ARA-DAC Weekly Analysis Result: 2293 (GFA)

Technical Report

GPS Week: 2293 (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

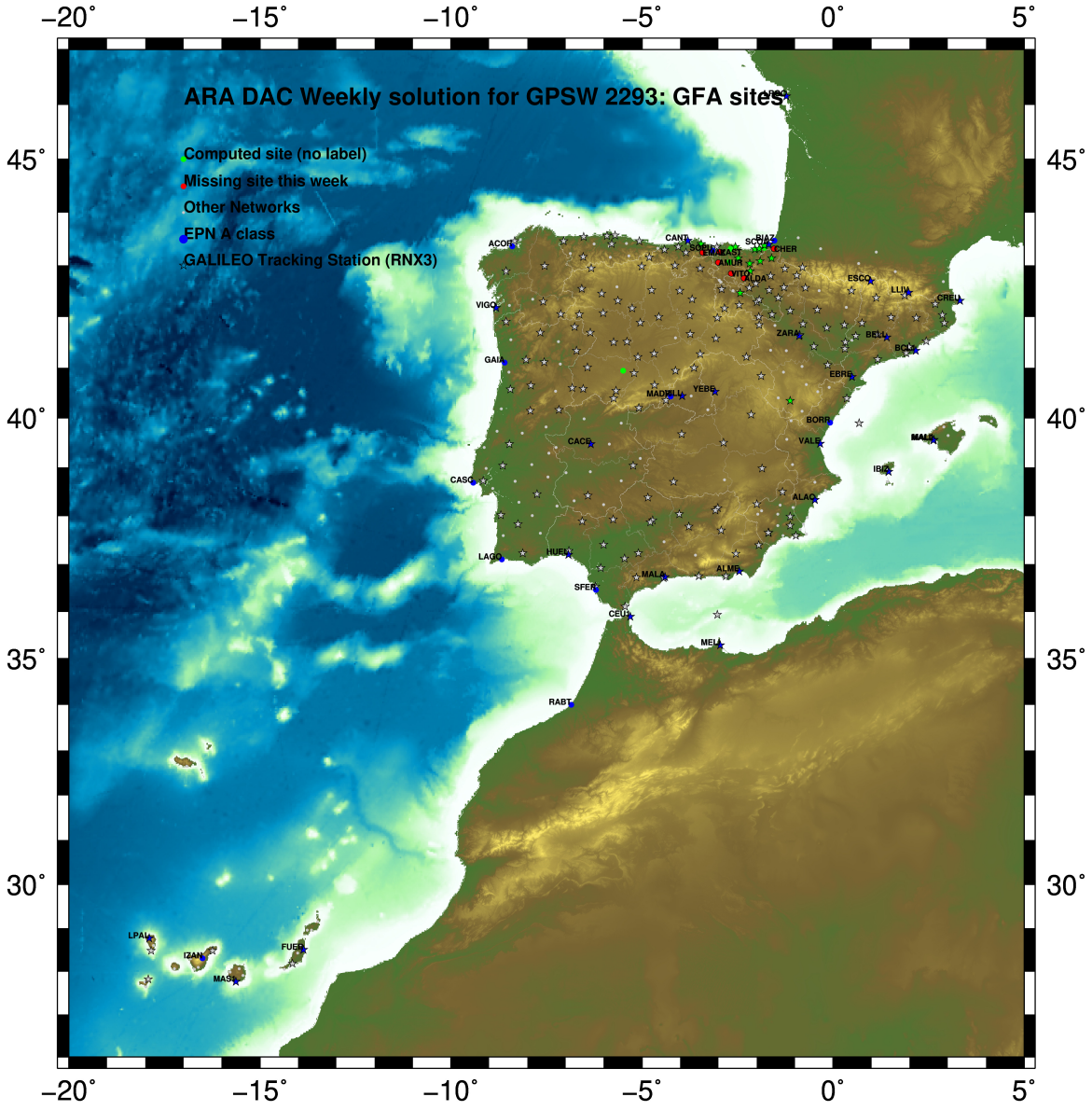


Fig.1: Computed Sites for GPS Week2293 (GFA)

3 Main Computation Parameters

The main parameters considered in the ARA analysis follow strictly the EPN recommendations.

- Preprocessing: Independent baselines are defined by the criterion of maximum common observations. Cycle slips are fixed with the MAUPRP program, analysing triple phase differences for each independent baseline. If MAUPRP does not fix all slips for one station, that station is edited out.
- Basic Observable : Carrier phase, L_1 and L_2; a priori sigma of single differences:0.002 m.
  - sampling (for ambiguity resolution): 30 s
  - sampling (for final processing): 180 s
  - Systems: GPS+GLONASS observations are used (Galileo is used if available starting GPS week 1986)
- Modelled observable: Double differences of carrier phase using different combinations based on the distance.
- Ground antenna phase center calibrations: Group APCV used from the PCV_COD.I20 file and individual calibrations from EPNC_20.ATX. In case no calibration values of an antenna/radome pairs are not available for a certain GNSS system at some station, the observatione of this/theese GNSS/GNSSs are excluded from the analysis of that station.
- Reference sites: the latest IGS cumulative solution is used to align our solution to the latest IGS20 release, regularly updated and available at: IGS0OPSSNX_1994002_00U_00U_CRD.SNX.gz. Following the EUREF guidelines, no other individual calibrations are included in the analysis starting GPSW 2238 (IGS20); also applies to repro3 solutions, which are based on IGS20 standards.
- Troposphere:
  - minimum elevation is 3 deg.; elevation dependent weighting.
  - VMF3 mapping function. ZPD parameters are estimated using the VMF3 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2014b (Scherneck).
- Atmospheric loading: not corrected, following the latest recommendations for IGS20 products.
- Tidal displacements:
  - Mean pole model : IERS2010_v1.2.0
  - Subdaily pole model: DESAI2016
  - Nutation model : IAU2000R06

4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria: 3*rms of single differences, in the weekly combination of daily normal equations (ADDNEQ)
- Station coordinates: minimum constraints (MC) to IGS sites (only translations).
- Troposphere: 3 deg. After having obtained coordinates valid for the entire week, tropospheric zenith delay is solved at each site at intervals of 1 hour throughout the week, holding the coordinates constrained at the weekly values.

- Ionospheric: second and third "High Order Ionosphere (HOI)" corrections used, using CODE files, to improve Ambiguity Resolution.
- Satellite clock bias: not estimated because are eliminated by double differencing the phase data.
- Receiver clock bias: not estimated because are eliminated by double differencing the phase data.
- Orbits and ERPs: CODE's orbits and ERP for both rapid and final solutions. DE421 planetary ephemeris and JGM3 Earth geopotential model is used.
- Ambiguity: an advanced ambiguity resolution (AR) scheme is included:
  - Code-Based Widelane (WL) and Narrow Line (NR) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
  - Phase-Based Widelane (L_5) AR for baselines shorter than 200km, the code-based wide-lane AR is replaced by a phase-only wide-lane with a subsequent narrow-lane AR.
  - Quasi-Ionosphere-Free (QIF) AR for the remaining real-valued ambiguities for baselines shorter than 2000km.
  - Direct L_1/L_2 AR for baselines shorter than 20km
- AR Verification: Each baseline is processed by introducing the resolved integer ambiguities and checking the residuals. If there is any problem, the ambiguities are re-initialized.

5 Computed Coordinates

In this section the adjusted coordinates are summarized. Note that the sites with an A flag are the computed ones, whereas sites flagged as W (IGS cumulative solution) are the ones used in the Minimal Constraints condition.

5.1 IGS20

The Reference Frame considered in this section is the IGS20 (IGS cumulative solution), mapped from 2015.0 to the observation epoch.

```
ARA FINAL WEEKLY COMBINATION: FINAL ORBITS                      08-JAN-24 03:21
------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: IGS20             EPOCH: 2023-12-20 11:59:45

NUM  STATION NAME           X (M)          Y (M)          Z (M)     FLAG     SYSTEM

111  ACOR 13434M001    4594489.52112  -678367.34510  4357066.33018    W      G
 50  ALSA 19419M001    4677250.78487  -176770.30876  4319079.92679    A      GRE
384  BIAZ 10074M002    4634455.99977  -124344.88869  4365785.50523    W      GR
101  BIDA 00000M000    4644177.77252  -145778.23699  4354832.53080    A      GR
113  BRZR 19387M001    4662220.94325  -220769.81234  4333309.48702    A      GR
573  CACE 13447M001    4899866.46132  -544566.94843  4033770.25760    W      GRE
592  CANT 13438M001    4625924.27099  -307096.14987  4365771.60963    W      GRE
908  CREU 13432M001    4715420.07908   273178.14596  4271946.89560    W      GRE
135  EBRE 13410M001    4833519.94579    41537.47882  4147461.77099    W      GRE
180  ELGE 19353S001    4657557.34665  -202241.38360  4338991.93316    A      GRE
209  GERN 19389M001    4642811.27617  -217222.83847  4353278.92771    A      GR
257  HOND 15012M002    4640529.27114  -145675.89885  4358781.80615    A      GRE
235  IGEL 19352S001    4645951.38114  -165574.41692  4352550.47180    A      GRE
240  ISPS 19484M001    4640596.43148  -206963.68950  4356391.96427    A      GRE
252  LARE 19440M001    4632831.91049  -279026.05656  4360314.48025    A      GRE
256  LAZK 19354S001    4666098.29464  -178186.10493  4330463.72139    A      GRE
261  LEIT 19428M001    4663520.88793  -155858.63304  4334519.93681    A      GRE
334  ORON 19427M001    4659695.73090  -130864.65032  4338948.93572    A      GRE
345  PAS2 19351S001    4644909.01838  -156644.98400  4353623.13137    A      GRE
493  PASA 19351S001    4644909.01445  -156644.98306  4353623.12823    A      GRE
553  RIO1 13448M002    4708446.78013  -199490.19575  4284089.78649    A      GRE
558  SALA 13469M001    4803054.43752  -462130.98372  4158379.12654    A      GR
526  SCOA 10088M002    4639940.45840  -136224.85916  4359552.46810    W      GRE
715  SOPU 19386M001    4643997.86000  -255913.82122  4350063.19030    W      GR
443  TERU 13487M001    4867391.27533   -95523.25818  4108341.73807    A      GRE
616  YEBE 13420M001    4848724.52139  -261631.84113  4123094.38148    W      GRE
655  ZARA 13462M001    4773803.11893   -73505.89964  4215454.14719    W      GRE
```

5.2 ETRF2000 (ETRS89) Coordinates

European **T**errestrial **R**eference **S**ystem, **1989** (**ETRS89**) is realized by ETRF2000 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

```
CONVERT TO ETRF2000                                             08-JAN-24 03:21
------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: ETRF2000          EPOCH: 2023-12-20 11:59:45

NUM  STATION NAME           X (M)          Y (M)          Z (M)     FLAG     SYSTEM

111  ACOR 13434M001    4594489.86155  -678367.97224  4357065.85584    W
 50  ALSA 19419M001    4677251.18977  -176770.94487  4319079.45234    A
384  BIAZ 10074M002    4634456.41545  -124345.51952  4365785.03521    W
101  BIDA 00000M000    4644178.18444  -145778.86905  4354832.05964    A
113  BRZR 19387M001    4662221.34337  -220770.44677  4333309.01326    A
573  CACE 13447M001    4899866.79385  -544567.61170  4033769.75868    W
592  CANT 13438M001    4625924.66210  -307096.78015  4365771.13781    W
908  CREU 13432M001    4715420.54060   273177.50683  4271946.42401    W
135  EBRE 13410M001    4833520.36625    41536.82479  4147461.28600    W
180  ELGE 19353S001    4657557.74972  -202242.01742  4338991.46006    A
209  GERN 19389M001    4642811.67836  -217223.47055  4353278.45568    A
257  HOND 15012M002    4640529.68339  -145676.53047  4358781.33531    A
235  IGEL 19352S001    4645951.79022  -165575.04925  4352550.00021    A
240  ISPS 19484M001    4640596.83530  -206964.32130  4356391.49257    A
252  LARE 19440M001    4632832.30494  -279026.68760  4360314.00822    A
256  LAZK 19354S001    4666098.70026  -178186.73970  4330463.24789    A
261  LEIT 19428M001    4663521.29687  -155859.26745  4334519.46384    A
334  ORON 19427M001    4659696.14355  -130865.28419  4338948.46343    A
345  PAS2 19351S001    4644909.42874  -156645.61617  4353622.66000    A
493  PASA 19351S001    4644909.42481  -156645.61523  4353622.65686    A
553  RIO1 13448M002    4708447.17917  -199490.83564  4284089.30903    A
558  SALA 13469M001    4803054.79116  -462131.63544  4158378.63720    A
526  SCOA 10088M002    4639940.87198  -136225.49068  4359551.99744    W
715  SOPU 19386M001    4643998.25674  -255914.45354  4350062.71763    W
443  TERU 13487M001    4867391.67425   -95523.91666  4108341.24826    A
616  YEBE 13420M001    4848724.89917  -261632.49785  4123093.89099    W
655  ZARA 13462M001    4773803.52940   -73506.54695  4215453.66580    W
```

5.3 ETRF2014 (ETRS89) Coordinates

European **T**errestrial **R**eference **S**ystem, **1989** (**ETRS89**) is realized by ETRF2014 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

CONVERT TO ETRF2014 08-JAN-24 03:21

LOCAL GEODETIC DATUM: ETRF2014 EPOCH: 2023-12-20 11:59:45

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG	SYSTEM
111	ACOR 13434M001	4594489.82147	-678368.00917	4357065.90816	W	
50	ALSA 19419M001	4677251.14725	-176770.98330	4319079.50456	A	
384	BIAZ 10074M002	4634456.37321	-124345.55834	4365785.08759	W	
101	BIDA 00000M000	4644178.14218	-145778.90774	4354832.11198	A	
113	BRZR 19387M001	4662221.30117	-220770.48511	4333309.06550	A	
573	CACE 13447M001	4899866.74991	-544567.64777	4033769.81015	W	
592	CANT 13438M001	4625924.62058	-307096.81833	4365771.19012	W	
908	CREU 13432M001	4715420.49594	273177.46693	4271946.47644	W	
135	EBRE 13410M001	4833520.32115	41536.78626	4147461.33791	W	
180	ELGE 19353S001	4657557.70750	-202242.05585	4338991.51233	A	
209	GERN 19389M001	4642811.63636	-217223.50899	4353278.50798	A	
257	HOND 15012M002	4640529.64117	-145676.56918	4358781.38766	A	
235	IGEL 19352S001	4645951.74801	-165575.08786	4352550.05254	A	
240	ISPS 19484M001	4640596.79329	-206964.35978	4356391.54489	A	
252	LARE 19440M001	4632832.26325	-279026.72585	4360314.06053	A	
256	LAZK 19354S001	4666098.65786	-178186.77818	4330463.30014	A	
261	LEIT 19428M001	4663521.25443	-155859.30602	4334519.51611	A	
334	ORON 19427M001	4659696.10107	-130865.32288	4338948.51572	A	
345	PAS2 19351S001	4644909.38651	-156645.65483	4353622.71233	A	
493	PASA 19351S001	4644909.38258	-156645.65389	4353622.70919	A	
553	RIO1 13448M002	4708447.13638	-199490.87385	4284089.36114	A	
558	SALA 13469M001	4803054.74813	-462131.67225	4158378.68894	A	
526	SCOA 10088M002	4639940.82973	-136225.52943	4359552.04980	W	
715	SOPU 19386M001	4643998.21485	-255914.49183	4350062.76991	W	
443	TERU 13487M001	4867391.62926	-95523.95454	4108341.29998	A	
616	YEBE 13420M001	4848724.85497	-261632.53520	4123093.94267	W	
655	ZARA 13462M001	4773803.48542	-73506.58534	4215453.71780	W	

6 Quality Control

6.1 Mean and Daily Repeatabilities

In this section, the mean and daily repeatabilities of the sites are shown. Repatabilities refer to the IGS20 solution and are given with respect to the Local frame (North-East-Up).

```
GFA FINAL WEEKLY COMBINATION: FINAL ORBITS                    08-JAN-24 03:21
-------------------------------------------------------------------------------
                     Weekday     Repeatability (mm)
Station        #Days 0123456      N      E      U
-------------------------------------------------------
ACOR 13434M001     7 XXXXXXX     0.68   0.96   3.31
ALSA 19419M001     7 XXXXXXX     1.16   0.80   2.72
BIAZ 10074M002     5 XXXXX       1.69   0.99   2.19
BIDA 00000M000     7 XXXXXXX     1.60   1.23   5.48
BRZR 19387M001     7 XXXXXXX     0.96   0.97   3.43
CACE 13447M001     7 XXXXXXX     0.41   0.76   3.10
CANT 13438M001     7 XXXXXXX     0.57   0.81   3.81
CREU 13432M001     6 XXXXX X     0.73   0.79   3.97
EBRE 13410M001     6 XXXXX X     0.86   0.86   6.39
ELGE 19353S001     7 XXXXXXX     1.92   1.42   3.61
GERN 19389M001     6 XXXX XX     1.94   2.36   9.42
HOND 15012M002     7 XXXXXXX     1.02   0.94   3.13
IGEL 19352S001     7 XXXXXXX     0.87   1.00   3.79
ISPS 19484M001     6 X XXXXX     0.91   0.75   4.19
LARE 19440M001     7 XXXXXXX     1.31   0.69   2.17
LAZK 19354S001     7 XXXXXXX     0.83   1.01   4.24
LEIT 19428M001     7 XXXXXXX     1.92   0.62   4.35
ORON 19427M001     7 XXXXXXX     1.19   0.95   5.30
PAS2 19351S001     3   XXX       1.77   0.70  11.82
PASA 19351S001     7 XXXXXXX     0.62   0.86   4.80
RIO1 13448M002     7 XXXXXXX     1.36   1.10   5.60
SALA 13469M001     7 XXXXXXX     0.43   0.82   0.97
SCOA 10088M002     7 XXXXXXX     0.78   0.75   3.54
SOPU 19386M001     7 XXXXXXX     1.20   0.71   3.22
TERU 13487M001     7 XXXXXXX     0.99   0.85   3.71
YEBE 13420M001     7 XXXXXXX     0.48   0.73   2.17
ZARA 13462M001     7 XXXXXXX     1.33   0.85   2.99

Comparison of individual solutions:
-----------------------------------
ACOR 13434M001   N    0.68    -1.15    0.16    0.08   -0.07   -0.40    0.77    0.83
ACOR 13434M001   E    0.96     1.74    0.26   -1.13    0.49   -0.28    0.78    0.46
ACOR 13434M001   U    3.31    -1.71   -6.39    0.31   -3.88   -2.17    1.20    0.75
ALSA 19419M001   N    1.16    -0.07   -1.91   -0.73    0.75   -0.49    1.76    0.02
ALSA 19419M001   E    0.80     0.20    1.17    0.80   -0.99    0.02    0.89   -0.09
ALSA 19419M001   U    2.72     0.17    2.31   -2.77   -2.23    3.09    3.42    2.26
BIAZ 10074M002   N    1.69    -0.07   -1.05   -0.35    2.64    1.78
BIAZ 10074M002   E    0.99     0.01   -0.24   -1.08    0.26    1.61
BIAZ 10074M002   U    2.19    -0.97   -1.91    0.37   -1.02    3.66
BIDA 00000M000   N    1.60    -2.20   -1.79    0.76    1.44    0.71    1.84    0.92
BIDA 00000M000   E    1.23     1.58    0.72    0.77   -1.40   -1.72    0.11    0.69
BIDA 00000M000   U    5.48    -3.51   -1.59   -6.40    2.83    5.33    7.77    5.27
BRZR 19387M001   N    0.96     0.72    0.87    0.97   -0.08   -0.63   -1.23   -1.19
BRZR 19387M001   E    0.97    -0.05   -0.26    0.06    0.10    0.21    2.26   -0.69
BRZR 19387M001   U    3.43    -0.14   -1.53   -1.78    3.73    4.30    5.67    0.57
CACE 13447M001   N    0.41     0.22   -0.30   -0.07   -0.45   -0.69   -0.17   -0.39
CACE 13447M001   E    0.76     1.11    0.49   -0.17   -0.19   -0.69    1.16   -0.34
CACE 13447M001   U    3.10     1.64   -1.81    1.88    1.04   -6.76   -0.66    0.96
CANT 13438M001   N    0.57     0.42    0.03    0.78    0.08   -0.28    0.53   -0.88
CANT 13438M001   E    0.81     0.45    0.30    0.48   -1.03    0.26    1.51   -0.11
CANT 13438M001   U    3.81    -1.16   -3.25   -0.09    0.30    4.99    6.98    1.16
CREU 13432M001   N    0.73     0.38    0.59    1.07    0.66   -0.31            -0.69
CREU 13432M001   E    0.79    -1.46   -0.04    0.06    0.95    0.17             0.28
CREU 13432M001   U    3.97    -4.08   -3.99   -0.55    3.43    5.75             1.03
EBRE 13410M001   N    0.86     1.10    1.42    0.26   -0.43   -0.15            -0.42
EBRE 13410M001   E    0.86    -0.73    0.33    1.09   -0.91    0.81            -0.66
EBRE 13410M001   U    6.39    -7.34   -3.83   -1.63    7.14    8.96            -1.39
ELGE 19353S001   N    1.92     1.93    1.49    2.38   -2.37   -1.27   -1.25   -1.33
ELGE 19353S001   E    1.42    -1.29   -0.97   -0.82    1.19    0.25    2.64    0.53
ELGE 19353S001   U    3.61     0.88   -3.34   -1.71    1.70    5.86    3.62    3.58
GERN 19389M001   N    1.94     2.23    2.04    0.33   -1.86           -1.28   -2.11
GERN 19389M001   E    2.36     2.51    2.32    1.27   -0.04           -3.39   -1.71
GERN 19389M001   U    9.42    -5.80   -8.11   -7.33    4.45           12.23   11.00
HOND 15012M002   N    1.02    -0.26   -0.08    1.37    1.94   -0.36   -0.22   -0.61
HOND 15012M002   E    0.94     0.27    0.35   -0.33   -0.66    0.20    1.92   -0.90
HOND 15012M002   U    3.13    -1.43    1.88   -2.53    1.27    5.02    4.46    0.39
IGEL 19352S001   N    0.87     0.83    0.25    1.37    0.23    0.16   -1.30    0.37
IGEL 19352S001   E    1.00    -0.15   -0.20   -0.48   -0.97    0.66    2.10   -0.06
IGEL 19352S001   U    3.79    -0.15   -1.00   -4.40    0.71    5.51    4.87    3.35
ISPS 19484M001   N    0.91     0.95            1.12   -0.31   -1.13   -0.75   -0.23
ISPS 19484M001   E    0.75     0.36            0.07   -0.29    0.82    1.05   -0.90
ISPS 19484M001   U    4.19    -3.39           -1.85    3.80    3.81    4.40    4.97
LARE 19440M001   N    1.31     2.33    1.02    0.91   -0.49   -0.42   -0.71   -1.46
LARE 19440M001   E    0.69     0.31    0.58    1.00   -0.92   -0.11    0.65   -0.36
LARE 19440M001   U    2.17     1.25   -1.52   -0.80   -1.63    0.06    4.50    0.89
LAZK 19354S001   N    0.83     0.35    0.11    0.77    0.86   -1.20   -0.66   -0.90
LAZK 19354S001   E    1.01    -0.28   -0.66   -0.58   -0.19    1.07    1.89    0.73
LAZK 19354S001   U    4.24    -2.90   -0.45   -1.10    1.02    8.89    3.52   -2.36
LEIT 19428M001   N    1.92    -3.95   -0.60    1.10    1.26    0.05    1.75    0.48
LEIT 19428M001   E    0.62     0.19    0.98    0.18   -0.77    0.36    0.50   -0.55
LEIT 19428M001   U    4.35    -0.89   -0.05   -2.90   -2.72    1.67    9.49    2.09
ORON 19427M001   N    1.19    -0.30   -1.32   -0.48    2.35   -0.01    0.61   -0.72
ORON 19427M001   E    0.95    -0.28    0.00   -0.00   -0.45   -0.25    2.24    0.10
ORON 19427M001   U    5.30    -0.49    0.96   -2.51   -3.66    8.06    7.69    4.86
PAS2 19351S001   N    1.77            -1.08    1.34    1.81
PAS2 19351S001   E    0.70            -0.86    0.48   -0.06
PAS2 19351S001   U   11.82            12.41  -10.98   -2.23
PASA 19351S001   N    0.62     0.27    0.14    1.20    0.67    0.27   -0.26   -0.40
PASA 19351S001   E    0.86    -0.22    0.15   -0.28   -0.47    0.33    1.91   -0.54
PASA 19351S001   U    4.80    -2.34    0.70   -5.55    0.67    7.22    6.79    1.72
RIO1 13448M002   N    1.36    -0.43   -0.48   -0.15   -1.51    2.56   -1.32    0.33
RIO1 13448M002   E    1.10     0.72    0.09   -0.23    0.49   -1.03    2.33   -0.02
RIO1 13448M002   U    5.60    -0.94   -4.69   -2.82    3.66    3.97   11.29   -0.75
SALA 13469M001   N    0.43    -0.57   -0.54    0.26   -0.62   -0.12   -0.05    0.19
```

SALA	13469M001	E	0.82	1.03	0.22	-0.09	0.47	0.02	1.61	0.38
SALA	13469M001	U	0.97	-0.32	0.52	-1.00	-0.18	0.59	1.56	-1.19
SCOA	10088M002	N	0.78	-0.23	-0.10	0.83	1.47	0.09	-0.05	-0.83
SCOA	10088M002	E	0.75	0.39	0.49	0.16	-0.69	-0.60	1.43	-0.35
SCOA	10088M002	U	3.54	-1.84	3.26	-1.72	-0.35	6.72	3.18	1.67
SOPU	19386M001	N	1.20	-1.46	-0.92	-0.16	0.39	1.82	1.10	-0.95
SOPU	19386M001	E	0.71	1.05	0.98	0.32	0.26	-0.90	-0.05	-0.02
SOPU	19386M001	U	3.22	1.62	-0.93	-2.75	4.16	4.13	4.04	0.62
TERU	13487M001	N	0.99	0.09	-0.31	0.26	-1.57	-1.58	0.72	-0.46
TERU	13487M001	E	0.85	-0.28	0.23	1.01	-0.64	-1.17	0.98	0.63
TERU	13487M001	U	3.71	-1.39	-2.40	-1.69	2.79	3.00	7.36	-0.94
YEBE	13420M001	N	0.48	0.35	-0.12	-0.13	-0.87	-0.67	0.12	0.06
YEBE	13420M001	E	0.73	0.63	0.36	0.52	0.46	-0.17	1.48	0.13
YEBE	13420M001	U	2.17	0.17	-1.38	-0.12	1.19	-3.73	-0.08	3.31
ZARA	13462M001	N	1.33	-1.35	-1.47	-1.30	1.08	0.04	1.49	-1.26
ZARA	13462M001	E	0.85	-0.65	-0.62	-0.05	-0.31	1.07	1.40	0.58
ZARA	13462M001	U	2.99	3.69	1.61	-0.75	4.25	3.55	-2.17	1.16

6.2 Datum verification

In this section, the datum verification is shown. A 3 parameter Helmert 3D (3 translations) is computed to the minimally constrained sites.

```
TRANSFORMATION IN EQUATORIAL SYSTEM (X, Y, Z):
RESIDUALS IN LOCAL SYSTEM (NORTH, EAST, UP)


LIST OF REMOVED STATIONS:

OUTLIER CRITERIA:                    15.00     15.00     20.00

ITERATION   1: CREU 13432M001        -2.98    -43.90    -78.51
ITERATION   2: ESCO 13435M001       -70.53     42.24     10.54
ITERATION   3: GAIA 13902M001         4.08     -8.90     37.67
```

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS			
1	ACOR 13434M001	I W	2.52	-1.09	-1.03	
2	ALAC 13433M001	I W	-0.53	0.59	2.21	
3	ALME 13437M001	I W	-1.37	-0.40	3.20	
4	BCL1 19482M001	I W	-1.48	1.57	-0.11	
5	BELL 13431M001	I W	0.11	0.47	1.01	
6	BIAZ 10074M002	I W	1.77	0.21	-1.19	
7	BORR 13480M001	I W	-2.95	-2.41	-0.34	
8	BRST 10004M004	I W	1.68	-2.15	2.17	
9	CACE 13447M001	I W	0.14	0.87	5.54	
10	CANT 13438M001	I W	2.63	0.68	-1.11	
11	CASC 13909S001	I W	-0.08	-1.75	1.47	
12	CEU1 13449M002	I W	0.30	0.05	-3.72	
13	CREU 13432M001	I W	-4.72	-44.34	-79.20	*
14	EBRE 13410M001	I W	1.35	2.38	-3.89	
15	ESCO 13435M001	I W	-72.18	42.96	11.73	*
16	FLRS 31907M001	I W	-1.35	-5.39	-8.65	
17	FUER 31330M001	I W	-1.48	-1.18	1.69	
18	GAIA 13902M001	I W	4.19	-9.12	38.64	*
19	HUEL 13451M001	I W	0.46	1.77	-7.16	
20	IBIZ 13454S001	I W	-0.38	1.19	0.11	
21	IZAN 31309M002	I W	-2.62	-1.52	0.43	
22	LAGO 13903M001	I W	-0.69	-1.83	0.87	
23	LLIV 13436M001	I W	-2.38	1.21	3.67	
24	LPAL 81701M001	I W	-0.59	-0.63	-3.82	
25	LROC 10023M001	I W	1.03	0.47	3.44	
26	MADR 13407S012	I W	-2.89	0.64	1.31	
27	MAL1 13444M002	I W	1.94	1.07	-4.87	
28	MALA 13443M001	I W	2.00	-1.05	1.21	
29	MALL 13444M001	I W	-1.40	1.54	-0.04	
30	MAS1 31303M002	I W	-2.60	-3.46	0.51	
31	MELI 19379M001	I W	-0.47	0.15	3.23	
32	PDEL 31906M004	I W	-0.21	-1.59	0.37	
33	RABT 35001M002	I W	-0.56	-1.30	-4.74	
34	SCOA 10088M002	I W	4.07	2.43	-6.47	
35	SFER 13402M004	I W	-0.67	-2.98	1.45	
36	SOPU 19386M001	I W	0.69	1.15	1.71	
37	VALE 13439M001	I W	-0.30	3.27	-0.96	
38	VIGO 13450M001	I W	1.47	-0.01	2.97	
39	VILL 13406M001	I W	-1.02	-0.74	5.88	
40	YEBE 13420M001	I W	-0.93	0.86	5.21	
41	ZARA 13462M001	I W	-1.03	2.14	0.39	
42	ZIMM 14001M004	I W	0.12	0.88	5.11	
	RMS / COMPONENT		1.63	1.79	3.48	
	IQR		2.38	2.44	3.32	
	MEAN		-0.15	-0.10	0.18	
	MEDIAN		-0.38	0.21	0.51	
	MIN		-2.95	-5.39	-8.65	
	MAX		4.07	3.27	5.88	
	OVERALL RMS/IQR/MAX(3D)		2.45	2.62	10.28	FLRS 31907M001 #SUM
ALL	RMS / COMPONENT		11.42	9.90	14.28	
ALL	IQR		2.41	2.67	4.08	
ALL	MEAN		-1.87	-0.34	-0.52	
ALL	MEDIAN		-0.43	0.18	0.69	
ALL	MIN		-72.18	-44.34	-79.20	
ALL	MAX		4.19	42.96	38.64	
ALL	OVERALL RMS/IQR/MAX(3D)		12.01	2.82	90.89	CREU 13432M001 #SUM_ALL

```
NUMBER OF PARAMETERS  :     3
NUMBER OF STATIONS    :    39
NUMBER OF COORDINATES :   117
RMS OF TRANSFORMATION :    2.45 MM


PARAMETERS:

TRANSLATION IN  X     :          -0.69     +-  0.39    MM
TRANSLATION IN  Y     :           0.40     +-  0.39    MM
TRANSLATION IN  Z     :           1.75     +-  0.39    MM


NUMBER OF ITERATIONS  :     3


ACCEPTED STATIONS     :    39    92.86 %
VERIFIED STATIONS     :     0     0.00 %
REJECTED STATIONS     :     3     7.14 %


LIST OF VERIFIED/REJECTED STATIONS
----------------------------------
```

6.3 Adjustment Statistics

In this section, the summary of the global adjustment and not subnetworks are shown. Also, the Helmert parameters of the combined solution with respect to the daily solutions are shown.

```
*_STATISTICAL PARAMETER________ __VALUE(S)____________
 NUMBER OF OBSERVATIONS                       18207191
 NUMBER OF UNKNOWNS                             178813
 NUMBER OF DEGREES OF FREEDOM                 18028378
 PHASE MEASUREMENTS SIGMA                      0.00100
 SAMPLING INTERVAL (SECONDS)                       180
 VARIANCE FACTOR                    3.151091697905793
```

7 Equipment

7.1 Receiver List

Serial numbers not shown.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ FIRMWARE___
 ACOR  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 ALSA  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 BIAZ  A    1 P 23:351:00000 23:355:86370 SPECTRA SP90M        ----- -----------
 BIDA  A    1 P 23:351:00000 23:357:86370 LEICA GR10           ----- -----------
 BRZR  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 CACE  A    1 P 23:351:00000 23:357:86370 TRIMBLE NETR9        ----- -----------
 CANT  A    1 P 23:351:00000 23:357:86370 LEICA GR10           ----- -----------
 CREU  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 EBRE  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 ELGE  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 GERN  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 HOND  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 IGEL  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 ISPS  A    1 P 23:351:00000 23:357:86370 TRIMBLE NETR9        ----- -----------
 LARE  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 LAZK  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 LEIT  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 ORON  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 PAS2  A    1 P 23:352:00000 23:354:86370 STONEX SC2200        ----- -----------
 PASA  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 RIO1  A    1 P 23:351:00000 23:357:86370 LEICA GR25           ----- -----------
 SALA  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 SCOA  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 SOPU  A    1 P 23:351:00000 23:357:86370 LEICA GR30           ----- -----------
 TERU  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 YEBE  A    1 P 23:351:00000 23:357:86370 LEICA GR50           ----- -----------
 ZARA  A    1 P 23:351:00000 23:357:86370 TRIMBLE NETR9        ----- -----------
```

7.2 Antennas

Serial number ONLY provided in case individual calibrations are used.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ DAZI
 ACOR  A    1 P 23:351:00000 23:357:86370 LEIAT504           LEIS -----
 ALSA  A    1 P 23:351:00000 23:357:86370 LEIAR10            NONE -----
 BIAZ  A    1 P 23:351:00000 23:355:86370 LEIAR25            LEIT -----
 BIDA  A    1 P 23:351:00000 23:357:86370 LEIAS10            NONE -----
 BRZR  A    1 P 23:351:00000 23:357:86370 LEIAS10            NONE -----
 CACE  A    1 P 23:351:00000 23:357:86370 TRM29659.00        NONE -----
 CANT  A    1 P 23:351:00000 23:357:86370 LEIAR25.R4         LEIT -----
 CREU  A    1 P 23:351:00000 23:357:86370 LEIAR25.R4         NONE -----
 EBRE  A    1 P 23:351:00000 23:357:86370 LEIAR25.R4         NONE -----
 ELGE  A    1 P 23:351:00000 23:357:86370 LEIAR25.R4         LEIT -----
 GERN  A    1 P 23:351:00000 23:357:86370 LEIAS10            NONE -----
 HOND  A    1 P 23:351:00000 23:357:86370 LEIAR20            LEIM -----
 IGEL  A    1 P 23:351:00000 23:357:86370 LEIAR20            LEIM -----
 ISPS  A    1 P 23:351:00000 23:357:86370 TRM59900.00        SCIS -----
 LARE  A    1 P 23:351:00000 23:357:86370 LEIAR20            LEIM -----
 LAZK  A    1 P 23:351:00000 23:357:86370 LEIAR25.R4         LEIT -----
 LEIT  A    1 P 23:351:00000 23:357:86370 LEIAR10            NONE -----
 ORON  A    1 P 23:351:00000 23:357:86370 LEIAR10            NONE -----
 PAS2  A    1 P 23:352:00000 23:354:86370 LEIAR20            LEIM -----
 PASA  A    1 P 23:351:00000 23:357:86370 LEIAR20            LEIM -----
 RIO1  A    1 P 23:351:00000 23:357:86370 LEIAR25.R4         LEIT -----
 SALA  A    1 P 23:351:00000 23:357:86370 LEIAR25            NONE -----
 SCOA  A    1 P 23:351:00000 23:357:86370 TRM55971.00        NONE -----
 SOPU  A    1 P 23:351:00000 23:357:86370 LEIAS10            NONE -----
 TERU  A    1 P 23:351:00000 23:357:86370 LEIAR20            LEIM -----
 YEBE  A    1 P 23:351:00000 23:357:86370 LEIAR20            LEIM -----
 ZARA  A    1 P 23:351:00000 23:357:86370 TRM29659.00        NONE -----
```

7.3 Eccentricities

```
*                                          UP______ NORTH___ EAST____
*SITE PT SOLN T DATA_START__ DATA_END____ AXE ARP->BENCHMARK(M)_________
 ACOR  A    1 P 23:351:00000 23:357:86370 UNE   3.0460   0.0000   0.0000
```

```
ALSA  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
BIAZ  A    1 P 23:351:00000 23:355:86370 UNE   0.0000   0.0000   0.0000
BIDA  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
BRZR  A    1 P 23:351:00000 23:357:86370 UNE   0.0771   0.0000   0.0000
CACE  A    1 P 23:351:00000 23:357:86370 UNE   0.0600   0.0000   0.0000
CANT  A    1 P 23:351:00000 23:357:86370 UNE   3.0490   0.0000   0.0000
CREU  A    1 P 23:351:00000 23:357:86370 UNE   0.0770   0.0000   0.0000
EBRE  A    1 P 23:351:00000 23:357:86370 UNE   0.0770   0.0000   0.0000
ELGE  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
GERN  A    1 P 23:351:00000 23:357:86370 UNE   0.0771   0.0000   0.0000
HOND  A    1 P 23:351:00000 23:357:86370 UNE   0.0771   0.0000   0.0000
IGEL  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
ISPS  A    1 P 23:351:00000 23:357:86370 UNE   0.0350   0.0000   0.0000
LARE  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
LAZK  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
LEIT  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
ORON  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
PAS2  A    1 P 23:352:00000 23:354:86370 UNE   0.0000   0.0000   0.0000
PASA  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
RIO1  A    1 P 23:351:00000 23:357:86370 UNE   0.0606   0.0000   0.0000
SALA  A    1 P 23:351:00000 23:357:86370 UNE   0.0600   0.0000   0.0000
SCOA  A    1 P 23:351:00000 23:357:86370 UNE   0.0000   0.0000   0.0000
SOPU  A    1 P 23:351:00000 23:357:86370 UNE   0.0771   0.0000   0.0000
TERU  A    1 P 23:351:00000 23:357:86370 UNE   0.0600   0.0000   0.0000
YEBE  A    1 P 23:351:00000 23:357:86370 UNE   0.0600   0.0000   0.0000
ZARA  A    1 P 23:351:00000 23:357:86370 UNE   3.2590   0.0000   0.0000
```

8 Inconsistencies (logsheet-RINEX metadata)

The following inconsistencies were found comparing the data available in the logsheets and the RINEX headers:

```
2024-01-07 05:05 UTC | LARE3510.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-07 07:57 UTC | LARE3520.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-07 10:45 UTC | LARE3530.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-07 13:22 UTC | LARE3540.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-07 16:16 UTC | LARE3550.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-07 19:05 UTC | LARE3560.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2024-01-07 22:22 UTC | LARE3570.23O | RECEIVER FIRM. VERS. |  4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
```

9 References

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

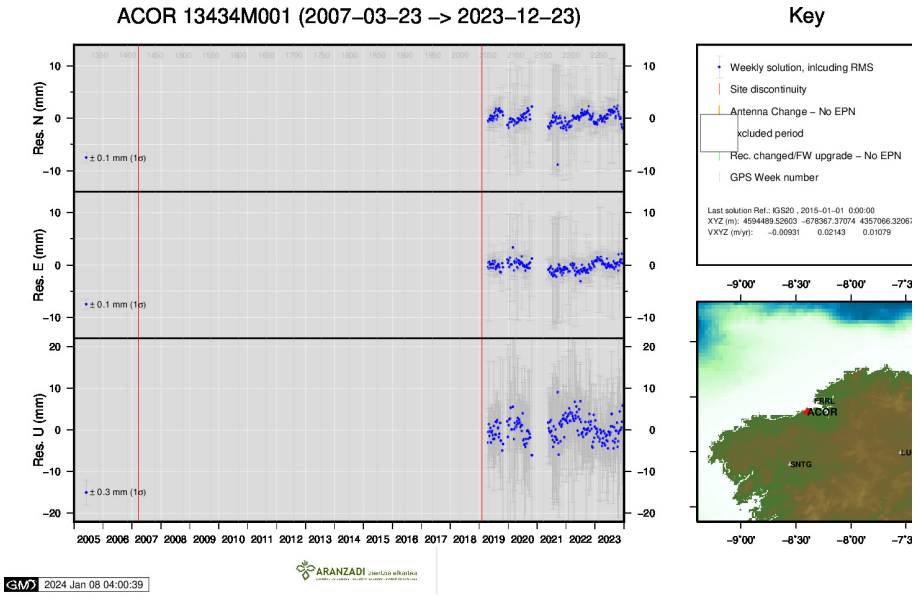
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres.* epncb.oma.be/$_d$*ocumentation/guidelines/guidelines*$_a$*nalysis*$_c$*entres.pdf*

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

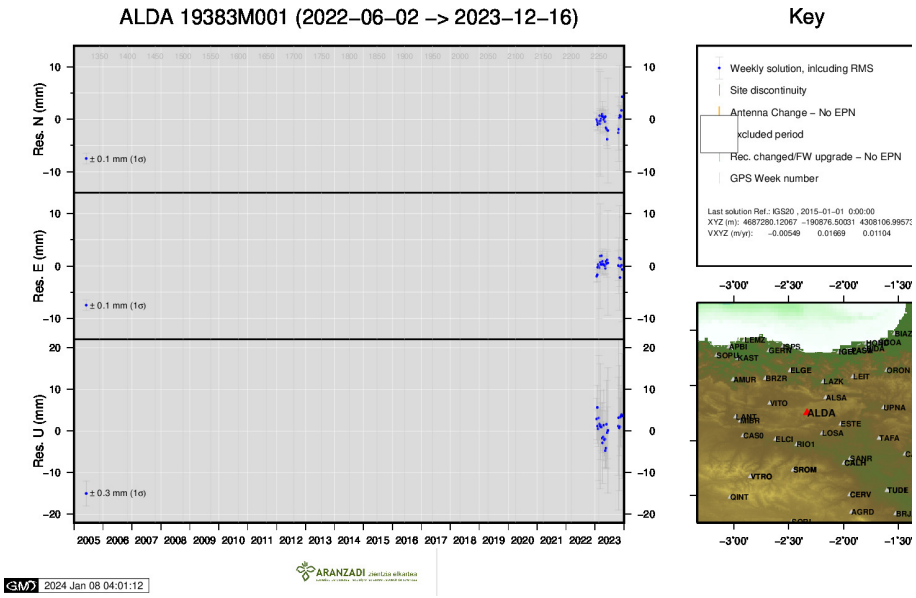
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems.* etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf

10 Cumulative Time Series

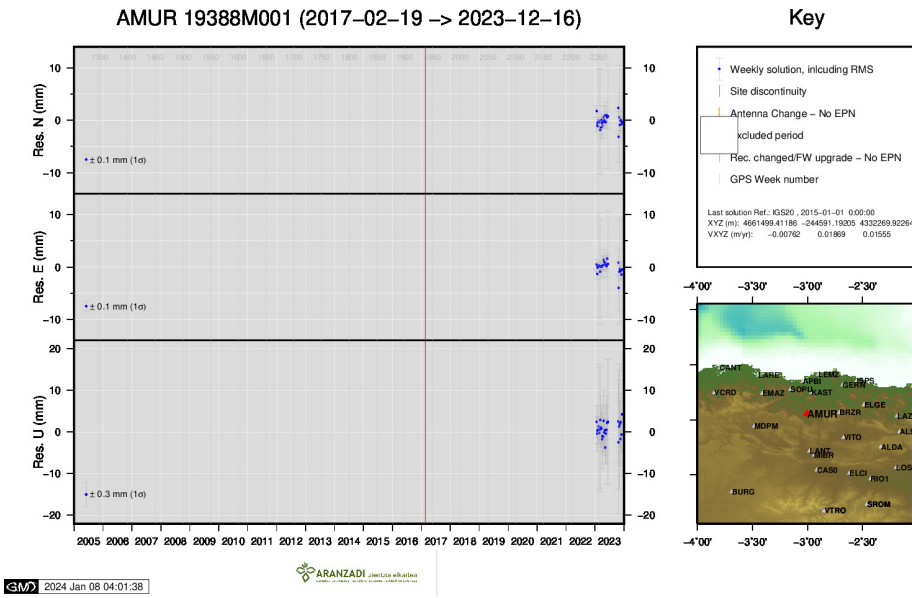
Time series of stations. Latest plots at: http://geolabpasaia.org/gnss/ARA-net/TSeries/, or click on the caption of each image.



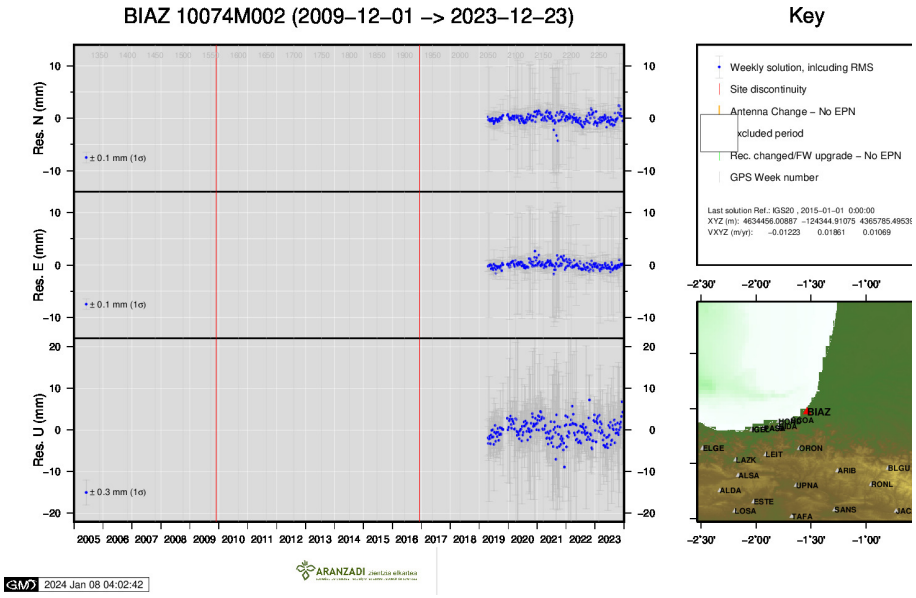
1) ACOR



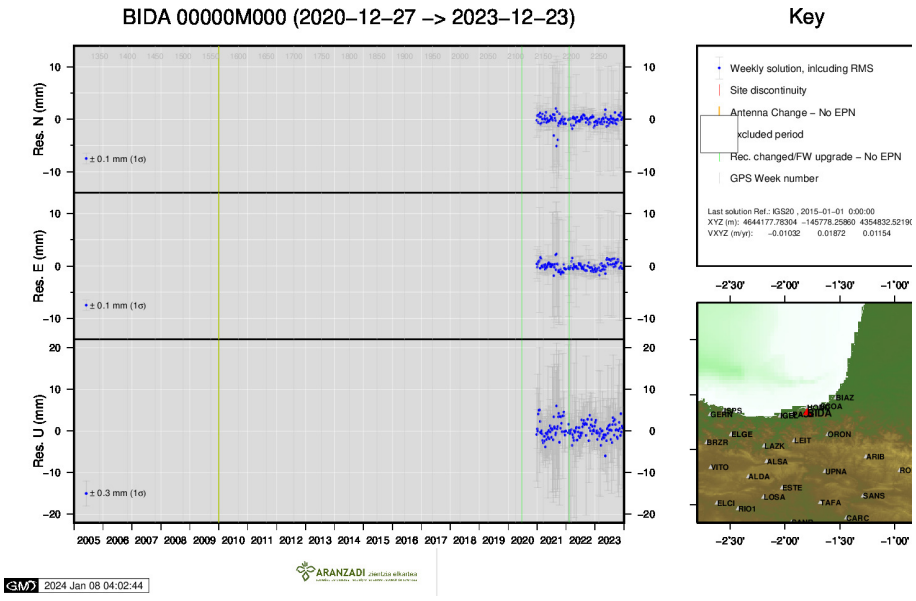
2) ALDA



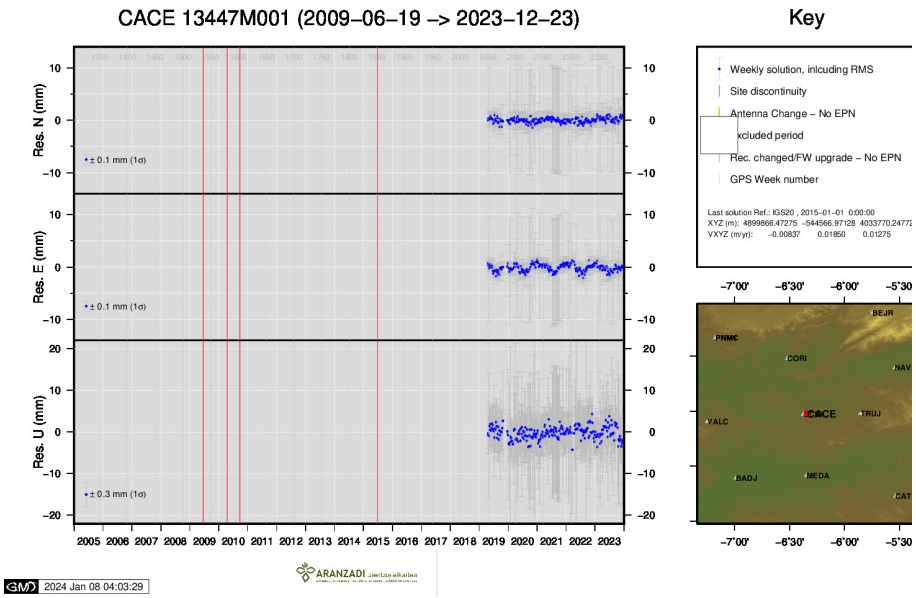
3) AMUR



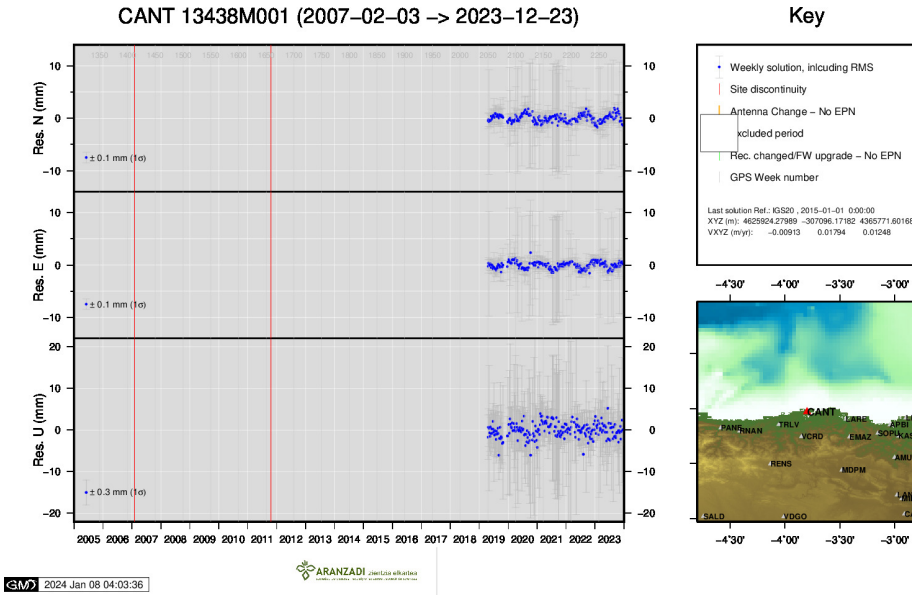
4) BIAZ



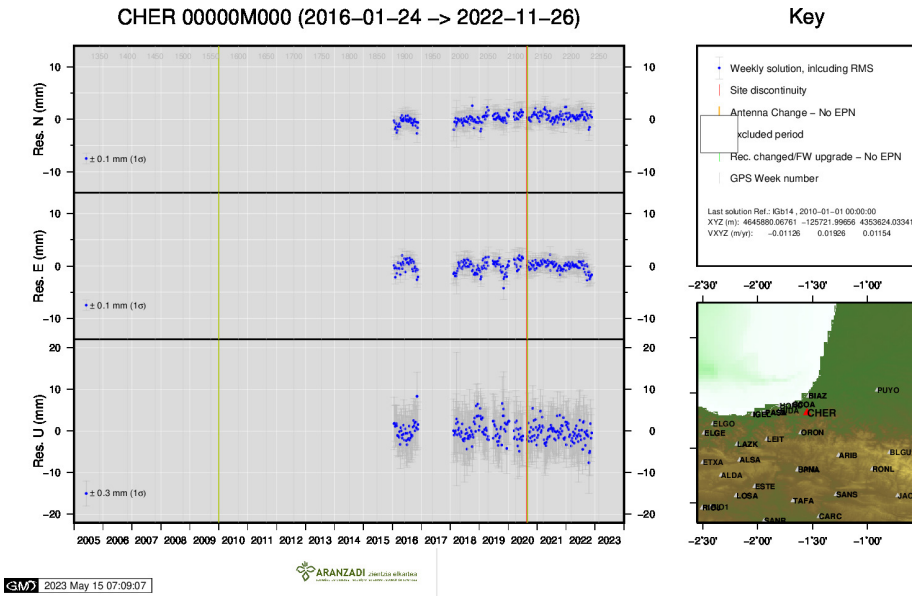
5) BIDA



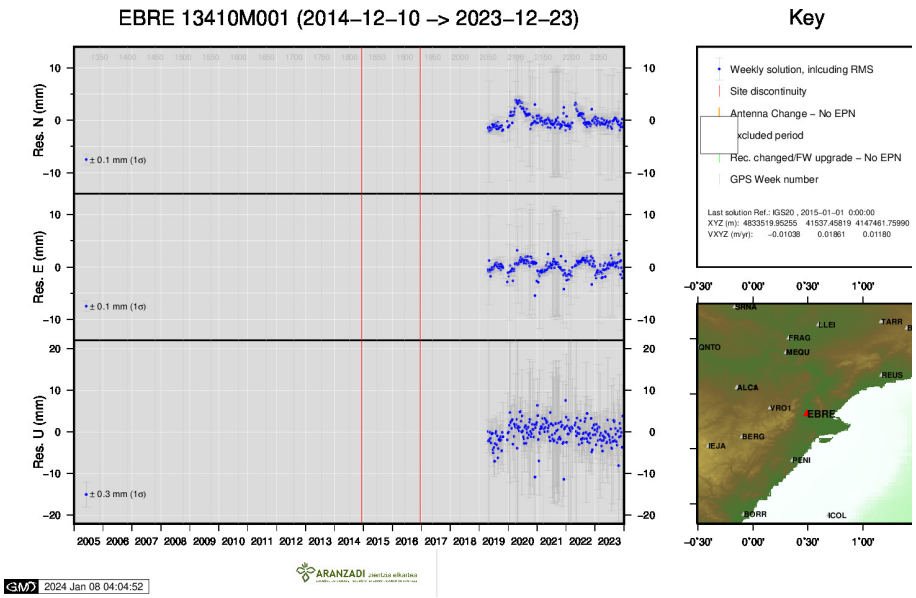
6) CACE



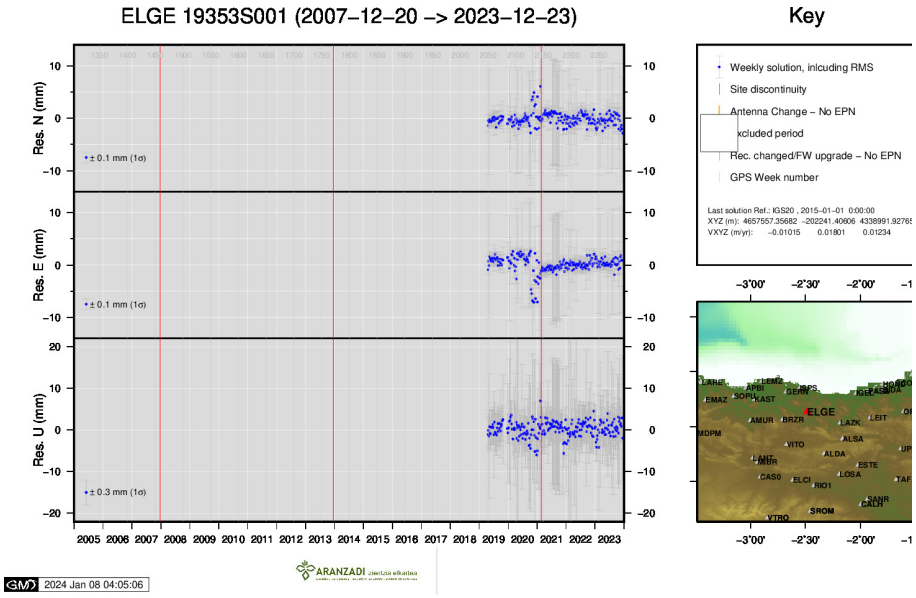
7) CANT



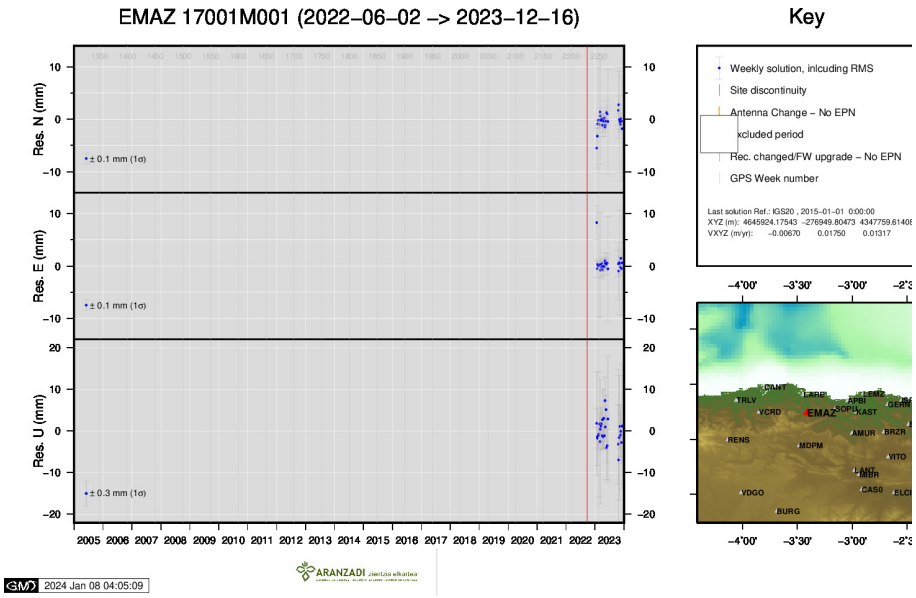
8) CHER



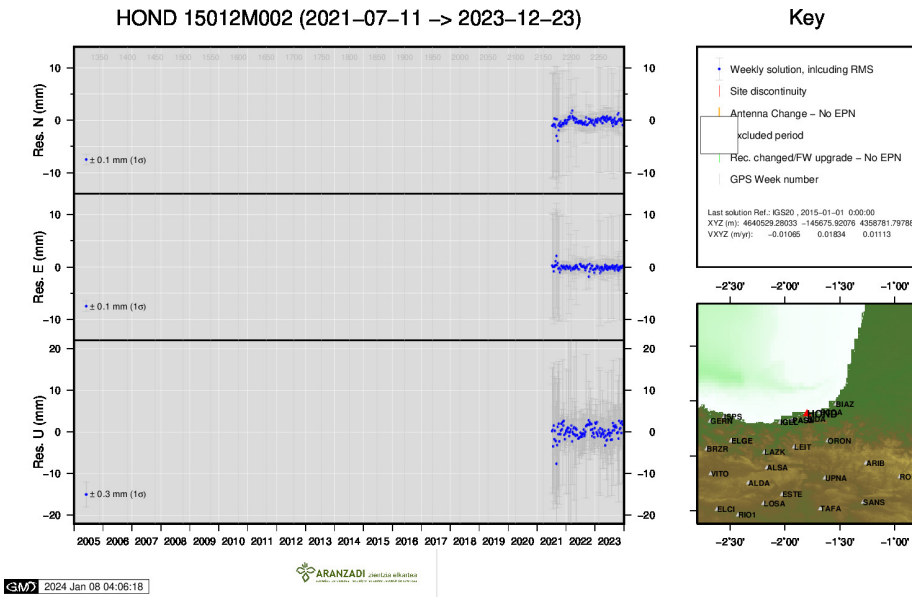
9) EBRE



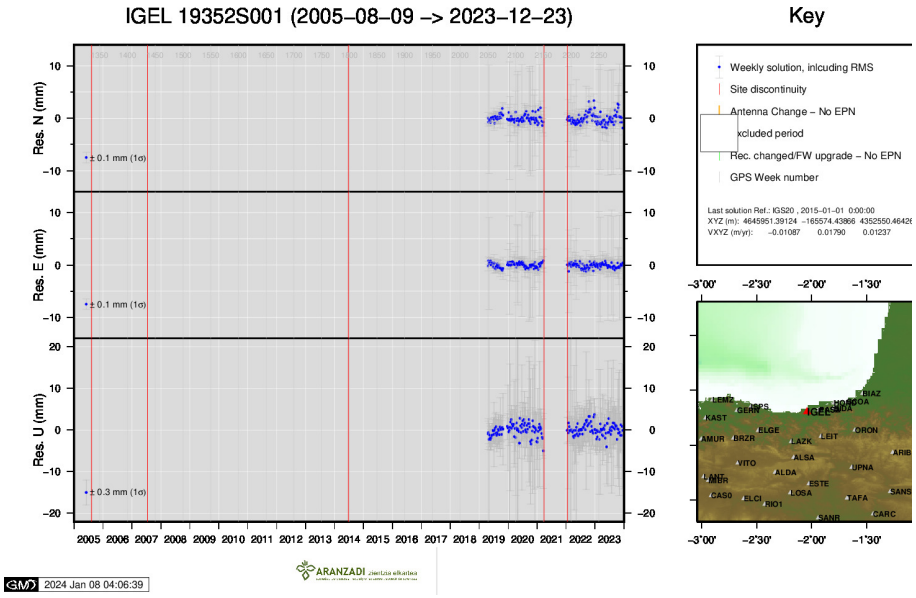
10) ELGE



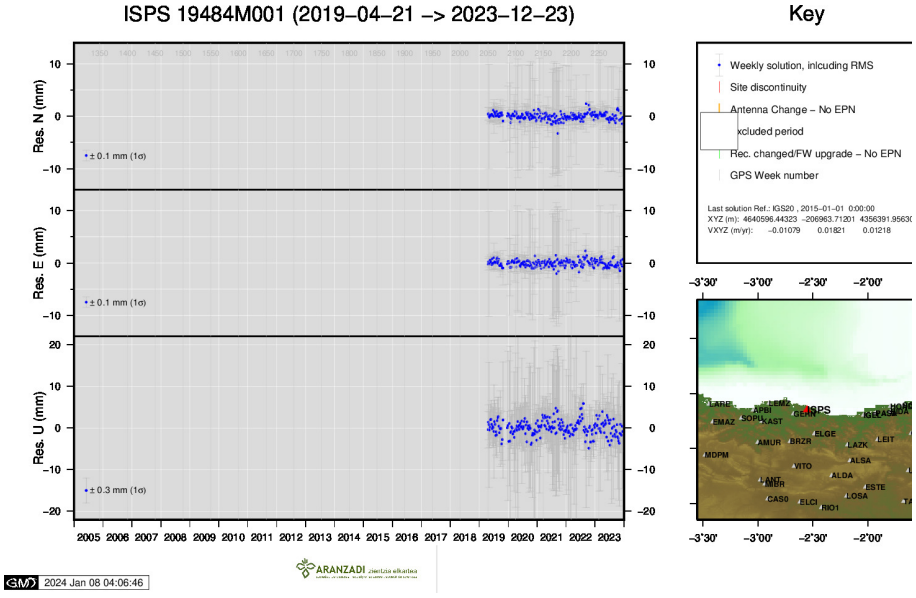
11) EMAZ



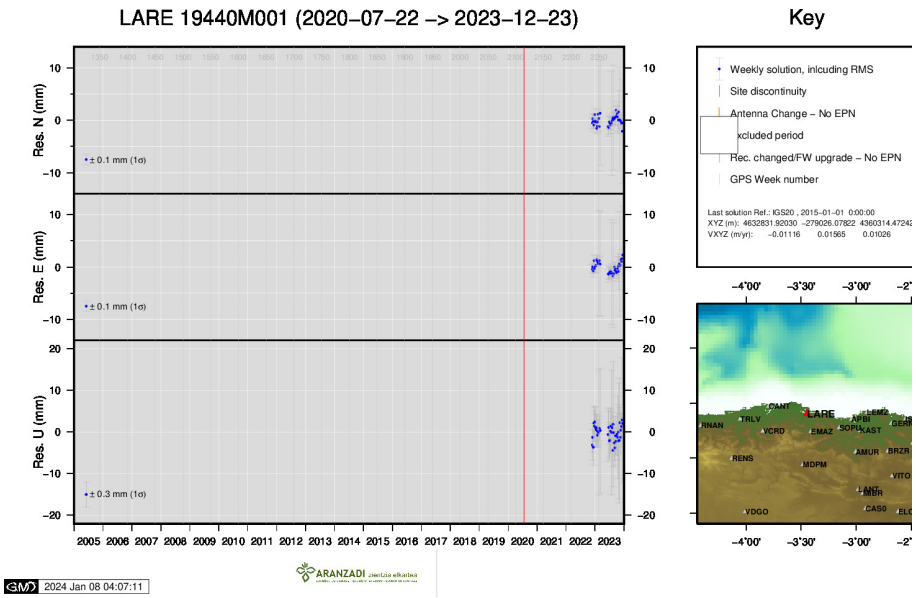
12) HOND



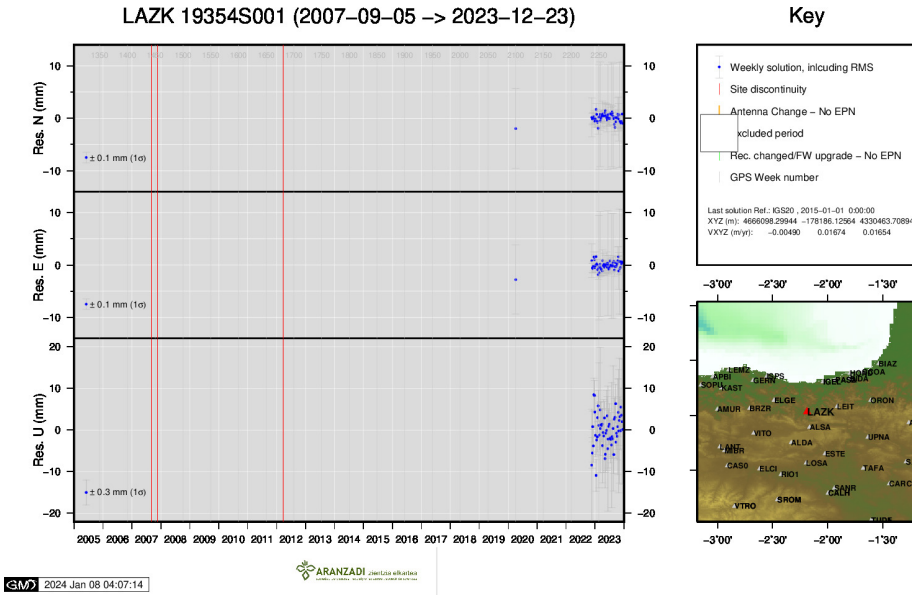
13) IGEL



14) ISPS



15) LARE



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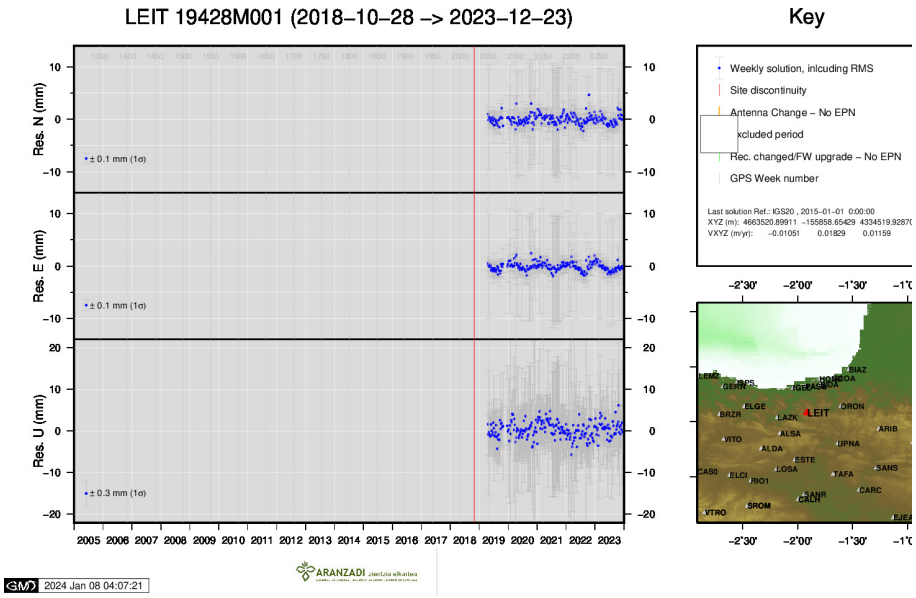
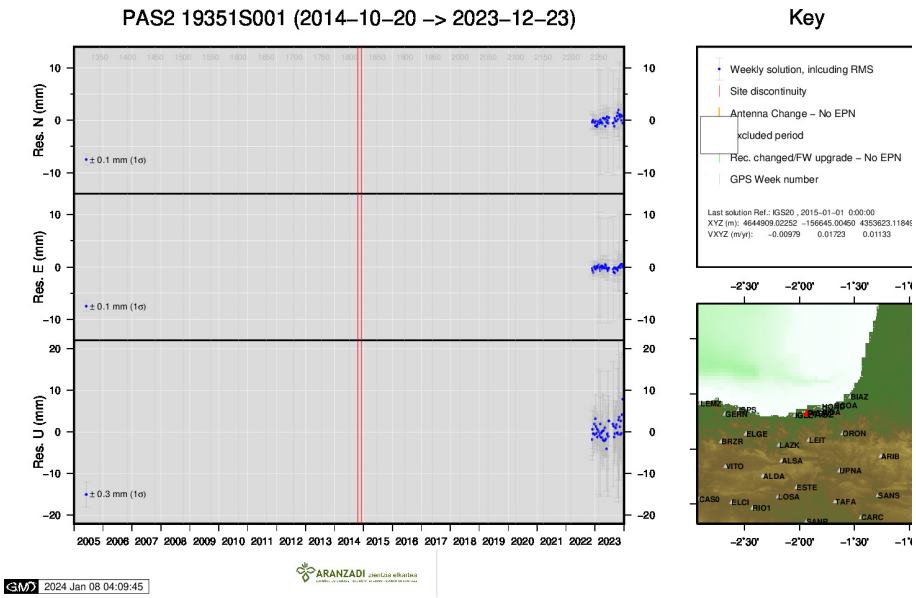
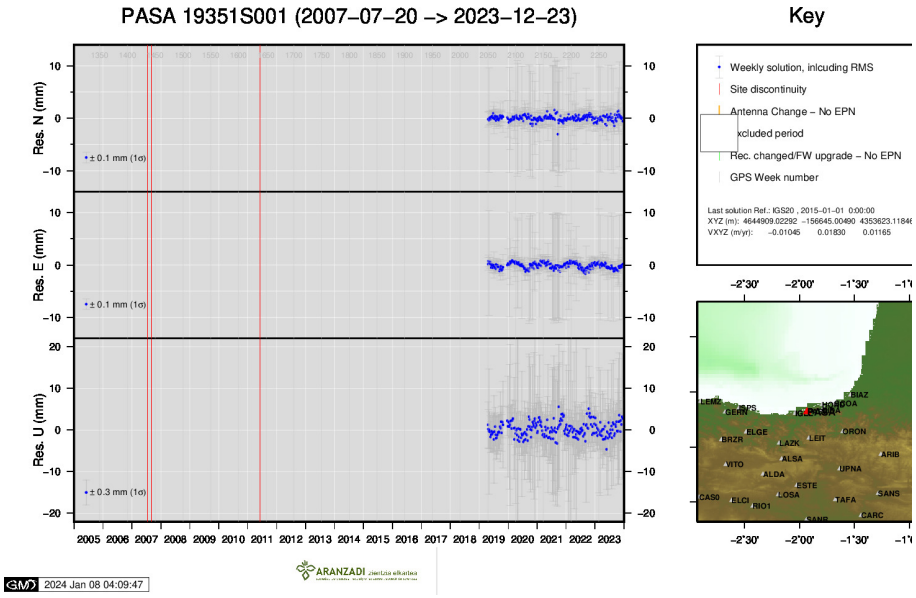


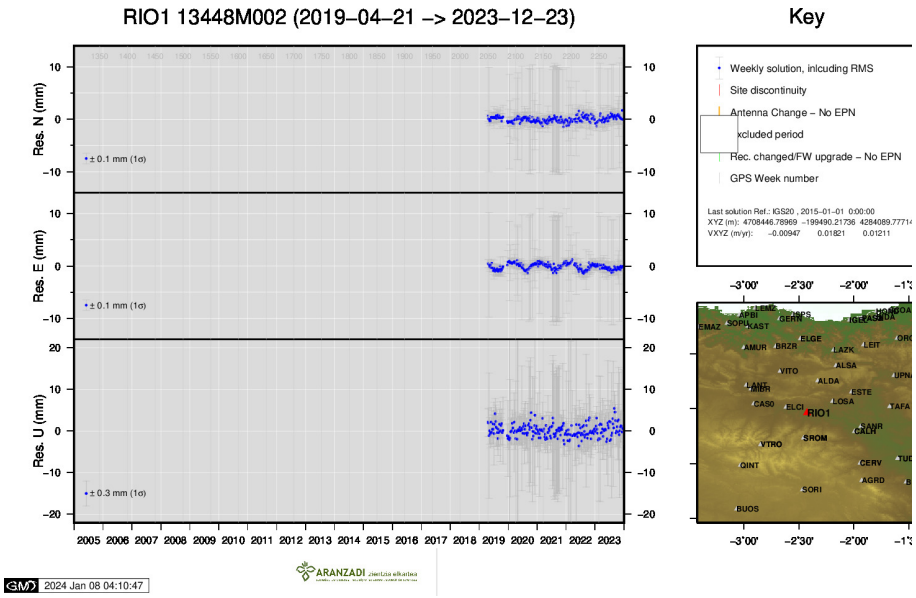
17) LEIT



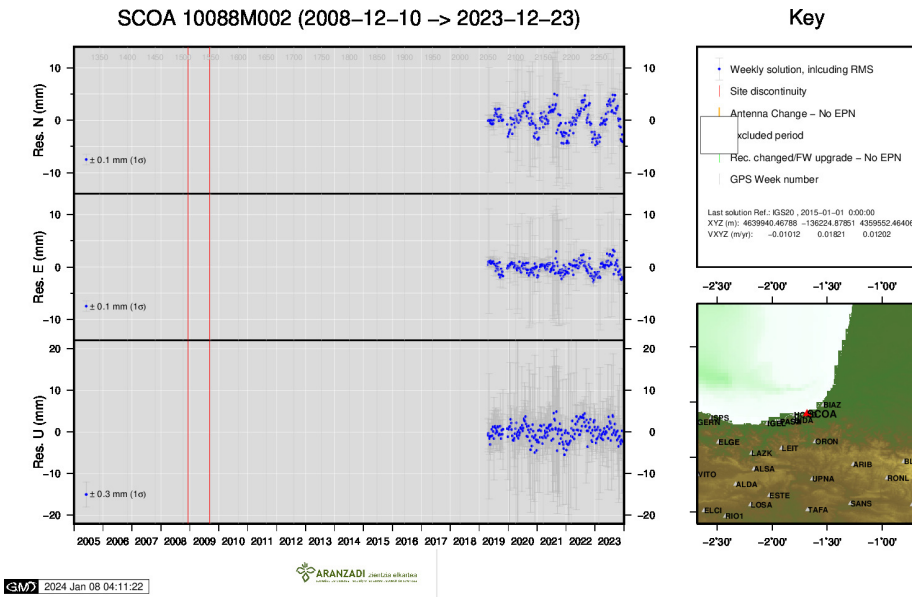
18) PAS2



19) PASA



20) RIO1



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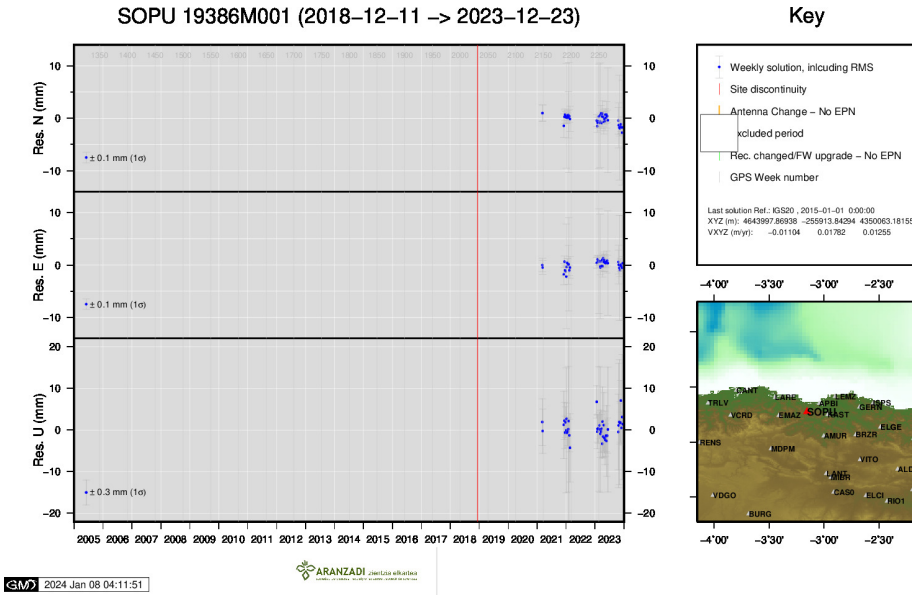

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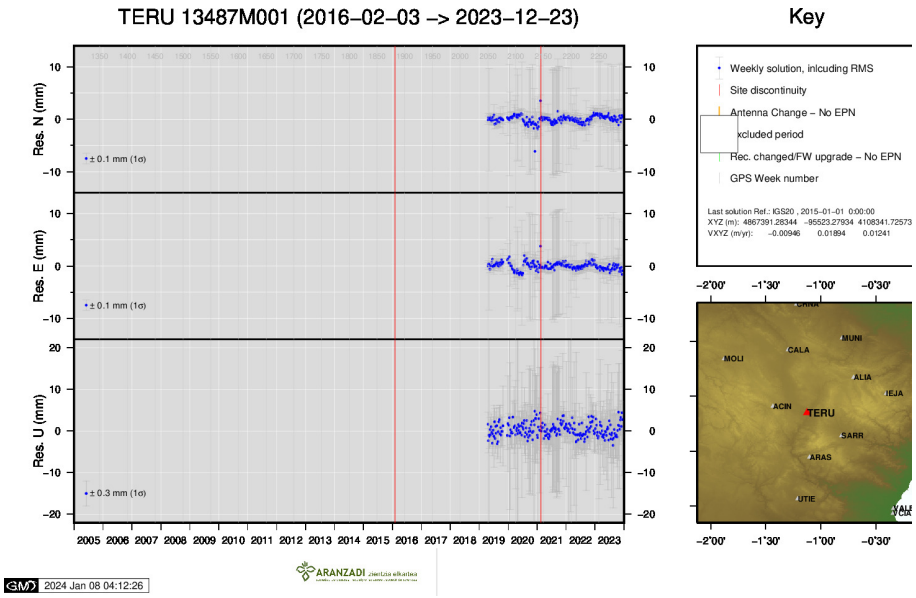
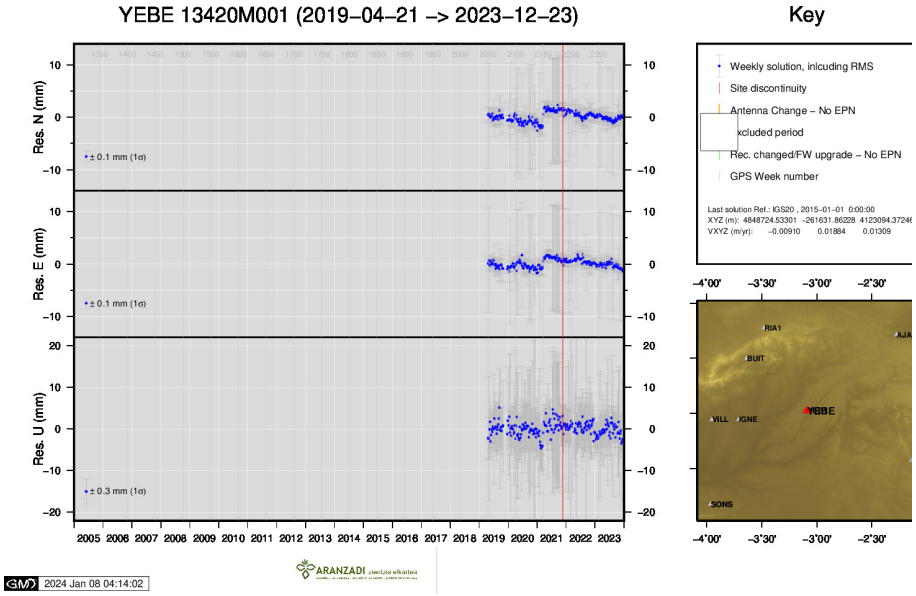
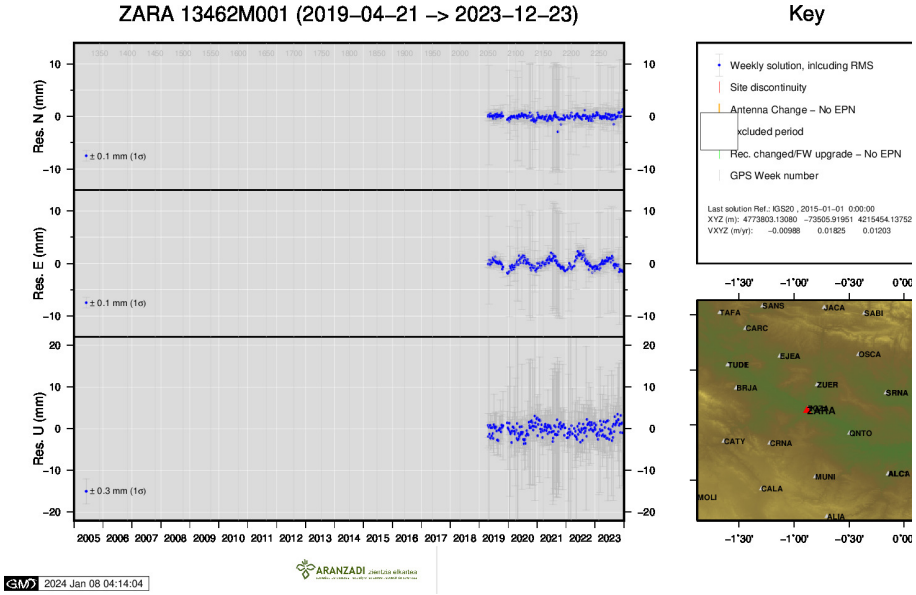


23) TERU



24) YEBE



25) ZARA