

# ARA-DAC Weekly Analysis Result: 2099 (GFA)

## Technical Report

**GPS Week: 2099 (GFA)**

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

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## 1 Introduction

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

## 2 Map of Computed Sites

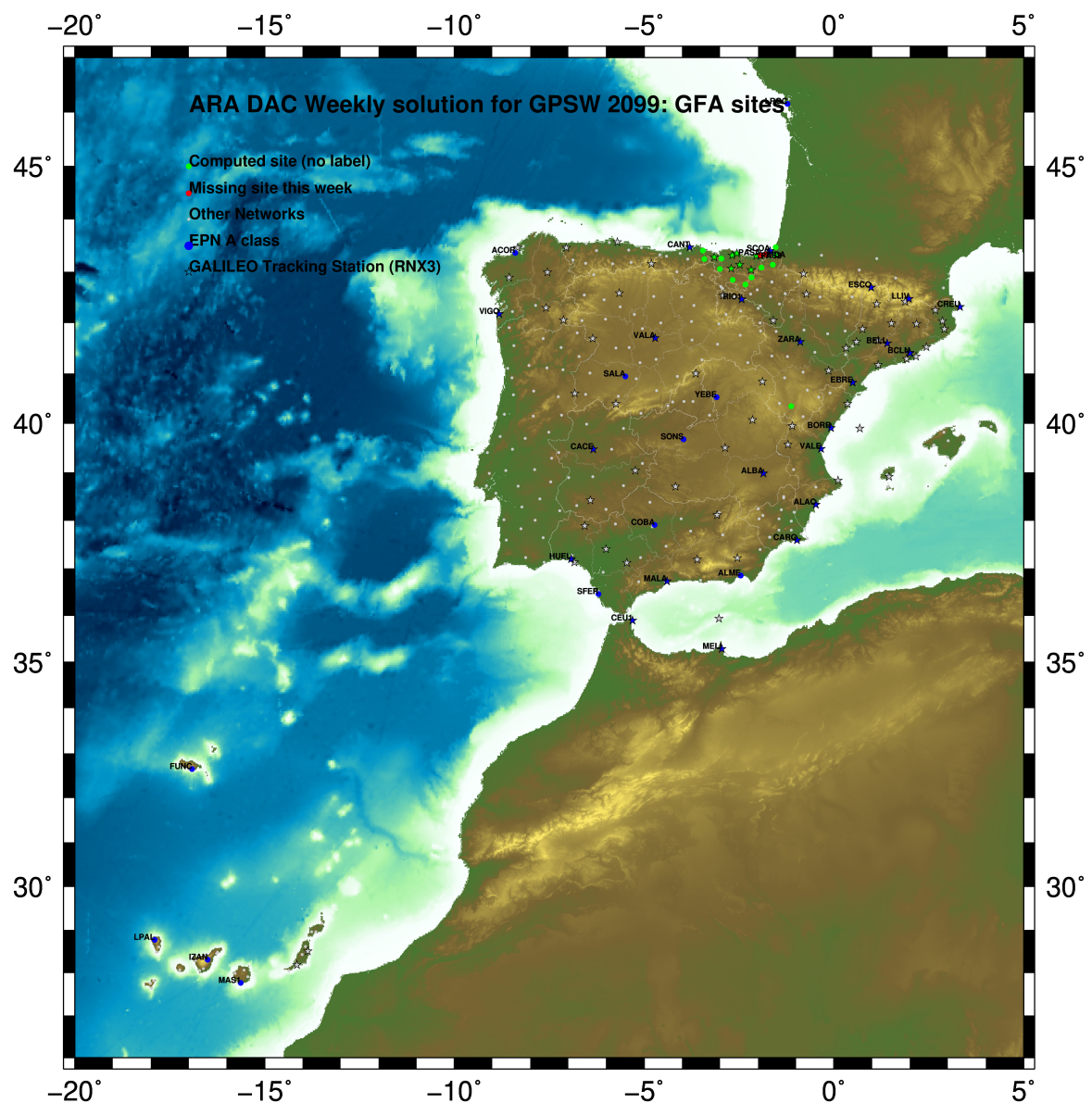


Fig.1: Computed Sites for GPS Week2009 (GFA)

### 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 Widelane (WL) 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 IGS14

The Reference Frame considered in this section is IGS14, release C2055.

ARA LAC 2099 WEEK FINAL COMBINATION: PRECISE ORBITS					18-APR-20 23:28
LOCAL GEODETIC DATUM: IGS14					EPOCH: 2020-04-01 12:00:00
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACOR 13434M001	4594489.55078	-678367.42784	4357066.29393	W
34	ALDA 19383M001	4687280.14656	-190876.54906	4308106.97174	A
43	ALSA 19419M001	4677250.82273	-176770.37743	4319079.88665	A
45	AMUR 19388M001	4661499.43843	-244591.24339	4332269.89356	A
81	BIAZ 10074M002	4634456.04028	-124344.96092	4365785.46785	A
92	BRZR 19387M001	4662220.97956	-220769.88337	4333309.45131	A
9	CACE 13447M001	4899866.49402	-544567.01989	4033770.21499	W
10	CANT 13438M001	4625924.30162	-307096.21806	4365771.56534	W
118	CHER 00000M000	4645880.30858	-125721.91078	4353624.38222	A
15	CREU 13432M001	4715420.11828	273178.07471	4271946.85148	W
17	EBRE 13410M001	4833519.97875	41537.40657	4147461.73004	W
139	ELGE 19353S001	4657557.39081	-202241.46045	4338991.88011	A
141	EMAZ 17001M001	4645924.19374	-276949.85084	4347759.58838	A
209	GERN 19389M001	4642811.30892	-217222.90698	4353278.88896	A
183	IGEL 19352S001	4645951.41771	-165574.48801	4352550.42929	A
188	ISPS 19484M001	4640596.46666	-206963.76187	4356391.92396	A
193	KAST 19499M001	4646949.06803	-240747.25890	4348015.00330	A
198	LARE 19440M001	4632831.93969	-279026.12173	4360314.43665	A
199	LAZK 19354S001	4666098.32631	-178186.17573	4330463.68018	A
203	LEIT 19428M001	4663520.92508	-155858.70122	4334519.89424	A
260	ORON 19427M001	4659695.76577	-130864.71955	4338948.89141	A
33	PASA 19351S001	4644909.04693	-156645.05221	4353623.08712	W
36	RID1 13448M002	4708446.81460	-199490.26810	4284089.74671	W
37	SALA 13469M001	4803054.47263	-462131.05504	4158379.08865	W
38	SCDA 10088M002	4639940.48638	-136224.92570	4359552.42237	W
321	SOPU 19386M001	4643997.89686	-255913.89099	4350063.15444	A
342	TERU 13487M001	4867391.31111	-95523.33745	4108341.69280	A
375	VITO 19385M001	4679397.68899	-218436.48947	4314898.37571	A
49	YEBE 13420M001	4848724.55552	-261631.91496	4123094.34072	W
50	ZARA 13462M001	4773803.15434	-73505.96930	4215454.10447	W

### 5.2 ETRF2000 (ETRS89) Coordinates

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

ETRF2000 FINAL COORD. wk 2099					18-APR-20 23:28
LOCAL GEODETIC DATUM: ETRF2000					EPOCH: 2020-04-01 12:00:00
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACOR 13434M001	4594489.86445	-678367.98169	4357065.86677	W
34	ALDA 19383M001	4687280.51541	-190877.11173	4308106.54350	A
43	ALSA 19419M001	4677251.19406	-176770.93898	4319079.45837	A
45	AMUR 19388M001	4661499.80254	-244591.80345	4332269.46666	A
81	BIAZ 10074M002	4634456.42121	-124345.51773	4365785.04455	A
92	BRZR 19387M001	4662221.34661	-220770.44345	4333309.02465	A
9	CACE 13447M001	4899866.80081	-544567.60595	4033769.76566	W
10	CANT 13438M001	4625924.66059	-307096.77449	4365771.14043	W
118	CHER 00000M000	4645880.68849	-125722.46881	4353623.95801	A
15	CREU 13432M001	4715420.54023	273177.51074	4271946.42672	W
17	EBRE 13410M001	4833520.36408	41536.82914	4147461.29323	W
139	ELGE 19353S001	4657557.76049	-202242.01997	4338991.45405	A
141	EMAZ 17001M001	4645924.55506	-276950.40934	4347759.16229	A
209	GERN 19389M001	4642811.67781	-217223.46496	4353278.46386	A
183	IGEL 19352S001	4645951.79275	-165575.04618	4352550.00459	A
188	ISPS 19484M001	4640596.83700	-206964.31959	4356391.49916	A
193	KAST 19499M001	4646949.43372	-240747.81740	4348014.57758	A
198	LARE 19440M001	4632832.30165	-279026.67882	4360314.01155	A
199	LAZK 19354S001	4666098.69827	-178186.73609	4330463.25375	A
203	LEIT 19428M001	4663521.30001	-155859.26124	4334519.46829	A
260	ORON 19427M001	4659696.14402	-130865.27908	4338948.46606	A
33	PASA 19351S001	4644909.42312	-156645.61024	4353622.66261	W
36	RID1 13448M002	4708447.18071	-199490.83305	4284089.31671	W
37	SALA 13469M001	4803054.79823	-462131.63072	4158378.64796	W
38	SCDA 10088M002	4639940.86545	-136225.48313	4359551.99850	W
321	SOPU 19386M001	4643998.26087	-255914.44921	4350062.72876	A
342	TERU 13487M001	4867391.67721	-95523.91895	4108341.25166	A
375	VITO 19385M001	4679398.05501	-218437.05138	4314897.94774	A
49	YEBE 13420M001	4848724.90272	-261632.49498	4123093.89897	W
50	ZARA 13462M001	4773803.53070	-73506.54080	4215453.67092	W

### 5.3 ETRF2014 (ETRS89) Coordinates

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

ETRF2014 FINAL COORD. wk 2099					18-APR-20 23:28
LOCAL GEODETIC DATUM: ETRF2014					EPOCH: 2020-04-01 12:00:00
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACOR 13434M001	4594489.82217	-678368.01996	4357065.91556	W
34	ALDA 19383M001	4687280.47089	-190877.15137	4308106.59218	A
43	ALSA 19419M001	4677251.14959	-176770.97871	4319079.50708	A
45	AMUR 19388M001	4661499.75843	-244591.84301	4332269.51538	A
81	BLAZ 10074M002	4634456.37701	-124345.55781	4365785.09340	A
92	BRZR 19387M001	4662221.30243	-220770.48308	4333309.07338	A
9	CACE 13447M001	4899866.75501	-544567.64347	4033769.81377	W
10	CANT 13438M001	4625924.61703	-307096.81396	4365771.18922	W
118	CHER 00000M000	4645880.64417	-125722.50885	4353624.00683	A
15	CREU 13432M001	4715420.49384	273177.46958	4271946.47563	W
17	EBRE 13410M001	4833520.31727	41536.78927	4147461.34171	W
139	ELGE 19353S001	4657557.71630	-202242.05969	4338991.50280	A
141	EMAZ 17001M001	4645924.51122	-276950.44884	4347759.21104	A
209	GERN 19389M001	4642811.63381	-217223.50469	4353278.51264	A
183	IGEL 19352S001	4645951.74856	-165575.08607	4352550.05338	A
188	ISPS 19484M001	4640596.79299	-206964.35936	4356391.54795	A
193	KAST 19499M001	4646949.38975	-240747.85702	4348014.62634	A
198	LARE 19440M001	4632832.25793	-279026.71836	4360314.06034	A
199	LAZK 19354S001	4666098.65392	-178186.77586	4330463.30249	A
203	LEIT 19428M001	4663521.25562	-155859.30110	4334519.51704	A
260	ORON 19427M001	4659696.09958	-130865.31904	4338948.51484	A
33	PASA 19351S001	4644909.37891	-156645.65017	4353622.71141	W
36	RI01 13448M002	4708447.13599	-199490.87257	4284089.36534	W
37	SALA 13469M001	4803054.75327	-462131.66893	4158378.69628	W
38	SC0A 10088M002	4639940.82122	-136225.52315	4359552.04732	W
321	SOPU 19386M001	4643998.21698	-255914.48879	4350062.77753	A
342	TERU 13487M001	4867391.63049	-95523.95820	4108341.29998	A
375	VITO 19385M001	4679398.01065	-218437.09095	4314897.99643	A
49	YEBE 13420M001	4848724.85671	-261632.53372	4123093.94726	W
50	ZARA 13462M001	4773803.48491	-73506.58051	4215453.71946	W

## 6 Quality Control

### 6.1 Mean and Daily Repeatabilities

In this section, the mean and daily repeatabilities of the sites are shown. Repeatabilities refer to the IGS14 solution and are given with respect the Local frame (North-East-Up).

ARA LAC 2099 WEEK FINAL COMBINATION: PRECISE ORBITS 18-APR-20 23:28

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	7	XXXXXX	0.66	0.60	1.63
ALDA 19383M001	7	XXXXXX	0.95	1.60	4.54
ALSA 19419M001	7	XXXXXX	1.43	0.42	4.44
AMUR 19388M001	7	XXXXXX	1.38	0.55	3.68
BIAZ 10074M002	7	XXXXXX	1.03	0.70	4.68
BRZR 19387M001	7	XXXXXX	0.83	1.21	3.24
CACE 13447M001	7	XXXXXX	0.70	0.69	2.68
CANT 13438M001	7	XXXXXX	0.47	0.65	2.83
CHER 00000M000	7	XXXXXX	0.95	0.98	5.02
CREU 13432M001	7	XXXXXX	0.50	0.48	2.30
EBRE 13410M001	7	XXXXXX	0.65	0.61	2.88
ELGE 19353S001	7	XXXXXX	1.98	2.66	3.77
EMAZ 17001M001	7	XXXXXX	2.44	1.29	3.69
GERN 19389M001	7	XXXXXX	0.98	0.55	5.70
IGEL 19352S001	7	XXXXXX	1.38	0.46	3.97
ISPS 19484M001	7	XXXXXX	0.97	1.27	4.53
KAST 19499M001	7	XXXXXX	2.58	1.10	6.51
LARE 19440M001	7	XXXXXX	1.54	1.00	3.19
LAZK 19354S001	7	XXXXXX	0.73	0.80	5.49
LEIT 19428M001	7	XXXXXX	1.77	1.14	2.38
ORON 19427M001	7	XXXXXX	0.91	0.74	3.78
PASA 19351S001	7	XXXXXX	1.53	0.44	4.13
RI01 13448M002	7	XXXXXX	0.57	0.42	3.12
SALA 13469M001	7	XXXXXX	0.36	0.52	2.42
SCOA 10088M002	7	XXXXXX	1.55	0.56	5.16
SOPU 19386M001	7	XXXXXX	0.72	1.09	6.68
TERU 13487M001	7	XXXXXX	0.41	1.00	1.96
VITO 19385M001	7	XXXXXX	0.33	0.56	4.19
YEBE 13420M001	7	XXXXXX	0.93	0.90	2.93
ZARA 13462M001	7	XXXXXX	0.62	0.50	3.08

Comparison of individual solutions:

ACOR 13434M001	N	0.66	0.97	0.70	-0.64	-0.54	0.29	0.47	0.42
ACOR 13434M001	E	0.60	1.04	-0.01	-0.45	0.82	0.45	-0.02	-0.08
ACOR 13434M001	U	1.63	0.86	-0.20	-1.71	1.07	2.67	1.93	-0.57
ALDA 19383M001	N	0.95	0.84	0.45	-0.84	-1.51	0.90	0.81	0.19
ALDA 19383M001	E	1.60	-1.49	-1.79	1.87	1.61	-0.94	-0.96	1.43
ALDA 19383M001	U	4.54	-2.24	-6.29	-1.81	5.12	-1.08	-4.84	5.03
ALSA 19419M001	N	1.43	1.17	1.43	-0.94	-1.56	-1.07	0.28	2.09
ALSA 19419M001	E	0.42	-0.35	-0.63	0.40	0.05	-0.25	0.30	-0.48
ALSA 19419M001	U	4.44	-2.19	-8.12	-1.53	4.90	-1.27	-2.66	3.51
AMUR 19388M001	N	1.38	0.85	1.60	0.95	1.00	-0.45	-0.76	-2.34
AMUR 19388M001	E	0.55	-0.46	0.85	-0.02	-0.44	0.47	0.38	0.55
AMUR 19388M001	U	3.68	-2.61	-6.03	-0.37	2.55	-3.50	-4.39	0.20
BIAZ 10074M002	N	1.03	1.02	1.68	-0.11	1.19	0.69	0.21	0.72
BIAZ 10074M002	E	0.70	0.05	0.32	-0.08	-0.74	0.19	0.12	1.48
BIAZ 10074M002	U	4.68	0.14	-10.77	2.57	1.57	-1.04	-2.22	0.60
BRZR 19387M001	N	0.83	0.26	0.89	0.59	0.33	-1.26	0.85	0.72
BRZR 19387M001	E	1.21	-0.58	1.11	0.96	-1.84	0.79	-0.52	-1.44
BRZR 19387M001	U	3.24	2.46	-1.29	0.05	-3.65	-1.26	-1.94	-6.07
CACE 13447M001	N	0.70	-0.66	-0.29	-0.68	-0.51	-0.24	1.28	-0.02
CACE 13447M001	E	0.69	0.66	-0.65	-0.32	-0.60	-0.42	1.17	0.10
CACE 13447M001	U	2.68	0.13	1.22	2.09	-4.54	3.51	1.26	-1.68
CANT 13438M001	N	0.47	0.36	-0.36	0.50	-0.14	-0.86	0.02	0.23
CANT 13438M001	E	0.65	-0.18	-0.52	-0.29	-1.05	-0.26	-0.59	-0.80
CANT 13438M001	U	2.83	-3.72	-5.28	-0.01	1.54	-1.49	-1.06	0.76
CHER 00000M000	N	0.95	1.09	1.61	0.02	0.37	0.75	0.62	0.79
CHER 00000M000	E	0.98	0.78	-0.20	-0.58	-0.71	0.10	1.75	1.11
CHER 00000M000	U	5.02	-1.36	-11.12	2.09	3.36	-1.07	-2.42	1.82
CREU 13432M001	N	0.50	-0.09	0.62	0.06	-0.82	0.40	-0.50	-0.11
CREU 13432M001	E	0.48	0.58	0.28	0.27	-0.42	0.63	-0.22	0.51
CREU 13432M001	U	2.30	-1.17	1.23	0.65	-0.83	1.75	-4.92	0.67
EBRE 13410M001	N	0.65	-0.14	-0.42	-0.42	-0.89	-0.08	-0.27	1.13
EBRE 13410M001	E	0.61	-0.81	-0.17	1.01	0.23	0.46	-0.27	0.42
EBRE 13410M001	U	2.88	-3.10	2.43	2.45	3.67	-2.65	-2.66	-0.86
ELGE 19353S001	N	1.98	-0.81	-1.14	-1.03	2.46	-0.16	-1.05	3.66
ELGE 19353S001	E	2.66	1.39	2.04	2.35	-3.35	-0.83	1.85	-3.93
ELGE 19353S001	U	3.77	-1.66	-7.32	-2.30	2.52	-1.87	-3.07	2.09
EMAZ 17001M001	N	2.44	-2.09	1.66	-1.94	-1.81	-3.51	-1.41	2.70
EMAZ 17001M001	E	1.29	-1.62	0.12	2.10	-1.18	0.71	-0.29	-1.02
EMAZ 17001M001	U	3.69	0.09	-5.87	2.63	3.19	-1.21	-2.55	-4.69
GERN 19389M001	N	0.98	0.74	0.25	-0.49	-0.38	-0.54	0.13	2.10
GERN 19389M001	E	0.55	-0.32	0.14	-0.43	-1.10	-0.09	-0.26	0.51
GERN 19389M001	U	5.70	-3.49	0.51	8.48	3.48	-5.27	-4.23	-7.27
IGEL 19352S001	N	1.38	0.83	-0.13	1.16	0.01	-2.20	0.29	2.10
IGEL 19352S001	E	0.46	-0.46	-0.25	-0.19	-0.74	-0.20	0.52	0.33
IGEL 19352S001	U	3.97	-1.46	-8.92	-1.44	0.69	-1.70	-2.36	-1.38
ISPS 19484M001	N	0.97	0.51	1.33	0.84	0.68	-1.19	0.84	-0.57
ISPS 19484M001	E	1.27	-0.14	-0.63	0.69	-1.01	0.36	1.65	-2.21
ISPS 19484M001	U	4.53	1.99	-5.70	-3.62	1.82	1.48	0.84	-8.21
KAST 19499M001	N	2.58	0.13	5.01	1.62	-2.94	0.03	0.73	-1.73
KAST 19499M001	E	1.10	-1.02	-0.86	2.16	0.01	-0.76	-0.17	-0.37
KAST 19499M001	U	6.51	-2.60	6.74	7.71	-1.27	-1.62	-6.74	-9.65
LARE 19440M001	N	1.54	-0.30	-1.47	-0.16	0.03	-2.06	0.67	2.69
LARE 19440M001	E	1.00	-1.88	-0.46	0.84	-0.66	-0.94	-0.21	-0.42
LARE 19440M001	U	3.19	-1.50	-4.26	0.29	1.78	1.07	-1.98	-5.70
LAZK 19354S001	N	0.73	0.37	0.39	1.05	0.97	-0.87	-0.26	-0.21
LAZK 19354S001	E	0.80	0.01	-0.52	-0.37	-1.26	-0.24	0.06	1.34
LAZK 19354S001	U	5.49	-2.29	-6.38	-7.28	1.19	-2.06	0.26	8.72
LEIT 19428M001	N	1.77	1.82	1.27	0.74	-0.52	0.95	0.55	-3.44
LEIT 19428M001	E	1.14	-0.92	-0.75	-0.55	-0.69	-0.34	0.13	2.35
LEIT 19428M001	U	2.38	-1.33	-3.78	-1.91	2.63	-0.98	-0.62	-2.47
ORON 19427M001	N	0.91	0.50	0.80	0.93	0.94	-0.79	0.38	-1.26

ORON 19427M001	E	0.74	-0.11	-0.80	-0.47	-0.94	-0.19	0.80	0.90
ORON 19427M001	U	3.78	-2.02	-5.92	-3.42	3.45	-0.14	-3.49	3.28
PASA 19351S001	N	1.53	-0.59	-0.23	0.64	-0.45	-0.48	-0.45	3.55
PASA 19351S001	E	0.44	0.06	-0.43	-0.35	-0.73	-0.13	0.54	0.03
PASA 19351S001	U	4.13	-0.97	-8.94	-1.39	1.60	-2.56	-2.69	-1.79
RI01 13448M002	N	0.57	0.76	-0.09	0.34	-0.23	-0.54	0.54	0.80
RI01 13448M002	E	0.42	-0.49	-0.67	0.37	0.11	0.13	-0.21	-0.41
RI01 13448M002	U	3.12	-1.54	-2.30	-1.08	1.18	2.64	-6.21	-1.62
SALA 13469M001	N	0.36	0.15	-0.44	-0.55	-0.09	-0.03	-0.02	-0.50
SALA 13469M001	E	0.52	0.58	-0.50	-0.21	-0.66	-0.41	-0.44	-0.47
SALA 13469M001	U	2.42	1.16	2.90	1.97	-0.17	-3.19	1.50	2.98
SCDA 10088M002	N	1.55	1.82	-0.74	-1.14	0.26	1.59	1.07	2.35
SCDA 10088M002	E	0.56	0.93	-0.17	0.89	-0.07	0.30	0.02	-0.33
SCDA 10088M002	U	5.16	1.20	-7.83	-2.77	-0.44	-5.92	-1.46	7.21
SOPU 19386M001	N	0.72	0.50	1.20	0.36	-0.54	-0.12	0.18	0.99
SOPU 19386M001	E	1.09	-0.84	-1.73	1.38	-0.21	-0.40	-0.72	0.92
SOPU 19386M001	U	6.68	-4.82	-0.79	10.02	6.07	-5.21	-6.94	-5.60
TERU 13487M001	N	0.41	0.58	-0.40	-0.02	0.66	-0.02	0.18	-0.16
TERU 13487M001	E	1.00	-1.30	-0.59	1.59	-0.55	0.43	-0.44	0.86
TERU 13487M001	U	1.96	-0.39	-0.96	0.50	2.93	1.78	-3.17	0.02
VITO 19385M001	N	0.33	0.47	-0.18	0.41	0.43	-0.20	-0.05	0.05
VITO 19385M001	E	0.56	-0.95	0.27	-0.23	-0.51	0.43	0.29	0.58
VITO 19385M001	U	4.19	-0.99	-5.46	-0.32	5.02	-1.18	-3.99	-5.63
YEBE 13420M001	N	0.93	-0.88	0.42	0.92	-1.62	0.24	-0.50	0.72
YEBE 13420M001	E	0.90	1.15	0.67	0.80	1.05	-0.78	0.81	0.35
YEBE 13420M001	U	2.93	-3.26	-1.69	1.51	-4.48	-2.70	1.05	2.71
ZARA 13462M001	N	0.62	0.78	-0.20	-0.43	-0.50	-0.31	0.16	1.04
ZARA 13462M001	E	0.50	-0.10	-0.29	-1.11	-0.26	0.16	0.29	0.03
ZARA 13462M001	U	3.08	-6.02	-1.24	-0.56	-0.20	0.72	-0.06	-4.29

## 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		
1	ACOR 13434M001	I W	-1.26	-0.49	-1.87
2	ALAC 13433M001	I W	0.15	-0.36	2.11
3	ALBA 13452M001	I W	-0.48	-1.46	-0.53
4	ALME 13437M001	I W	-1.91	1.30	1.79
5	BCLN 13412M001	I W	-0.29	-1.28	0.75
6	BELL 13431M001	I W	0.44	0.78	-0.56
7	BORR 13480M001	I W	-1.28	-1.61	0.22
8	BRST 10004M004	I W	-1.37	-1.88	0.01
9	CACE 13447M001	I W	0.43	-0.26	1.74
10	CANT 13438M001	I W	-0.61	-0.84	1.24
11	CARG 19412M001	I W	0.17	-1.52	1.77
13	CEU1 13449M002	I W	-0.22	1.05	-3.72
14	COBA 13453M001	I W	0.57	0.68	-3.07
15	CREU 13432M001	I W	-0.82	0.83	0.14
17	EBRE 13410M001	I W	-3.90	-0.13	-3.05
18	ESCO 13435M001	I W	0.24	-0.81	3.75
19	FUNC 13911S001	I W	2.54	0.88	-0.64
22	HUEL 13451M001	I W	-0.14	2.31	-5.80
23	IZAN 31309M002	I W	0.98	-1.08	-2.51
25	LLIV 13436M001	I W	-0.31	-0.33	1.68
26	LPAL 81701M001	I W	-1.29	1.15	-2.41
27	LROC 10023M001	I W	-0.42	-1.51	3.65
28	MALA 13443M001	I W	0.66	-0.52	-1.23
29	MAS1 31303M002	I W	0.54	1.93	1.20
32	MELI 19379M001	I W	0.12	0.09	-4.24
33	PASA 19351S001	I W	-0.79	-0.78	0.91
34	PDEL 31906M004	I W	8.01	6.46	-3.08
36	RIO1 13448M002	I W	-1.53	-0.59	-0.77
37	SALA 13469M001	I W	-0.84	1.18	-1.62
38	SCOA 10088M002	I W	-0.48	-0.71	0.18
39	SFER 13402M004	I W	0.33	-1.26	1.61
42	SONS 13446M001	I W	0.06	-0.03	-3.63
44	TERC 31909M001	I W	4.31	-5.18	-6.28
46	VALA 13463M002	I W	-1.39	0.14	2.68
47	VALE 13439M001	I W	-0.11	1.80	1.99
48	VIGO 13450M001	I W	0.76	0.21	2.83
49	YEBE 13420M001	I W	-0.80	0.88	4.44
50	ZARA 13462M001	I W	0.21	0.23	3.30
51	ZIMM 14001M004	I W	-0.27	0.72	7.02
	RMS / COMPONENT		1.82	1.71	2.89
	MEAN		-0.00	0.00	0.00
	MIN		-3.90	-5.18	-6.28
	MAX		8.01	6.46	7.02

NUMBER OF PARAMETERS : 3  
NUMBER OF COORDINATES : 117  
RMS OF TRANSFORMATION : 2.21 MM

BARYCENTER COORDINATES:

LATITUDE : 39 43 1.41  
LONGITUDE : - 5 15 34.67  
HEIGHT : -51.112 KM

PARAMETERS:

TRANSLATION IN N : -0.00 +- 0.35 MM  
TRANSLATION IN E : 0.00 +- 0.35 MM  
TRANSLATION IN U : 0.00 +- 0.35 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          17106016
NUMBER OF UNKNOWN               198381
NUMBER OF DEGREES OF FREEDOM    16907635
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
VARIANCE FACTOR                 1.786533351576900
```

Helmert Transformation Parameters With Respect to Combined Solution:

Sol	Rms (m)	Translation (m)			Rotation (")			Scale (ppm)
		X	Y	Z	X	Y	Z	
1	0.00171	-0.0092	-0.0208	-0.0030	0.0005	-0.0001	-0.0005	0.00102
2	0.00231	-0.0218	-0.0110	0.0151	0.0001	-0.0008	-0.0004	0.00074
3	0.00217	0.0030	-0.0106	-0.0088	0.0003	0.0003	-0.0002	0.00033
4	0.00202	0.0009	-0.0030	-0.0018	0.0001	0.0000	-0.0001	-0.00017
5	0.00175	0.0099	-0.0045	-0.0136	0.0001	0.0005	-0.0001	0.00016
6	0.00201	0.0034	-0.0074	-0.0084	0.0003	0.0003	-0.0001	0.00026
7	0.00221	0.0064	0.0068	-0.0063	-0.0001	0.0003	0.0002	0.00008

Statistics of individual solutions:

File	RMS (m)	DOF	Chi**2/DOF	#Observations authentic / pseudo	#Parameters explicit / implicit / singular
1	0.00130	2403480	1.70	2431537	3 969 27091 0
2	0.00131	2382506	1.71	2411964	3 966 28495 0
3	0.00133	2341181	1.76	2369895	3 969 27748 0
4	0.00136	2379740	1.84	2408271	3 966 27568 0
5	0.00133	2462061	1.78	2493164	3 978 30128 0
6	0.00131	2483960	1.72	2513265	3 981 28327 0
7	0.00139	2448917	1.94	2477920	3 972 28034 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 20:089:00000 20:095:86370 LEICA GR50 -----
ALDA A 1 P 20:089:00000 20:095:86370 LEICA GR10 -----
ALSA A 1 P 20:089:00000 20:095:86370 LEICA GR50 -----
AMUR A 1 P 20:089:00000 20:095:86370 LEICA GR10 -----
BIAZ A 1 P 20:089:00000 20:095:86370 TRI SP90M -----
BRZR A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
CACE A 1 P 20:089:00000 20:095:86370 TRIMBLE NETR9 -----
CANT A 1 P 20:089:00000 20:095:86370 LEICA GR10 -----
CHER A 1 P 20:089:00000 20:095:86370 LEICA GRX1200+GNSS -----
CREU A 1 P 20:089:00000 20:095:86370 LEICA GR50 -----
EBRE A 1 P 20:089:00000 20:095:86370 LEICA GR50 -----
ELGE A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
EMAZ A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
GERN A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
IGEL A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
ISPS A 1 P 20:089:00000 20:095:86370 TRIMBLE NETR9 -----
KAST A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
LARE A 1 P 20:089:00000 20:095:86370 LEICA GRX1200GGPRO -----
LAZK A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
LEIT A 1 P 20:089:00000 20:095:86370 LEICA GR50 -----
ORON A 1 P 20:089:00000 20:095:86370 LEICA GR50 -----
PASA A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
RIO1 A 1 P 20:089:00000 20:095:86370 LEICA GR25 -----
SALA A 1 P 20:089:00000 20:095:86370 LEICA GRX1200+GNSS -----
SCOA A 1 P 20:089:00000 20:095:86370 LEICA GR25 -----
SOPU A 1 P 20:089:00000 20:095:86370 LEICA GR30 -----
TERU A 1 P 20:089:00000 20:095:86370 LEICA GRX1200GGPRO -----
VITO A 1 P 20:089:00000 20:095:86370 LEICA GR10 -----
YEBE A 1 P 20:089:00000 20:095:86370 TRIMBLE NETR9 -----
ZARA A 1 P 20:089:00000 20:095:86370 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 20:089:00000 20:095:86370 LEIAT504 LEIS -----
ALDA A 1 P 20:089:00000 20:095:86370 LEIAS10 NONE -----
ALSA A 1 P 20:089:00000 20:095:86370 LEIAR10 NONE -----
AMUR A 1 P 20:089:00000 20:095:86370 LEIAS10 NONE -----
BIAZ A 1 P 20:089:00000 20:095:86370 LEIAR25 LEIT -----
BRZR A 1 P 20:089:00000 20:095:86370 LEIAS10 NONE -----
```

CACE	A	1	P	20:089:00000	20:095:86370	TRM29659.00	NONE	----
CANT	A	1	P	20:089:00000	20:095:86370	LEIAR25_R4	LEIT	25066
CHER	A	1	P	20:089:00000	20:095:86370	LEIAX1203+GNSS	NONE	----
CREU	A	1	P	20:089:00000	20:095:86370	LEIAR25_R4	NONE	26357
EBRE	A	1	P	20:089:00000	20:095:86370	LEIAR25_R4	NONE	26359
ELGE	A	1	P	20:089:00000	20:095:86370	LEIAR25_R4	LEIT	----
EMAZ	A	1	P	20:089:00000	20:095:86370	LEIAS10	NONE	----
GERN	A	1	P	20:089:00000	20:095:86370	LEIAS10	NONE	----
IGEL	A	1	P	20:089:00000	20:095:86370	LEIAR20	LEIM	----
ISPS	A	1	P	20:089:00000	20:095:86370	TRM59900.00	SCIS	----
KAST	A	1	P	20:089:00000	20:095:86370	LEIAS10	NONE	----
LARE	A	1	P	20:089:00000	20:095:86370	LEIAT504	NONE	----
LAZK	A	1	P	20:089:00000	20:095:86370	LEIAR25_R4	LEIT	----
LEIT	A	1	P	20:089:00000	20:095:86370	LEIAR10	NONE	----
ORDN	A	1	P	20:089:00000	20:095:86370	LEIAR10	NONE	----
PASA	A	1	P	20:089:00000	20:095:86370	LEIAR20	LEIM	73034
RIO1	A	1	P	20:089:00000	20:095:86370	LEIAR25_R4	LEIT	25138
SALA	A	1	P	20:089:00000	20:095:86370	LEIAR25	NONE	----
SCOA	A	1	P	20:089:00000	20:095:86370	TRM55971.00	NONE	----
SOPU	A	1	P	20:089:00000	20:095:86370	LEIAS10	NONE	----
TERU	A	1	P	20:089:00000	20:095:86370	LEIAT504GG	LEIS	----
VITO	A	1	P	20:089:00000	20:095:86370	LEIAS10	NONE	----
YEBE	A	1	P	20:089:00000	20:095:86370	TRM29659.00	NONE	----
ZARA	A	1	P	20:089:00000	20:095:86370	TRM29659.00	NONE	----

### 7.3 Eccentricities

*SITE	PT	SOLN	T	DATA_START_	DATA_END_	AXE	UP_	NORTH_	EAST_
							ARP->BENCHMARK(M)		
ACOR	A	1	P	20:089:00000	20:095:86370	UNE	3.0460	0.0000	0.0000
ALDA	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
ALSA	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
AMUR	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
BIAZ	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
BRZR	A	1	P	20:089:00000	20:095:86370	UNE	0.0771	0.0000	0.0000
CACE	A	1	P	20:089:00000	20:095:86370	UNE	0.0600	0.0000	0.0000
CANT	A	1	P	20:089:00000	20:095:86370	UNE	3.0490	0.0000	0.0000
CHER	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
CREU	A	1	P	20:089:00000	20:095:86370	UNE	0.0770	0.0000	0.0000
EBRE	A	1	P	20:089:00000	20:095:86370	UNE	0.0770	0.0000	0.0000
ELGE	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
EMAZ	A	1	P	20:089:00000	20:095:86370	UNE	0.0350	0.0000	0.0000
GERN	A	1	P	20:089:00000	20:095:86370	UNE	0.0771	0.0000	0.0000
IGEL	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
ISPS	A	1	P	20:089:00000	20:095:86370	UNE	0.0350	0.0000	0.0000
KAST	A	1	P	20:089:00000	20:095:86370	UNE	0.0350	0.0000	0.0000
LARE	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
LAZK	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
LEIT	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
ORDN	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
PASA	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
RIO1	A	1	P	20:089:00000	20:095:86370	UNE	0.0606	0.0000	0.0000
SALA	A	1	P	20:089:00000	20:095:86370	UNE	0.0600	0.0000	0.0000
SCOA	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
SOPU	A	1	P	20:089:00000	20:095:86370	UNE	0.0771	0.0000	0.0000
TERU	A	1	P	20:089:00000	20:095:86370	UNE	0.0600	0.0000	0.0000
VITO	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
YEBE	A	1	P	20:089:00000	20:095:86370	UNE	0.0000	0.0000	0.0000
ZARA	A	1	P	20:089:00000	20:095:86370	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](http://etrs89.ensg.ign.fr/memo-V8.pdf)

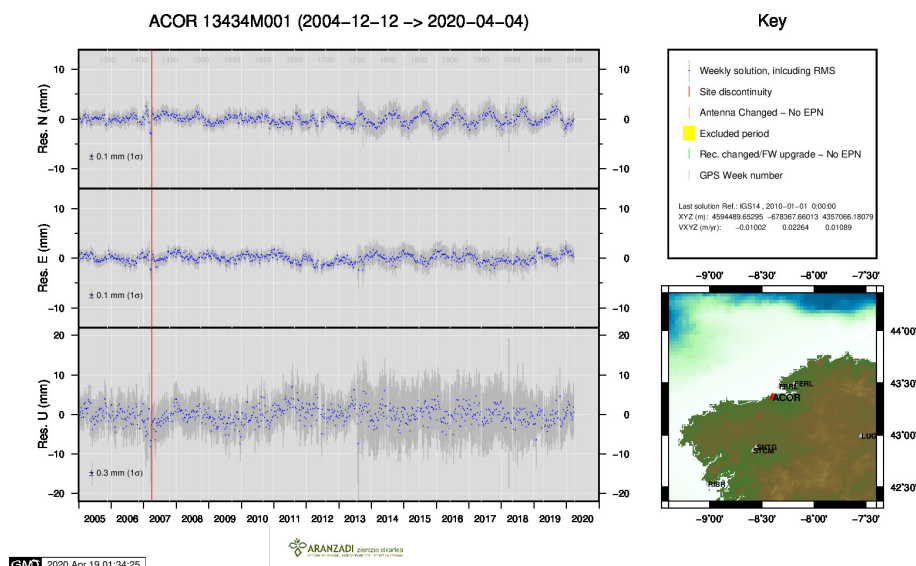
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](http://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

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)

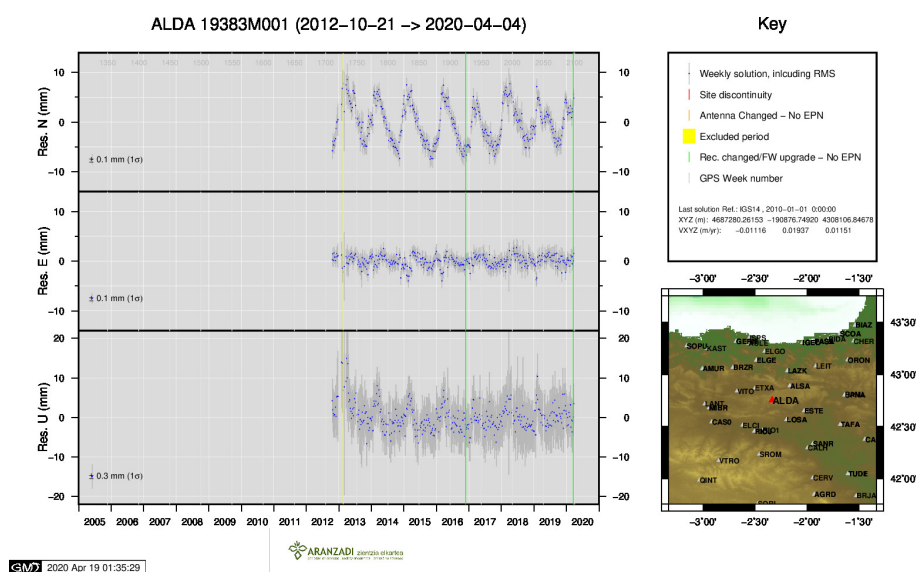


## 9 Cumulative Time Series

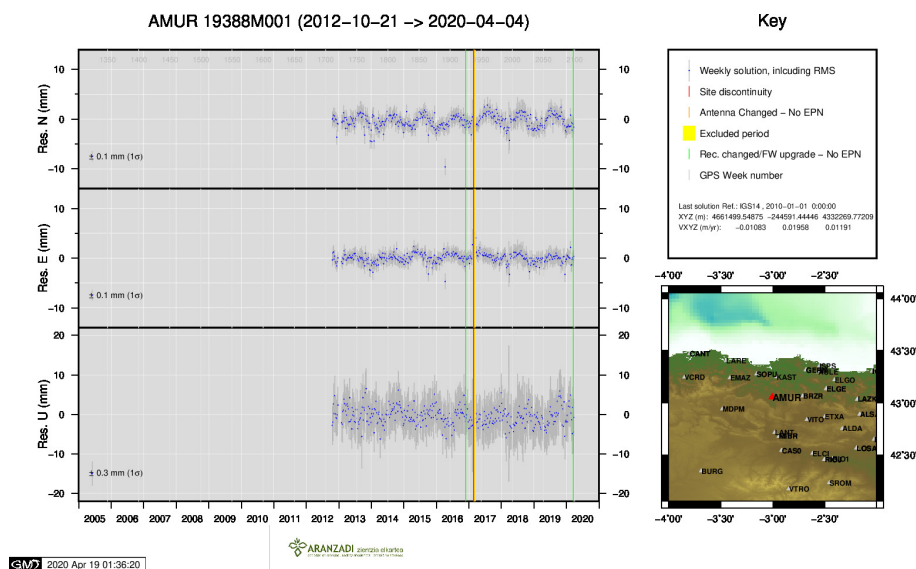
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



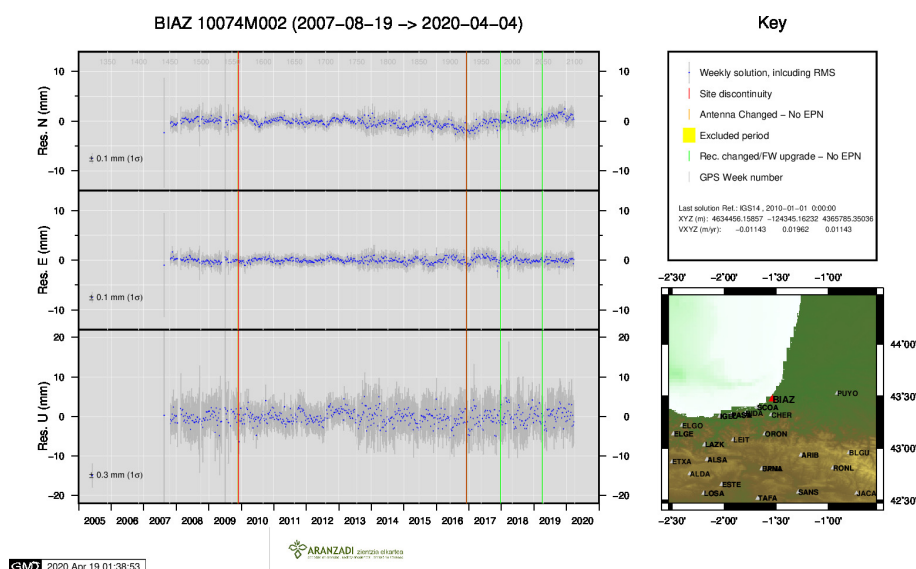
1 ) ACOR



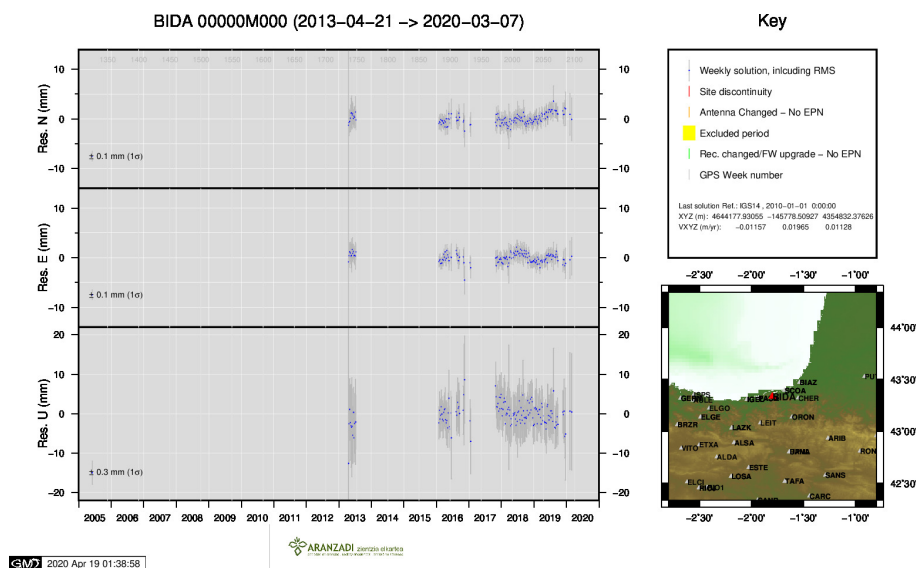
2 ) ALDA



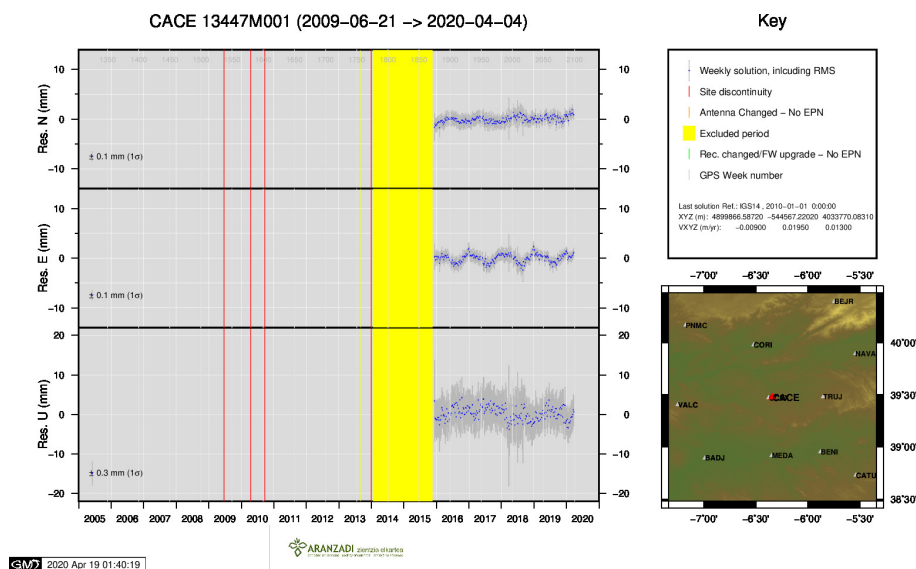
## 3 ) AMUR



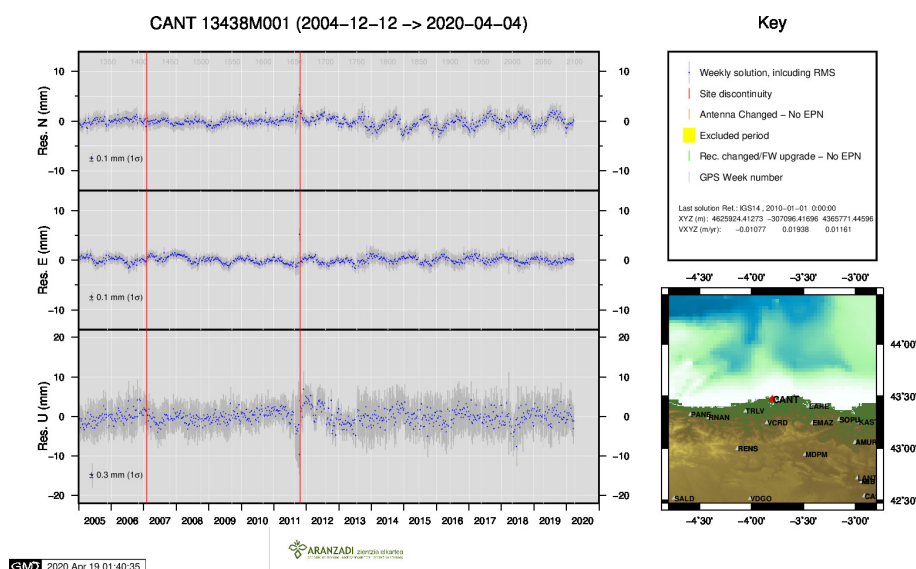
## 4 ) BLAZ



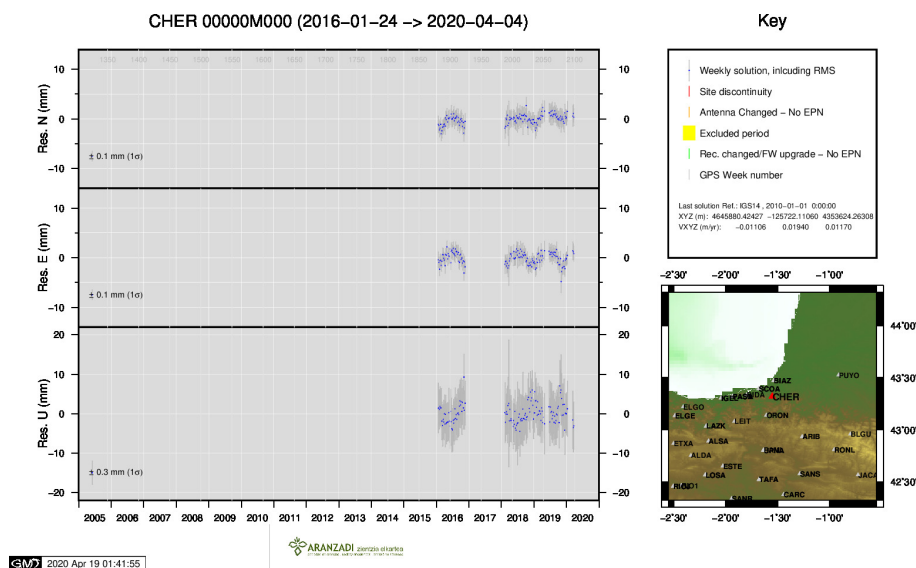
## 5 ) BIDA



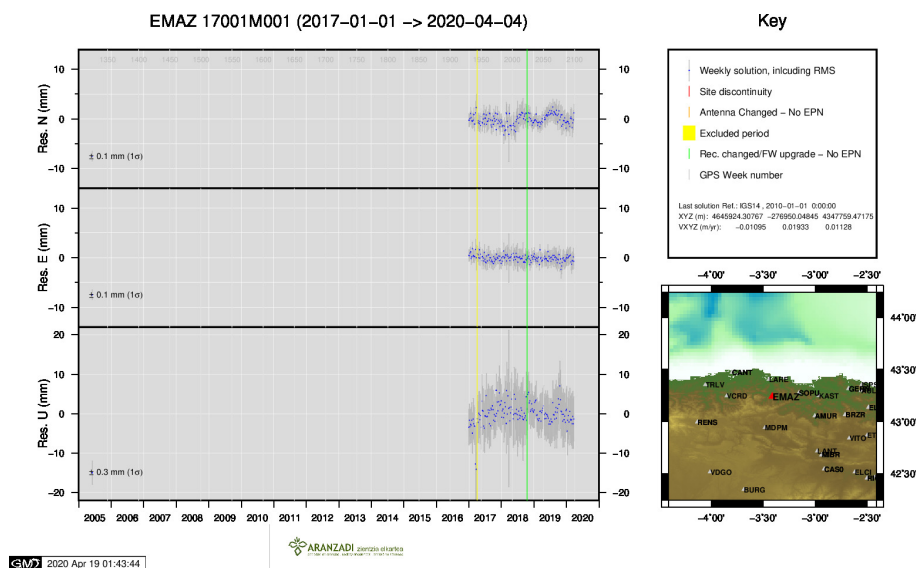
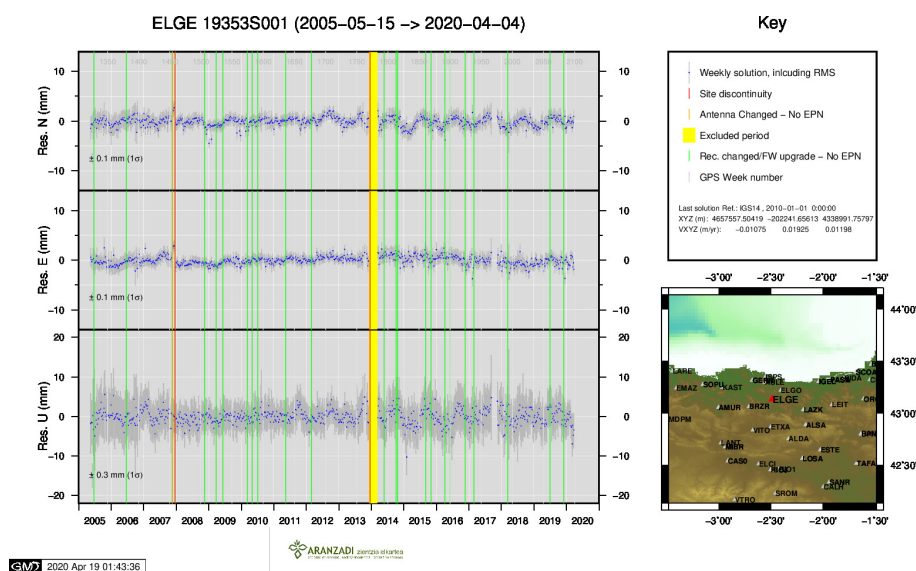
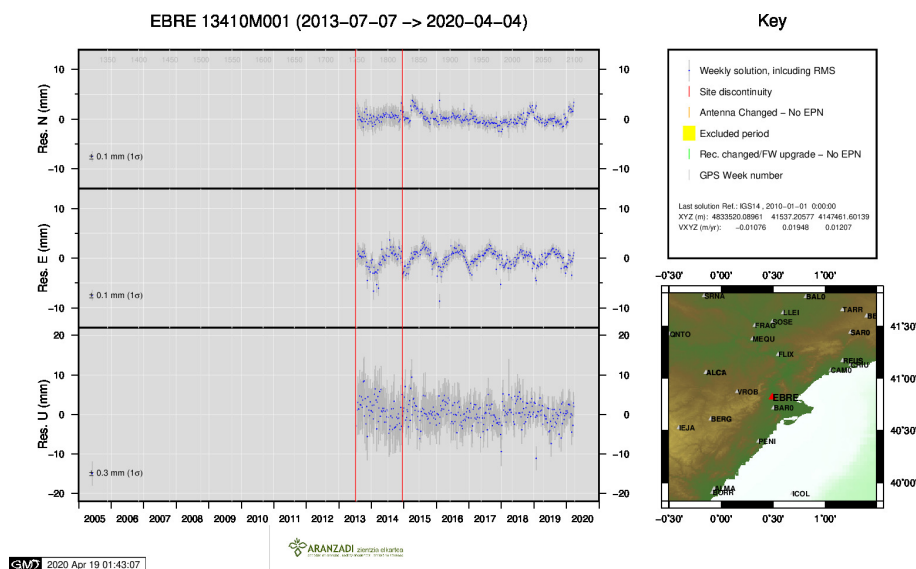
6 ) CACE

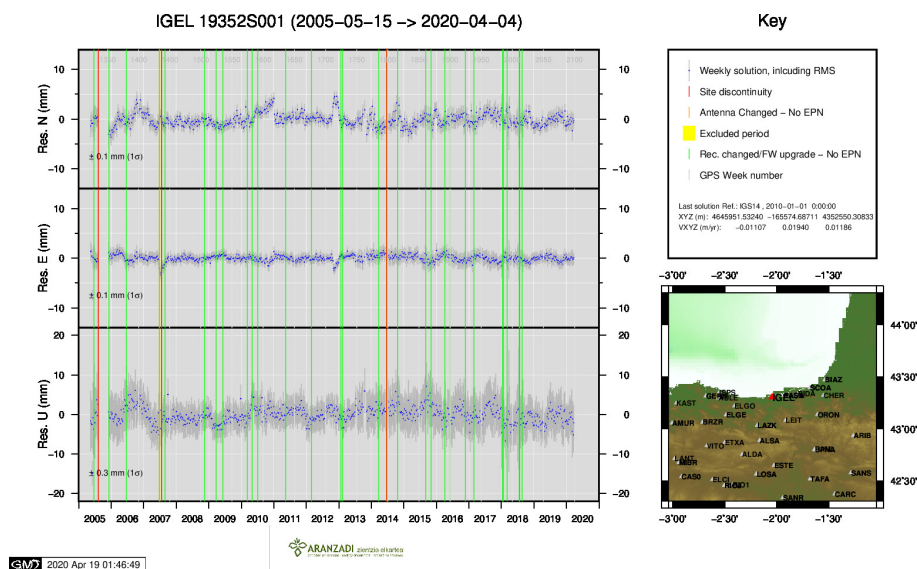


7 ) CANT

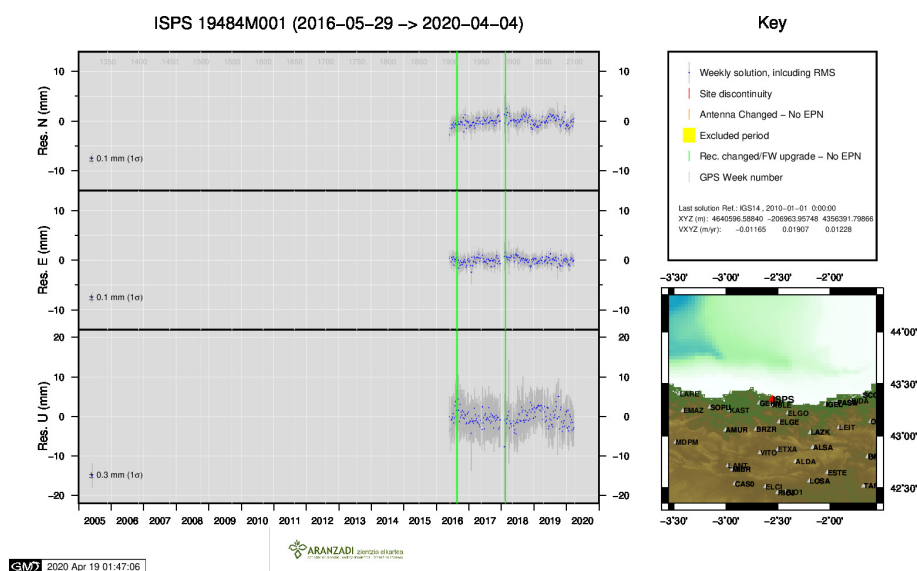


8 ) CHER

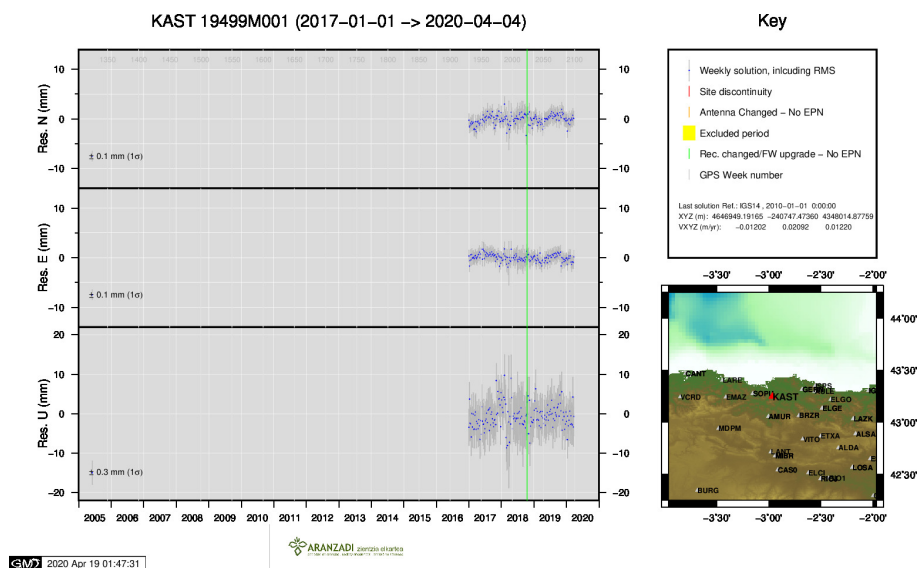




12 ) IGEL

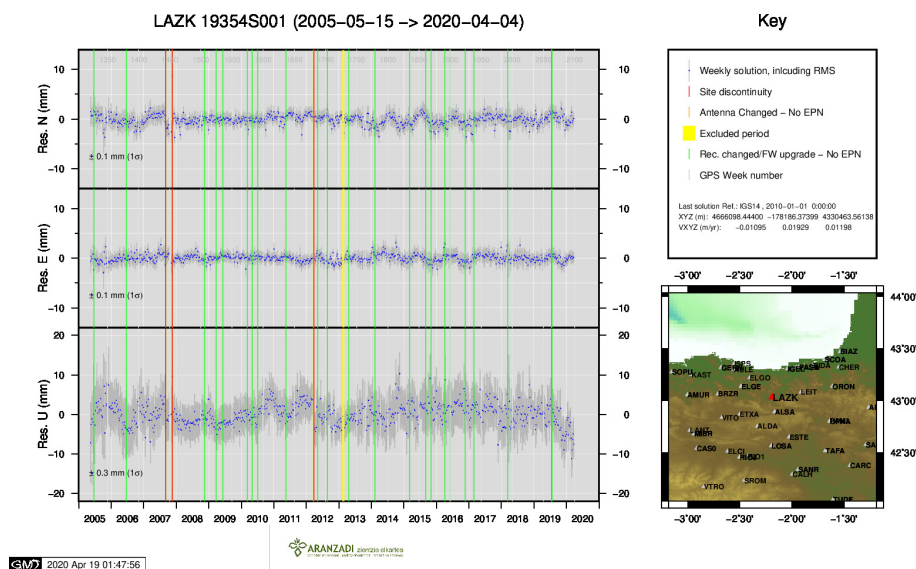


13 ) ISPS

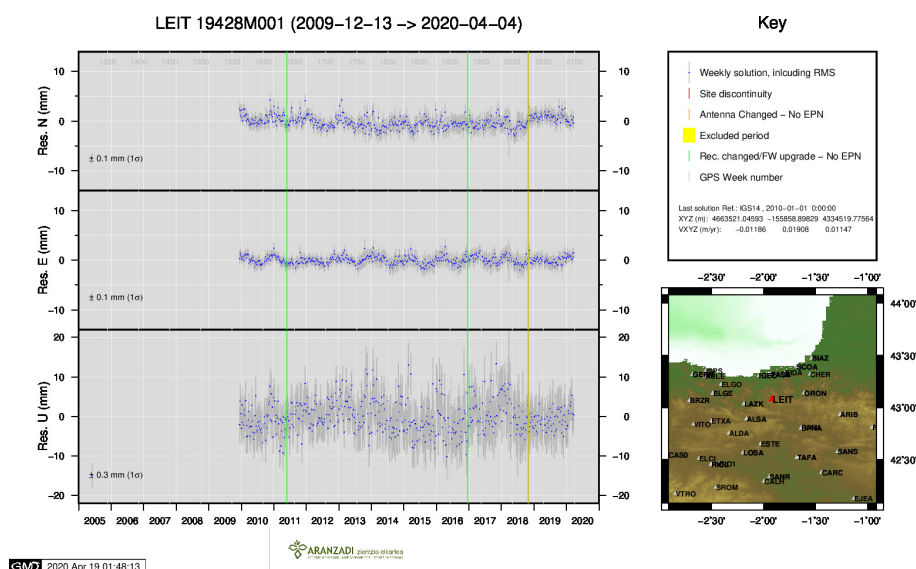


14 ) KAST

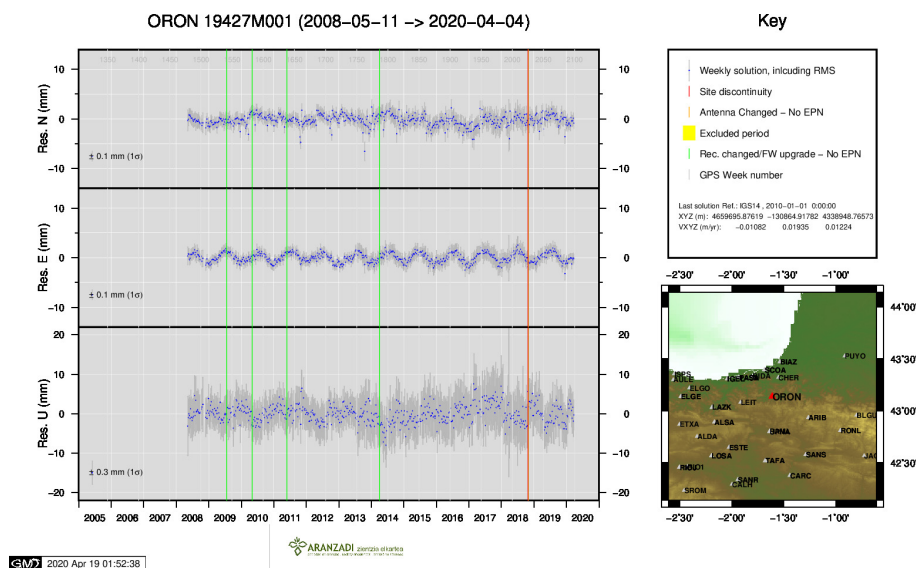




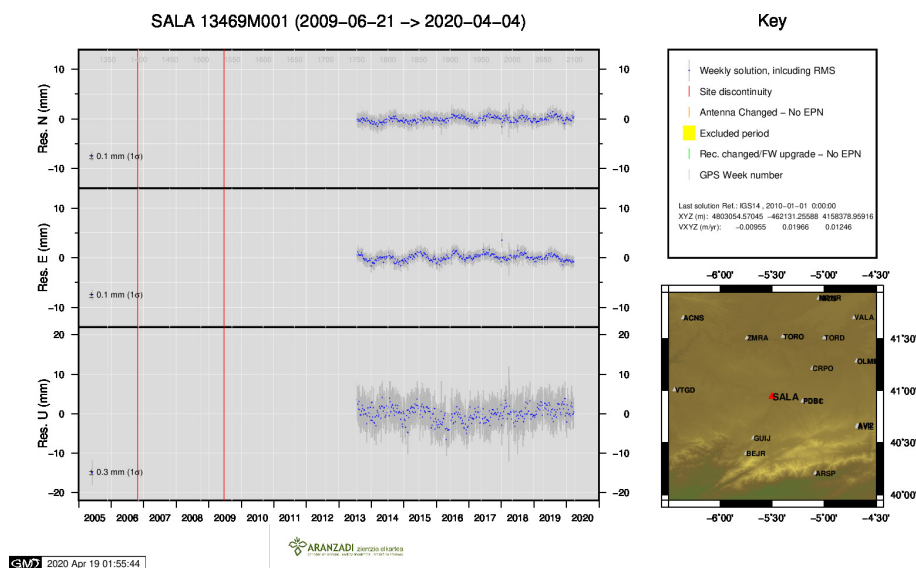
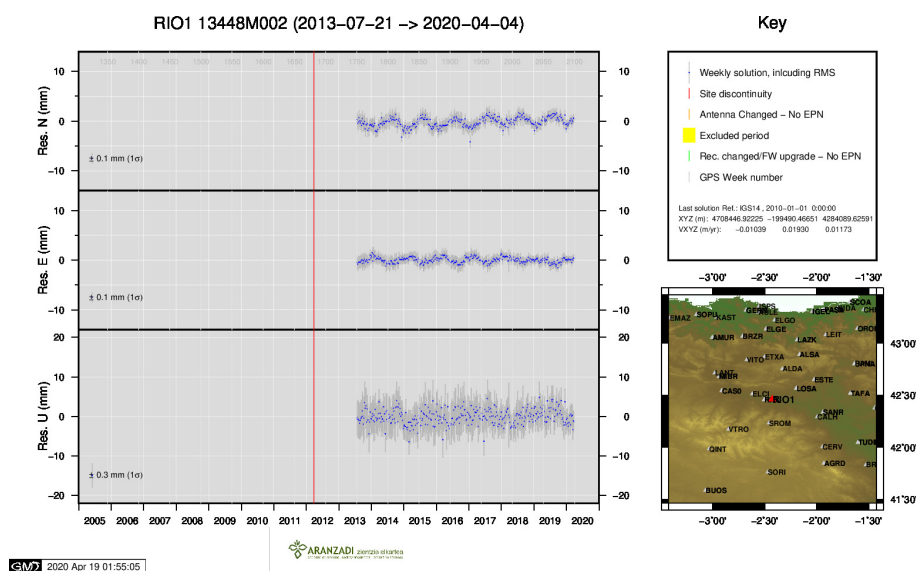
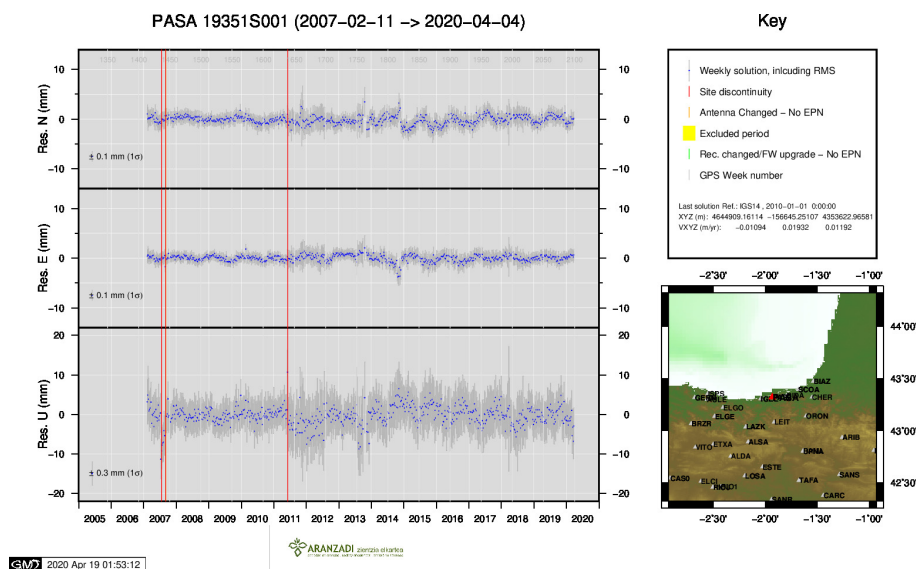
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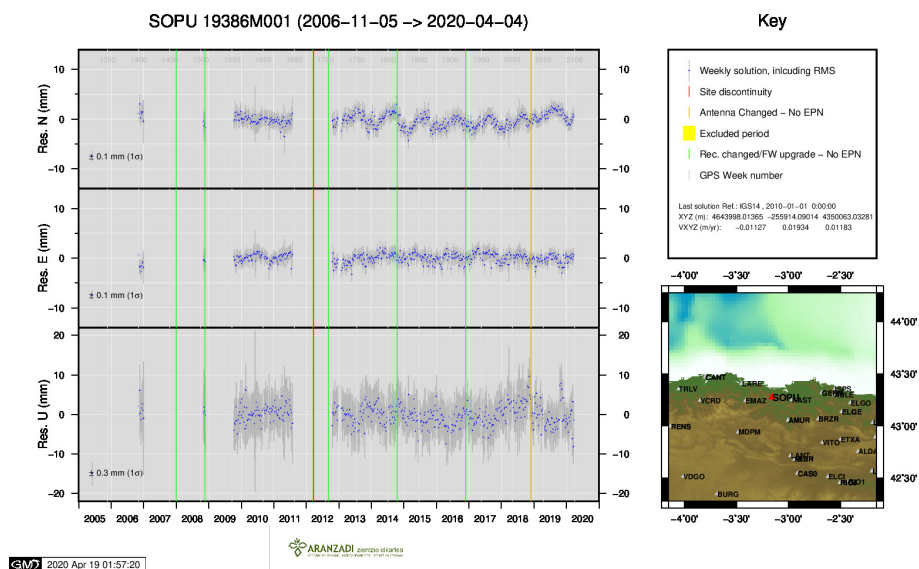


16 ) LEIT

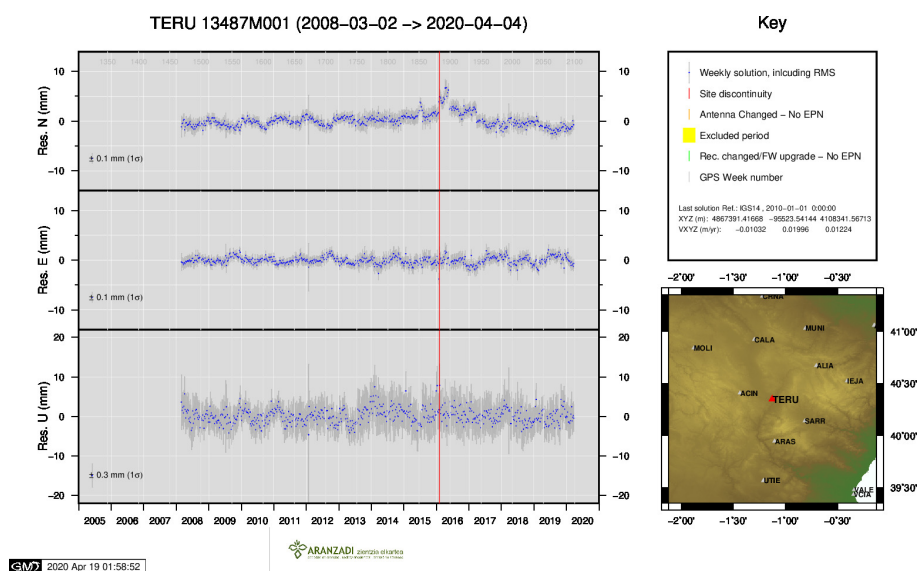


17 ) ORON

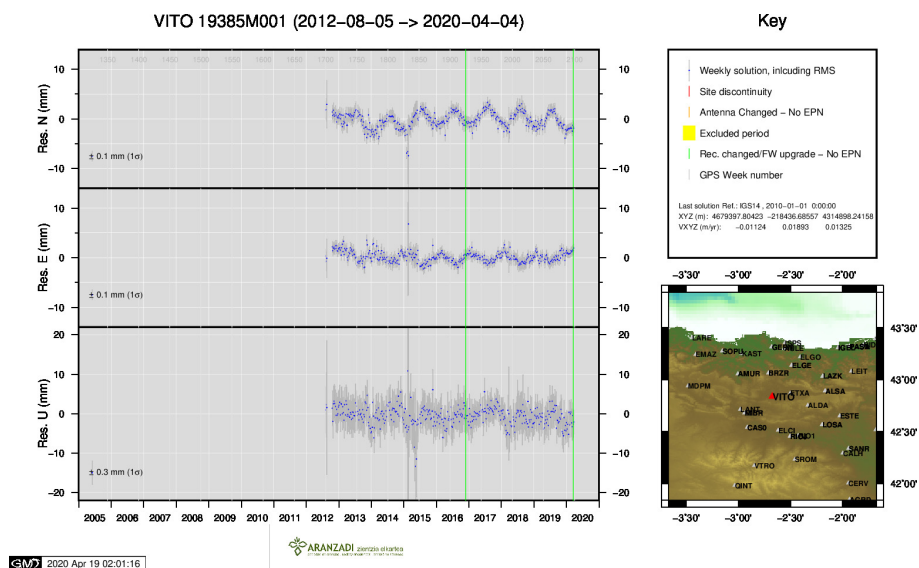




21 ) SOPU

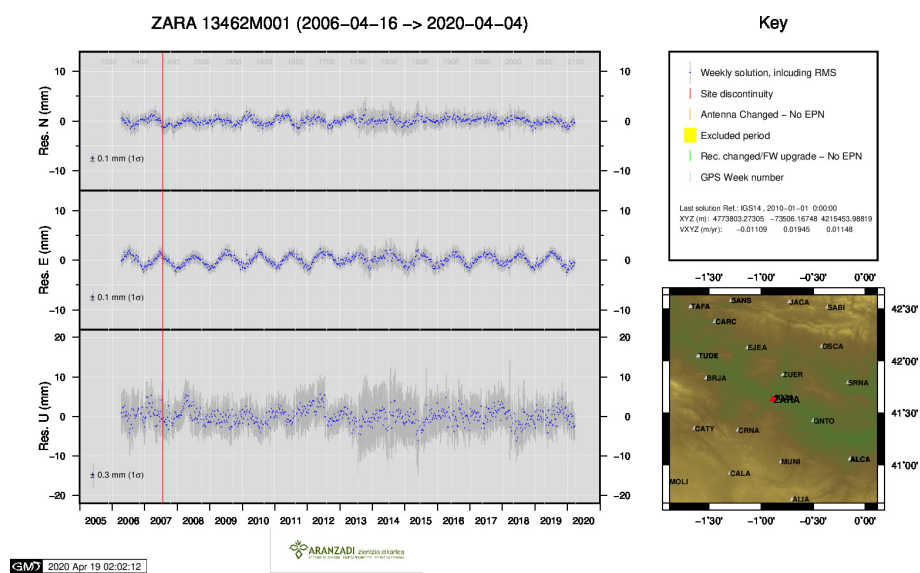


22 ) TERU



23 ) VITO





24 ) ZARA