

# ARA-DAC Weekly Analysis Result: 2067 (GFA)

## Technical Report

**GPS Week: 2067 (GFA)**

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

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### 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 C2010.

ARA LAC 2067 WEEK FINAL COMBINATION: PRECISE ORBITS 09-SEP-19 09:01

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LOCAL GEODETIC DATUM: IGS14 EPOCH: 2019-08-21 12:00:00

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACOR 13434M001	4594489.55537	-678367.44258	4357066.28725	W
33	ALDA 19383M001	4687280.15791	-190876.56205	4308106.95732	A
42	ALSA 19419M001	4677250.82808	-176770.39011	4319079.87488	A
44	AMUR 19388M001	4661499.44337	-244591.26592	4332269.88734	A
78	BLAZ 10074M002	4634456.04644	-124344.97385	4365785.46042	A
89	BRZR 19387M001	4662220.98928	-220769.89655	4333309.44784	A
9	CACE 13447M001	4899866.49911	-544567.03394	4033770.20684	W
10	CANT 13438M001	4625924.30896	-307096.23111	4365771.56006	W
114	CHER 00000M000	4645880.31631	-125721.92298	4353624.37618	A
15	CREU 13432M001	4715420.12552	273178.06342	4271946.84229	W
16	EBRE 13410M001	4833519.98769	41537.39418	4147461.71974	W
135	ELGE 19353S001	4657557.40024	-202241.47067	4338991.87434	A
137	EMAZ 17001M001	4645924.20183	-276949.86216	4347759.58238	A
157	GERN 19389M001	4642811.31264	-217222.92130	4353278.88459	A
177	IGEL 19352S001	4645951.42560	-165574.50025	4352550.42236	A
182	ISPS 19484M001	4640596.47632	-206963.77425	4356391.91832	A
187	KAST 19499M001	4646949.07759	-240747.27176	4348014.99770	A
192	LARE 19440M001	4632831.94623	-279026.13674	4360314.43001	A
193	LAZK 19354S001	4666098.33784	-178186.18772	4330463.67688	A
197	LEIT 19428M001	4663520.92818	-155858.71472	4334519.88481	A
253	ORON 19427M001	4659695.77034	-130864.73054	4338948.88394	A
30	PASA 19351S001	4644909.05468	-156645.06509	4353623.08031	W
33	RID1 13448M002	4708446.82112	-199490.28128	4284089.74036	W
34	SALA 13469M001	4803054.47845	-462131.06629	4158379.08050	W
35	SCDA 10088M002	4639940.49332	-136224.93764	4359552.41989	W
313	SOPU 19386M001	4643997.90312	-255913.90310	4350063.14790	A
333	TERU 13487M001	4867391.31839	-95523.34860	4108341.68405	A
366	VITO 19385M001	4679397.69613	-218436.50352	4314899.37185	A
43	YEBE 13420M001	4848724.56229	-261631.92710	4123094.33177	W
44	ZARA 13462M001	4773803.16272	-73505.97979	4215454.09939	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 2067 09-SEP-19 09:01

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LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2019-08-21 12:00:00

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACOR 13434M001	4594489.86389	-678367.98458	4357065.86779	W
33	ALDA 19383M001	4687280.52053	-190877.11269	4308106.53680	A
42	ALSA 19419M001	4677251.19312	-176770.93966	4319079.45530	A
44	AMUR 19388M001	4661499.80134	-244591.80401	4332269.46814	A
78	BLAZ 10074M002	4634456.42090	-124345.51874	4365785.04475	A
89	BRZR 19387M001	4662221.35013	-220770.44465	4333309.02887	A
9	CACE 13447M001	4899866.80089	-544567.60751	4033769.76565	W
10	CANT 13438M001	4625924.66189	-307096.77563	4365771.14281	W
114	CHER 00000M000	4645880.68977	-125722.46908	4353623.95962	A
15	CREU 13432M001	4715420.54020	273177.51150	4271946.42518	W
16	EBRE 13410M001	4833520.36646	41536.82907	4147461.29082	W
135	ELGE 19353S001	4657557.76367	-202242.01823	4338991.45596	A
137	EMAZ 17001M001	4645924.55707	-276950.40871	4347759.16397	A
157	GERN 19389M001	4642811.67530	-217223.46735	4353278.46715	A
177	IGEL 19352S001	4645951.79429	-165575.04648	4352550.00531	A
182	ISPS 19484M001	4640596.84040	-206964.32004	4356391.50117	A
187	KAST 19499M001	4646949.43711	-240747.81831	4348014.57966	A
192	LARE 19440M001	4632832.30209	-279026.68191	4360314.01258	A
193	LAZK 19354S001	4666098.70351	-178186.73610	4330463.25813	A
197	LEIT 19428M001	4663521.29676	-155859.26277	4334519.46653	A
253	ORON 19427M001	4659696.14217	-130865.27810	4338948.46626	A
30	PASA 19351S001	4644909.42450	-156645.61118	4353622.66345	W
33	RID1 13448M002	4708447.18105	-199490.83415	4284089.31812	W
34	SALA 13469M001	4803054.79866	-462131.62969	4158378.64778	W
35	SCDA 10088M002	4639940.86595	-136225.48315	4359552.00365	W
313	SOPU 19386M001	4643998.26099	-255914.44938	4350062.72990	A
333	TERU 13487M001	4867391.67831	-95523.91770	4108341.25088	A
366	VITO 19385M001	4679398.05598	-218437.05341	4314899.95160	A
43	YEBE 13420M001	4848724.90368	-261632.49475	4123093.89801	W
44	ZARA 13462M001	4773803.53270	-73506.53909	4215453.67367	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 2067		09-SEP-19 09:01			
LOCAL GEODETIC DATUM: ETRF2014		EPOCH: 2019-08-21 12:00:00			
NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACDR 13434M001	4594489.82144	-678368.02308	4357065.91630	W
33	ALDA 19383M001	4687280.47587	-190877.15254	4308106.58521	A
42	ALSA 19419M001	4677251.14852	-176770.97959	4319079.50374	A
44	AMUR 19388M001	4661499.75709	-244591.84377	4332269.51659	A
78	BLAZ 10074M002	4634456.37656	-124345.55903	4365785.09332	A
89	BRZR 19387M001	4662221.30581	-220770.48449	4333309.07733	A
9	CACE 13447M001	4899866.75498	-544567.64528	4033769.81350	W
10	CANT 13438M001	4625924.61818	-307096.81531	4365771.19132	W
114	CHER 00000M000	4645880.64531	-125722.50931	4353624.00816	A
15	CREU 13432M001	4715420.49371	273177.47017	4271946.47382	W
16	EBRE 13410M001	4833520.31956	41536.78899	4147461.33903	W
135	ELGE 19353S001	4657557.71934	-202242.05815	4338991.50443	A
137	EMAZ 17001M001	4645924.51308	-276950.44842	4347759.21245	A
157	GERN 19389M001	4642811.63115	-217223.50728	4353278.51565	A
177	IGEL 19352S001	4645951.74996	-165575.08658	4352550.05383	A
182	ISPS 19484M001	4640596.79625	-206964.36001	4356391.54969	A
187	KAST 19499M001	4646949.39300	-240747.85814	4348014.62814	A
192	LARE 19440M001	4632832.25823	-279026.72166	4360314.06108	A
193	LAZK 19354S001	4666098.65902	-178186.77607	4330463.30660	A
197	LEIT 19428M001	4663521.25223	-155859.30283	4334519.51502	A
253	ORON 19427M001	4659696.09760	-130865.31827	4338948.51476	A
30	PASA 19351S001	4644909.38015	-156645.65131	4353622.71197	W
33	RI01 13448M002	4708447.13620	-199490.87389	4284089.36647	W
34	SALA 13469M001	4803054.75358	-462131.66813	4158378.69583	W
35	SOA 10088M002	4639940.82159	-136225.52337	4359552.05220	W
313	SOPU 19386M001	4643998.21695	-255914.48917	4350062.77838	A
333	TERU 13487M001	4867391.63150	-95523.95717	4108341.29894	A
366	VITO 19385M001	4679398.01148	-218437.09320	4314898.00001	A
43	YEBE 13420M001	4848724.85757	-261632.53372	4123093.94603	W
44	ZARA 13462M001	4773803.48680	-73506.57901	4215453.72194	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 2067 WEEK FINAL COMBINATION: PRECISE ORBITS 09-SEP-19 09:01

Station	#Days	Weekday 0123456	Repeatability (mm)		
			N	E	U
ACOR 13434M001	7	XXXXXX	0.59	0.71	3.69
ALDA 19383M001	7	XXXXXX	0.99	0.64	3.19
ALSA 19419M001	7	XXXXXX	2.28	0.32	2.29
AMUR 19388M001	7	XXXXXX	0.57	0.95	5.58
BLAZ 10074M002	7	XXXXXX	0.61	0.93	1.09
BRZR 19387M001	7	XXXXXX	0.99	1.34	6.45
CACE 13447M001	7	XXXXXX	1.27	0.53	4.88
CANT 13438M001	7	XXXXXX	0.69	0.66	2.79
CHER 00000M000	7	XXXXXX	0.86	1.54	3.69
CREU 13432M001	7	XXXXXX	1.57	0.54	4.18
EBRE 13410M001	7	XXXXXX	0.88	0.99	6.34
ELGE 19353S001	7	XXXXXX	0.54	0.49	2.56
EMAZ 17001M001	7	XXXXXX	0.94	0.55	2.14
GERN 19389M001	7	XXXXXX	0.58	0.80	1.31
IGEL 19352S001	7	XXXXXX	0.42	0.68	2.64
ISPS 19484M001	7	XXXXXX	0.79	1.66	2.80
KAST 19499M001	7	XXXXXX	0.55	0.56	4.09
LARE 19440M001	7	XXXXXX	2.01	1.45	3.39
LAZK 19354S001	7	XXXXXX	1.02	0.67	2.85
LEIT 19428M001	7	XXXXXX	0.56	0.43	2.84
ORON 19427M001	7	XXXXXX	0.58	0.48	2.37
PASA 19351S001	7	XXXXXX	0.42	0.83	1.91
RI01 13448M002	7	XXXXXX	0.78	0.63	3.10
SALA 13469M001	7	XXXXXX	0.65	0.63	2.20
SCDA 10088M002	7	XXXXXX	1.06	1.99	1.15
SOPU 19386M001	7	XXXXXX	1.37	1.23	3.92
TERU 13487M001	7	XXXXXX	0.81	0.98	2.26
VITD 19385M001	7	XXXXXX	0.82	0.74	3.34
YEBE 13420M001	7	XXXXXX	0.50	1.05	3.41
ZARA 13462M001	7	XXXXXX	0.62	0.70	5.30

Comparison of individual solutions:

ACOR 13434M001	N	0.59	-0.03	0.10	-0.77	-0.19	-0.98	0.64	0.33
ACOR 13434M001	E	0.71	-1.25	-0.09	-0.56	-0.61	0.73	-0.49	0.14
ACOR 13434M001	U	3.69	-6.74	-1.89	0.41	2.92	3.88	2.15	-2.05
ALDA 19383M001	N	0.99	-0.44	-0.98	-0.40	1.30	0.71	0.76	-1.36
ALDA 19383M001	E	0.64	0.57	0.14	-0.56	-1.16	0.14	-0.03	0.66
ALDA 19383M001	U	3.19	-0.49	3.34	-3.45	-1.78	3.49	-4.73	0.21
ALSA 19419M001	N	2.28	0.39	1.21	1.39	0.25	2.65	-1.23	-4.38
ALSA 19419M001	E	0.32	0.49	0.45	-0.00	-0.09	0.26	0.32	0.04
ALSA 19419M001	U	2.29	-0.24	3.81	-1.83	-0.38	-0.19	-1.45	-3.36
AMUR 19388M001	N	0.57	0.71	0.43	-0.26	-0.46	-0.29	0.71	0.62
AMUR 19388M001	E	0.95	-0.04	1.31	1.32	-0.73	0.85	-0.19	-0.85
AMUR 19388M001	U	5.58	-9.86	-6.39	0.42	3.76	-5.45	-0.58	2.15
BLAZ 10074M002	N	0.61	0.69	0.13	-0.57	0.81	0.75	-0.24	-0.41
BLAZ 10074M002	E	0.93	-0.66	0.22	0.96	0.06	1.65	0.02	-1.02
BLAZ 10074M002	U	1.09	-1.27	-0.34	1.76	-0.17	-1.30	-0.26	0.72
BRZR 19387M001	N	0.99	0.32	-0.09	-1.62	0.00	1.57	0.84	-0.06
BRZR 19387M001	E	1.34	-1.32	-1.47	-0.05	-0.19	1.98	1.47	0.81
BRZR 19387M001	U	6.45	-6.58	12.64	3.06	-1.21	-5.84	0.17	-1.29
CACE 13447M001	N	1.27	-1.55	-0.28	-0.43	2.42	-0.51	0.40	-0.87
CACE 13447M001	E	0.53	-0.11	0.17	-0.64	-0.82	0.22	0.69	0.19
CACE 13447M001	U	4.88	2.13	-7.85	-4.34	-2.95	6.64	0.41	-2.26
CANT 13438M001	N	0.69	-0.39	0.36	-1.31	0.25	0.36	0.82	0.09
CANT 13438M001	E	0.66	0.04	0.58	1.27	-0.71	-0.08	0.30	-0.23
CANT 13438M001	U	2.79	-4.00	1.05	-2.68	4.74	-0.29	-0.07	0.19
CHER 00000M000	N	0.86	-0.86	-0.41	0.27	1.54	0.82	-0.63	0.10
CHER 00000M000	E	1.54	-0.84	-1.30	-0.77	0.60	2.72	1.88	0.20
CHER 00000M000	U	3.69	3.36	-0.38	3.51	-5.15	-0.66	3.94	-3.94
CREU 13432M001	N	1.57	1.61	1.50	-2.78	0.50	-0.82	1.08	-0.27
CREU 13432M001	E	0.54	0.34	-0.93	0.84	0.17	-0.08	0.11	-0.13
CREU 13432M001	U	4.18	-3.92	7.12	0.39	-4.09	-3.12	3.48	-0.53
EBRE 13410M001	N	0.88	-1.40	-0.04	-0.21	1.44	-0.07	-0.51	0.49
EBRE 13410M001	E	0.99	1.58	-0.15	-0.09	-0.04	0.70	-1.57	0.62
EBRE 13410M001	U	6.34	6.09	8.25	4.47	2.01	-2.60	-5.96	-8.34
ELGE 19353S001	N	0.54	0.59	-0.83	0.58	0.57	-0.15	0.14	0.11
ELGE 19353S001	E	0.49	0.92	0.34	-0.39	-0.21	0.32	-0.02	0.40
ELGE 19353S001	U	2.56	-0.06	-5.42	0.70	0.44	0.91	1.77	2.27
EMAZ 17001M001	N	0.94	-0.75	0.58	-0.69	-1.73	-0.77	0.15	0.55
EMAZ 17001M001	E	0.55	0.01	0.14	0.47	-0.25	0.95	-0.54	-0.55
EMAZ 17001M001	U	2.14	-0.43	1.06	-1.35	2.74	-2.15	-0.39	3.46
GERN 19389M001	N	0.58	-0.22	-0.29	-0.23	-0.34	1.02	0.26	0.80
GERN 19389M001	E	0.80	1.27	1.15	0.07	-0.85	0.10	-0.34	-0.17
GERN 19389M001	U	1.31	-0.53	2.09	-0.30	-0.89	1.87	-1.04	-0.48
IGEL 19352S001	N	0.42	0.46	-0.03	-0.51	0.35	0.49	0.44	-0.20
IGEL 19352S001	E	0.68	-0.10	0.78	0.22	-0.50	1.15	0.34	-0.66
IGEL 19352S001	U	2.64	1.85	-5.46	1.33	0.47	-1.11	1.72	1.55
ISPS 19484M001	N	0.79	0.92	-0.09	0.14	0.11	0.18	-1.33	1.03
ISPS 19484M001	E	1.66	0.50	0.48	0.85	2.36	0.87	-2.75	-1.19
ISPS 19484M001	U	2.80	2.85	2.20	0.12	-2.16	-0.22	2.51	-4.79
KAST 19499M001	N	0.55	0.94	0.20	-0.61	-0.38	0.57	0.27	-0.03
KAST 19499M001	E	0.56	0.07	1.24	0.35	-0.16	0.19	-0.07	-0.34
KAST 19499M001	U	4.09	-4.21	7.05	4.42	-0.98	-0.46	-2.10	-2.78
LARE 19440M001	N	2.01	-3.73	-2.39	-0.89	0.22	0.59	1.56	-1.03
LARE 19440M001	E	1.45	-1.24	-0.52	1.61	0.33	1.75	-0.49	-2.18
LARE 19440M001	U	3.39	2.30	1.64	-4.55	1.94	-3.74	0.97	4.64
LAZK 19354S001	N	1.02	1.25	0.17	0.44	0.32	0.87	-0.12	-1.90
LAZK 19354S001	E	0.67	0.26	-0.62	0.23	-0.67	0.76	0.32	1.02
LAZK 19354S001	U	2.85	1.45	-3.62	0.37	2.67	-2.53	-2.12	3.93
LEIT 19428M001	N	0.56	-0.11	-0.19	-0.24	-0.13	0.98	-0.57	0.68
LEIT 19428M001	E	0.43	-0.03	-0.45	0.43	0.66	0.37	0.37	0.09
LEIT 19428M001	U	2.84	3.60	2.08	-2.02	-2.38	-0.79	0.58	-4.53
ORON 19427M001	N	0.58	-0.30	-0.52	0.55	0.52	0.54	0.75	-0.47

ORDN 19427M001	E	0.48	-0.61	0.43	0.50	-0.12	0.70	0.27	0.04
ORDN 19427M001	U	2.37	1.47	1.85	-0.24	-4.34	0.79	-1.60	-2.48
PASA 19351S001	N	0.42	0.23	0.02	-0.51	0.12	0.83	0.17	0.12
PASA 19351S001	E	0.83	-0.69	1.10	0.73	-0.76	0.27	1.05	-0.45
PASA 19351S001	U	1.91	1.90	-3.12	1.88	1.01	-1.92	0.60	-0.06
RID1 13448M002	N	0.78	0.85	-0.52	-0.55	-0.75	-0.11	-0.43	1.25
RID1 13448M002	E	0.63	1.01	-0.05	0.62	-0.55	0.26	0.61	-0.48
RID1 13448M002	U	3.10	-3.64	5.70	-0.38	0.98	-2.63	-1.94	0.24
SALA 13469M001	N	0.65	-0.44	0.17	0.13	0.26	1.07	-0.66	-0.82
SALA 13469M001	E	0.63	0.06	-0.60	-0.24	-0.23	-0.81	0.34	1.05
SALA 13469M001	U	2.20	3.34	0.14	1.05	-1.10	-0.52	-3.14	2.34
SCDA 10088M002	N	1.06	0.22	-1.81	0.31	1.66	-0.10	0.24	0.69
SCDA 10088M002	E	1.99	0.65	-2.97	-1.33	0.52	2.62	2.28	-0.58
SCDA 10088M002	U	1.15	-1.57	-1.18	-0.69	0.56	0.07	1.27	1.30
SOPU 19386M001	N	1.37	1.27	-2.45	1.34	0.82	0.74	0.30	-0.72
SOPU 19386M001	E	1.23	-0.00	1.33	0.65	-1.33	1.97	-0.17	-1.12
SOPU 19386M001	U	3.92	-4.32	6.92	3.72	-0.15	-3.03	-1.64	-0.18
TERU 13487M001	N	0.81	-1.69	0.58	-0.15	-0.19	0.55	0.51	0.35
TERU 13487M001	E	0.98	1.98	-1.17	0.02	-0.12	0.16	0.42	-0.53
TERU 13487M001	U	2.26	-0.49	3.19	2.35	-2.54	2.58	-1.21	0.27
VITO 19385M001	N	0.82	0.63	0.78	-0.71	-0.94	-0.07	1.20	0.41
VITO 19385M001	E	0.74	1.20	-0.13	0.78	-0.33	0.82	-0.22	-0.65
VITO 19385M001	U	3.34	-3.29	-2.27	1.93	-2.62	-3.20	0.83	-5.43
YEBE 13420M001	N	0.50	-0.21	0.40	0.53	0.70	-0.54	-0.34	-0.37
YEBE 13420M001	E	1.05	1.04	-1.08	-0.42	0.18	-1.64	1.22	0.18
YEBE 13420M001	U	3.41	-1.24	-3.26	2.37	0.95	-0.93	-6.89	-1.67
ZARA 13462M001	N	0.62	0.13	0.17	-1.08	0.10	0.97	-0.09	0.38
ZARA 13462M001	E	0.70	-0.08	-0.72	-0.31	0.04	0.36	1.34	0.62
ZARA 13462M001	U	5.30	0.68	7.25	4.02	-5.65	-4.60	-4.51	-5.10



## 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	-2.72	0.59	0.08
2	ALAC 13433M001	I W	1.15	0.12	-0.19
3	ALBA 13452M001	I W	-0.10	-0.09	-2.10
4	ALME 13437M001	I W	-0.87	1.59	3.82
5	BCLN 13412M001	I W	0.48	-0.01	-2.11
6	BELL 13431M001	I W	-0.88	1.52	-2.18
7	BORR 13480M001	I W	-0.66	-1.67	-1.83
8	BRST 10004M004	I W	-3.31	1.96	-0.95
9	CACE 13447M001	I W	0.38	1.74	1.93
10	CANT 13438M001	I W	-1.43	0.49	0.11
11	CARG 19412M001	I W	0.31	0.78	1.43
12	CASC 13909S001	I W	1.67	-1.00	1.42
13	CEU1 13449M002	I W	0.63	-0.30	-2.70
14	COBA 13453M001	I W	1.80	0.78	-3.28
15	CREU 13432M001	I W	0.35	0.14	1.95
16	EBRE 13410M001	I W	-0.14	0.03	-3.14
17	ESCO 13435M001	I W	2.48	1.08	-7.74
18	FUNC 13911S001	I W	4.87	-0.33	0.68
19	GAIA 13902M001	I W	-0.34	1.05	2.52
21	HUEL 13451M001	I W	2.97	-3.45	-4.82
22	IZAN 13109M002	I W	0.74	-0.07	4.10
23	LLIV 13436M001	I W	-0.89	0.79	0.10
24	LPAL 81701M001	I W	-0.86	-0.56	5.49
25	LROC 10023M001	I W	0.58	-0.00	0.22
26	MALA 13443M001	I W	-0.12	-2.87	4.27
27	MAS1 31303M002	I W	1.32	0.43	6.43
29	MELI 19379M001	I W	2.46	-1.95	-4.41
30	PASA 19351S001	I W	-0.09	0.30	0.56
32	RABT 35001M002	I W	1.65	-0.01	-5.39
33	RIO1 13448M002	I W	-1.81	0.82	-0.94
34	SALA 13469M001	I W	0.07	0.29	-0.42
35	SCOA 10088M002	I W	-5.12	-0.41	-2.32
38	SONS 13446M001	I W	-1.90	-1.11	-4.63
40	VALA 13463M002	I W	-1.00	-1.09	0.70
41	VALE 13439M001	I W	-1.55	-0.09	-2.95
42	VIGO 13450M001	I W	-0.19	0.53	8.19
43	YEBE 13420M001	I W	0.67	-0.12	4.74
44	ZARA 13462M001	I W	-0.51	-0.32	0.63
45	ZIMM 14001M004	I W	-0.06	0.41	2.74
	RMS / COMPONENT		1.78	1.13	3.45
	MEAN		0.00	-0.00	0.00
	MIN		-5.12	-3.45	-7.74
	MAX		4.87	1.96	8.19

NUMBER OF PARAMETERS : 3  
NUMBER OF COORDINATES : 117  
RMS OF TRANSFORMATION : 2.33 MM

BARYCENTER COORDINATES:

LATITUDE : 39 38 21.48  
LONGITUDE : - 4 23 1.03  
HEIGHT : -38.281 KM

PARAMETERS:

TRANSLATION IN N : 0.00 +- 0.37 MM  
TRANSLATION IN E : 0.00 +- 0.37 MM  
TRANSLATION IN U : -0.00 +- 0.37 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          17321282
NUMBER OF UNKNOWN               214092
NUMBER OF DEGREES OF FREEDOM    17107190
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
VARIANCE FACTOR                  2.367061232406815

Helmert Transformation Parameters With Respect to Combined Solution:
-----
Sol  Rms (m)      Translation (m)      Rotation (")      Scale (ppm)
      X          Y          Z          X          Y          Z
-----
  1  0.00301      0.0034 -0.0143  0.0005  0.0003  0.0001 -0.0003  -0.00059
  2  0.00291      0.0053 -0.0425  0.0014  0.0009  0.0001 -0.0010  -0.00116
  3  0.00254      0.0035 -0.0018 -0.0028  0.0000  0.0001 -0.0001  -0.00015
  4  0.00289     -0.0259 -0.0274  0.0266  0.0003 -0.0012 -0.0009   0.00008
  5  0.00230     -0.0129  0.0035  0.0124 -0.0002 -0.0006  0.0000   0.00039
  6  0.00215     -0.0106  0.0192  0.0007 -0.0004 -0.0002  0.0005   0.00118
  7  0.00203      0.0054  0.0098 -0.0079 -0.0002  0.0003  0.0002   0.00012
```

```
Statistics of individual solutions:
-----
File  RMS (m)      DOF  Ch3**2/DOF  #Observations authentic / pseudo  #Parameters explicit / implicit / singular
-----
  1  0.00159      2421953      2.52          2456320      3          1002      33368      0
  2  0.00157      2413138      2.47          2444879      3           957      30787      0
  3  0.00158      2399623      2.48          2430467      3           957      29890      0
  4  0.00159      2353204      2.52          2384115      3           954      29960      0
  5  0.00150      2510618      2.24          2541684      3          1005      30064      0
  6  0.00148      2497039      2.18          2527860      3          1005      29819      0
  7  0.00146      2505771      2.12          2535957      3           996      29193      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 19:230:00000 19:236:86370 LEICA GR10 -----
ALDA  A  1 P 19:230:00000 19:236:86370 LEICA GR10 -----
ALSA  A  1 P 19:230:00000 19:236:86370 LEICA GR50 -----
AMUR  A  1 P 19:230:00000 19:236:86370 LEICA GR10 -----
BIAZ  A  1 P 19:230:00000 19:236:86370 TRI SP90M -----
BRZR  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
CACE  A  1 P 19:230:00000 19:236:86370 TRIMBLE NETR9 -----
CANT  A  1 P 19:230:00000 19:236:86370 LEICA GR10 -----
CHER  A  1 P 19:230:00000 19:236:86370 LEICA GRX1200+GNSS -----
CREU  A  1 P 19:230:00000 19:236:86370 LEICA GR50 -----
EBRE  A  1 P 19:230:00000 19:236:86370 LEICA GR50 -----
ELGE  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
EMAZ  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
GERN  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
IGEL  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
ISPS  A  1 P 19:230:00000 19:236:86370 TRIMBLE NETR9 -----
KAST  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
LARE  A  1 P 19:230:00000 19:236:86370 LEICA GRX1200GGPRO -----
LAZK  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
LEIT  A  1 P 19:230:00000 19:236:86370 LEICA GR50 -----
ORON  A  1 P 19:230:00000 19:236:86370 LEICA GR50 -----
PASA  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
RIO1  A  1 P 19:230:00000 19:236:86370 LEICA GR25 -----
SALA  A  1 P 19:230:00000 19:236:86370 LEICA GRX1200+GNSS -----
SCOA  A  1 P 19:230:00000 19:236:86370 LEICA GR25 -----
SOPU  A  1 P 19:230:00000 19:236:86370 LEICA GR30 -----
TERU  A  1 P 19:230:00000 19:236:86370 LEICA GRX1200GGPRO -----
VITO  A  1 P 19:230:00000 19:236:86370 LEICA GR10 -----
YEBE  A  1 P 19:230:00000 19:236:86370 TRIMBLE NETR9 -----
ZARA  A  1 P 19:230:00000 19:236:86370 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 19:230:00000 19:236:86370 LEIAT504      LEIS -----
ALDA  A  1 P 19:230:00000 19:236:86370 LEIAS10       NONE -----
ALSA  A  1 P 19:230:00000 19:236:86370 LEIAR10       NONE -----
AMUR  A  1 P 19:230:00000 19:236:86370 LEIAS10       NONE -----
BIAZ  A  1 P 19:230:00000 19:236:86370 LEIAR25       LEIT -----
BRZR  A  1 P 19:230:00000 19:236:86370 LEIAS10       NONE -----
```

CACE	A	1	P	19:230:00000	19:236:86370	TRM29659.00	NONE	----
CANT	A	1	P	19:230:00000	19:236:86370	LEIAR25_R4	LEIT	25066
CHER	A	1	P	19:230:00000	19:236:86370	LEIAX1203+GNSS	NONE	----
CREU	A	1	P	19:230:00000	19:236:86370	LEIAR25_R4	NONE	26357
EBRE	A	1	P	19:230:00000	19:236:86370	LEIAR25_R4	NONE	26359
ELGE	A	1	P	19:230:00000	19:236:86370	LEIAR25_R4	LEIT	----
EMAZ	A	1	P	19:230:00000	19:236:86370	LEIAS10	NONE	----
GERN	A	1	P	19:230:00000	19:236:86370	LEIAS10	NONE	----
IGEL	A	1	P	19:230:00000	19:236:86370	LEIAR20	LEIM	----
ISPS	A	1	P	19:230:00000	19:236:86370	TRM59900.00	SCIS	----
KAST	A	1	P	19:230:00000	19:236:86370	LEIAS10	NONE	----
LARE	A	1	P	19:230:00000	19:236:86370	LEIAT504	NONE	----
LAZK	A	1	P	19:230:00000	19:236:86370	LEIAR25_R4	LEIT	----
LEIT	A	1	P	19:230:00000	19:236:86370	LEIAR10	NONE	----
ORDN	A	1	P	19:230:00000	19:236:86370	LEIAR10	NONE	----
PASA	A	1	P	19:230:00000	19:236:86370	LEIAR20	LEIM	73034
RIO1	A	1	P	19:230:00000	19:236:86370	LEIAR25_R4	LEIT	25138
SALA	A	1	P	19:230:00000	19:236:86370	LEIAR25	NONE	----
SCOA	A	1	P	19:230:00000	19:236:86370	TRM55971.00	NONE	----
SOPU	A	1	P	19:230:00000	19:236:86370	LEIAS10	NONE	----
TERU	A	1	P	19:230:00000	19:236:86370	LEIAT504GG	LEIS	----
VITO	A	1	P	19:230:00000	19:236:86370	LEIAS10	NONE	----
YEBE	A	1	P	19:230:00000	19:236:86370	TRM29659.00	NONE	----
ZARA	A	1	P	19:230:00000	19:236:86370	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	19:230:00000	19:236:86370	UNE	3.0460	0.0000	0.0000
ALDA	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
ALSA	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
AMUR	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
BIAZ	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
BRZR	A	1	P	19:230:00000	19:236:86370	UNE	0.0771	0.0000	0.0000
CACE	A	1	P	19:230:00000	19:236:86370	UNE	0.0600	0.0000	0.0000
CANT	A	1	P	19:230:00000	19:236:86370	UNE	3.0490	0.0000	0.0000
CHER	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
CREU	A	1	P	19:230:00000	19:236:86370	UNE	0.0770	0.0000	0.0000
EBRE	A	1	P	19:230:00000	19:236:86370	UNE	0.0770	0.0000	0.0000
ELGE	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
EMAZ	A	1	P	19:230:00000	19:236:86370	UNE	0.0350	0.0000	0.0000
GERN	A	1	P	19:230:00000	19:236:86370	UNE	0.0771	0.0000	0.0000
IGEL	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
ISPS	A	1	P	19:230:00000	19:236:86370	UNE	0.0350	0.0000	0.0000
KAST	A	1	P	19:230:00000	19:236:86370	UNE	0.0350	0.0000	0.0000
LARE	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
LAZK	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
LEIT	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
ORDN	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
PASA	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
RIO1	A	1	P	19:230:00000	19:236:86370	UNE	0.0606	0.0000	0.0000
SALA	A	1	P	19:230:00000	19:236:86370	UNE	0.0600	0.0000	0.0000
SCOA	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
SOPU	A	1	P	19:230:00000	19:236:86370	UNE	0.0771	0.0000	0.0000
TERU	A	1	P	19:230:00000	19:236:86370	UNE	0.0600	0.0000	0.0000
VITO	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
YEBE	A	1	P	19:230:00000	19:236:86370	UNE	0.0000	0.0000	0.0000
ZARA	A	1	P	19:230:00000	19:236:86370	UNE	3.2590	0.0000	0.0000

## 8 References

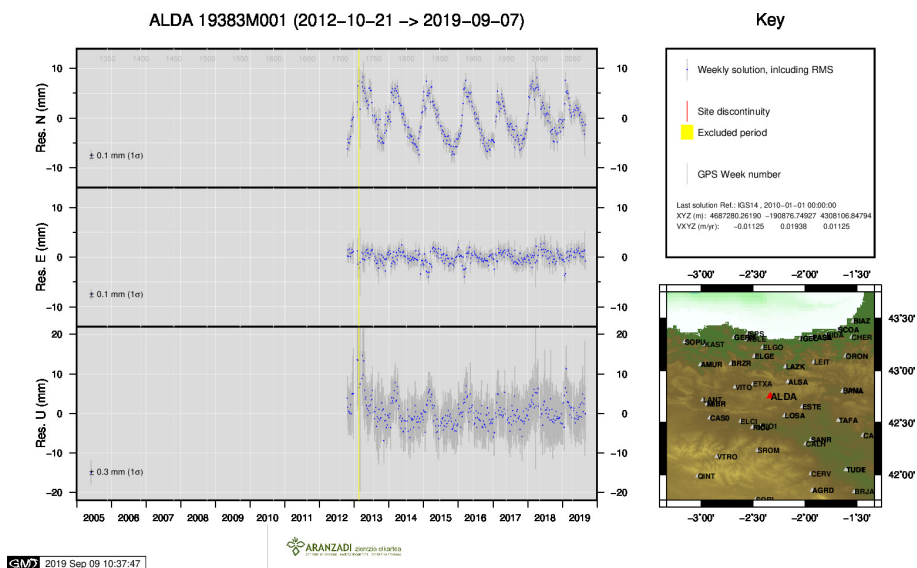
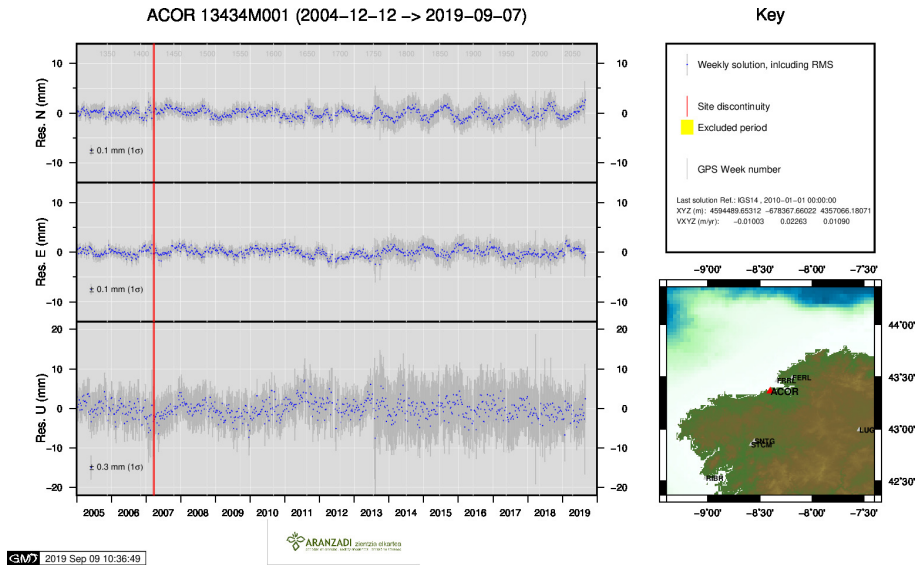
C. Boucher and Z. Altamimi (2011): *Specifications for reference frame fixing in the analysis of a EUREF GPS campaign*. [etrs89.ensg.ign.fr/memo-V8.pdf](http://etrs89.ensg.ign.fr/memo-V8.pdf)

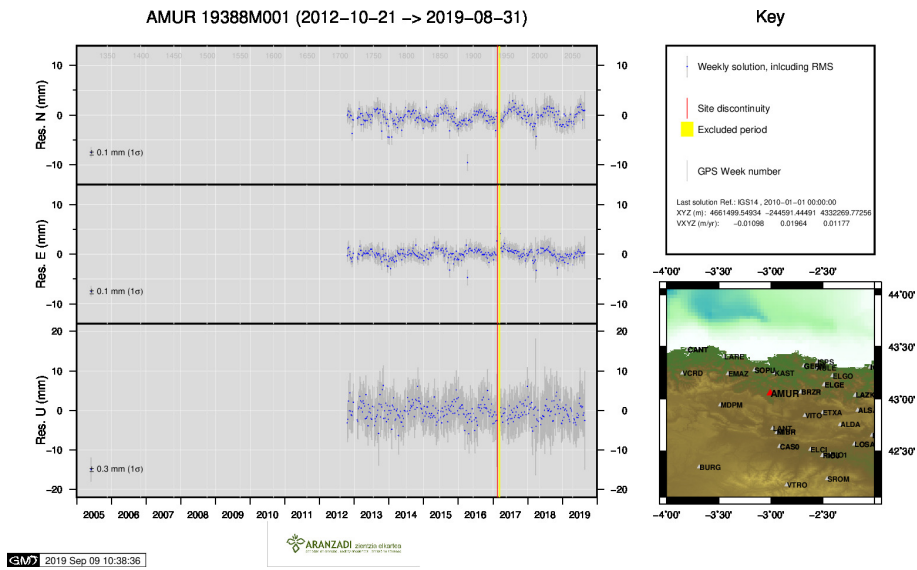
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](http://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

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)

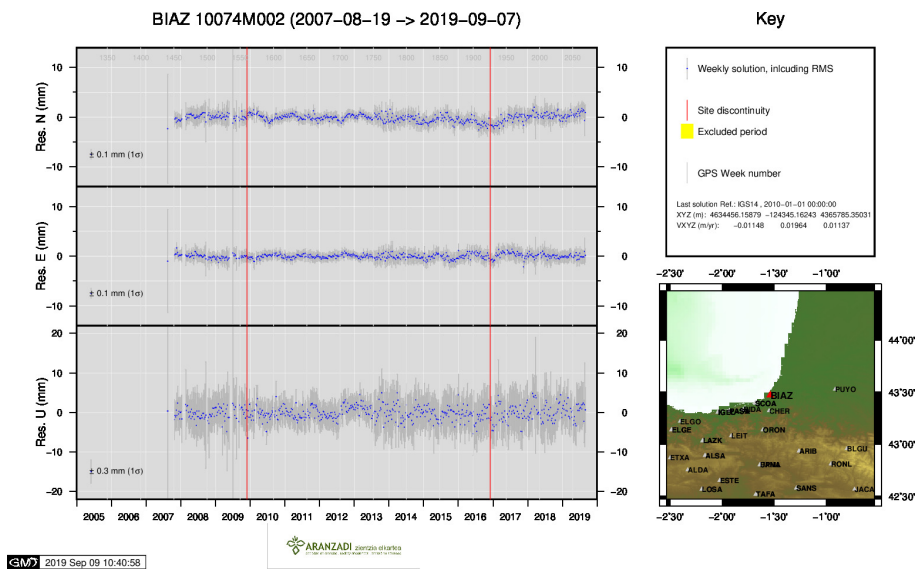
## 9 Cumulative Time Series

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

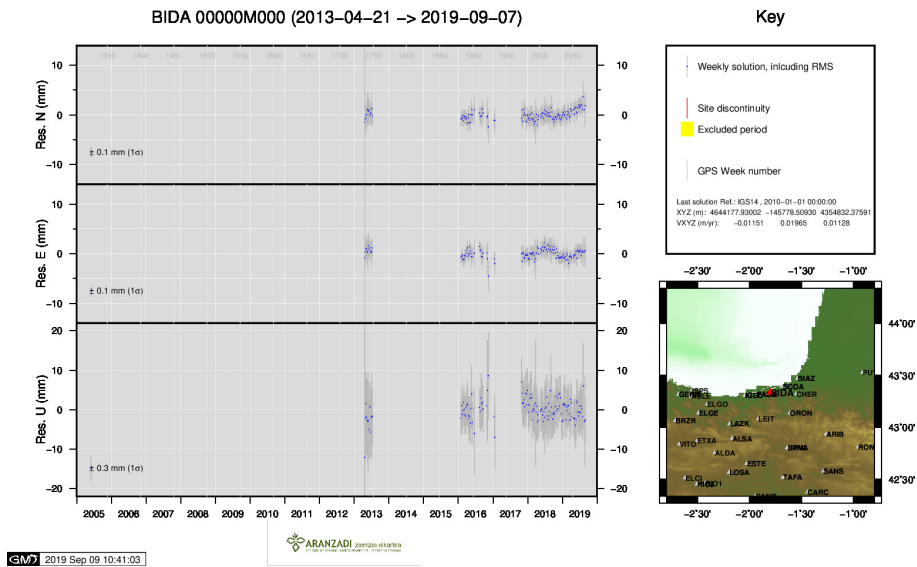




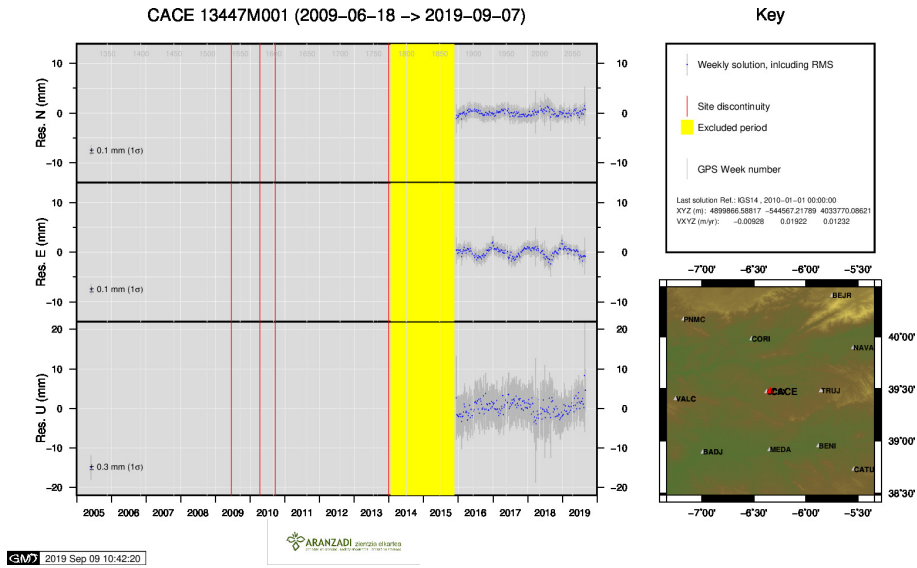
3 ) AMUR



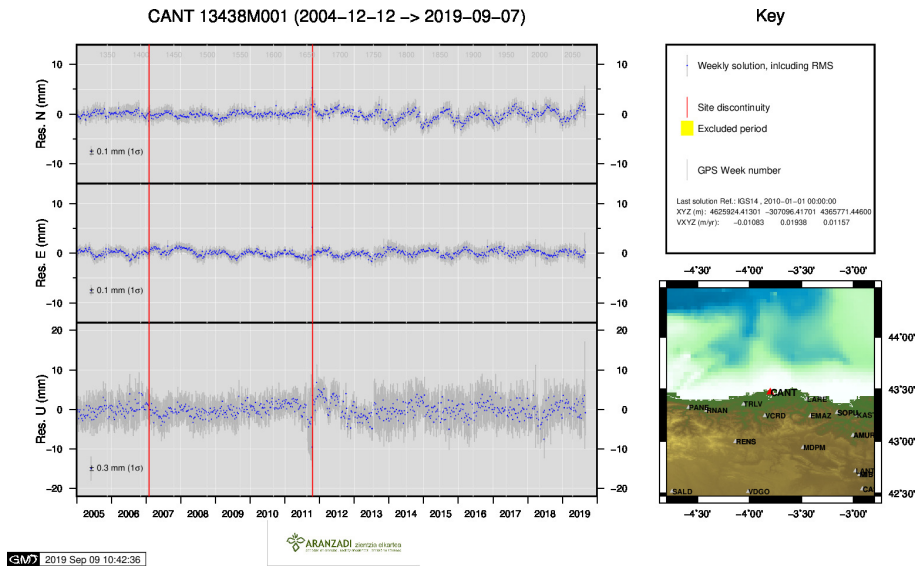
4 ) BIAZ



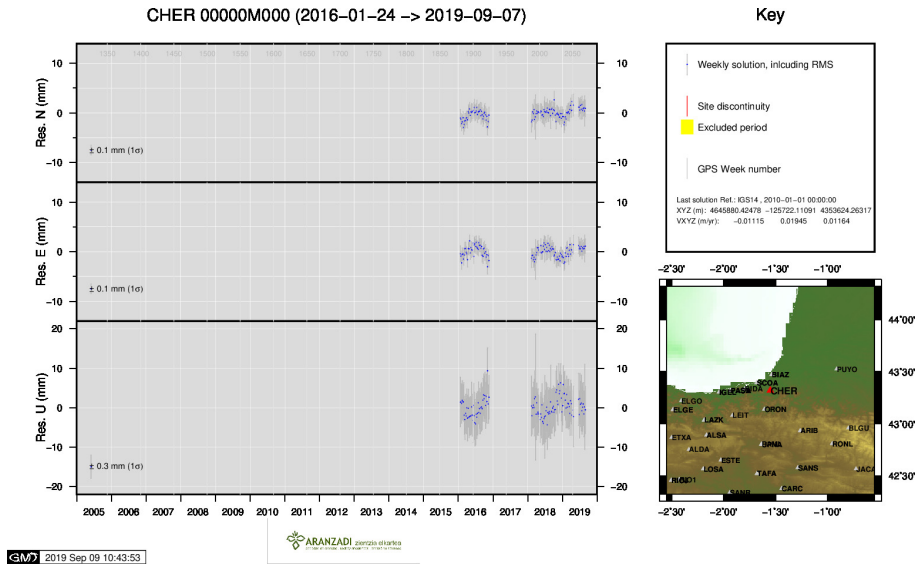
5 ) BIDA



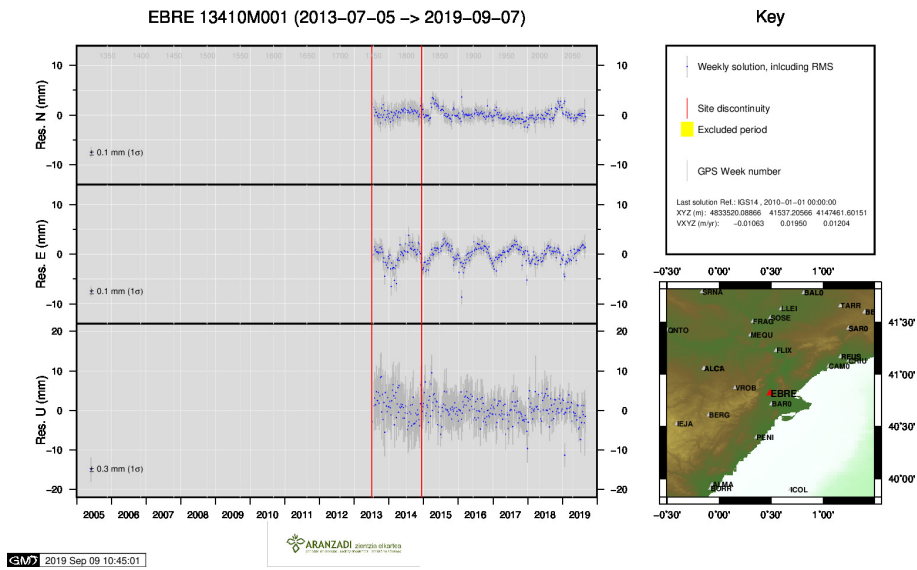
6 ) CACE



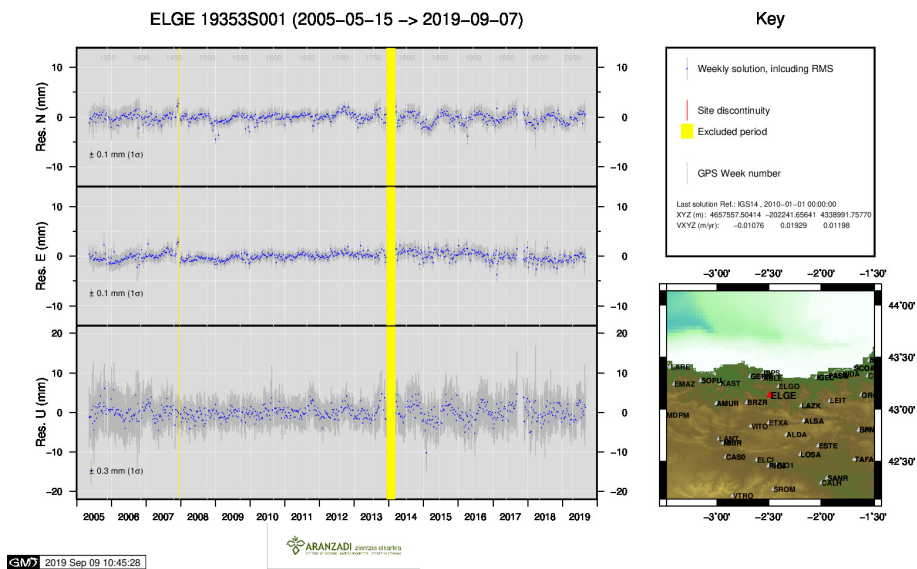
7 ) CANT



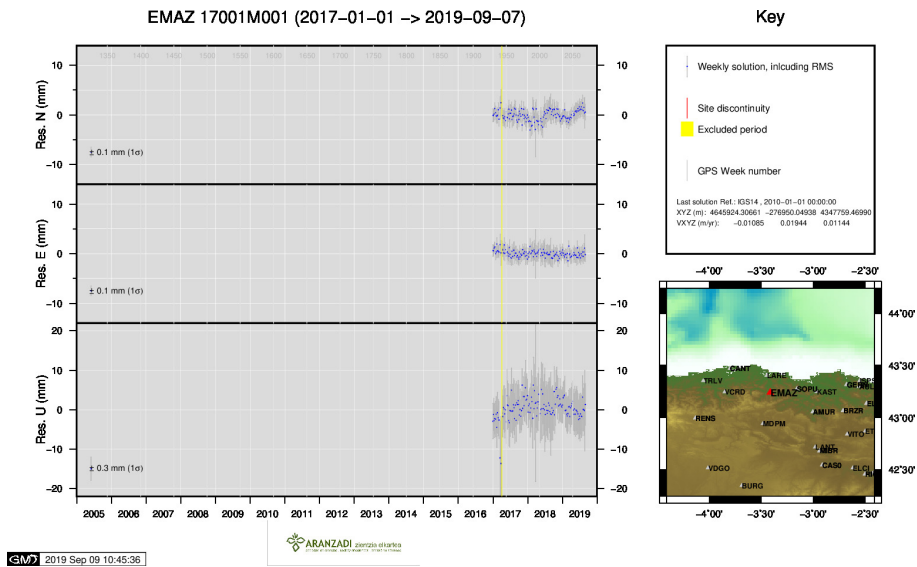
8 ) CHER



9 ) EBRE

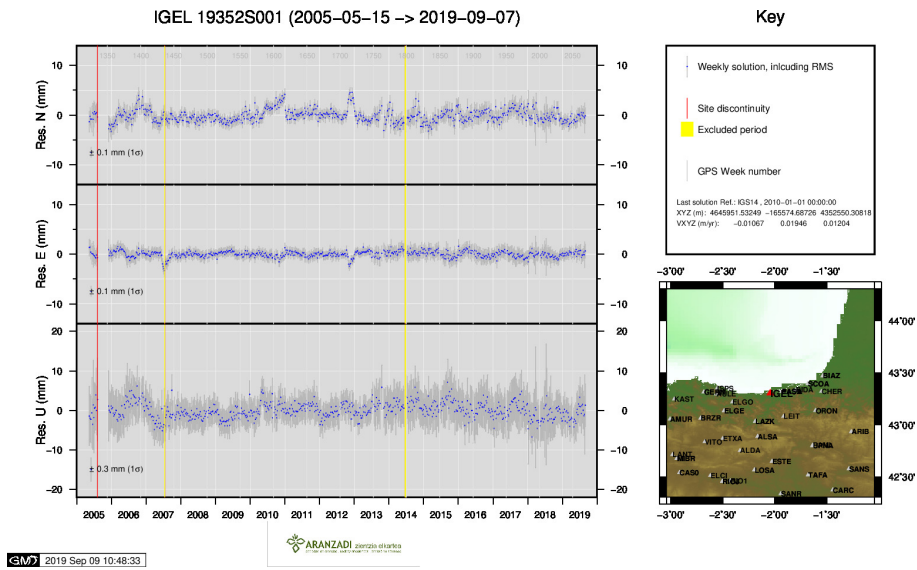


10 ) ELGE

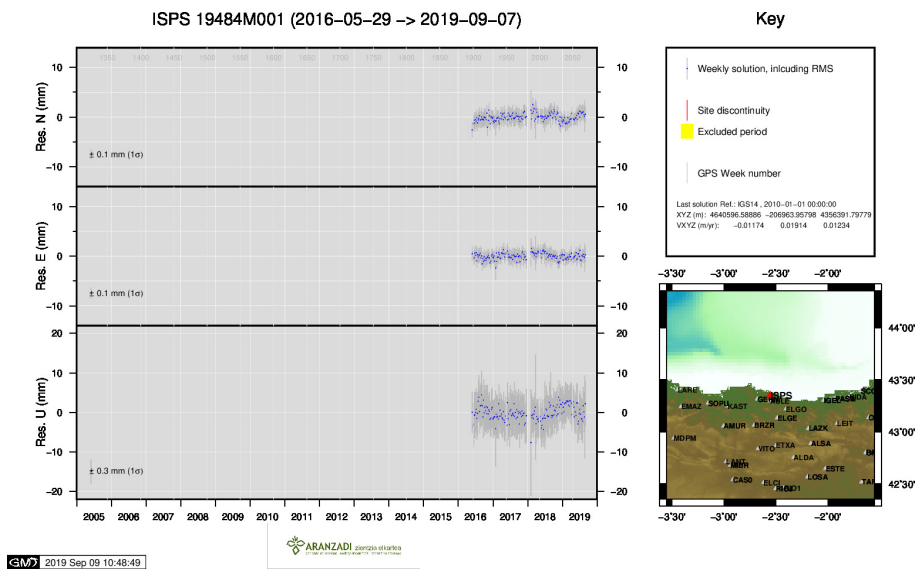


11 ) EMAZ

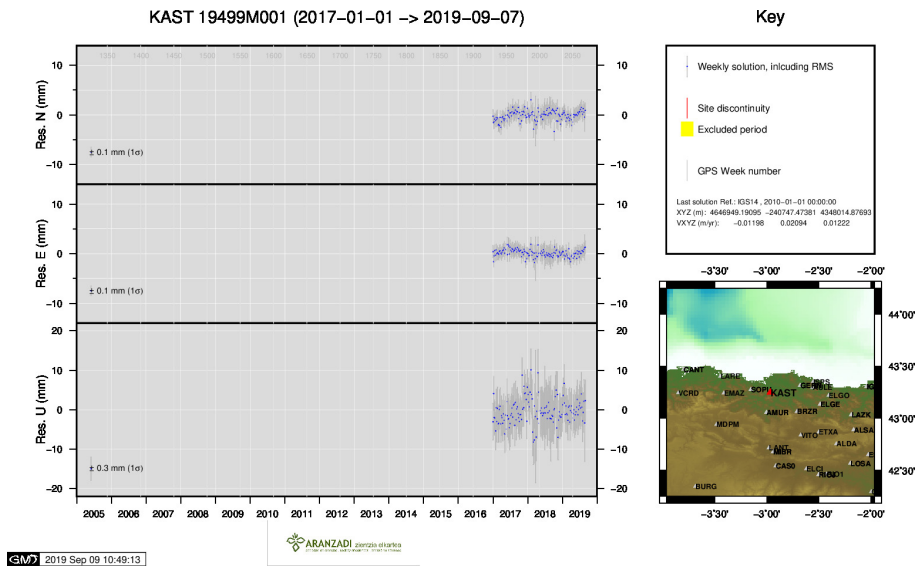




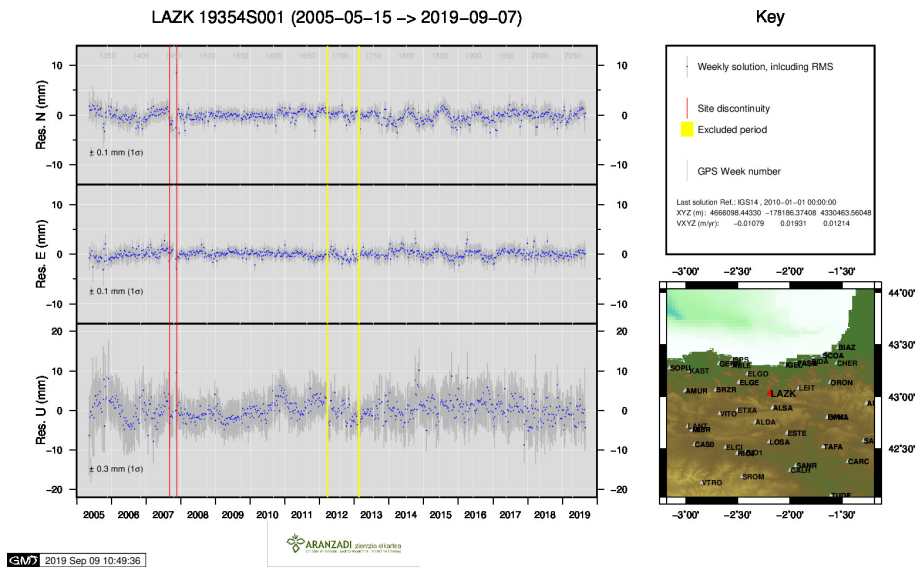
12 ) IGEL



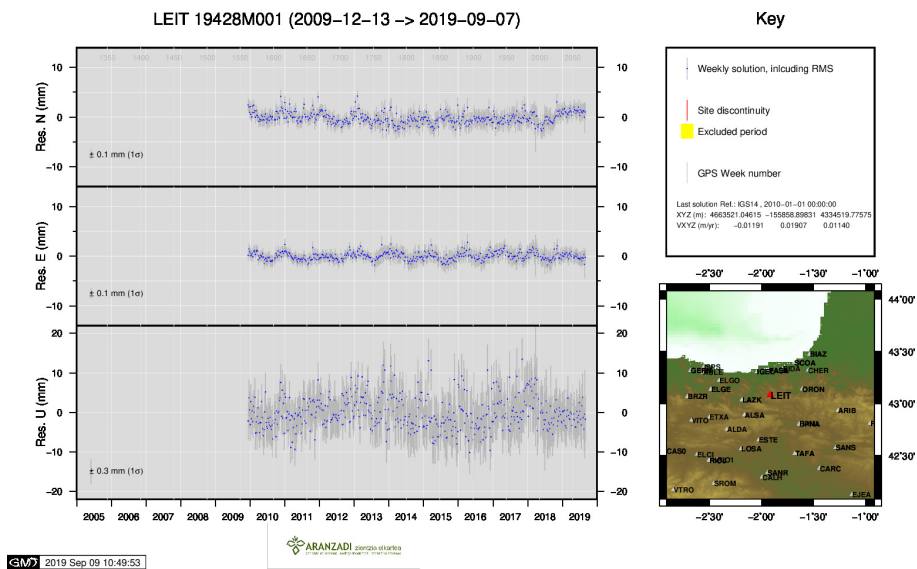
13 ) ISPS



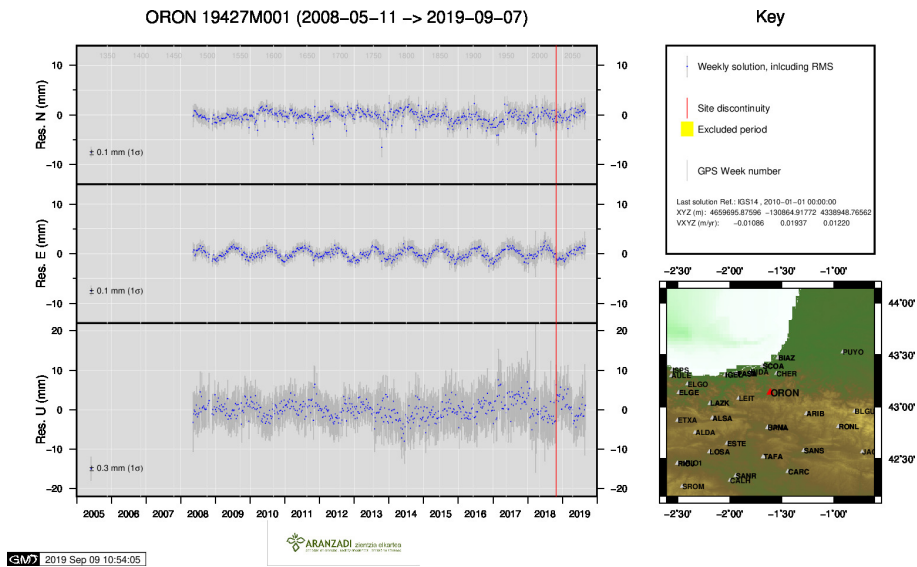
14 ) KAST



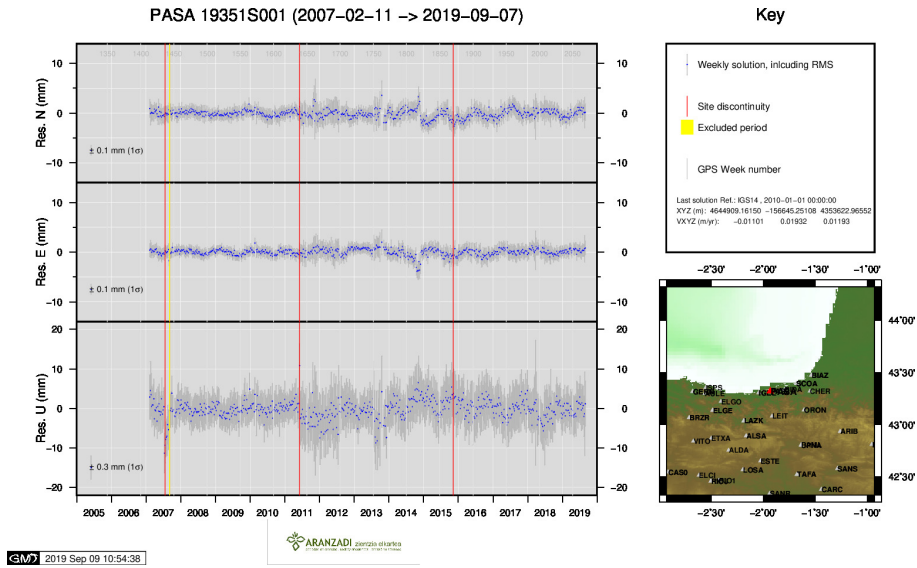
15 ) LAZK



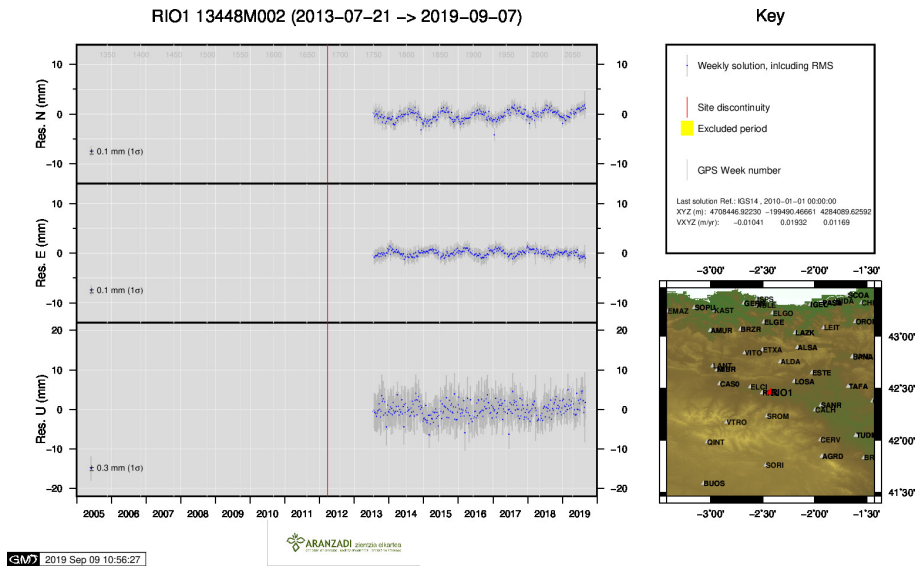
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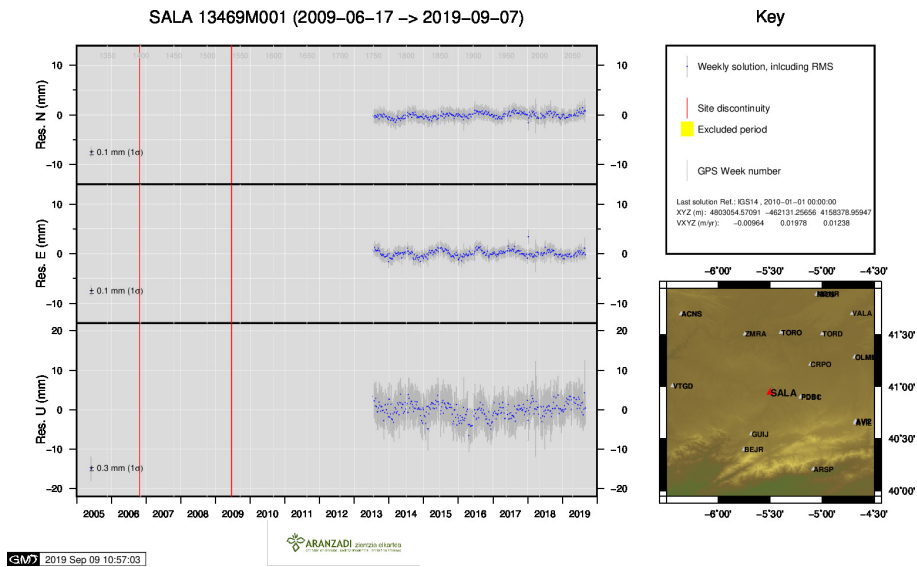
17 ) ORON



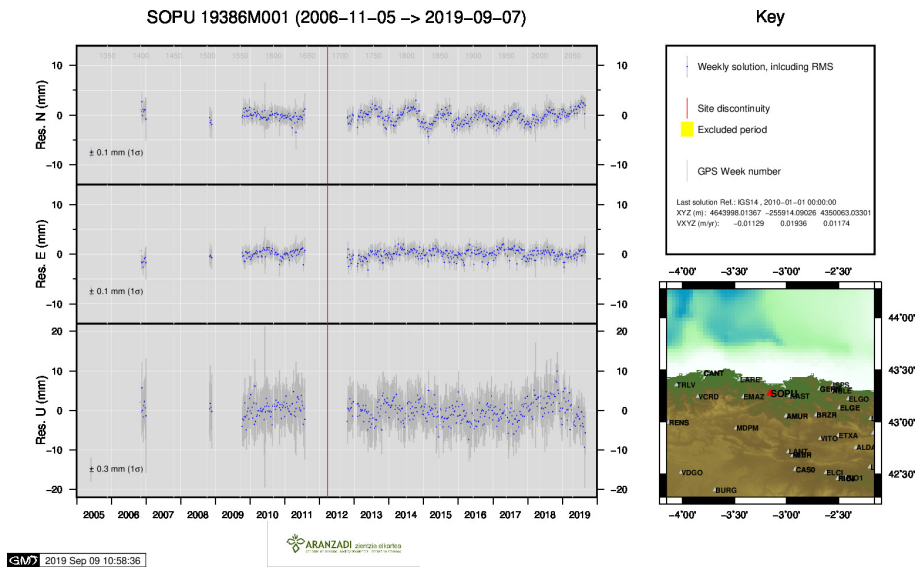
18 ) PASA



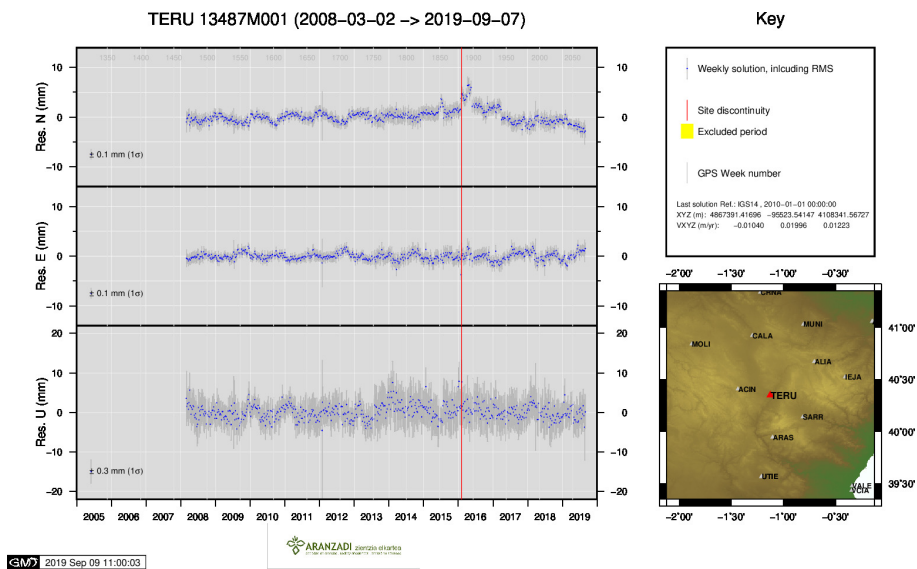
19 ) RIO1



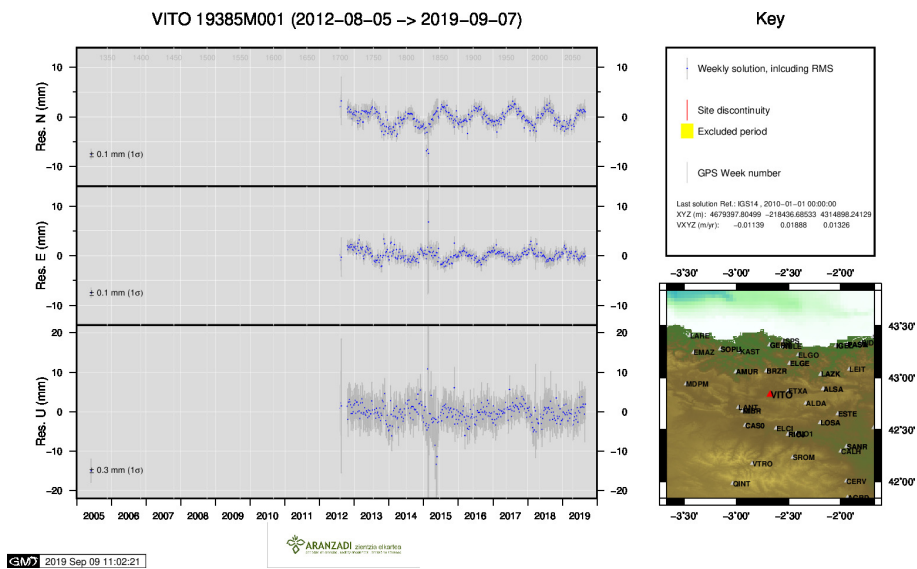
20 ) SALA



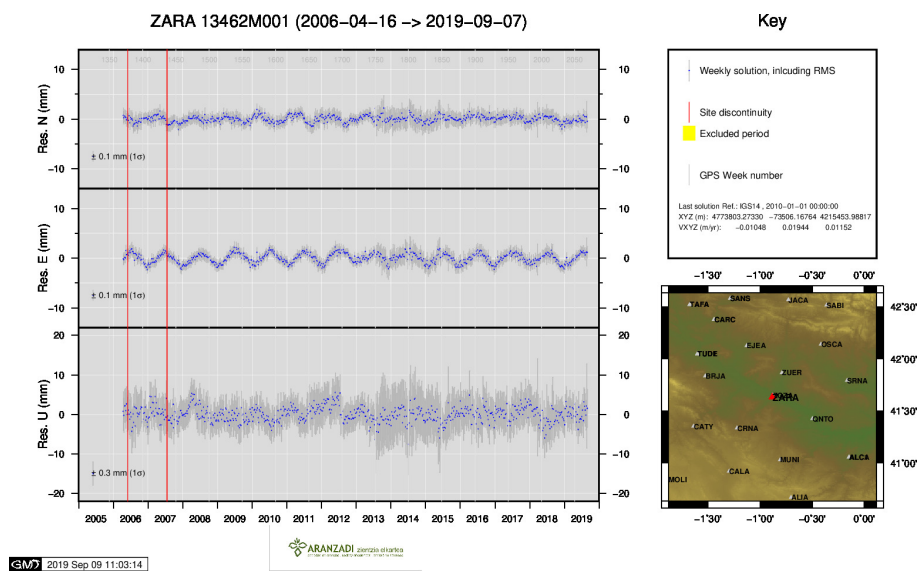
21 ) SOPU



22 ) TERU



23 ) VITO



24 ) ZARA