

# ARA-DAC Weekly Analysis Result: 2248 (GFA)

## Technical Report

**GPS Week: 2248 (GFA)**

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

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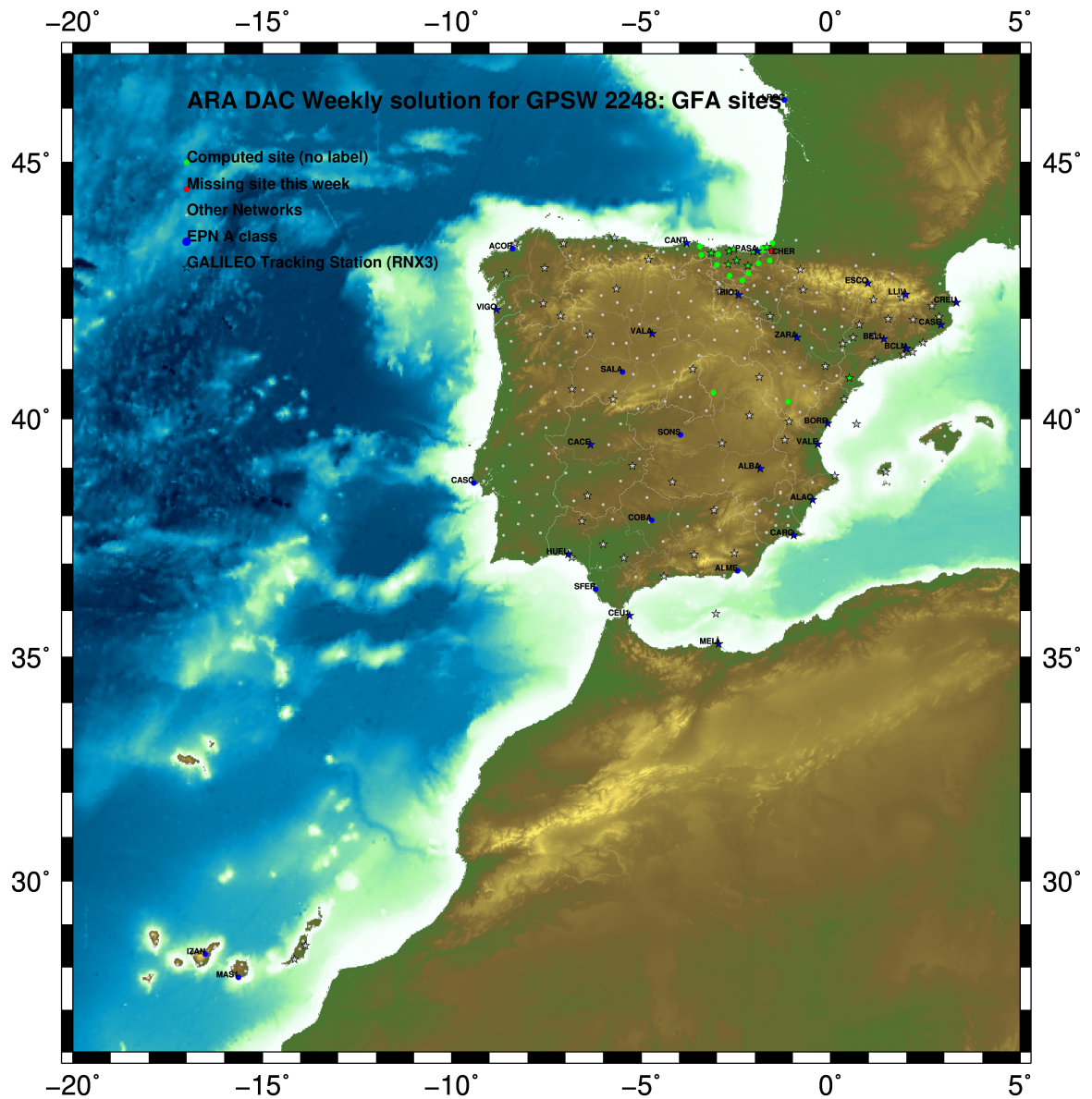
Report generated on 2023/03/02 at 16:53:11



# 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



2023 Mar 02 16:53:06

Fig.1: Computed Sites for GPS Week2248 (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. 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).
- 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.

ARA FINAL WEEKLY COMBINATION: FINAL ORBITS 02-MAR-23 14:18

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LOCAL GEODETIC DATUM: IGS20 EPOCH: 2023-02-08 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM	
4	ACOR	13434M001	4594489.51991	-678367.36411	4357066.32159	W	GRE
39	ALDA	19383M001	4687280.11556	-190876.49629	4308106.99762	A	GRE
50	ALSA	19419M001	4677250.79094	-176770.32485	4319079.91841	A	GRE
53	AMUR	19388M001	4661499.40549	-244591.18754	4332269.92483	A	GRE
100	BIAZ	10074M002	4634456.00323	-124344.90646	4365785.49738	A	GR
101	BIDA	00000M000	4644177.77487	-145778.25462	4354832.52164	A	GR
113	BRZR	19387M001	4662220.94411	-220769.82960	4333309.47958	A	GRE
104	CACE	13447M001	4899866.46542	-544566.96649	4033770.25102	W	GRE
116	CANT	13438M001	4625924.27495	-307096.16698	4365771.60320	W	GRE
162	CREU	13432M001	4715420.08233	273178.12889	4271946.88877	W	GRE
204	EBRE	13410M001	4833519.94646	41537.46181	4147461.76211	A	GRE
180	ELGE	19353S001	4657557.34921	-202241.40198	4338991.92799	A	GRE
182	EMAZ	17001M001	4645924.16800	-276949.79985	4347759.61425	A	GRE
209	GERN	19389M001	4642811.27236	-217222.85290	4353278.91461	A	GRE
257	HOND	15012M002	4640529.27285	-145676.91618	4358781.79890	A	GRE
235	IGEL	19352S001	4645951.38318	-165574.43424	4352550.46451	A	GRE
240	ISPS	19484M001	4640596.43630	-206963.70704	4356391.95876	A	GRE
245	KAST	19499M001	4646949.03115	-240747.20068	4348015.03466	A	GRE
252	LARE	19440M001	4632831.91277	-279026.07286	4360314.47334	A	GRE
256	LAZK	19354S001	4666098.29546	-178186.12234	4330463.71272	A	GRE
261	LEIT	19428M001	4663520.89342	-155858.64895	4334519.93028	A	GRE
334	ORDN	19427M001	4659695.73493	-130864.66710	4338948.92697	A	GRE
345	PAS2	19351S001	4644909.01502	-156644.99996	4353623.11878	A	GRE
493	PASA	19351S001	4644909.01506	-156644.99999	4353623.11883	W	GRE
553	RID1	13448M002	4708446.78259	-199490.21255	4284089.77839	W	GRE
558	SALA	13469M001	4803054.44359	-462131.00156	4158379.12229	W	GRE
566	SCDA	10088M002	4639940.46248	-136224.87514	4359552.46156	A	GRE
418	SOPU	19386M001	4643997.86294	-255913.83741	4350063.18306	A	GRE
443	TERU	13487M001	4867391.27561	-95523.27542	4108341.72882	A	GRE
493	VITO	19385M001	4679397.65669	-218436.43427	4314898.40967	A	GRE
752	YEBE	13420M001	4848724.52494	-261631.85797	4123094.37446	A	GRE
755	ZARA	13462M001	4773803.12272	-73505.91600	4215454.13905	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 02-MAR-23 14:18

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LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2023-02-08 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM	
4	ACOR	13434M001	4594489.85314	-678367.97450	4357065.85795	W	
39	ALDA	19383M001	4687280.50896	-190877.11664	4308106.53283	A	
50	ALSA	19419M001	4677251.18704	-176770.94399	4319079.45466	A	
53	AMUR	19388M001	4661499.79373	-244591.80501	4332269.46149	A	
100	BIAZ	10074M002	4634456.40985	-124345.52046	4365785.03795	A	
101	BIDA	00000M000	4644178.17783	-145778.86981	4354832.06110	A	
113	BRZR	19387M001	4662221.33556	-220770.44710	4333309.01650	A	
104	CACE	13447M001	4899866.79094	-544567.61212	4033769.76341	W	
116	CANT	13438M001	4625924.65761	-307096.78043	4365771.14201	W	
162	CREU	13432M001	4715420.53366	273177.50680	4271946.42781	W	
204	EBRE	13410M001	4833520.35774	41536.82519	4147461.28808	A	
180	ELGE	19353S001	4657557.74353	-202242.01889	4338991.46556	A	
182	EMAZ	17001M001	4645924.55321	-276950.41559	4347759.15179	A	
209	GERN	19389M001	4642811.66583	-217223.46811	4353278.45322	A	
257	HOND	15012M002	4640529.67613	-145676.53094	4358781.33867	A	
235	IGEL	19352S001	4645951.78336	-165575.04969	4352550.00355	A	
240	ISPS	19484M001	4640596.83136	-206964.32197	4356391.49769	A	
245	KAST	19499M001	4646949.42112	-240747.81644	4348014.57260	A	
252	LARE	19440M001	4632832.29868	-279026.68706	4360314.01195	A	
256	LAZK	19354S001	4666098.69227	-178186.74018	4330463.24989	A	
261	LEIT	19428M001	4663521.29247	-155859.26643	4334519.46797	A	
334	ORDN	19427M001	4659696.13860	-130865.28406	4338948.46532	A	
345	PAS2	19351S001	4644909.41646	-156645.61526	4353622.65803	A	
493	PASA	19351S001	4644909.41650	-156645.61529	4353622.65808	W	
553	RID1	13448M002	4708447.17298	-199490.83538	4284089.31170	W	
558	SALA	13469M001	4803054.78970	-462131.63592	4158378.64402	W	
566	SCDA	10088M002	4639940.86706	-136225.48981	4359552.00150	A	
418	SOPU	19386M001	4643998.25108	-255914.45286	4350062.72104	A	
443	TERU	13487M001	4867391.66588	-95523.91638	4108341.25009	A	
493	VITO	19385M001	4679398.04701	-218437.05377	4314899.94518	A	
752	YEBE	13420M001	4848724.89459	-261632.49721	4123093.89507	A	
755	ZARA	13462M001	4773803.52425	-73506.54607	4215453.66854	W	

### 5.3 ETRF2014 (ETRS89) Coordinates

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

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CONVERT TO ETRF2014                                02-MAR-23 14:18
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LOCAL GEODETIC DATUM: ETRF2014      EPOCH: 2023-02-08 11:59:45
NUM  STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
4    ACDR 13434M001    4594489.81277 -678368.01176 4357065.90984 W
39   ALDA 19383M001    4687280.46615 -190877.15527 4308106.58459 A
50   ALSA 19419M001    4677251.14430 -176770.98271 4319079.50646 A
53   AMUR 19388M001    4661499.75138 -244591.84355 4332269.51330 A
100  BIAZ 10074M002    4634456.36738 -124345.55955 4365785.08990 A
101  BIDA 00000M000    4644178.13533 -145778.90879 4354832.11301 A
113  BRZR 19387M001    4662221.29312 -220770.48573 4333309.06832 A
104  CACE 13447M001    4899866.74680 -544567.64853 4033769.81447 W
116  CANT 13438M001    4625924.61584 -307096.81891 4365771.19390 W
162  CREU 13432M001    4715420.48882 273177.46664 4271946.47981 W
204  EBRE 13410M001    4833520.31248 41536.78637 4147461.33958 A
180  ELGE 19353S001    4657557.70108 -202242.05760 4338991.51740 A
182  EMAZ 17001M001    4645924.51113 -276950.45408 4347759.20363 A
209  GERN 19389M001    4642811.62358 -217223.50684 4353278.50510 A
257  HOND 15012M002    4640529.63367 -145676.56994 4358781.39059 A
235  IGEL 19352S001    4645951.74091 -165575.08859 4352550.05545 A
240  ISPS 19484M001    4640596.78910 -206964.36075 4356391.54958 A
245  KAST 19499M001    4646949.37892 -240747.85506 4348014.62446 A
252  LARE 19440M001    4632832.25675 -279026.72560 4360314.06383 A
256  LAZK 19354S001    4666098.64964 -178186.77894 4330463.30172 A
261  LEIT 19428M001    4663521.24980 -155859.30529 4334519.51982 A
334  ORDN 19427M001    4659696.09588 -130865.32303 4338948.51719 A
345  PAS2 19351S001    4644909.37399 -156645.65420 4353622.70993 A
493  PASA 19351S001    4644909.37403 -156645.65423 4353622.70998 W
553  RIO1 13448M002    4708447.12997 -199490.87388 4284089.36339 W
558  SALA 13469M001    4803054.74645 -462131.67306 4158378.69535 W
566  SOA 10088M002    4639940.82457 -136225.52884 4359552.05343 A
418  SOPU 19386M001    4643998.20896 -255914.49144 4350062.77290 A
443  TERU 13487M001    4867391.62073 -95523.95456 4108341.30140 A
493  VITO 19385M001    4679398.00437 -218437.09233 4314897.99694 A
752  YEBE 13420M001    4848724.85021 -261632.53487 4123093.94634 A
755  ZARA 13462M001    4773803.48009 -73506.58474 4215453.72011 W

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## 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).

ARA FINAL WEEKLY COMBINATION: FINAL ORBITS 02-MAR-23 14:18

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	7	XXXXXX	0.51	0.73	2.32
ALDA 19383M001	7	XXXXXX	1.19	0.63	2.08
ALSA 19419M001	7	XXXXXX	2.14	1.11	1.84
AMUR 19388M001	7	XXXXXX	0.55	0.61	1.39
BLAZ 10074M002	7	XXXXXX	0.59	0.43	3.53
BIDA 00000M000	7	XXXXXX	0.42	0.46	2.06
BRZR 19387M001	7	XXXXXX	0.35	1.05	2.27
CACE 13447M001	5	XXXX	0.43	0.29	2.15
CANT 13438M001	7	XXXXXX	0.84	0.42	2.44
CREU 13432M001	7	XXXXXX	0.59	0.49	2.37
EBRE 13410M001	7	XXXXXX	0.86	0.64	3.21
ELGE 19353S001	7	XXXXXX	0.91	0.91	2.11
EMAZ 17001M001	7	XXXXXX	0.95	0.84	1.48
GERN 19389M001	7	XXXXXX	0.66	0.40	1.50
HOND 15012M002	7	XXXXXX	0.29	0.44	1.53
IGEL 19352S001	7	XXXXXX	0.32	0.34	1.46
ISPS 19484M001	7	XXXXXX	0.37	0.63	2.10
KAST 19499M001	7	XXXXXX	0.42	0.53	1.33
LARE 19440M001	7	XXXXXX	1.81	0.54	1.57
LAZK 19354S001	7	XXXXXX	0.29	0.67	4.86
LEIT 19428M001	7	XXXXXX	1.53	0.64	3.37
ORON 19427M001	7	XXXXXX	0.33	0.51	2.73
PAS2 19351S001	7	XXXXXX	0.40	0.42	1.44
PASA 19351S001	7	XXXXXX	0.39	0.42	1.41
RI01 13448M002	7	XXXXXX	0.45	0.56	2.70
SALA 13469M001	7	XXXXXX	0.46	0.43	1.86
SCDA 10088M002	7	XXXXXX	0.39	0.64	2.70
SOPU 19386M001	7	XXXXXX	0.30	0.55	2.12
TERU 13487M001	7	XXXXXX	0.31	0.59	2.12
VITD 19385M001	7	XXXXXX	0.38	0.51	2.01
YEBE 13420M001	7	XXXXXX	0.35	0.38	1.80
ZARA 13462M001	7	XXXXXX	0.40	0.41	1.40

Comparison of individual solutions:

ACOR 13434M001	N	0.51	-0.31	-0.29	0.69	0.69	-0.08	0.53	0.35
ACOR 13434M001	E	0.73	0.07	-1.20	-0.20	-0.36	-0.95	0.80	0.24
ACOR 13434M001	U	2.32	-4.36	1.21	-1.51	0.35	0.97	-1.09	-2.70
ALDA 19383M001	N	1.19	1.64	1.97	-0.92	-0.31	0.57	-0.06	-0.80
ALDA 19383M001	E	0.63	-0.34	-0.96	0.47	0.80	-0.50	0.15	-0.50
ALDA 19383M001	U	2.08	-0.80	2.86	2.17	-2.61	-1.43	1.69	0.95
ALSA 19419M001	N	2.14	1.93	1.03	0.83	-1.24	1.44	1.46	-4.03
ALSA 19419M001	E	1.11	-1.49	-0.41	-0.62	-0.64	-0.35	0.46	1.97
ALSA 19419M001	U	1.84	2.29	0.58	0.51	-1.53	-0.78	1.51	-3.03
AMUR 19388M001	N	0.55	-0.67	-0.32	0.92	0.39	-0.38	-0.02	-0.35
AMUR 19388M001	E	0.61	-0.09	0.30	0.66	0.35	-0.36	-0.04	-1.21
AMUR 19388M001	U	1.39	-0.93	-0.25	1.46	0.19	0.11	-2.86	-0.62
BLAZ 10074M002	N	0.59	-0.62	-0.59	-0.16	1.12	0.23	-0.14	-0.20
BLAZ 10074M002	E	0.43	-0.80	-0.27	0.29	0.45	0.20	0.19	-0.10
BLAZ 10074M002	U	3.53	4.72	4.03	-3.23	-3.23	-1.17	-0.21	3.76
BIDA 00000M000	N	0.42	-0.44	0.27	-0.37	-0.14	-0.47	0.24	0.61
BIDA 00000M000	E	0.46	-0.59	-0.32	-0.19	0.03	0.80	-0.08	0.35
BIDA 00000M000	U	2.06	1.82	3.10	-0.75	-0.56	2.01	-2.57	0.97
BRZR 19387M001	N	0.35	-0.44	-0.34	0.34	0.19	-0.02	0.51	0.09
BRZR 19387M001	E	1.05	1.18	-1.28	1.42	-0.81	0.11	0.85	0.43
BRZR 19387M001	U	2.27	-1.47	2.79	2.75	-2.50	-0.21	-2.15	-1.56
CACE 13447M001	N	0.43			0.17	-0.57	-0.49	-0.24	-0.25
CACE 13447M001	E	0.29			-0.08	0.11	-0.00	0.41	0.39
CACE 13447M001	U	2.15			0.62	-1.27	0.26	-3.14	-2.56
CANT 13438M001	N	0.84	-0.07	0.07	1.03	0.65	0.90	0.70	1.21
CANT 13438M001	E	0.42	0.28	0.20	-0.04	0.06	0.00	0.03	0.96
CANT 13438M001	U	2.44	1.17	2.23	-3.11	3.36	-2.56	-0.90	1.02
CREU 13432M001	N	0.59	0.52	-0.50	-0.10	-0.01	0.61	0.07	1.10
CREU 13432M001	E	0.49	-0.41	-0.42	0.95	0.00	-0.07	-0.32	-0.29
CREU 13432M001	U	2.37	4.67	1.78	-2.04	-1.48	-1.53	0.21	-0.12
EBRE 13410M001	N	0.86	0.68	-0.86	-0.19	-0.49	-0.01	1.14	1.28
EBRE 13410M001	E	0.64	-0.65	-0.28	1.24	0.07	-0.34	-0.51	0.14
EBRE 13410M001	U	3.21	-0.27	3.26	-0.43	5.83	-1.16	-2.70	-2.87
ELGE 19353S001	N	0.91	0.52	-1.12	-1.07	-0.26	0.18	0.76	1.28
ELGE 19353S001	E	0.91	0.90	-1.13	1.35	-0.24	0.35	0.88	-0.22
ELGE 19353S001	U	2.11	1.29	3.52	-0.58	-1.94	-2.52	-0.67	-1.28
EMAZ 17001M001	N	0.95	-0.73	-0.92	1.30	1.06	0.79	0.76	0.02
EMAZ 17001M001	E	0.84	-0.10	-1.10	0.99	-0.23	0.59	1.22	0.30
EMAZ 17001M001	U	1.48	-0.24	1.55	-2.05	2.11	-0.42	-1.22	-0.61
GERN 19389M001	N	0.66	-0.36	-0.79	1.31	0.14	-0.06	0.19	0.21
GERN 19389M001	E	0.40	-0.13	-0.26	-0.14	0.20	0.45	0.69	0.38
GERN 19389M001	U	1.50	-1.60	0.19	-2.06	-1.86	1.40	-0.21	-1.06
HOND 15012M002	N	0.29	0.01	-0.22	-0.24	-0.08	-0.36	0.51	0.08
HOND 15012M002	E	0.44	-0.50	-0.30	-0.21	0.19	-0.27	0.73	0.39
HOND 15012M002	U	1.53	2.04	2.22	0.18	0.07	-1.61	-0.13	1.49
IGEL 19352S001	N	0.32	-0.68	-0.19	-0.02	0.21	0.04	0.02	0.25
IGEL 19352S001	E	0.34	-0.13	-0.04	0.00	-0.10	-0.14	0.75	-0.32
IGEL 19352S001	U	1.46	2.18	2.20	1.18	-1.03	-0.36	0.71	-0.36
ISPS 19484M001	N	0.37	-0.42	0.03	0.30	0.25	-0.37	0.48	0.34
ISPS 19484M001	E	0.63	0.62	-0.98	0.16	0.17	-0.03	0.40	0.92
ISPS 19484M001	U	2.10	-0.21	1.70	-1.56	-4.19	1.11	-0.49	-1.48
KAST 19499M001	N	0.42	-0.49	-0.33	0.28	0.68	0.05	0.42	0.06
KAST 19499M001	E	0.53	0.11	-0.63	0.89	-0.09	0.09	0.68	0.12
KAST 19499M001	U	1.33	-1.84	0.77	-1.02	-1.20	-1.13	-1.52	0.72
LARE 19440M001	N	1.81	-2.28	-1.51	-1.47	2.55	0.55	0.90	1.56
LARE 19440M001	E	0.54	0.53	0.16	0.42	-0.70	0.53	0.68	0.18
LARE 19440M001	U	1.57	-0.72	2.94	-0.92	-1.48	0.00	-1.15	-1.14
LAZK 19354S001	N	0.29	0.41	0.34	0.02	0.16	-0.17	0.40	0.08
LAZK 19354S001	E	0.67	-1.09	-0.22	1.02	0.23	-0.40	-0.38	-0.14

LAZK	19354S001	U	4.86	4.11	5.07	-6.33	-6.75	-1.14	1.08	3.28
LEIT	19428M001	N	1.53	2.42	0.28	-0.13	-0.09	0.45	0.26	-2.79
LEIT	19428M001	E	0.64	0.23	-0.49	0.04	-0.40	-1.02	-0.27	0.93
LEIT	19428M001	U	3.37	-3.58	5.59	-3.48	1.10	-0.01	-1.11	3.09
ORDN	19427M001	N	0.33	-0.08	-0.10	0.12	0.50	-0.19	-0.10	0.56
ORDN	19427M001	E	0.51	-0.46	0.05	-0.16	0.03	-1.08	0.35	0.16
ORDN	19427M001	U	2.73	3.34	4.94	0.15	0.36	-0.13	-2.72	1.28
PAS2	19351S001	N	0.40	-0.63	-0.34	-0.13	0.63	0.11	-0.04	-0.01
PAS2	19351S001	E	0.42	-0.52	-0.49	-0.16	0.05	0.14	0.37	0.60
PAS2	19351S001	U	1.44	1.44	1.81	1.98	0.52	-0.46	-1.49	0.67
PASA	19351S001	N	0.39	-0.60	-0.38	-0.10	0.62	0.15	-0.05	-0.07
PASA	19351S001	E	0.42	-0.55	-0.49	-0.13	0.06	0.15	0.37	0.58
PASA	19351S001	U	1.41	1.52	1.83	1.75	0.41	-0.45	-1.47	0.83
RID1	13448M002	N	0.45	0.04	-0.55	0.52	0.19	-0.14	-0.21	0.73
RID1	13448M002	E	0.56	-0.83	0.12	-0.09	0.19	-0.25	-0.74	0.72
RID1	13448M002	U	2.70	2.64	3.18	-1.76	2.04	-3.89	-0.37	-2.04
SALA	13469M001	N	0.46	-0.35	-0.22	0.80	-0.15	-0.22	0.10	-0.63
SALA	13469M001	E	0.43	0.17	-0.60	0.06	-0.09	-0.16	0.67	0.48
SALA	13469M001	U	1.86	-3.48	1.10	0.09	1.62	-1.43	-1.00	-1.33
SCDA	10088M002	N	0.39	-0.09	-0.65	0.09	0.41	-0.15	-0.11	0.50
SCDA	10088M002	E	0.64	-1.08	-0.54	0.65	0.61	-0.19	0.41	-0.02
SCDA	10088M002	U	2.70	3.79	4.10	0.30	-1.96	-2.63	-0.02	1.37
SOPU	19386M001	N	0.30	0.36	-0.15	-0.23	0.34	0.39	0.18	-0.23
SOPU	19386M001	E	0.55	0.05	-0.27	0.22	-0.25	-0.34	0.71	1.01
SOPU	19386M001	U	2.12	-2.55	-2.40	2.60	-1.91	-1.92	0.61	0.54
TERU	13487M001	N	0.31	0.09	0.04	0.15	0.55	-0.44	0.19	0.15
TERU	13487M001	E	0.59	-0.91	0.35	0.57	0.64	0.03	0.32	0.54
TERU	13487M001	U	2.12	0.40	-0.93	2.22	2.53	0.07	-0.79	-3.74
VITO	19385M001	N	0.38	-0.59	0.35	-0.03	0.35	-0.32	-0.17	0.37
VITO	19385M001	E	0.51	-0.86	-0.42	0.61	-0.22	0.25	0.35	0.12
VITO	19385M001	U	2.01	0.30	3.32	-0.73	-0.50	-2.60	-2.30	-0.41
YEBE	13420M001	N	0.35	0.24	-0.37	0.28	-0.16	-0.45	-0.36	0.31
YEBE	13420M001	E	0.38	-0.33	-0.54	0.24	0.12	0.26	0.55	-0.03
YEBE	13420M001	U	1.80	-1.06	2.20	0.11	-1.00	-0.65	-1.83	-2.94
ZARA	13462M001	N	0.40	0.77	0.32	-0.14	0.09	-0.20	-0.33	0.31
ZARA	13462M001	E	0.41	-0.71	-0.17	-0.38	-0.02	-0.11	-0.32	-0.46
ZARA	13462M001	U	1.40	-2.10	-0.19	1.43	1.50	1.05	-0.65	-1.20



### 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	0.50	0.43	1.84
2	ALAC 13433M001	I W	-2.95	3.66	2.18
3	ALBA 13452M001	I W	3.66	-1.84	-6.37
4	ALME 13437M001	I W	-2.64	0.39	1.52
5	BCLN 13412M001	I W	0.92	-1.11	1.18
6	BELL 13431M001	I W	-0.56	0.24	2.76
7	BORR 13480M001	I W	-2.10	-1.03	0.42
8	BRST 10004M004	I W	-1.71	-2.05	0.42
9	CACE 13447M001	I W	-0.44	1.12	4.22
10	CANT 13438M001	I W	-1.28	2.31	-7.19
11	CARG 19412M001	I W	1.29	0.49	-5.40
12	CASE 13494M001	I W	-4.48	2.06	-1.10
13	CEU1 13449M002	I W	0.83	-0.92	-6.58
14	COBA 13453M001	I W	1.40	1.55	-6.77
15	CREU 13432M001	I W	-3.66	1.60	-2.13
17	ESCO 13435M001	I W	-4.98	0.10	4.96
18	HUEL 13451M001	I W	8.76	-9.05	8.38
20	IZAN 31309M002	I W	0.44	1.62	-2.37
21	LLIV 13436M001	I W	-0.24	0.64	3.31
23	LROC 10023M001	I W	-1.01	1.37	8.71
25	MAS1 31303M002	I W	-1.18	-0.77	-8.78
26	MELI 19379M001	I W	1.73	2.81	-9.46
27	PASA 19351S001	I W	1.82	0.51	-2.01
28	PDEL 31906M004	I W	0.10	-2.99	6.83
29	RIO1 13448M002	I W	-1.31	-2.06	1.80
30	SALA 13469M001	I W	1.14	2.24	-1.47
32	SFER 13402M004	I W	-2.80	-8.87	3.92
33	SONS 13446M001	I W	1.45	4.46	-0.20
34	VALA 13463M002	I W	0.70	1.97	0.73
35	VALE 13439M001	I W	-4.52	5.33	-7.77
36	VIGO 13450M001	I W	3.23	-0.73	-0.03
39	ZARA 13462M001	I W	-0.98	1.95	1.52
40	ZIMM 14001M004	I W	-2.45	0.10	8.81
298	CASC 13909S001	A W	3.60	-8.41	5.66
RMS / COMPONENT			2.76	3.30	5.08
IQR			3.40	2.98	5.68
MEAN			-0.23	-0.08	0.05
MEDIAN			-0.34	0.46	0.58
MIN			-4.98	-9.05	-9.46
MAX			8.76	5.33	8.81
OVERALL RMS/IQR/MAX(3D)			3.85	3.83	15.13
					HUEL 13451M001 #SUM
ALL RMS / COMPONENT			2.76	3.30	5.08
ALL IQR			3.40	2.98	5.68
ALL MEAN			-0.23	-0.08	0.05
ALL MEDIAN			-0.34	0.46	0.58
ALL MIN			-4.98	-9.05	-9.46
ALL MAX			8.76	5.33	8.81
ALL OVERALL RMS/IQR/MAX(3D)			3.85	3.83	15.13
					HUEL 13451M001 #SUM_ALL

NUMBER OF PARAMETERS : 3  
NUMBER OF STATIONS : 34  
NUMBER OF COORDINATES : 102  
RMS OF TRANSFORMATION : 3.85 MM

PARAMETERS:

TRANSLATION IN X : -0.00 +- 0.66 MM  
TRANSLATION IN Y : -0.00 +- 0.66 MM  
TRANSLATION IN Z : 0.00 +- 0.66 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          20607249
NUMBER OF UNKNOWN(S)            199617
NUMBER OF DEGREES OF FREEDOM    20407632
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
WEIGHTED SQUARE SUM OF O-C     41.205042893619172
```

## 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 23:036:00000 23:042:86370 LEICA GR50 -----
ALDA A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
ALSA A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
AMUR A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
BIAZ A 1 P 23:036:00000 23:042:86370 SPECTRA SP90M -----
BIDA A 1 P 23:036:00000 23:042:86370 LEICA GR10 -----
BRZR A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
CACE A 1 P 23:038:00000 23:042:86370 TRIMBLE NETR9 -----
CANT A 1 P 23:036:00000 23:042:86370 LEICA GR10 -----
CREU A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
EBRE A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
ELGE A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
EMAZ A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
GERN A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
HOND A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
IGEL A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
ISPS A 1 P 23:036:00000 23:042:86370 TRIMBLE NETR9 -----
KAST A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
LARE A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
LAZK A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
LEIT A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
ORON A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
PAS2 A 1 P 23:036:00000 23:042:86370 STONEX SC2200 -----
PASA A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
RIO1 A 1 P 23:036:00000 23:042:86370 LEICA GR25 -----
SALA A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
SCOA A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
SOPU A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
TERU A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
VITO A 1 P 23:036:00000 23:042:86370 LEICA GR30 -----
YEBE A 1 P 23:036:00000 23:042:86370 LEICA GR50 -----
ZARA A 1 P 23:036:00000 23:042:86370 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 23:036:00000 23:042:86370 LEIAT504 LEIS -----
ALDA A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
ALSA A 1 P 23:036:00000 23:042:86370 LEIAR10 NONE -----
AMUR A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
BIAZ A 1 P 23:036:00000 23:042:86370 LEIAR25 LEIT -----
BIDA A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
BRZR A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
CACE A 1 P 23:038:00000 23:042:86370 TRM29659.00 NONE -----
CANT A 1 P 23:036:00000 23:042:86370 LEIAR25_R4 LEIT -----
CREU A 1 P 23:036:00000 23:042:86370 LEIAR25_R4 NONE -----
EBRE A 1 P 23:036:00000 23:042:86370 LEIAR25_R4 NONE -----
ELGE A 1 P 23:036:00000 23:042:86370 LEIAR25_R4 LEIT -----
EMAZ A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
GERN A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
HOND A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
IGEL A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
ISPS A 1 P 23:036:00000 23:042:86370 TRM59900.00 SCIS -----
KAST A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
LARE A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
LAZK A 1 P 23:036:00000 23:042:86370 LEIAR25_R4 LEIT -----
LEIT A 1 P 23:036:00000 23:042:86370 LEIAR10 NONE -----
ORON A 1 P 23:036:00000 23:042:86370 LEIAR10 NONE -----
PAS2 A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
PASA A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
RIO1 A 1 P 23:036:00000 23:042:86370 LEIAR25_R4 LEIT -----
SALA A 1 P 23:036:00000 23:042:86370 LEIAR25 NONE -----
SCOA A 1 P 23:036:00000 23:042:86370 TRM55971.00 NONE -----
SOPU A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
TERU A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
VITO A 1 P 23:036:00000 23:042:86370 LEIAS10 NONE -----
YEBE A 1 P 23:036:00000 23:042:86370 LEIAR20 LEIM -----
ZARA A 1 P 23:036:00000 23:042:86370 TRM29659.00 NONE -----
```

### 7.3 Eccentricities

*S	PT	SOLN	T	DATA_START	DATA_END	AXE	UP	NORTH	EAST
AR	P						ARP	BENCHMARK	(M)
ACDR	A	1	P	23:036:00000	23:042:86370	UNE	3.0460	0.0000	0.0000
ALDA	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
ALSA	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
AMUR	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
BLAZ	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
BIDA	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
BRZR	A	1	P	23:036:00000	23:042:86370	UNE	0.0771	0.0000	0.0000
CACE	A	1	P	23:038:00000	23:042:86370	UNE	0.0600	0.0000	0.0000
CANT	A	1	P	23:036:00000	23:042:86370	UNE	3.0490	0.0000	0.0000
CREU	A	1	P	23:036:00000	23:042:86370	UNE	0.0770	0.0000	0.0000
EBRE	A	1	P	23:036:00000	23:042:86370	UNE	0.0770	0.0000	0.0000
ELGE	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
EMAZ	A	1	P	23:036:00000	23:042:86370	UNE	0.0350	0.0000	0.0000
GERN	A	1	P	23:036:00000	23:042:86370	UNE	0.0771	0.0000	0.0000
HOND	A	1	P	23:036:00000	23:042:86370	UNE	0.0771	0.0000	0.0000
IGEL	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
ISPS	A	1	P	23:036:00000	23:042:86370	UNE	0.0350	0.0000	0.0000
KAST	A	1	P	23:036:00000	23:042:86370	UNE	0.0350	0.0000	0.0000
LARE	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
LAZK	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
LEIT	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
ORDN	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
PAS2	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
PASA	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
RID1	A	1	P	23:036:00000	23:042:86370	UNE	0.0606	0.0000	0.0000
SALA	A	1	P	23:036:00000	23:042:86370	UNE	0.0600	0.0000	0.0000
SCDA	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
SOPU	A	1	P	23:036:00000	23:042:86370	UNE	0.0771	0.0000	0.0000
TERU	A	1	P	23:036:00000	23:042:86370	UNE	0.0600	0.0000	0.0000
VITO	A	1	P	23:036:00000	23:042:86370	UNE	0.0000	0.0000	0.0000
YEBE	A	1	P	23:036:00000	23:042:86370	UNE	0.0600	0.0000	0.0000
ZARA	A	1	P	23:036:00000	23:042:86370	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:

2023-02-28 14:24 UTC	ALDA0360.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: alda00esp_20221108.log
2023-02-28 14:24 UTC	ALSA0360.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: alsa00esp_20181108.log
2023-02-28 14:24 UTC	AMUR0360.230	ANTENNA SER. NO.	16471028 -> 12041036 (source: amur00esp_20221114.log
2023-02-28 14:24 UTC	AMUR0360.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: amur00esp_20221114.log
2023-02-28 14:24 UTC	ISPS0360.230	RECEIVER FIRM. VERS.	5.30 -> 5.22 (source: isps00esp_20220907.log
2023-02-28 14:24 UTC	LEIT0360.230	RECEIVER FIRM. VERS.	4.52/7.711 -> 4.31/7.403 (source: leit00esp_20200723.log
2023-02-28 14:24 UTC	LEIT0360.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: leit00esp_20181204.log
2023-02-28 14:24 UTC	ORON0360.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: oron00esp_20181101.log
2023-02-28 14:24 UTC	VITO0360.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: vito00esp_20221108.log
2023-02-28 17:23 UTC	ALDA0370.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: alda00esp_20221108.log
2023-02-28 17:23 UTC	ALSA0370.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: alsa00esp_20181108.log
2023-02-28 17:23 UTC	AMUR0370.230	ANTENNA SER. NO.	16471028 -> 12041036 (source: amur00esp_20221114.log
2023-02-28 17:23 UTC	AMUR0370.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: amur00esp_20221114.log
2023-02-28 17:23 UTC	ISPS0370.230	RECEIVER FIRM. VERS.	5.30 -> 5.22 (source: isps00esp_20220907.log
2023-02-28 17:23 UTC	LARE0370.230	RECEIVER FIRM. VERS.	4.52/7.711 -> 4.31/7.403 (source: lare00esp_20200723.log
2023-02-28 17:23 UTC	LEIT0370.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: leit00esp_20181204.log
2023-02-28 17:23 UTC	ORON0370.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: oron00esp_20181101.log
2023-02-28 17:23 UTC	VITO0370.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: vito00esp_20221108.log
2023-02-28 20:26 UTC	ALDA0380.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: alda00esp_20221108.log
2023-02-28 20:26 UTC	ALSA0380.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: alsa00esp_20181108.log
2023-02-28 20:26 UTC	AMUR0380.230	ANTENNA SER. NO.	16471028 -> 12041036 (source: amur00esp_20221114.log
2023-02-28 20:26 UTC	AMUR0380.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: amur00esp_20221114.log
2023-02-28 20:26 UTC	ISPS0380.230	RECEIVER FIRM. VERS.	5.30 -> 5.22 (source: isps00esp_20220907.log
2023-02-28 20:26 UTC	LARE0380.230	RECEIVER FIRM. VERS.	4.52/7.711 -> 4.31/7.403 (source: lare00esp_20200723.log
2023-02-28 20:26 UTC	LEIT0380.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: leit00esp_20181204.log
2023-02-28 20:27 UTC	ORON0380.230	RECEIVER FIRM. VERS.	4.31/7.403 -> 4.31 (source: oron00esp_20181101.log
2023-02-28 20:27 UTC	VITO0380.230	RECEIVER FIRM. VERS.	4.60/7.811 -> 4.60.259 (source: vito00esp_20221108.log
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2023-03-01 01:32 UTC	LARE0390.230	RECEIVER FIRM. VERS.	4.52/7.711 -> 4.31/7.403 (source: lare00esp_20200723.log
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2023-03-01 11:16 UTC | ORON0420.230 | RECEIVER FIRM. VERS. | 4.31/7.403 -> 4.31 (source: oron00esp\_20181101.log)  
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## 9 References

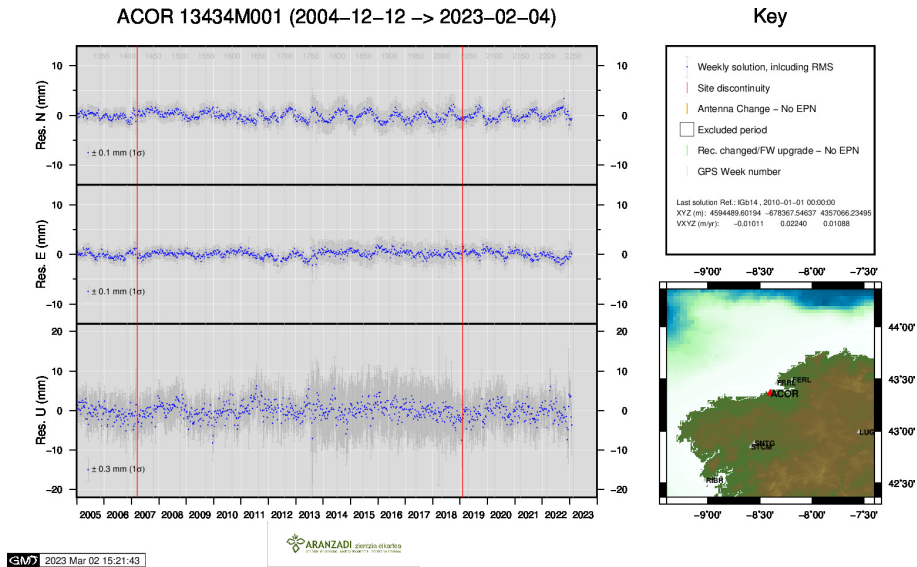
C. Boucher and Z. Altamimi (2011): *Specifications for reference frame fixing in the analysis of a EUREF GPS campaign*. [etrs89.ensg.ign.fr/memo-V8.pdf](http://etrs89.ensg.ign.fr/memo-V8.pdf)

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

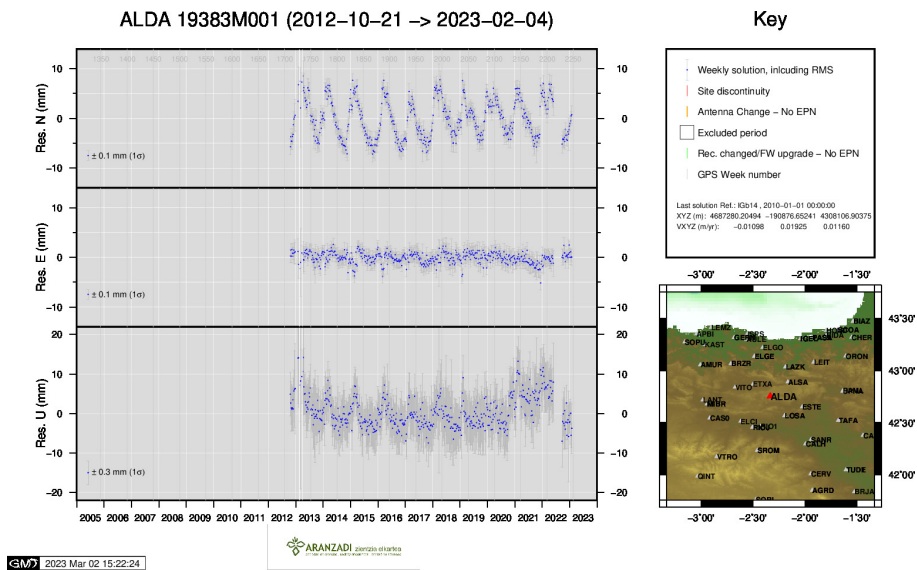
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems*. [etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf](http://etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf)

### 10 Cumulative Time Series

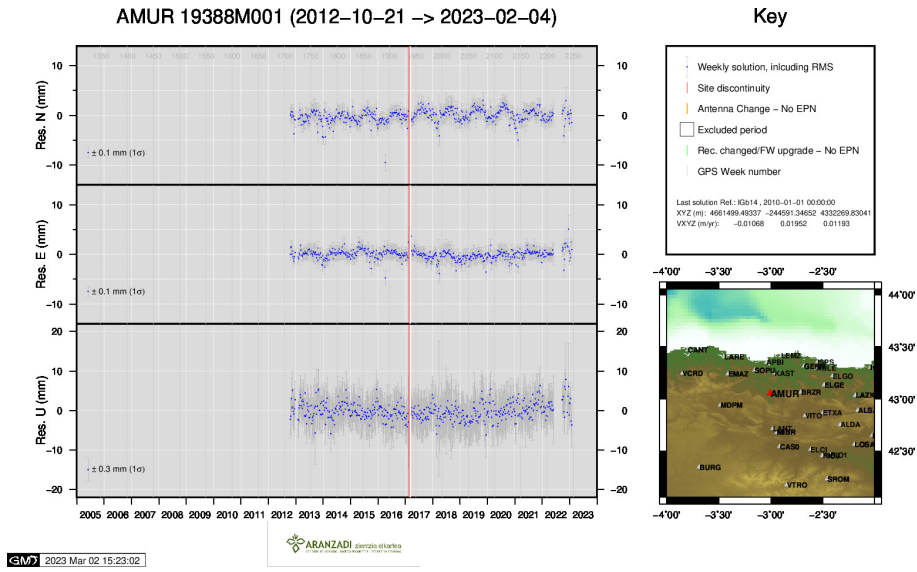
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



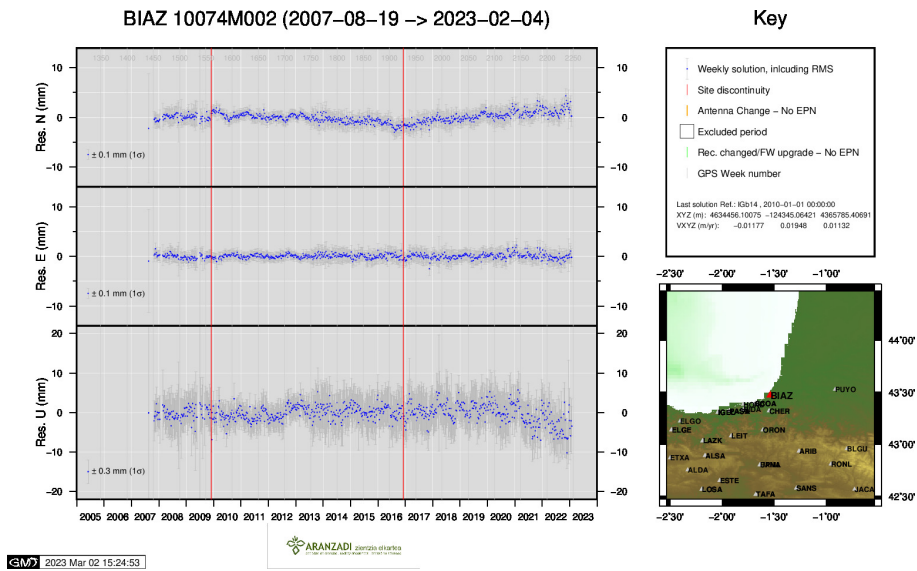
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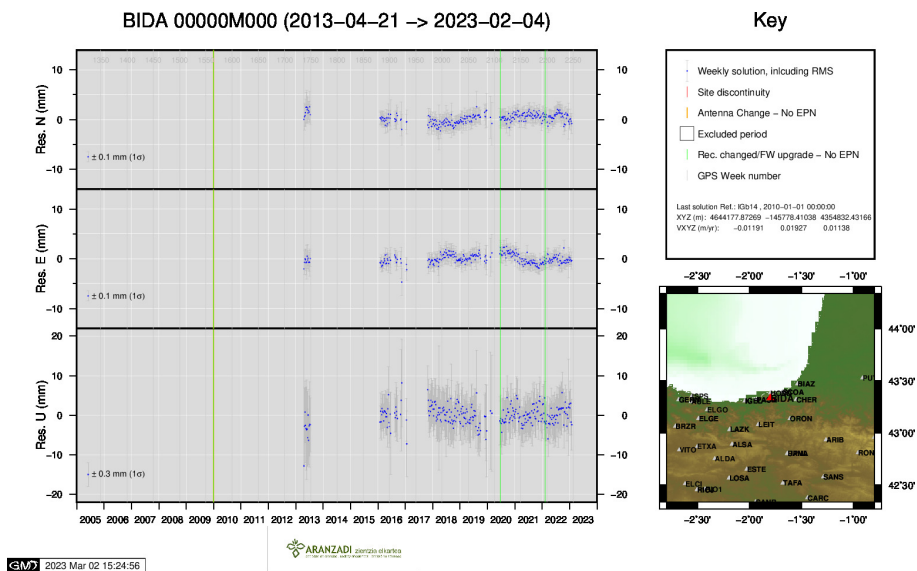
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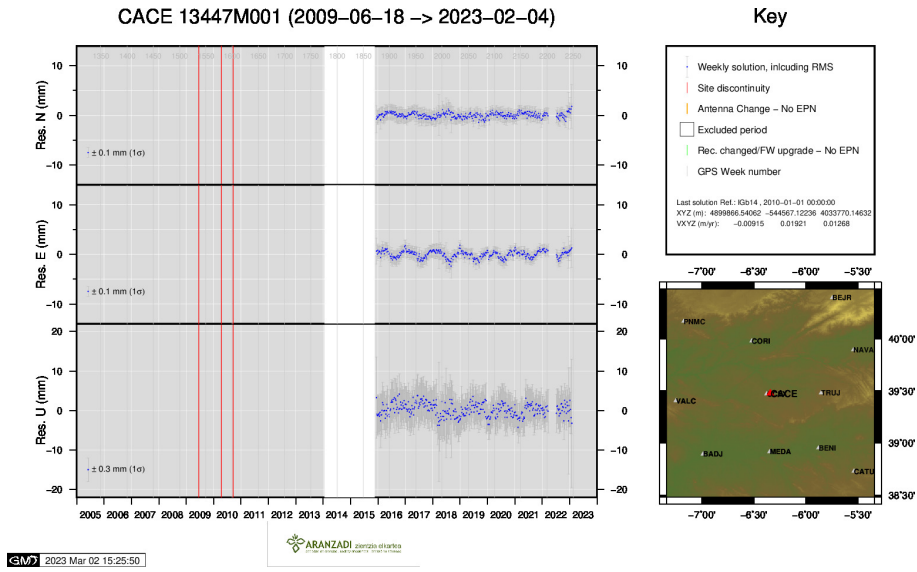
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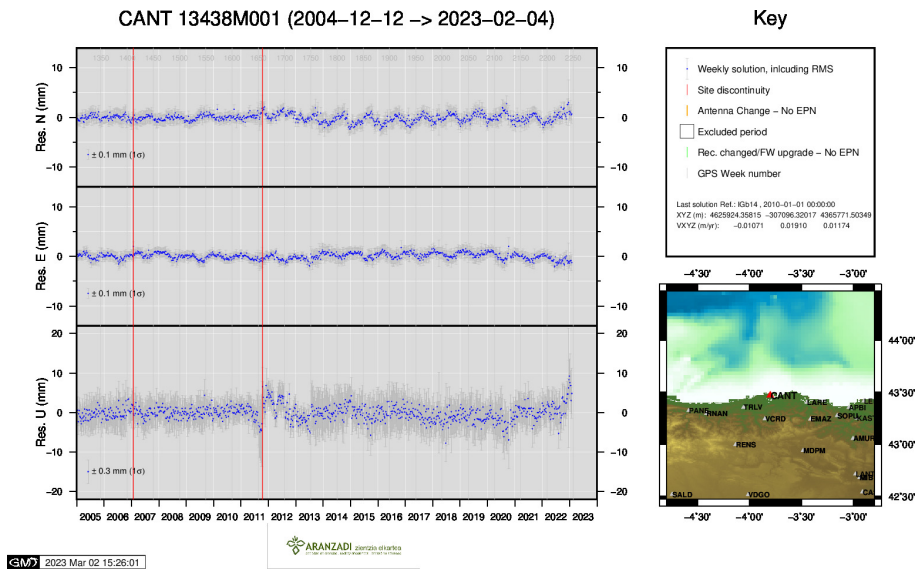
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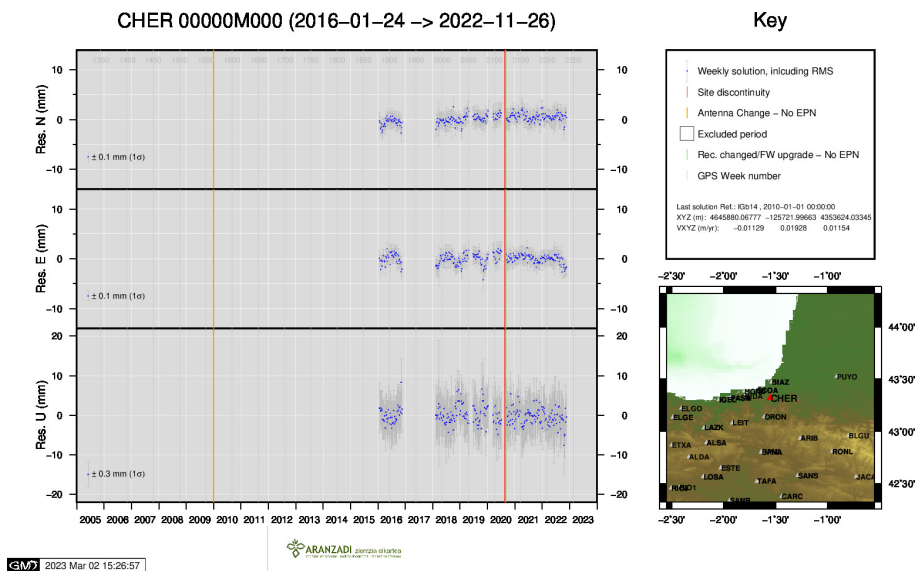
5 ) BIDA



6 ) CACE

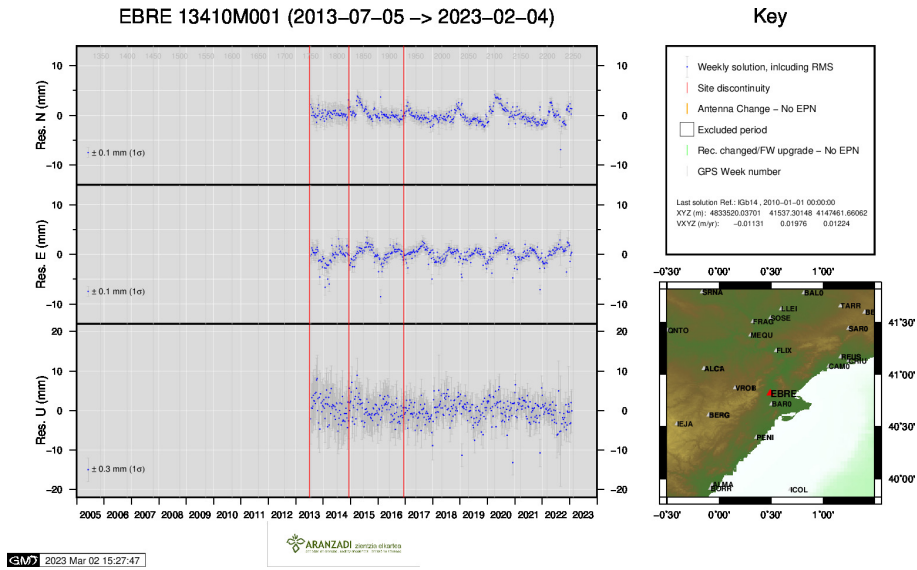


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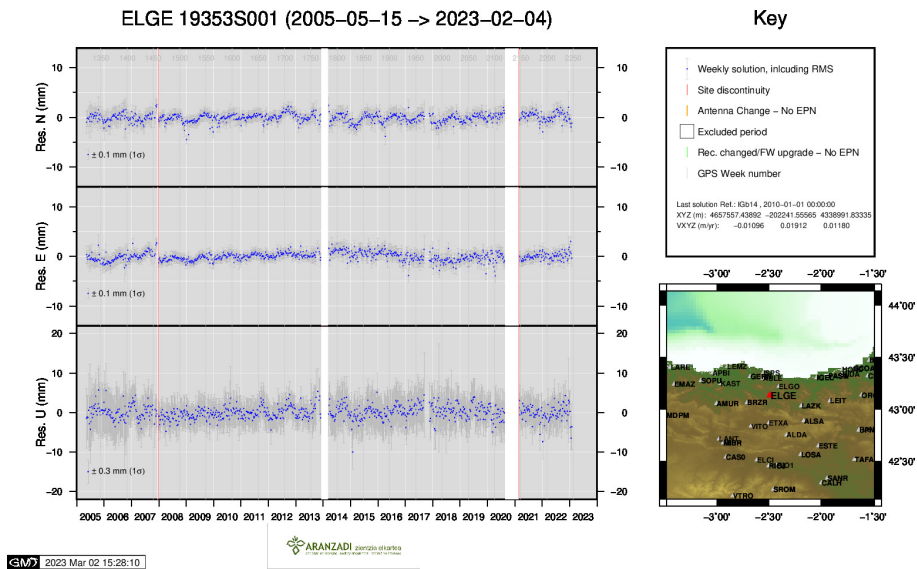


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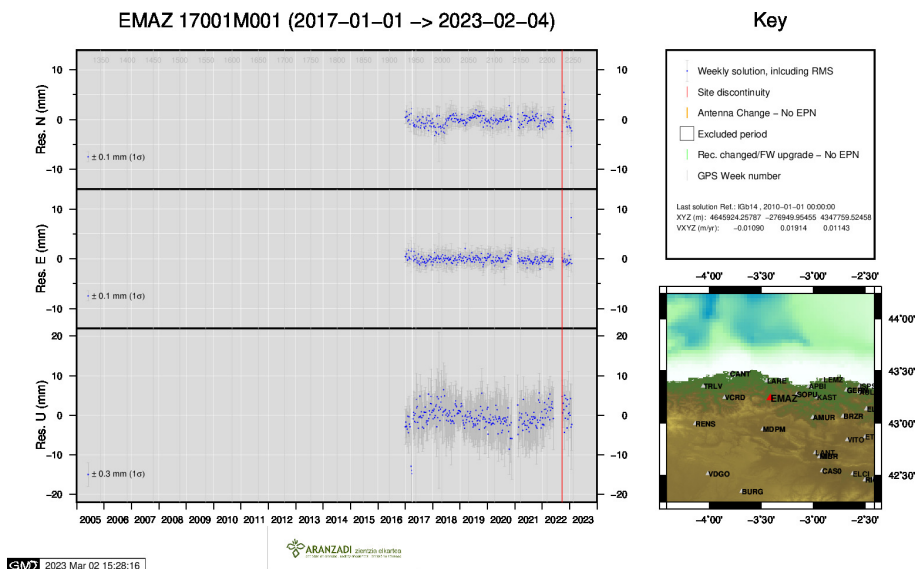




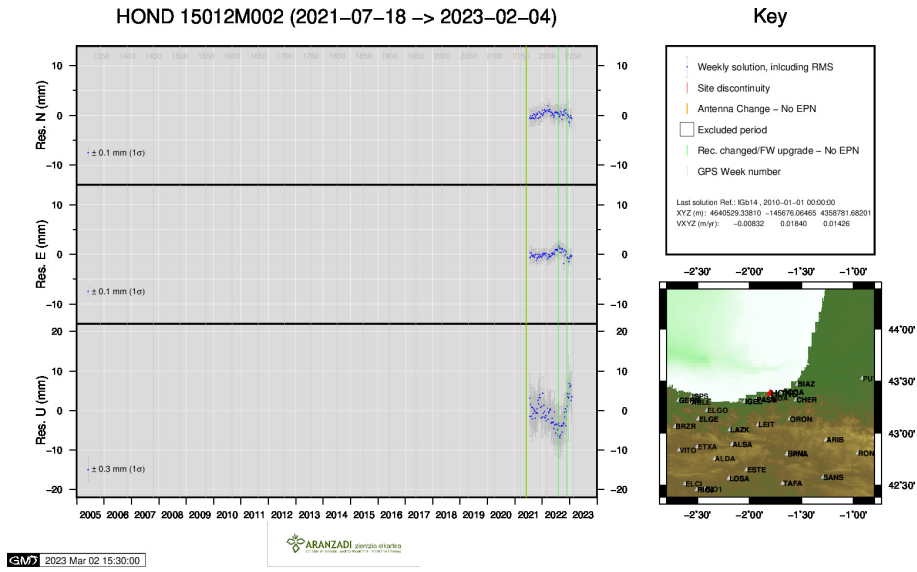
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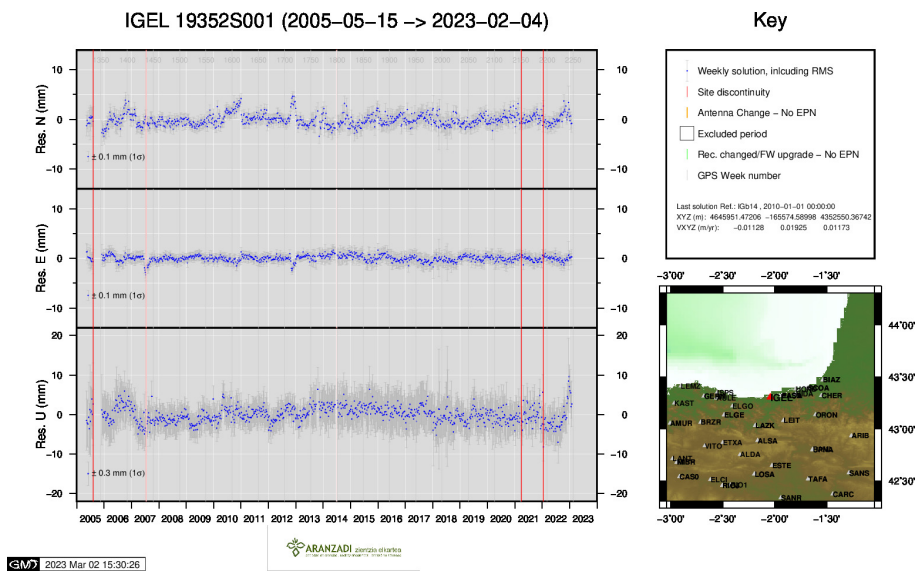
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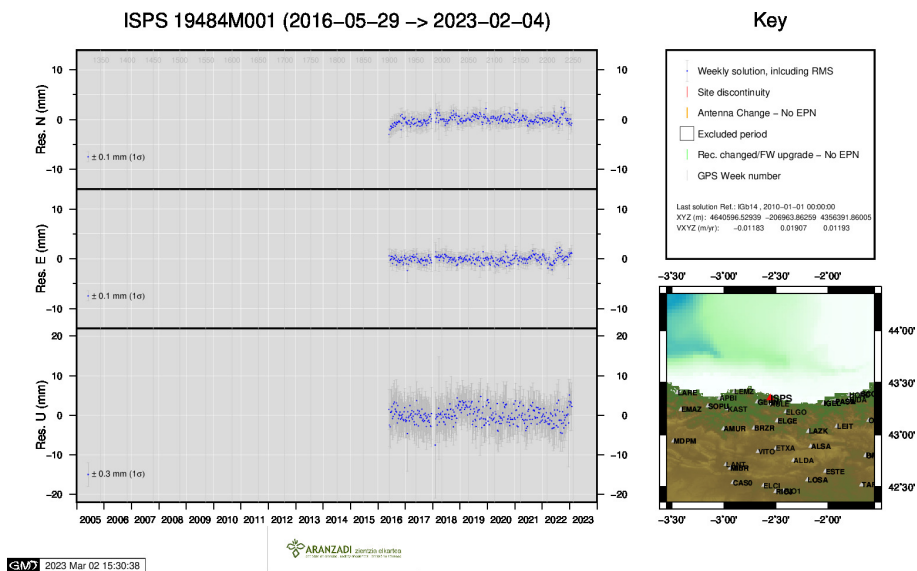
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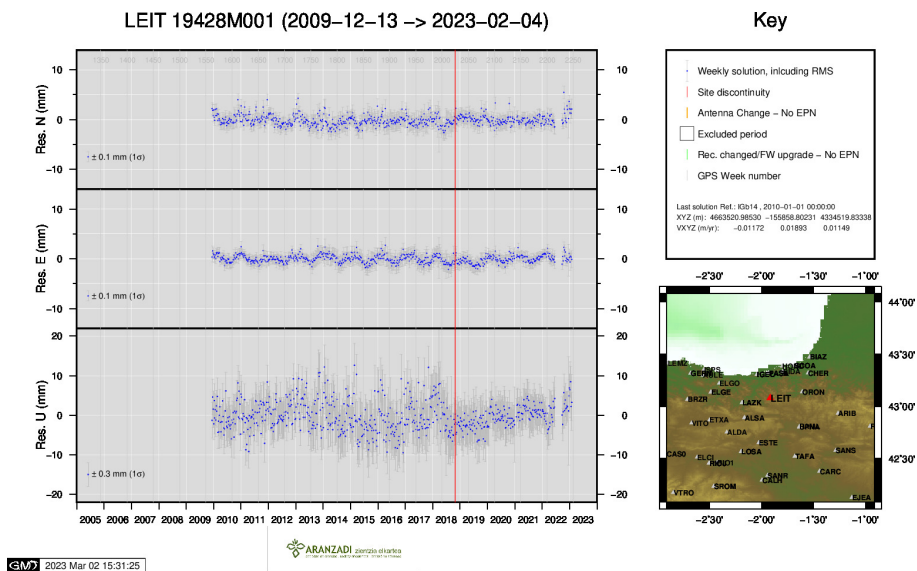
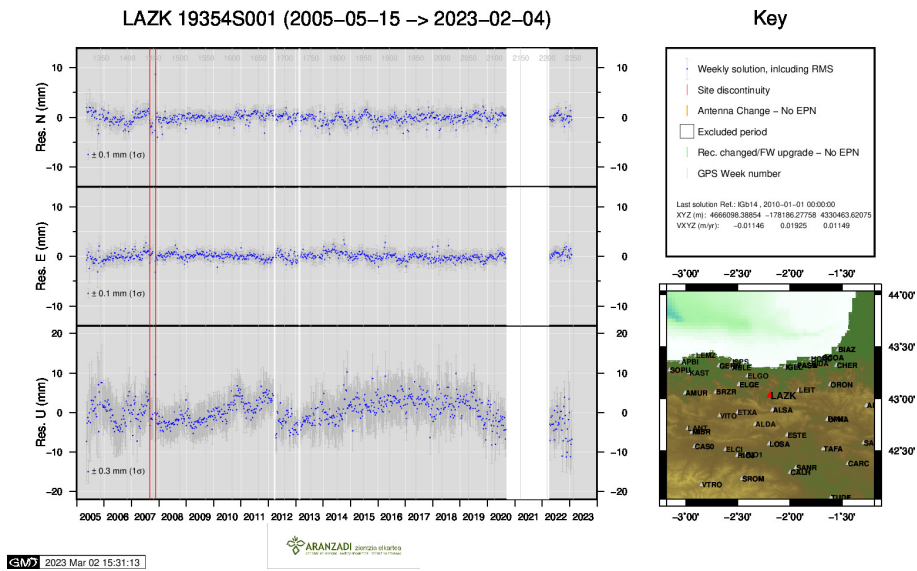
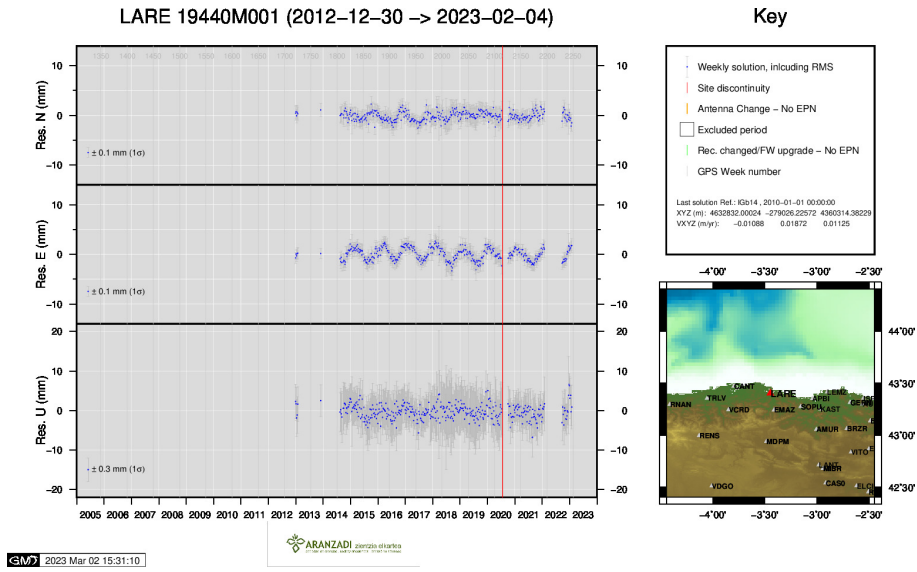
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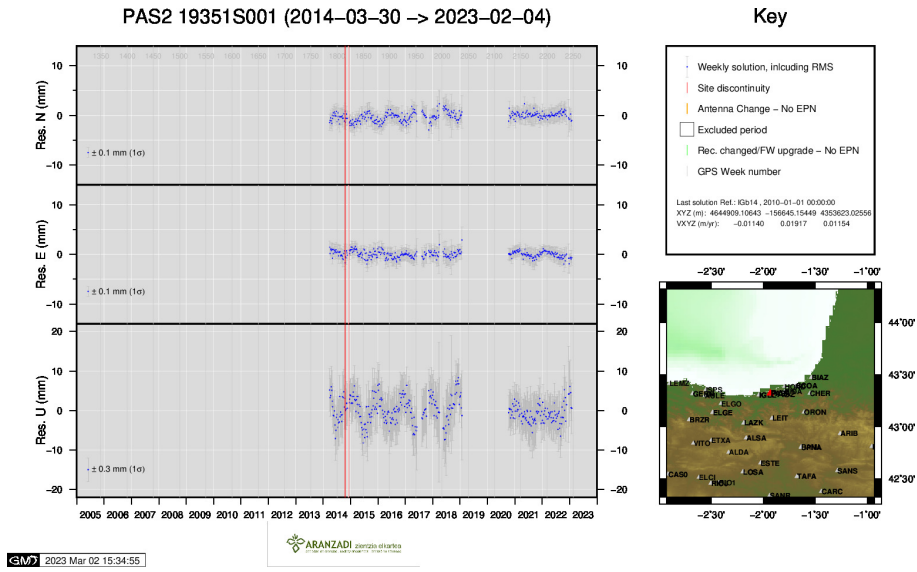


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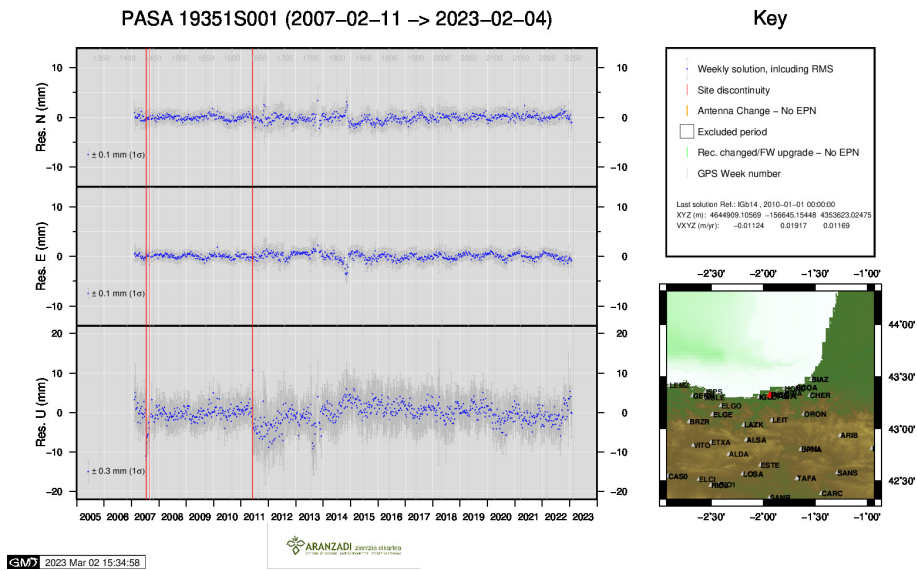


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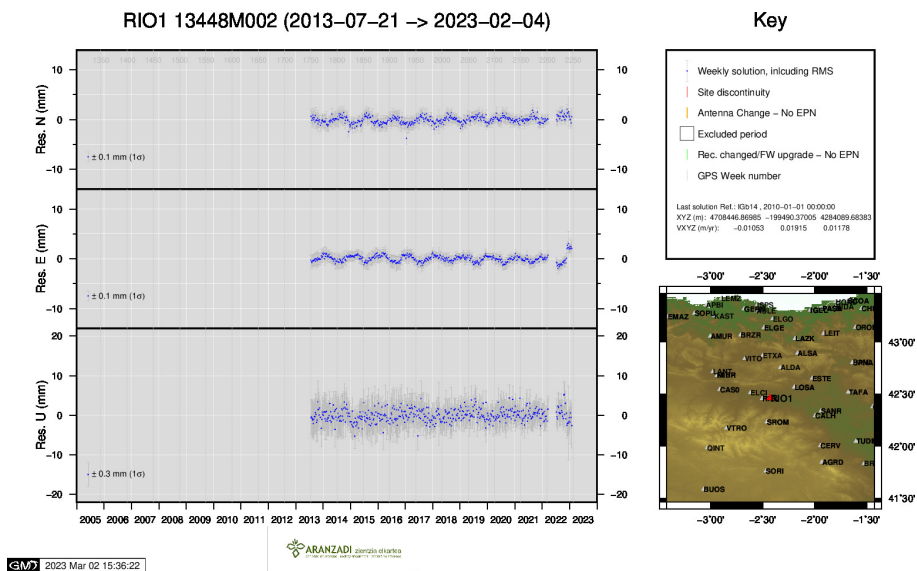




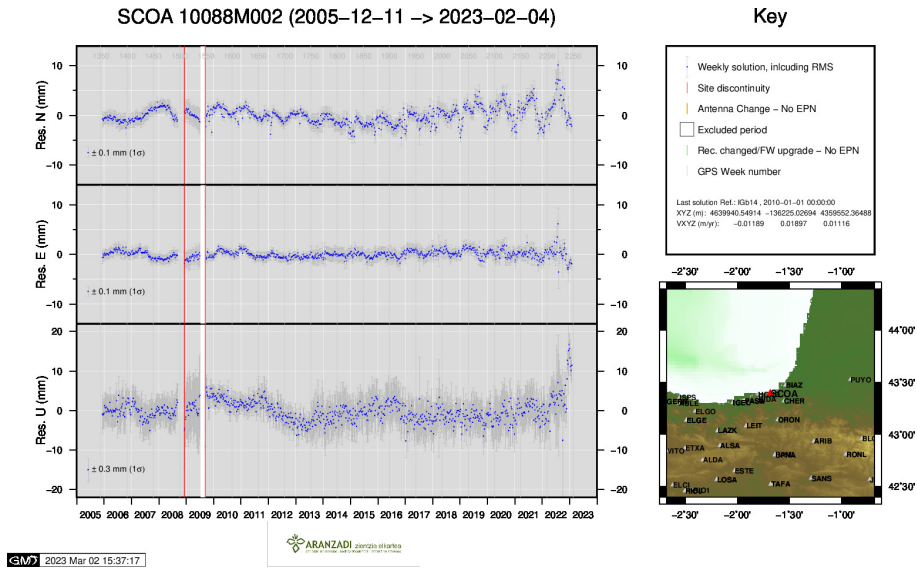
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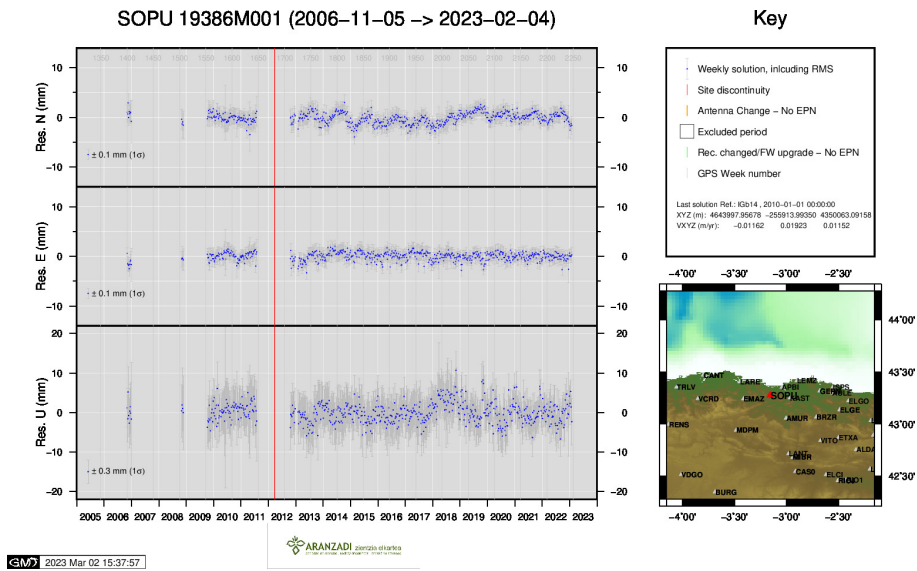
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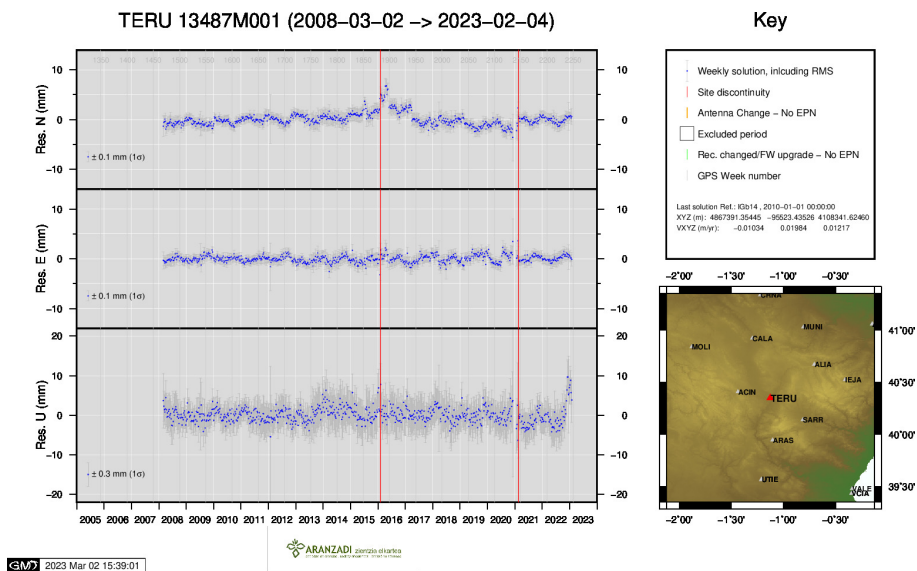
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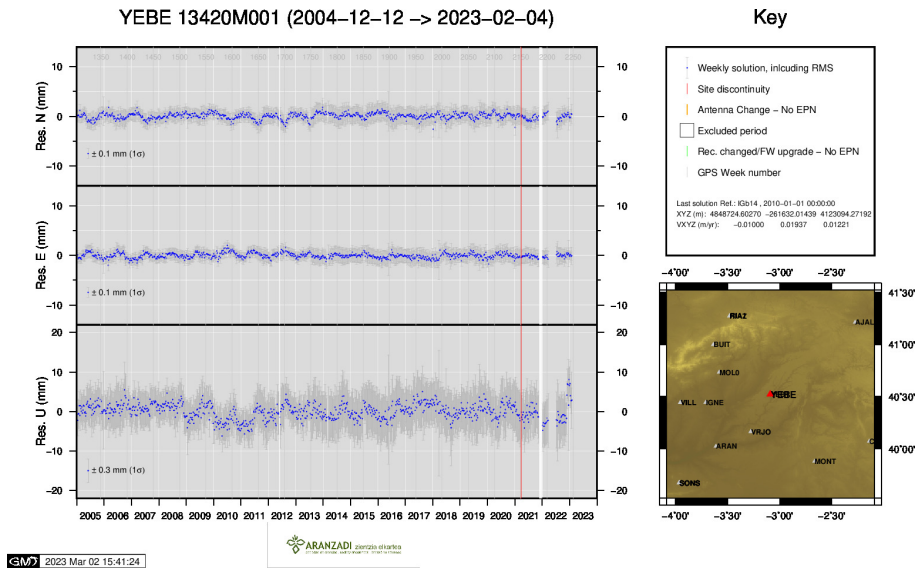
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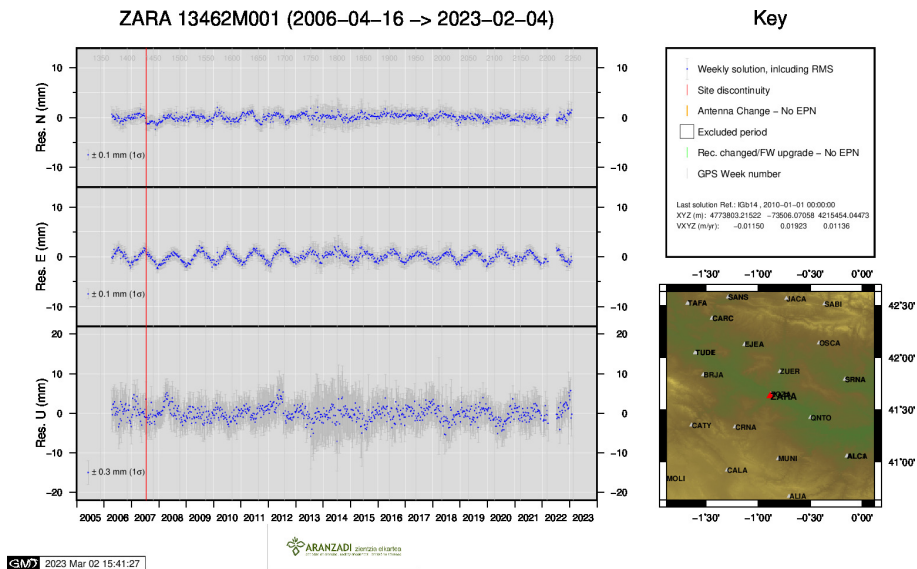
22 ) SOPU



23 ) TERU



24 ) YEBE



25 ) ZARA