

ARA-DAC Weekly Analysis Result: 2292 (GFA)

Technical Report

GPS Week: 2292 (GFA)

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

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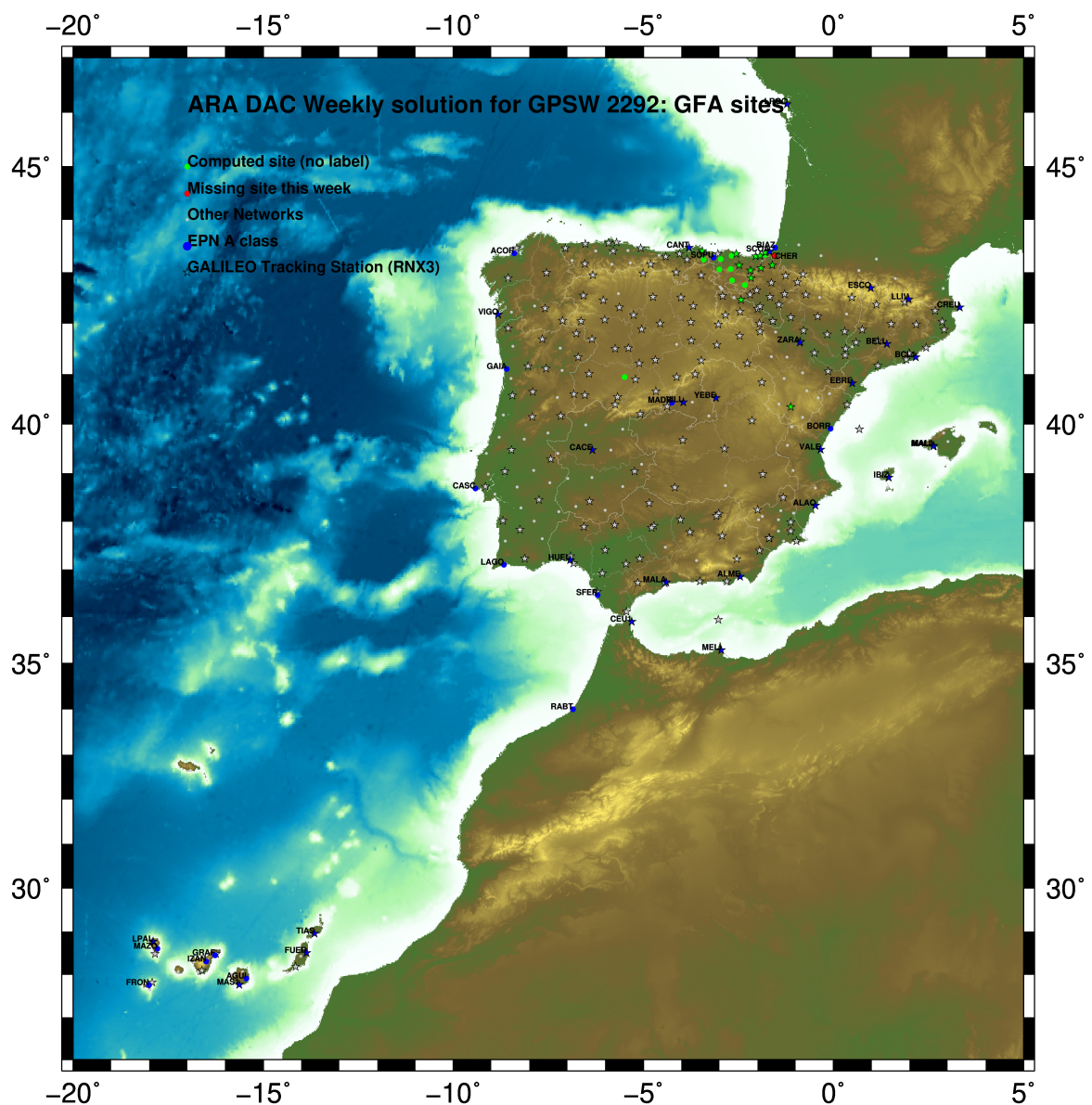


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1 Introduction

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



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Fig.1: Computed Sites for GPS Week2292 (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.

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ARA FINAL WEEKLY COMBINATION: FINAL ORBITS                                01-JAN-24 06:10
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LOCAL GEODETIC DATUM: IGS20                EPOCH: 2023-12-13 11:59:45
-----
NUM STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
111 ACRD 13434M001    4594489.51907 -678367.34435 4357066.32921 W   G
 39 ALDA 19383M001    4687280.11368 -190876.48135 4308107.00985 A   GR
 50 ALSA 19419M001    4677250.78347 -176770.31036 4319079.92810 A   GRE
 53 AMUR 19388M001    4661499.40645 -244591.17116 4332269.93804 A   GR
384 BIAZ 10074M002    4634456.00026 -124344.88957 4365785.50832 W   GR
101 BIDA 00000M000    4644177.77239 -145778.23761 4354832.53159 A   GR
113 BRZR 19387M001    4662220.94568 -220769.81335 4333309.49027 A   GR
 573 CACE 13447M001    4899866.46151 -544566.94903 4033770.25777 W   GRE
 592 CANT 13438M001    4625924.27234 -307096.15043 4365771.61225 W   GRE
 908 CREU 13432M001    4715420.07670 273178.14581 4271946.89446 W   GRE
135 EBRE 13410M001    4833519.93828 41537.47724 4147461.76721 W   GRE
180 ELGE 19353S001    4657557.34921 -202241.38444 4338991.93781 A   GRE
182 ENAZ 17001M001    4645924.16972 -276949.78384 4347759.62400 A   GR
209 GERN 19389M001    4642811.28008 -217222.84024 4353278.93202 A   GR
257 HOND 15012M002    4640529.27036 -145675.89982 4358781.80810 A   GRE
235 IGEL 19352S001    4645951.38049 -165574.41804 4352550.47397 A   GRE
240 ISPS 19484M001    4640596.43276 -206963.69161 4356391.96501 A   GRE
245 KAST 19499M001    4646949.03102 -240747.18294 4348015.04589 A   GR
252 LARE 19440M001    4632831.91185 -279026.05813 4360314.48049 A   GRE
256 LAZK 19354S001    4666098.29419 -178186.10546 4330463.72452 A   GRE
261 LEIT 19428M001    4663520.88851 -155858.63327 4334519.93953 A   GRE
334 ORDN 19427M001    4659695.73086 -130864.65044 4338948.93679 A   GRE
345 PAS2 19351S001    4644909.01414 -156644.98395 4353623.13055 A   GRE
493 PASA 19351S001    4644909.01368 -156644.98425 4353623.12966 A   GRE
553 RID1 13448M002    4708446.77790 -199490.19649 4284089.78783 A   GRE
558 SALA 13469M001    4803054.43959 -462130.98393 4158379.12784 A   GR
526 SCDA 10088M002    4639940.45871 -136224.85948 4359552.47154 W   GRE
715 SOPU 19386M001    4643997.86156 -255913.82297 4350063.19158 W   GR
443 TERU 13487M001    4867391.27597 -95523.25936 4108341.73949 A   GRE
493 VITO 19385M001    4679397.65396 -218436.41871 4314898.41991 A   GR
616 YEBE 13420M001    4848724.52092 -261631.84138 4123094.38158 W   GRE
655 ZARA 13462M001    4773803.12036 -73505.89989 4215454.14877 W   GRE
    
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5.2 ETRF2000 (ETRS89) Coordinates

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

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CONVERT TO ETRF2000                                                    01-JAN-24 06:10
-----
LOCAL GEODETIC DATUM: ETRF2000                EPOCH: 2023-12-13 11:59:45
-----
NUM STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
111 ACRD 13434M001    4594489.85934 -678367.97112 4357065.85511 W   W
 39 ALDA 19383M001    4687280.51561 -190877.11832 4308106.53458 A   A
 50 ALSA 19419M001    4677251.18817 -176770.94609 4319079.45389 A   A
 53 AMUR 19388M001    4661499.80309 -244591.80518 4332269.46425 A   A
384 BIAZ 10074M002    4634456.41574 -124345.52003 4365785.03853 W   W
101 BIDA 00000M000    4644178.18411 -145778.86929 4354832.06067 A   A
113 BRZR 19387M001    4662221.34561 -220770.44740 4333309.01675 A   A
 573 CACE 13447M001    4899866.79389 -544567.61191 4033769.75911 W   W
 592 CANT 13438M001    4625924.66326 -307096.78033 4365771.14066 W   W
 908 CREU 13432M001    4715420.53799 273177.50706 4271946.42310 W   W
135 EBRE 13410M001    4833520.35853 41536.82360 4147461.28247 W   W
180 ELGE 19353S001    4657557.75208 -202242.01788 4338991.46495 A   A
182 ENAZ 17001M001    4645924.56326 -276950.41608 4347759.15111 A   A
209 GERN 19389M001    4642811.69208 -217223.47195 4353278.46022 A   A
257 HOND 15012M002    4640529.69241 -145676.53107 4358781.33749 A   A
235 IGEL 19352S001    4645951.78937 -165575.04999 4352550.00262 A   A
240 ISPS 19484M001    4640596.83639 -206964.32303 4356391.49355 A   A
245 KAST 19499M001    4646949.42944 -240747.81521 4348014.57341 A   A
252 LARE 19440M001    4632832.30611 -279026.68880 4360314.00870 A   A
256 LAZK 19354S001    4666098.69961 -178186.73985 4330463.25125 A   A
261 LEIT 19428M001    4663521.29726 -155859.26730 4334519.46680 A   A
334 ORDN 19427M001    4659696.14332 -130865.28394 4338948.46473 A   A
345 PAS2 19351S001    4644909.42431 -156645.61575 4353622.65941 A   A
493 PASA 19351S001    4644909.42385 -156645.61605 4353622.65852 A   A
553 RID1 13448M002    4708447.17675 -199490.83600 4284089.31060 A   A
558 SALA 13469M001    4803054.79306 -462131.63526 4158378.63875 A   A
526 SCDA 10088M002    4639940.87209 -136225.49063 4359552.00111 W   W
715 SOPU 19386M001    4643998.25811 -255914.45492 4350062.71914 W   W
443 TERU 13487M001    4867391.67469 -95523.31745 4108341.24893 A   A
493 VITO 19385M001    4679398.05273 -218437.05481 4314897.94494 A   A
616 YEBE 13420M001    4848724.89852 -261632.49771 4123093.89133 W   W
655 ZARA 13462M001    4773803.83063 -73506.54682 4215453.66763 W   W
    
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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                                01-JAN-24 06:10
-----
LOCAL GEODETIC DATUM: ETRF2014                    EPOCH: 2023-12-13 11:59:45
NUM  STATION NAME      X (M)      Y (M)      Z (M)  FLAG  SYSTEM
111  ACDR 13434M001    4594489.81926 -678368.00806 4357065.90742  W
 39  ALDA 19383M001    4687280.47303 -190877.15667 4308106.58675  A
 50  ALSA 19419M001    4677251.14565 -176770.98453 4319079.50610  A
 53  AMUR 19388M001    4661499.76097 -244591.84344 4332269.51647  A
384  BIAZ 10074M002    4634456.37350 -124345.55885 4365785.09091  W
101  BIDA 00000M000    4644178.14184 -145778.90799 4354832.11300  A
113  BRZR 19387M001    4662221.30340 -220770.48575 4333309.06898  A
 573  CACE 13447M001    4899866.74994 -544567.64798 4033769.81056  W
 592  CANT 13438M001    4625924.62174 -307096.81852 4365771.19297  W
 908  CREU 13432M001    4715420.49333  273177.46715 4271946.47553  W
135  EBRE 13410M001    4833520.31343  41536.78506 4147461.33437  W
180  ELGE 19353S001    4657557.70986 -202242.05632 4338991.51721  A
182  EMAZ 17001M001    4645924.52142 -276950.45430 4347759.20336  A
209  GERN 19389M001    4642811.64007 -217223.51039 4353278.51252  A
257  HOND 15012M002    4640529.64018 -145676.56979 4358781.38983  A
235  IGEL 19352S001    4645951.74715 -165575.08861 4352550.05493  A
240  ISPS 19484M001    4640596.79437 -206964.36152 4356391.54586  A
245  KAST 19499M001    4646949.38747 -240747.85355 4348014.62568  A
252  LARE 19440M001    4632832.26441 -279026.72706 4360314.06100  A
256  LAZK 19354S001    4666098.65721 -178186.77834 4330463.30350  A
261  LEIT 19428M001    4663521.25481 -155859.30588 4334519.51906  A
334  ORON 19427M001    4659696.10082 -130865.32263 4338948.51702  A
345  PAS2 19351S001    4644909.38206 -156645.65441 4353622.71173  A
493  PASA 19351S001    4644909.38160 -156645.65471 4353622.71084  A
553  RIO1 13448M002    4708447.13395 -199490.87422 4284089.36271  A
558  SALA 13469M001    4803054.75002 -462131.67208 4158378.69048  A
526  SOGA 10088M002    4639940.82983 -136225.52938 4359552.05346  W
715  SOPU 19386M001    4643998.21621 -255914.49322 4350062.77142  W
443  TERU 13487M001    4867391.62971 -95523.95534 4108341.30164  A
493  VITO 19385M001    4679398.01032 -218437.09308 4314897.99712  A
616  YEBE 13420M001    4848724.85432 -261632.53507 4123093.94301  W
655  ZARA 13462M001    4773803.48665 -73506.58521 4215453.71961  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).

GFA FINAL WEEKLY COMBINATION: FINAL ORBITS 01-JAN-24 06:10

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	6	X XXXXX	1.63	1.27	2.20
ALDA 19383M001	7	XXXXXXX	3.24	2.41	4.34
ALSA 19419M001	7	XXXXXXX	2.82	2.22	4.13
AMUR 19388M001	7	XXXXXXX	2.47	1.05	7.19
BLAZ 10074M002	7	XXXXXXX	2.55	1.31	2.91
BIDA 00000M000	7	XXXXXXX	1.89	1.35	4.20
BRZR 19387M001	7	XXXXXXX	2.25	1.55	3.60
CACE 13447M001	6	X XXXXX	0.85	0.80	2.44
CANT 13438M001	7	XXXXXXX	2.61	0.92	4.87
CREU 13432M001	7	XXXXXXX	1.95	0.97	2.32
EBRE 13410M001	7	XXXXXXX	3.34	4.10	8.00
ELGE 19353S001	7	XXXXXXX	2.45	1.72	3.50
EMAZ 17001M001	7	XXXXXXX	2.79	0.87	6.48
GERN 19389M001	7	XXXXXXX	1.81	1.64	4.33
HOND 15012M002	7	XXXXXXX	1.80	1.01	2.30
IGEL 19352S001	7	XXXXXXX	1.82	0.67	3.11
ISPS 19484M001	7	XXXXXXX	3.06	2.72	6.62
KAST 19499M001	7	XXXXXXX	2.39	1.55	8.72
LARE 19440M001	7	XXXXXXX	2.44	1.08	3.04
LAZK 19354S001	7	XXXXXXX	3.28	0.98	7.40
LEIT 19428M001	7	XXXXXXX	2.07	1.20	4.04
ORON 19427M001	7	XXXXXXX	2.18	0.92	1.81
PAS2 19351S001	5	XXI XX	2.33	1.03	5.08
PASA 19351S001	7	XXXXXXX	2.27	0.67	3.22
RI01 13448M002	7	XXXXXXX	3.16	1.36	2.96
SALA 13469M001	6	X XXXXX	0.67	0.82	1.61
SCDA 10088M002	7	XXXXXXX	2.23	1.99	2.64
SOPU 19386M001	7	XXXXXXX	2.33	1.58	6.66
TERU 13487M001	7	XXXXXXX	3.02	1.81	3.88
VITD 19385M001	7	XXXXXXX	3.60	1.70	4.52
YEBE 13420M001	6	X XXXXX	0.78	0.48	0.92
ZARA 13462M001	7	XXXXXXX	2.89	1.70	2.88

Comparison of individual solutions:

ACOR 13434M001	N	1.63	2.54		1.63	-1.35	-0.68	-0.86	-1.09
ACOR 13434M001	E	1.27	-1.97		-0.62	-0.77	-0.41	1.73	0.32
ACOR 13434M001	U	2.20	-1.55		-3.38	0.32	0.58	-3.13	-0.40
ALDA 19383M001	N	3.24	-1.14	6.53	-0.63	-3.69	-0.14	-1.07	-2.12
ALDA 19383M001	E	2.41	-4.03	1.79	3.39	1.92	-0.51	0.26	-0.25
ALDA 19383M001	U	4.34	-4.95	8.09	2.26	-0.95	2.31	-3.07	1.48
ALSA 19419M001	N	2.82	-3.76	4.07	-2.69	-0.49	1.79	-0.29	-2.52
ALSA 19419M001	E	2.22	0.91	1.50	-4.10	1.94	0.52	1.45	1.86
ALSA 19419M001	U	4.13	-5.00	5.90	-1.69	5.96	0.05	0.69	-2.01
AMUR 19388M001	N	2.47	-3.94	2.94	0.49	1.92	-0.42	-0.23	-2.89
AMUR 19388M001	E	1.05	-0.70	0.60	1.21	-1.12	1.42	0.36	0.97
AMUR 19388M001	U	7.19	0.65	14.43	3.48	5.19	-1.75	-4.17	-6.50
BLAZ 10074M002	N	2.55	-0.99	-5.54	1.03	-0.03	0.58	-0.75	-2.33
BLAZ 10074M002	E	1.31	-0.73	-0.53	0.24	1.23	2.72	0.63	-0.30
BLAZ 10074M002	U	2.91	1.39	-0.80	0.94	1.26	-3.95	-2.15	-5.05
BIDA 00000M000	N	1.89	-0.54	-3.61	0.92	-1.00	-1.35	-0.33	-2.08
BIDA 00000M000	E	1.35	-0.87	1.08	-0.71	2.60	-0.85	0.75	0.64
BIDA 00000M000	U	4.20	-8.65	-2.21	4.03	2.26	0.56	-0.50	-2.08
BRZR 19387M001	N	2.25	2.46	-3.19	-0.40	-1.74	-2.65	-1.49	-1.31
BRZR 19387M001	E	1.55	0.18	1.39	-2.39	-1.01	1.88	1.35	0.50
BRZR 19387M001	U	3.60	-3.59	-3.88	5.64	-0.36	-1.33	-1.98	-3.45
CACE 13447M001	N	0.85	0.18		-1.82	-0.13	-0.19	-0.44	0.05
CACE 13447M001	E	0.80	0.18		-0.37	-1.26	0.22	0.89	0.74
CACE 13447M001	U	2.44	-2.40		0.49	-2.98	1.62	-0.28	3.51
CANT 13438M001	N	2.61	1.37	-5.46	1.48	0.18	-1.27	-1.57	-1.69
CANT 13438M001	E	0.92	-1.18	1.04	-0.65	0.67	1.28	0.26	0.11
CANT 13438M001	U	4.87	-7.42	5.24	1.41	5.02	1.91	-5.22	-1.43
CREU 13432M001	N	1.95	0.51	-3.97	-0.70	0.22	-2.02	-1.24	-0.86
CREU 13432M001	E	0.97	-0.03	1.15	0.51	-0.41	1.86	-0.03	-0.68
CREU 13432M001	U	2.32	1.15	-0.68	-4.17	3.02	-0.53	-0.93	-1.68
EBRE 13410M001	N	3.34	-0.75	-5.94	-3.66	2.83	2.31	-1.19	-1.75
EBRE 13410M001	E	4.10	4.70	1.73	5.59	-4.41	-4.84	-0.92	0.92
EBRE 13410M001	U	8.00	4.36	-13.76	1.80	-9.48	0.66	8.04	4.14
ELGE 19353S001	N	2.45	1.77	-2.50	1.58	-1.01	-4.03	-2.48	-0.78
ELGE 19353S001	E	1.72	-2.32	-1.48	1.32	1.72	1.63	1.50	-0.79
ELGE 19353S001	U	3.50	2.95	0.16	2.28	-1.02	-5.09	-4.08	-4.00
EMAZ 17001M001	N	2.79	1.51	-4.97	1.60	2.58	-3.08	-0.87	-0.67
EMAZ 17001M001	E	0.87	-0.26	0.63	1.44	-0.74	0.97	0.73	0.10
EMAZ 17001M001	U	6.48	-6.44	-10.85	5.97	-4.37	5.13	3.42	0.11
GERN 19389M001	N	1.81	1.51	-2.62	-0.63	0.55	-1.55	-2.23	-1.56
GERN 19389M001	E	1.64	-1.22	1.02	-2.36	-0.60	0.57	0.87	2.55
GERN 19389M001	U	4.33	-2.22	-0.88	4.93	5.65	-3.32	0.57	-6.28
HOND 15012M002	N	1.80	0.57	-2.76	0.58	-1.04	-1.70	-2.00	-1.79
HOND 15012M002	E	1.01	-0.83	1.04	-0.99	1.42	0.40	0.43	0.97
HOND 15012M002	U	2.30	-4.68	0.14	0.37	1.45	-1.77	-2.07	0.50
IGEL 19352S001	N	1.82	0.05	-2.16	1.12	-1.30	-2.59	-1.48	-1.82
IGEL 19352S001	E	0.67	0.02	-0.53	-0.08	0.48	1.04	0.91	0.46
IGEL 19352S001	U	3.11	-6.88	-1.31	1.87	1.45	0.33	-1.62	0.67
ISPS 19484M001	N	3.06	-1.29	-7.00	-0.47	2.09	-0.47	0.42	0.61
ISPS 19484M001	E	2.72	-4.18	-1.65	-1.61	3.70	1.97	1.13	1.65
ISPS 19484M001	U	6.62	-13.73	-2.16	1.28	6.41	4.81	1.74	-0.86
KAST 19499M001	N	2.39	0.88	-5.10	0.12	0.09	-1.65	0.84	-2.01
KAST 19499M001	E	1.55	1.06	0.96	-1.07	-2.86	1.16	0.66	1.12
KAST 19499M001	U	8.72	-12.44	-11.68	5.37	1.94	2.44	11.13	1.60
LARE 19440M001	N	2.44	0.68	-5.67	-0.46	0.74	-0.61	-0.13	1.41
LARE 19440M001	E	1.08	-0.60	0.96	1.08	-1.42	0.03	0.90	1.32
LARE 19440M001	U	3.04	-5.42	0.98	3.02	-0.11	0.62	-3.93	-0.52
LAZK 19354S001	N	3.28	-0.91	5.83	-0.76	-0.25	-0.28	-4.09	-3.48
LAZK 19354S001	E	0.98	-0.68	1.68	0.50	1.18	0.68	0.38	0.46

LAZK	19354S001	U	7.40	-7.80	9.29	3.65	10.02	-0.63	-2.29	-7.89
LEIT	19428M001	N	2.07	-1.46	3.56	-0.93	-0.53	0.05	0.51	-3.08
LEIT	19428M001	E	1.20	-0.16	2.72	0.30	1.03	0.02	-0.05	0.31
LEIT	19428M001	U	4.04	-3.20	7.71	-1.73	3.97	-0.39	-0.60	-2.97
ORDN	19427M001	N	2.18	1.11	-4.22	-0.85	-0.39	1.50	-1.19	-2.19
ORDN	19427M001	E	0.92	0.91	0.66	-0.25	1.85	-0.05	-0.57	-0.17
ORDN	19427M001	U	1.81	0.09	1.30	0.15	-2.52	-1.75	-2.79	0.80
PAS2	19351S001	N	2.33		-3.26	1.43	-0.71		-1.29	-2.63
PAS2	19351S001	E	1.03		1.59	-0.48	-0.40		0.33	1.10
PAS2	19351S001	U	5.08		-2.33	1.68	7.59		-3.09	-5.28
PASA	19351S001	N	2.27	0.40	-3.57	1.59	-0.08	-2.88	-1.53	-2.17
PASA	19351S001	E	0.67	-0.28	0.76	-0.12	-0.35	0.98	0.63	0.72
PASA	19351S001	U	3.22	-3.19	0.61	0.05	5.25	-3.32	-2.68	-2.43
RID1	13448M002	N	3.16	-1.81	5.58	-0.62	1.19	-2.61	-2.73	-3.07
RID1	13448M002	E	1.36	0.60	2.81	0.16	-0.98	-0.19	1.22	0.61
RID1	13448M002	U	2.96	-0.64	3.97	1.19	2.11	3.70	-2.28	-3.41
SALA	13469M001	N	0.67	0.71		0.29	-0.66	-0.71	-0.26	-0.83
SALA	13469M001	E	0.82	0.56		-1.38	0.04	0.50	0.92	0.26
SALA	13469M001	U	1.61	1.37		0.78	1.39	-0.64	-2.55	-1.30
SCDA	10088M002	N	2.23	0.50	-3.84	1.15	-0.18	-2.36	-2.75	0.55
SCDA	10088M002	E	1.99	-2.38	-1.56	-0.28	1.80	1.49	0.51	3.15
SCDA	10088M002	U	2.64	-2.05	3.25	0.46	-3.87	0.03	-2.16	-2.69
SOPU	19386M001	N	2.33	1.19	-5.37	0.12	-0.94	-0.75	-0.19	-0.89
SOPU	19386M001	E	1.58	-2.32	-1.09	-0.62	0.80	0.46	1.96	1.84
SOPU	19386M001	U	6.66	-7.59	-5.62	9.33	6.76	2.24	-5.84	-2.20
TERU	13487M001	N	3.02	-0.38	6.53	0.76	-0.73	-2.49	-1.78	-1.16
TERU	13487M001	E	1.81	1.47	3.75	-0.15	0.91	0.77	0.16	1.41
TERU	13487M001	U	3.88	-4.49	0.61	0.48	7.49	1.22	-1.48	-3.13
VITO	19385M001	N	3.60	-1.68	7.53	-2.90	-0.74	-1.68	-1.72	-1.86
VITO	19385M001	E	1.70	-2.38	0.59	-0.04	2.87	1.67	-0.06	0.46
VITO	19385M001	U	4.52	0.19	7.44	-1.18	2.69	6.65	-1.67	-3.37
YEBE	13420M001	N	0.78	0.33		0.61	0.48	-0.73	-1.13	-0.74
YEBE	13420M001	E	0.48	-0.20		0.07	-0.41	0.37	0.84	0.30
YEBE	13420M001	U	0.92	-1.21		0.60	-0.95	1.01	0.57	-0.40
ZARA	13462M001	N	2.89	-1.02	6.03	-0.96	-1.41	-2.16	-1.29	-1.85
ZARA	13462M001	E	1.70	0.09	3.44	2.10	0.76	0.54	-0.31	-0.30
ZARA	13462M001	U	2.88	-3.48	2.91	2.55	3.58	-0.35	-2.80	-1.38

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 -3.93 -43.45 -74.55
ITERATION 2: ESCO 13435M001 -69.27 41.89 11.63
ITERATION 3: GATA 13902M001 4.71 -7.42 39.98
ITERATION 4: TIAS 31320M001 7.47 -19.74 -3.43

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
1	ACOR 13434M001	I W	1.90	-2.32	1.40
2	AGUI 31322M001	I W	0.99	-2.56	-8.11
3	ALAC 13433M001	I W	-0.70	-0.87	2.72
4	ALME 13437M001	I W	-1.70	-0.33	4.49
5	BCL1 19482M001	I W	-1.76	0.57	0.53
6	BELL 13431M001	I W	-0.45	-0.24	2.23
7	BIAZ 10074M002	I W	0.05	0.35	-3.51
8	BORR 13480M001	I W	-3.15	-2.15	-0.32
9	BRST 10004M004	I W	0.68	-2.31	4.26
10	CACE 13447M001	I W	0.33	0.71	5.37
11	CANT 13438M001	I W	1.85	0.43	-3.75
12	CASC 13909S001	I W	0.56	-1.49	2.30
13	CEU1 13449M002	I W	-0.63	-0.11	-3.75
14	CREU 13432M001	I W	-5.19	-44.20	-75.14
15	EBRE 13410M001	I W	-0.50	3.16	4.40
16	ESCO 13435M001	I W	-70.44	42.15	12.66
17	FLRS 31907M001	I W	-1.70	-5.08	-8.72
18	FRON 83214M001	I W	3.07	-3.65	7.53
19	FUER 31330M001	I W	-0.43	-0.84	-1.68
20	GATA 13902M001	I W	5.03	-8.03	40.82
21	GRAF 31327M001	I W	1.52	-0.35	0.24
22	HUEL 13451M001	I W	0.81	1.90	-5.70
23	IBIZ 13454S001	I W	-1.38	1.35	5.07
24	IZAN 31309M002	I W	-1.45	-0.73	-5.12
25	LAGO 13903M001	I W	-0.19	-1.79	2.36
26	LLIV 13436M001	I W	-3.23	1.10	2.55
27	LPAL 81701M001	I W	0.52	-0.41	-7.76
28	LROC 10023M001	I W	0.26	1.50	5.33
29	MADR 13407S012	I W	-2.99	-0.85	1.50
30	MAL1 13444M002	I W	1.84	2.19	-2.86
31	MALA 13443M001	I W	1.75	-2.08	2.94
32	MALL 13444M001	I W	-2.03	2.38	3.80
33	MAS1 31303M002	I W	-2.06	-2.88	-1.65
34	MAZO 83207M001	I W	-1.92	-1.44	-15.47
35	MELI 19379M001	I W	-2.08	0.17	3.37
36	PDEL 31906M004	I W	0.98	-1.70	-2.98
37	RABT 35001M002	I W	-0.45	-1.51	-5.85
38	SCOA 10088M002	I W	1.97	2.02	-8.89
39	SFER 13402M004	I W	-0.74	-2.60	1.99
40	SOPU 19386M001	I W	1.07	2.08	-0.21
41	TIAS 31320M001	I W	7.64	-20.20	-3.51
42	VALE 13439M001	I W	-0.40	2.58	-2.78
43	VIGO 13450M001	I W	0.98	0.85	5.74
44	VILL 13406M001	I W	-0.67	-1.17	4.27
45	YEBE 13420M001	I W	-1.12	0.41	5.62
46	ZARA 13462M001	I W	-1.07	1.64	-1.59
47	ZIMM 14001M004	I W	-1.50	-0.49	15.33
RMS / COMPONENT			1.55	1.87	5.51
IQR			2.48	2.80	7.77
MEAN			-0.31	-0.34	0.11
MEDIAN			-0.45	-0.35	1.40
MIN			-3.23	-5.08	-15.47
MAX			3.07	3.16	15.33
OVERALL RMS/IQR/MAX(3D)			3.48	3.46	15.66
					MAZO 83207M001 #SUM
ALL RMS / COMPONENT			10.61	9.72	13.80
ALL IQR			2.68	3.19	7.79
ALL MEAN			-1.62	-0.95	-0.44
ALL MEDIAN			-0.45	-0.41	1.40
ALL MIN			-70.44	-44.20	-75.14
ALL MAX			7.64	42.15	40.82
ALL OVERALL RMS/IQR/MAX(3D)			11.51	3.88	87.33
					CREU 13432M001 #SUM_ALL

NUMBER OF PARAMETERS : 3
NUMBER OF STATIONS : 43
NUMBER OF COORDINATES : 129
RMS OF TRANSFORMATION : 3.48 MM

PARAMETERS:

TRANSLATION IN X : -0.44 +- 0.53 MM
TRANSLATION IN Y : 0.75 +- 0.53 MM
TRANSLATION IN Z : 1.29 +- 0.53 MM

NUMBER OF ITERATIONS : 3

ACCEPTED STATIONS : 43 91.49 %
VERIFIED STATIONS : 0 0.00 %

REJECTED STATIONS : 4 8.51 %

LIST OF VERIFIED/REJECTED STATIONS

STATION RESIDUALS (MILLIMETERS)

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          19206894
NUMBER OF UNKNOWNNS             198189
NUMBER OF DEGREES OF FREEDOM    19008705
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)      180
VARIANCE FACTOR                  79816.278287995257415
```

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 23:344:00000 23:350:86370 LEICA GR50 -----
ALDA A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
ALSA A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
AMUR A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
BIAZ A 1 P 23:344:00000 23:350:86370 SPECTRA SP90M -----
BIDA A 1 P 23:344:00000 23:350:86370 LEICA GR10 -----
BRZR A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
CACE A 1 P 23:344:00000 23:350:86370 TRIMBLE NETR9 -----
CANT A 1 P 23:344:00000 23:350:86370 LEICA GR10 -----
CREU A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
EBRE A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
ELGE A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
EMAZ A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
GERN A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
HOND A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
IGEL A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
ISPS A 1 P 23:344:00000 23:350:86370 TRIMBLE NETR9 -----
KAST A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
LARE A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
LAZK A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
LEIT A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
ORON A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
PAS2 A 1 P 23:345:00000 23:350:86370 STONEX SC2200 -----
PASA A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
RIO1 A 1 P 23:344:00000 23:350:86370 LEICA GR25 -----
SALA A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
SCOA A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
SOPU A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
TERU A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
VITO A 1 P 23:344:00000 23:350:86370 LEICA GR30 -----
YEBE A 1 P 23:344:00000 23:350:86370 LEICA GR50 -----
ZARA A 1 P 23:344:00000 23:350:86370 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 23:344:00000 23:350:86370 LEIAT504 LEIS -----
ALDA A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
ALSA A 1 P 23:344:00000 23:350:86370 LEIAR10 NONE -----
AMUR A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
BIAZ A 1 P 23:344:00000 23:350:86370 LEIAR25 LEIT -----
BIDA A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
BRZR A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
CACE A 1 P 23:344:00000 23:350:86370 TRM29659.00 NONE -----
CANT A 1 P 23:344:00000 23:350:86370 LEIAR25_R4 LEIT -----
CREU A 1 P 23:344:00000 23:350:86370 LEIAR25_R4 NONE -----
EBRE A 1 P 23:344:00000 23:350:86370 LEIAR25_R4 NONE -----
ELGE A 1 P 23:344:00000 23:350:86370 LEIAR25_R4 LEIT -----
EMAZ A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
GERN A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
HOND A 1 P 23:344:00000 23:350:86370 LEIAR20 LEIM -----
IGEL A 1 P 23:344:00000 23:350:86370 LEIAR20 LEIM -----
ISPS A 1 P 23:344:00000 23:350:86370 TRM59900.00 SCIS -----
KAST A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
LARE A 1 P 23:344:00000 23:350:86370 LEIAR20 LEIM -----
LAZK A 1 P 23:344:00000 23:350:86370 LEIAR25_R4 LEIT -----
LEIT A 1 P 23:344:00000 23:350:86370 LEIAR10 NONE -----
ORON A 1 P 23:344:00000 23:350:86370 LEIAR10 NONE -----
PAS2 A 1 P 23:345:00000 23:350:86370 LEIAR20 LEIM -----
PASA A 1 P 23:344:00000 23:350:86370 LEIAR20 LEIM -----
RIO1 A 1 P 23:344:00000 23:350:86370 LEIAR25_R4 LEIT -----
SALA A 1 P 23:344:00000 23:350:86370 LEIAR25 NONE -----
SCOA A 1 P 23:344:00000 23:350:86370 TRM55971.00 NONE -----
SOPU A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
TERU A 1 P 23:344:00000 23:350:86370 LEIAR20 LEIM -----
VITO A 1 P 23:344:00000 23:350:86370 LEIAS10 NONE -----
YEBE A 1 P 23:344:00000 23:350:86370 LEIAR20 LEIM -----
ZARA A 1 P 23:344:00000 23:350:86370 TRM29659.00 NONE -----
```

7.3 Eccentricities

```

*
*SITE PT SOLN T DATA_START__ DATA_END_____ AXE ARP->BENCHMARK(M)-----
ACOR A 1 P 23:344:00000 23:350:86370 UNE 3.0460 0.0000 0.0000
ALDA A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
ALSA A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
AMUR A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
BIDA A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
BRZR A 1 P 23:344:00000 23:350:86370 UNE 0.0771 0.0000 0.0000
CACE A 1 P 23:344:00000 23:350:86370 UNE 0.0600 0.0000 0.0000
CANT A 1 P 23:344:00000 23:350:86370 UNE 3.0490 0.0000 0.0000
CREU A 1 P 23:344:00000 23:350:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 23:344:00000 23:350:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
EMAZ A 1 P 23:344:00000 23:350:86370 UNE 0.0350 0.0000 0.0000
GERN A 1 P 23:344:00000 23:350:86370 UNE 0.0771 0.0000 0.0000
HOND A 1 P 23:344:00000 23:350:86370 UNE 0.0771 0.0000 0.0000
IGEL A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
ISPS A 1 P 23:344:00000 23:350:86370 UNE 0.0350 0.0000 0.0000
KAST A 1 P 23:344:00000 23:350:86370 UNE 0.0350 0.0000 0.0000
LARE A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
LAZK A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
LEIT A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
ORDN A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
PAS2 A 1 P 23:345:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
PASA A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
RIO1 A 1 P 23:344:00000 23:350:86370 UNE 0.0606 0.0000 0.0000
SALA A 1 P 23:344:00000 23:350:86370 UNE 0.0600 0.0000 0.0000
SCDA A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
SOPU A 1 P 23:344:00000 23:350:86370 UNE 0.0771 0.0000 0.0000
TERU A 1 P 23:344:00000 23:350:86370 UNE 0.0600 0.0000 0.0000
VITO A 1 P 23:344:00000 23:350:86370 UNE 0.0000 0.0000 0.0000
YEBE A 1 P 23:344:00000 23:350:86370 UNE 0.0600 0.0000 0.0000
ZARA A 1 P 23:344:00000 23:350:86370 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:

```

2023-12-31 05:30 UTC | LARE3440.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-12-31 08:39 UTC | LARE3450.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-12-31 11:47 UTC | LARE3460.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-12-31 14:56 UTC | LARE3470.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-12-31 18:04 UTC | LARE3480.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-12-31 21:04 UTC | LARE3490.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-01 02:15 UTC | LARE3500.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.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

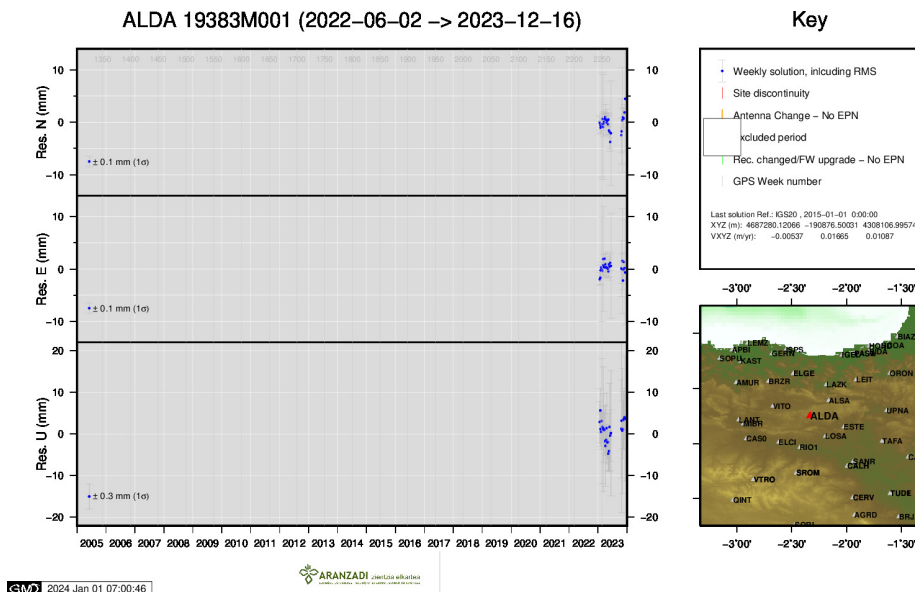
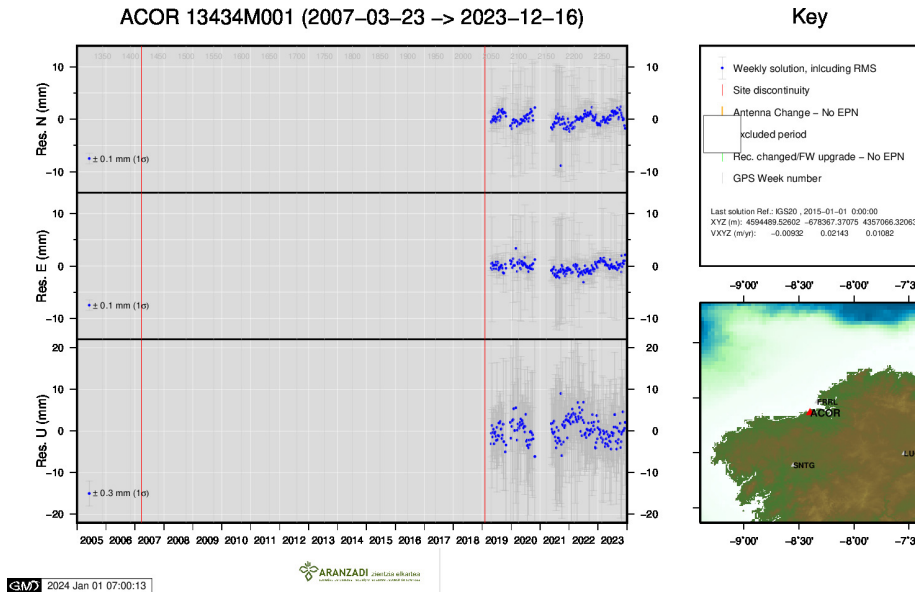
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf

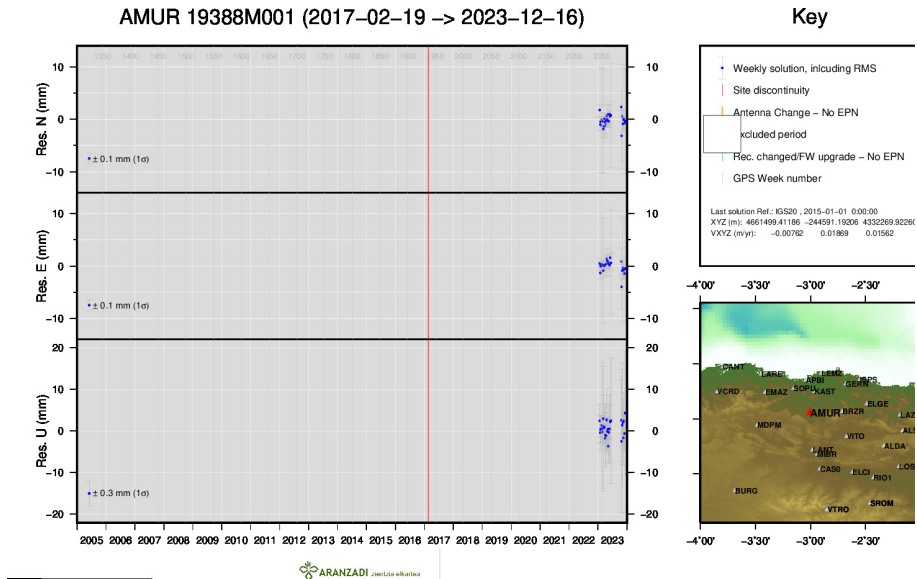
Johnston, G., Riddell, A., Hausler, G. (2017). The International GNSS Service. Teunissen, Peter J.G., Montenbruck, O. (Eds.), Springer Handbook of Global Navigation Satellite Systems (1st ed., pp. 967-982). Cham, Switzerland: Springer International Publishing. DOI: 10.1007/978-3-319-42928-1

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

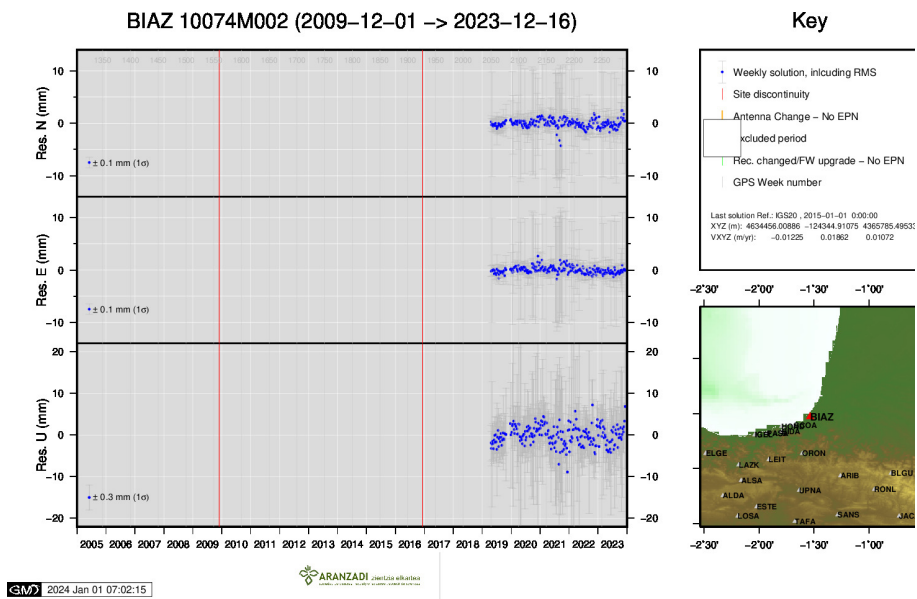
10 Cumulative Time Series

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

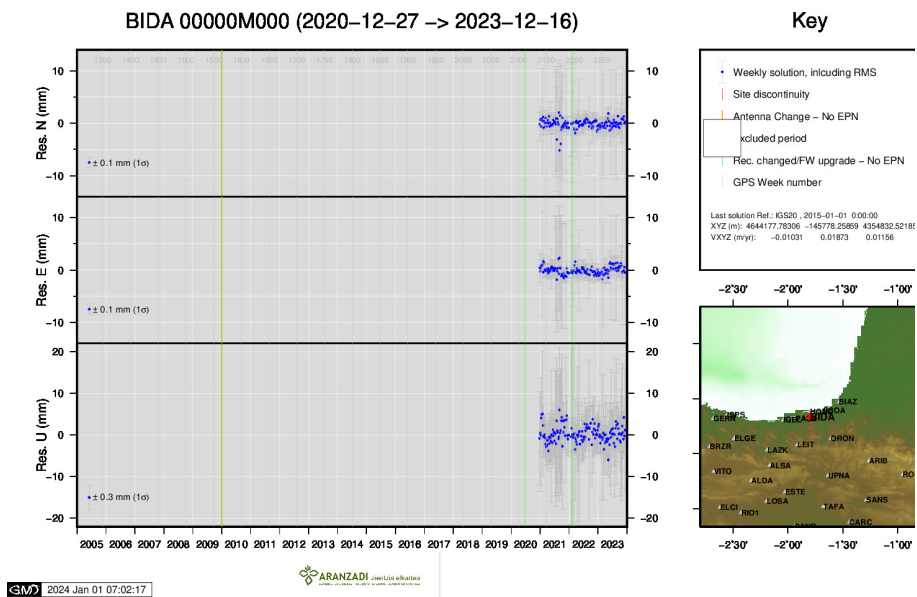




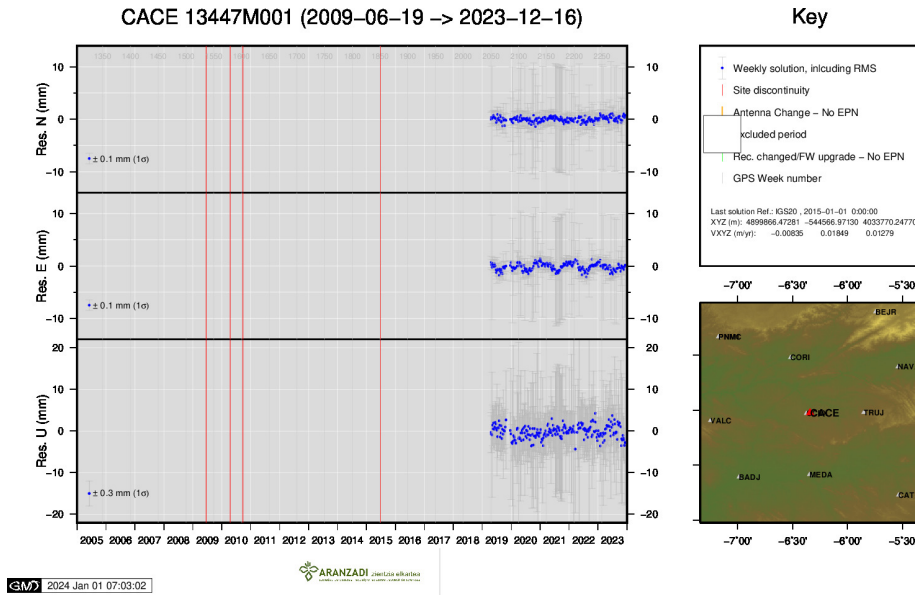
3) AMUR



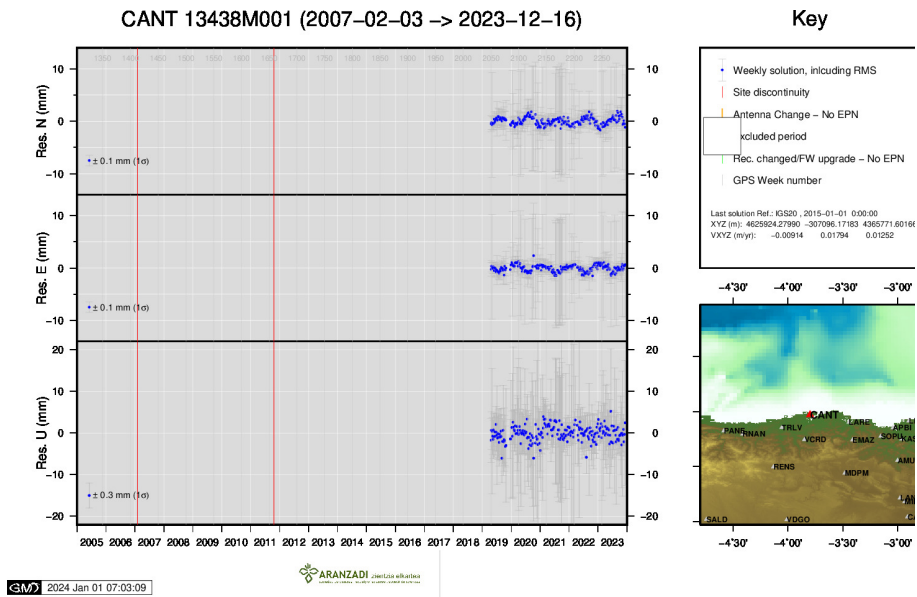
4) BIAZ



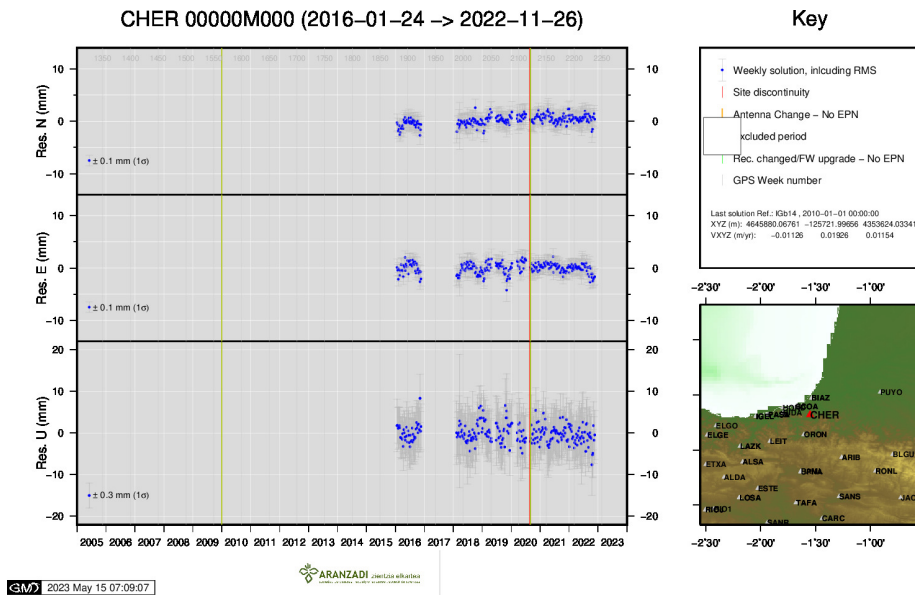
5) BIDA



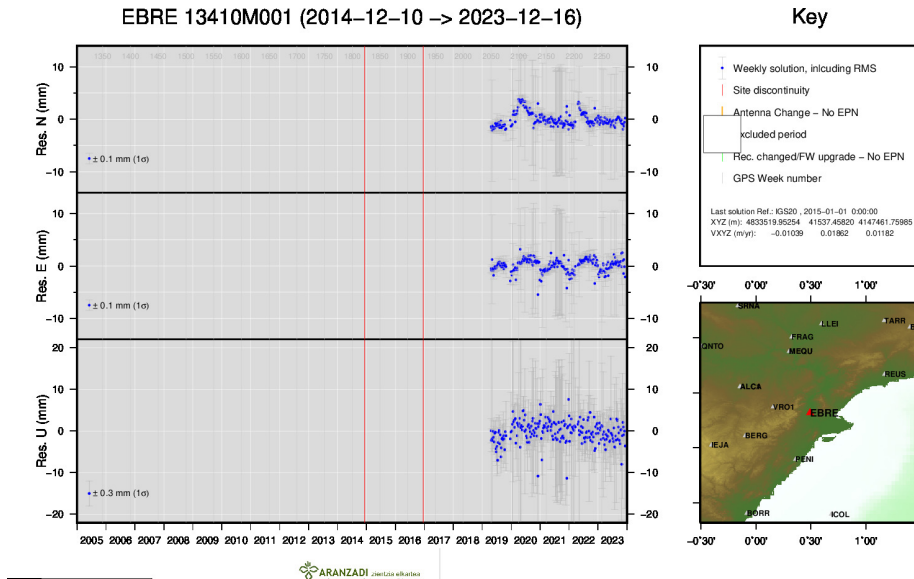
6) CACE



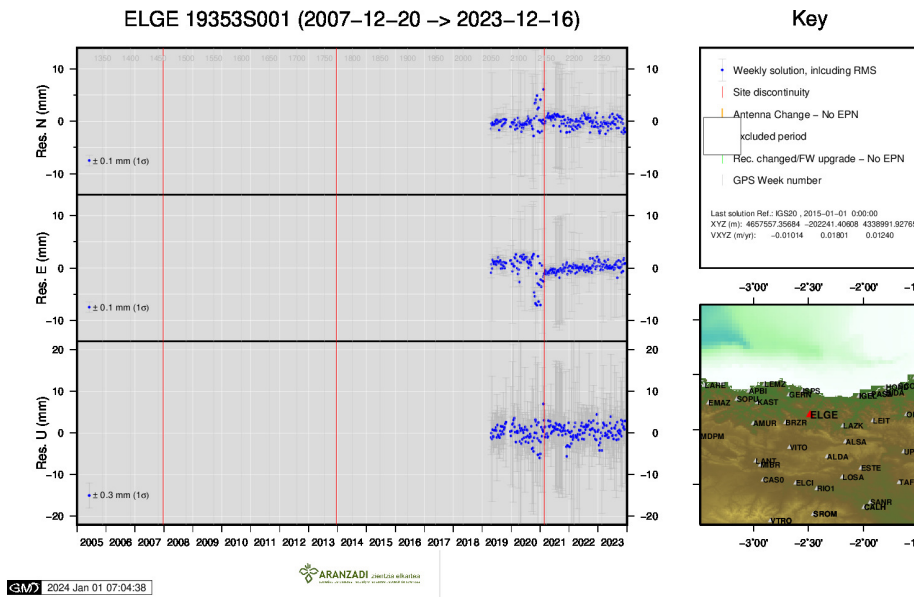
7) CANT



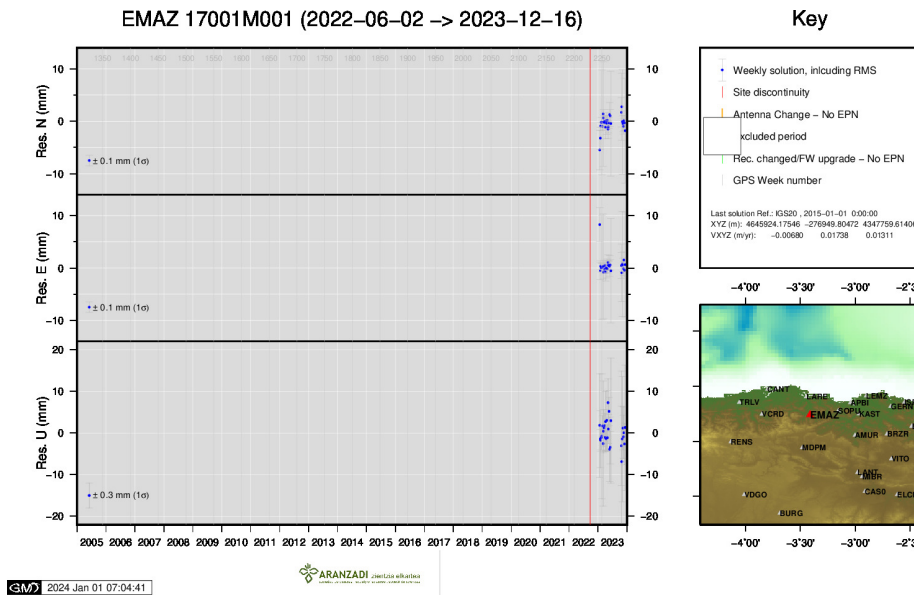
8) CHER



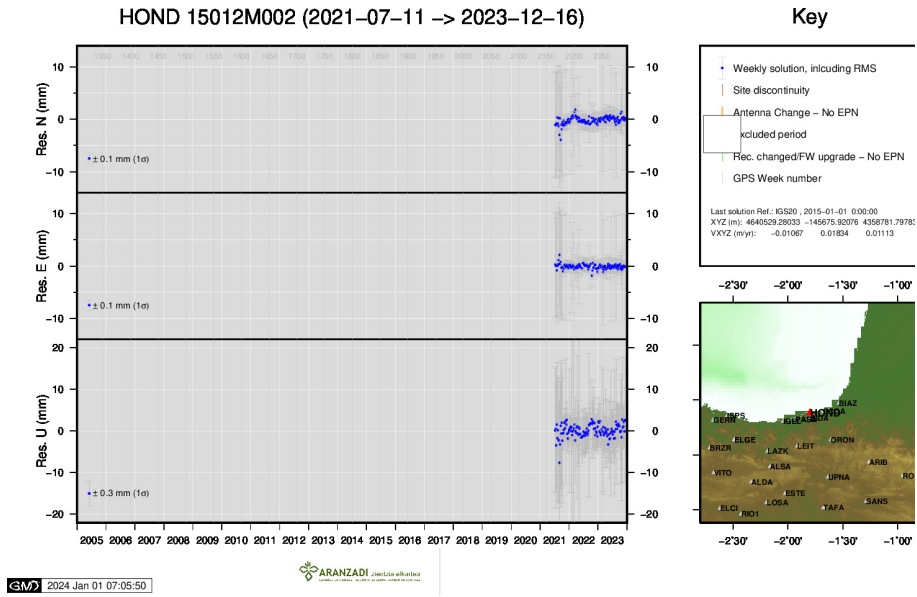
9) EBRE



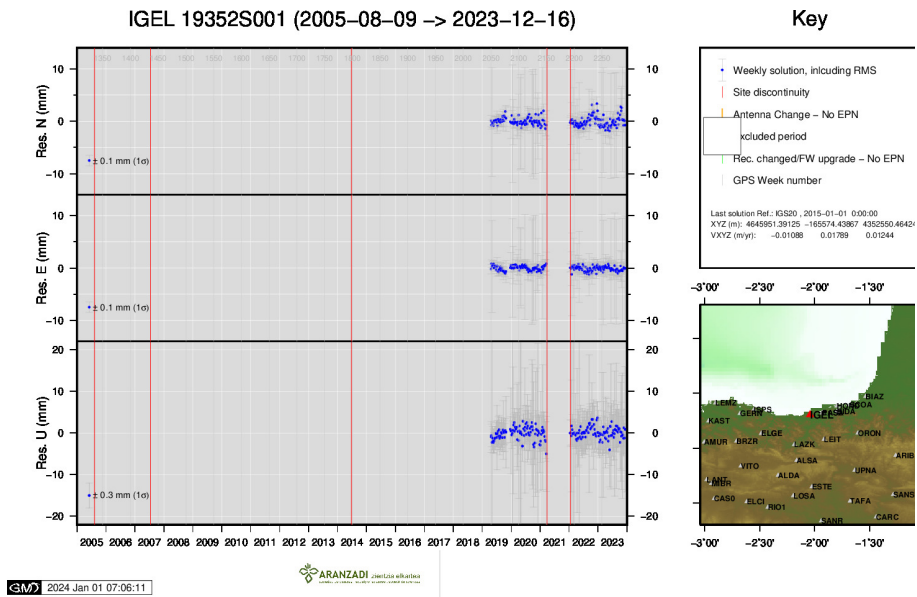
10) ELGE



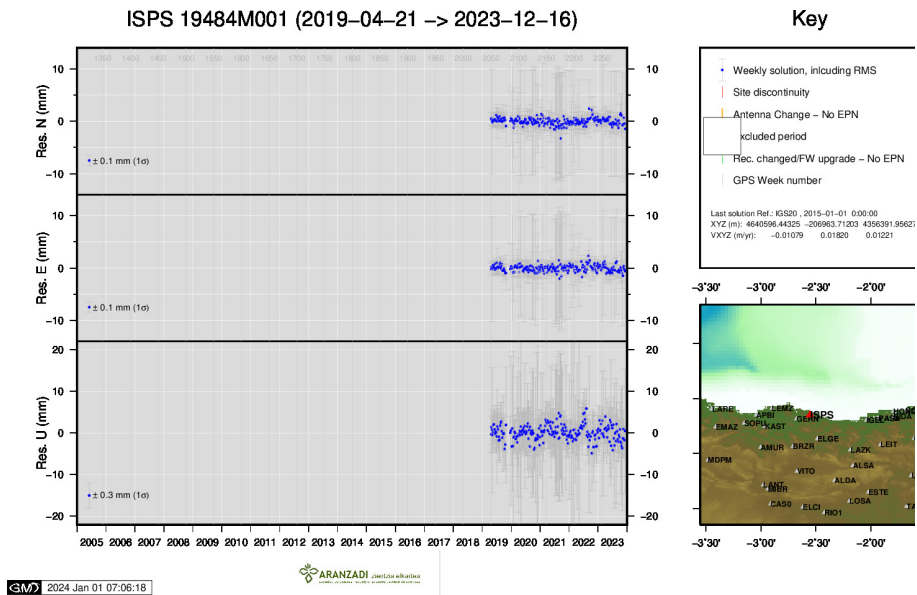
11) EMAZ



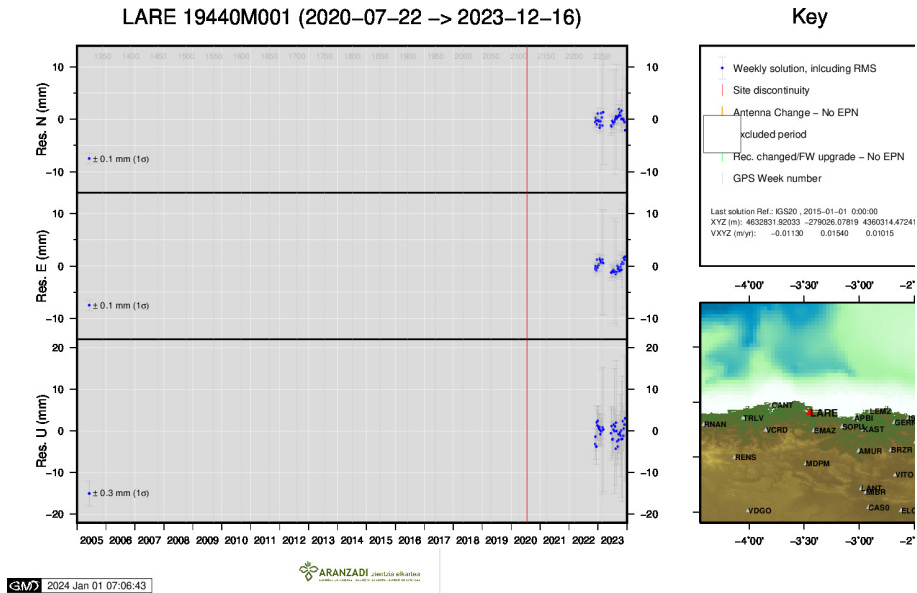
12) HOND



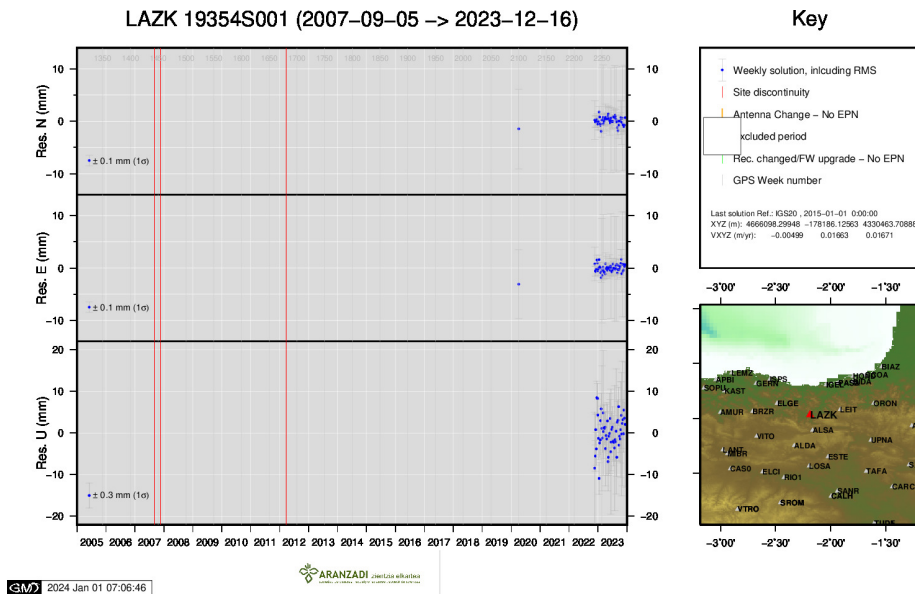
13) IGEL



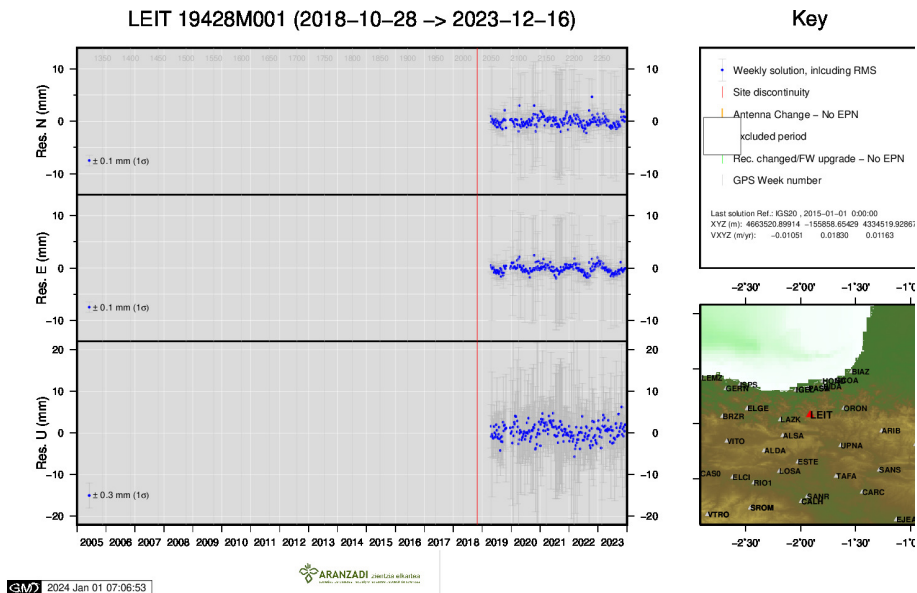
14) ISPS



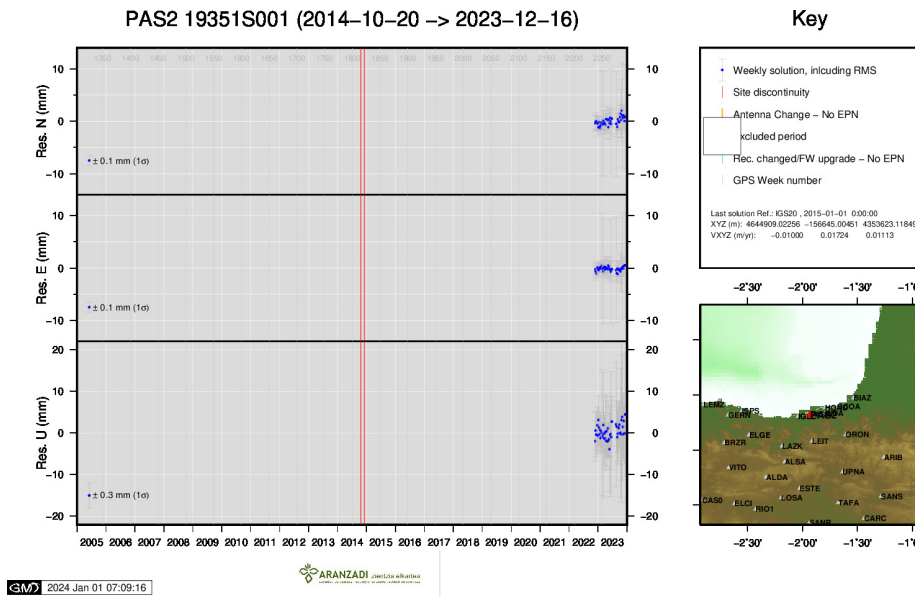
15) LARE



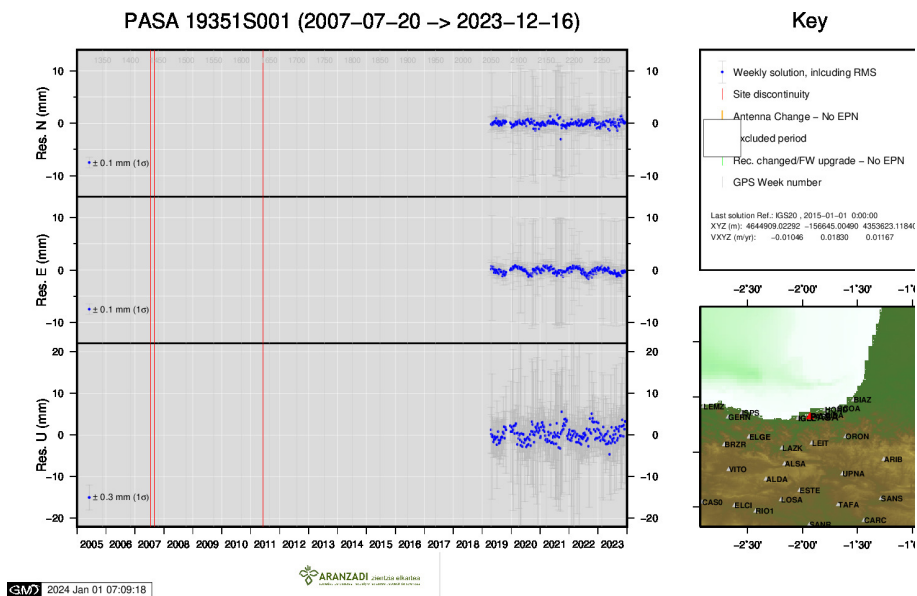
16) LAZK



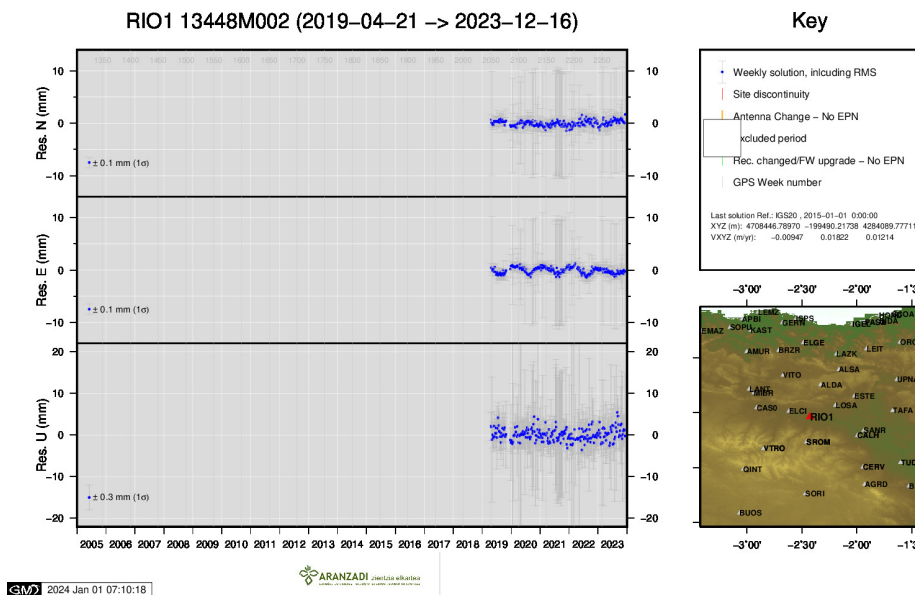
17) LEIT



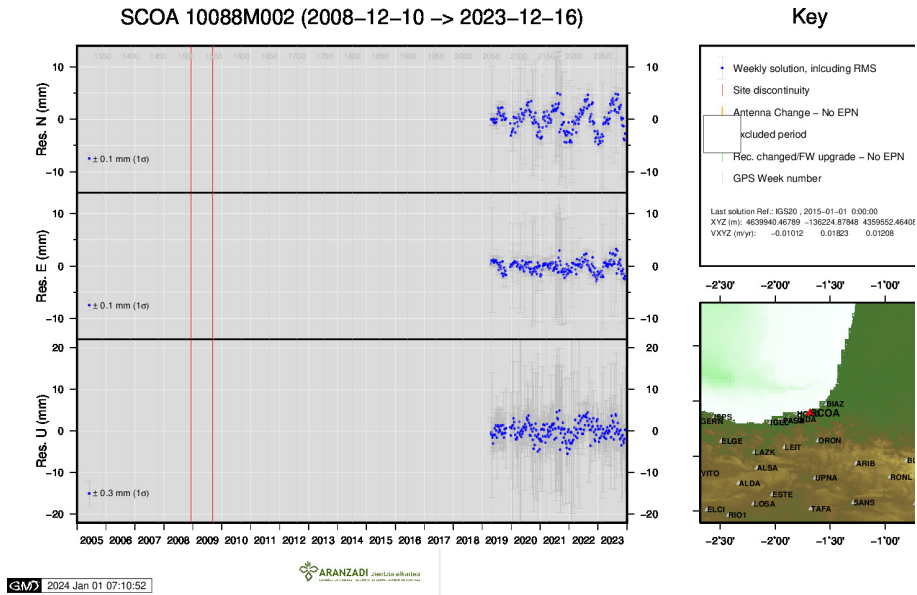
18) PAS2



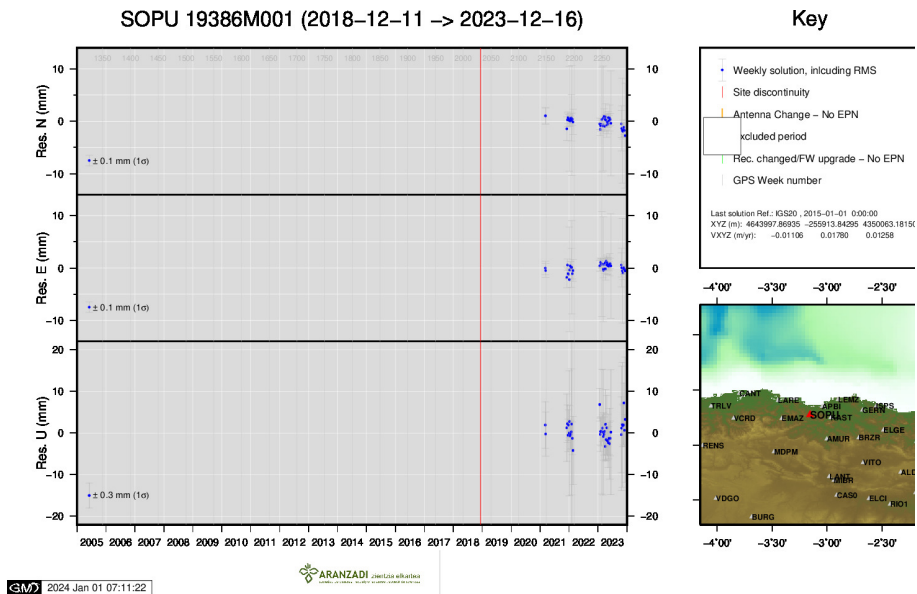
19) PASA



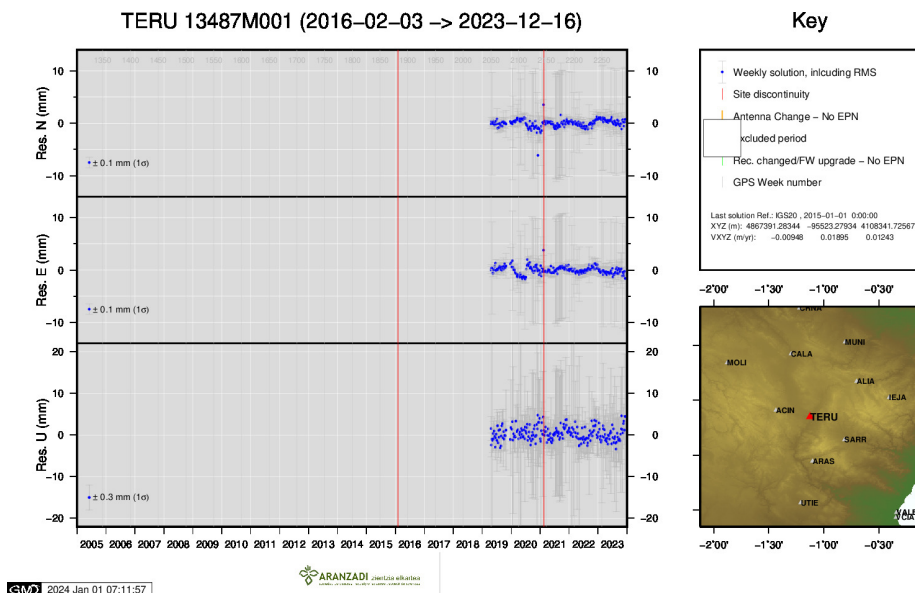
20) RIO1



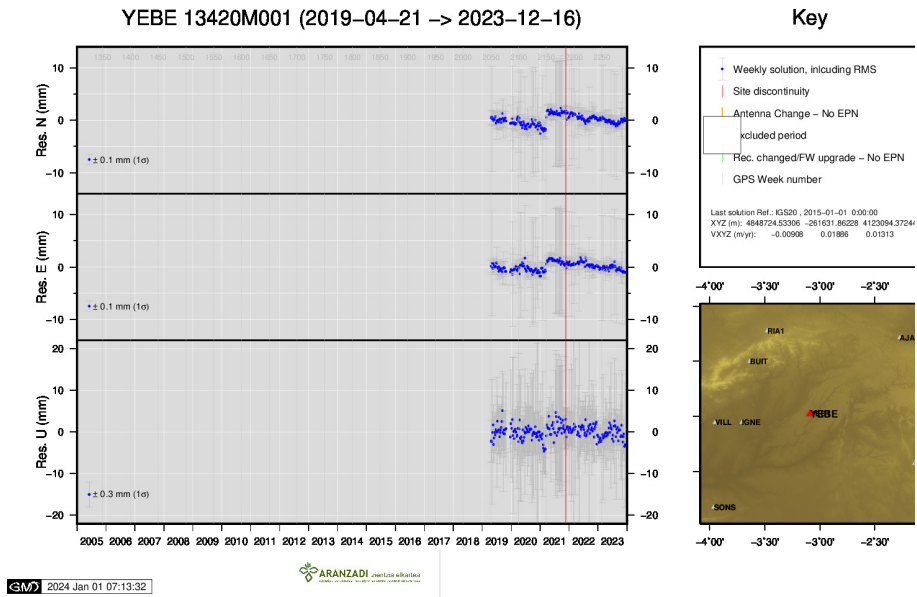
21) SCOA



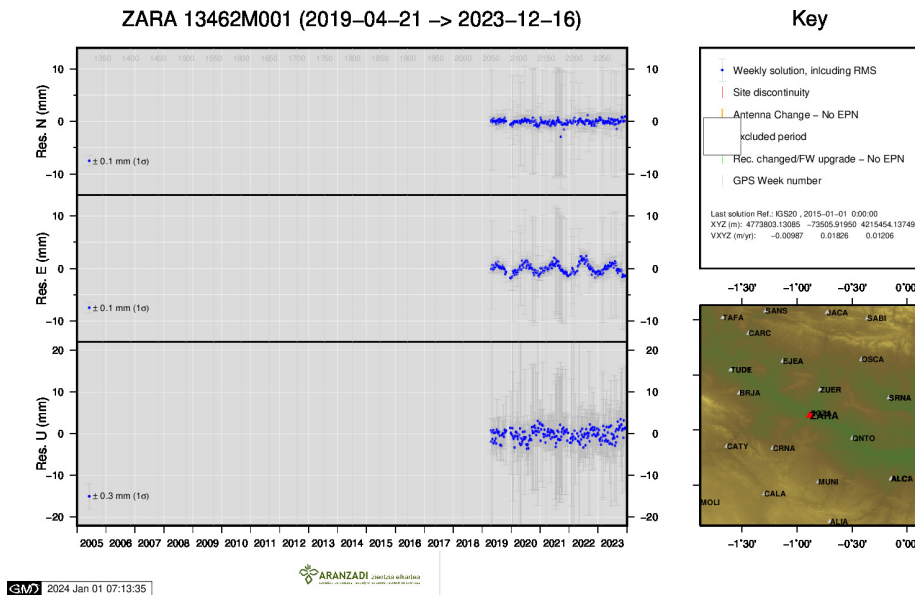
22) SOPU



23) TERU



24) YEBE



25) ZARA