ARA-DAC Weekly Analysis Result: 2367 (GFA)

Technical Report

GPS Week: 2367 (GFA)

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

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Report generated on 2025/06/09 at 02:47:42

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

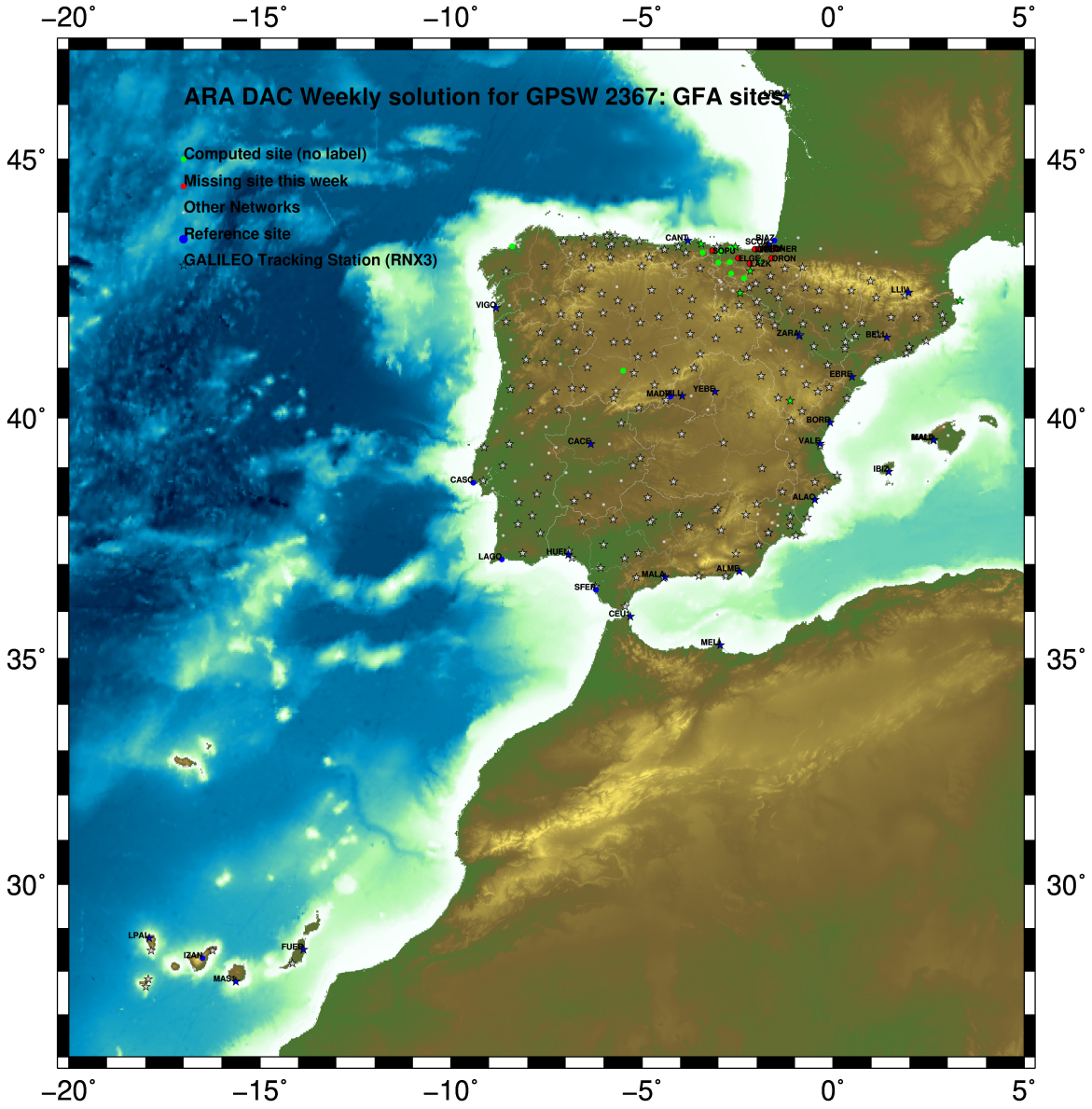


Fig.1: Computed Sites for GPS Week2367 (GFA)

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/these GNSS/GNSSs are excluded from the analysis of that station.
- Reference sites: the latest IGS cumulative solution is used to align our solution to the latest IGS20 release, regularly updated and available at: IGS0OPSSNX_1994002_00U_00U_CRD.SNX.gz. Following the EUREF guidelines, no other individual calibrations are included in the analysis starting GPSW 2238 (IGS20); also applies to repro3 solutions, which are based on IGS20 standards.
- Troposphere:
  - minimum elevation is 3 deg.; elevation dependent weighting.
  - VMF3 mapping function. ZPD parameters are estimated using the VMF3 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2014b (Scherneck).
- Atmospheric loading: not corrected, following the latest recommendations for IGS20 products.
- Tidal displacements:
  - Mean pole model : IERS2010_v1.2.0
  - Subdaily pole model: DESAI2016
  - Nutation model : IAU2000R06

4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria: 3*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                      09-JUN-25 01:08
------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: IGS20             EPOCH: 2025-05-21 11:59:45

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

111  ACOR 13434M001    4594489.47545  -678367.25648  4357066.32478    A      G
 39  ALDA 19383M001    4687280.09484  -190876.45207  4308107.03181    A      GR
 50  ALSA 19419M001    4677250.76926  -176770.28039  4319079.94578    A      GRE
 53  AMUR 19388M001    4661499.38726  -244591.14162  4332269.95033    A      GR
384  BIAZ 10074M002    4634455.98191  -124344.86006  4365785.52341    W      GR
113  BRZR 19387M001    4662220.92827  -220769.78375  4333309.50650    A      GR
573  CACE 13447M001    4899866.45077  -544566.92161  4033770.27920    W      GRE
592  CANT 13438M001    4625924.25467  -307096.12182  4365771.62859    W      GRE
908  CREU 13432M001    4715420.06175   273178.17492  4271946.91349    A      GRE
135  EBRE 13410M001    4833519.92403    41537.51055  4147461.79083    W      GRE
182  EMAZ 17001M001    4645924.14718  -276949.75395  4347759.63697    A      GR
209  GERN 19389M001    4642811.25468  -217222.81074  4353278.94376    A      GR
257  HOND 15012M002    4640529.25393  -145675.87106  4358781.82545    A      GRE
240  ISPS 19484M001    4640596.41760  -206963.66395  4356391.98798    A      GRE
245  KAST 19499M001    4646949.01165  -240747.15318  4348015.06166    A      GR
252  LARE 19440M001    4632831.89418  -279026.03105  4360314.49650    A      GRE
261  LEIT 19428M001    4663520.87121  -155858.60501  4334519.95634    A      GRE
493  PASA 19351S001    4644908.99730  -156644.95502  4353623.14717    A      GRE
553  RIO1 13448M002    4708446.76390  -199490.16766  4284089.80370    A      GRE
558  SALA 13469M001    4803054.42733  -462130.95532  4158379.14784    A      GR
526  SCOA 10088M002    4639940.43964  -136224.82812  4359552.49199    W      GRE
443  TERU 13487M001    4867391.25586   -95523.22903  4108341.75340    A      GRE
493  VITO 19385M001    4679397.63756  -218436.38979  4314898.43811    A      GR
616  YEBE 13420M001    4848724.50541  -261631.81197  4123094.39837    W      GRE
655  ZARA 13462M001    4773803.10359   -73505.86954  4215454.16455    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                                             09-JUN-25 01:08
------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: ETRF2000          EPOCH: 2025-05-21 11:59:45

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

111  ACOR 13434M001    4594489.82773  -678367.91117  4357065.83285    A
 39  ALDA 19383M001    4687280.51131  -190877.11737  4308106.53866    A
 50  ALSA 19419M001    4677251.18862  -176770.94440  4319079.45374    A
 53  AMUR 19388M001    4661499.79823  -244591.80385  4332269.45873    A
384  BIAZ 10074M002    4634456.41248  -124345.51858  4365785.03598    W
113  BRZR 19387M001    4662221.34266  -220770.44601  4333309.01518    A
573  CACE 13447M001    4899866.79483  -544567.61389  4033769.76169    W
592  CANT 13438M001    4625924.65968  -307096.77977  4365771.13928    W
908  CREU 13432M001    4715420.54003   273177.50778  4271946.42442    A
135  EBRE 13410M001    4833520.35958    41536.82790  4147461.28782    W
182  EMAZ 17001M001    4645924.55491  -276950.41433  4347759.14630    A
209  GERN 19389M001    4642811.67122  -217223.47056  4353278.45423    A
257  HOND 15012M002    4640529.68094  -145676.53040  4358781.33716    A
240  ISPS 19484M001    4640596.83584  -206964.32348  4356391.49880    A
245  KAST 19499M001    4646949.42447  -240747.81359  4348014.57142    A
252  LARE 19440M001    4632832.30266  -279026.68979  4360314.00698    A
261  LEIT 19428M001    4663521.29478  -155859.26725  4334519.46584    A
493  PASA 19351S001    4644909.42235  -156645.61494  4353622.65833    A
553  RIO1 13448M002    4708447.17716  -199490.83561  4284089.30852    A
558  SALA 13469M001    4803054.79335  -462131.63558  4158378.64030    A
526  SCOA 10088M002    4639940.86803  -136225.48736  4359552.00389    W
443  TERU 13487M001    4867391.66900   -95523.91632  4108341.24537    A
493  VITO 19385M001    4679398.05074  -218437.05418  4314897.94527    A
616  YEBE 13420M001    4848724.89655  -261632.49743  4123093.88963    W
655  ZARA 13462M001    4773803.52875   -73506.54521  4215453.66529    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                                                  09-JUN-25 01:08
--------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: ETRF2014          EPOCH: 2025-05-21 11:59:45

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

111  ACOR 13434M001    4594489.78812  -678367.94757  4357065.88587    A
 39  ALDA 19383M001    4687280.46910  -190877.15523  4308106.59154    A
 50  ALSA 19419M001    4677251.14647  -176770.98236  4319079.50665    A
 53  AMUR 19388M001    4661499.75650  -244591.84162  4332269.51166    A
384  BIAZ 10074M002    4634456.37063  -124345.55694  4365785.08906    W
113  BRZR 19387M001    4662221.30084  -220770.48387  4333309.06812    A
573  CACE 13447M001    4899866.75120  -544567.64939  4033769.81383    W
592  CANT 13438M001    4625924.61857  -307096.81746  4365771.19230    W
908  CREU 13432M001    4715420.49565   273177.46828  4271946.47756    A
135  EBRE 13410M001    4833520.31475    41536.78983  4147461.34041    W
182  EMAZ 17001M001    4645924.51348  -276950.45205  4347759.19927    A
209  GERN 19389M001    4642811.62961  -217223.50853  4353278.50724    A
257  HOND 15012M002    4640529.63910  -145676.56865  4358781.39021    A
240  ISPS 19484M001    4640596.79422  -206964.36149  4356391.55182    A
245  KAST 19499M001    4646949.38289  -240747.85144  4348014.62440    A
252  LARE 19440M001    4632832.26138  -279026.72756  4360314.05999    A
261  LEIT 19428M001    4663521.25271  -155859.30536  4334519.51881    A
493  PASA 19351S001    4644909.38049  -156645.65312  4353622.71136    A
553  RIO1 13448M002    4708447.13473  -199490.87333  4284089.36133    A
558  SALA 13469M001    4803054.75067  -462131.67185  4158378.69272    A
526  SCOA 10088M002    4639940.82616  -136225.52565  4359552.05695    W
443  TERU 13487M001    4867391.62429   -95523.95370  4108341.29777    A
493  VITO 19385M001    4679398.00872  -218437.09197  4314897.99816    A
616  YEBE 13420M001    4848724.85266  -261632.53426  4123093.94199    W
655  ZARA 13462M001    4773803.48508   -73506.58312  4215453.71797    W
```

5.4 ETRF2020 (ETRS89) Coordinates

European **T**errestrial **R**eference **S**ystem, **1989** (**ETRS89**) is realized by ETRF2020 (Boucher and Altamimi, 2011) and (Altamimi, 2017).

```
CONVERT TO ETRF2020                                                  09-JUN-25 01:08
--------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: ETRF2020          EPOCH: 2025-05-21 11:59:45

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

111  ACOR 13434M001    4594489.78426  -678367.93290  4357065.89383    A
 39  ALDA 19383M001    4687280.46392  -190877.14008  4308106.59976    A
 50  ALSA 19419M001    4677251.14122  -176770.96723  4319079.51486    A
 53  AMUR 19388M001    4661499.75142  -244591.82657  4332269.51982    A
384  BIAZ 10074M002    4634456.36511  -124345.54192  4365785.09720    W
113  BRZR 19387M001    4662221.29569  -220770.46881  4333309.07629    A
573  CACE 13447M001    4899866.74775  -544567.63369  4033769.82232    W
592  CANT 13438M001    4625924.61359  -307096.80255  4365771.20039    W
908  CREU 13432M001    4715420.48917   273177.48372  4271946.48590    A
135  EBRE 13410M001    4833520.30928    41536.80555  4147461.34892    W
182  EMAZ 17001M001    4645924.50846  -276950.43706  4347759.20740    A
209  GERN 19389M001    4642811.62440  -217223.49352  4353278.51538    A
257  HOND 15012M002    4640529.63366  -145676.55363  4358781.39837    A
240  ISPS 19484M001    4640596.78897  -206964.34649  4356391.55996    A
245  KAST 19499M001    4646949.37776  -240747.83643  4348014.63255    A
252  LARE 19440M001    4632832.25633  -279026.71262  4360314.06810    A
261  LEIT 19428M001    4663521.24736  -155859.29026  4334519.52700    A
493  PASA 19351S001    4644909.37510  -156645.63809  4353622.71952    A
553  RIO1 13448M002    4708447.12964  -199490.85811  4284089.36958    A
558  SALA 13469M001    4803054.74667  -462131.65643  4158378.70107    A
526  SCOA 10088M002    4639940.82069  -136225.51062  4359552.06510    W
443  TERU 13487M001    4867391.61932   -95523.93793  4108341.30631    A
493  VITO 19385M001    4679398.00360  -218437.07685  4314898.00636    A
616  YEBE 13420M001    4848724.84816  -261632.51862  4123093.95046    W
655  ZARA 13462M001    4773803.47978   -73506.56763  4215453.72636    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                    09-JUN-25 01:08
------------------------------------------------------------------------------
                     Weekday     Repeatability (mm)
Station        #Days 0123456      N      E      U
------------------------------------------------------------
ACOR 13434M001     7 XXXXXXX     1.36   0.45   4.07
ALDA 19383M001     7 XXXXXXX     1.90   0.60   4.49
ALSA 19419M001     7 XXXXXXX     1.49   1.04   5.05
AMUR 19388M001     7 XXXXXXX     1.16   1.13   5.29
BIAZ 10074M002     7 XXXXXXX     1.02   0.84   7.31
BRZR 19387M001     7 XXXXXXX     0.95   0.71   4.94
CACE 13447M001     7 XXXXXXX     0.45   0.52   2.65
CANT 13438M001     7 XXXXXXX     0.78   0.74   5.43
CREU 13432M001     7 XXXXXXX     1.68   0.82   6.72
EBRE 13410M001     7 XXXXXXX     1.46   2.03   5.57
EMAZ 17001M001     7 XXXXXXX     0.92   1.21   5.12
GERN 19389M001     7 XXXXXXX     0.97   1.58   4.42
HOND 15012M002     6 X XXXXX     0.56   0.50   5.05
ISPS 19484M001     7 XXXXXXX     0.62   0.51   4.25
KAST 19499M001     7 XXXXXXX     0.48   0.87   5.59
LARE 19440M001     7 XXXXXXX     0.92   0.89   4.00
LEIT 19428M001     7 XXXXXXX     0.87   0.97   5.18
PASA 19351S001     7 XXXXXXX     0.79   0.90   5.72
RIO1 13448M002     7 XXXXXXX     0.65   0.65   4.60
SALA 13469M001     7 XXXXXXX     0.41   0.38   1.71
SCOA 10088M002     7 XXXXXXX     1.03   0.69   5.43
TERU 13487M001     7 XXXXXXX     1.14   0.51   4.37
VITO 19385M001     7 XXXXXXX     0.65   0.82   4.25
YEBE 13420M001     7 XXXXXXX     0.33   0.23   2.19
ZARA 13462M001     7 XXXXXXX     0.81   1.16   5.23

Comparison of individual solutions:
-----------------------------------
ACOR 13434M001   N    1.36      2.29    0.40   -0.11    0.57   -0.13   -2.26   -0.45
ACOR 13434M001   E    0.45     -0.44   -0.44    0.62    0.41   -0.05   -0.22    0.47
ACOR 13434M001   U    4.07      4.59   -4.59    1.79    0.63   -7.07    1.50    1.15
ALDA 19383M001   N    1.90     -2.11   -2.20    1.58    1.80    0.19    2.52   -0.44
ALDA 19383M001   E    0.60      0.69   -0.73   -0.29   -0.29    0.99   -0.17    0.06
ALDA 19383M001   U    4.49      2.78    8.59    4.79    2.89   -1.14   -2.59    0.11
ALSA 19419M001   N    1.49     -2.41    0.81    0.97    0.40    1.09   -1.10    1.81
ALSA 19419M001   E    1.04     -0.04   -1.82    0.88    0.78    0.11   -0.93    0.95
ALSA 19419M001   U    5.05      1.19    6.21    9.00   -0.21   -4.51    2.11   -2.64
AMUR 19388M001   N    1.16     -0.86    1.47   -0.07    1.27    1.62    0.87   -0.45
AMUR 19388M001   E    1.13      0.51   -1.88   -0.24    0.39   -0.34   -0.76    1.72
AMUR 19388M001   U    5.29      6.99    4.58    8.56   -0.43   -3.41   -1.43   -3.31
BIAZ 10074M002   N    1.02     -1.10   -0.38   -0.17   -0.10    1.61    1.51    0.13
BIAZ 10074M002   E    0.84     -1.39    0.64    0.34    0.12    0.18   -1.13    0.69
BIAZ 10074M002   U    7.31     -1.07   14.77    7.96    0.33   -4.62   -2.05   -3.54
BRZR 19387M001   N    0.95      0.02    0.24    0.76    1.53    0.55    1.37    0.52
BRZR 19387M001   E    0.71     -0.53   -0.30   -0.58    0.61    0.71   -0.98   -0.71
BRZR 19387M001   U    4.94     -2.06    4.72    6.88    2.28    2.65   -1.93   -7.50
CACE 13447M001   N    0.45     -0.70   -0.62    0.41    0.28    0.21   -0.11    0.14
CACE 13447M001   E    0.52     -0.35    0.51    0.03    0.30    0.36    0.96    0.31
CACE 13447M001   U    2.65     -1.21   -4.38    1.74    0.21   -1.78    2.42    3.07
CANT 13438M001   N    0.78     -1.07    0.93    0.27   -0.51    0.64    0.94    0.08
CANT 13438M001   E    0.74      0.52   -1.02   -0.01    0.63   -0.44   -1.05    0.52
CANT 13438M001   U    5.43      2.37    7.20    9.54   -1.25   -3.43   -3.62   -1.47
CREU 13432M001   N    1.68     -0.11   -0.77    0.72    0.44    3.79   -0.28   -1.13
CREU 13432M001   E    0.82     -0.90   -0.44   -0.32    0.23   -1.06   -0.55    1.19
CREU 13432M001   U    6.72      1.05   -0.38   13.82    6.61    3.30   -4.59   -1.64
EBRE 13410M001   N    1.46      0.20    1.87    2.12   -1.84    0.52    0.91   -0.54
EBRE 13410M001   E    2.03     -1.34    3.89   -2.48   -0.22    0.28   -1.22   -0.01
EBRE 13410M001   U    5.57      4.63    2.93   11.08    1.00   -5.04    2.06    1.63
EMAZ 17001M001   N    0.92      0.76   -0.85    0.24    1.09   -1.48    0.53    0.32
EMAZ 17001M001   E    1.21     -2.07    0.87   -0.05    1.33   -1.15   -0.79    0.08
EMAZ 17001M001   U    5.12      0.86   10.65    2.23    0.59   -2.37   -5.57   -1.03
GERN 19389M001   N    0.97     -0.53   -0.71    0.40    0.07    1.85    1.09   -0.24
GERN 19389M001   E    1.58     -0.03   -1.50   -2.66    0.38    0.45    1.99    1.16
GERN 19389M001   U    4.42      0.84    6.20    5.91    6.01   -2.16   -0.42   -1.53
HOND 15012M002   N    0.56      0.30            0.70    0.25    0.93    0.25   -0.07
HOND 15012M002   E    0.50     -0.80            0.31    0.26   -0.13   -0.27    0.59
HOND 15012M002   U    5.05      1.02            8.32    4.57   -3.15   -3.99   -3.21
ISPS 19484M001   N    0.62      0.53   -0.60   -0.04    0.14    0.85    0.92    0.22
ISPS 19484M001   E    0.51     -0.48   -0.03    0.26    0.82   -0.40   -0.62    0.18
ISPS 19484M001   U    4.25      5.57    1.39    6.02    5.60   -2.11    0.07   -1.86
KAST 19499M001   N    0.48      0.40   -0.03    1.07   -0.01    0.20    0.17    0.14
KAST 19499M001   E    0.87     -0.21   -1.59    0.68    0.72    0.01   -0.67    0.75
KAST 19499M001   U    5.59      4.31    4.63    7.51    5.62    2.53   -5.25   -5.02
LARE 19440M001   N    0.92      0.76   -0.63    0.27   -1.30    0.95    1.10   -0.46
LARE 19440M001   E    0.89     -1.32    0.25    0.94   -0.84   -0.33   -0.95    0.53
LARE 19440M001   U    4.00      2.34    6.53    3.76    1.06   -4.55   -3.46   -0.43
LEIT 19428M001   N    0.87      0.68   -0.67   -0.70    0.43    1.06    1.26   -0.47
LEIT 19428M001   E    0.97      1.57   -1.29    0.61    0.05   -0.64   -0.79    0.37
LEIT 19428M001   U    5.18      1.65    8.42    8.41    0.41   -2.15   -2.57   -2.31
PASA 19351S001   N    0.79     -0.87   -0.39    1.04    0.01    1.23    0.46    0.01
PASA 19351S001   E    0.90     -0.78   -1.75    0.21    0.58   -0.11    0.58    0.69
PASA 19351S001   U    5.72      0.52    6.35    9.70    2.95   -4.03    1.81   -5.76
RIO1 13448M002   N    0.65     -0.39    0.86   -0.51    1.00    0.16    0.10    0.57
RIO1 13448M002   E    0.65     -0.73   -0.94    0.56    0.39    0.09   -0.19    0.75
RIO1 13448M002   U    4.60      3.05    3.75    9.00    1.27   -3.95   -2.31    0.35
SALA 13469M001   N    0.41     -0.33    0.38   -0.04   -0.76    0.36    0.24    0.01
SALA 13469M001   E    0.38     -0.05   -0.44   -0.47   -0.05    0.09    0.42    0.51
SALA 13469M001   U    1.71      1.80   -1.92    1.93   -0.74   -2.38    0.18   -0.73
SCOA 10088M002   N    1.03      0.26   -1.72    0.12    0.18    0.82    1.58    0.32
SCOA 10088M002   E    0.69      0.09   -0.04   -1.08    0.56   -0.75   -0.19    0.85
SCOA 10088M002   U    5.43      0.46    6.75    9.64    3.45   -3.37   -2.46   -2.96
TERU 13487M001   N    1.14      1.12   -0.16   -2.18   -0.29   -1.25   -0.21   -0.23
TERU 13487M001   E    0.51     -0.39   -0.69    0.37    0.05    0.31    0.46   -0.70
TERU 13487M001   U    4.37     -2.24   -0.31   -9.41   -2.15    0.40    4.02   -0.35
```

VITO	19385M001	N	0.65	0.24	0.86	0.48	-0.11	0.41	0.97	0.60
VITO	19385M001	E	0.82	-0.77	-1.39	0.23	0.42	0.87	-0.62	0.36
VITO	19385M001	U	4.25	1.21	1.21	8.68	3.58	-1.00	-3.15	-2.55
YEBE	13420M001	N	0.33	-0.40	-0.01	0.05	-0.50	0.05	0.50	0.05
YEBE	13420M001	E	0.23	-0.08	-0.12	0.20	-0.25	0.09	0.41	-0.13
YEBE	13420M001	U	2.19	2.35	-0.10	2.90	-1.16	-1.88	-3.01	-0.99
ZARA	13462M001	N	0.81	-0.28	0.01	-0.67	0.44	0.96	1.52	0.12
ZARA	13462M001	E	1.16	0.16	-1.82	-1.29	1.43	0.69	-0.08	0.79
ZARA	13462M001	U	5.23	0.38	3.97	9.66	2.15	0.08	-7.10	-0.21

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


-----------------------------------------------------------------------
| NUM |      NAME        | FLG |     RESIDUALS IN MILLIMETERS   |   |
-----------------------------------------------------------------------
|     |                  |     |                                |   |
|   2 | ALAC 13433M001   | I W |      -0.10     -0.68      1.92 |   |
|   3 | ALME 13437M001   | I W |      -0.30      0.29      2.03 |   |
|   4 | BELL 13431M001   | I W |      -0.55     -0.21     -0.11 |   |
|   5 | BIAZ 10074M002   | I W |       1.64     -0.25     -2.26 |   |
|   6 | BORR 13480M001   | I W |      -4.71     -0.28     -0.02 |   |
|   7 | BRST 10004M004   | I W |      -0.74     -2.17      1.27 |   |
|   8 | CACE 13447M001   | I W |       0.89      1.93      2.41 |   |
|   9 | CANT 13438M001   | I W |       1.74      0.30     -1.08 |   |
|  10 | CASC 13909S001   | I W |       1.19     -0.94      1.51 |   |
|  11 | CEU1 13449M002   | I W |       0.29      0.19     -4.08 |   |
|  13 | EBRE 13410M001   | I W |      -3.24     -0.92     -0.66 |   |
|  15 | FLRS 31907M001   | I W |      -0.39     -1.25     -6.50 |   |
|  16 | FUER 31330M001   | I W |       0.54     -0.51     -1.58 |   |
|  18 | HUEL 13451M001   | I W |       1.53      2.87     -5.59 |   |
|  19 | IBIZ 13454S001   | I W |      -0.41      0.63      0.93 |   |
|  20 | IZAN 31309M002   | I W |      -0.88     -1.56     -5.48 |   |
|  21 | LAGO 13903M001   | I W |      -0.03     -0.60      0.18 |   |
|  22 | LLIV 13436M001   | I W |      -3.38      0.31      5.13 |   |
|  23 | LPAL 81701M001   | I W |       1.19      0.70     -7.55 |   |
|  24 | LROC 10023M001   | I W |       1.16     -0.68      4.14 |   |
|  25 | MADR 13407S012   | I W |      -0.35      1.47      3.26 |   |
|  26 | MAL1 13444M002   | I W |       2.50     -0.56     -2.85 |   |
|  27 | MALA 13443M001   | I W |       0.21      0.09     11.12 |   |
|  28 | MALL 13444M001   | I W |      -0.50      0.29      2.91 |   |
|  29 | MAS1 31303M002   | I W |      -0.82     -1.78     -3.61 |   |
|  30 | MELI 19379M001   | I W |       0.43     -0.75     -0.21 |   |
|  31 | PDEL 31906M004   | I W |      -0.64     -1.79     -4.92 |   |
|  32 | SCOA 10088M002   | I W |      -1.70     -1.10    -10.52 |   |
|  33 | SFER 13402M004   | I W |      -1.51     -3.89     -1.77 |   |
|  34 | VALE 13439M001   | I W |      -0.34      2.06     -3.34 |   |
|  35 | VIGO 13450M001   | I W |       2.57      1.91      3.64 |   |
|  36 | VILL 13406M001   | I W |      -0.31     -0.64      5.10 |   |
|  37 | YEBE 13420M001   | I W |      -0.32     -0.30      8.03 |   |
|  38 | ZARA 13462M001   | I W |       0.10     -0.21      0.37 |   |
|  39 | ZIMM 14001M004   | I W |      -0.08     -1.31      8.15 |   |
|     |                  |     |                                |   |
-----------------------------------------------------------------------
|     | RMS / COMPONENT  |     |       1.53      1.34      4.64 |   |
|     | IQR              |     |       1.53      1.24      6.25 |   |
|     | MEAN             |     |      -0.15     -0.27     -0.00 |   |
|     | MEDIAN           |     |      -0.30     -0.30     -0.02 |   |
|     | MIN              |     |      -4.71     -3.89    -10.52 |   |
|     | MAX              |     |       2.57      2.87     11.12 |   |
-----------------------------------------------------------------------
        OVERALL RMS/IQR/MAX(3D)        2.93      2.24     11.13       MALA 13443M001      #SUM
-----------------------------------------------------------------------
| ALL | RMS / COMPONENT  |     |       1.53      1.34      4.64 |   |
| ALL | IQR              |     |       1.53      1.24      6.25 |   |
| ALL | MEAN             |     |      -0.15     -0.27     -0.00 |   |
| ALL | MEDIAN           |     |      -0.30     -0.30     -0.02 |   |
| ALL | MIN              |     |      -4.71     -3.89    -10.52 |   |
| ALL | MAX              |     |       2.57      2.87     11.12 |   |
-----------------------------------------------------------------------
  ALL   OVERALL RMS/IQR/MAX(3D)        2.93      2.24     11.13       MALA 13443M001      #SUM_ALL


NUMBER OF PARAMETERS  :     3
NUMBER OF STATIONS    :    35
NUMBER OF COORDINATES :   105
RMS OF TRANSFORMATION :    2.93 MM


PARAMETERS:

TRANSLATION IN  X     :          -0.00     +-  0.49    MM
TRANSLATION IN  Y     :           0.00     +-  0.49    MM
TRANSLATION IN  Z     :           0.00     +-  0.49    MM


NUMBER OF ITERATIONS  :     1
```

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                      19541151
 NUMBER OF UNKNOWNS                            182146
 NUMBER OF DEGREES OF FREEDOM                19359005
 PHASE MEASUREMENTS SIGMA                     0.00100
 SAMPLING INTERVAL (SECONDS)                      180
 VARIANCE FACTOR                 3.131027833366275
```

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 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 ALDA  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 ALSA  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 AMUR  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 BIAZ  A    1 P 25:138:00000 25:144:86370 SPECTRA SP90M        ----- -----------
 BRZR  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 CACE  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 CANT  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 CREU  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 EBRE  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 EMAZ  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 GERN  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 HOND  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 ISPS  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 KAST  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 LARE  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 LEIT  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 PASA  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 RIO1  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 SALA  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 SCOA  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 TERU  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 VITO  A    1 P 25:138:00000 25:144:86370 LEICA GR30           ----- -----------
 YEBE  A    1 P 25:138:00000 25:144:86370 LEICA GR50           ----- -----------
 ZARA  A    1 P 25:138:00000 25:144:86370 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 25:138:00000 25:144:86370 LEIAT504         LEIS -----
 ALDA  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 ALSA  A    1 P 25:138:00000 25:144:86370 LEIAR10          NONE -----
 AMUR  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 BIAZ  A    1 P 25:138:00000 25:144:86370 LEIAR25          LEIT -----
 BRZR  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 CACE  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 CANT  A    1 P 25:138:00000 25:144:86370 LEIAR25.R4       LEIT -----
 CREU  A    1 P 25:138:00000 25:144:86370 LEIAR25.R4       NONE -----
 EBRE  A    1 P 25:138:00000 25:144:86370 LEIAR25.R4       NONE -----
 EMAZ  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 GERN  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 HOND  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 ISPS  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 KAST  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 LARE  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 LEIT  A    1 P 25:138:00000 25:144:86370 LEIAR10          NONE -----
 PASA  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 RIO1  A    1 P 25:138:00000 25:144:86370 LEIAR25.R4       LEIT -----
 SALA  A    1 P 25:138:00000 25:144:86370 LEIAR25          NONE -----
 SCOA  A    1 P 25:138:00000 25:144:86370 TRM55971.00      NONE -----
 TERU  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 VITO  A    1 P 25:138:00000 25:144:86370 LEIAS10          NONE -----
 YEBE  A    1 P 25:138:00000 25:144:86370 LEIAR20          LEIM -----
 ZARA  A    1 P 25:138:00000 25:144:86370 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 25:138:00000 25:144:86370 UNE   3.0460   0.0000   0.0000
 ALDA  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
 ALSA  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
 AMUR  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
 BIAZ  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
```

```
BRZR  A    1 P 25:138:00000 25:144:86370 UNE   0.0771   0.0000   0.0000
CACE  A    1 P 25:138:00000 25:144:86370 UNE   0.0600   0.0000   0.0000
CANT  A    1 P 25:138:00000 25:144:86370 UNE   3.0490   0.0000   0.0000
CREU  A    1 P 25:138:00000 25:144:86370 UNE   0.0770   0.0000   0.0000
EBRE  A    1 P 25:138:00000 25:144:86370 UNE   0.0770   0.0000   0.0000
EMAZ  A    1 P 25:138:00000 25:144:86370 UNE   0.0350   0.0000   0.0000
GERN  A    1 P 25:138:00000 25:144:86370 UNE   0.0771   0.0000   0.0000
HOND  A    1 P 25:138:00000 25:144:86370 UNE   0.0771   0.0000   0.0000
ISPS  A    1 P 25:138:00000 25:144:86370 UNE   0.0350   0.0000   0.0000
KAST  A    1 P 25:138:00000 25:144:86370 UNE   0.0350   0.0000   0.0000
LARE  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
LEIT  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
PASA  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
RIO1  A    1 P 25:138:00000 25:144:86370 UNE   0.0606   0.0000   0.0000
SALA  A    1 P 25:138:00000 25:144:86370 UNE   0.0600   0.0000   0.0000
SCOA  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
TERU  A    1 P 25:138:00000 25:144:86370 UNE   0.0600   0.0000   0.0000
VITO  A    1 P 25:138:00000 25:144:86370 UNE   0.0000   0.0000   0.0000
YEBE  A    1 P 25:138:00000 25:144:86370 UNE   0.0600   0.0000   0.0000
ZARA  A    1 P 25:138:00000 25:144:86370 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:

```
2025-06-08 21:58 UTC | CANT1440.25O | RECEIVER TYPE        |  LEICA GR10 -> LEICA GR50 (source: cant00esp_20250509.log
2025-06-08 21:58 UTC | CANT1440.25O | RECEIVER FIRM. VERS. |  4.00/6.713 -> 4.80/7.900 (source: cant00esp_20250509.log
2025-06-08 03:22 UTC | ISPS1380.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.log
2025-06-08 06:26 UTC | ISPS1390.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.log
2025-06-08 09:31 UTC | ISPS1400.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.log
2025-06-08 12:40 UTC | ISPS1410.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.log
2025-06-08 15:47 UTC | ISPS1420.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.log
2025-06-08 18:53 UTC | ISPS1430.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.log
2025-06-08 21:58 UTC | ISPS1440.25O | ANTENNA SER. NO.     |   -> 24238009 (source: isps00esp_20250114.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

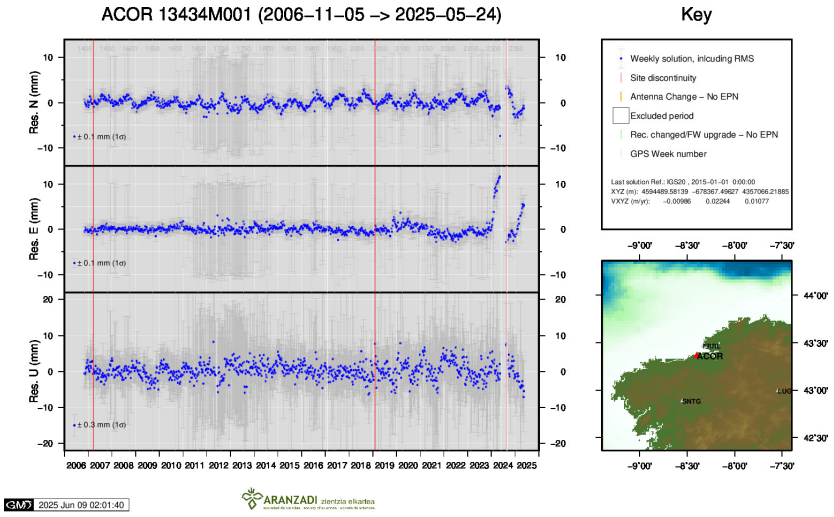
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres.* epncb.oma.be/$_d$*ocumentation/guidelines/guidelines*$_a$*nalysis*$_c$*entres.pdf*

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

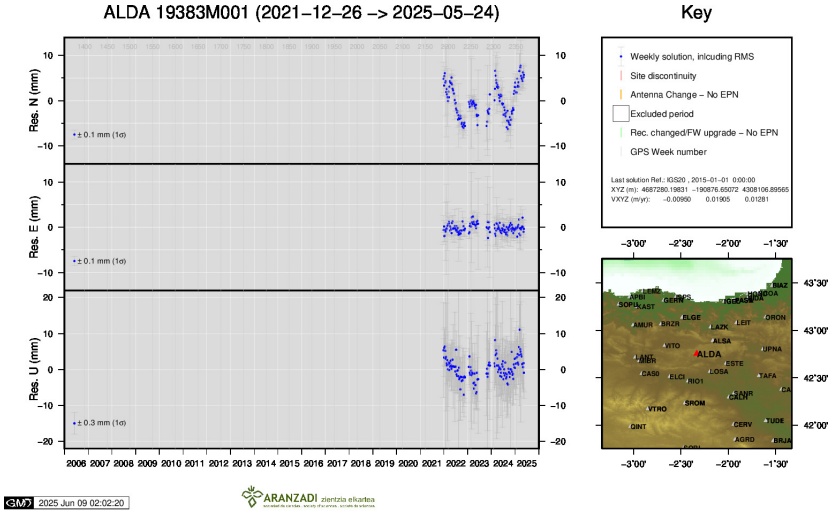
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems.* etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf

10 Cumulative Time Series

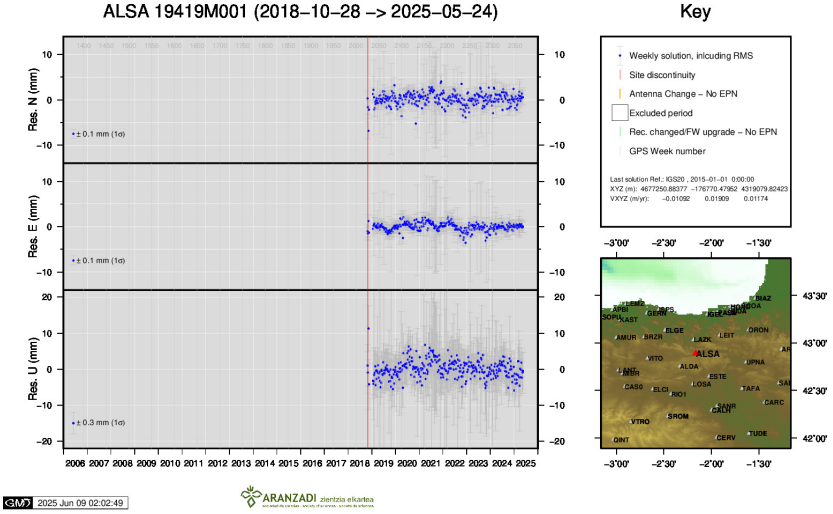
Time series of stations. Latest plots at: http://geolabpasaia.org/gnss/ARA-net/TSeries/, or click on the caption of each image.



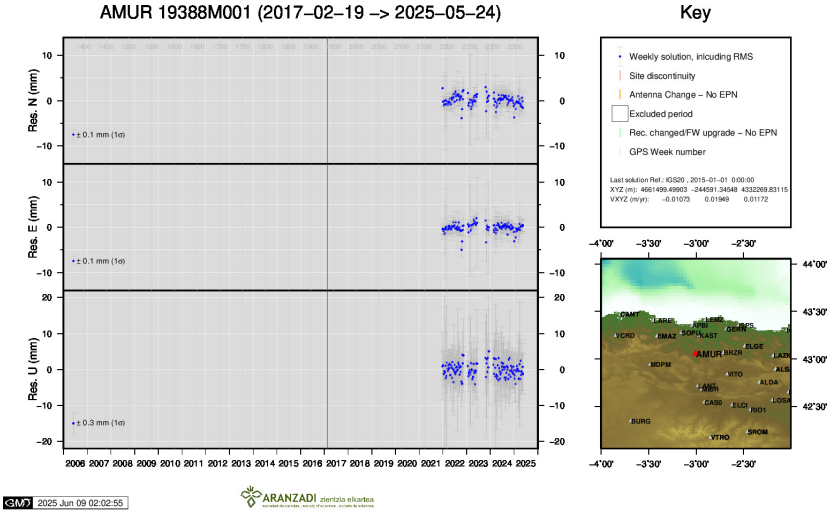
1) ACOR



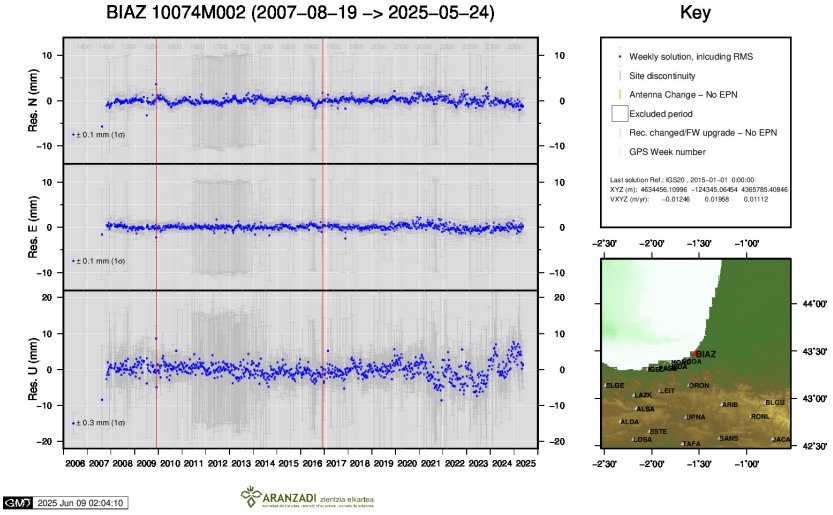
2) ALDA



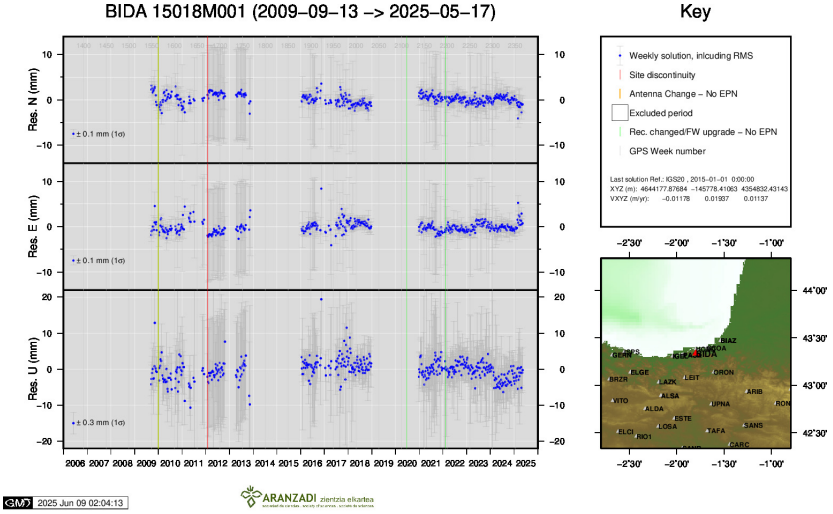
3) ALSA



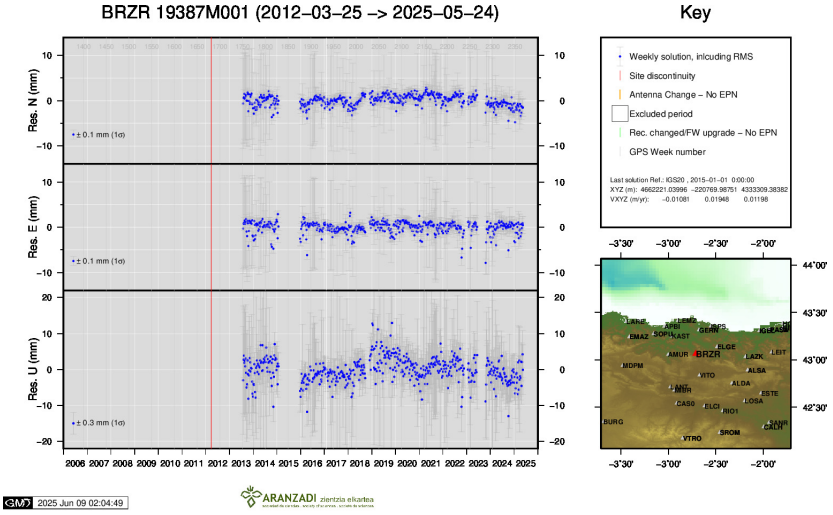
4) AMUR



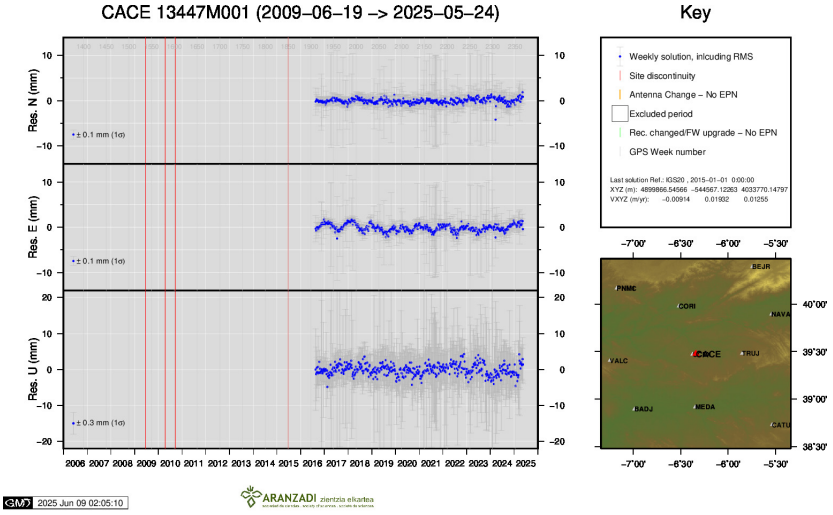
5) BIAZ



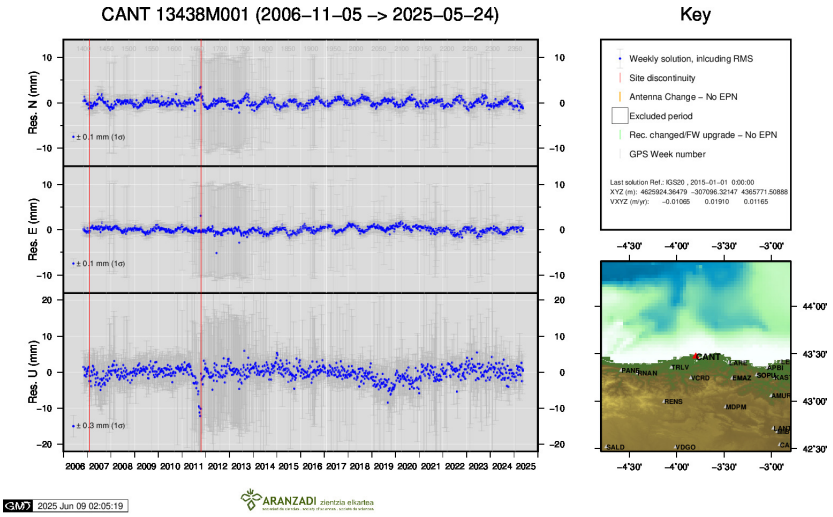
6) BIDA



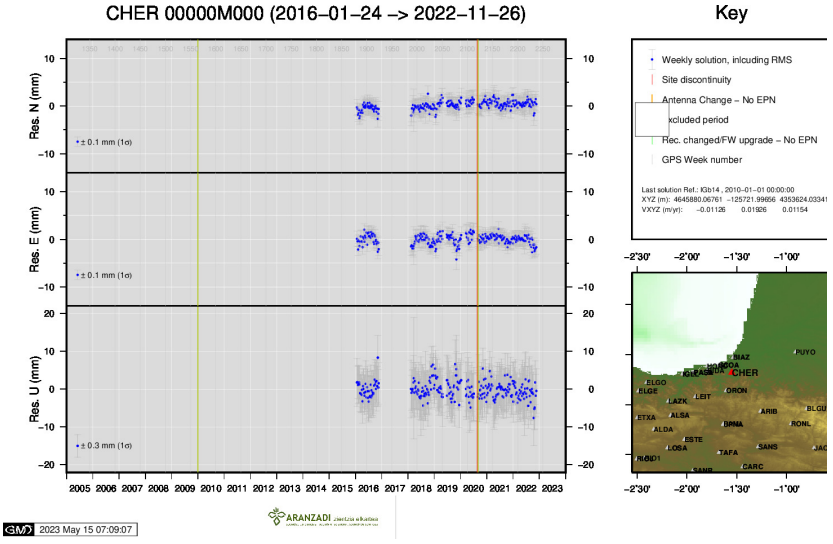
7) BRZR



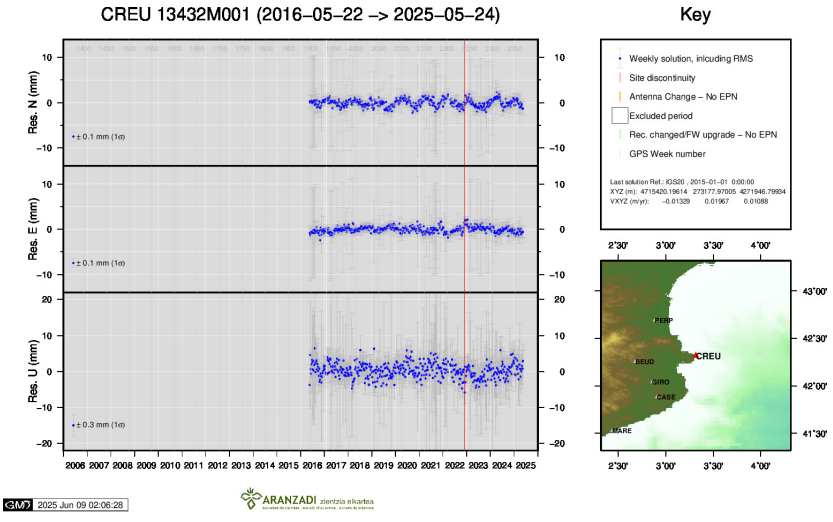
8) CACE



9) CANT



10) CHER



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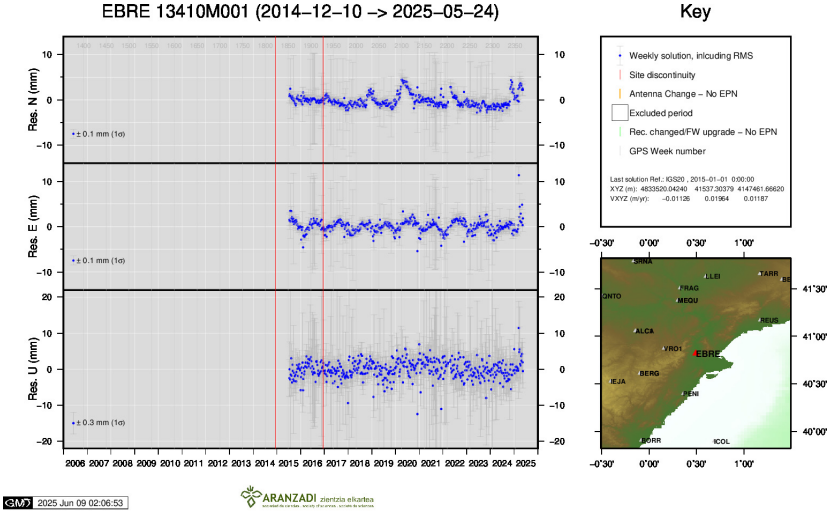

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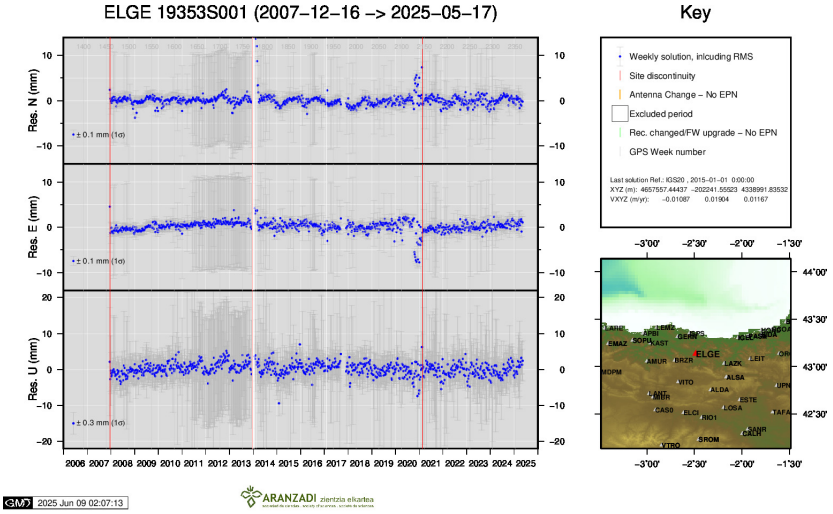

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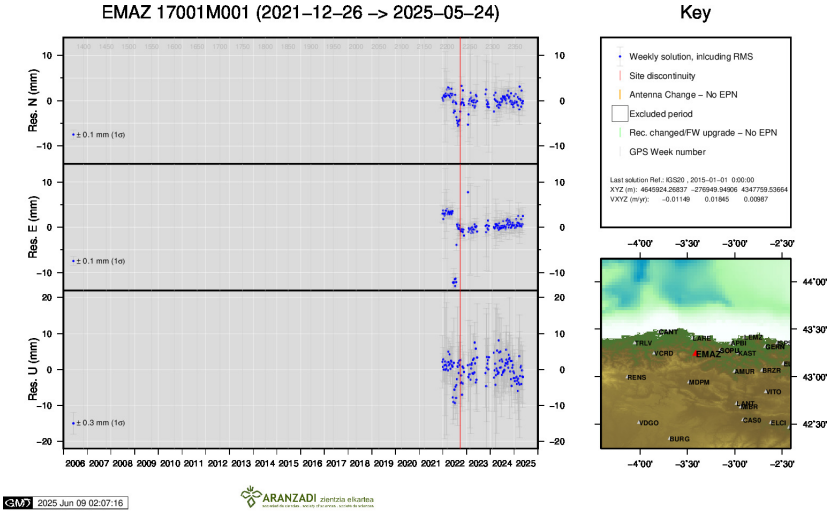

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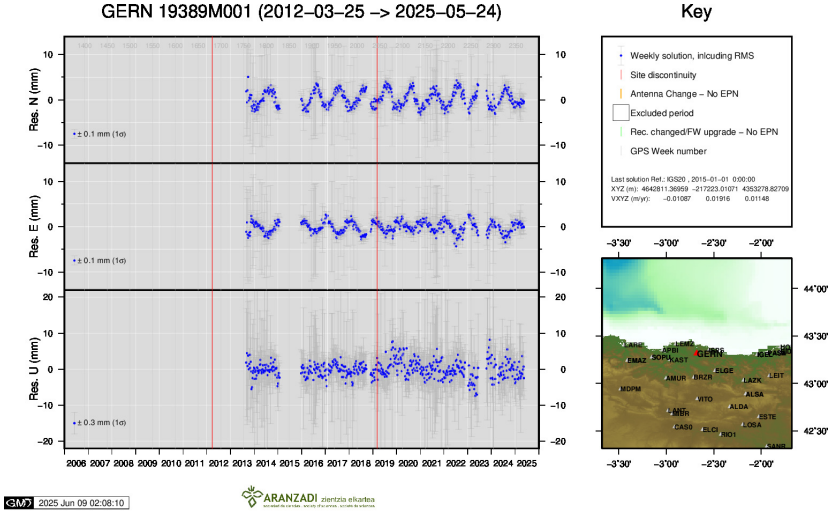

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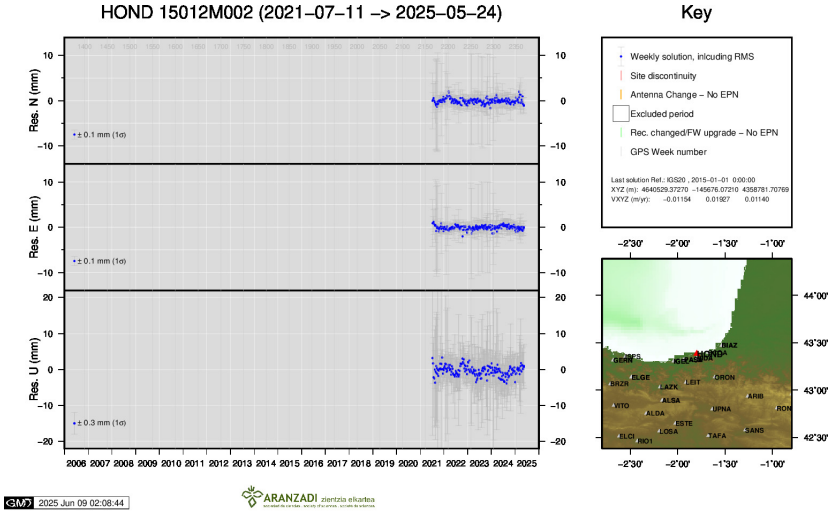

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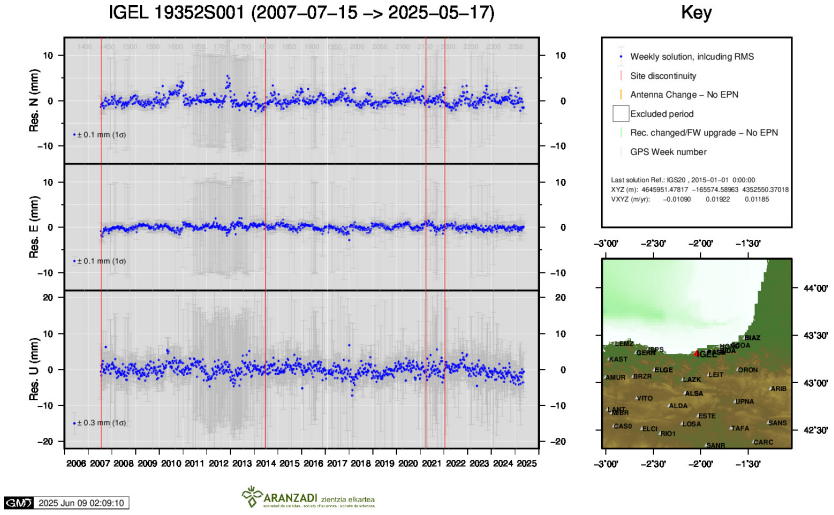

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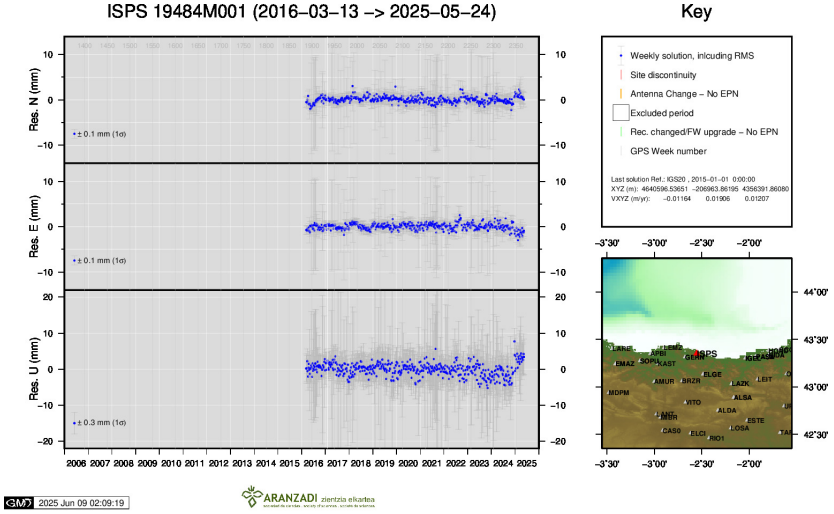

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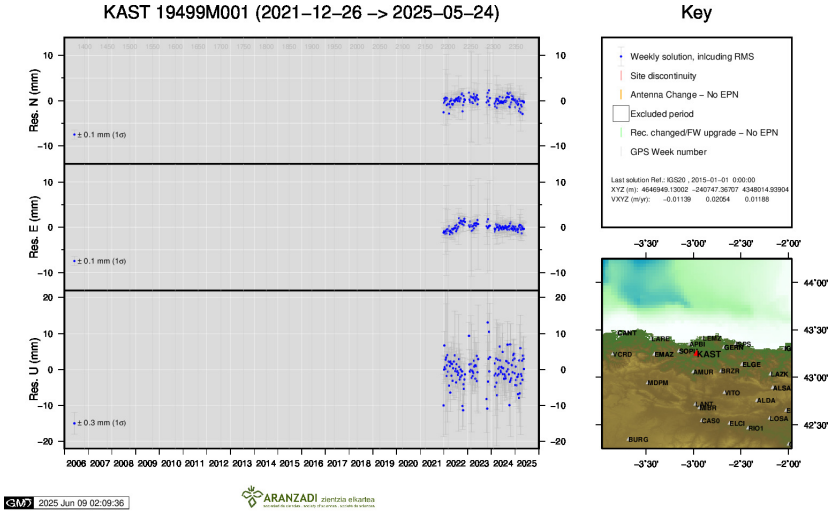

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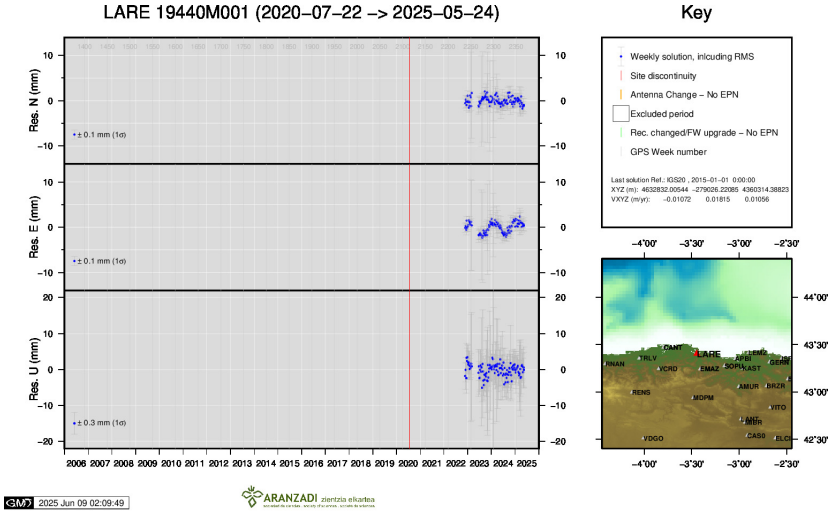

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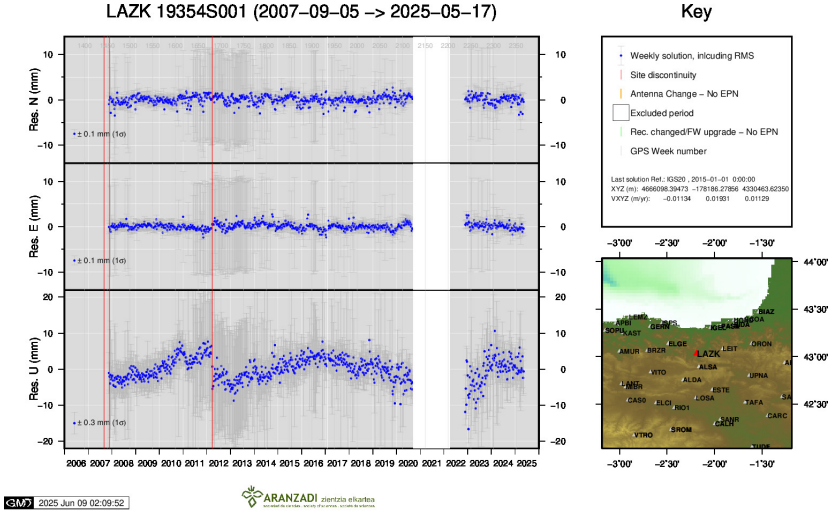

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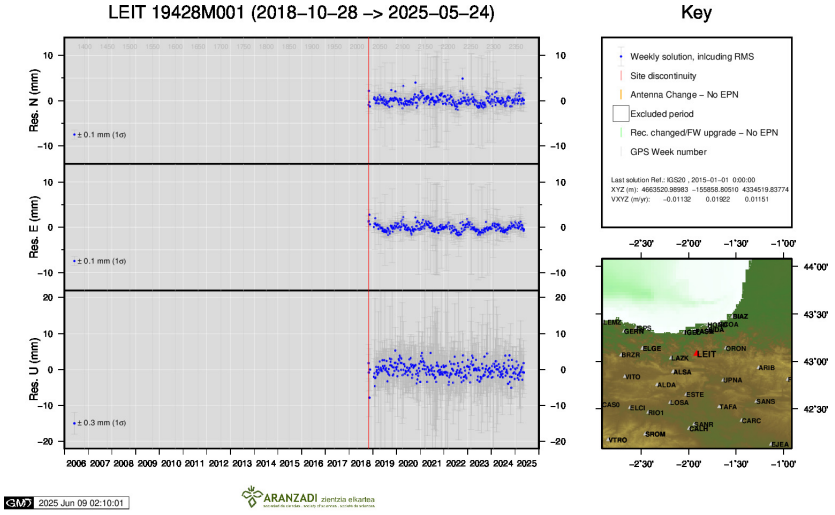

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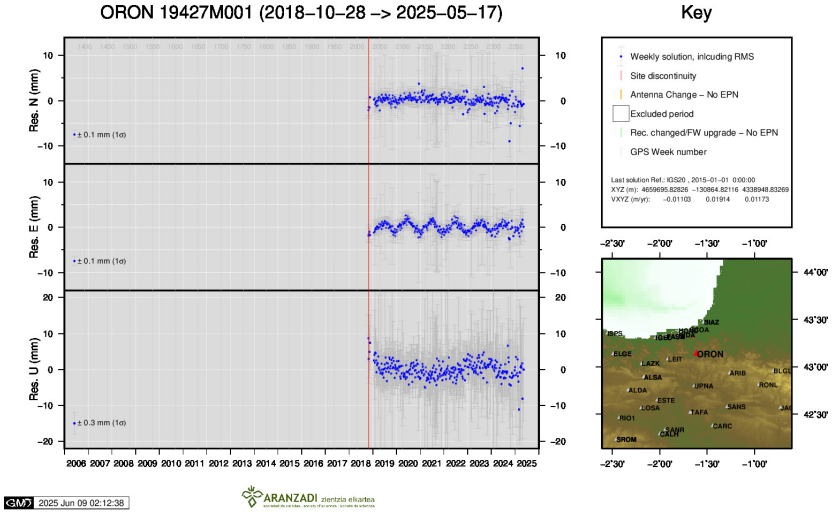

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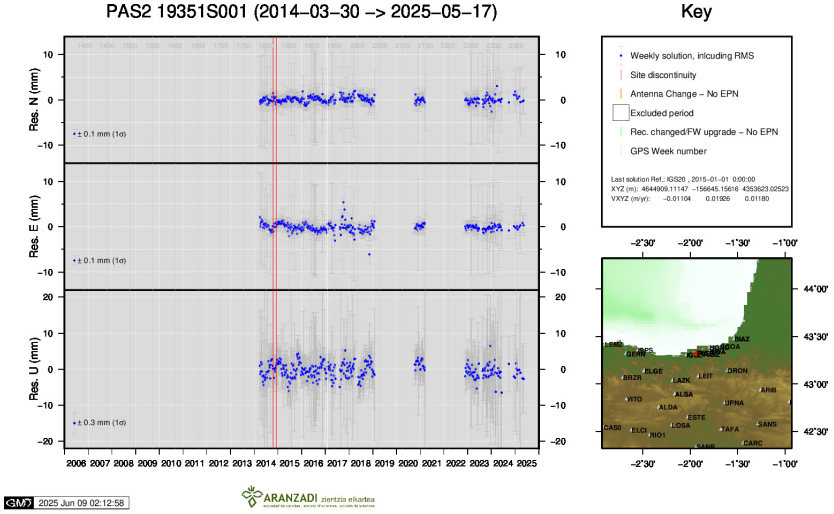

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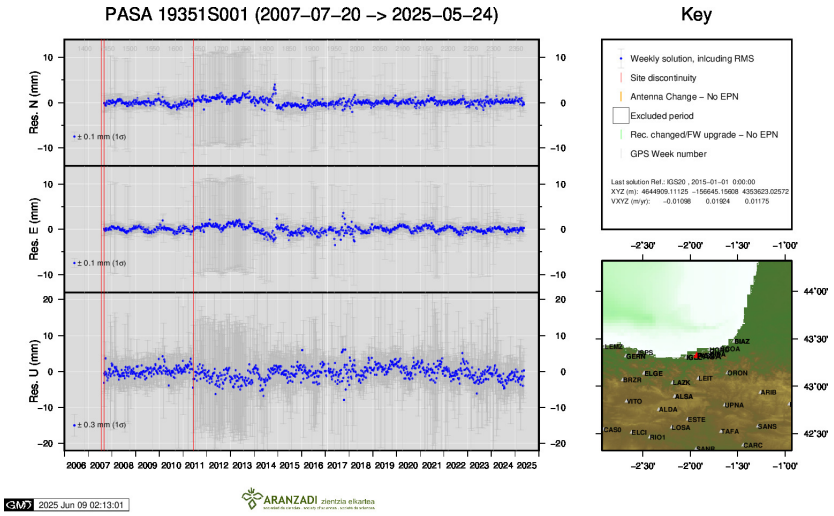

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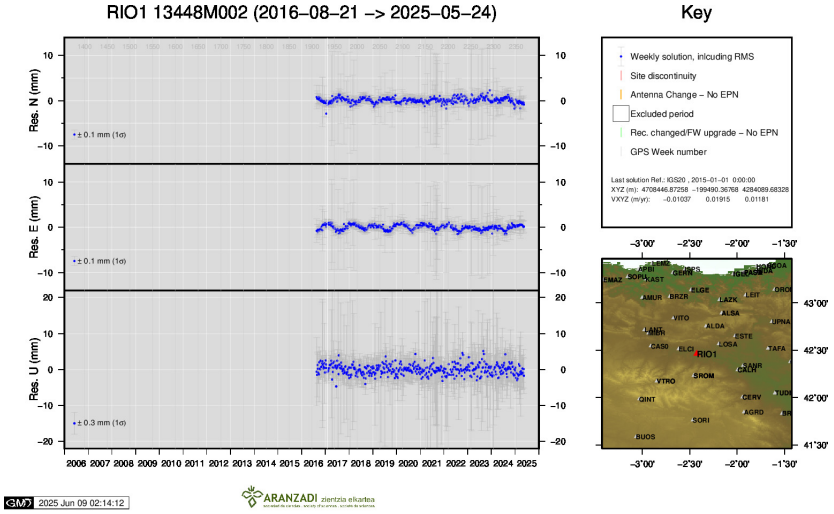
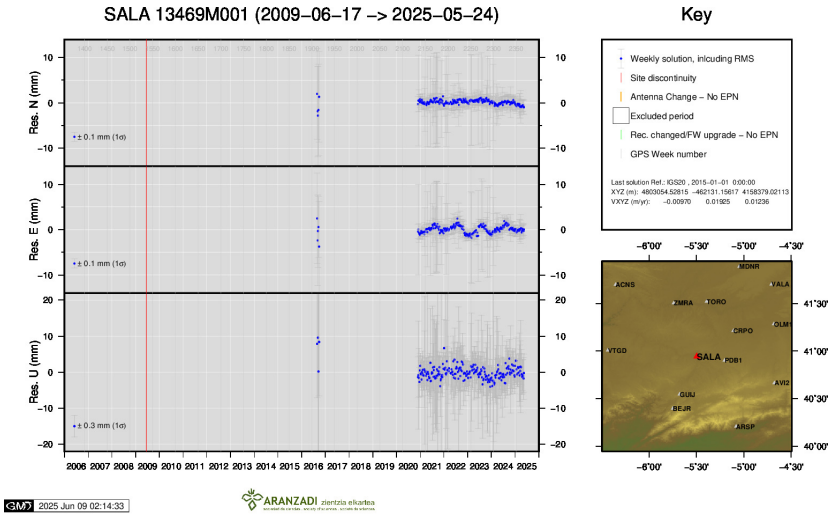


26) RIO1



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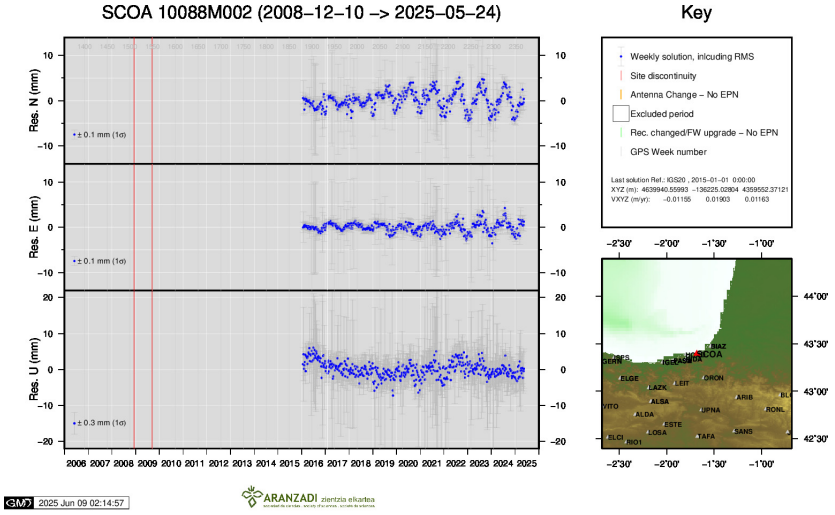

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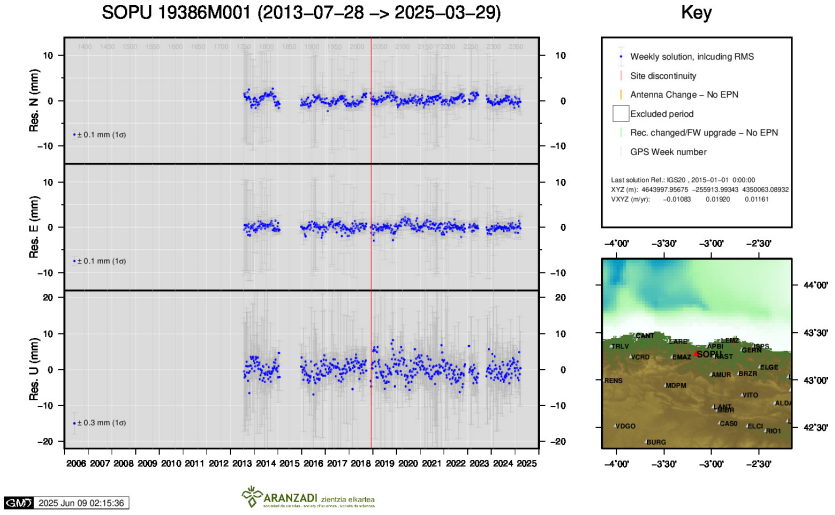

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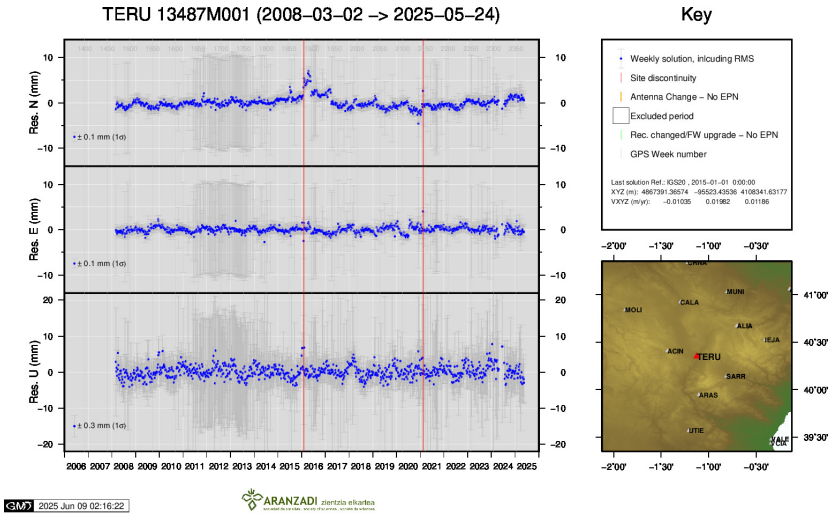

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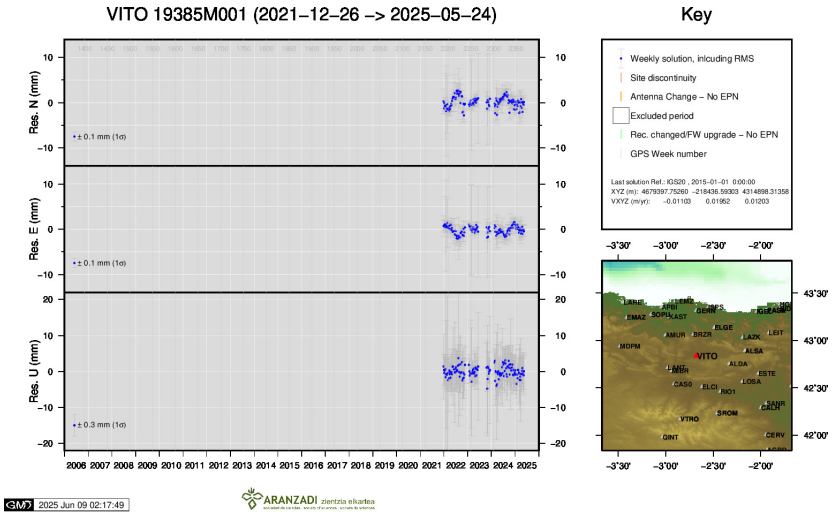

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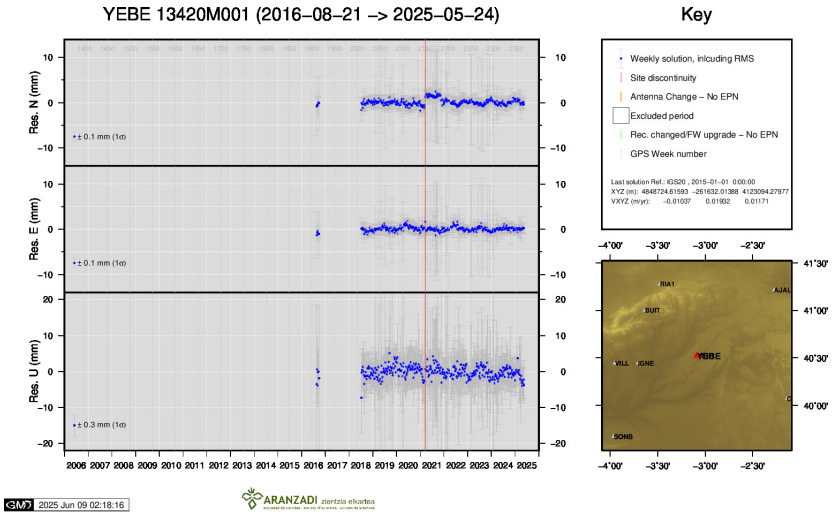
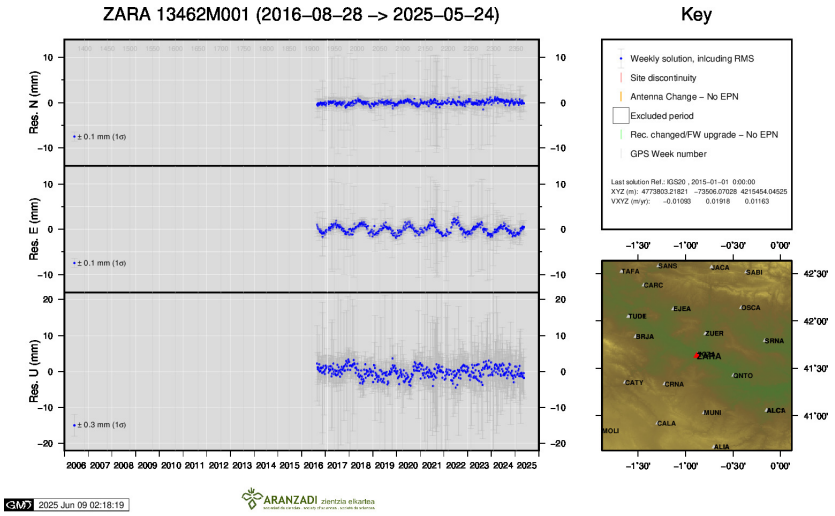


32) YEBE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Res. E (mm)
Res. U (mm)
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±0.1 mm (1σ)
±0.3 mm (1σ)
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025
Weekly solution, inlcuding RMS
Site discontinuity
Antenna Change – No EPN
Excluded period
Rec. changed/FW upgrade – No EPN
GPS Week number
Last solution Ref.: IGS20 , 2015–01–01 0:00:00
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TAFA
SANS
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ZUER
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ZARA
GNTO
CATY
CRNA
MUNI
ALCA
CALA
MOLI
ALIA
2025 Jun 09 02:18:19
ARANZADI zientzia elkartea

33) ZARA