

ARA-DAC Weekly Analysis Result: 2245 (GFA)

Technical Report

GPS Week: 2245 (GFA)

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

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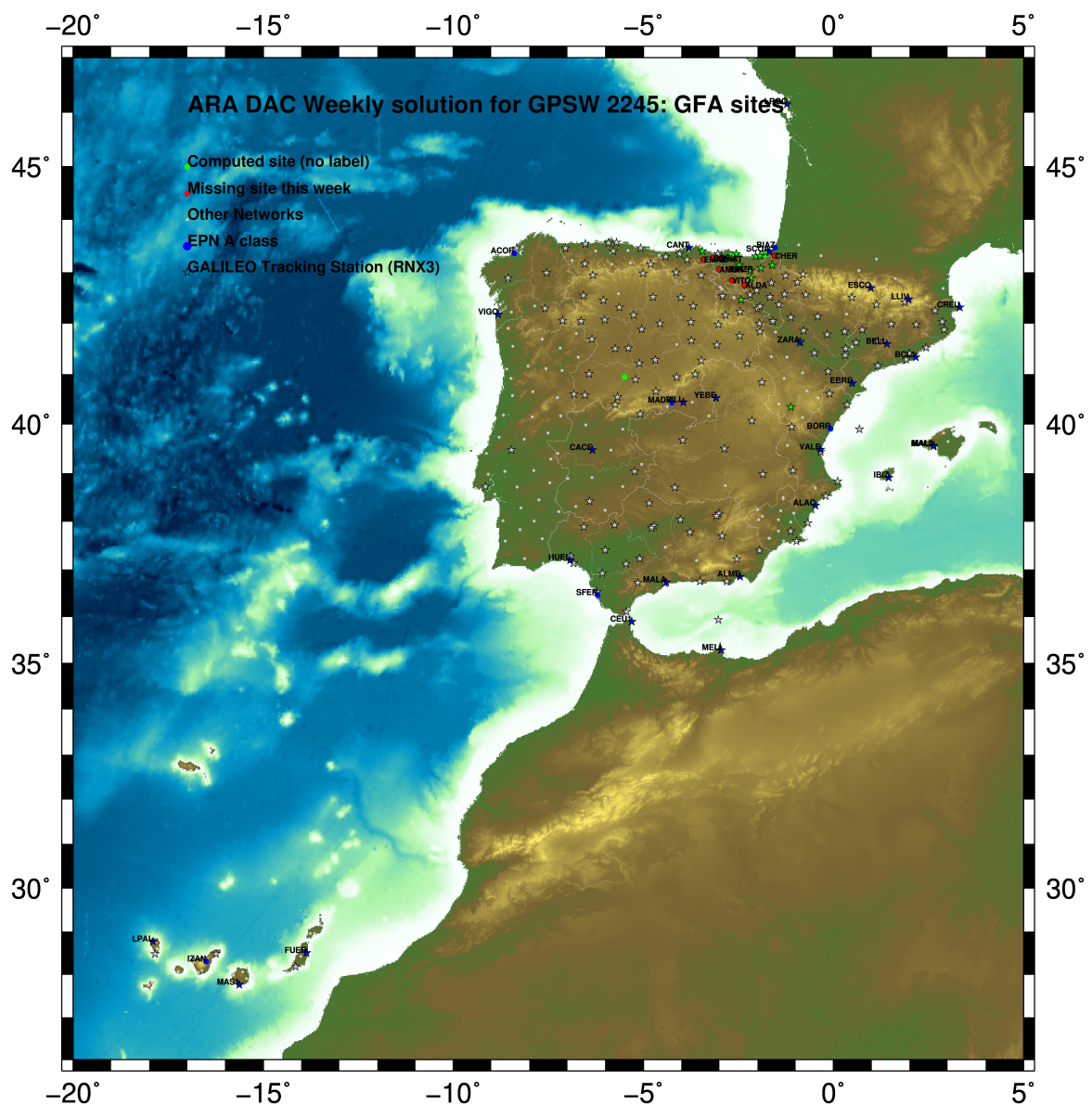


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1 Introduction

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 Dec 13 18:03:26

Fig.1: Computed Sites for GPS Week2245 (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.
- 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: $3 \times \text{rms}$ 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 13-DEC-23 17:05

LOCAL GEODETIC DATUM: IGS20 EPOCH: 2023-01-18 11:59:45

| NUM | STATION NAME | X (M) | Y (M) | Z (M) | FLAG | SYSTEM |
|-----|----------------|---------------|---------------|---------------|------|--------|
| 111 | ACOR 13434M001 | 4594489.52696 | -678367.36499 | 4357066.32139 | W | G |
| 50 | ALSA 19419M001 | 4677250.79525 | -176770.32676 | 4319079.91936 | A | GRE |
| 384 | BIAZ 10074M002 | 4634456.00647 | -124344.90593 | 4365785.49598 | W | GR |
| 101 | BIDA 00000M000 | 4644177.78561 | -145778.25527 | 4354832.52604 | A | GR |
| 573 | CACE 13447M001 | 4899866.47142 | -544566.96567 | 4033770.24761 | W | GRE |
| 592 | CANT 13438M001 | 4625924.28077 | -307096.16630 | 4365771.60159 | W | GRE |
| 908 | CREU 13432M001 | 4715420.09046 | 273178.13108 | 4271946.88831 | W | GRE |
| 135 | EBRE 13410M001 | 4833519.95029 | 41537.46048 | 4147461.75964 | W | GRE |
| 180 | ELGE 19353S001 | 4657557.35645 | -202241.39998 | 4338991.92588 | A | GRE |
| 209 | GERN 19389M001 | 4642811.28112 | -217222.85273 | 4353278.91503 | A | GR |
| 257 | HOND 15012M002 | 4640529.28220 | -145676.91671 | 4358761.80095 | A | GRE |
| 235 | IGEL 19352S001 | 4645951.39096 | -165574.43451 | 4352550.46567 | A | GRE |
| 240 | ISPS 19484M001 | 4640596.44263 | -206963.70713 | 4356391.95726 | A | GRE |
| 252 | LARE 19440M001 | 4632831.92133 | -279026.07355 | 4360314.47393 | A | GRE |
| 256 | LAZK 19354S001 | 4666098.29107 | -178186.11930 | 4330463.70454 | A | GRE |
| 261 | LEIT 19428M001 | 4663520.89981 | -155858.64844 | 4334519.93147 | A | GRE |
| 334 | ORON 19427M001 | 4659695.73939 | -130864.66817 | 4338948.92660 | A | GRE |
| 345 | PAS2 19351S001 | 4644909.02411 | -156645.00059 | 4353623.12088 | A | GRE |
| 493 | PASA 19351S001 | 4644909.02417 | -156645.00057 | 4353623.12095 | A | GRE |
| 553 | RI01 13448M002 | 4708446.79141 | -199490.21311 | 4284089.77887 | A | GRE |
| 558 | SALA 13469M001 | 4803054.44909 | -462131.00163 | 4158379.11915 | A | GR |
| 526 | SC0A 10088M002 | 4639940.46888 | -136224.87529 | 4359552.46142 | W | GRE |
| 443 | TERU 13487M001 | 4867391.28488 | -95523.27507 | 4108341.72981 | A | GRE |
| 616 | YEBE 13420M001 | 4848724.53101 | -261631.85762 | 4123094.37207 | W | GRE |
| 655 | ZARA 13462M001 | 4773803.13157 | -73505.91552 | 4215454.13980 | 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 13-DEC-23 17:05

LOCAL GEODETIC DATUM: ETRF2000 EPOCH: 2023-01-18 11:59:45

| NUM | STATION NAME | X (M) | Y (M) | Z (M) | FLAG | SYSTEM |
|-----|----------------|---------------|---------------|---------------|------|--------|
| 111 | ACOR 13434M001 | 4594489.85971 | -678367.97426 | 4357065.85846 | W | |
| 50 | ALSA 19419M001 | 4677251.19077 | -176770.94477 | 4319079.45632 | A | |
| 384 | BIAZ 10074M002 | 4634456.41249 | -124345.51880 | 4365785.03725 | W | |
| 101 | BIDA 00000M000 | 4644178.18797 | -145778.86934 | 4354832.06521 | A | |
| 573 | CACE 13447M001 | 4899866.79647 | -544567.61012 | 4033769.76075 | W | |
| 592 | CANT 13438M001 | 4625924.66286 | -307096.77863 | 4365771.14111 | W | |
| 908 | CREU 13432M001 | 4715420.54111 | 273177.51012 | 4271946.42806 | W | |
| 135 | EBRE 13410M001 | 4833520.36096 | 41536.82502 | 4147461.28634 | W | |
| 180 | ELGE 19353S001 | 4657557.75019 | -202242.01576 | 4338991.46416 | A | |
| 209 | GERN 19389M001 | 4642811.67401 | -217223.46682 | 4353278.45435 | A | |
| 257 | HOND 15012M002 | 4640529.68488 | -145676.53035 | 4358781.34142 | A | |
| 235 | IGEL 19352S001 | 4645951.79055 | -165575.04884 | 4352550.00542 | A | |
| 240 | ISPS 19484M001 | 4640596.83710 | -206964.32094 | 4356391.49690 | A | |
| 252 | LARE 19440M001 | 4632832.30667 | -279026.68662 | 4360314.01325 | A | |
| 256 | LAZK 19354S001 | 4666098.68729 | -178186.73601 | 4330463.24242 | A | |
| 261 | LEIT 19428M001 | 4663521.29927 | -155859.26479 | 4334519.46987 | A | |
| 334 | ORON 19427M001 | 4659696.14246 | -130865.28400 | 4338948.46566 | A | |
| 345 | PAS2 19351S001 | 4644909.42495 | -156645.61477 | 4353622.66084 | A | |
| 493 | PASA 19351S001 | 4644909.42501 | -156645.61475 | 4353622.66091 | A | |
| 553 | RI01 13448M002 | 4708447.18122 | -199490.83480 | 4284089.31290 | A | |
| 558 | SALA 13469M001 | 4803054.79470 | -462131.63483 | 4158378.64162 | A | |
| 526 | SC0A 10088M002 | 4639940.87286 | -136225.48883 | 4359552.00207 | W | |
| 443 | TERU 13487M001 | 4867391.67457 | -95523.91486 | 4108341.25182 | A | |
| 616 | YEBE 13420M001 | 4848724.90012 | -261632.49569 | 4123093.89341 | W | |
| 655 | ZARA 13462M001 | 4773803.53251 | -73506.54444 | 4215453.67001 | 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 13-DEC-23 17:05

LOCAL GEODETIC DATUM: ETRF2014 EPOCH: 2023-01-18 11:59:45

| NUM | STATION NAME | X (M) | Y (M) | Z (M) | FLAG | SYSTEM |
|-----|----------------|---------------|---------------|---------------|------|--------|
| 111 | ACDR 13434M001 | 4594489.81932 | -678368.01154 | 4357065.91032 | W | |
| 50 | ALSA 19419M001 | 4677251.14801 | -176770.98351 | 4319079.50809 | A | |
| 384 | BIAZ 10074M002 | 4634456.37000 | -124345.55792 | 4365785.08918 | W | |
| 101 | BIDA 00000M000 | 4644178.14545 | -145778.90833 | 4354832.11709 | A | |
| 573 | CACE 13447M001 | 4899866.75232 | -544567.64656 | 4033769.81179 | W | |
| 592 | CANT 13438M001 | 4625924.62107 | -307096.81713 | 4365771.19297 | W | |
| 908 | CREU 13432M001 | 4715420.49626 | 273177.46995 | 4271946.48003 | W | |
| 135 | EBRE 13410M001 | 4833520.31569 | 41536.78618 | 4147461.33781 | W | |
| 180 | ELGE 19353S001 | 4657557.70772 | -202242.05450 | 4338991.51597 | A | |
| 209 | GERN 19389M001 | 4642811.63175 | -217223.50557 | 4353278.50620 | A | |
| 257 | HOND 15012M002 | 4640529.64240 | -145676.56936 | 4358781.39332 | A | |
| 235 | IGEL 19352S001 | 4645951.74809 | -165575.08776 | 4352550.05729 | A | |
| 240 | ISPS 19484M001 | 4640596.79483 | -206964.35973 | 4356391.54876 | A | |
| 252 | LARE 19440M001 | 4632832.26472 | -279026.72519 | 4360314.06510 | A | |
| 256 | LAZK 19354S001 | 4666098.64465 | -178186.77479 | 4330463.29422 | A | |
| 261 | LEIT 19428M001 | 4663521.25658 | -155859.30367 | 4334519.52169 | A | |
| 334 | ORON 19427M001 | 4659696.09973 | -130865.32299 | 4338948.51751 | A | |
| 345 | PAS2 19351S001 | 4644909.38247 | -156645.65372 | 4353622.71271 | A | |
| 493 | PASA 19351S001 | 4644909.38253 | -156645.65370 | 4353622.71278 | A | |
| 553 | RI01 13448M002 | 4708447.13820 | -199490.87333 | 4284089.36456 | A | |
| 558 | SALA 13469M001 | 4803054.75144 | -462131.67200 | 4158378.69292 | A | |
| 526 | SC0A 10088M002 | 4639940.83035 | -136225.52788 | 4359552.05397 | W | |
| 443 | TERU 13487M001 | 4867391.62941 | -95523.95307 | 4108341.30310 | A | |
| 616 | YEBE 13420M001 | 4848724.85573 | -261632.53338 | 4123093.94466 | W | |
| 655 | ZARA 13462M001 | 4773803.48833 | -73506.58313 | 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 13-DEC-23 17:05

| Station | #Days | Weekday 0123456 | Repeatability (mm) | | |
|----------------|-------|--------------------|--------------------|------|------|
| | | | N | E | U |
| ACOR 13434M001 | 7 | XXXXXX | 0.85 | 0.90 | 2.72 |
| ALSA 19419M001 | 7 | XXXXXX | 2.60 | 1.56 | 2.02 |
| BIAZ 10074M002 | 7 | XXXXXX | 1.17 | 0.88 | 2.99 |
| BIDA 00000M000 | 7 | XXXXXX | 0.89 | 0.95 | 3.21 |
| CACE 13447M001 | 7 | XXXXXX | 0.67 | 1.03 | 2.91 |
| CANT 13438M001 | 7 | XXXXXX | 0.63 | 0.97 | 2.95 |
| CREU 13432M001 | 7 | XXXXXX | 1.15 | 1.16 | 4.51 |
| EBRE 13410M001 | 5 | X XXXX | 1.89 | 3.93 | 9.08 |
| ELGE 19353S001 | 6 | XX XXX | 1.70 | 1.22 | 6.86 |
| GERN 19389M001 | 2 | XX | 0.60 | 2.05 | 0.55 |
| HOND 15012M002 | 6 | XXXX X | 0.64 | 0.68 | 3.29 |
| IGEL 19352S001 | 7 | XXXXXX | 0.81 | 0.71 | 4.19 |
| ISPS 19484M001 | 7 | XXXXXX | 0.76 | 0.80 | 2.58 |
| LARE 19440M001 | 7 | XXXXXX | 0.75 | 1.40 | 2.49 |
| LAZK 19354S001 | 7 | XXXXXX | 0.79 | 2.12 | 7.72 |
| LEIT 19428M001 | 6 | XXX XX | 0.69 | 1.85 | 2.38 |
| ORON 19427M001 | 7 | XXXXXX | 1.35 | 1.35 | 5.64 |
| PAS2 19351S001 | 7 | XXXXXX | 0.85 | 0.84 | 4.31 |
| PASA 19351S001 | 7 | XXXXXX | 0.79 | 0.84 | 4.38 |
| RI01 13448M002 | 7 | XXXXXX | 1.21 | 0.64 | 2.33 |
| SALA 13469M001 | 7 | XXXXXX | 0.64 | 1.26 | 2.79 |
| SCDA 10088M002 | 7 | XXXXXX | 0.63 | 1.07 | 1.87 |
| TERU 13487M001 | 7 | XXXXXX | 1.05 | 1.21 | 3.97 |
| YEBE 13420M001 | 7 | XXXXXX | 1.00 | 0.66 | 2.94 |
| ZARA 13462M001 | 7 | XXXXXX | 0.52 | 1.01 | 3.58 |

Comparison of individual solutions:

| | | | | | | | | | |
|----------------|---|------|-------|-------|-------|--------|--------|-------|-------|
| ACOR 13434M001 | N | 0.85 | 0.02 | -0.50 | 1.06 | 0.80 | -0.77 | -1.30 | -0.28 |
| ACOR 13434M001 | E | 0.90 | -1.01 | -0.26 | 0.57 | -0.16 | 0.08 | 1.21 | 1.38 |
| ACOR 13434M001 | U | 2.72 | -4.49 | 3.83 | 0.88 | -0.66 | 1.53 | 2.41 | 0.52 |
| ALSA 19419M001 | N | 2.60 | -1.16 | -3.74 | -2.50 | 2.90 | -1.89 | 1.60 | 2.10 |
| ALSA 19419M001 | E | 1.56 | -1.41 | -2.30 | -1.40 | 1.35 | 0.47 | 1.57 | 0.89 |
| ALSA 19419M001 | U | 2.02 | 0.29 | -0.50 | 1.37 | -3.77 | 1.59 | 0.18 | -2.33 |
| BIAZ 10074M002 | N | 1.17 | 0.57 | -0.04 | 1.02 | -0.13 | 0.57 | -0.96 | -2.37 |
| BIAZ 10074M002 | E | 0.88 | -1.12 | 1.01 | -0.53 | 0.77 | 0.33 | -1.10 | -0.43 |
| BIAZ 10074M002 | U | 2.99 | 0.31 | 3.23 | -0.45 | -3.41 | 3.44 | -3.29 | 2.95 |
| BIDA 00000M000 | N | 0.89 | -0.85 | 0.13 | -0.47 | -0.77 | -1.49 | 0.04 | 1.01 |
| BIDA 00000M000 | E | 0.95 | -1.23 | 1.70 | -0.31 | -0.63 | 0.30 | -0.51 | -0.34 |
| BIDA 00000M000 | U | 3.21 | -0.73 | 5.10 | 1.72 | 1.70 | 3.75 | -2.01 | -3.37 |
| CACE 13447M001 | N | 0.67 | 0.66 | -0.44 | -0.39 | 0.90 | 0.23 | -0.81 | 0.62 |
| CACE 13447M001 | E | 1.03 | -0.65 | -0.18 | -1.23 | -0.23 | 1.24 | 1.65 | 0.28 |
| CACE 13447M001 | U | 2.91 | -3.92 | 2.00 | -3.25 | 3.61 | -0.34 | 0.81 | 2.68 |
| CANT 13438M001 | N | 0.63 | -0.02 | 0.83 | 0.66 | 0.40 | -0.93 | -0.50 | 0.10 |
| CANT 13438M001 | E | 0.97 | -1.30 | -0.10 | -0.58 | -1.23 | -0.38 | -1.18 | 0.78 |
| CANT 13438M001 | U | 2.95 | 2.10 | 4.00 | -2.40 | -4.36 | 2.12 | -0.42 | -1.54 |
| CREU 13432M001 | N | 1.15 | -0.09 | -0.16 | -0.91 | -1.14 | 2.33 | -0.58 | 0.07 |
| CREU 13432M001 | E | 1.16 | -2.46 | 0.07 | -0.06 | 1.22 | -0.11 | -0.68 | -0.22 |
| CREU 13432M001 | U | 4.51 | -0.96 | 0.78 | 3.26 | 0.92 | -2.25 | 5.02 | -8.89 |
| EBRE 13410M001 | N | 1.89 | -3.01 | | | 1.39 | 0.93 | 1.19 | 0.97 |
| EBRE 13410M001 | E | 3.93 | 4.93 | | | -4.86 | -3.54 | -0.65 | 0.97 |
| EBRE 13410M001 | U | 9.08 | 3.69 | | | -11.88 | -10.82 | 6.26 | 4.31 |
| ELGE 19353S001 | N | 1.70 | 1.35 | 0.24 | -1.04 | | -2.32 | -1.92 | 1.56 |
| ELGE 19353S001 | E | 1.22 | -0.87 | 0.92 | 1.53 | | -0.51 | -1.29 | -1.27 |
| ELGE 19353S001 | U | 6.86 | 8.30 | 4.58 | -6.78 | | -9.93 | 0.65 | 0.54 |
| GERN 19389M001 | N | 0.60 | | | | | | 0.02 | 0.60 |
| GERN 19389M001 | E | 2.05 | | | | | | -1.97 | 0.56 |
| GERN 19389M001 | U | 0.55 | | | | | | -0.54 | 0.14 |
| HOND 15012M002 | N | 0.64 | -0.85 | 0.31 | -1.07 | 0.07 | -0.07 | | 0.29 |
| HOND 15012M002 | E | 0.68 | -0.81 | 0.62 | -0.90 | -0.26 | -0.07 | | 0.63 |
| HOND 15012M002 | U | 3.29 | 0.94 | 3.04 | 3.02 | 2.56 | 3.17 | | -4.28 |
| IGEL 19352S001 | N | 0.81 | -0.31 | 0.50 | -1.29 | -0.94 | 0.64 | -0.83 | 0.04 |
| IGEL 19352S001 | E | 0.71 | -0.93 | -0.41 | -1.05 | 0.19 | -0.14 | 0.49 | 0.79 |
| IGEL 19352S001 | U | 4.19 | 1.24 | 5.85 | 3.69 | -2.09 | 4.96 | -4.35 | -2.82 |
| ISPS 19484M001 | N | 0.76 | -0.58 | 0.47 | -0.34 | 0.26 | -1.30 | 1.02 | 0.06 |
| ISPS 19484M001 | E | 0.80 | -0.86 | 0.33 | -0.82 | -0.38 | -1.04 | -0.63 | 0.81 |
| ISPS 19484M001 | U | 2.58 | 4.26 | 2.28 | 3.05 | 0.59 | -0.74 | 1.48 | 2.06 |
| LARE 19440M001 | N | 0.75 | 0.52 | -0.86 | -0.68 | 0.12 | -0.50 | -0.48 | 1.20 |
| LARE 19440M001 | E | 1.40 | -1.80 | -0.92 | -2.11 | 0.41 | -0.81 | 0.46 | 1.45 |
| LARE 19440M001 | U | 2.49 | -2.75 | 4.08 | -1.94 | 1.44 | -1.41 | -1.80 | -1.43 |
| LAZK 19354S001 | N | 0.79 | -1.30 | -0.03 | -0.05 | 0.70 | -1.03 | -0.64 | -0.32 |
| LAZK 19354S001 | E | 2.12 | -1.99 | 0.53 | -0.52 | 2.37 | 2.87 | -1.28 | -2.66 |
| LAZK 19354S001 | U | 7.72 | 6.16 | 0.00 | -5.09 | -13.23 | -4.27 | 4.32 | 9.04 |
| LEIT 19428M001 | N | 0.69 | -0.56 | -1.19 | -0.80 | 0.04 | | 0.05 | -0.12 |
| LEIT 19428M001 | E | 1.85 | -1.64 | -0.74 | -0.53 | 3.48 | | -0.61 | -1.08 |
| LEIT 19428M001 | U | 2.38 | -1.77 | 4.16 | -0.57 | -2.65 | | -0.39 | -0.49 |
| ORON 19427M001 | N | 1.35 | -1.55 | -2.79 | 0.64 | 0.38 | -0.30 | 0.34 | 0.07 |
| ORON 19427M001 | E | 1.35 | 1.42 | -0.99 | -2.56 | 0.98 | 0.53 | 0.05 | 0.30 |
| ORON 19427M001 | U | 5.64 | 8.06 | 2.38 | -8.08 | 3.39 | -4.59 | 2.18 | 4.21 |
| PAS2 19351S001 | N | 0.85 | -0.16 | 1.00 | -0.98 | -0.35 | 0.15 | -1.42 | -0.43 |
| PAS2 19351S001 | E | 0.84 | -0.70 | -0.57 | -1.41 | 0.83 | 0.19 | -0.23 | 0.81 |
| PAS2 19351S001 | U | 4.31 | 2.78 | 3.68 | 5.74 | -1.89 | 4.01 | -3.20 | -5.21 |
| PASA 19351S001 | N | 0.79 | -0.13 | 0.90 | -1.03 | -0.34 | 0.12 | -1.26 | -0.40 |
| PASA 19351S001 | E | 0.84 | -0.65 | -0.49 | -1.54 | 0.79 | 0.25 | -0.16 | 0.73 |
| PASA 19351S001 | U | 4.38 | 2.62 | 3.67 | 5.26 | -1.62 | 4.87 | -3.52 | -5.31 |
| RI01 13448M002 | N | 1.21 | 0.61 | 1.38 | -0.69 | 0.16 | -1.55 | -1.51 | -1.13 |
| RI01 13448M002 | E | 0.64 | 0.05 | -0.87 | -0.92 | -0.02 | -0.35 | 0.66 | 0.56 |
| RI01 13448M002 | U | 2.33 | -2.00 | -1.46 | 0.30 | 0.48 | -1.22 | 4.41 | -2.28 |
| SALA 13469M001 | N | 0.64 | -0.05 | -0.44 | -0.75 | 0.80 | 0.12 | -1.01 | 0.22 |
| SALA 13469M001 | E | 1.26 | -0.72 | -1.20 | -1.18 | 0.13 | 1.00 | 1.57 | 1.65 |
| SALA 13469M001 | U | 2.79 | 1.81 | 2.39 | -5.34 | 0.65 | 1.73 | 1.94 | -1.39 |
| SCDA 10088M002 | N | 0.63 | -0.40 | 0.64 | -0.81 | -0.27 | -0.77 | -0.44 | -0.55 |
| SCDA 10088M002 | E | 1.07 | -1.31 | 1.71 | -0.68 | 0.72 | -0.96 | -0.51 | -0.34 |
| SCDA 10088M002 | U | 1.87 | 2.93 | 0.30 | 1.00 | -0.09 | 3.15 | 1.06 | -0.42 |

| | | | | | | | | | |
|----------------|---|------|-------|-------|-------|-------|-------|-------|-------|
| TERU 13487M001 | N | 1.05 | 0.30 | 2.07 | -0.84 | 0.81 | -0.37 | 0.88 | -0.18 |
| TERU 13487M001 | E | 1.21 | -0.62 | 0.94 | 2.39 | -1.25 | -0.20 | -0.44 | 0.15 |
| TERU 13487M001 | U | 3.97 | -5.70 | -5.17 | 1.30 | -1.81 | -4.27 | -2.81 | -2.06 |
| YEBE 13420M001 | N | 1.00 | -0.16 | -1.54 | -1.33 | 0.17 | 0.98 | 0.04 | 0.95 |
| YEBE 13420M001 | E | 0.66 | -0.73 | 0.42 | 0.68 | -0.30 | -0.83 | 0.63 | 0.52 |
| YEBE 13420M001 | U | 2.94 | -2.46 | 6.01 | 0.25 | -2.44 | 1.62 | -0.93 | 0.33 |
| ZARA 13462M001 | N | 0.52 | -0.09 | -0.49 | -0.76 | -0.70 | -0.28 | -0.16 | -0.45 |
| ZARA 13462M001 | E | 1.01 | -1.15 | -0.88 | -0.59 | -0.80 | -0.69 | 0.60 | -1.49 |
| ZARA 13462M001 | U | 3.58 | -3.38 | 2.30 | 1.10 | 5.76 | 2.36 | -3.24 | -3.13 |

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 | 1.17 | -1.03 | 1.27 |
| 2 | ALAC 13433M001 | I W | 0.44 | -0.81 | -0.39 |
| 3 | ALME 13437M001 | I W | -0.05 | -0.31 | 0.39 |
| 4 | BCL1 19482M001 | I W | -1.07 | -0.65 | -1.97 |
| 5 | BELL 13431M001 | I W | 1.23 | 0.07 | -0.21 |
| 6 | BIAZ 10074M002 | I W | -0.49 | -0.08 | 2.47 |
| 7 | BORR 13480M001 | I W | 0.49 | -5.58 | -3.56 |
| 8 | BRST 10004M004 | I W | 0.50 | -1.83 | 6.09 |
| 9 | CACE 13447M001 | I W | 1.59 | 0.19 | 3.44 |
| 10 | CANT 13438M001 | I W | 2.37 | -0.20 | -2.26 |
| 11 | CEU1 13449M002 | I W | 1.20 | 0.90 | -0.75 |
| 12 | CREU 13432M001 | I W | -1.07 | -6.20 | -13.09 |
| 13 | EBRE 13410M001 | I W | -0.18 | 2.85 | 1.31 |
| 14 | ESCO 13435M001 | I W | -7.95 | 6.89 | 8.10 |
| 15 | FUER 31330M001 | I W | 0.50 | -0.85 | 0.25 |
| 16 | HUEL 13451M001 | I W | 1.67 | 1.69 | -2.81 |
| 17 | IBIZ 13454S001 | I W | -1.46 | 2.42 | 4.54 |
| 18 | IZAN 31309M002 | I W | -1.10 | -0.53 | 0.86 |
| 19 | LLIV 13436M001 | I W | -1.98 | 0.89 | 2.38 |
| 20 | LPAL 81701M001 | I W | 0.72 | -0.03 | -1.90 |
| 21 | LROC 10023M001 | I W | 0.32 | 0.64 | 1.97 |
| 22 | MADR 13407S012 | I W | -2.70 | -2.20 | -7.54 |
| 23 | MAL1 13444M002 | I W | 0.74 | 1.70 | -1.33 |
| 24 | MALA 13443M001 | I W | 3.37 | -2.26 | -0.09 |
| 25 | MALL 13444M001 | I W | -1.51 | 2.07 | 4.99 |
| 26 | MAS1 31303M002 | I W | -1.07 | -1.77 | -1.18 |
| 27 | MELI 19379M001 | I W | 0.69 | 1.35 | 9.07 |
| 28 | SCOA 10088M002 | I W | 3.04 | 1.38 | -7.45 |
| 29 | SFER 13402M004 | I W | -0.09 | -1.79 | 2.78 |
| 30 | VALE 13439M001 | I W | 1.13 | 2.12 | -2.82 |
| 31 | VIGO 13450M001 | I W | 1.13 | 0.10 | -1.40 |
| 32 | VILL 13406M001 | I W | -0.12 | -0.25 | -3.44 |
| 33 | YEBE 13420M001 | I W | -0.13 | -0.19 | 4.03 |
| 34 | ZARA 13462M001 | I W | -0.00 | 0.60 | -3.08 |
| 35 | ZIMM 14001M004 | I W | -2.31 | -0.78 | 1.77 |
| RMS / COMPONENT | | | 1.96 | 2.27 | 4.34 |
| IQR | | | 2.20 | 2.20 | 4.73 |
| MEAN | | | -0.03 | -0.04 | 0.01 |
| MEDIAN | | | 0.32 | -0.08 | -0.09 |
| MIN | | | -7.95 | -6.20 | -13.09 |
| MAX | | | 3.37 | 6.89 | 9.07 |
| OVERALL RMS/IQR/MAX(3D) | | | 3.05 | 2.50 | 14.52 |
| | | | | | CREU 13432M001 |
| | | | | | #SUM |
| ALL RMS / COMPONENT | | | 1.96 | 2.27 | 4.34 |
| ALL IQR | | | 2.20 | 2.20 | 4.73 |
| ALL MEAN | | | -0.03 | -0.04 | 0.01 |
| ALL MEDIAN | | | 0.32 | -0.08 | -0.09 |
| ALL MIN | | | -7.95 | -6.20 | -13.09 |
| ALL MAX | | | 3.37 | 6.89 | 9.07 |
| ALL OVERALL RMS/IQR/MAX(3D) | | | 3.05 | 2.50 | 14.52 |
| | | | | | CREU 13432M001 |
| | | | | | #SUM_ALL |

NUMBER OF PARAMETERS : 3
NUMBER OF STATIONS : 35
NUMBER OF COORDINATES : 105
RMS OF TRANSFORMATION : 3.05 MM

PARAMETERS:

TRANSLATION IN X : -0.00 +- 0.51 MM
TRANSLATION IN Y : 0.00 +- 0.51 MM
TRANSLATION IN Z : 0.00 +- 0.51 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          23453771
NUMBER OF UNKNOWN(S)            221728
NUMBER OF DEGREES OF FREEDOM    23232043
PHASE MEASUREMENTS SIGMA        0.00100
SAMPLING INTERVAL (SECONDS)      180
VARIANCE FACTOR                  1.912590148647102
```

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 23:015:00000 23:021:86370 LEICA GR50 -----
ALDA A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
ALSA A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
AMUR A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
BIAZ A 1 P 23:015:00000 23:021:86370 SPECTRA SP90M -----
BIDA A 1 P 23:015:00000 23:021:86370 LEICA GR10 -----
BRZR A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
CACE A 1 P 23:015:00000 23:021:86370 TRIMBLE NETR9 -----
CANT A 1 P 23:015:00000 23:021:86370 LEICA GR10 -----
CREU A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
EBRE A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
ELGE A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
EMAZ A 1 P 23:015:00000 23:018:86370 LEICA GR30 -----
GERN A 1 P 23:015:00000 23:019:86370 LEICA GR30 -----
HOND A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
IGEL A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
ISPS A 1 P 23:015:00000 23:021:86370 TRIMBLE NETR9 -----
KAST A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
LARE A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
LAZK A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
LEIT A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
ORON A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
PAS2 A 1 P 23:015:00000 23:021:86370 STONEX SC2200 -----
PASA A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
RIO1 A 1 P 23:015:00000 23:021:86370 LEICA GR25 -----
SALA A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
SCDA A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
SOPU A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
TERU A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
VITO A 1 P 23:015:00000 23:021:86370 LEICA GR30 -----
YEBE A 1 P 23:015:00000 23:021:86370 LEICA GR50 -----
ZARA A 1 P 23:015:00000 23:021:86370 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 23:015:00000 23:021:86370 LEIAT504 LEIS -----
ALDA A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
ALSA A 1 P 23:015:00000 23:021:86370 LEIAR10 NONE -----
AMUR A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
BIAZ A 1 P 23:015:00000 23:021:86370 LEIAR25 LEIT -----
BIDA A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
BRZR A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
CACE A 1 P 23:015:00000 23:021:86370 TRM29659.00 NONE -----
CANT A 1 P 23:015:00000 23:021:86370 LEIAR25_R4 LEIT -----
CREU A 1 P 23:015:00000 23:021:86370 LEIAR25_R4 NONE -----
EBRE A 1 P 23:015:00000 23:021:86370 LEIAR25_R4 NONE -----
ELGE A 1 P 23:015:00000 23:021:86370 LEIAR25_R4 LEIT -----
EMAZ A 1 P 23:015:00000 23:018:86370 LEIAS10 NONE -----
GERN A 1 P 23:015:00000 23:019:86370 LEIAS10 NONE -----
HOND A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
IGEL A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
ISPS A 1 P 23:015:00000 23:021:86370 TRM59900.00 SCIS -----
KAST A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
LARE A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
LAZK A 1 P 23:015:00000 23:021:86370 LEIAR25_R4 LEIT -----
LEIT A 1 P 23:015:00000 23:021:86370 LEIAR10 NONE -----
ORON A 1 P 23:015:00000 23:021:86370 LEIAR10 NONE -----
PAS2 A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
PASA A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
RIO1 A 1 P 23:015:00000 23:021:86370 LEIAR25_R4 LEIT -----
SALA A 1 P 23:015:00000 23:021:86370 LEIAR25 NONE -----
SCDA A 1 P 23:015:00000 23:021:86370 TRM55971.00 NONE -----
SOPU A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
TERU A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
VITO A 1 P 23:015:00000 23:021:86370 LEIAS10 NONE -----
YEBE A 1 P 23:015:00000 23:021:86370 LEIAR20 LEIM -----
ZARA A 1 P 23:015:00000 23:021:86370 TRM29659.00 NONE -----
```

7.3 Eccentricities

```

*
*SITE PT SOLN T DATA_START__ DATA_END_____ AXE ARP-->BENCHMARK(M)-----
ACDR A 1 P 23:015:00000 23:021:86370 UNE 3.0460 0.0000 0.0000
ALDA A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
ALSA A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
AMUR A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
BIAZ A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
BIDA A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
BRZR A 1 P 23:015:00000 23:021:86370 UNE 0.0771 0.0000 0.0000
CACE A 1 P 23:015:00000 23:021:86370 UNE 0.0600 0.0000 0.0000
CANT A 1 P 23:015:00000 23:021:86370 UNE 3.0490 0.0000 0.0000
CREU A 1 P 23:015:00000 23:021:86370 UNE 0.0770 0.0000 0.0000
EBRE A 1 P 23:015:00000 23:021:86370 UNE 0.0770 0.0000 0.0000
ELGE A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
EMAZ A 1 P 23:015:00000 23:018:86370 UNE 0.0350 0.0000 0.0000
GERN A 1 P 23:015:00000 23:019:86370 UNE 0.0771 0.0000 0.0000
HOND A 1 P 23:015:00000 23:021:86370 UNE 0.0771 0.0000 0.0000
IGEL A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
ISPS A 1 P 23:015:00000 23:021:86370 UNE 0.0350 0.0000 0.0000
KAST A 1 P 23:015:00000 23:021:86370 UNE 0.0350 0.0000 0.0000
LARE A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
LAZK A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
LEIT A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
ORDN A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
PAS2 A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
PASA A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
RIO1 A 1 P 23:015:00000 23:021:86370 UNE 0.0606 0.0000 0.0000
SALA A 1 P 23:015:00000 23:021:86370 UNE 0.0600 0.0000 0.0000
SCDA A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
SOPU A 1 P 23:015:00000 23:021:86370 UNE 0.0771 0.0000 0.0000
TERU A 1 P 23:015:00000 23:021:86370 UNE 0.0600 0.0000 0.0000
VITO A 1 P 23:015:00000 23:021:86370 UNE 0.0000 0.0000 0.0000
YEBE A 1 P 23:015:00000 23:021:86370 UNE 0.0600 0.0000 0.0000
ZARA A 1 P 23:015:00000 23:021:86370 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:

```

2023-12-12 18:35 UTC | ISPS0150.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-12 21:40 UTC | ISPS0160.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-13 02:59 UTC | ISPS0170.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-13 05:49 UTC | ISPS0180.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-13 08:35 UTC | ISPS0190.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-13 11:20 UTC | ISPS0200.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-13 14:06 UTC | ISPS0210.230 | RECEIVER FIRM. VERS. | 5.30 -> 5.22 (source: isps00esp_20230913.log
2023-12-12 18:35 UTC | LARE0150.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-12 21:40 UTC | LARE0160.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-13 02:59 UTC | LARE0170.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-13 05:49 UTC | LARE0180.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-13 08:35 UTC | LARE0190.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-13 11:20 UTC | LARE0200.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-13 14:06 UTC | LARE0210.230 | RECEIVER FIRM. VERS. | 4.52/7.711 -> 4.31/7.403 (source: lare00esp_20230308.log
2023-12-13 11:20 UTC | PAS20200.230 | RECEIVER FIRM. VERS. | 2.12-200428-STX -> 2.12-210914-STX (source: pas200esp_20231031.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

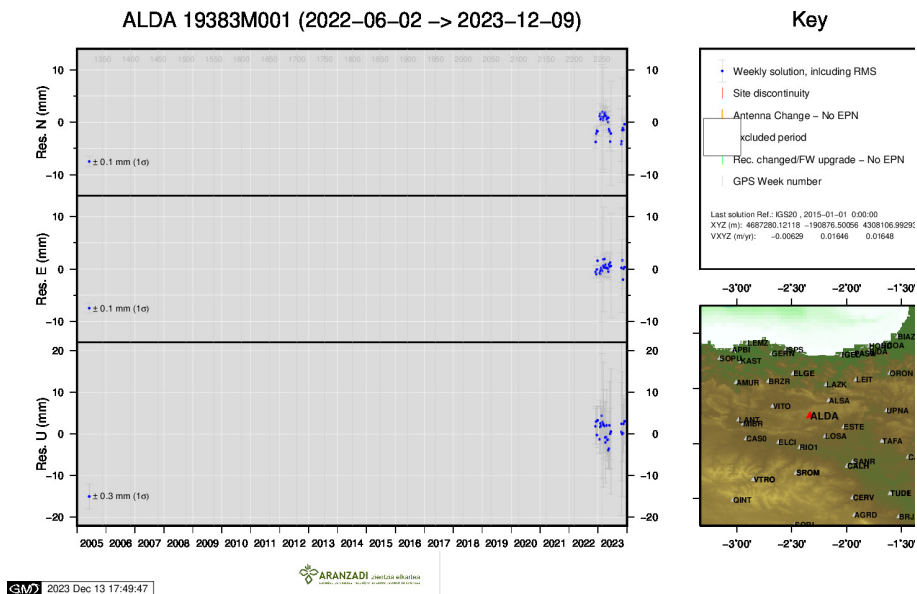
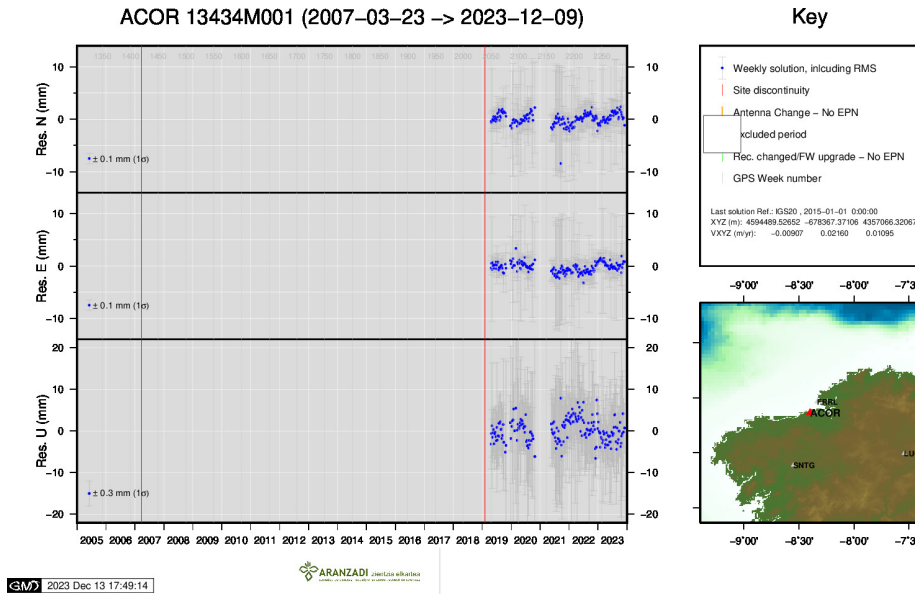
EPN Coordination Group and the EPN Central Bureau (2018): *Guidelines for the EPN Analysis Centres*. epncb.oma.be/documentation/guidelines/guidelines_analysis_centres.pdf

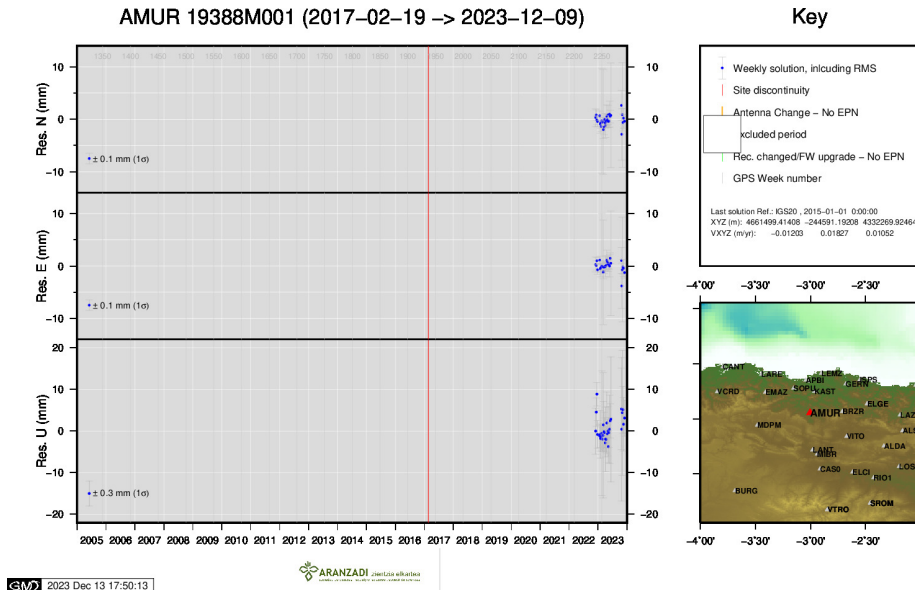
Johnston, G., Riddell, A., Hausler, G. (2017). The International GNSS Service. Teunissen, Peter J.G., Montenbruck, O. (Eds.), Springer Handbook of Global Navigation Satellite Systems (1st ed., pp. 967-982). Cham, Switzerland: Springer International Publishing. DOI: 10.1007/978-3-319-42928-1

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

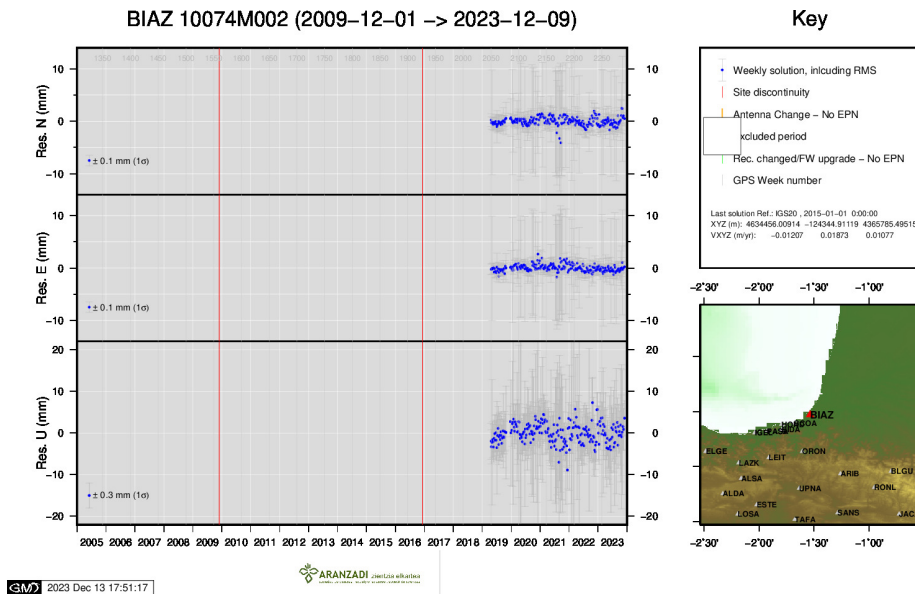
10 Cumulative Time Series

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

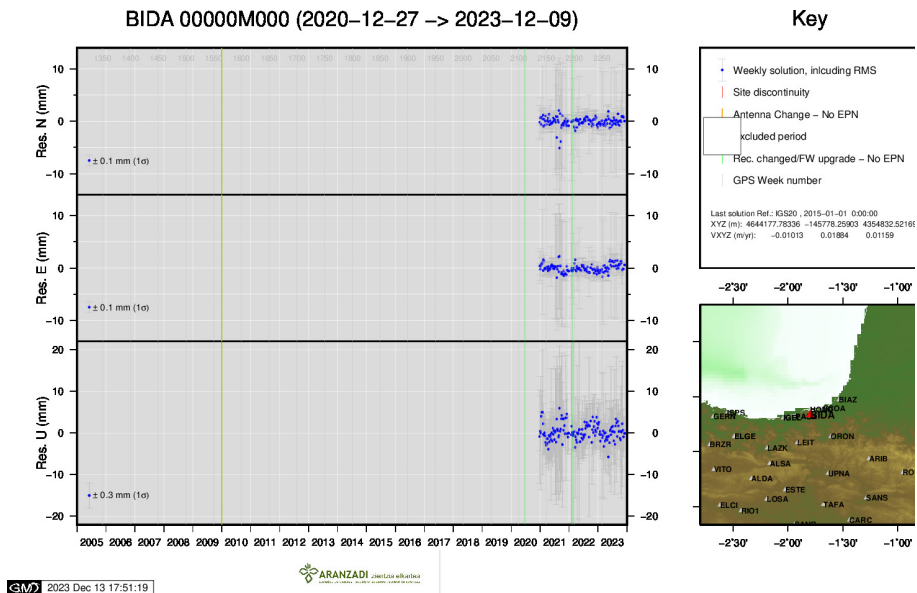




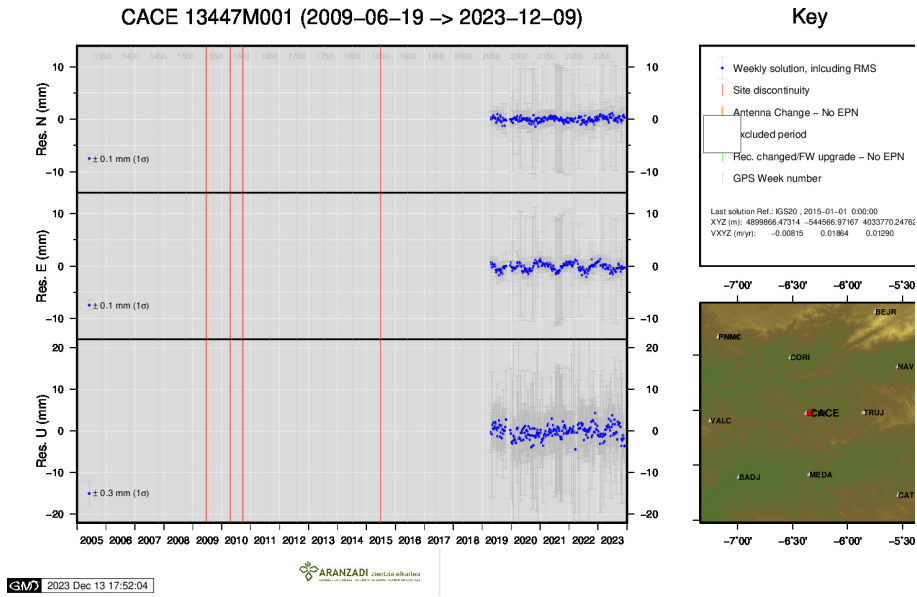
3) AMUR



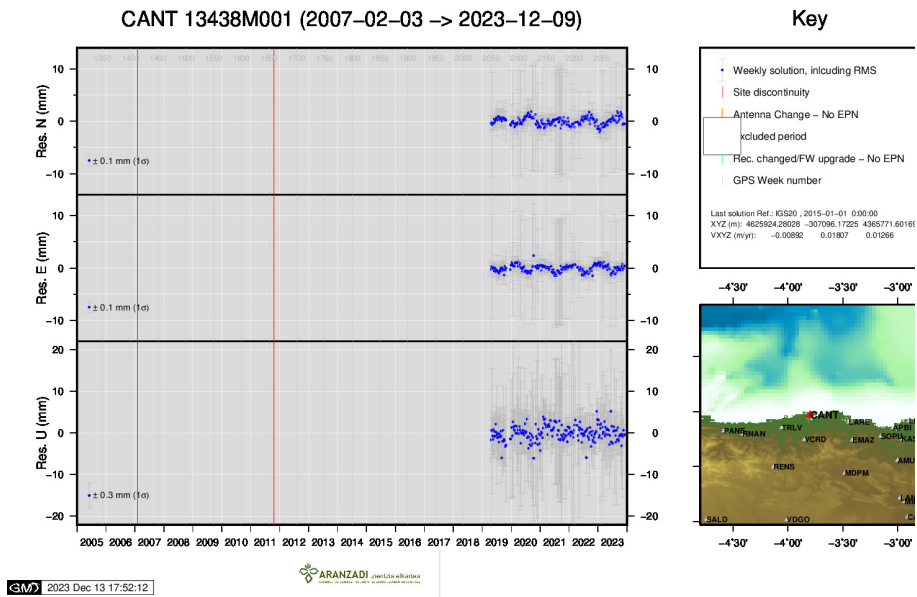
4) BIAZ



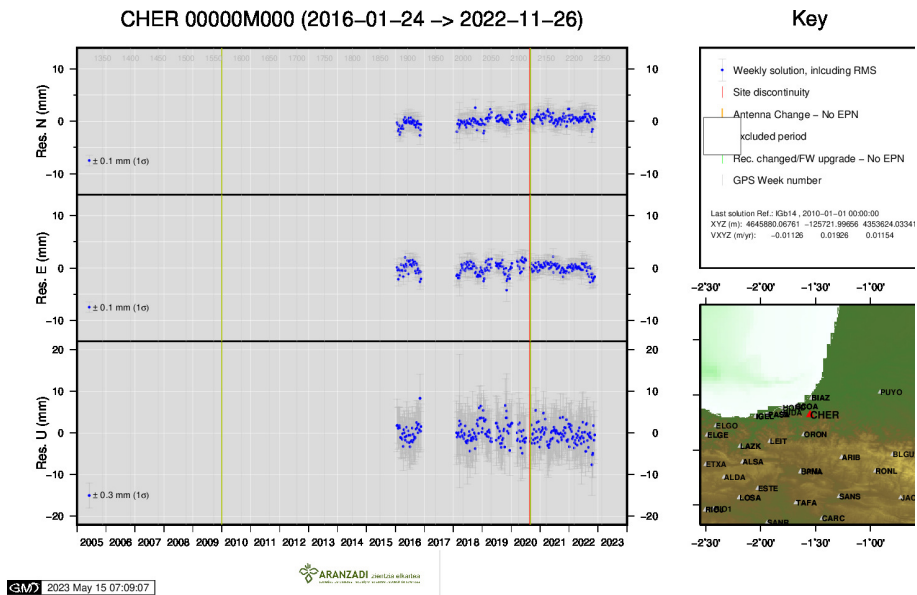
5) BIDA



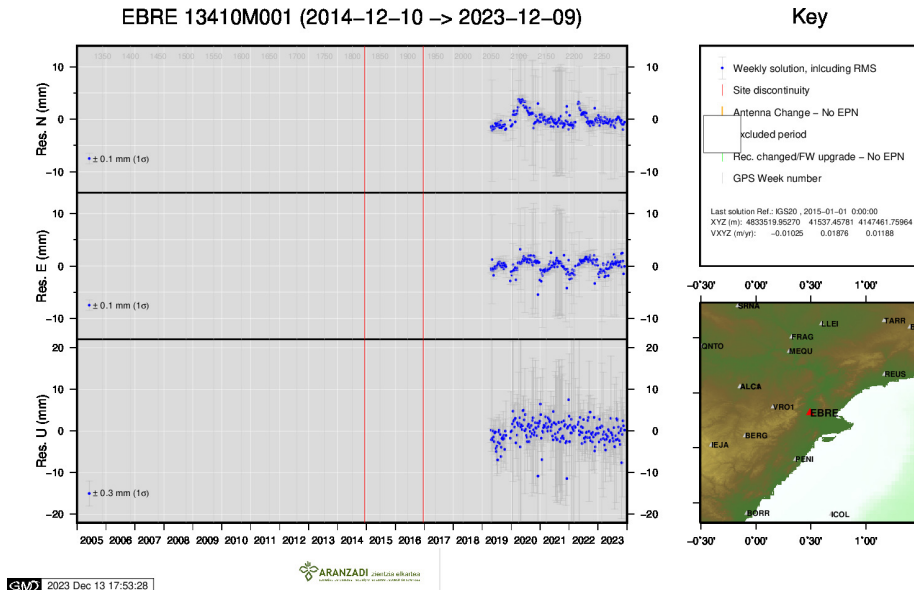
6) CACE



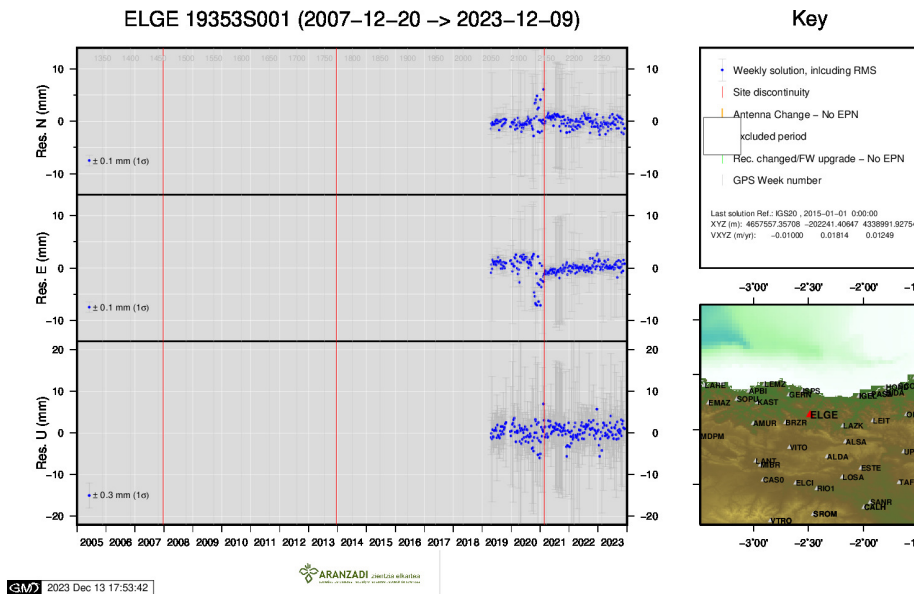
7) CANT



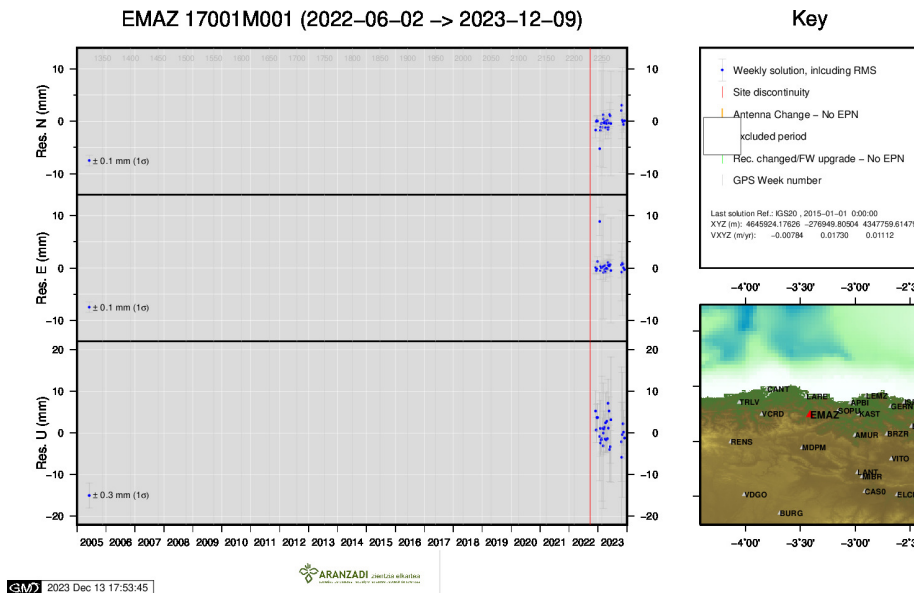
8) CHER



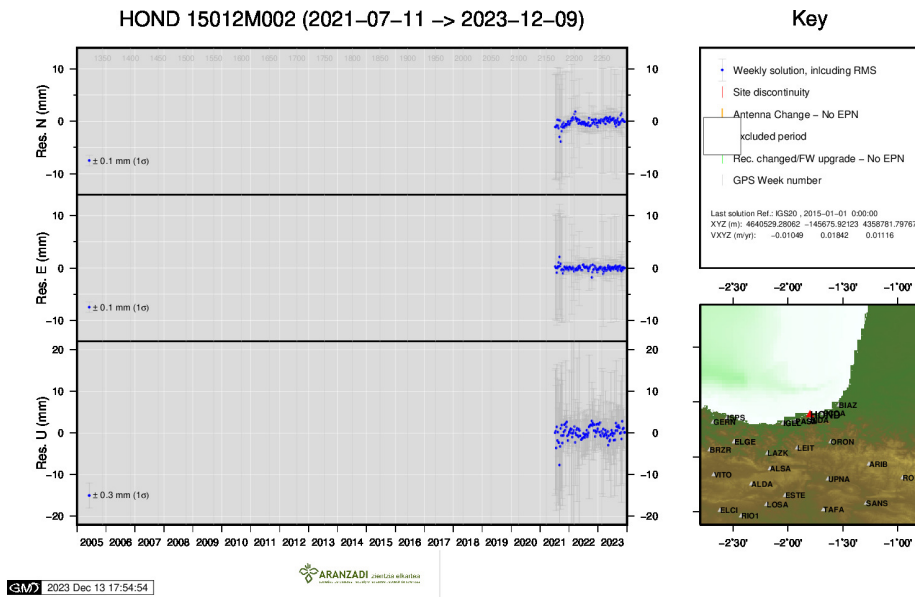
9) EBRE



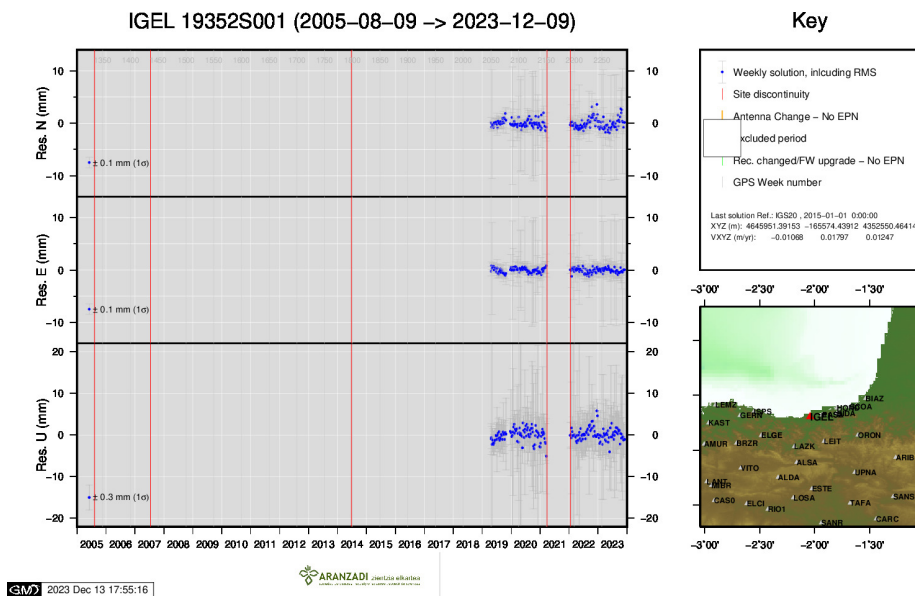
10) ELGE



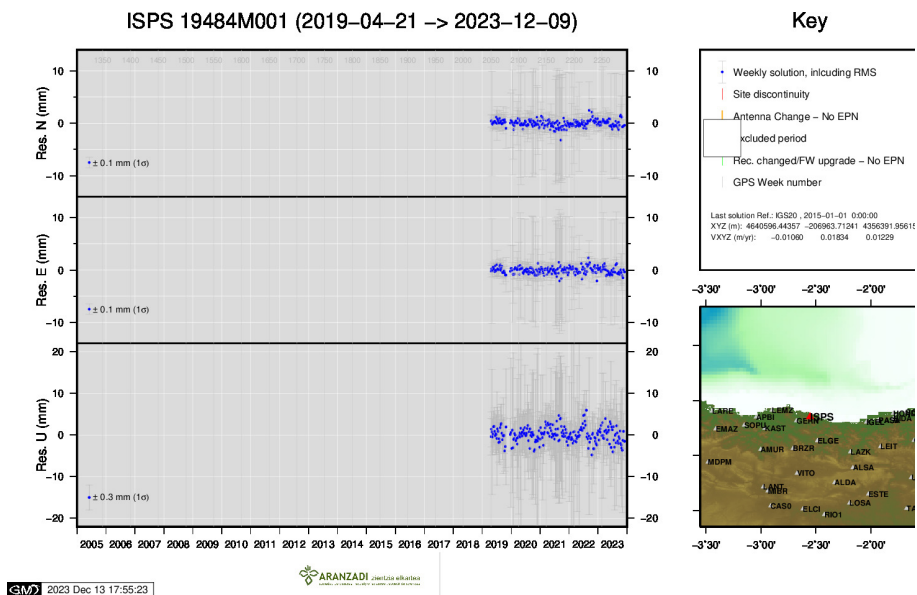
11) EMAZ



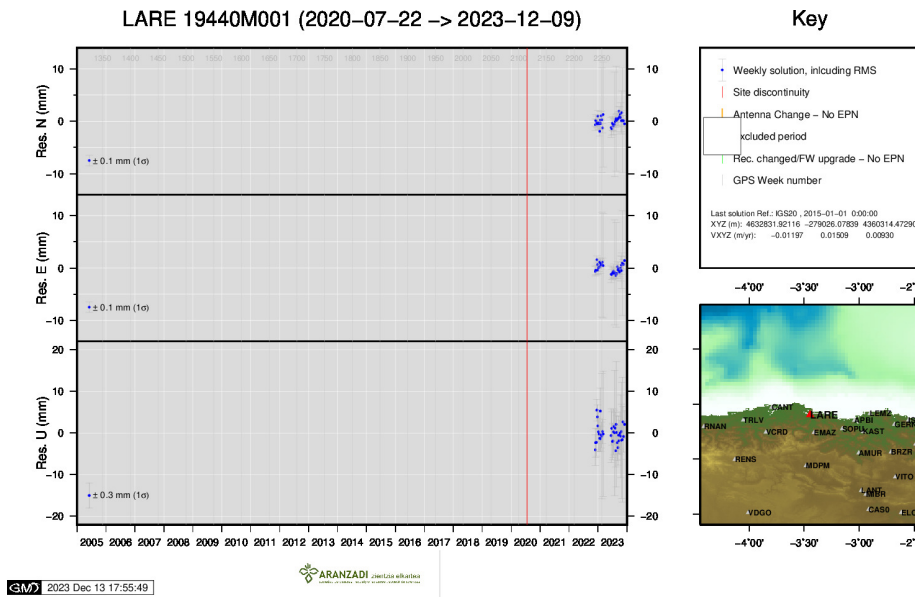
12) HOND



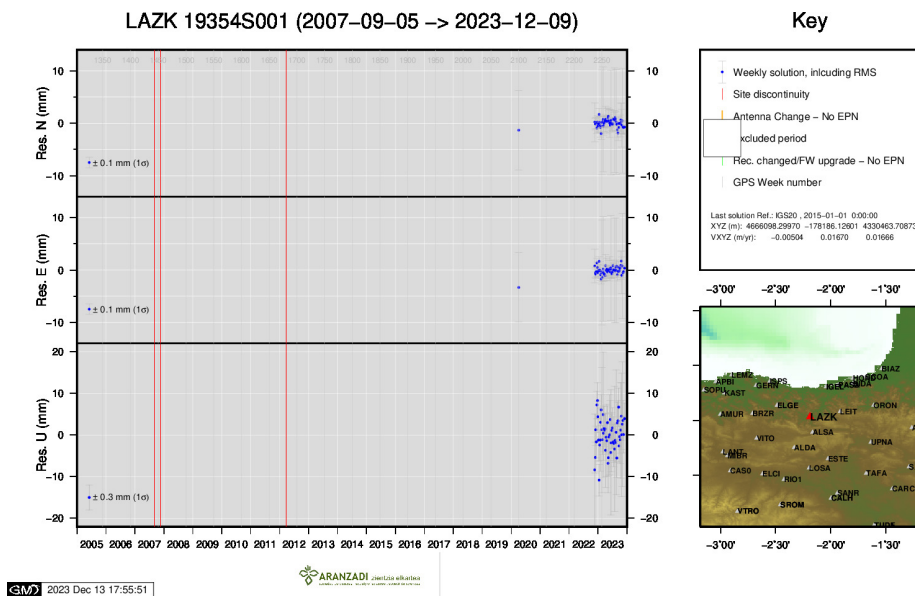
13) IGEL



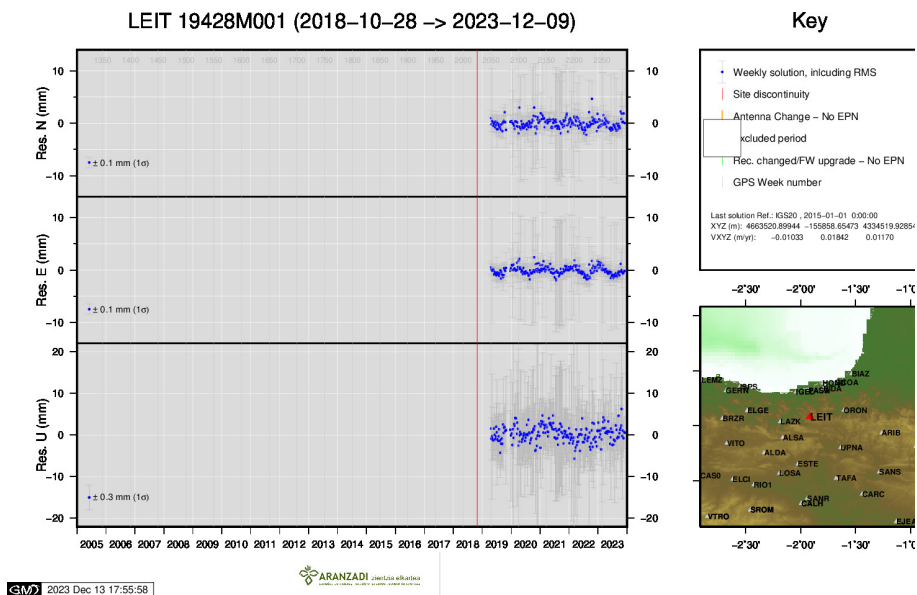
14) ISPS



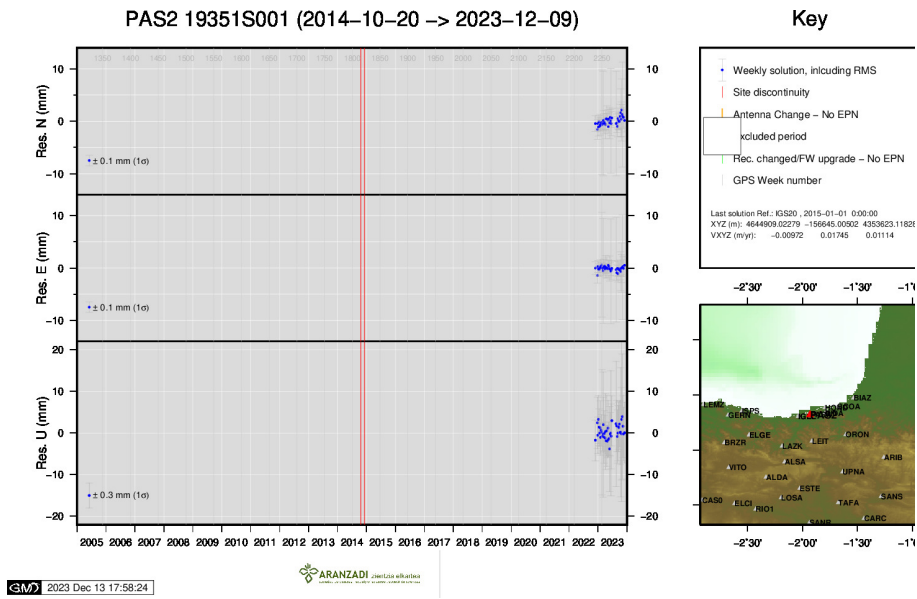
15) LARE



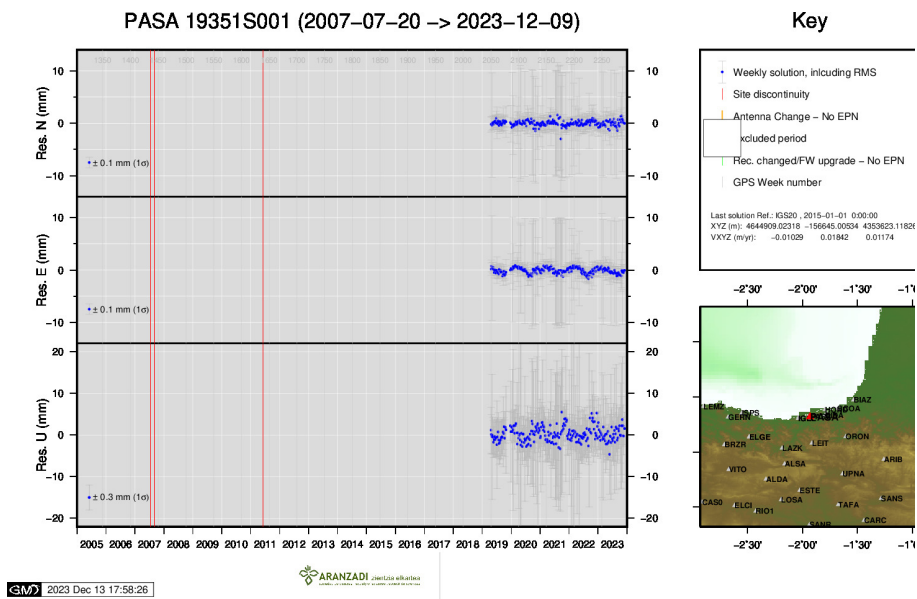
16) LAZK



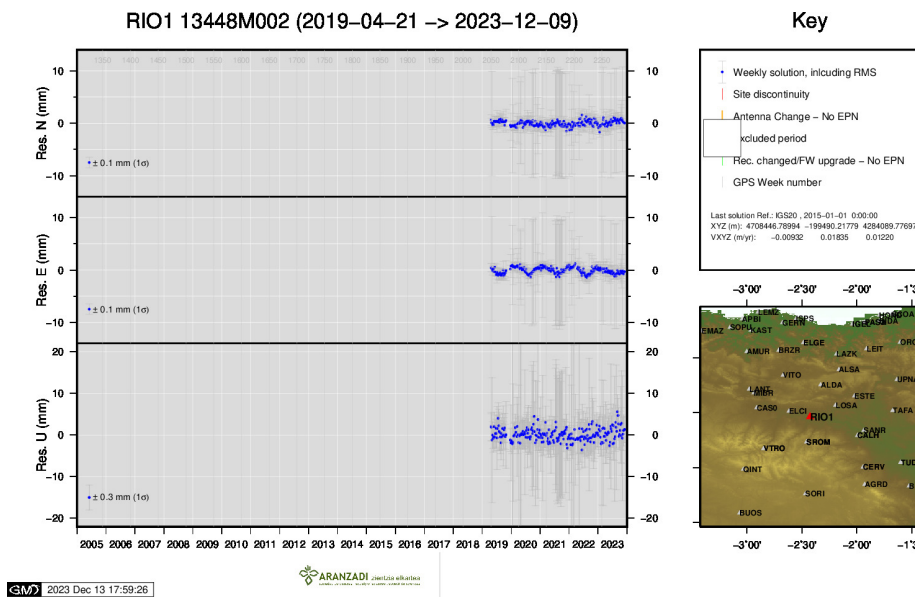
17) LEIT



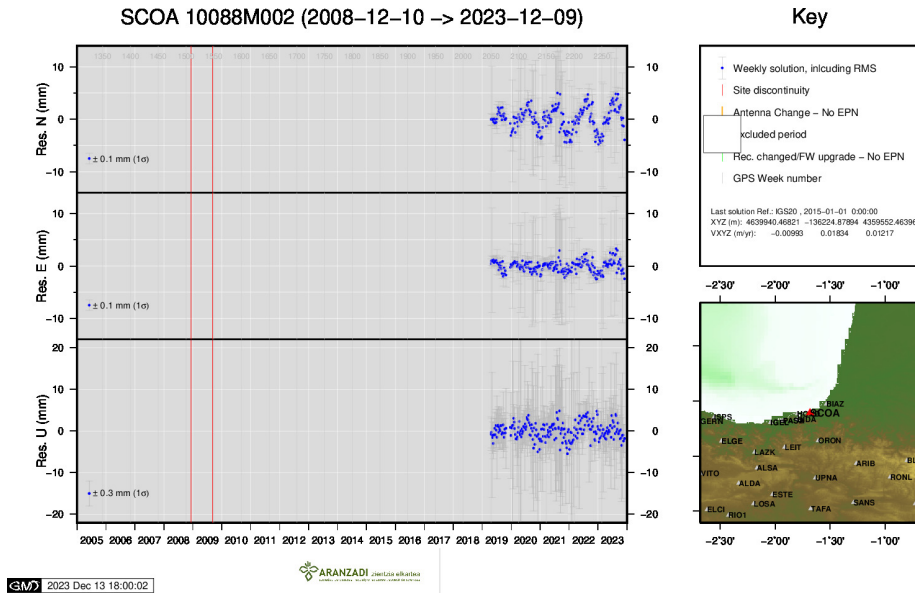
18) PAS2



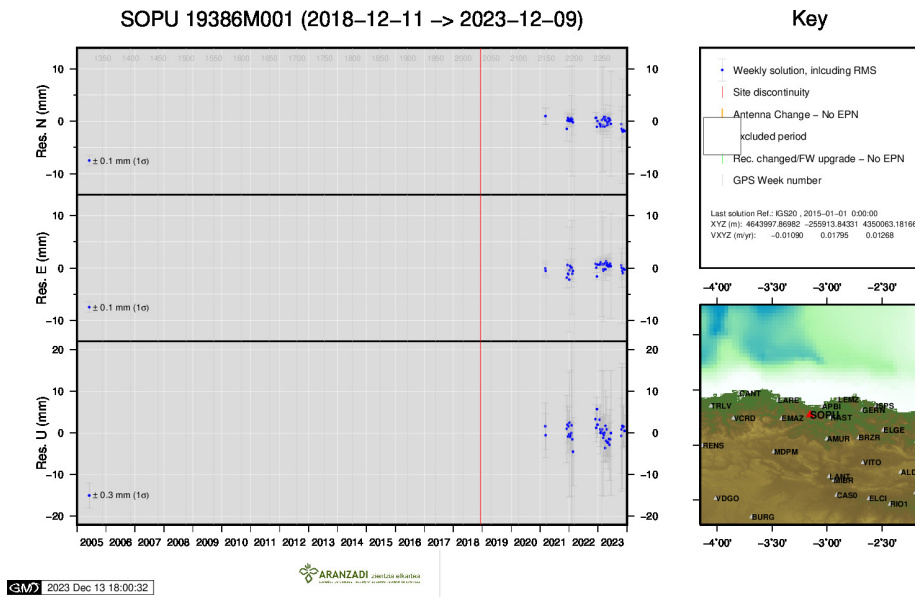
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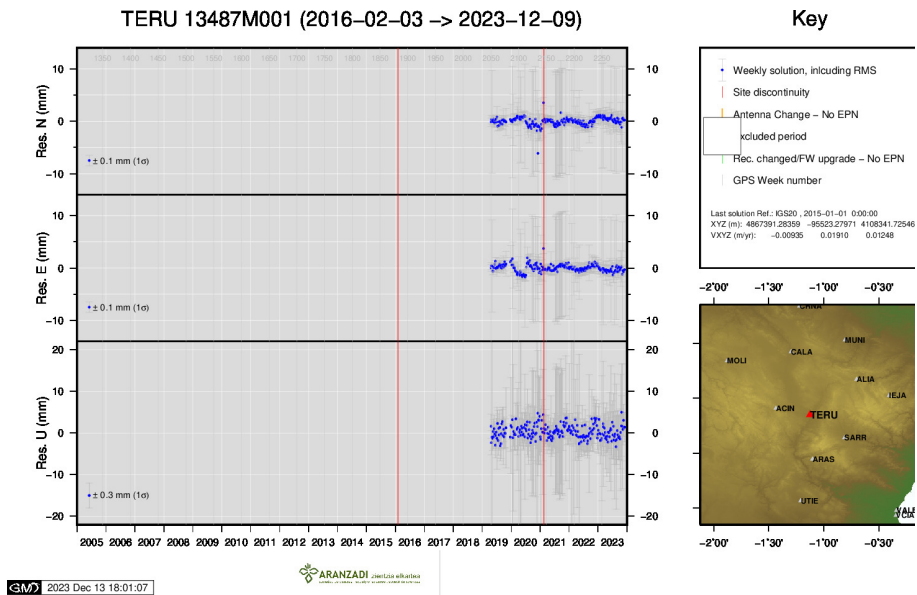
20) RIO1



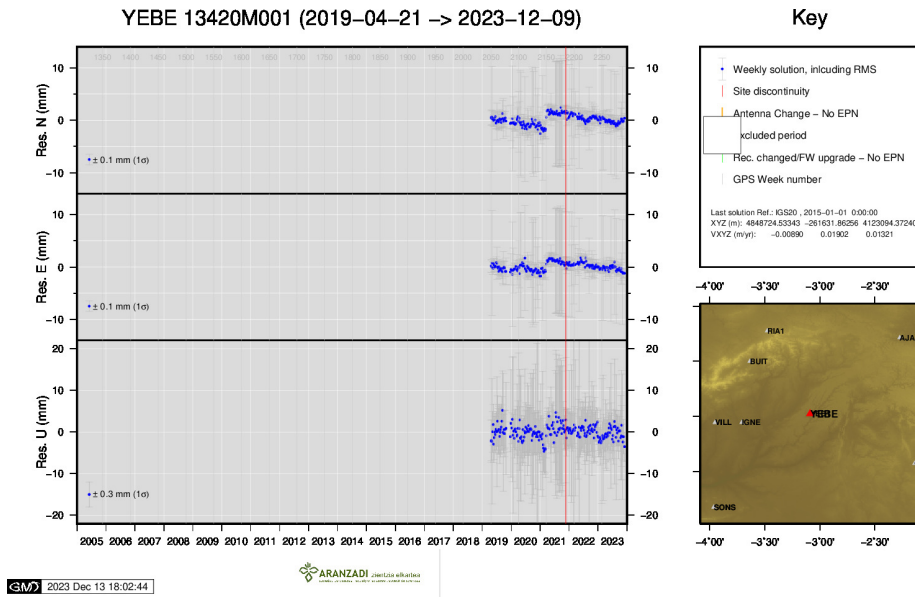
21) SCOA



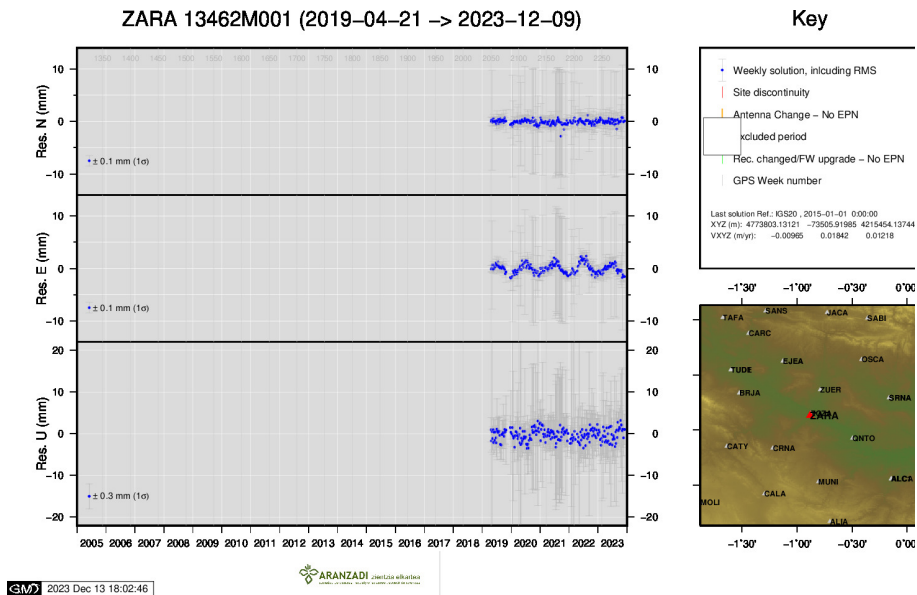
22) SOPU



23) TERU



24) YEBE



25) ZARA