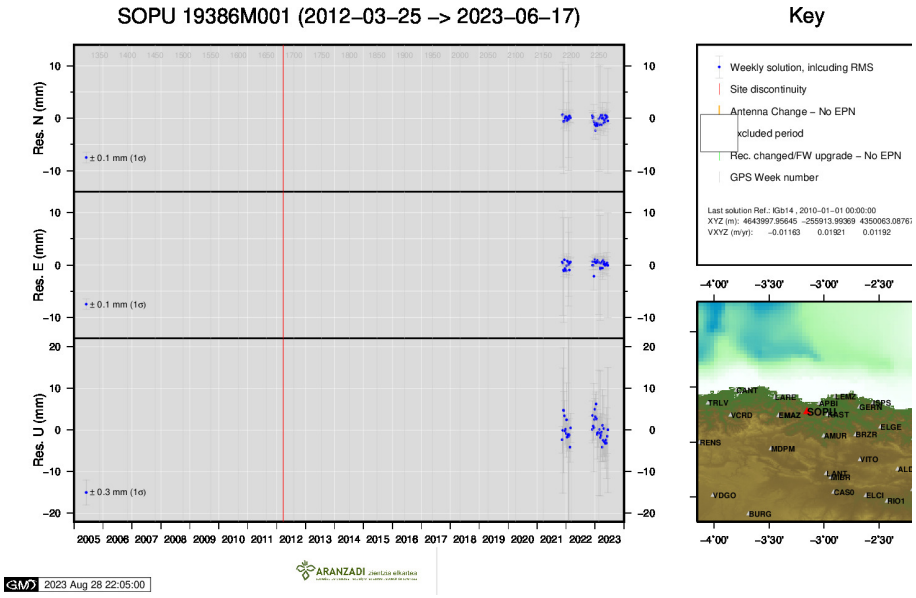
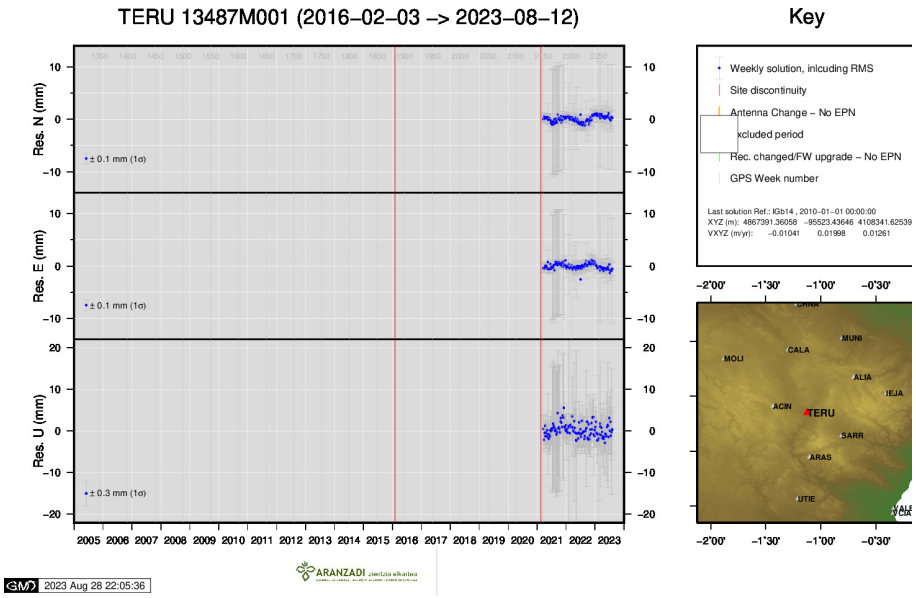


21) SCOA



22) SOPU



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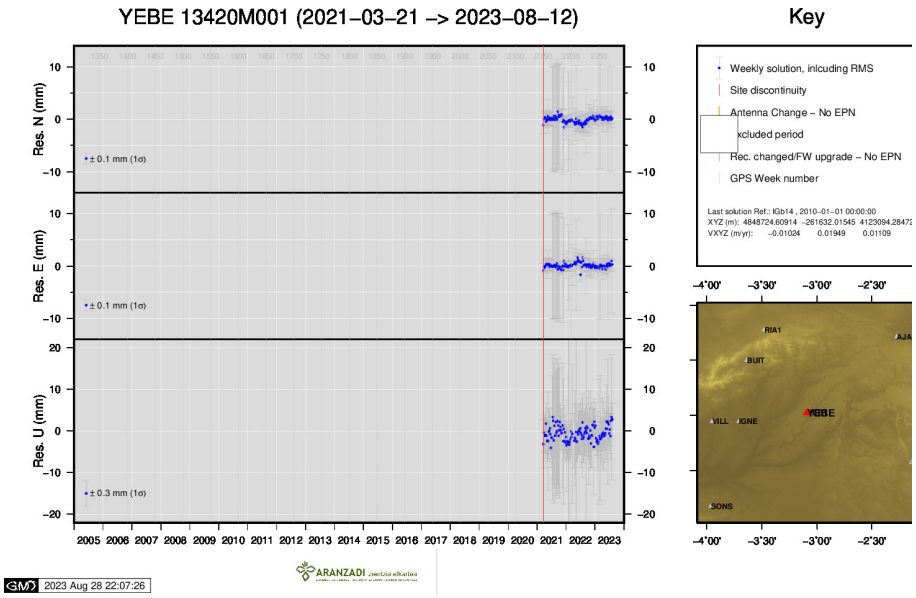

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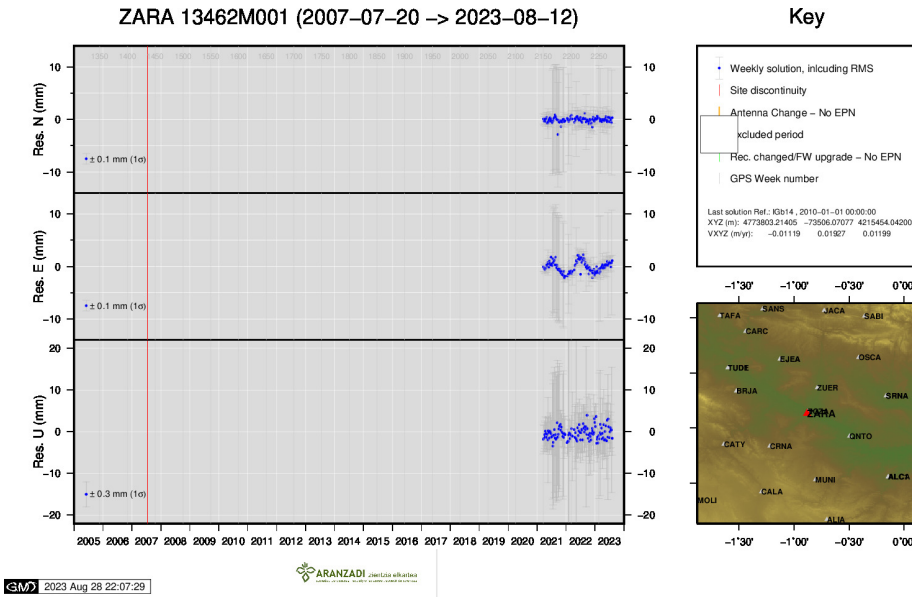

25) ZARA