

# ARA-DAC Weekly Analysis Result: 2109 (GFA)

## Technical Report

**GPS Week: 2109 (GFA)**

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

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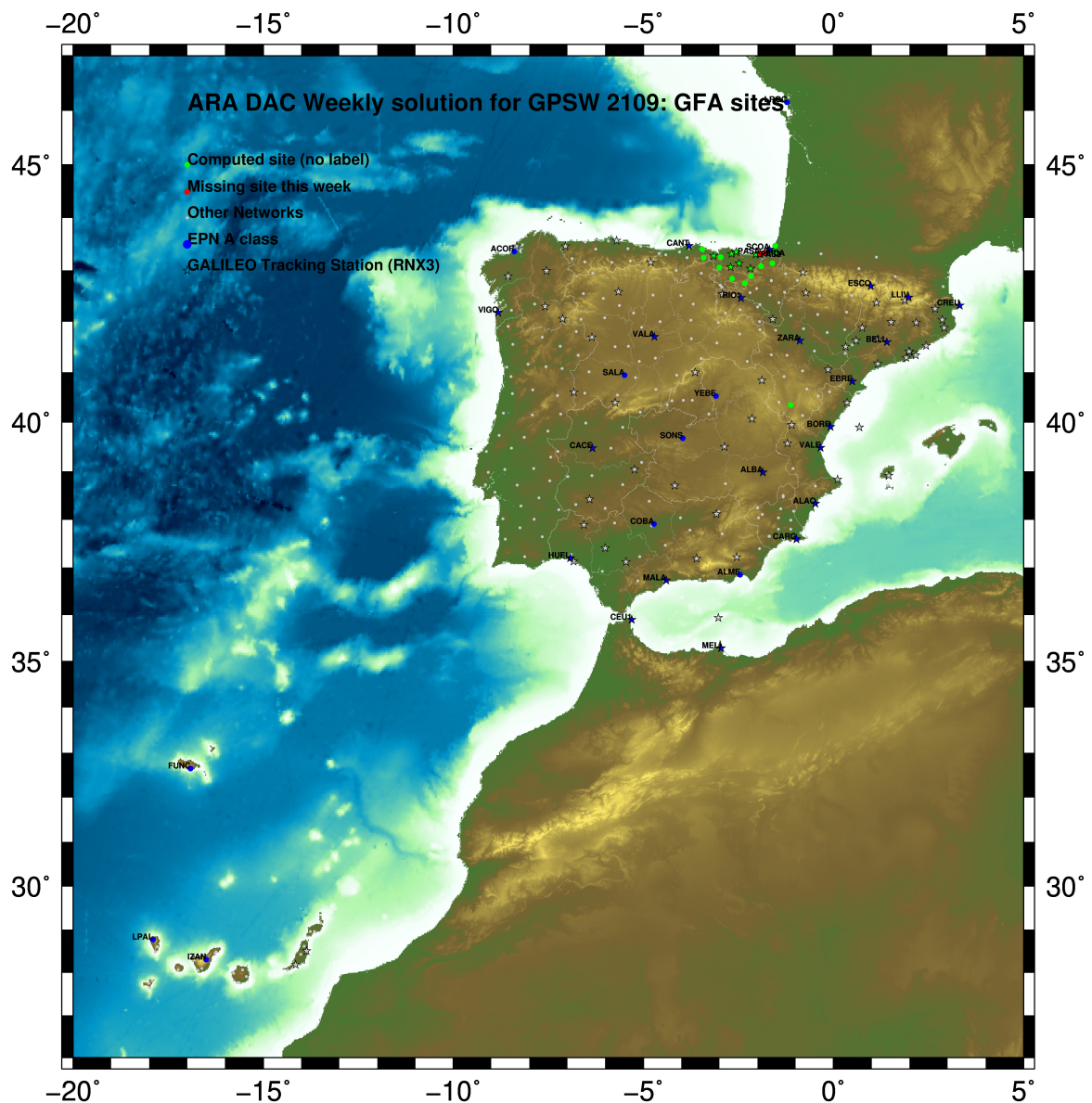
Report generated on 2020/07/01 at 14:29:32



# 1 Introduction

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

# 2 Map of Computed Sites



GM 2020 Jul 01 14:29:23

Fig.1: Computed Sites for GPS Week2109 (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 also used if available from GPSW 1986 on)
- 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.I14 file and individual calibrations from EPNC\_14.ATX. EPN\_A class sites (CRD + VEL) IGS14 used to define the reference frame (from GPSW 1934). If individual calibrations, other from these, are available, they are also included in the analysis.
- Troposphere:
  - 3 deg elev. cutoff; elevation dependent weighting
  - VMF1 mapping function. ZPD parameters are estimated using the VMF1 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2004 (Scherneck).
- Atmosph. Loading: computed from a global grid using the GRDS1S2 program of Bernese 5.2.

### 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. DE405 planetary ephemeris and JGM3 Earth geopotential model is used.
- Tidal displacements: according to IERS2010 Conventions. Atmospheric loading corrections used.

- Ambiguity: an advanced ambiguity resolution (AR) scheme is included:
  - Code-Based Wideline (WL) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
  - Phase-Based Wideline ( $L_5$ ) 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 IGS14

The Reference Frame considered in this section is IGS14, release C2085.

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ARA LAC 2109 WEEK FINAL COMBINATION: PRECISE ORBITS          01-JUL-20 10:46
-----
LOCAL GEODETIC DATUM: IGS14          EPOCH: 2020-06-10 12:00:00
-----
NUM STATION NAME          X (M)          Y (M)          Z (M)          FLAG
-----
  4 ACRD 13434M001        4594489.54746        -678367.42403        4357066.29529        W
 39 ALDA 19383M001        4687280.14306        -190876.54591        4308106.96758        A
 50 ALSA 19419M001        4677250.82037        -176770.37394        4319079.88812        A
 53 AMUR 19388M001        4661499.43452        -244591.23926        4332269.89629        A
100 BIAZ 10074M002        4634456.03612        -124344.95710        4365785.46944        A
113 BRZR 19387M001        4662220.97727        -220769.88038        4333309.45257        A
 98 CACE 13447M001        4899866.49062        -544567.01825        4033770.21656        W
109 CANT 13438M001        4625924.29834        -307096.21517        4365771.56745        W
154 CHER 00000M000        4645880.30707        -125721.90835        4353624.38573        A
154 CREU 13432M001        4715420.11546        273178.07830        4271946.85283        W
190 EBRE 13410M001        4833519.97865        41537.41090        4147461.73403        W
180 ELGE 19353S001        4657557.38947        -202241.45423        4338991.88142        A
182 EMAZ 17001M001        4645924.19230        -276949.84721        4347759.58957        A
209 GERN 19389M001        4642811.30832        -217222.90543        4353278.89487        A
235 IGEL 19352S001        4645951.41428        -165574.48473        4352550.43109        A
240 ISPS 19484M001        4640596.46464        -206963.75892        4356391.92553        A
245 KAST 19499M001        4646949.06568        -240747.25556        4348015.00587        A
252 LARE 19440M001        4632831.93439        -279026.11982        4360314.43551        A
256 LAZK 19354S001        4666098.32121        -178186.17188        4330463.68024        A
261 LEIT 19428M001        4663520.92193        -155858.69819        4334519.89718        A
334 ORDN 19427M001        4659695.76387        -130864.71604        4338948.89491        A
456 PASA 19351S001        4644909.04316        -156645.04974        4353623.08813        W
513 RID1 13448M002        4708446.81240        -199490.26554        4284089.74872        W
518 SALA 13469M001        4803054.47152        -462131.05242        4158379.09102        W
526 SCDA 10088M002        4639940.48154        -136224.92382        4359552.42515        W
418 SOPU 19386M001        4643997.89296        -255913.88792        4350063.15502        A
443 TERU 13487M001        4867391.30691        -95523.33415        4108341.69324        A
493 VITO 19385M001        4679397.68572        -218436.48729        4314898.37805        A
698 YEBE 13420M001        4848724.55237        -261631.91148        4123094.34075        W
701 ZARA 13462M001        4773803.15137        -73505.96535        4215454.10627        W

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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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ETRF2000 FINAL COORD. wk 2109          01-JUL-20 10:46
-----
LOCAL GEODETIC DATUM: ETRF2000        EPOCH: 2020-06-10 12:00:00
-----
NUM STATION NAME          X (M)          Y (M)          Z (M)          FLAG
-----
  4 ACRD 13434M001        4594489.86274        -678367.98159        4357065.86572        W
 39 ALDA 19383M001        4687280.51386        -190877.11234        4308106.53693        A
 50 ALSA 19419M001        4677251.19366        -176770.93925        4319079.45843        A
 53 AMUR 19388M001        4661499.80055        -244591.80307        4332269.46698        A
100 BIAZ 10074M002        4634456.41908        -124345.51763        4365785.04376        A
113 BRZR 19387M001        4662221.34626        -220770.44420        4333309.02351        A
 98 CACE 13447M001        4899866.79898        -544567.60821        4033769.76469        W
109 CANT 13438M001        4625924.65920        -307096.77532        4365771.14015        W
154 CHER 00000M000        4645880.68899        -125722.47011        4353623.95913        A
154 CREU 13432M001        4715420.53969        273177.51056        4271946.42568        W
190 EBRE 13410M001        4833520.36603        41536.82962        4147461.29475        W
180 ELGE 19353S001        4657557.76110        -202242.01749        4338991.45296        A
182 EMAZ 17001M001        4645924.55553        -276950.40944        4347759.16108        A
209 GERN 19389M001        4642811.67916        -217223.46714        4353278.46737        A
235 IGEL 19352S001        4645951.79131        -165575.04663        4352550.00399        A
240 ISPS 19484M001        4640596.83694        -206964.32037        4356391.49834        A
245 KAST 19499M001        4646949.43330        -240747.81779        4348014.57775        A
252 LARE 19440M001        4632832.29826        -279026.68063        4360314.00802        A
256 LAZK 19354S001        4666098.69514        -178186.73598        4330463.25140        A
261 LEIT 19428M001        4663521.29885        -155859.26195        4334519.46883        A
334 ORDN 19427M001        4659696.14412        -130865.27931        4338948.46717        A
456 PASA 19351S001        4644909.42135        -156645.61150        4353622.66123        W
513 RID1 13448M002        4708447.18044        -199490.83426        4284089.31629        W
518 SALA 13469M001        4803054.79880        -462131.63194        4158378.64784        W
526 SCDA 10088M002        4639940.86262        -136225.48498        4359551.99889        W
418 SOPU 19386M001        4643998.25889        -255914.44987        4350062.72695        A
443 TERU 13487M001        4867391.67494        -95523.91952        4108341.24960        A
493 VITO 19385M001        4679398.05367        -218437.05295        4314897.94767        A
698 YEBE 13420M001        4848724.90138        -261632.49537        4123093.89651        W
701 ZARA 13462M001        4773803.52973        -73506.54067        4215453.67027        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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ETRF2014 FINAL COORD. wk 2109                                01-JUL-20 10:46
-----
LOCAL GEODETIC DATUM: ETRF2014          EPOCH: 2020-06-10 12:00:00
NUM STATION NAME          X (M)          Y (M)          Z (M)          FLAG
4  ACRD 13434M001         4594489.82052    -678368.01978    4357065.91460    W
39 ALDA 19383M001         4687280.46938    -190877.15192    4308106.58569    A
50 ALSA 19419M001         4677251.14923    -176770.97891    4319079.50723    A
53 AMUR 19388M001         4661499.75649    -244591.84255    4332269.51579    A
100 BIAZ 10074M002         4634456.37491    -124345.55765    4365785.09269    A
113 BRZR 19387M001         4662221.30212    -220770.48377    4333309.07232    A
98 CACE 13447M001         4899866.75321    -544567.64565    4033769.81288    W
109 CANT 13438M001         4625924.61568    -307096.81472    4365771.18902    W
154 CHER 00000M000         4645880.64472    -125722.51009    4353624.00804    A
154 CREU 13432M001         4715420.49332    273177.46946    4271946.47468    W
190 EBRE 13410M001         4833520.31924    41536.78981    4147461.34332    W
180 ELGE 19353S001         4657557.71695    -202242.05715    4338991.50179    A
182 EMAZ 17001M001         4645924.51172    -276950.44888    4347759.20992    A
209 GERN 19389M001         4642811.63520    -217223.50680    4353278.51624    A
235 IGEL 19352S001         4645951.74716    -165575.08646    4352550.05288    A
240 ISPS 19484M001         4640596.79298    -206964.36007    4356391.54721    A
245 KAST 19499M001         4646949.38937    -240747.85735    4348014.62660    A
252 LARE 19440M001         4632832.25459    -279026.72011    4360314.05689    A
256 LAZK 19354S001         4666098.65083    -178186.77569    4330463.30023    A
261 LEIT 19428M001         4663521.25449    -155859.30175    4334519.51767    A
334 ORON 19427M001         4659696.09973    -130865.31921    4338948.51603    A
456 PASA 19351S001         4644909.37718    -156645.65136    4353622.71012    W
513 RIO1 13448M002         4708447.13576    -199490.87372    4284089.36501    W
518 SALA 13469M001         4803054.75388    -462131.67008    4158378.69625    W
526 SOGA 10088M002         4639940.81844    -136225.52494    4359552.04780    W
418 SOPU 19386M001         4643998.21504    -255914.48939    4350062.77579    A
443 TERU 13487M001         4867391.62825    -95523.95871    4108341.29801    A
493 VITO 19385M001         4679398.00935    -218437.09246    4314897.99644    A
698 YEBE 13420M001         4848724.85540    -261632.53404    4123093.94488    W
701 ZARA 13462M001         4773803.48396    -73506.58031    4215453.71890    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 IGS14 solution and are given with respect the Local frame (North-East-Up).

ARA LAC 2109 WEEK FINAL COMBINATION: PRECISE ORBITS 01-JUL-20 10:46

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	7	XXXXXX	0.59	0.97	1.76
ALDA 19383M001	7	XXXXXX	1.27	2.00	2.49
ALSA 19419M001	7	XXXXXX	0.68	0.94	1.85
AMUR 19388M001	7	XXXXXX	1.10	1.49	2.92
BLAZ 10074M002	7	XXXXXX	0.47	1.16	2.83
BRZR 19387M001	7	XXXXXX	1.95	2.14	5.01
CACE 13447M001	7	XXXXXX	0.60	0.57	2.83
CANT 13438M001	7	XXXXXX	0.52	0.76	2.19
CHER 00000M000	5	XXX X	1.09	0.97	4.46
CREU 13432M001	7	XXXXXX	1.11	0.91	3.65
EBRE 13410M001	7	XXXXXX	0.95	1.14	6.70
ELGE 19353S001	7	XXXXXX	1.24	1.75	2.23
EMAZ 17001M001	7	XXXXXX	0.65	0.72	1.98
GERN 19389M001	7	XXXXXX	0.74	2.41	5.21
IGEL 19352S001	7	XXXXXX	0.82	0.68	2.60
ISPS 19484M001	7	XXXXXX	0.69	0.75	1.93
KAST 19499M001	7	XXXXXX	1.24	0.96	4.59
LARE 19440M001	4	XXX	0.78	0.62	3.99
LAZK 19354S001	7	XXXXXX	0.66	1.57	5.19
LEIT 19428M001	7	XXXXXX	0.83	1.25	2.81
ORDN 19427M001	7	XXXXXX	0.40	0.97	2.02
PASA 19351S001	7	XXXXXX	1.15	0.80	3.43
RI01 13448M002	7	XXXXXX	0.69	0.79	2.54
SALA 13469M001	7	XXXXXX	0.49	0.45	2.68
SCDA 10088M002	7	XXXXXX	1.14	0.85	2.15
SOPU 19386M001	7	XXXXXX	0.81	0.90	4.23
TERU 13487M001	7	XXXXXX	0.69	0.80	2.18
VITD 19385M001	7	XXXXXX	0.83	0.83	4.98
YEBE 13420M001	7	XXXXXX	0.72	0.60	2.54
ZARA 13462M001	7	XXXXXX	0.78	0.92	4.31

Comparison of individual solutions:

ACOR 13434M001	N	0.59	0.46	0.23	0.05	0.52	-0.69	-0.87	0.55
ACOR 13434M001	E	0.97	1.38	1.02	0.67	-0.06	0.42	0.93	-1.09
ACOR 13434M001	U	1.76	-0.82	1.80	3.44	-0.59	-1.13	-0.46	1.04
ALDA 19383M001	N	1.27	0.84	-1.08	0.14	2.59	-0.49	-0.29	0.86
ALDA 19383M001	E	2.00	-1.40	-1.49	-1.76	-2.41	-0.50	3.17	-0.76
ALDA 19383M001	U	2.49	-0.38	-1.30	-0.75	-3.78	3.49	-1.52	-2.48
ALSA 19419M001	N	0.68	1.00	0.91	0.01	0.54	-0.46	-0.62	-0.24
ALSA 19419M001	E	0.94	-0.92	-0.95	-0.87	-0.32	0.88	-1.33	0.34
ALSA 19419M001	U	1.85	-1.49	-2.76	1.28	-2.80	-0.51	-0.75	0.63
AMUR 19388M001	N	1.10	0.35	-0.20	-1.15	0.77	0.12	2.06	0.97
AMUR 19388M001	E	1.49	-0.47	-0.44	-2.06	-1.06	-0.33	2.68	0.42
AMUR 19388M001	U	2.92	-2.65	-4.03	-1.42	-2.31	4.33	-0.18	-1.35
BLAZ 10074M002	N	0.47	0.74	0.24	-0.53	-0.15	0.62	-0.15	0.13
BLAZ 10074M002	E	1.16	-1.82	1.28	-0.86	-0.94	0.95	-0.78	0.13
BLAZ 10074M002	U	2.83	4.77	0.73	-1.94	-3.88	-1.98	-1.39	0.21
BRZR 19387M001	N	1.95	0.83	0.87	1.00	2.14	0.06	-3.42	2.01
BRZR 19387M001	E	2.14	-0.35	0.43	-0.44	-0.40	0.29	-4.70	2.19
BRZR 19387M001	U	5.01	2.41	2.07	-1.74	-3.14	2.81	-10.04	4.31
CACE 13447M001	N	0.60	-0.38	-0.59	-0.39	0.50	-1.09	-0.21	0.10
CACE 13447M001	E	0.57	0.72	0.15	0.76	-0.29	0.41	0.76	-0.05
CACE 13447M001	U	2.83	-4.86	1.59	4.20	0.04	0.01	-0.23	2.01
CANT 13438M001	N	0.52	0.79	-0.22	0.43	0.41	-0.74	0.21	0.22
CANT 13438M001	E	0.76	-1.33	-0.83	-0.36	-0.80	-0.24	-0.36	-0.04
CANT 13438M001	U	2.19	-2.63	-3.28	-2.09	1.29	0.05	-0.34	2.22
CHER 00000M000	N	1.09	-0.18	0.51	-1.33	-0.53			1.55
CHER 00000M000	E	0.97	-0.58	-0.76	-1.30	-0.50			0.93
CHER 00000M000	U	4.46	3.69	4.07	4.07	-4.03			-4.10
CREU 13432M001	N	1.11	0.44	0.75	0.97	0.47	0.25	-2.28	-0.42
CREU 13432M001	E	0.91	0.96	-0.23	-0.50	-0.62	0.97	-1.27	-0.90
CREU 13432M001	U	3.65	0.69	-0.45	-1.31	-1.06	-2.29	-7.26	4.28
EBRE 13410M001	N	0.95	-1.17	0.10	0.17	-0.34	1.52	-1.18	0.39
EBRE 13410M001	E	1.14	0.30	0.41	-2.29	-0.78	0.60	1.03	-0.49
EBRE 13410M001	U	6.70	11.74	-1.12	-9.77	0.63	-0.85	-0.27	-5.81
ELGE 19353S001	N	1.24	0.56	0.49	-0.39	0.57	-0.82	2.60	0.90
ELGE 19353S001	E	1.75	-1.63	-1.08	-0.87	-1.61	-0.58	3.26	-0.52
ELGE 19353S001	U	2.23	-1.65	-4.32	-1.45	0.71	1.70	0.47	1.65
EMAZ 17001M001	N	0.65	-0.12	-1.02	0.31	0.54	-0.56	0.80	0.33
EMAZ 17001M001	E	0.72	-0.37	-0.98	0.38	-1.09	-0.67	-0.09	-0.49
EMAZ 17001M001	U	1.98	3.20	0.48	-3.17	-1.11	0.05	-1.34	0.03
GERN 19389M001	N	0.74	1.21	0.07	0.93	0.81	0.03	0.54	0.13
GERN 19389M001	E	2.41	0.24	-2.91	-1.46	-1.24	-2.94	2.26	2.98
GERN 19389M001	U	5.21	-0.15	9.30	0.09	-6.75	1.42	-5.33	-0.81
IGEL 19352S001	N	0.82	0.93	0.61	0.45	-0.45	0.39	1.42	0.46
IGEL 19352S001	E	0.68	-0.46	-0.81	0.13	-0.40	0.31	-1.21	0.41
IGEL 19352S001	U	2.60	-1.38	0.12	1.51	-4.75	-1.63	2.20	-2.51
ISPS 19484M001	N	0.69	0.31	1.25	0.47	0.25	0.32	0.82	0.40
ISPS 19484M001	E	0.75	-0.39	-0.49	0.07	-0.82	-1.27	-0.58	0.57
ISPS 19484M001	U	1.93	1.48	2.47	-1.02	-1.32	0.14	-1.54	-2.98
KAST 19499M001	N	1.24	1.19	-0.29	-0.19	1.46	1.41	-1.23	1.43
KAST 19499M001	E	0.96	-0.88	-0.24	-0.72	-1.01	-0.05	-1.28	1.26
KAST 19499M001	U	4.59	-0.66	-3.17	-2.43	-2.29	9.09	-4.50	1.40
LARE 19440M001	N	0.78	0.24	0.15	-0.27	-1.29			
LARE 19440M001	E	0.62	-0.83	-0.60	-0.27	-0.22			
LARE 19440M001	U	3.99	2.60	-3.71	-1.28	5.06			
LAZK 19354S001	N	0.66	0.90	0.48	-0.46	-0.31	-0.61	0.90	0.28
LAZK 19354S001	E	1.57	-1.61	-2.02	-0.79	-0.78	-0.15	2.59	-0.39
LAZK 19354S001	U	5.19	-5.18	-5.61	-2.39	4.66	-6.18	5.36	3.01
LEIT 19428M001	N	0.83	0.14	0.22	-0.12	0.13	-0.59	1.88	-0.41
LEIT 19428M001	E	1.25	-1.86	-0.90	-0.34	-1.00	-0.27	1.88	-0.66
LEIT 19428M001	U	2.81	1.09	-6.28	-0.91	-1.18	-1.40	1.57	0.57
ORDN 19427M001	N	0.40	0.37	0.01	0.12	0.02	-0.52	0.58	0.46

ORDN 19427M001	E	0.97	-1.04	-1.74	0.17	0.06	0.16	-1.15	0.37
ORDN 19427M001	U	2.02	-1.43	-3.30	-2.56	-0.88	0.21	2.06	-0.19
PASA 19351S001	N	1.15	0.56	0.10	-0.17	2.54	-0.58	0.59	0.71
PASA 19351S001	E	0.80	-1.01	-1.36	-0.48	-0.34	0.09	0.21	0.75
PASA 19351S001	U	3.43	1.65	-1.70	3.71	-6.66	-0.16	-1.59	-2.11
RIO1 13448M002	N	0.69	-0.12	0.51	-0.47	-0.48	0.30	-0.03	1.44
RIO1 13448M002	E	0.79	-0.18	-1.41	-1.17	-0.31	0.38	-0.26	-0.15
RIO1 13448M002	U	2.54	-2.36	-0.27	-0.16	-0.07	3.20	-2.85	-3.83
SALA 13469M001	N	0.49	0.25	0.37	-0.02	0.60	-0.26	-0.83	0.35
SALA 13469M001	E	0.45	-0.25	0.09	0.27	0.22	0.36	0.63	0.72
SALA 13469M001	U	2.68	0.12	-3.18	0.55	-0.55	3.52	-2.32	3.83
SCDA 10088M002	N	1.14	0.01	-0.69	-0.17	1.13	-1.33	-0.09	2.04
SCDA 10088M002	E	0.85	-0.61	-0.79	-1.14	0.87	-0.13	-1.10	0.29
SCDA 10088M002	U	2.15	2.77	-0.53	-1.38	-3.03	0.46	-2.52	1.48
SOPU 19386M001	N	0.81	0.30	0.91	-0.14	1.27	-0.05	0.48	1.08
SOPU 19386M001	E	0.90	-0.63	-0.76	-0.58	-0.80	-0.27	-1.09	1.27
SOPU 19386M001	U	4.23	-0.12	-5.59	-4.54	-1.74	4.73	-0.97	5.41
TERU 13487M001	N	0.69	-0.36	-1.19	-0.18	1.05	-0.14	0.01	0.34
TERU 13487M001	E	0.80	-0.46	-0.62	-0.16	-1.16	1.20	-0.16	-0.63
TERU 13487M001	U	2.18	-1.20	-2.34	-2.07	-1.77	0.45	1.88	-3.23
VITO 19385M001	N	0.83	0.96	-0.28	-0.68	0.86	0.14	-0.63	1.24
VITO 19385M001	E	0.83	-0.35	-1.12	-1.16	-0.59	1.00	0.32	-0.08
VITO 19385M001	U	4.98	1.21	0.68	1.88	0.63	4.73	-8.70	-6.68
YEBE 13420M001	N	0.72	0.17	-0.34	-0.99	-0.52	-0.40	0.21	-1.22
YEBE 13420M001	E	0.60	-0.10	1.28	0.20	-0.33	0.18	0.54	-0.10
YEBE 13420M001	U	2.54	3.64	1.42	-0.43	-0.53	-2.44	-0.75	4.08
ZARA 13462M001	N	0.78	-0.76	0.17	0.54	1.56	-0.26	0.23	-0.45
ZARA 13462M001	E	0.92	-1.16	-0.32	-0.85	0.46	-0.58	-1.48	0.41
ZARA 13462M001	U	4.31	3.39	-5.48	-4.85	-2.63	5.05	-3.69	-0.51

## 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.

LOCAL GEODETIC DATUM: IGS14  
RESIDUALS IN LOCAL SYSTEM (NORTH, EAST, UP)

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
4	ACOR 13434M001	I W	-1.20	0.10	0.53
10	ALAC 13433M001	I W	-1.16	-0.02	0.48
13	ALBA 13452M001	I W	-0.21	-1.45	-0.78
19	ALME 13437M001	I W	0.34	2.20	-1.32
46	BELL 13431M001	I W	0.02	-0.82	2.08
65	BORR 13480M001	I W	0.79	-2.67	-2.18
70	BRST 10004M004	I W	-1.22	-0.33	1.13
98	CACE 13447M001	I W	0.22	2.05	3.11
109	CANT 13438M001	I W	-0.69	-0.19	2.05
110	CARG 19412M001	I W	0.79	-0.02	0.12
121	CEU1 13449M002	I W	0.50	-0.51	-6.44
135	COBA 13453M001	I W	0.62	0.45	-6.20
154	CREU 13432M001	I W	-0.41	1.44	1.07
190	EBRE 13410M001	I W	-2.85	-1.39	-5.46
208	ESCO 13435M001	I W	-1.07	2.88	-3.24
219	FUNC 13911S001	I W	-2.45	-10.13	-5.33
286	HUEL 13451M001	I W	1.61	-1.38	-5.66
300	IZAN 31309M002	I W	0.79	-0.72	-2.79
359	LLIV 13436M001	I W	0.94	0.01	0.47
364	LPAL 81701M001	I W	-0.99	1.04	-1.89
366	LRDC 10023M001	I W	0.91	0.71	2.65
400	MELI 19379M001	I W	1.75	2.00	2.14
456	PASA 19351S001	I W	-1.05	0.45	2.70
464	PDEL 31906M004	I W	3.55	1.86	2.31
513	RID1 13448M002	I W	-0.99	1.09	0.43
518	SALA 13469M001	I W	0.26	2.02	-1.17
526	SCOA 10088M002	I W	-3.05	1.52	1.53
557	SONS 13446M001	I W	-0.61	1.44	-1.28
588	TERC 31909M001	I W	4.13	-4.34	-0.93
654	VALA 13463M002	I W	0.35	0.17	1.15
658	VALE 13439M001	I W	0.56	0.66	1.99
669	VIGO 13450M001	I W	0.02	0.68	4.51
698	YEBO 13420M001	I W	0.27	1.55	7.13
701	ZARA 13462M001	I W	-0.19	0.19	4.78
710	ZIMM 14001M004	I W	-0.32	-0.20	2.52
84	MALA 13443M001	I W	0.05	-0.35	-0.22
	RMS / COMPONENT		1.45	2.26	3.19
	MEAN		-0.00	0.00	0.00
	MIN		-3.05	-10.13	-6.44
	MAX		4.13	2.88	7.13

NUMBER OF PARAMETERS : 3  
NUMBER OF COORDINATES : 108  
RMS OF TRANSFORMATION : 2.41 MM

BARYCENTER COORDINATES:

LATITUDE : 40 4 16.70  
LONGITUDE : - 5 5 48.72  
HEIGHT : -48.249 KM

PARAMETERS:

TRANSLATION IN N : 0.00 +- 0.40 MM  
TRANSLATION IN E : 0.00 +- 0.40 MM  
TRANSLATION IN U : -0.00 +- 0.40 MM

### 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 the daily solutions are shown.

```
* STATISTICAL PARAMETER-----VALUE(S)-----
NUMBER OF OBSERVATIONS          14982835
NUMBER OF UNKNOWN               191336
NUMBER OF DEGREES OF FREEDOM    14791499
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)      180
VARIANCE FACTOR                  2.149009051148950

Helmert Transformation Parameters With Respect to Combined Solution:
-----
Sol  Rms (m)      Translation (m)      Rotation (")      Scale (ppm)
      X          Y          Z          X          Y          Z
-----
 1  0.00203    -0.0133 -0.0065  0.0086  0.0001 -0.0005 -0.0002  0.00078
 2  0.00233    -0.0131 -0.0040  0.0182 -0.0000 -0.0007 -0.0002 -0.00016
 3  0.00210    -0.0106 -0.0065  0.0132  0.0001 -0.0005 -0.0002 -0.00007
 4  0.00195    -0.0101 -0.0140  0.0065  0.0003 -0.0004 -0.0004  0.00038
 5  0.00211    0.0184  0.0058 -0.0121 -0.0001  0.0007  0.0002 -0.00104
 6  0.00249    0.0089 -0.0047 -0.0077  0.0001  0.0004 -0.0001 -0.00058
 7  0.00203    0.0090 -0.0064 -0.0070  0.0002  0.0003 -0.0001 -0.00052
```

```
Statistics of individual solutions:
-----
File  RMS (m)      DOF  Chi**2/DOF  #Observations authentic / pseudo  #Parameters explicit / implicit / singular
-----
 1  0.00150    2038012  2.26                2065053      3      852      26192      0
 2  0.00147    2103100  2.17                2131659      3      873      27689      0
 3  0.00143    2134339  2.03                2161606      3      873      26397      0
 4  0.00142    2107193  2.00                2133595      3      873      25532      0
 5  0.00149    2106102  2.22                2134415      3      876      27440      0
 6  0.00153    2111786  2.34                2142463      3      864      29816      0
 7  0.00141    2185786  1.97                2214044      3      885      27376      0
```

## 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 20:159:00000 20:165:86370 LEICA GR50 -----
ALDA  A  1 P 20:159:00000 20:165:86370 LEICA GR10 -----
ALSA  A  1 P 20:159:00000 20:165:86370 LEICA GR50 -----
AMUR  A  1 P 20:159:00000 20:165:86370 LEICA GR10 -----
BIAZ  A  1 P 20:159:00000 20:165:82770 TRI SP90M -----
BRZR  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
CACE  A  1 P 20:159:00000 20:165:86370 TRIMBLE NETR9 -----
CANT  A  1 P 20:159:00000 20:165:86370 LEICA GR10 -----
CHER  A  1 P 20:159:00000 20:165:82770 LEICA GRX1200+GNSS -----
CREU  A  1 P 20:159:00000 20:165:86370 LEICA GR50 -----
EBRE  A  1 P 20:159:00000 20:165:86370 LEICA GR50 -----
ELGE  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
EMAZ  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
GERN  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
IGEL  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
ISPS  A  1 P 20:159:00000 20:165:86370 TRIMBLE NETR9 -----
KAST  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
LARE  A  1 P 20:159:00000 20:162:32280 LEICA GRX1200GGPRO -----
LAZK  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
LEIT  A  1 P 20:159:00000 20:165:86370 LEICA GR50 -----
ORON  A  1 P 20:159:00000 20:165:86370 LEICA GR50 -----
PASA  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
RIO1  A  1 P 20:159:00000 20:165:86370 LEICA GR25 -----
SALA  A  1 P 20:159:00000 20:165:86370 LEICA GRX1200+GNSS -----
SCOA  A  1 P 20:159:00000 20:165:86370 LEICA GR25 -----
SOPU  A  1 P 20:159:00000 20:165:86370 LEICA GR30 -----
TERU  A  1 P 20:159:00000 20:165:86370 LEICA GRX1200GGPRO -----
VITO  A  1 P 20:159:00000 20:165:86370 LEICA GR10 -----
YEBE  A  1 P 20:159:00000 20:165:86370 TRIMBLE NETR9 -----
ZARA  A  1 P 20:159:00000 20:165:86370 TRIMBLE NETR9 -----
```

### 7.2 Antennas

Serial number ONLY provided in case individual calibrations are available.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__
ACOR  A  1 P 20:159:00000 20:165:86370 LEIAT504      LEIS -----
ALDA  A  1 P 20:159:00000 20:165:86370 LEIAS10       NONE -----
ALSA  A  1 P 20:159:00000 20:165:86370 LEIAR10       NONE -----
AMUR  A  1 P 20:159:00000 20:165:86370 LEIAS10       NONE -----
BIAZ  A  1 P 20:159:00000 20:165:82770 LEIAR25       LEIT -----
BRZR  A  1 P 20:159:00000 20:165:86370 LEIAS10       NONE -----
```

```

CACE A 1 P 20:159:00000 20:165:86370 TRM29659.00 NONE -----
CANT A 1 P 20:159:00000 20:165:86370 LEIAR25.R4 LEIT 25066
CHER A 1 P 20:159:00000 20:165:82770 LEIAX1203+GNSS NONE -----
CREU A 1 P 20:159:00000 20:165:86370 LEIAR25.R4 NONE 26357
EBRE A 1 P 20:159:00000 20:165:86370 LEIAR25.R4 NONE 26359
ELGE A 1 P 20:159:00000 20:165:86370 LEIAR25.R4 LEIT -----
EMAZ A 1 P 20:159:00000 20:165:86370 LEIAS10 NONE -----
GERN A 1 P 20:159:00000 20:165:86370 LEIAS10 NONE -----
IGEL A 1 P 20:159:00000 20:165:86370 LEIAR20 LEIM -----
ISPS A 1 P 20:159:00000 20:165:86370 TRM59900.00 SCIS -----
KAST A 1 P 20:159:00000 20:165:86370 LEIAS10 NONE -----
LARE A 1 P 20:159:00000 20:162:32280 LEIAT504 NONE -----
LAZK A 1 P 20:159:00000 20:165:86370 LEIAR25.R4 LEIT -----
LEIT A 1 P 20:159:00000 20:165:86370 LEIAR10 NONE -----
ORDN A 1 P 20:159:00000 20:165:86370 LEIAR10 NONE -----
PASA A 1 P 20:159:00000 20:165:86370 LEIAR20 LEIM 73034
RID1 A 1 P 20:159:00000 20:165:86370 LEIAR25.R4 LEIT 25138
SALA A 1 P 20:159:00000 20:165:86370 LEIAR25 NONE -----
SCOA A 1 P 20:159:00000 20:165:86370 TRM55971.00 NONE -----
SOPU A 1 P 20:159:00000 20:165:86370 LEIAS10 NONE -----
TERU A 1 P 20:159:00000 20:165:86370 LEIAT504GG LEIS -----
VITO A 1 P 20:159:00000 20:165:86370 LEIAS10 NONE -----
YEBE A 1 P 20:159:00000 20:165:86370 TRM29659.00 NONE -----
ZARA A 1 P 20:159:00000 20:165:86370 TRM29659.00 NONE -----

```

### 7.3 Eccentricities

```

*
*SITE PT SOLN T DATA_START_ DATA_END_ AXE ARP->BENCHMARK(M) UP_ NORTH_ EAST_
ACOR A 1 P 20:159:00000 20:165:86370 UNE 3.0460 0.0000 0.0000
ALDA A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
ALSA A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
AMUR A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 20:159:00000 20:165:82770 UNE 0.0000 0.0000 0.0000
BRZR A 1 P 20:159:00000 20:165:86370 UNE 0.0771 0.0000 0.0000
CACE A 1 P 20:159:00000 20:165:86370 UNE 0.0600 0.0000 0.0000
CANT A 1 P 20:159:00000 20:165:86370 UNE 3.0490 0.0000 0.0000
CHER A 1 P 20:159:00000 20:165:82770 UNE 0.0000 0.0000 0.0000
CREU A 1 P 20:159:00000 20:165:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 20:159:00000 20:165:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
EMAZ A 1 P 20:159:00000 20:165:86370 UNE 0.0350 0.0000 0.0000
GERN A 1 P 20:159:00000 20:165:86370 UNE 0.0771 0.0000 0.0000
IGEL A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
ISPS A 1 P 20:159:00000 20:165:86370 UNE 0.0350 0.0000 0.0000
KAST A 1 P 20:159:00000 20:165:86370 UNE 0.0350 0.0000 0.0000
LARE A 1 P 20:159:00000 20:162:32280 UNE 0.0000 0.0000 0.0000
LAZK A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
LEIT A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
ORDN A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
PASA A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
RID1 A 1 P 20:159:00000 20:165:86370 UNE 0.0606 0.0000 0.0000
SALA A 1 P 20:159:00000 20:165:86370 UNE 0.0600 0.0000 0.0000
SCOA A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
SOPU A 1 P 20:159:00000 20:165:86370 UNE 0.0771 0.0000 0.0000
TERU A 1 P 20:159:00000 20:165:86370 UNE 0.0600 0.0000 0.0000
VITO A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
YEBE A 1 P 20:159:00000 20:165:86370 UNE 0.0000 0.0000 0.0000
ZARA A 1 P 20:159:00000 20:165:86370 UNE 3.2590 0.0000 0.0000

```

## 8 References

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

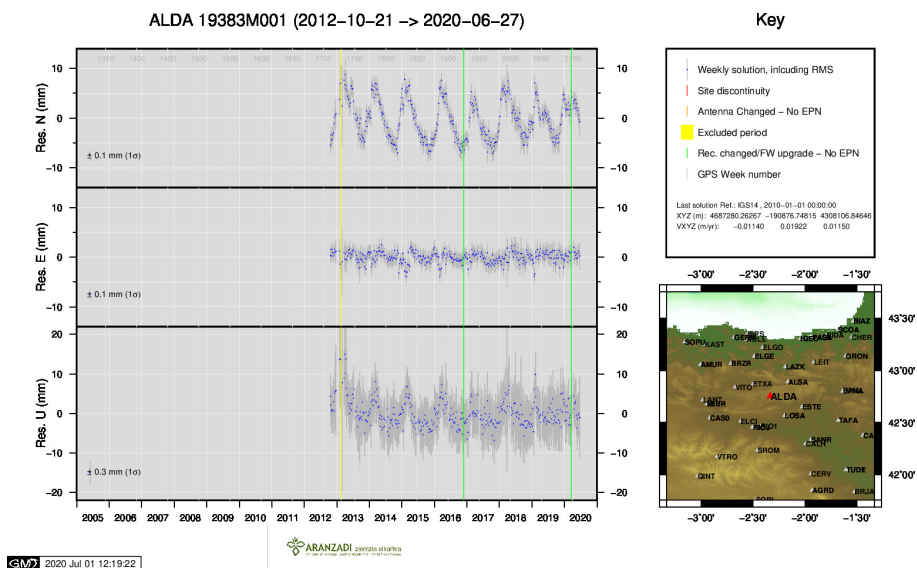
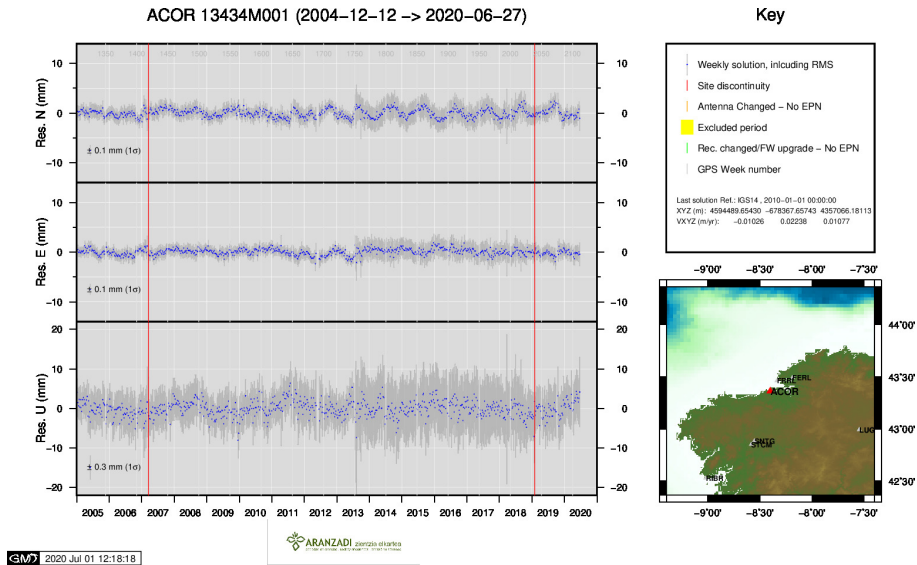
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](https://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

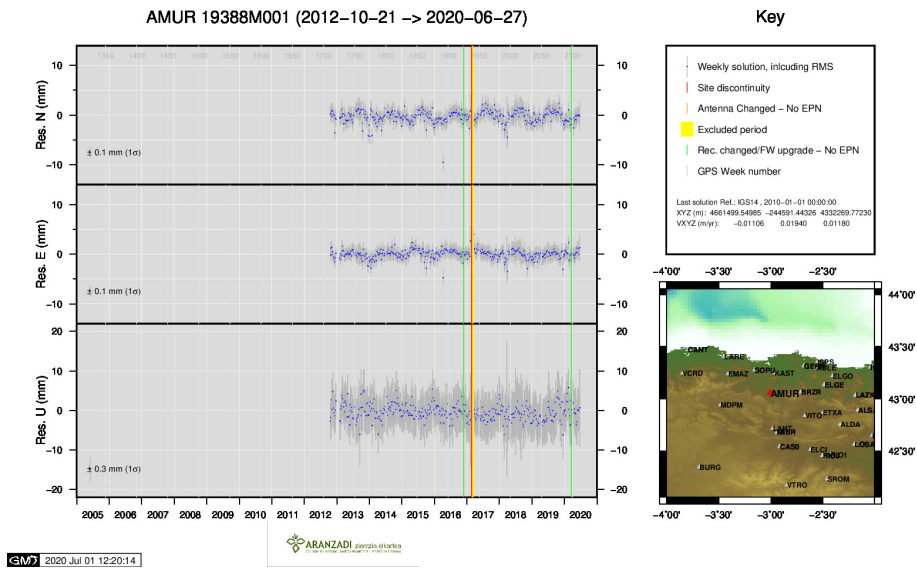
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems*. [etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf](https://etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf)



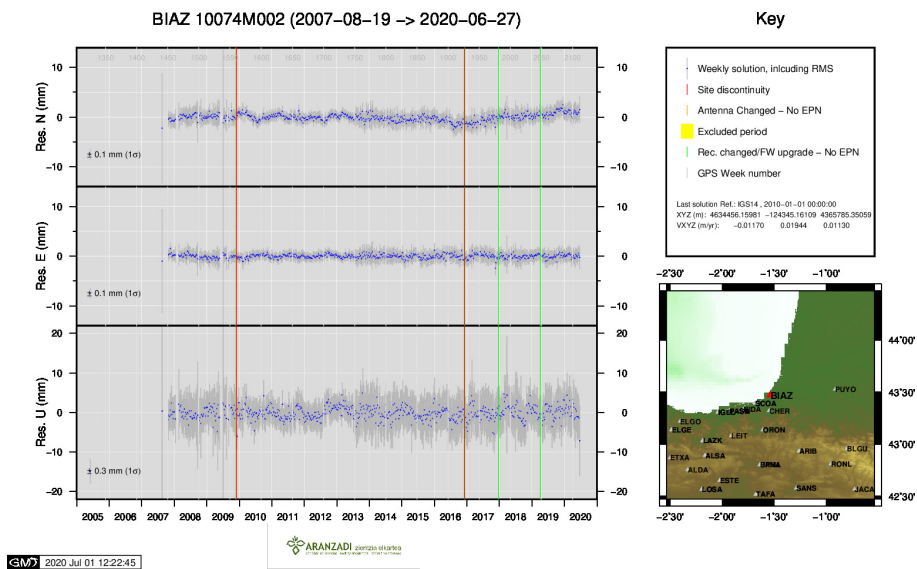
## 9 Cumulative Time Series

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

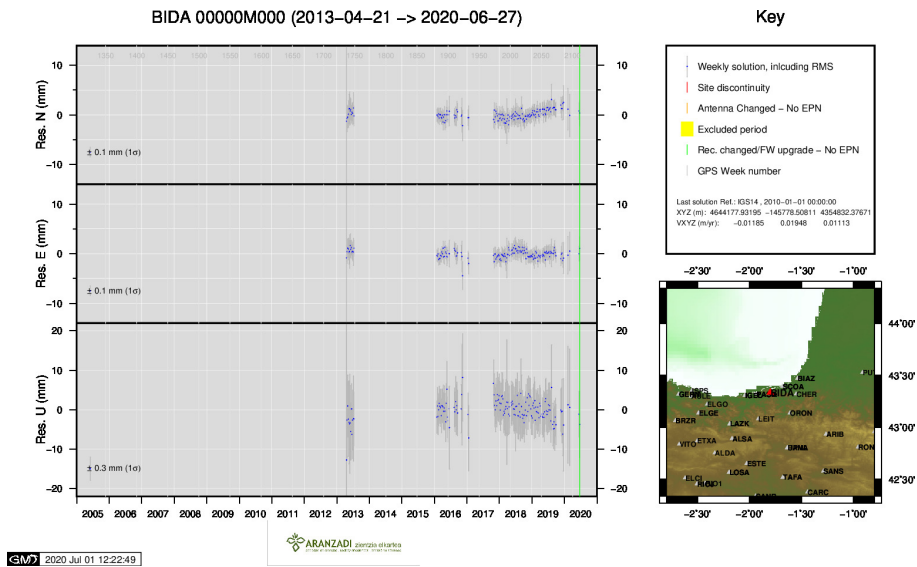




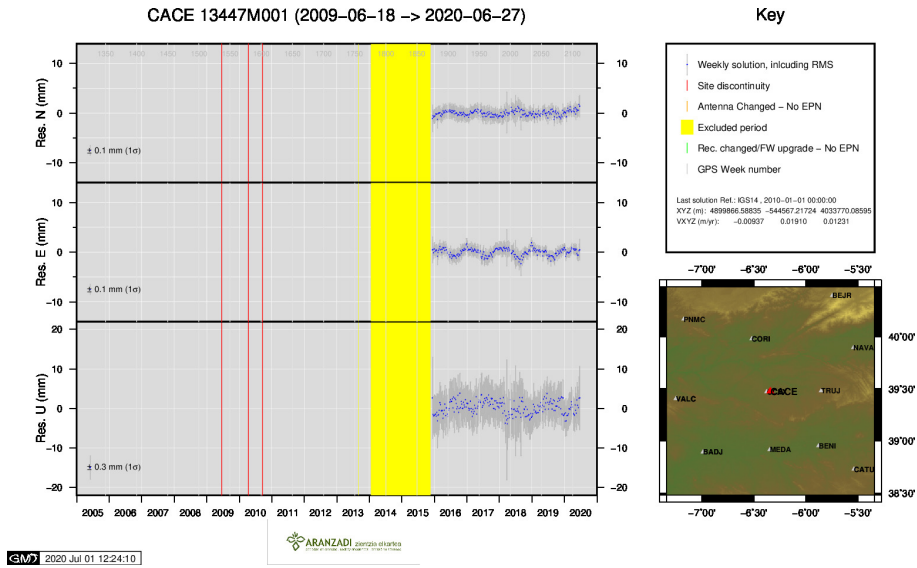
3 ) AMUR



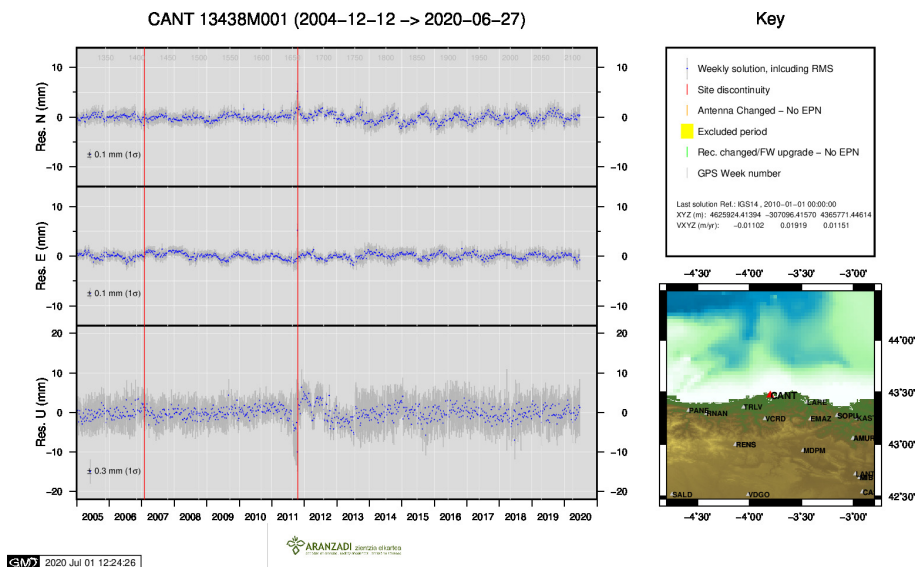
4 ) BIAZ



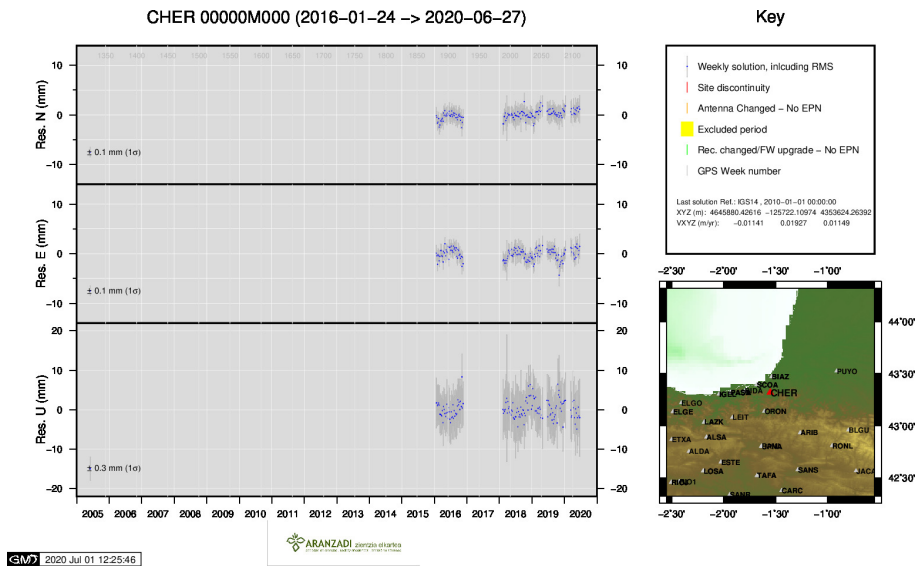
5 ) BIDA



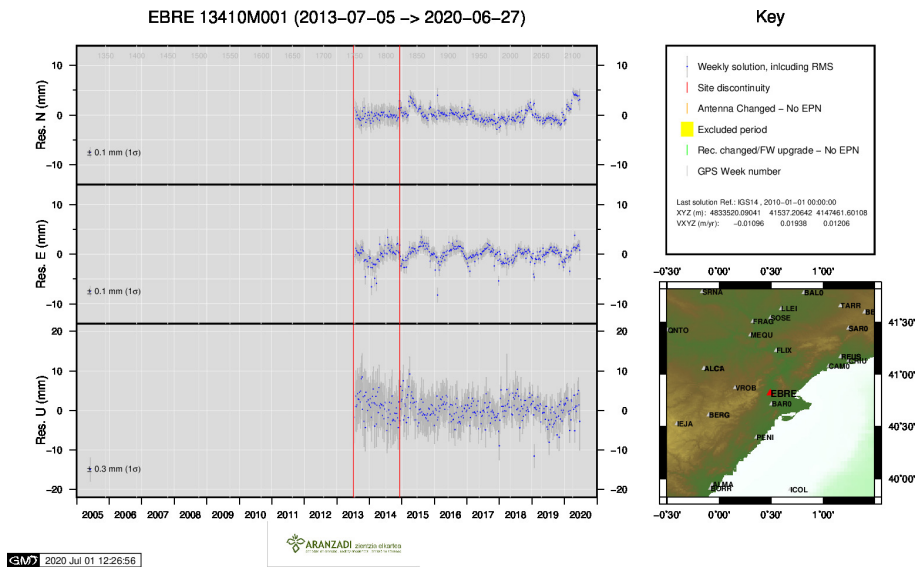
6 ) CACE



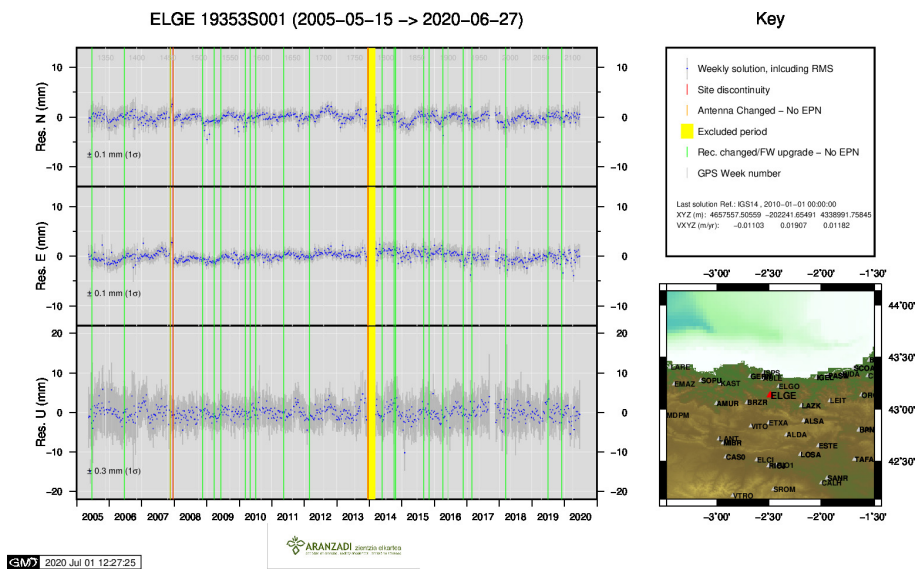
7 ) CANT



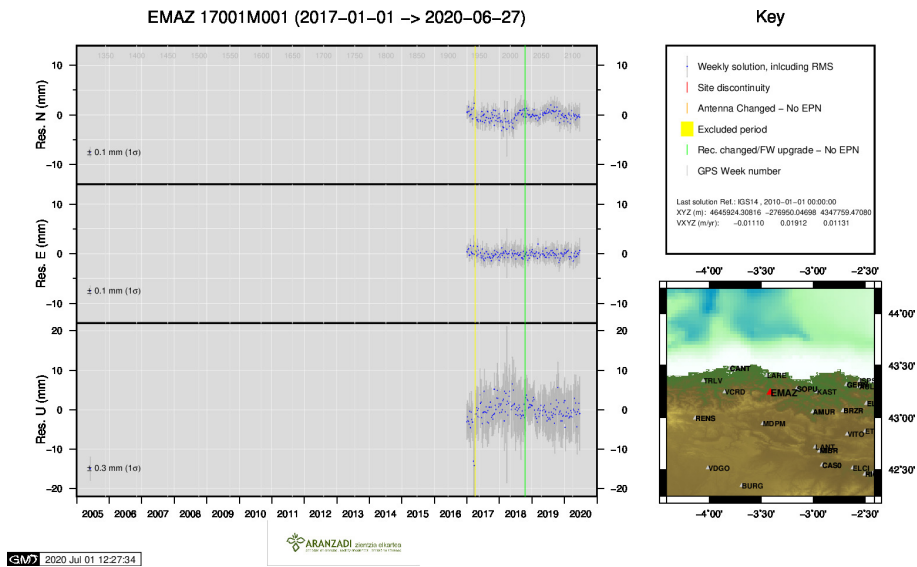
8 ) CHER



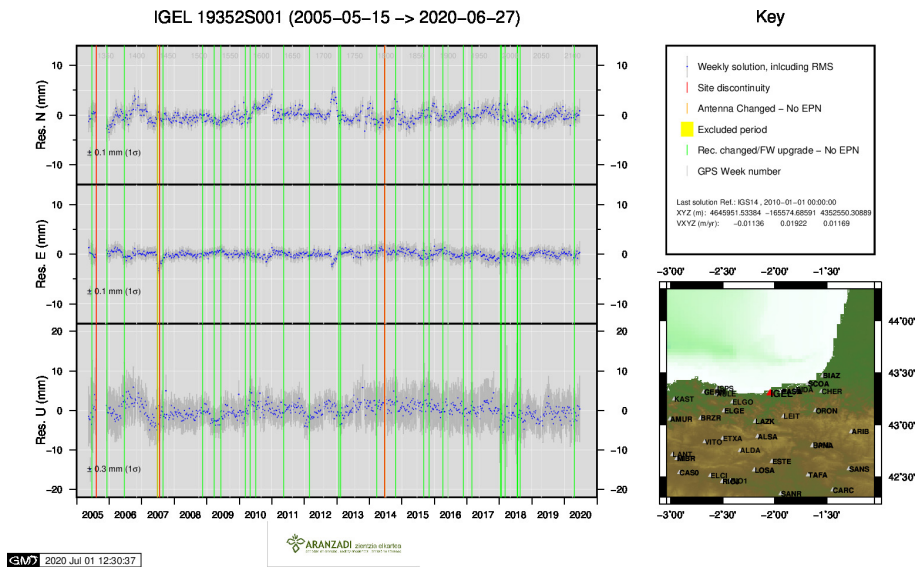
9 ) EBRE



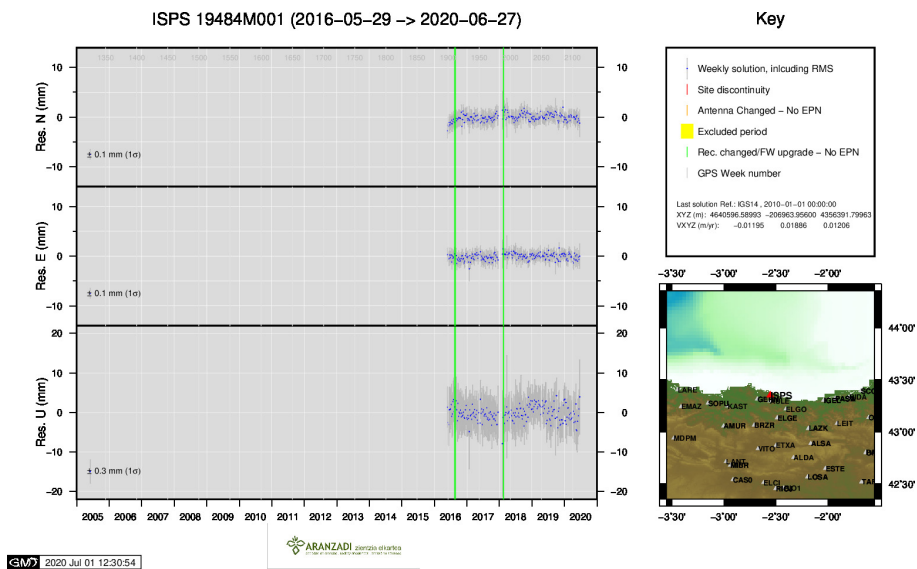
10 ) ELGE



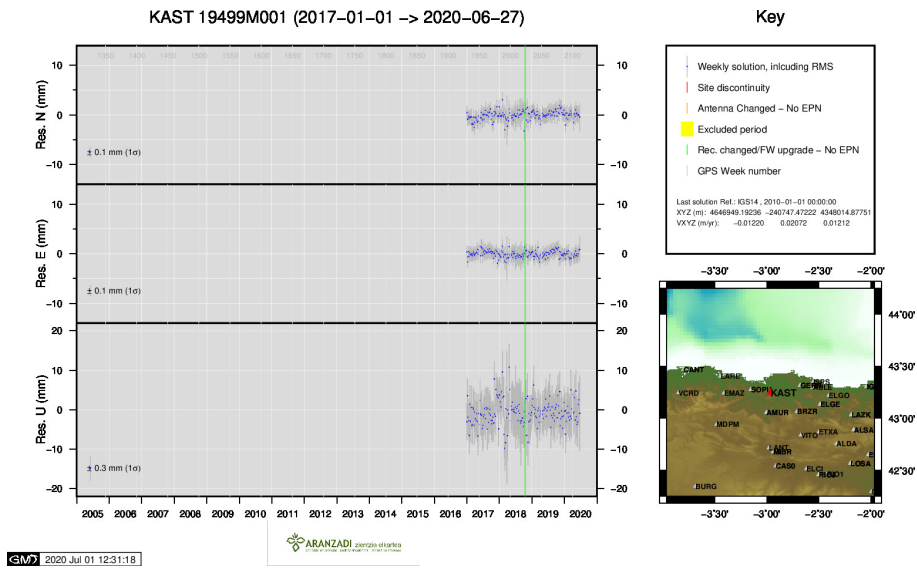
11 ) EMAZ



12 ) IGEL

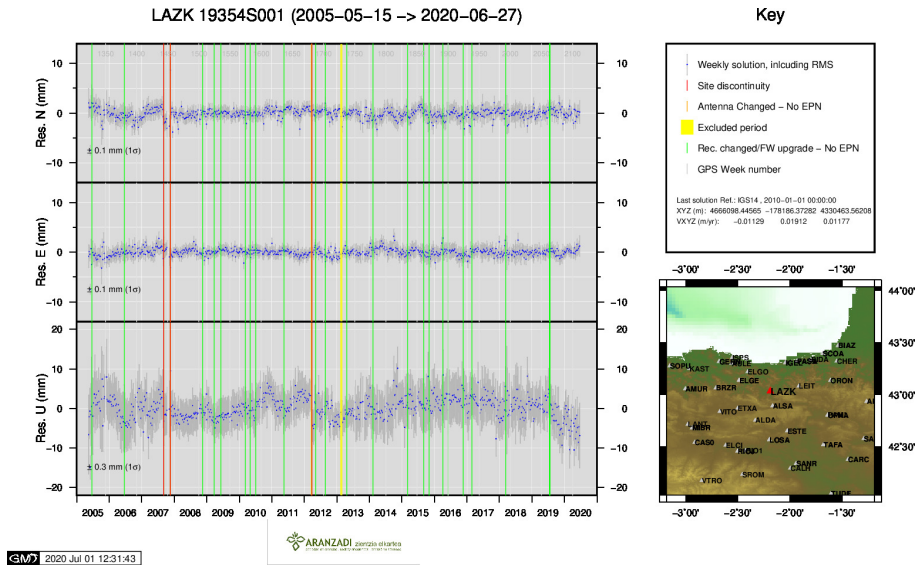


13 ) ISPS

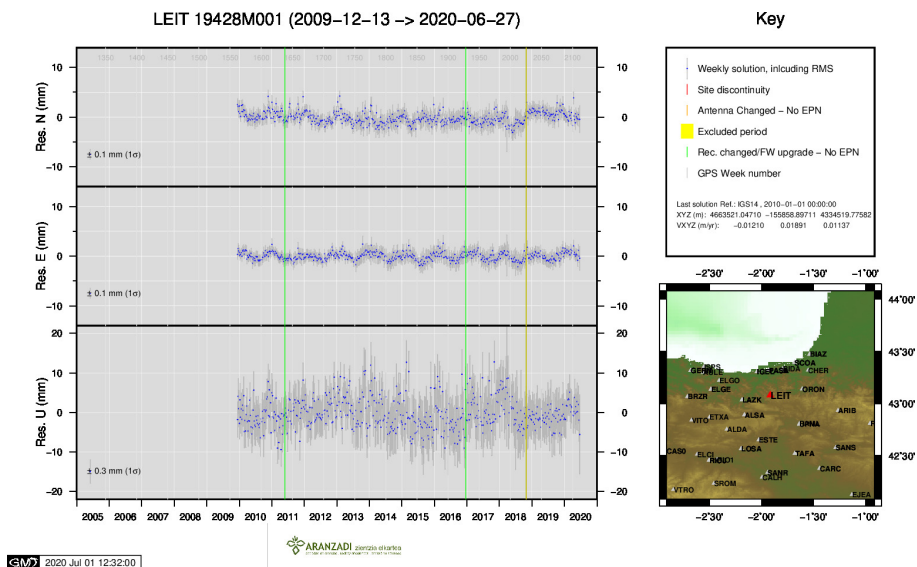


14 ) KAST

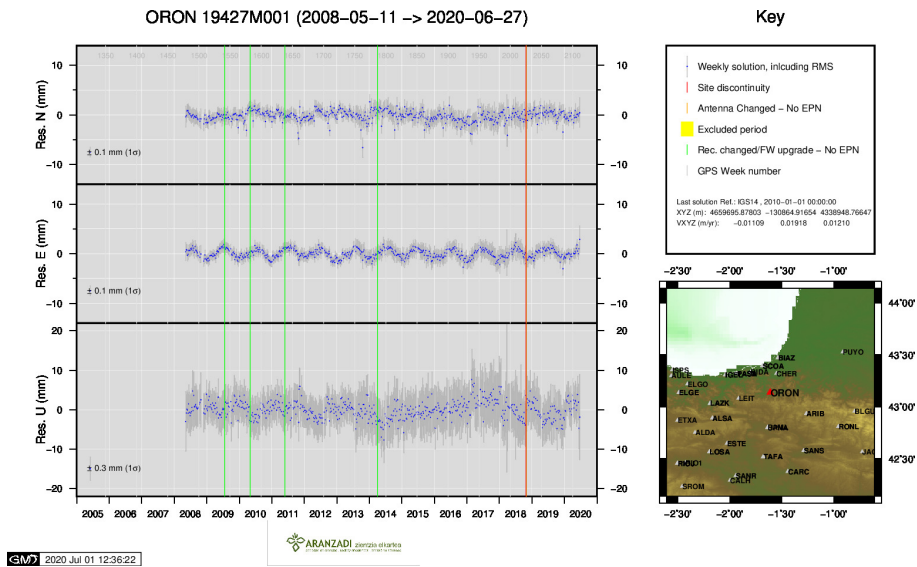




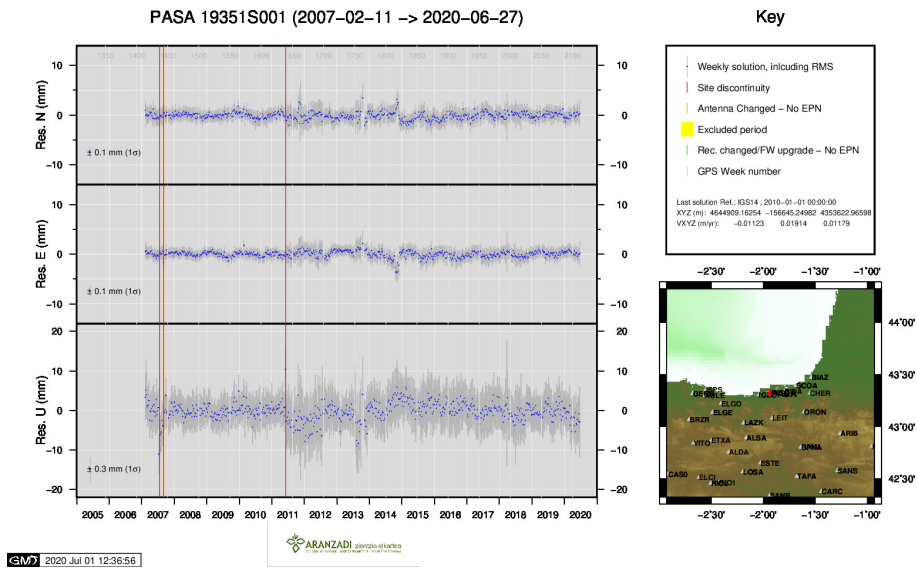
15 ) LAZK



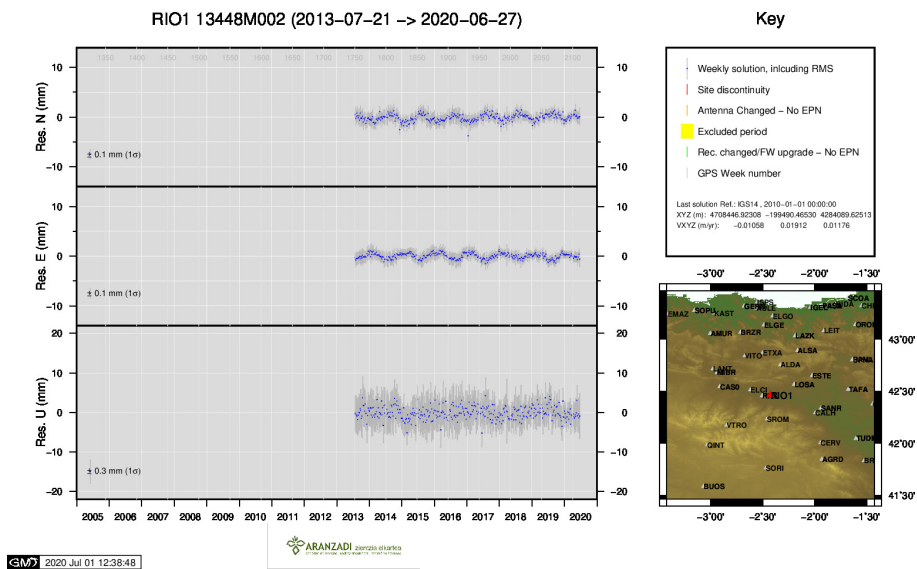
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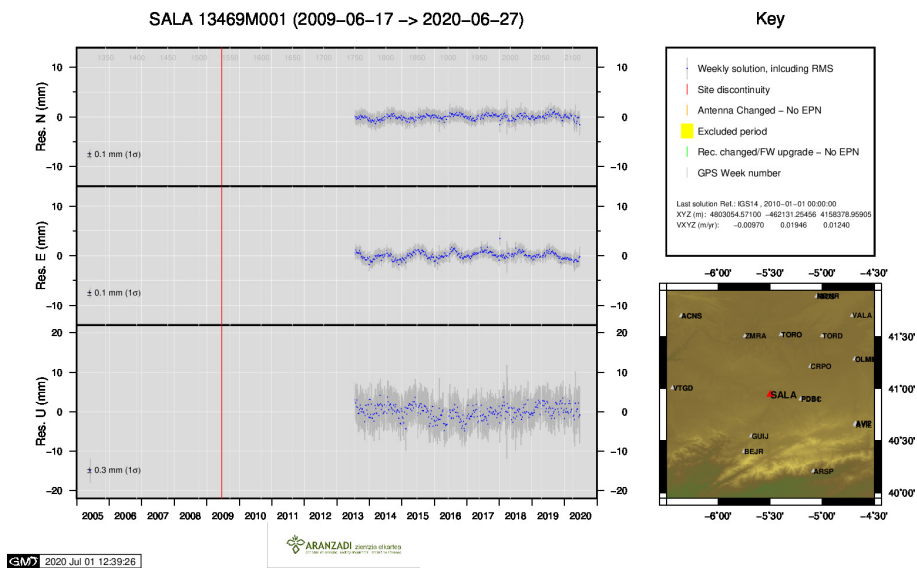
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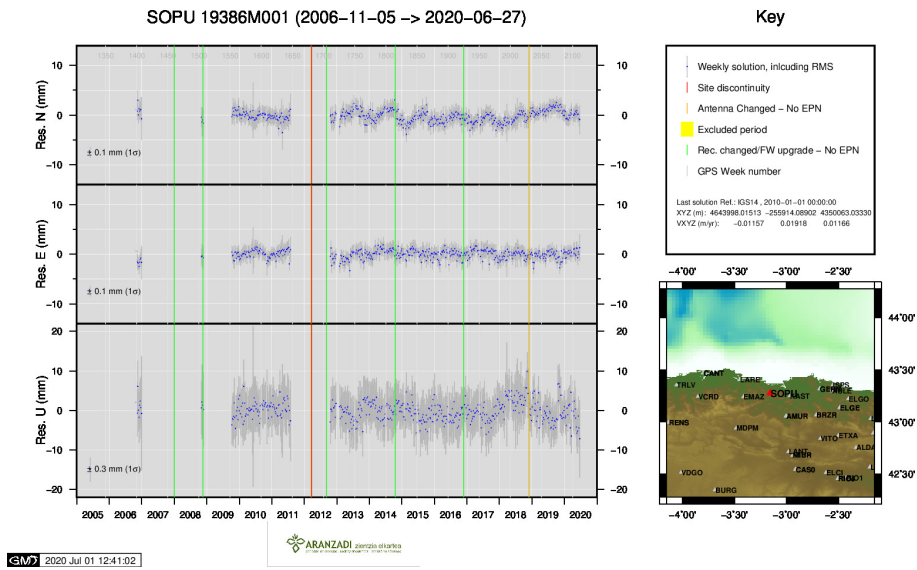
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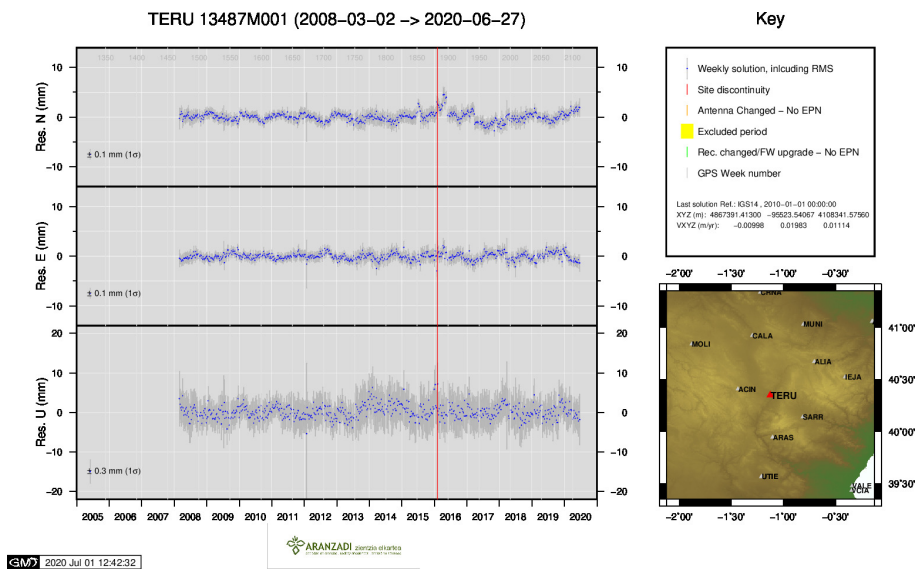
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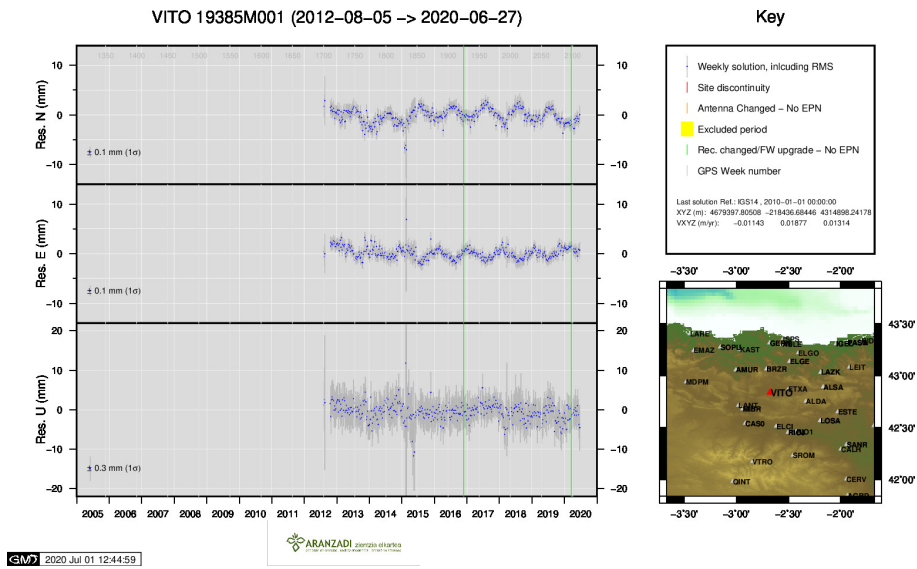
20 ) SALA



21 ) SOPU

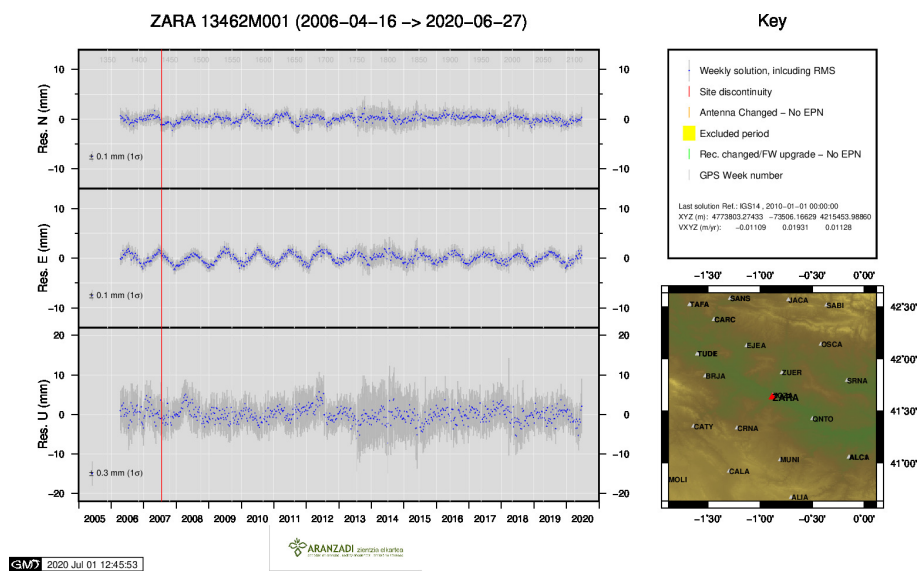


22 ) TERU



23 ) VITO





24 ) ZARA