

# ARA-DAC Weekly Analysis Result: 2283 (GFA)

## Technical Report

**GPS Week: 2283 (GFA)**

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

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Report generated on 2023/10/30 at 19:11:04

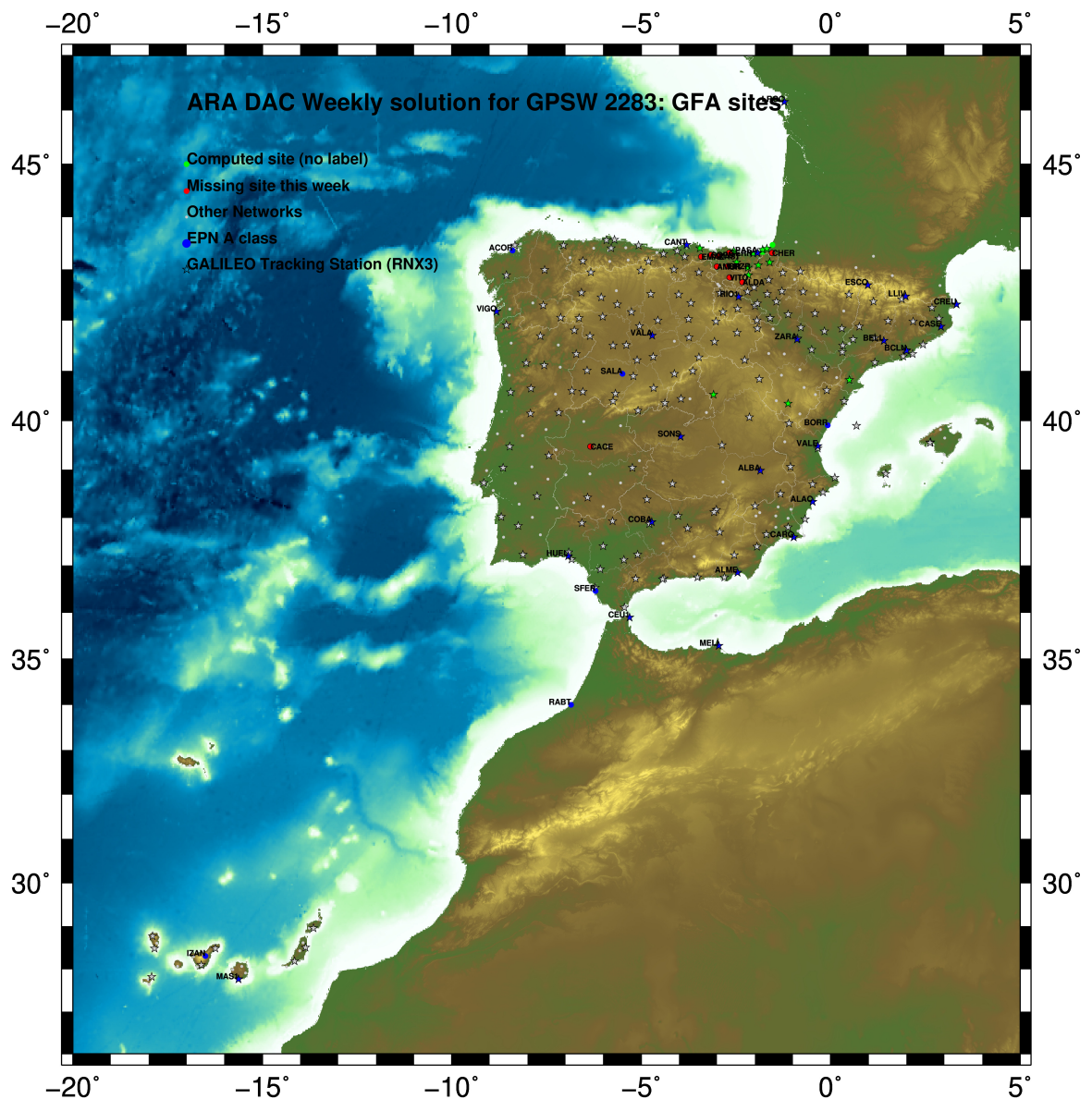


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# 1 Introduction

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



GM 2023 Oct 30 19:10:59

Fig.1: Computed Sites for GPS Week2283 (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 observation of this/these GNSS/GNSSs are excluded from the analysis of that station.
- EPN\_A class sites (CRD + VEL) IGS20 used to define the reference frame (no EPN release is available at the time this report is generated). Following the EUREF guidelines, no other individual calibrations are included in the analysis starting GPSW 2238 (IGS20).
- Calibraciones de antena: calibraciones absolutas del IGS, incluidas en el fichero igs20.atx. A partir de la semana GPS 2238 (IGS20) No se incluyen calibraciones absolutas individuales de ninguna otra antena.
- El datum se establece con las estaciones EPN de clase A (coordenadas y velocidades) en datum IGS20 (solución PRELIMINAR, basada en IGB14). En caso de no disponer de datos de calibración de una determinada antena/radomo para cierto sistema GNSS, las observaciones de éste se omiten en el cálculo de la estación.
- 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 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. 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 are the ones used in the Minimal Constraints condition.

### 5.1 IGS20

The Reference Frame considered in this section is a PRELIMINARY IGS20, based on the previously used IGB14 solution.

ARA FINAL WEEKLY COMBINATION: FINAL ORBITS 30-OCT-23 18:25

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LOCAL GEODETIC DATUM: IGS20 EPOCH: 2023-10-11 11:59:45

| NUM | STATION NAME   | X (M)         | Y (M)         | Z (M)         | FLAG | SYSTEM |
|-----|----------------|---------------|---------------|---------------|------|--------|
| 4   | ACOR 13434M001 | 4594489.51395 | -678367.35072 | 4357066.33346 | W    | G      |
| 50  | ALSA 19419M001 | 4677250.78313 | -176770.31190 | 4319079.92680 | A    | GRE    |
| 100 | BIAZ 10074M002 | 4634455.99254 | -124344.89345 | 4365785.50429 | A    | GR     |
| 101 | BIDA 00000M000 | 4644177.76768 | -145778.23994 | 4354832.53099 | A    | GR     |
| 116 | CANT 13438M001 | 4625924.26574 | -307096.15474 | 4365771.61320 | W    | GRE    |
| 162 | CREU 13432M001 | 4715420.07312 | 273178.14285  | 4271946.89519 | W    | GRE    |
| 204 | EBRE 13410M001 | 4833519.93494 | 41537.47700   | 4147461.76743 | A    | GRE    |
| 180 | ELGE 19353S001 | 4657557.34191 | -202241.38866 | 4338991.93890 | A    | GRE    |
| 257 | HOND 15012M002 | 4640529.26578 | -145675.90282 | 4358781.80722 | A    | GRE    |
| 235 | IGEL 19352S001 | 4645951.37398 | -165574.42183 | 4352550.47436 | A    | GRE    |
| 240 | ISPS 19484M001 | 4640596.42839 | -206963.69483 | 4356391.96847 | A    | GRE    |
| 252 | LARE 19440M001 | 4632831.90437 | -279026.06361 | 4360314.48224 | A    | GRE    |
| 256 | LAZK 19354S001 | 4666098.28820 | -178186.10896 | 4330463.72196 | A    | GRE    |
| 261 | LEIT 19428M001 | 4663520.88615 | -155858.63708 | 4334519.93887 | A    | GRE    |
| 334 | ORON 19427M001 | 4659695.72677 | -130864.65327 | 4338948.93706 | A    | GRE    |
| 345 | PASZ 19351S001 | 4644909.00786 | -156644.98811 | 4353623.12883 | A    | GRE    |
| 493 | PASA 19351S001 | 4644909.00785 | -156644.98827 | 4353623.12895 | W    | GRE    |
| 553 | RID1 13448M002 | 4708446.77623 | -199490.20048 | 4284089.78878 | W    | GR     |
| 558 | SALA 13469M001 | 4803054.43662 | -462130.98655 | 4158379.12956 | W    | GR     |
| 566 | SCDA 10088M002 | 4639940.45067 | -136224.85963 | 4359552.47495 | A    | GRE    |
| 443 | TERU 13487M001 | 4867391.26839 | -95523.26127  | 4108341.73466 | A    | GRE    |
| 752 | YEBE 13420M001 | 4848724.52017 | -261631.84460 | 4123094.38343 | A    | GRE    |
| 755 | ZARA 13462M001 | 4773803.11754 | -73505.90223  | 4215454.14863 | W    | GRE    |

### 5.2 ETRF2000 (ETRS89) Coordinates

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

CONVERT TO ETRF2000 30-OCT-23 18:25

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LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2023-10-11 11:59:45

| NUM | STATION NAME   | X (M)         | Y (M)         | Z (M)         | FLAG | SYSTEM |
|-----|----------------|---------------|---------------|---------------|------|--------|
| 4   | ACOR 13434M001 | 4594489.85278 | -678367.97414 | 4357065.86150 | W    |        |
| 50  | ALSA 19419M001 | 4677251.18607 | -176770.94424 | 4319079.45473 | A    |        |
| 100 | BIAZ 10074M002 | 4634456.40620 | -124345.52054 | 4365785.03662 | A    |        |
| 101 | BIDA 00000M000 | 4644178.17761 | -145778.86825 | 4354832.06219 | A    |        |
| 116 | CANT 13438M001 | 4625924.65497 | -307096.78128 | 4365771.14374 | W    |        |
| 162 | CREU 13432M001 | 4715420.53238 | 273177.50751  | 4271946.42596 | W    |        |
| 204 | EBRE 13410M001 | 4833520.35336 | 41536.82684   | 4147461.28488 | A    |        |
| 180 | ELGE 19353S001 | 4657557.74303 | -202242.01872 | 4338991.46817 | A    |        |
| 257 | HOND 15012M002 | 4640529.67604 | -145676.53070 | 4358781.33874 | A    |        |
| 235 | IGEL 19352S001 | 4645951.78108 | -165575.05041 | 4352550.00514 | A    |        |
| 240 | ISPS 19484M001 | 4640596.83027 | -206964.32288 | 4356391.49914 | A    |        |
| 252 | LARE 19440M001 | 4632832.29692 | -279026.69091 | 4360314.01258 | A    |        |
| 256 | LAZK 19354S001 | 4666098.69186 | -178186.73997 | 4330463.25083 | A    |        |
| 261 | LEIT 19428M001 | 4663521.29312 | -155859.26773 | 4334519.46827 | A    |        |
| 334 | ORON 19427M001 | 4659696.13743 | -130865.28339 | 4338948.46713 | A    |        |
| 345 | PASZ 19351S001 | 4644909.41624 | -156645.61654 | 4353622.65982 | A    |        |
| 493 | PASA 19351S001 | 4644909.41623 | -156645.61670 | 4353622.65994 | W    |        |
| 553 | RID1 13448M002 | 4708447.17335 | -199490.83658 | 4284089.31371 | W    |        |
| 558 | SALA 13469M001 | 4803054.78858 | -462131.63441 | 4158378.64268 | W    |        |
| 566 | SCDA 10088M002 | 4639940.86225 | -136225.48741 | 4359552.00665 | A    |        |
| 443 | TERU 13487M001 | 4867391.66538 | -95523.91586  | 4108341.24731 | A    |        |
| 752 | YEBE 13420M001 | 4848724.89614 | -261632.49743 | 4123093.89540 | A    |        |
| 755 | ZARA 13462M001 | 4773803.52602 | -73506.54571  | 4215453.66966 | W    |        |

### 5.3 ETRF2014 (ETRS89) Coordinates

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

CONVERT TO ETRF2014 30-OCT-23 18:25

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LOCAL GEODETIC DATUM: ETRF2014 EPOCH: 2023-10-11 11:59:45

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

|     |      |           |               |               |               |   |
|-----|------|-----------|---------------|---------------|---------------|---|
| 4   | ACOR | 13434M001 | 4594489.81264 | -678368.01114 | 4357065.91372 | W |
| 50  | ALSA | 19419M001 | 4677251.14350 | -176770.98274 | 4319079.50685 | A |
| 100 | BIAZ | 10074M002 | 4634456.36392 | -124345.55942 | 4365785.08891 | A |
| 101 | BIDA | 00000M000 | 4644178.13529 | -145778.90701 | 4354832.11443 | A |
| 116 | CANT | 13438M001 | 4625924.61340 | -307096.81953 | 4365771.19596 | W |
| 162 | CREU | 13432M001 | 4715420.48767 | 273177.46755  | 4271946.47830 | W |
| 204 | EBRE | 13410M001 | 4833520.30822 | 41536.78824   | 4147461.33669 | A |
| 180 | ELGE | 19353S001 | 4657557.70077 | -202242.05721 | 4338991.52034 | A |
| 257 | HOND | 15012M002 | 4640529.63376 | -145676.56947 | 4358781.39099 | A |
| 235 | IGEL | 19352S001 | 4645951.73882 | -165575.08909 | 4352550.05736 | A |
| 240 | ISPS | 19484M001 | 4640596.78820 | -206964.36143 | 4356391.55136 | A |
| 252 | LARE | 19440M001 | 4632832.25518 | -279026.72923 | 4360314.06479 | A |
| 256 | LAZK | 19354S001 | 4666098.64941 | -178186.77851 | 4330463.30299 | A |
| 261 | LEIT | 19428M001 | 4663521.25063 | -155859.30636 | 4334519.52045 | A |
| 334 | ORON | 19427M001 | 4659696.09489 | -130865.32213 | 4338948.51934 | A |
| 345 | PAS2 | 19351S001 | 4644909.37395 | -156645.65525 | 4353622.71205 | A |
| 493 | PASA | 19351S001 | 4644909.37394 | -156645.65541 | 4353622.71217 | W |
| 553 | RI01 | 13448M002 | 4708447.13051 | -199490.87485 | 4284089.36573 | W |
| 558 | SALA | 13469M001 | 4803054.74551 | -462131.67130 | 4158378.69433 | W |
| 566 | SC0A | 10088M002 | 4639940.81995 | -136225.52622 | 4359552.05891 | A |
| 443 | TERU | 13487M001 | 4867391.62036 | -95523.95380  | 4108341.29894 | A |
| 752 | YEBE | 13420M001 | 4848724.85191 | -261632.53485 | 4123093.94700 | A |
| 755 | ZARA | 13462M001 | 4773803.48200 | -73506.58416  | 4215453.72156 | 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 IGS20 solution and are given with respect to the Local frame (North-East-Up).

GFA FINAL WEEKLY COMBINATION: FINAL ORBITS 30-OCT-23 18:25

| Station        | #Days | Weekday<br>0123456 | Repeatability (mm) |      |      |
|----------------|-------|--------------------|--------------------|------|------|
|                |       |                    | N                  | E    | U    |
| ACDR 13434M001 | 7     | XXXXXX             | 0.71               | 1.07 | 2.46 |
| ALSA 19419M001 | 7     | XXXXXX             | 2.64               | 1.39 | 5.89 |
| BLAZ 10074M002 | 7     | XXXXXX             | 1.14               | 0.71 | 4.84 |
| BIDA 00000M000 | 7     | XXXXXX             | 1.96               | 0.95 | 3.57 |
| CANT 13438M001 | 7     | XXXXXX             | 0.78               | 0.55 | 4.88 |
| CREU 13432M001 | 7     | XXXXXX             | 0.78               | 1.05 | 1.97 |
| EBRE 13410M001 | 7     | XXXXXX             | 0.60               | 0.87 | 4.33 |
| ELGE 19353S001 | 7     | XXXXXX             | 0.89               | 0.70 | 3.95 |
| HOND 15012M002 | 7     | XXXXXX             | 1.21               | 0.58 | 2.50 |
| IGEL 19352S001 | 7     | XXXXXX             | 1.13               | 0.75 | 5.16 |
| ISPS 19484M001 | 7     | XXXXXX             | 1.06               | 1.86 | 2.39 |
| LARE 19440M001 | 7     | XXXXXX             | 1.93               | 0.55 | 3.95 |
| LAZK 19354S001 | 7     | XXXXXX             | 0.90               | 0.82 | 4.48 |
| LEIT 19428M001 | 7     | XXXXXX             | 1.59               | 0.90 | 3.08 |
| ORON 19427M001 | 7     | XXXXXX             | 1.10               | 0.95 | 5.10 |
| PAS2 19351S001 | 7     | XXXXXX             | 1.41               | 0.97 | 3.84 |
| PASA 19351S001 | 7     | XXXXXX             | 1.33               | 0.72 | 3.83 |
| RIO1 13448M002 | 7     | XXXXXX             | 0.61               | 0.50 | 3.63 |
| SALA 13469M001 | 7     | XXXXXX             | 0.65               | 0.75 | 2.57 |
| SCDA 10088M002 | 7     | XXXXXX             | 1.39               | 1.31 | 6.04 |
| TERU 13487M001 | 7     | XXXXXX             | 0.45               | 0.52 | 2.04 |
| YEBE 13420M001 | 7     | XXXXXX             | 0.52               | 0.72 | 2.04 |
| ZARA 13462M001 | 7     | XXXXXX             | 0.65               | 0.85 | 2.18 |

Comparison of individual solutions:

|                |   |      |       |       |       |        |       |       |       |
|----------------|---|------|-------|-------|-------|--------|-------|-------|-------|
| ACDR 13434M001 | N | 0.71 | 0.15  | -0.82 | -0.14 | 0.42   | 0.95  | 0.72  | -0.82 |
| ACDR 13434M001 | E | 1.07 | 0.29  | 0.75  | 0.70  | 0.46   | 1.51  | -1.81 | -0.10 |
| ACDR 13434M001 | U | 2.46 | 1.47  | -4.32 | 0.26  | 0.30   | -0.67 | 3.47  | -1.66 |
| ALSA 19419M001 | N | 2.64 | 0.33  | 1.01  | 1.70  | -0.62  | -0.99 | -5.76 | 1.81  |
| ALSA 19419M001 | E | 1.39 | -0.21 | 0.15  | -0.17 | -1.83  | -0.49 | 2.53  | -1.22 |
| ALSA 19419M001 | U | 5.89 | 0.89  | -0.82 | -1.16 | -10.16 | 4.07  | 7.56  | 5.33  |
| BLAZ 10074M002 | N | 1.14 | -2.00 | -1.07 | 0.19  | -0.27  | -1.08 | -1.08 | 0.45  |
| BLAZ 10074M002 | E | 0.71 | -0.13 | 0.04  | 0.39  | -0.05  | -0.36 | -1.65 | -0.11 |
| BLAZ 10074M002 | U | 4.84 | -0.30 | -2.55 | -1.84 | 0.61   | 7.92  | 7.59  | -3.16 |
| BIDA 00000M000 | N | 1.96 | -1.76 | -2.50 | -1.29 | 0.04   | -0.74 | -1.75 | 2.89  |
| BIDA 00000M000 | E | 0.95 | -0.11 | 1.05  | 0.26  | -0.24  | -1.07 | -1.74 | 0.13  |
| BIDA 00000M000 | U | 3.57 | -1.50 | -3.47 | -0.09 | 2.31   | 6.63  | 3.55  | 0.44  |
| CANT 13438M001 | N | 0.78 | -1.18 | -0.58 | 0.33  | -0.66  | -0.89 | 0.56  | -0.48 |
| CANT 13438M001 | E | 0.55 | -0.12 | 0.26  | -0.41 | 0.11   | -0.35 | -0.09 | -1.19 |
| CANT 13438M001 | U | 4.88 | -0.78 | -4.88 | -2.72 | -2.30  | 6.32  | 0.25  | 8.09  |
| CREU 13432M001 | N | 0.78 | 0.16  | -0.46 | 0.57  | 0.26   | -0.28 | -0.76 | 1.52  |
| CREU 13432M001 | E | 1.05 | -0.93 | 1.02  | -0.39 | 0.34   | -1.64 | 0.84  | -1.00 |
| CREU 13432M001 | U | 1.97 | 3.12  | -0.11 | -2.28 | -0.08  | -0.39 | 1.64  | 2.35  |
| EBRE 13410M001 | N | 0.60 | 0.18  | -0.41 | 1.07  | 0.20   | -0.52 | -0.21 | 0.69  |
| EBRE 13410M001 | E | 0.87 | -0.03 | 0.46  | 0.56  | 0.11   | -1.84 | -0.06 | -0.80 |
| EBRE 13410M001 | U | 4.33 | -1.42 | -4.58 | -1.55 | -1.50  | 4.45  | 0.97  | 8.00  |
| ELGE 19353S001 | N | 0.89 | -0.52 | 0.10  | 0.53  | -0.00  | -0.76 | -0.55 | -1.82 |
| ELGE 19353S001 | E | 0.70 | -0.62 | -0.43 | 0.03  | 0.01   | -1.06 | 1.02  | 0.48  |
| ELGE 19353S001 | U | 3.95 | 1.39  | -1.46 | -5.28 | 2.59   | 6.85  | 2.82  | 0.19  |
| HOND 15012M002 | N | 1.21 | -1.79 | -1.66 | -0.44 | 0.01   | -1.23 | -0.67 | 0.81  |
| HOND 15012M002 | E | 0.58 | -0.07 | -0.04 | 0.72  | -0.35  | -0.81 | -0.75 | -0.33 |
| HOND 15012M002 | U | 2.50 | -0.39 | -0.11 | 1.60  | -0.28  | 5.62  | 1.77  | -0.28 |
| IGEL 19352S001 | N | 1.13 | -1.46 | -1.50 | -1.49 | -0.39  | -0.28 | -0.68 | 0.62  |
| IGEL 19352S001 | E | 0.75 | 0.03  | 0.55  | 0.25  | -0.20  | -1.60 | -0.10 | -0.63 |
| IGEL 19352S001 | U | 5.16 | 2.38  | -4.72 | -2.38 | -1.83  | 5.62  | 9.54  | -0.09 |
| ISPS 19484M001 | N | 1.06 | -0.69 | -1.31 | -0.16 | -0.46  | 0.30  | -1.62 | -1.27 |
| ISPS 19484M001 | E | 1.86 | -2.04 | -0.10 | 2.22  | 0.01   | -3.21 | 1.16  | 0.33  |
| ISPS 19484M001 | U | 2.39 | 3.21  | -1.11 | -0.24 | -0.72  | 0.92  | 3.00  | 3.50  |
| LARE 19440M001 | N | 1.93 | 1.07  | 1.03  | 0.73  | 0.77   | -0.40 | -2.43 | -3.59 |
| LARE 19440M001 | E | 0.55 | -0.72 | -0.02 | 0.31  | -0.08  | -0.27 | -0.04 | -1.05 |
| LARE 19440M001 | U | 3.95 | -1.51 | -2.51 | -2.34 | -2.72  | 1.39  | 6.54  | 5.22  |
| LAZK 19354S001 | N | 0.90 | -1.68 | -0.29 | -0.56 | -0.41  | -0.68 | 0.25  | 0.98  |
| LAZK 19354S001 | E | 0.82 | -0.27 | 0.05  | -0.43 | -0.21  | -0.83 | 1.46  | -0.95 |
| LAZK 19354S001 | U | 4.48 | -0.12 | -3.26 | 1.05  | -3.72  | 4.51  | 8.55  | -1.29 |
| LEIT 19428M001 | N | 1.59 | 0.11  | -1.49 | 0.58  | -0.94  | -2.95 | 0.78  | 1.53  |
| LEIT 19428M001 | E | 0.90 | -0.52 | 0.48  | -0.14 | 1.09   | -0.86 | 0.38  | -1.50 |
| LEIT 19428M001 | U | 3.08 | -0.02 | -2.03 | 4.08  | -2.88  | 4.41  | 2.66  | 1.14  |
| ORON 19427M001 | N | 1.10 | 0.14  | -0.50 | 0.61  | -1.16  | -1.61 | -1.45 | 0.76  |
| ORON 19427M001 | E | 0.95 | 0.45  | -1.02 | 0.83  | -0.76  | -1.69 | 0.19  | -0.19 |
| ORON 19427M001 | U | 5.10 | -1.38 | -3.52 | -1.81 | 5.11   | 7.22  | 7.44  | 2.26  |
| PAS2 19351S001 | N | 1.41 | -1.19 | -1.49 | -1.58 | -1.29  | -1.14 | -0.56 | 1.57  |
| PAS2 19351S001 | E | 0.97 | -0.24 | 0.86  | 1.15  | -0.68  | -0.65 | -1.56 | -0.48 |
| PAS2 19351S001 | U | 3.84 | 1.07  | -4.55 | -0.12 | 0.87   | 5.73  | 5.75  | -0.24 |
| PASA 19351S001 | N | 1.33 | -1.35 | -1.22 | -1.31 | -0.39  | -1.53 | -0.83 | 1.54  |
| PASA 19351S001 | E | 0.72 | 0.07  | 0.58  | 0.57  | -0.90  | -0.73 | -0.97 | -0.37 |
| PASA 19351S001 | U | 3.83 | 0.76  | -3.74 | 0.20  | -0.90  | 6.55  | 5.44  | 0.11  |
| RIO1 13448M002 | N | 0.61 | -0.26 | -0.85 | 0.26  | -0.76  | -0.58 | -0.57 | 0.37  |
| RIO1 13448M002 | E | 0.50 | -0.53 | 0.72  | -0.10 | 0.01   | -0.58 | -0.46 | -0.38 |
| RIO1 13448M002 | U | 3.63 | -0.29 | -2.61 | 1.19  | -3.79  | 5.76  | 1.13  | 4.68  |
| SALA 13469M001 | N | 0.65 | -0.64 | 0.81  | -0.08 | -1.18  | -0.11 | 0.24  | -0.10 |
| SALA 13469M001 | E | 0.75 | -0.93 | 0.18  | 0.07  | -0.20  | 1.43  | -0.52 | -0.28 |
| SALA 13469M001 | U | 2.57 | -0.72 | -3.95 | 0.55  | -0.72  | 4.73  | -0.63 | 0.08  |
| SCDA 10088M002 | N | 1.39 | -2.05 | -2.17 | -0.31 | -0.68  | -0.70 | 1.22  | -0.33 |
| SCDA 10088M002 | E | 1.31 | 0.26  | -0.21 | -0.45 | -0.34  | 1.31  | 0.53  | -2.82 |
| SCDA 10088M002 | U | 6.04 | -2.46 | -7.72 | -1.41 | 3.35   | 9.92  | 6.43  | 0.05  |
| TERU 13487M001 | N | 0.45 | 0.10  | 0.49  | 0.32  | 0.36   | 0.83  | 0.09  | 0.19  |
| TERU 13487M001 | E | 0.52 | -0.67 | 0.54  | -0.10 | 0.53   | 0.35  | 0.49  | 0.51  |
| TERU 13487M001 | U | 2.04 | 1.77  | -0.14 | 2.47  | -2.01  | -3.28 | -0.99 | -0.13 |
| YEBE 13420M001 | N | 0.52 | -0.48 | -0.14 | 0.42  | -0.14  | -0.80 | 0.37  | -0.62 |
| YEBE 13420M001 | E | 0.72 | 0.94  | -0.86 | -0.73 | 0.05   | 0.79  | -0.29 | -0.50 |
| YEBE 13420M001 | U | 2.04 | 1.34  | -0.54 | 2.85  | -3.28  | -1.94 | 0.54  | 0.21  |
| ZARA 13462M001 | N | 0.65 | -0.30 | -0.25 | 0.00  | -0.84  | -0.83 | -0.90 | 0.46  |
| ZARA 13462M001 | E | 0.85 | -0.27 | 0.13  | 0.53  | -0.45  | -1.93 | -0.23 | 0.09  |
| ZARA 13462M001 | U | 2.18 | 1.11  | 2.92  | -1.82 | 0.52   | 1.56  | 1.25  | 3.35  |

## 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 |        |                         |
|-----------------------------|----------------|-----|--------------------------|--------|-------------------------|
| 1                           | ACOR 13434M001 | I W | -2.22                    | 2.07   | -2.11                   |
| 2                           | ALAC 13433M001 | I W | -1.60                    | 1.58   | 2.25                    |
| 3                           | ALBA 13452M001 | I W | 4.62                     | -1.62  | -4.65                   |
| 4                           | ALME 13437M001 | I W | -1.71                    | -0.27  | 4.37                    |
| 5                           | BCLN 13412M001 | I W | 2.07                     | -2.46  | 3.11                    |
| 6                           | BELL 13431M001 | I W | -1.20                    | -0.88  | 1.65                    |
| 7                           | BORR 13480M001 | I W | -1.39                    | 2.11   | 3.72                    |
| 8                           | BRST 10004M004 | I W | -3.02                    | 1.01   | 1.25                    |
| 9                           | CANT 13438M001 | I W | -4.21                    | 3.08   | -7.22                   |
| 10                          | CARG 19412M001 | I W | 2.21                     | 0.85   | -3.48                   |
| 11                          | CASE 13494M001 | I W | -5.00                    | 1.35   | 1.04                    |
| 12                          | CEU1 13449M002 | I W | 1.04                     | -1.41  | -3.36                   |
| 13                          | COBA 13453M001 | I W | 2.28                     | 0.98   | -5.03                   |
| 14                          | CREU 13432M001 | I W | -3.20                    | 0.67   | -0.40                   |
| 16                          | ESCO 13435M001 | I W | -3.93                    | 0.65   | 0.77                    |
| 17                          | HUEL 13451M001 | I W | 10.06                    | -8.67  | 10.16                   |
| 19                          | IZAN 31309M002 | I W | 2.29                     | 0.98   | 2.16                    |
| 20                          | LLIV 13436M001 | I W | -0.31                    | 0.25   | 4.66                    |
| 22                          | LRGC 10023M001 | I W | -0.44                    | 2.75   | 5.44                    |
| 24                          | MAS1 31303M002 | I W | 1.66                     | -1.33  | -1.69                   |
| 25                          | MELI 19379M001 | I W | 4.72                     | 0.85   | -2.96                   |
| 26                          | PASA 19351S001 | I W | 0.43                     | 1.64   | -4.34                   |
| 27                          | RABT 35001M002 | I W | 1.19                     | 0.52   | -9.02                   |
| 28                          | RID1 13448M002 | I W | -2.70                    | -1.34  | -0.35                   |
| 29                          | SALA 13469M001 | I W | 1.59                     | 0.42   | -0.50                   |
| 31                          | SFER 13402M004 | I W | -1.48                    | -11.45 | 4.33                    |
| 32                          | SONS 13446M001 | I W | 0.28                     | 2.52   | -0.76                   |
| 33                          | VALA 13463M002 | I W | 0.98                     | -0.28  | 0.40                    |
| 34                          | VALE 13439M001 | I W | -4.16                    | 3.22   | -2.56                   |
| 35                          | VIGO 13450M001 | I W | 2.68                     | -0.29  | 0.79                    |
| 38                          | ZARA 13462M001 | I W | -0.78                    | 1.09   | -1.31                   |
| 39                          | ZIMM 14001M004 | I W | -2.63                    | -1.62  | 1.08                    |
| RMS / COMPONENT             |                |     | 3.14                     | 3.01   | 3.94                    |
| IQR                         |                |     | 4.29                     | 2.57   | 4.96                    |
| MEAN                        |                |     | -0.06                    | -0.09  | -0.08                   |
| MEDIAN                      |                |     | -0.38                    | 0.66   | 0.03                    |
| MIN                         |                |     | -5.00                    | -11.45 | -9.02                   |
| MAX                         |                |     | 10.06                    | 3.22   | 10.16                   |
| OVERALL RMS/IQR/MAX(3D)     |                |     | 3.39                     | 3.31   | 16.72                   |
|                             |                |     |                          |        | HUEL 13451M001 #SUM     |
| ALL RMS / COMPONENT         |                |     | 3.14                     | 3.01   | 3.94                    |
| ALL IQR                     |                |     | 4.29                     | 2.57   | 4.96                    |
| ALL MEAN                    |                |     | -0.06                    | -0.09  | -0.08                   |
| ALL MEDIAN                  |                |     | -0.38                    | 0.66   | 0.03                    |
| ALL MIN                     |                |     | -5.00                    | -11.45 | -9.02                   |
| ALL MAX                     |                |     | 10.06                    | 3.22   | 10.16                   |
| ALL OVERALL RMS/IQR/MAX(3D) |                |     | 3.39                     | 3.31   | 16.72                   |
|                             |                |     |                          |        | HUEL 13451M001 #SUM_ALL |

NUMBER OF PARAMETERS : 3  
NUMBER OF STATIONS : 32  
NUMBER OF COORDINATES : 96  
RMS OF TRANSFORMATION : 3.39 MM

PARAMETERS:

TRANSLATION IN X : -0.00 +- 0.60 MM  
TRANSLATION IN Y : 0.00 +- 0.60 MM  
TRANSLATION IN Z : -0.00 +- 0.60 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          17003916
NUMBER OF UNKNOWN(S)            181513
NUMBER OF DEGREES OF FREEDOM    16822403
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)     180
VARIANCE FACTOR                  3.900522748015444
```

## 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 23:281:00000 23:287:86370 LEICA GR50 -----
ALSA A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
BIAZ A 1 P 23:281:00000 23:287:86370 SPECTRA SP90M -----
BIDA A 1 P 23:281:00000 23:287:86370 LEICA GR10 -----
CANT A 1 P 23:281:00000 23:287:86370 LEICA GR10 -----
CREU A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
EBRE A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
ELGE A 1 P 23:281:00000 23:287:86370 LEICA GR30 -----
HOND A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
IGEL A 1 P 23:281:00000 23:287:86370 LEICA GR30 -----
ISPS A 1 P 23:281:00000 23:287:86370 TRIMBLE NETR9 -----
LARE A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
LAZK A 1 P 23:281:00000 23:287:86370 LEICA GR30 -----
LEIT A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
ORDN A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
PAS2 A 1 P 23:281:00000 23:287:86370 STONEX SC2200 -----
PASA A 1 P 23:281:00000 23:287:86370 LEICA GR30 -----
RI01 A 1 P 23:281:00000 23:287:86370 LEICA GR25 -----
SALA A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
SCDA A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
TERU A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
YEBE A 1 P 23:281:00000 23:287:86370 LEICA GR50 -----
ZARA A 1 P 23:281:00000 23:287:86370 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 23:281:00000 23:287:86370 LEIAT504 LEIS -----
ALSA A 1 P 23:281:00000 23:287:86370 LEIAR10 NONE -----
BIAZ A 1 P 23:281:00000 23:287:86370 LEIAR25 LEIT -----
BIDA A 1 P 23:281:00000 23:287:86370 LEIAS10 NONE -----
CANT A 1 P 23:281:00000 23:287:86370 LEIAR25_R4 LEIT -----
CREU A 1 P 23:281:00000 23:287:86370 LEIAR25_R4 NONE -----
EBRE A 1 P 23:281:00000 23:287:86370 LEIAR25_R4 NONE -----
ELGE A 1 P 23:281:00000 23:287:86370 LEIAR25_R4 LEIT -----
HOND A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
IGEL A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
ISPS A 1 P 23:281:00000 23:287:86370 TRM59900.00 SCIS -----
LARE A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
LAZK A 1 P 23:281:00000 23:287:86370 LEIAR25_R4 LEIT -----
LEIT A 1 P 23:281:00000 23:287:86370 LEIAR10 NONE -----
ORDN A 1 P 23:281:00000 23:287:86370 LEIAR10 NONE -----
PAS2 A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
PASA A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
RI01 A 1 P 23:281:00000 23:287:86370 LEIAR25_R4 LEIT -----
SALA A 1 P 23:281:00000 23:287:86370 LEIAR25 NONE -----
SCDA A 1 P 23:281:00000 23:287:86370 TRM55971.00 NONE -----
TERU A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
YEBE A 1 P 23:281:00000 23:287:86370 LEIAR20 LEIM -----
ZARA A 1 P 23:281:00000 23:287:86370 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 23:281:00000 23:287:86370 UNE 3.0460 0.0000 0.0000
ALSA A 1 P 23:281:00000 23:287:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 23:281:00000 23:287:86370 UNE 0.0000 0.0000 0.0000
BIDA A 1 P 23:281:00000 23:287:86370 UNE 0.0000 0.0000 0.0000
CANT A 1 P 23:281:00000 23:287:86370 UNE 3.0490 0.0000 0.0000
CREU A 1 P 23:281:00000 23:287:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 23:281:00000 23:287:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 23:281:00000 23:287:86370 UNE 0.0000 0.0000 0.0000
HOND A 1 P 23:281:00000 23:287:86370 UNE 0.0771 0.0000 0.0000
```

|      |   |   |   |              |              |     |        |        |        |
|------|---|---|---|--------------|--------------|-----|--------|--------|--------|
| IGEL | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| ISPS | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0350 | 0.0000 | 0.0000 |
| LARE | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| LAZK | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| LEIT | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| ORON | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| PAS2 | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| PASA | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| RIO1 | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0606 | 0.0000 | 0.0000 |
| SALA | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0600 | 0.0000 | 0.0000 |
| SCOA | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0000 | 0.0000 | 0.0000 |
| TERU | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0600 | 0.0000 | 0.0000 |
| YEBE | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 0.0600 | 0.0000 | 0.0000 |
| ZARA | A | 1 | P | 23:281:00000 | 23:287:86370 | UNE | 3.2590 | 0.0000 | 0.0000 |

## 8 Inconsistencies (logsheets-RINEX metadata)

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

```

2023-10-29 02:38 UTC | LARE2810.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-10-29 05:23 UTC | LARE2820.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-10-29 11:50 UTC | LARE2830.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-10-29 09:03 UTC | LARE2840.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-10-29 11:46 UTC | LARE2850.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-10-29 14:27 UTC | LARE2860.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log
2023-10-29 16:52 UTC | LARE2870.230 | RECEIVER FIRM. VERS. | 4.70/7.813 -> 4.61/7.811 (source: lare00esp_20230308.log

```

## 9 References

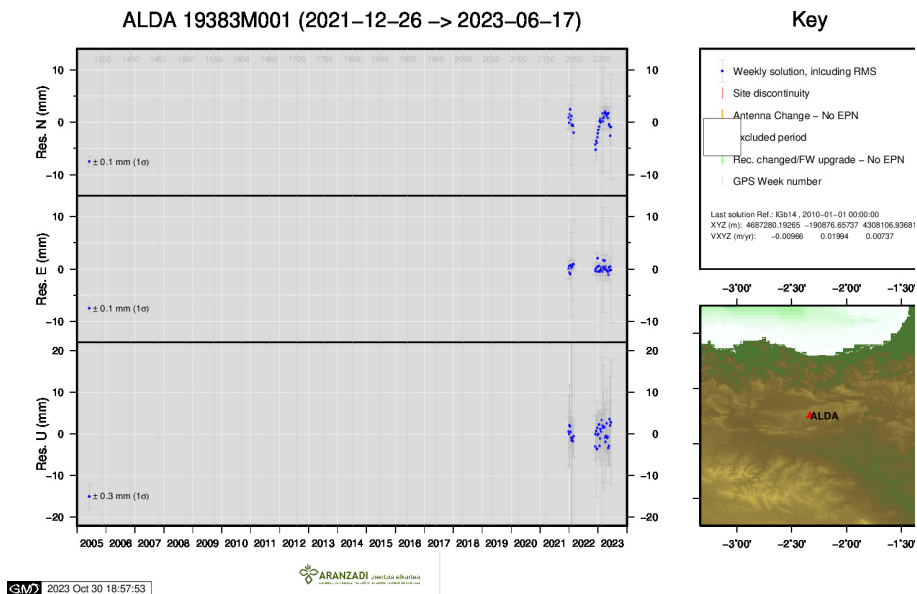
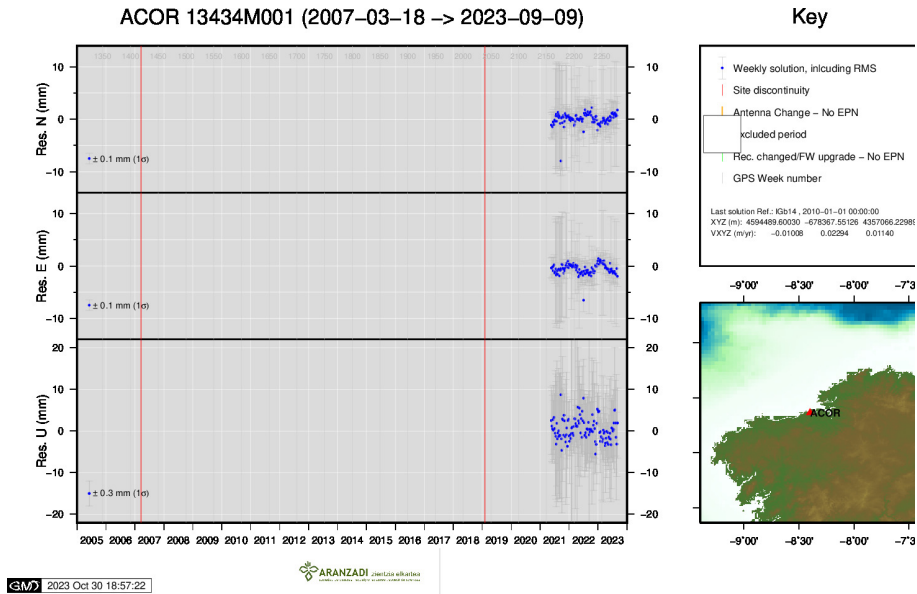
C. Boucher and Z. Altamimi (2011): *Specifications for reference frame fixing in the analysis of a EUREF GPS campaign*. [etrs89.ensg.ign.fr/memo-V8.pdf](https://etrs89.ensg.ign.fr/memo-V8.pdf)

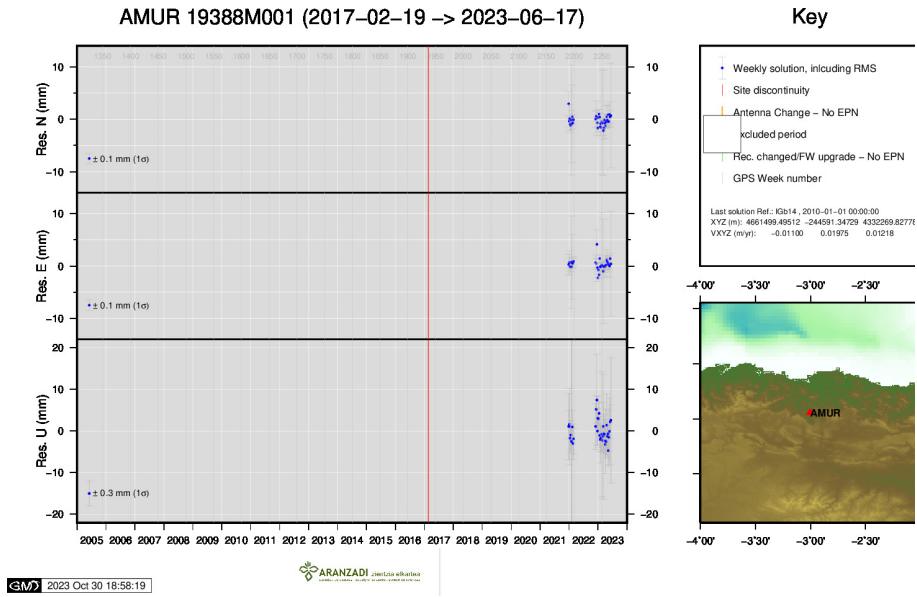
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. [epncb.oma.be/documentation/guidelines/guidelines\\_analysis\\_centres.pdf](https://epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf)

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

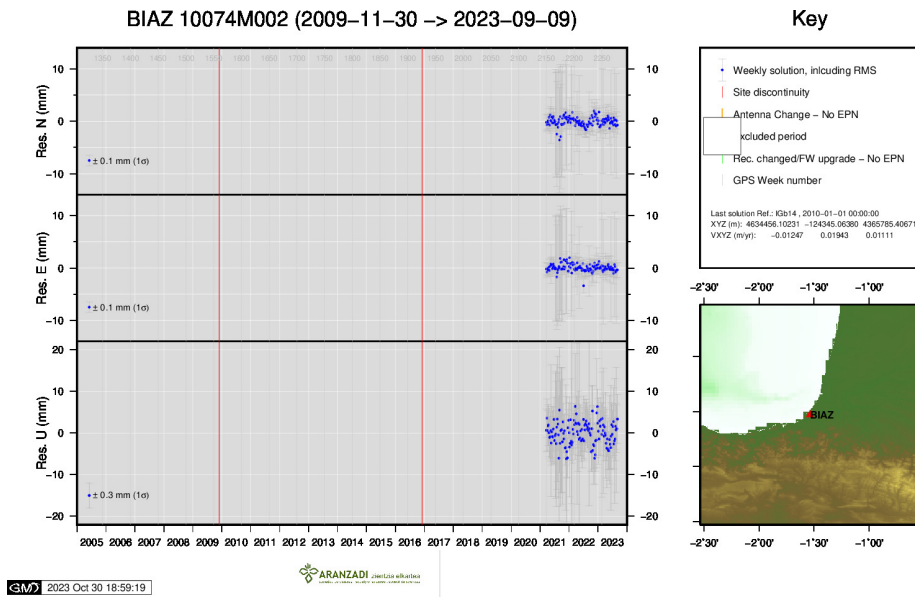
## 10 Cumulative Time Series

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

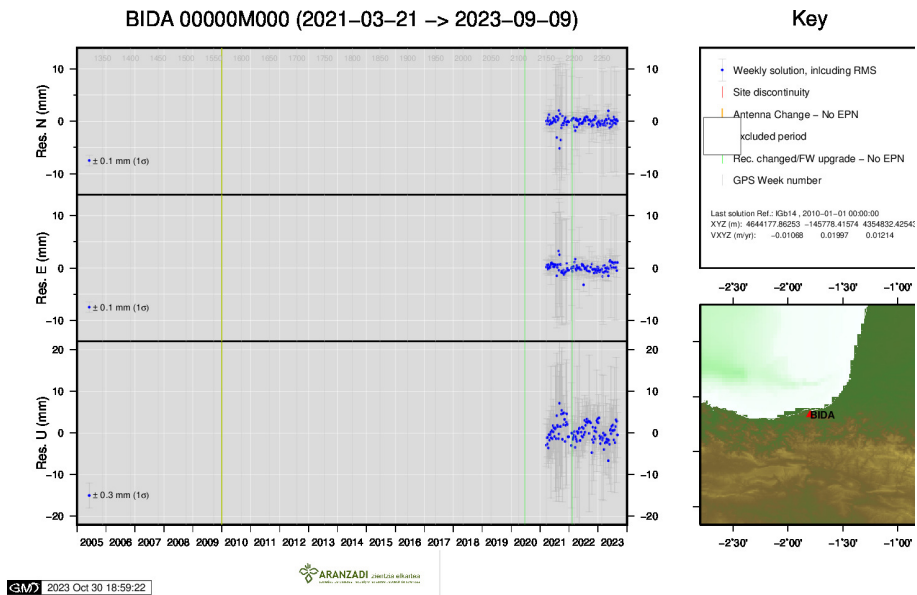




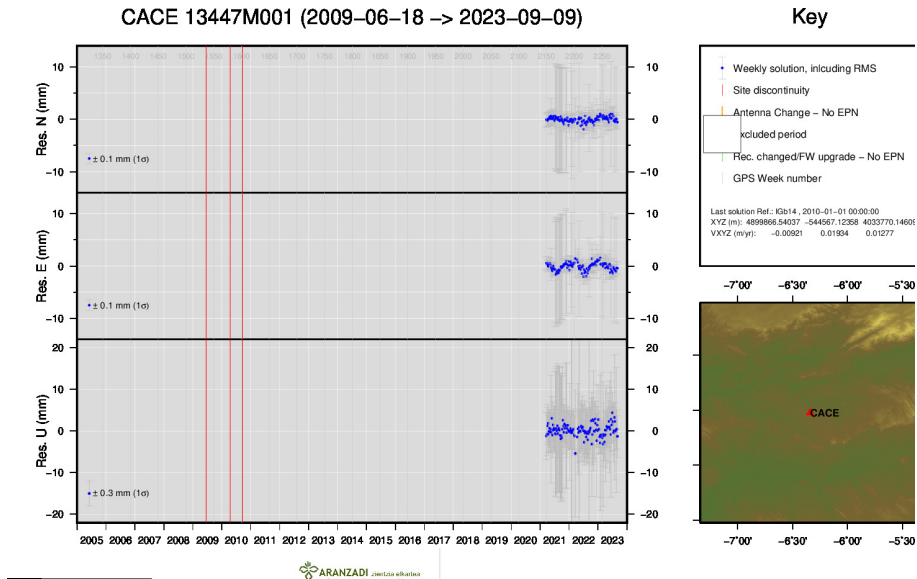
3 ) AMUR



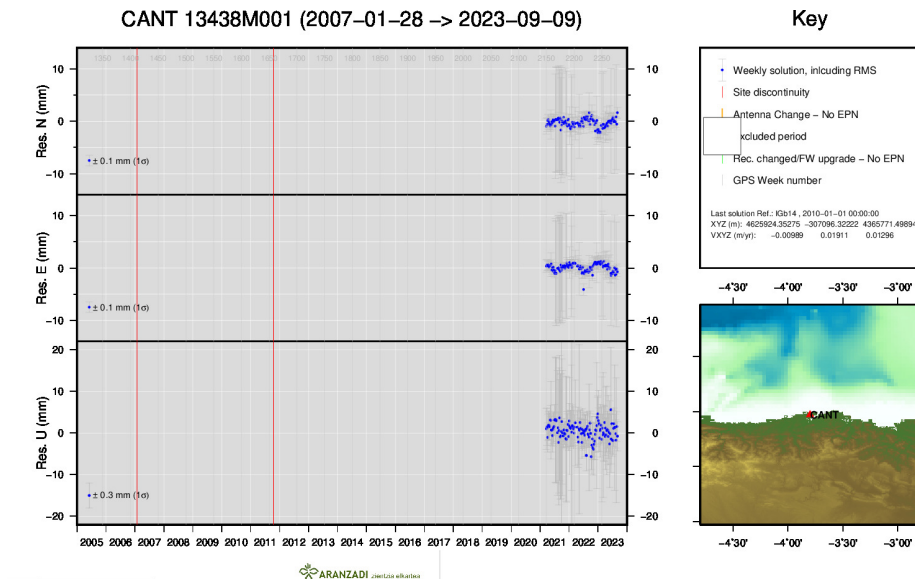
4 ) BIAZ



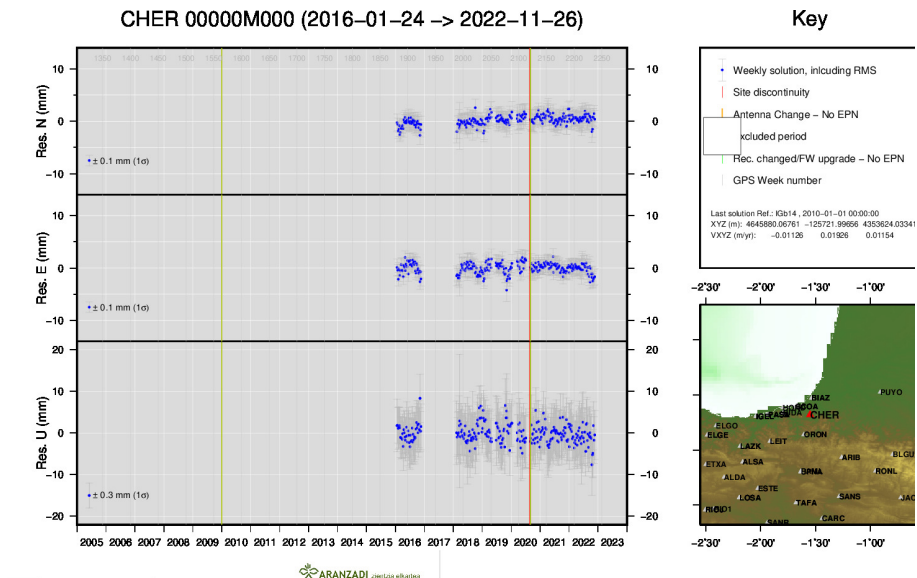
5 ) BIDA



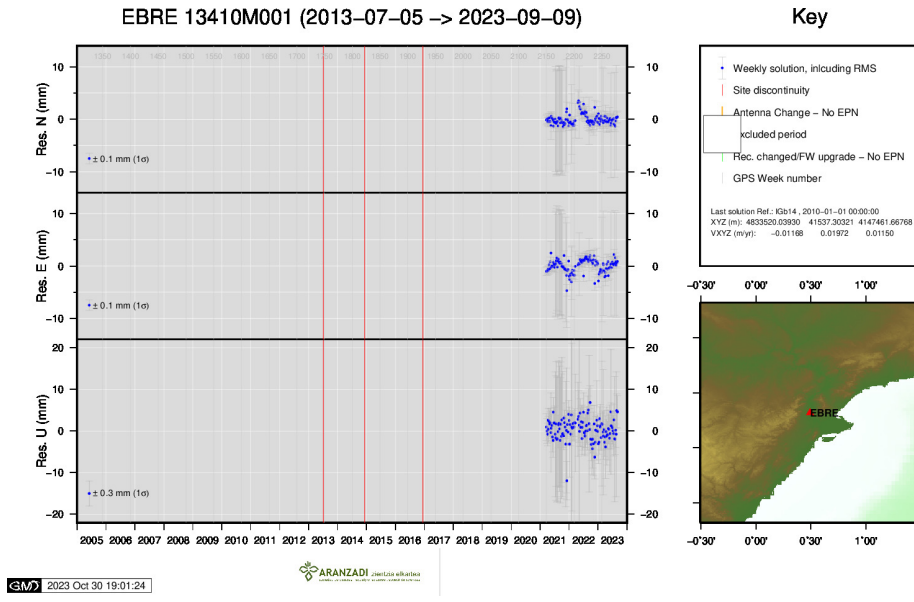
6 ) CACE



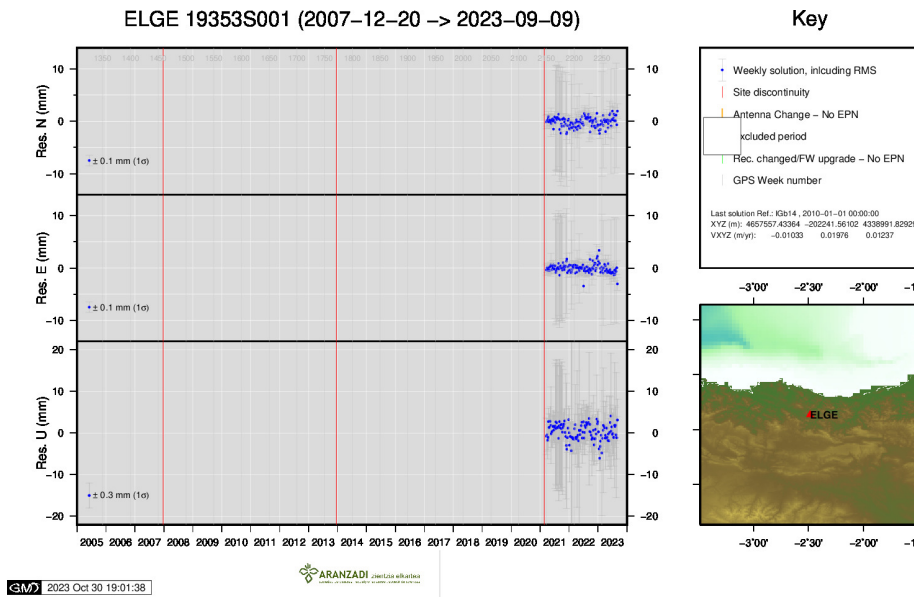
7 ) CANT



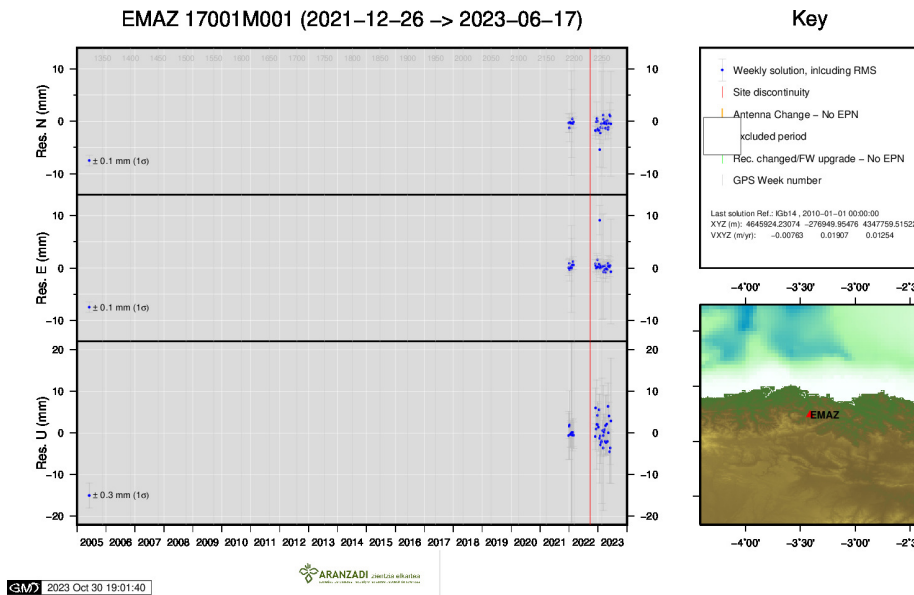
8 ) CHER



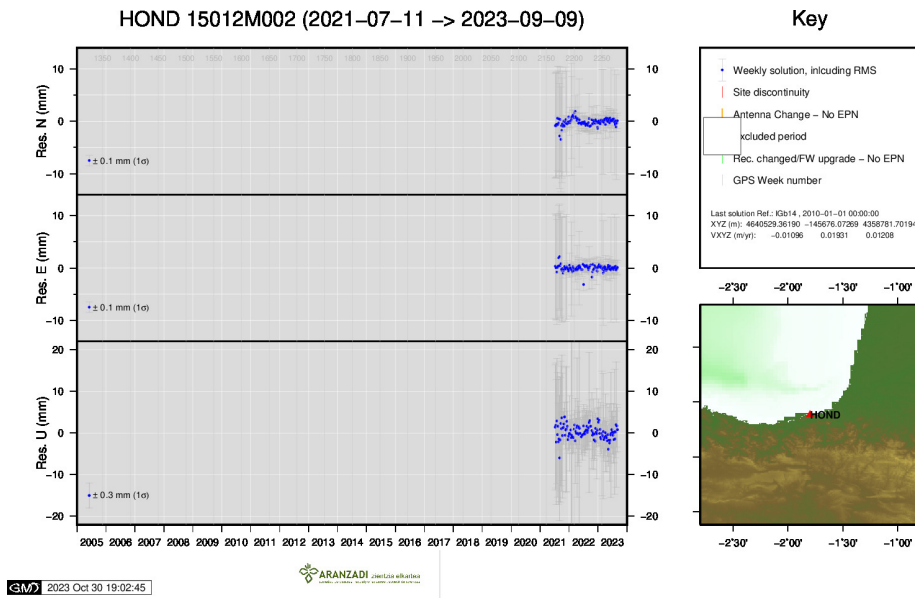
9 ) EBRE



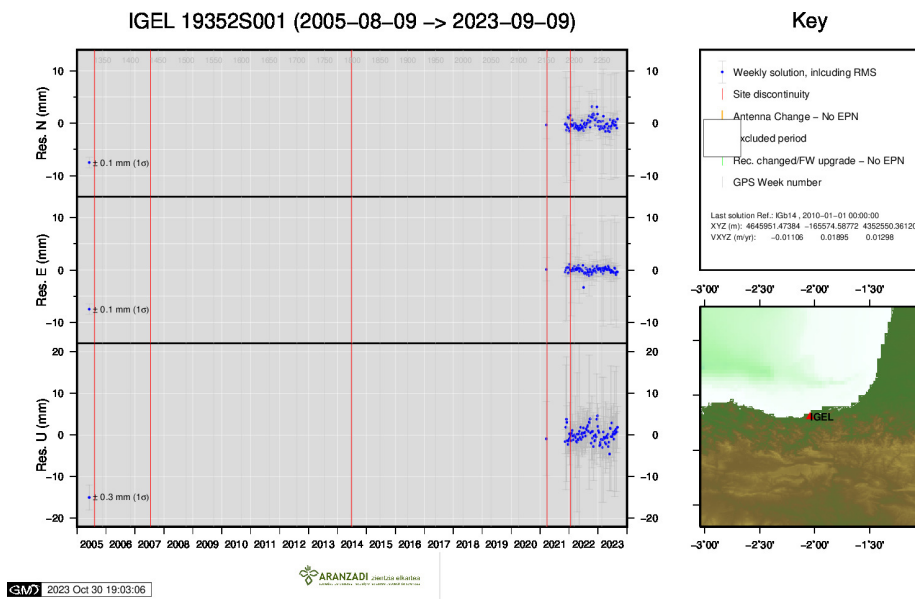
10 ) ELGE



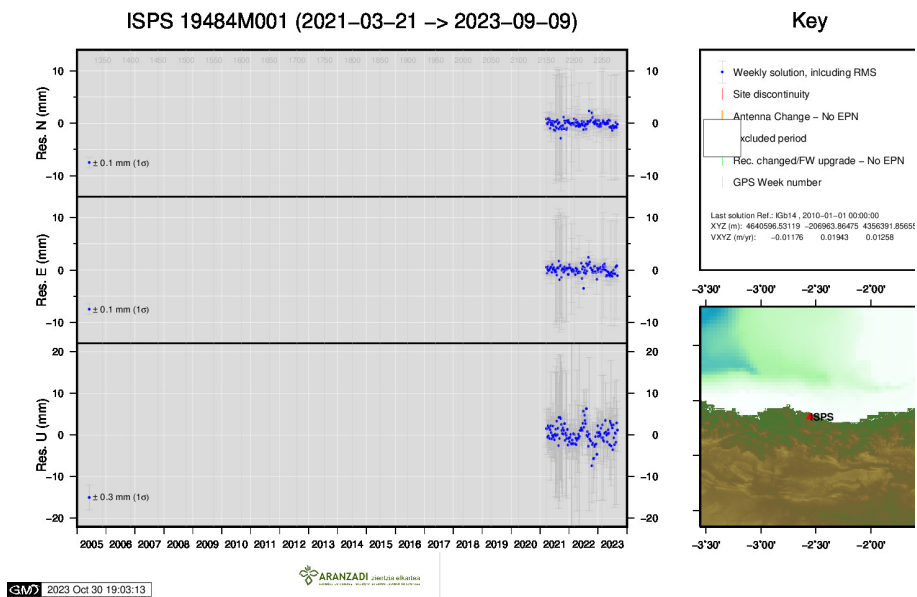
11 ) EMAZ



12 ) HOND

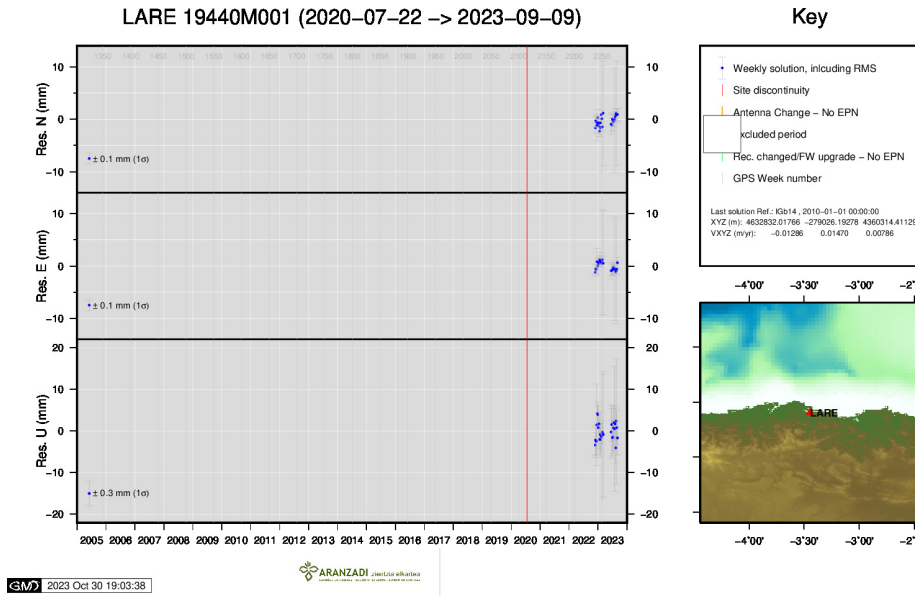


13 ) IGEL

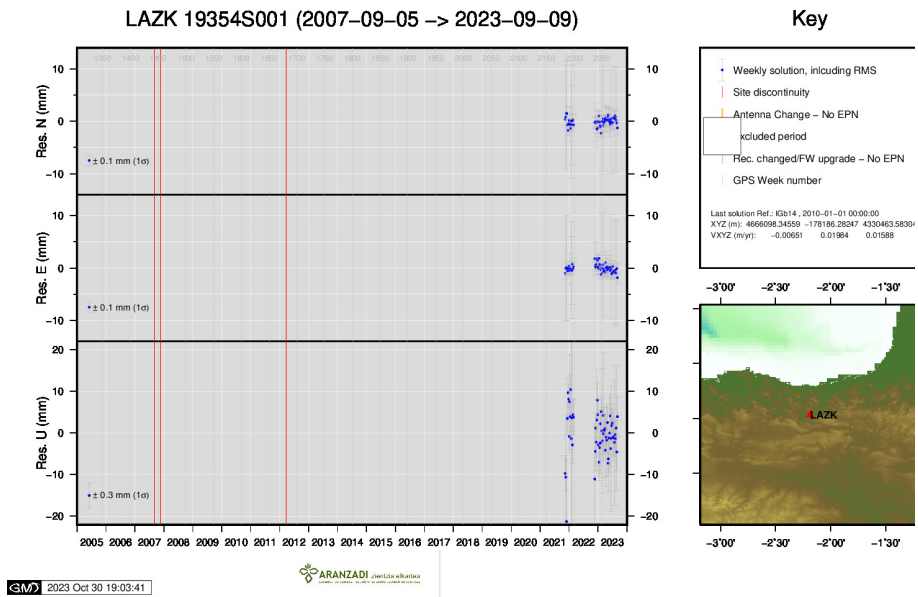


14 ) ISPS

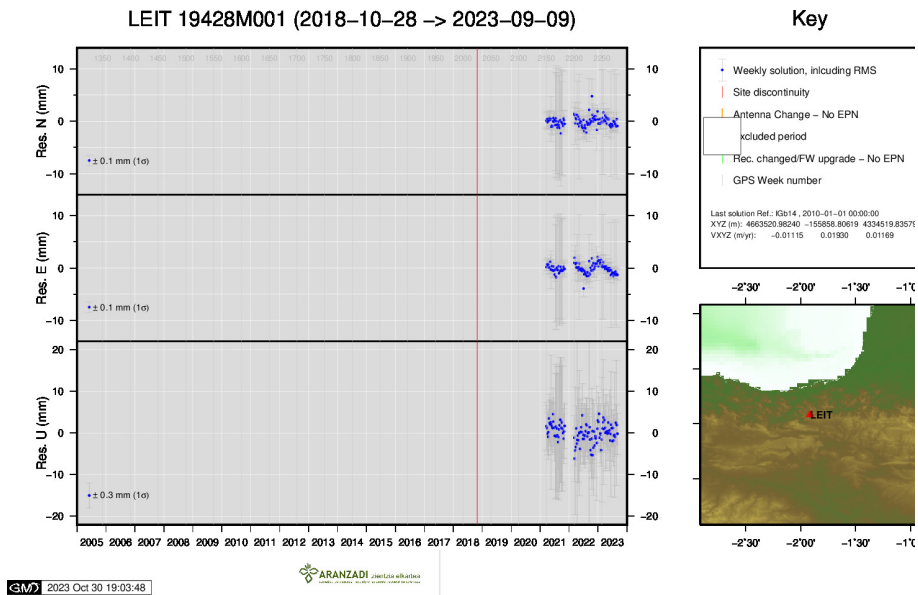




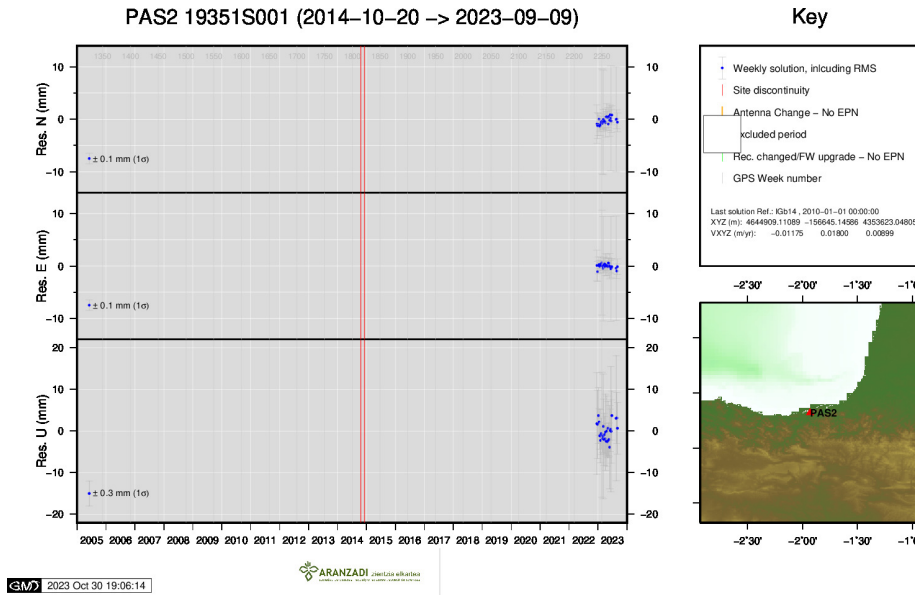
15 ) LARE



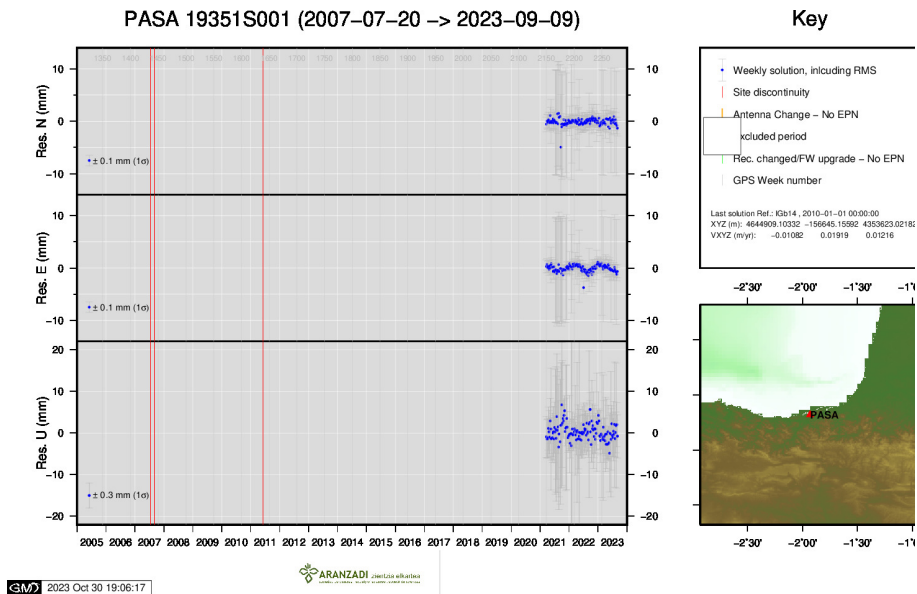
16 ) LAZK



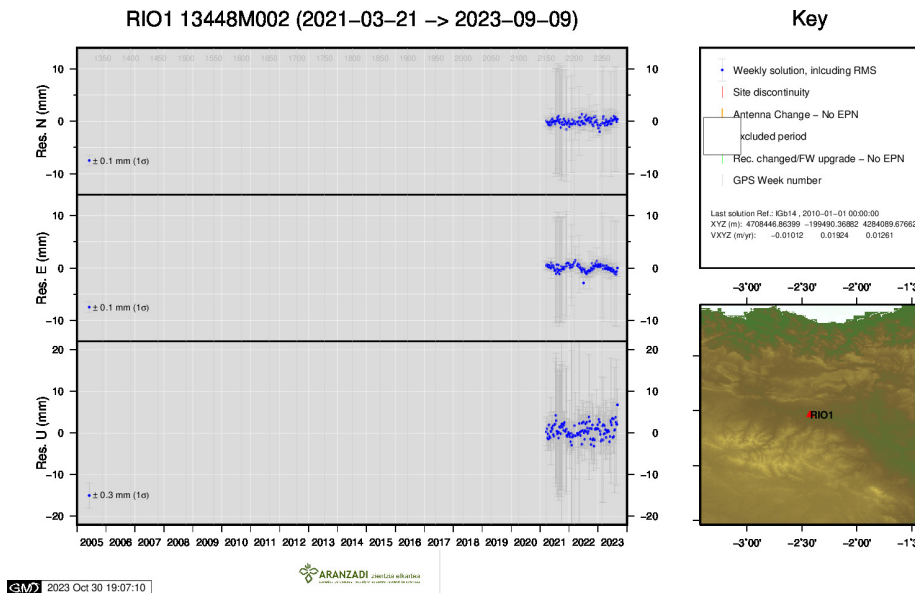
17 ) LEIT



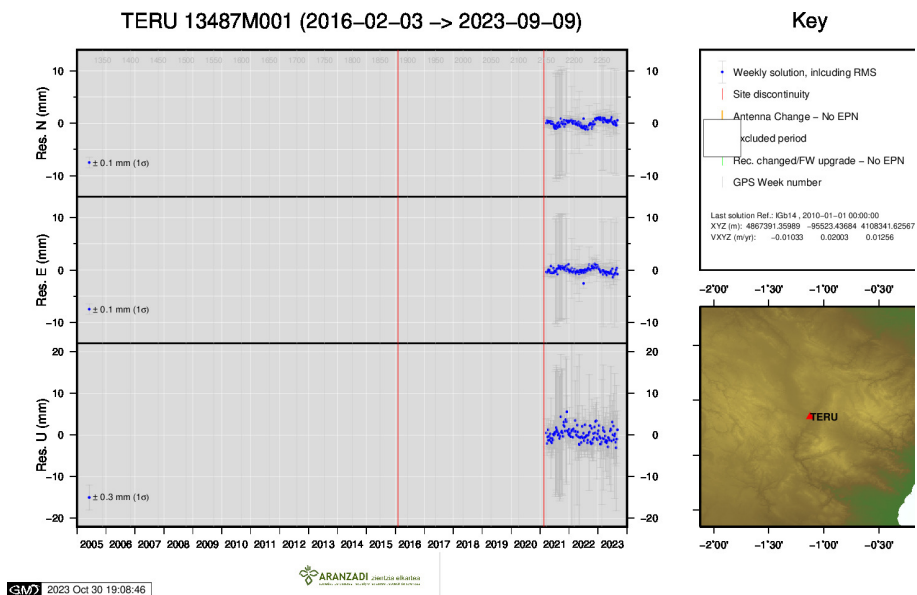
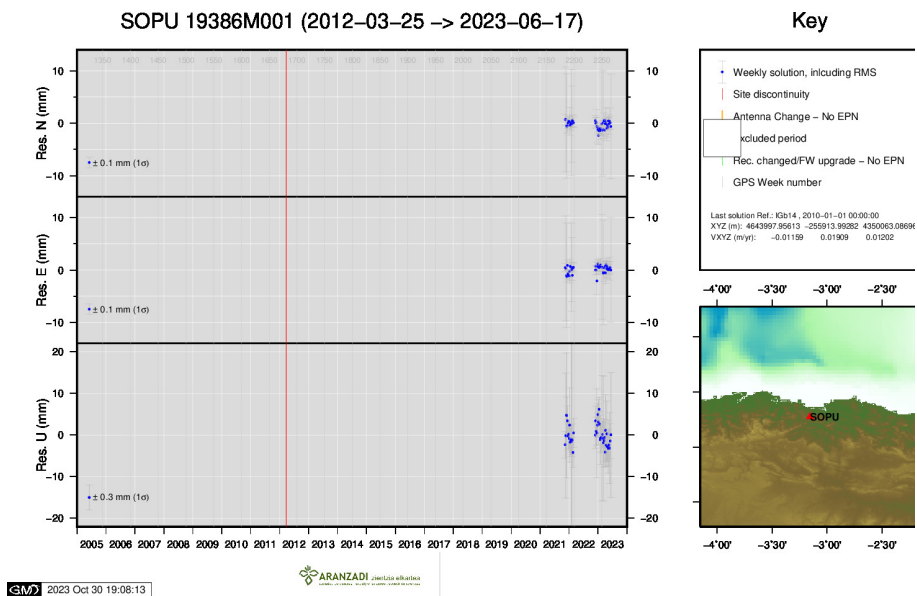
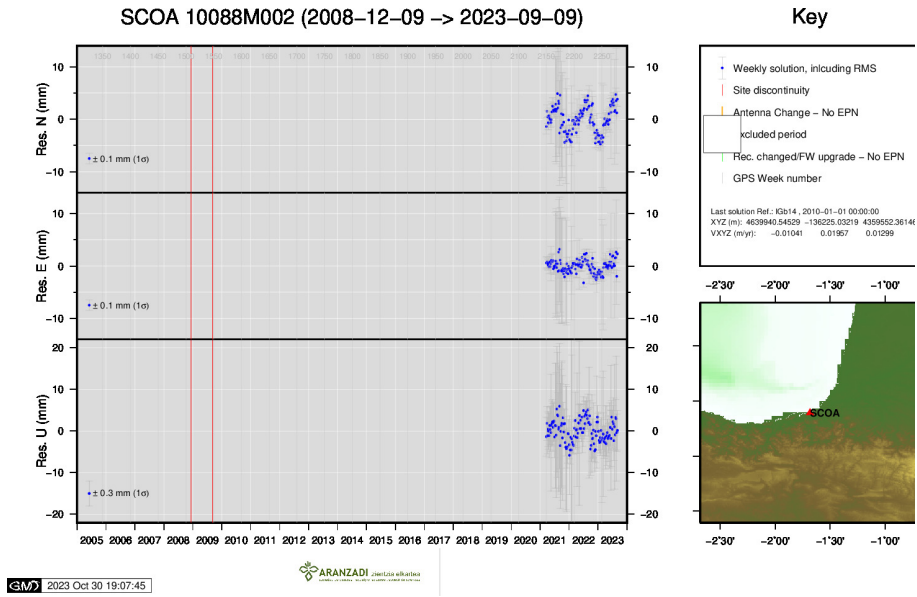
18 ) PAS2

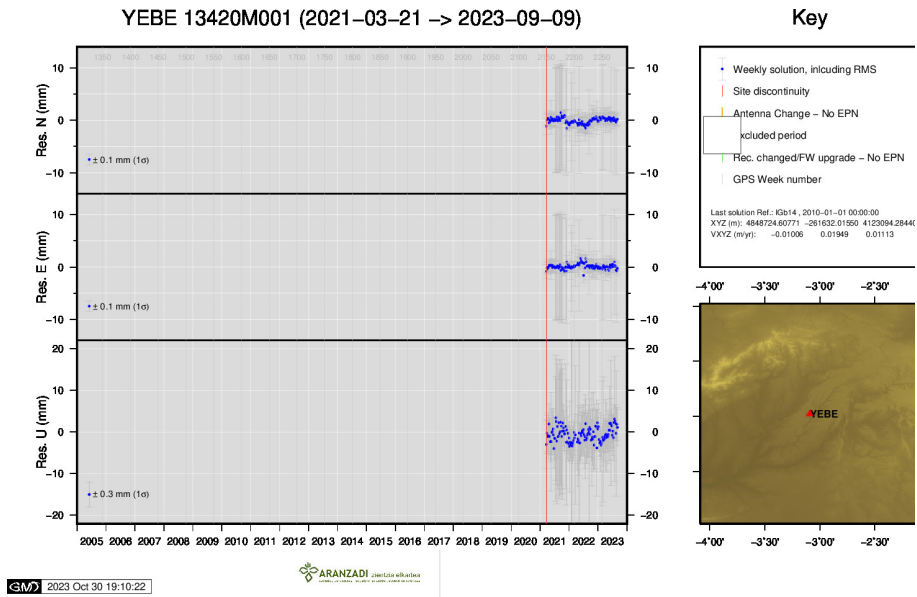


19 ) PASA

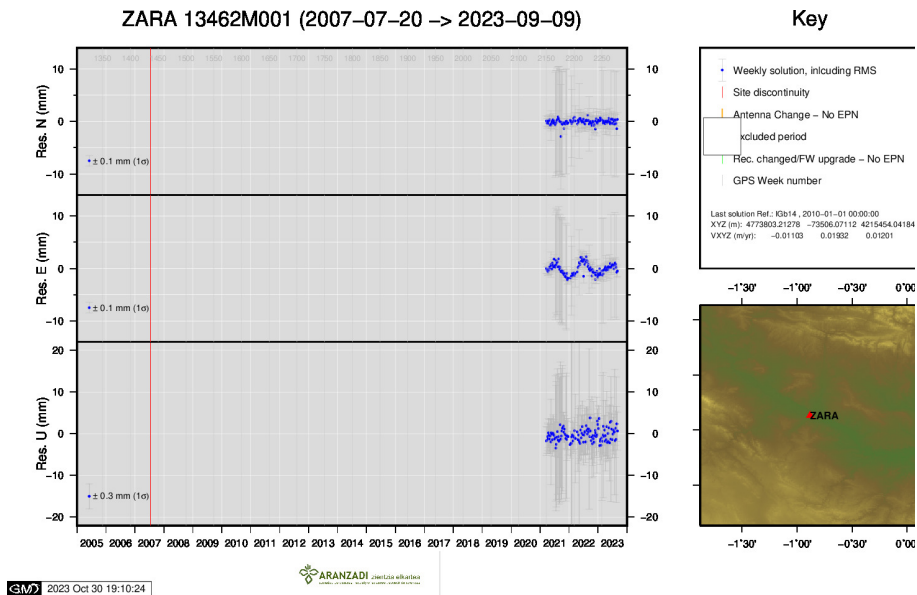


20 ) RIO1





24 ) YEBE



25 ) ZARA