ARA-DAC Weekly Analysis Result: 2078 (GFA)

Technical Report

GPS Week: 2078 (GFA)

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

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1 Introduction

In may 2015 ARA (EUREF's acronym of the ARANZADI's Department of Applied Geodesy), kicks off as a EUREF's Operational Center. In July 2015, the Densification solutions ARA computes routinely in a weekly basis start being submitted to the EUREF's EPN Densification Project.

2 Map of Computed Sites

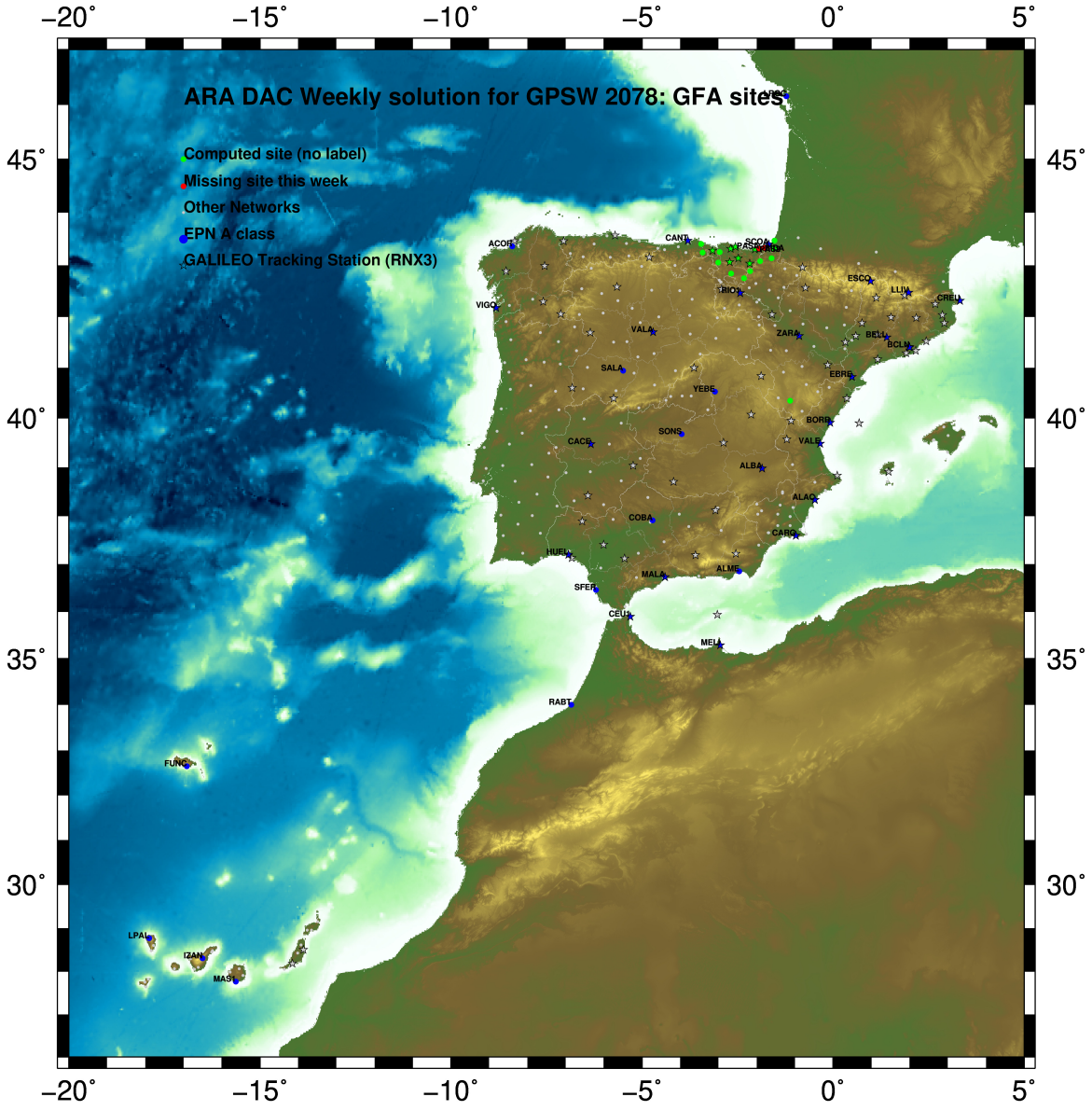

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Fig.1: Computed Sites for GPS Week2078 (GFA)

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 also used if avalaible from GPSW 1986 on)
- Modelled observable: Double differences of carrier phase using different combinations based on the distance.
- Ground antenna phase center calibrations: Group APCV used from the PCV_COD.I14 file and individual calibrations from EPNC_14.ATX. EPN_A class sites (CRD + VEL) IGS14 used to define the reference frame (from GPSW 1934). If individual calibrations, other from these, are available, they are also included in the analysis.
- Troposphere:
  - 3 deg elev. cutoff; elevation dependent weighting
  - VMF1 mapping function. ZPD parameters are estimated using the VMF1 mapping function.
  - CHENHER gradient estimation model.
- Ionosphere: no a priori model, ionospheric effect almost removed by iono free combination.
- Ocean Loading: FES2004 (Scherneck).
- Atmosph. Loading: computed from a global grid using the GRDS1S2 program of Bernese 5.2.

4 Estimated Parameters

- Adjustment: Least Squares
- Rejection Criteria: 3*rms of single differences, in the weekly combination of daily normal equations (ADDNEQ)
- Station coordinates: minimum constraints (MC) to EPN A class sites (only translations).
- Troposphere: 3 deg. After having obtained coordinates valid for the entire week, tropospheric zenith delay is solved at each site at intervals of 1 hour throughout the week, holding the coordinates constrained at the weekly values.
- Ionospheric: second and third "High Order Ionosphere (HOI)" corrections used, using CODE files, to improve Ambiguity Resolution.
- Satellite clock bias: not estimated because are eliminated by double differencing the phase data.
- Receiver clock bias: not estimated because are eliminated by double differencing the phase data.
- Orbits and ERPs: CODE's orbits and ERP for both rapid and final solutions. DE405 planetary ephemeris and JGM3 Earth geopotential model is used.
- Tidal displacements: according to IERS2010 Conventions. Atmospheric loading corrections used.

- Ambiguity: an advanced ambiguity resolution (AR) scheme is included:
  - Code-Based Widelane (WL) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
  - Phase-Based Widelane (L_5) AR for baselines shorter than 200km, the code-based wide-lane AR is replaced by a phase-only wide-lane with a subsequent narrow-lane AR.
  - Quasi-Ionosphere-Free (QIF)AR for the remaining real-valued ambiguities for baselines shorter than 2000km.
  - Direct L_1/L_2 AR for baselines shorter than 20km
- AR Verification: Each baseline is processed by introducing the resolved integer ambiguities and checking the residuals. If there is any problem, the ambiguities are re-initialized.

5 Computed Coordinates

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

5.1 IGS14

The Reference Frame considered in this section is IGS14, release C2055.

```
ARA LAC 2078 WEEK FINAL COMBINATION: PRECISE ORBITS             24-NOV-19 11:31
------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: IGS14             EPOCH: 2019-11-06 12:00:00

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

  1  ACOR 13434M001    4594489.55337  -678367.43588  4357066.28786    W
 34  ALDA 19383M001    4687280.15552  -190876.55813  4308106.95877    A
 43  ALSA 19419M001    4677250.82613  -176770.38717  4319079.88030    A
 45  AMUR 19388M001    4661499.44447  -244591.25378  4332269.89611    A
 81  BIAZ 10074M002    4634456.04768  -124344.96981  4365785.46748    A
 92  BRZR 19387M001    4662220.99176  -220769.89571  4333309.45230    A
  9  CACE 13447M001    4899866.49861  -544567.02910  4033770.20939    W
 10  CANT 13438M001    4625924.30989  -307096.22749  4365771.56539    W
118  CHER 00000M000    4645880.32083  -125721.92504  4353624.38427    A
 15  CREU 13432M001    4715420.12744   273178.06694  4271946.84899    W
 17  EBRE 13410M001    4833519.98025    41537.39493  4147461.71831    W
139  ELGE 19353S001    4657557.40011  -202241.46646  4338991.87921    A
141  EMAZ 17001M001    4645924.20066  -276949.86099  4347759.58589    A
209  GERN 19389M001    4642811.32390  -217222.92074  4353278.89555    A
183  IGEL 19352S001    4645951.42559  -165574.49708  4352550.42904    A
188  ISPS 19484M001    4640596.47696  -206963.76933  4356391.92261    A
193  KAST 19499M001    4646949.07459  -240747.26984  4348015.00050    A
198  LARE 19440M001    4632831.94461  -279026.13375  4360314.43360    A
199  LAZK 19354S001    4666098.33312  -178186.18555  4330463.68077    A
203  LEIT 19428M001    4663520.93071  -155858.71181  4334519.89338    A
260  ORON 19427M001    4659695.77170  -130864.72857  4338948.88988    A
 33  PASA 19351S001    4644909.05751  -156645.06184  4353623.08892    W
 36  RIO1 13448M002    4708446.82338  -199490.27800  4284089.74677    W
 37  SALA 13469M001    4803054.47715  -462131.06320  4158379.08385    W
 38  SCOA 10088M002    4639940.49081  -136224.93520  4359552.42116    W
321  SOPU 19386M001    4643997.90879  -255913.90155  4350063.15727    A
342  TERU 13487M001    4867391.31951   -95523.34618  4108341.69231    A
375  VITO 19385M001    4679397.69602  -218436.49824  4314898.37437    A
 49  YEBE 13420M001    4848724.56136  -261631.92429  4123094.33566    W
 50  ZARA 13462M001    4773803.16548   -73505.97842  4215454.10493    W
```

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).

```
ETRF2000 FINAL COORD. wk 2078                                   24-NOV-19 11:31
------------------------------------------------------------------------------
LOCAL GEODETIC DATUM: ETRF2000          EPOCH: 2019-11-06 12:00:00

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

  1  ACOR 13434M001    4594489.86366  -678367.98195  4357065.86575    W
 34  ALDA 19383M001    4687280.52028  -190877.11291  4308106.53560    A
 43  ALSA 19419M001    4677251.19333  -176770.94084  4319079.45807    A
 45  AMUR 19388M001    4661499.80455  -244591.80598  4332269.47426    A
 81  BIAZ 10074M002    4634456.42437  -124345.51880  4365785.04919    A
 92  BRZR 19387M001    4662221.35474  -220770.44793  4333309.03069    A
  9  CACE 13447M001    4899866.80211  -544567.60696  4033769.76540    W
 10  CANT 13438M001    4625924.66490  -307096.77610  4365771.14551    W
118  CHER 00000M000    4645880.69650  -125722.47524  4353623.96508    A
 15  CREU 13432M001    4715420.54462   273177.51088  4271946.42925    W
 17  EBRE 13410M001    4833520.36128    41536.82558  4147461.28668    W
139  ELGE 19353S001    4657557.76569  -202242.01813  4338991.45819    A
141  EMAZ 17001M001    4645924.55799  -276950.41165  4347759.16484    A
209  GERN 19389M001    4642811.68870  -217223.47089  4353278.47547    A
183  IGEL 19352S001    4645951.79646  -165575.04741  4352550.00936    A
188  ISPS 19484M001    4640596.84319  -206964.31922  4356391.50283    A
193  KAST 19499M001    4646949.43623  -240747.82050  4348014.57982    A
198  LARE 19440M001    4632832.30257  -279026.68302  4360314.01353    A
199  LAZK 19354S001    4666098.70095  -178186.73805  4330463.25938    A
203  LEIT 19428M001    4663521.30148  -155859.26397  4334519.47247    A
260  ORON 19427M001    4659696.14574  -130865.28025  4338948.46956    A
 33  PASA 19351S001    4644909.42952  -156645.61203  4353622.66943    W
 36  RIO1 13448M002    4708447.18544  -199490.83502  4284089.32186    W
 37  SALA 13469M001    4803054.79921  -462131.63082  4158378.64839    W
 38  SCOA 10088M002    4639940.86565  -136225.48480  4359552.00230    W
321  SOPU 19386M001    4643998.26877  -255914.45194  4350062.73663    A
342  TERU 13487M001    4867391.68155   -95523.91954  4108341.25640    A
375  VITO 19385M001    4679398.05799  -218437.05226  4314897.95147    A
 49  YEBE 13420M001    4848724.90475  -261632.49620  4123093.89916    W
 50  ZARA 13462M001    4773803.53766   -73506.54192  4215453.67652    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).

ETRF2014 FINAL COORD. wk 2078 24-NOV-19 11:31

LOCAL GEODETIC DATUM: ETRF2014 EPOCH: 2019-11-06 12:00:00

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
1	ACOR 13434M001	4594489.82127	-678368.02037	4357065.91436	W
34	ALDA 19383M001	4687280.47567	-190877.15269	4308106.58410	A
43	ALSA 19419M001	4677251.14878	-176770.98071	4319079.50661	A
45	AMUR 19388M001	4661499.76035	-244591.84567	4332269.52280	A
81	BIAZ 10074M002	4634456.38007	-124345.55902	4365785.09785	A
92	BRZR 19387M001	4662221.31047	-220770.48770	4333309.07924	A
9	CACE 13447M001	4899866.75624	-544567.64465	4033769.81334	W
10	CANT 13438M001	4625924.62124	-307096.81571	4365771.19411	W
118	CHER 00000M000	4645880.65210	-125722.51541	4353624.01372	A
15	CREU 13432M001	4715420.49816	273177.46960	4271946.47798	W
17	EBRE 13410M001	4833520.31441	41536.78558	4147461.33498	W
139	ELGE 19353S001	4657557.72140	-202242.05799	4338991.50676	A
141	EMAZ 17001M001	4645924.51405	-276950.45129	4347759.21341	A
209	GERN 19389M001	4642811.64460	-217223.51075	4353278.52408	A
183	IGEL 19352S001	4645951.75218	-165575.08744	4352550.05797	A
188	ISPS 19484M001	4640596.79909	-206964.35912	4356391.55144	A
193	KAST 19499M001	4646949.39217	-240747.86026	4348014.62840	A
198	LARE 19440M001	4632832.25875	-279026.72270	4360314.06213	A
199	LAZK 19354S001	4666098.65651	-178186.77795	4330463.30794	A
203	LEIT 19428M001	4663521.25699	-155859.30397	4334519.52104	A
260	ORON 19427M001	4659696.10121	-130865.32034	4338948.51816	A
33	PASA 19351S001	4644909.38522	-156645.65209	4353622.71805	W
36	RIO1 13448M002	4708447.14063	-199490.87469	4284089.37031	W
37	SALA 13469M001	4803054.75417	-462131.66918	4158378.69654	W
38	SCOA 10088M002	4639940.82134	-136225.52496	4359552.05094	W
321	SOPU 19386M001	4643998.22478	-255914.49165	4350062.78521	A
342	TERU 13487M001	4867391.63478	-95523.95894	4108341.30455	A
375	VITO 19385M001	4679398.01354	-218437.09197	4314897.99998	A
49	YEBE 13420M001	4848724.85867	-261632.53509	4123093.94727	W
50	ZARA 13462M001	4773803.49179	-73506.58176	4215453.72488	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 IGS14 solution and are given with respect the Local frame (North-East-Up).

```
ARA LAC 2078 WEEK FINAL COMBINATION: PRECISE ORBITS              24-NOV-19 11:31
------------------------------------------------------------------------------
                      Weekday     Repeatability (mm)
Station         #Days 0123456       N      E      U
------------------------------------------------------
ACOR 13434M001     6  XXXXX X     0.79   0.89   2.20
ALDA 19383M001     7  XXXXXXX     1.36   0.97   6.06
ALSA 19419M001     7  XXXXXXX     1.00   1.66   4.16
AMUR 19388M001     7  XXXXXXX     1.79   1.77   6.90
BIAZ 10074M002     7  XXXXXXX     0.86   0.53   5.00
BRZR 19387M001     7  XXXXXXX     1.81   1.47   6.99
CACE 13447M001     7  XXXXXXX     0.92   0.46   2.48
CANT 13438M001     7  XXXXXXX     0.84   0.65   3.01
CHER 00000M000     5  X  XXXX     1.06   1.50   4.16
CREU 13432M001     7  XXXXXXX     1.31   1.03   4.72
EBRE 13410M001     7  XXXXXXX     1.79   4.76   6.41
ELGE 19353S001     6  X XXXXX     1.04   0.62   3.66
EMAZ 17001M001     7  XXXXXXX     1.86   2.58   4.00
GERN 19389M001     7  XXXXXXX     1.58   1.03   4.45
IGEL 19352S001     7  XXXXXXX     0.97   0.57   4.44
ISPS 19484M001     7  XXXXXXX     1.60   1.20   4.07
KAST 19499M001     7  XXXXXXX     1.02   1.58   5.10
LARE 19440M001     7  XXXXXXX     1.26   1.26   3.25
LAZK 19354S001     7  XXXXXXX     1.21   1.70   5.05
LEIT 19428M001     7  XXXXXXX     0.96   1.33   5.77
ORON 19427M001     7  XXXXXXX     0.84   1.97   4.75
PASA 19351S001     7  XXXXXXX     1.09   0.68   4.21
RIO1 13448M002     7  XXXXXXX     1.20   1.63   2.93
SALA 13469M001     7  XXXXXXX     0.44   1.00   2.54
SCOA 10088M002     7  XXXXXXX     1.42   1.00   3.55
SOPU 19386M001     6  XX XXXX     1.49   1.31   5.10
TERU 13487M001     7  XXXXXXX     1.59   1.18   3.65
VITO 19385M001     7  XXXXXXX     1.33   0.65   4.87
YEBE 13420M001     7  XXXXXXX     0.63   1.11   3.28
ZARA 13462M001     7  XXXXXXX     0.78   1.52   3.94

Comparison of individual solutions:
-----------------------------------
ACOR 13434M001   N    0.79     -0.26   -0.62    0.18   -0.62   -1.48           -0.32
ACOR 13434M001   E    0.89      0.44   -0.72   -0.62   -1.54   -0.41           -0.59
ACOR 13434M001   U    2.20     -0.58    1.14    2.97   -1.85    2.96            1.26
ALDA 19383M001   N    1.36      2.95    0.48   -1.37   -0.21   -0.48    0.18    0.05
ALDA 19383M001   E    0.97     -0.26    1.39    0.43   -0.71    0.75   -1.25   -0.91
ALDA 19383M001   U    6.06     -3.28    4.51   -1.67   -2.42   -0.33   -8.88  -10.07
ALSA 19419M001   N    1.00     -1.16   -0.72    0.83    1.18    0.58    0.19    1.31
ALSA 19419M001   E    1.66     -1.73   -1.93    2.69    0.22   -0.17    0.50    1.50
ALSA 19419M001   U    4.16      3.94   -4.46   -1.20   -1.77   -0.66   -4.50   -6.58
AMUR 19388M001   N    1.79      2.27   -3.59   -0.45    0.50    0.00    0.28   -0.82
AMUR 19388M001   E    1.77     -0.75   -3.25   -0.67    2.01    0.59   -0.77    1.49
AMUR 19388M001   U    6.90      1.81  -14.94   -1.93    0.53   -7.06   -1.82   -1.32
BIAZ 10074M002   N    0.86     -0.41    0.58   -0.30    1.03   -0.86   -1.43    0.10
BIAZ 10074M002   E    0.53     -0.47    0.29    1.03   -0.49   -0.09   -0.28    0.02
BIAZ 10074M002   U    5.00      6.77    0.67   -5.89   -5.06    5.21   -1.89   -3.61
BRZR 19387M001   N    1.81      0.29   -1.68    0.47    0.87    3.77    0.99    0.76
BRZR 19387M001   E    1.47     -0.06   -2.95    0.91    1.49   -0.83    0.40    0.58
BRZR 19387M001   U    6.99    -10.33   -7.89   -3.27    2.69   -7.95    1.23    6.47
CACE 13447M001   N    0.92     -0.74   -1.39   -0.44    1.08   -1.12   -0.09    0.13
CACE 13447M001   E    0.46      0.59   -0.63   -0.15   -0.69    0.15   -0.16    0.07
CACE 13447M001   U    2.48     -2.24   -2.39   -0.23   -0.73    3.53    3.61    0.08
CANT 13438M001   N    0.84      0.18    1.71   -0.07    1.03   -0.23   -0.25   -0.36
CANT 13438M001   E    0.65      0.44    0.55   -0.44    0.46    0.92    0.63    0.60
CANT 13438M001   U    3.01     -1.09    1.87   -4.40   -1.00    2.91   -4.49   -0.74
CHER 00000M000   N    1.06      0.13                    1.41   -0.41    0.99   -1.15
CHER 00000M000   E    1.50      2.39                    0.97   -0.14    0.83   -1.27
CHER 00000M000   U    4.16     -1.85                   -0.67    4.57   -2.86   -6.01
CREU 13432M001   N    1.31     -1.63    0.93    0.08    1.91    1.45    0.18   -0.98
CREU 13432M001   E    1.03     -1.67    1.26    0.78   -0.83    0.63   -0.11    0.47
CREU 13432M001   U    4.72     -6.10   -6.80   -3.27    1.40    1.26    1.58    5.77
EBRE 13410M001   N    1.79      1.83   -0.72    2.56   -2.43   -0.70    0.89    1.24
EBRE 13410M001   E    4.76     -5.56    6.19    2.29   -3.77    6.27   -2.64   -1.17
EBRE 13410M001   U    6.41     -7.62   -2.20   -7.70    7.26    4.52   -5.94    3.95
ELGE 19353S001   N    1.04      0.30            1.28    0.33    1.28    1.38   -0.03
ELGE 19353S001   E    0.62     -0.13           -0.07   -0.84    1.06    0.01    0.22
ELGE 19353S001   U    3.66     -3.35            0.29    0.76   -4.75   -5.54   -1.27
EMAZ 17001M001   N    1.86      3.46    0.82    1.60   -1.66   -1.54   -0.17   -0.62
EMAZ 17001M001   E    2.58      0.94    1.25   -0.35    1.95    5.51   -1.34   -1.20
EMAZ 17001M001   U    4.00     -0.70    5.58   -3.35   -0.01   -5.05   -5.11    1.27
GERN 19389M001   N    1.58      2.29    2.41    1.29   -1.11    0.04    1.02   -0.22
GERN 19389M001   E    1.03      0.60    1.71    0.12   -1.02   -0.43   -1.36    0.26
GERN 19389M001   U    4.45     -7.42   -2.30    2.99   -1.11   -3.20   -5.30   -3.17
IGEL 19352S001   N    0.97      1.55    1.05    0.30    0.88    0.57    0.93    0.36
IGEL 19352S001   E    0.57     -0.38   -1.01    0.49    0.27    0.52    0.22   -0.40
IGEL 19352S001   U    4.44     -3.92   -3.50    2.22   -2.43   -7.77    1.71   -4.06
ISPS 19484M001   N    1.60      0.48    3.37    0.73    0.95    0.81   -0.02    1.27
ISPS 19484M001   E    1.20      0.39    0.35   -0.15   -1.24    1.55   -1.79   -1.07
ISPS 19484M001   U    4.07     -3.35   -7.03   -2.53   -2.07   -3.60   -3.61   -1.49
KAST 19499M001   N    1.02      0.86    0.00    0.12    1.41    1.18    1.28    0.69
KAST 19499M001   E    1.58     -1.24    1.25   -1.44    1.40   -2.46   -0.39    1.26
KAST 19499M001   U    5.10     -5.19    2.79   -7.11    1.18   -7.58   -3.39   -0.28
LARE 19440M001   N    1.26      2.44    0.25   -0.17   -0.07    0.23   -0.62   -1.73
LARE 19440M001   E    1.26      0.00   -0.52    0.07    2.78    0.92    0.40    0.74
LARE 19440M001   U    3.25     -0.75    0.66   -3.37    0.27   -0.05   -6.32    3.32
LAZK 19354S001   N    1.21      0.11   -0.38    0.66    0.44    1.53    1.37    1.95
LAZK 19354S001   E    1.70      0.35   -3.54    1.63    0.76    0.90    0.03   -0.78
LAZK 19354S001   U    5.05      0.75   -8.40   -1.50    3.68   -2.66   -6.37   -4.33
LEIT 19428M001   N    0.96      1.42   -1.01    0.92   -0.60    1.04    0.47   -0.04
LEIT 19428M001   E    1.33      2.19   -1.65   -1.08   -0.02    0.83   -0.21    1.09
LEIT 19428M001   U    5.77      8.66   -0.77   -0.17   -5.19   -5.35   -6.21   -5.49
ORON 19427M001   N    0.84      0.79   -0.97    0.32   -0.10    0.39    0.31    1.53
```

ORON	19427M001	E	1.97	-1.79	-2.57	3.15	0.99	1.60	0.08	-0.16
ORON	19427M001	U	4.75	-5.55	2.06	-5.49	1.56	1.27	-7.94	-1.77
PASA	19351S001	N	1.09	1.25	1.00	0.61	-0.09	1.57	1.31	0.09
PASA	19351S001	E	0.68	-1.06	-0.84	0.13	0.09	0.01	0.70	0.66
PASA	19351S001	U	4.21	-2.35	-5.18	0.00	-1.85	-5.92	2.52	-5.40
RIO1	13448M002	N	1.20	-1.70	0.93	0.65	1.20	1.56	-0.14	0.72
RIO1	13448M002	E	1.63	1.17	-3.20	0.13	1.40	0.39	0.37	1.44
RIO1	13448M002	U	2.93	-0.13	1.48	-2.05	-3.16	-4.67	-3.65	0.17
SALA	13469M001	N	0.44	-0.35	-0.47	-0.36	-0.01	-0.26	-0.48	0.63
SALA	13469M001	E	1.00	0.02	-1.09	0.36	-0.29	-0.73	1.99	-0.26
SALA	13469M001	U	2.54	0.34	-0.25	0.86	3.69	3.89	2.98	0.25
SCOA	10088M002	N	1.42	1.08	0.87	0.23	1.10	-1.68	2.12	1.30
SCOA	10088M002	E	1.00	-1.08	-1.44	-0.14	0.17	0.79	1.42	0.08
SCOA	10088M002	U	3.55	-3.58	-4.77	-5.13	3.41	-0.49	-0.98	-1.09
SOPU	19386M001	N	1.49	0.83	1.88		1.52	0.25	-1.22	1.74
SOPU	19386M001	E	1.31	1.07	0.20		-0.51	1.63	-0.47	-2.05
SOPU	19386M001	U	5.10	-8.48	-1.84		-2.72	-5.54	-2.56	3.16
TERU	13487M001	N	1.59	0.24	3.57	0.86	-0.96	-0.16	-0.02	-0.76
TERU	13487M001	E	1.18	1.09	1.62	-0.22	0.03	0.39	-2.08	0.09
TERU	13487M001	U	3.65	3.84	1.56	0.50	-6.01	-3.76	-2.49	-2.45
VITO	19385M001	N	1.33	0.16	3.08	0.92	0.34	-0.36	-0.06	0.09
VITO	19385M001	E	0.65	0.03	0.59	0.08	-0.20	-0.18	0.20	1.44
VITO	19385M001	U	4.87	-7.17	-7.55	-1.15	-1.61	2.59	-3.33	-3.51
YEBE	13420M001	N	0.63	-1.05	-0.12	0.24	-0.27	-0.67	-0.57	0.62
YEBE	13420M001	E	1.11	-2.30	-0.09	0.65	-0.59	-0.94	0.58	0.20
YEBE	13420M001	U	3.28	-1.23	-1.30	-5.08	1.92	-0.56	5.41	1.51
ZARA	13462M001	N	0.78	0.55	-0.26	1.38	1.08	-0.23	0.39	0.02
ZARA	13462M001	E	1.52	0.75	2.49	-0.32	-0.21	1.65	-1.31	1.58
ZARA	13462M001	U	3.94	4.47	-4.21	-0.55	-1.47	-4.85	-3.16	-4.42

6.2 Datum verification

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

```
LOCAL GEODETIC DATUM: IGS14
RESIDUALS IN LOCAL SYSTEM (NORTH, EAST, UP)
```

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
1	ACOR 13434M001	I W	-0.88	-1.41	0.44
2	ALAC 13433M001	I W	0.47	-1.19	-0.86
3	ALBA 13452M001	I W	-0.23	-0.64	0.18
4	ALME 13437M001	I W	0.00	-0.22	0.39
5	BCLN 13412M001	I W	-0.42	2.81	1.75
6	BELL 13431M001	I W	-0.48	0.46	1.94
7	BORR 13480M001	I W	-1.48	-1.63	-2.04
8	BRST 10004M004	I W	-0.69	0.65	1.60
9	CACE 13447M001	I W	1.41	1.01	1.14
10	CANT 13438M001	I W	-1.67	0.49	-5.06
11	CARG 19412M001	I W	0.32	-1.50	1.29
13	CEU1 13449M002	I W	-0.70	1.32	0.33
14	COBA 13453M001	I W	1.63	-0.29	-4.04
15	CREU 13432M001	I W	0.15	0.32	-4.58
17	EBRE 13410M001	I W	-0.21	3.80	3.31
18	ESCO 13435M001	I W	-1.03	1.24	-7.19
19	FUNC 13911S001	I W	1.23	-2.25	4.42
22	HUEL 13451M001	I W	2.46	0.78	-4.06
23	IZAN 31309M002	I W	2.01	-3.44	3.88
25	LLIV 13436M001	I W	-1.87	1.15	-0.85
26	LPAL 81701M001	I W	0.12	-0.04	5.10
27	LROC 10023M001	I W	-0.45	0.97	-2.00
28	MALA 13443M001	I W	0.04	-2.52	2.96
29	MAS1 31303M002	I W	1.61	-0.71	4.36
32	MELI 19379M001	I W	1.65	0.60	7.63
33	PASA 19351S001	I W	-1.87	0.53	-7.94
34	PDEL 31906M004	I W	-0.29	-0.33	6.94
35	RABT 35001M002	I W	1.20	-0.51	-3.43
36	RIO1 13448M002	I W	-2.18	1.15	-7.54
37	SALA 13469M001	I W	-0.61	1.37	-2.14
38	SCOA 10088M002	I W	-3.03	1.13	-1.72
39	SFER 13402M004	I W	1.71	-1.97	2.67
42	SONS 13446M001	I W	-0.75	-0.45	-0.96
44	TERC 31909M001	I W	4.07	-6.07	3.67
46	VALA 13463M002	I W	-1.63	1.51	0.69
47	VALE 13439M001	I W	-0.43	0.60	0.18
48	VIGO 13450M001	I W	-0.20	1.06	0.47
49	YEBE 13420M001	I W	0.54	2.18	2.81
50	ZARA 13462M001	I W	0.54	0.96	-5.26
51	ZIMM 14001M004	I W	-0.05	-0.93	1.54
	RMS / COMPONENT		1.40	1.75	3.79
	MEAN		-0.00	0.00	-0.00
	MIN		-3.03	-6.07	-7.94
	MAX		4.07	3.80	7.63

```
NUMBER OF PARAMETERS  :     3
NUMBER OF COORDINATES :   120
RMS OF TRANSFORMATION :    2.54 MM

BARYCENTER COORDINATES:

LATITUDE              :    39 34 24.71
LONGITUDE             :  -  5 18 10.20
HEIGHT                :         -50.642 KM


PARAMETERS:

TRANSLATION IN  N     :           0.00     +-  0.40    MM
TRANSLATION IN  E     :           0.00     +-  0.40    MM
TRANSLATION IN  U     :          -0.00     +-  0.40    MM
```

6.3 Adjustment Statistics

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

```
*_STATISTICAL PARAMETER________ __VALUE(S)____________
 NUMBER OF OBSERVATIONS                       16862806
 NUMBER OF UNKNOWNS                             211964
 NUMBER OF DEGREES OF FREEDOM                 16650842
 PHASE MEASUREMENTS SIGMA                      0.00100
 SAMPLING INTERVAL (SECONDS)                       180
 VARIANCE FACTOR                    2.254370845420714
```

Helmert Transformation Parameters With Respect to Combined Solution:

		Translation (m)			Rotation (")			
Sol	Rms (m)	X	Y	Z	X	Y	Z	Scale (ppm)
1	0.00282	0.0292	-0.0181	-0.0211	0.0005	0.0011	-0.0003	-0.00200
2	0.00354	0.0028	-0.0186	0.0028	0.0003	-0.0000	-0.0005	-0.00101
3	0.00283	0.0182	-0.0058	-0.0219	0.0002	0.0009	-0.0001	-0.00027
4	0.00312	0.0104	0.0121	-0.0059	-0.0003	0.0004	0.0003	-0.00049
5	0.00267	-0.0038	-0.0144	0.0148	0.0002	-0.0004	-0.0004	-0.00113
6	0.00328	-0.0040	0.0048	-0.0021	-0.0001	-0.0000	0.0001	0.00062
7	0.00259	-0.0215	0.0023	0.0171	-0.0001	-0.0009	-0.0000	0.00094

Statistics of individual solutions:

File	RMS (m)	DOF	Chi**2/DOF	#Observations authentic	/ pseudo	#Parameters explicit	/ implicit / singular	
1	0.00162	2354628	2.61	2386618	3	987	31006	0
2	0.00159	2314406	2.52	2346081	3	984	30694	0
3	0.00151	2373797	2.27	2405665	3	1002	30869	0
4	0.00140	2386768	1.97	2416118	3	1011	28342	0
5	0.00146	2399701	2.13	2431700	3	1008	30994	0
6	0.00144	2389399	2.08	2419965	3	1005	29564	0
7	0.00144	2426179	2.08	2456659	3	1002	29481	0

7 Equipment

7.1 Receiver List

Serial numbers not shown.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__ FIRMWARE___
 ACOR  A    1 P 19:307:00000 19:313:86370 LEICA GR50           ----- -----------
 ALDA  A    1 P 19:307:00000 19:313:86370 LEICA GR10           ----- -----------
 ALSA  A    1 P 19:307:00000 19:313:86370 LEICA GR50           ----- -----------
 AMUR  A    1 P 19:307:00000 19:313:86370 LEICA GR10           ----- -----------
 BIAZ  A    1 P 19:307:00000 19:313:79170 TRI SP90M            ----- -----------
 BRZR  A    1 P 19:307:03600 19:313:86370 LEICA GR30           ----- -----------
 CACE  A    1 P 19:307:00000 19:313:86370 TRIMBLE NETR9        ----- -----------
 CANT  A    1 P 19:307:00000 19:313:86370 LEICA GR10           ----- -----------
 CHER  A    1 P 19:307:00000 19:313:33540 LEICA GRX1200+GNSS   ----- -----------
 CREU  A    1 P 19:307:00000 19:313:86370 LEICA GR50           ----- -----------
 EBRE  A    1 P 19:307:00000 19:313:86370 LEICA GR50           ----- -----------
 ELGE  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 EMAZ  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 GERN  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 IGEL  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 ISPS  A    1 P 19:307:00000 19:313:86370 TRIMBLE NETR9        ----- -----------
 KAST  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 LARE  A    1 P 19:307:00000 19:313:86370 LEICA GRX1200GGPRO   ----- -----------
 LAZK  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 LEIT  A    1 P 19:307:00000 19:313:86370 LEICA GR50           ----- -----------
 ORON  A    1 P 19:307:00000 19:313:86370 LEICA GR50           ----- -----------
 PASA  A    1 P 19:307:00000 19:313:86370 LEICA GR30           ----- -----------
 RIO1  A    1 P 19:307:00000 19:313:86370 LEICA GR25           ----- -----------
 SALA  A    1 P 19:307:00000 19:313:86370 LEICA GRX1200+GNSS   ----- -----------
 SCOA  A    1 P 19:307:00000 19:313:86370 LEICA GR25           ----- -----------
 SOPU  A    1 P 19:307:10800 19:313:86370 LEICA GR30           ----- -----------
 TERU  A    1 P 19:307:00000 19:313:86370 LEICA GRX1200GGPRO   ----- -----------
 VITO  A    1 P 19:307:00000 19:313:86370 LEICA GR10           ----- -----------
 YEBE  A    1 P 19:307:00000 19:313:86370 TRIMBLE NETR9        ----- -----------
 ZARA  A    1 P 19:307:00000 19:313:86370 TRIMBLE NETR9        ----- -----------
```

7.2 Antennas

Serial number ONLY provided in case individual calibrations are vailable.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_________ S/N__
 ACOR  A    1 P 19:307:00000 19:313:86370 LEIAT504         LEIS -----
 ALDA  A    1 P 19:307:00000 19:313:86370 LEIAS10          NONE -----
 ALSA  A    1 P 19:307:00000 19:313:86370 LEIAR10          NONE -----
 AMUR  A    1 P 19:307:00000 19:313:86370 LEIAS10          NONE -----
 BIAZ  A    1 P 19:307:00000 19:313:79170 LEIAR25          LEIT -----
 BRZR  A    1 P 19:307:03600 19:313:86370 LEIAS10          NONE -----
```

```
 CACE  A    1 P 19:307:00000 19:313:86370 TRM29659.00     NONE -----
 CANT  A    1 P 19:307:00000 19:313:86370 LEIAR25.R4      LEIT 25066
 CHER  A    1 P 19:307:00000 19:313:33540 LEIAX1203+GNSS  NONE -----
 CREU  A    1 P 19:307:00000 19:313:86370 LEIAR25.R4      NONE 26357
 EBRE  A    1 P 19:307:00000 19:313:86370 LEIAR25.R4      NONE 26359
 ELGE  A    1 P 19:307:00000 19:313:86370 LEIAR25.R4      LEIT -----
 EMAZ  A    1 P 19:307:00000 19:313:86370 LEIAS10         NONE -----
 GERN  A    1 P 19:307:00000 19:313:86370 LEIAS10         NONE -----
 IGEL  A    1 P 19:307:00000 19:313:86370 LEIAR20         LEIM -----
 ISPS  A    1 P 19:307:00000 19:313:86370 TRM59900.00     SCIS -----
 KAST  A    1 P 19:307:00000 19:313:86370 LEIAS10         NONE -----
 LARE  A    1 P 19:307:00000 19:313:86370 LEIAT504        NONE -----
 LAZK  A    1 P 19:307:00000 19:313:86370 LEIAR25.R4      LEIT -----
 LEIT  A    1 P 19:307:00000 19:313:86370 LEIAR10         NONE -----
 ORON  A    1 P 19:307:00000 19:313:86370 LEIAR10         NONE -----
 PASA  A    1 P 19:307:00000 19:313:86370 LEIAR20         LEIM 73034
 RIO1  A    1 P 19:307:00000 19:313:86370 LEIAR25.R4      LEIT 25138
 SALA  A    1 P 19:307:00000 19:313:86370 LEIAR25         NONE -----
 SCOA  A    1 P 19:307:00000 19:313:86370 TRM55971.00     NONE -----
 SOPU  A    1 P 19:307:10800 19:313:86370 LEIAS10         NONE -----
 TERU  A    1 P 19:307:00000 19:313:86370 LEIAT504GG      LEIS -----
 VITO  A    1 P 19:307:00000 19:313:86370 LEIAS10         NONE -----
 YEBE  A    1 P 19:307:00000 19:313:86370 TRM29659.00     NONE -----
 ZARA  A    1 P 19:307:00000 19:313:86370 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 19:307:00000 19:313:86370 UNE   3.0460   0.0000   0.0000
 ALDA  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 ALSA  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 AMUR  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 BIAZ  A    1 P 19:307:00000 19:313:79170 UNE   0.0000   0.0000   0.0000
 BRZR  A    1 P 19:307:03600 19:313:86370 UNE   0.0771   0.0000   0.0000
 CACE  A    1 P 19:307:00000 19:313:86370 UNE   0.0600   0.0000   0.0000
 CANT  A    1 P 19:307:00000 19:313:86370 UNE   3.0490   0.0000   0.0000
 CHER  A    1 P 19:307:00000 19:313:33540 UNE   0.0000   0.0000   0.0000
 CREU  A    1 P 19:307:00000 19:313:86370 UNE   0.0770   0.0000   0.0000
 EBRE  A    1 P 19:307:00000 19:313:86370 UNE   0.0770   0.0000   0.0000
 ELGE  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 EMAZ  A    1 P 19:307:00000 19:313:86370 UNE   0.0350   0.0000   0.0000
 GERN  A    1 P 19:307:00000 19:313:86370 UNE   0.0771   0.0000   0.0000
 IGEL  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 ISPS  A    1 P 19:307:00000 19:313:86370 UNE   0.0350   0.0000   0.0000
 KAST  A    1 P 19:307:00000 19:313:86370 UNE   0.0350   0.0000   0.0000
 LARE  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 LAZK  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 LEIT  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 ORON  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 PASA  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 RIO1  A    1 P 19:307:00000 19:313:86370 UNE   0.0606   0.0000   0.0000
 SALA  A    1 P 19:307:00000 19:313:86370 UNE   0.0600   0.0000   0.0000
 SCOA  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 SOPU  A    1 P 19:307:10800 19:313:86370 UNE   0.0771   0.0000   0.0000
 TERU  A    1 P 19:307:00000 19:313:86370 UNE   0.0600   0.0000   0.0000
 VITO  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 YEBE  A    1 P 19:307:00000 19:313:86370 UNE   0.0000   0.0000   0.0000
 ZARA  A    1 P 19:307:00000 19:313:86370 UNE   3.2590   0.0000   0.0000
```

8 References

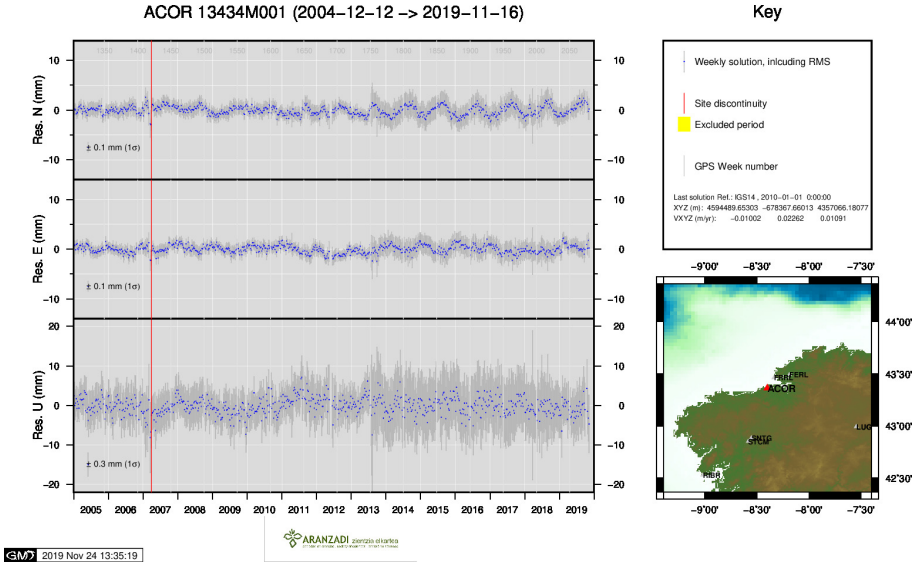
C. Boucher and Z. Altamimi (2011): *Specifications for reference frame fixing in the analysis of a EUREF GPS campaign.* etrs89.ensg.ign.fr/memo-V8.pdf

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*

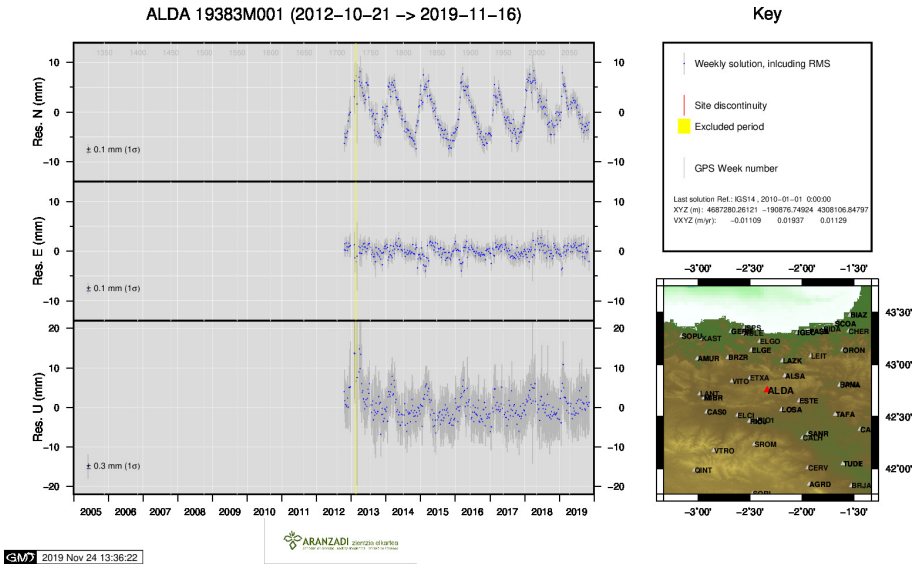
Z. Altamimi (2018): *EUREF Technical Note 1: Relationship and Transformation between the International and the European Terrestrial Reference Systems.* etrs89.ensg.ign.fr/pub/EUREF-TN-1.pdf

9 Cumulative Time Series

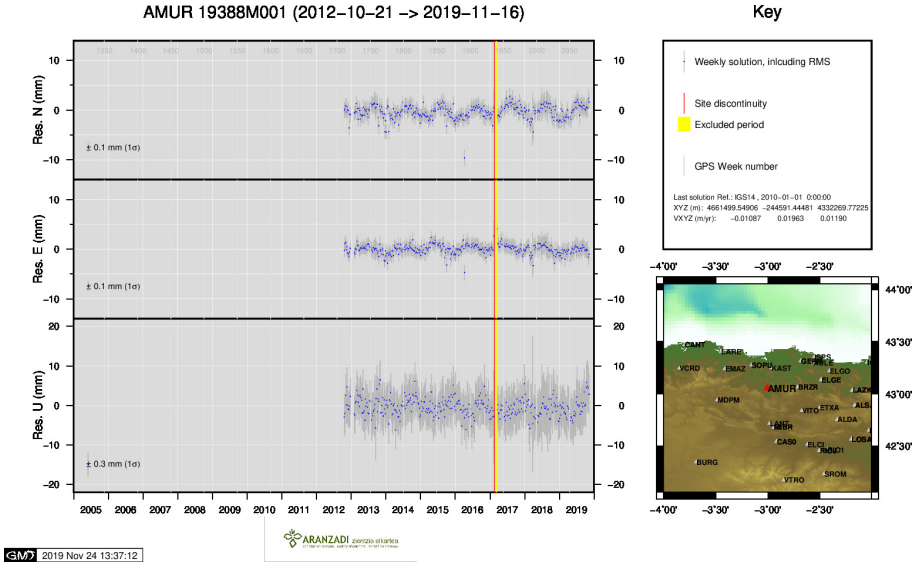
Time series of stations. Latest plots at: http://geolabpasaia.org/gnss/ARA-net/TSeries/, or click on the caption of each image.



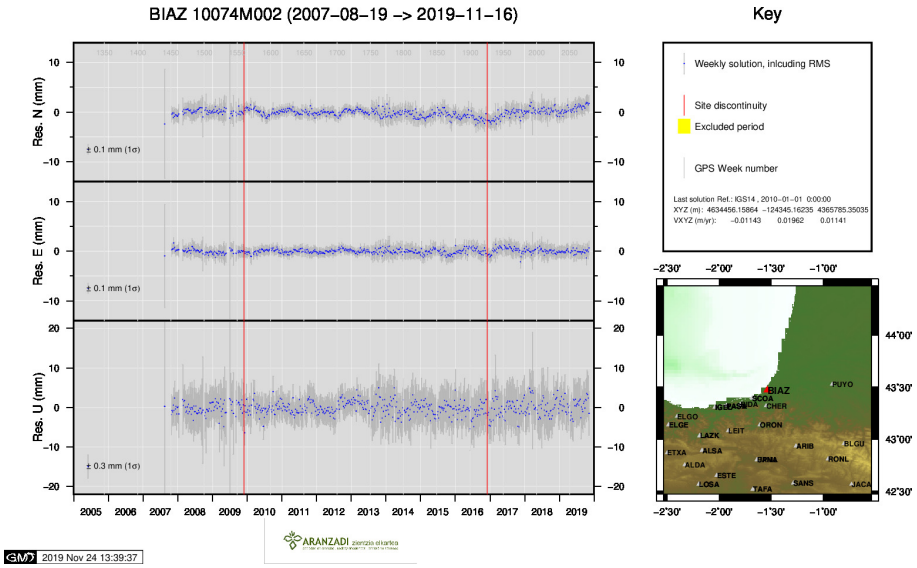
1) ACOR



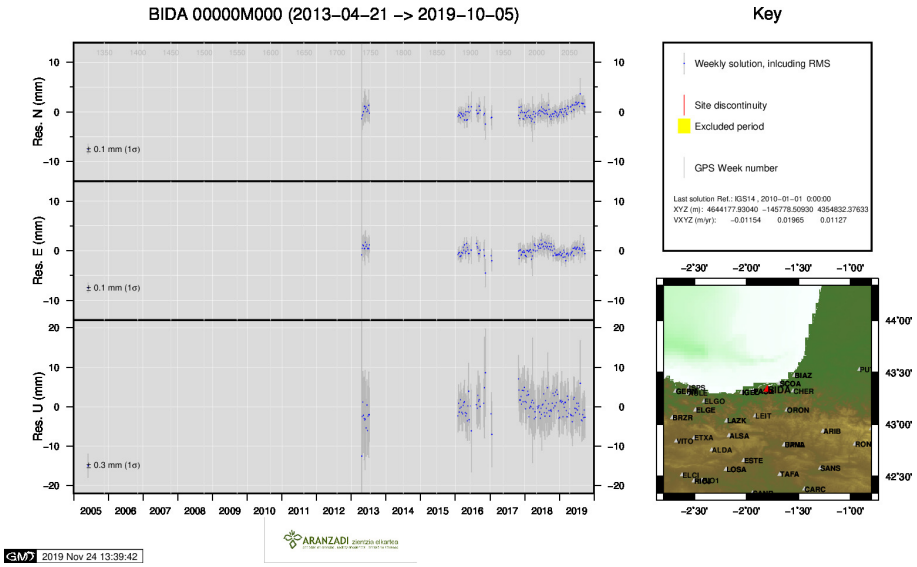
2) ALDA



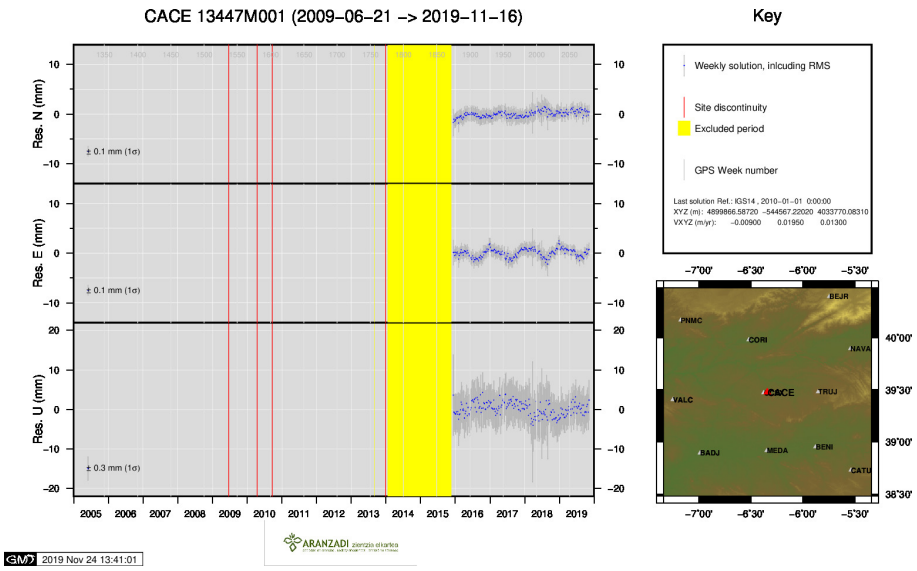
3) AMUR



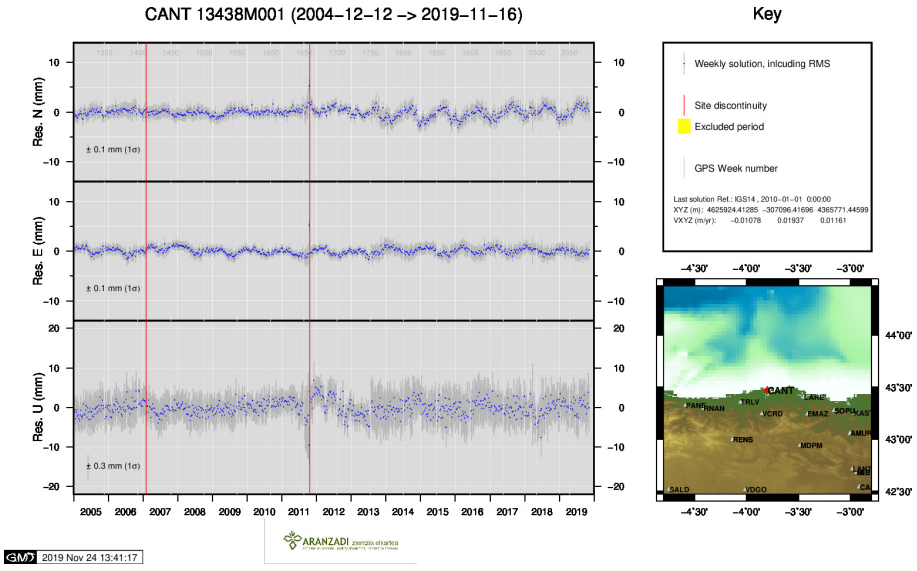
4) BIAZ



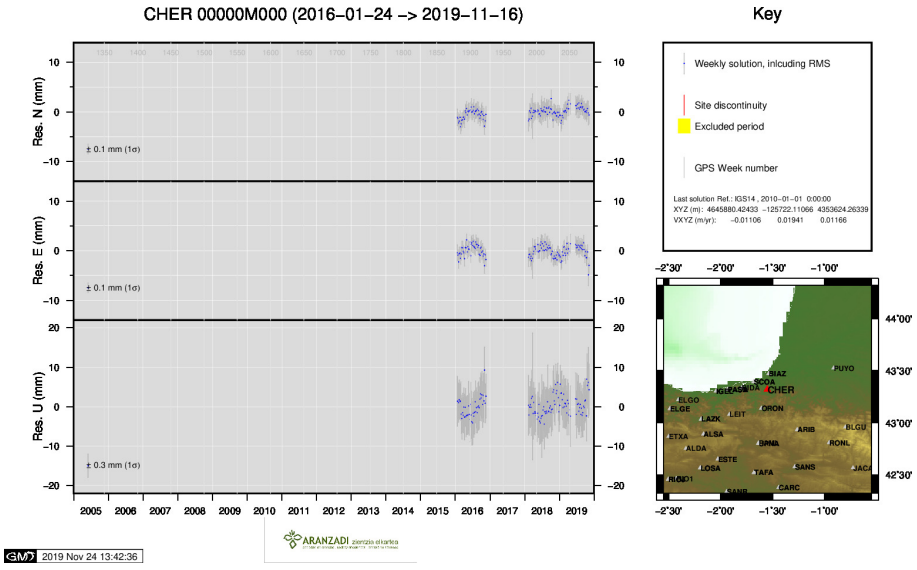
5) BIDA



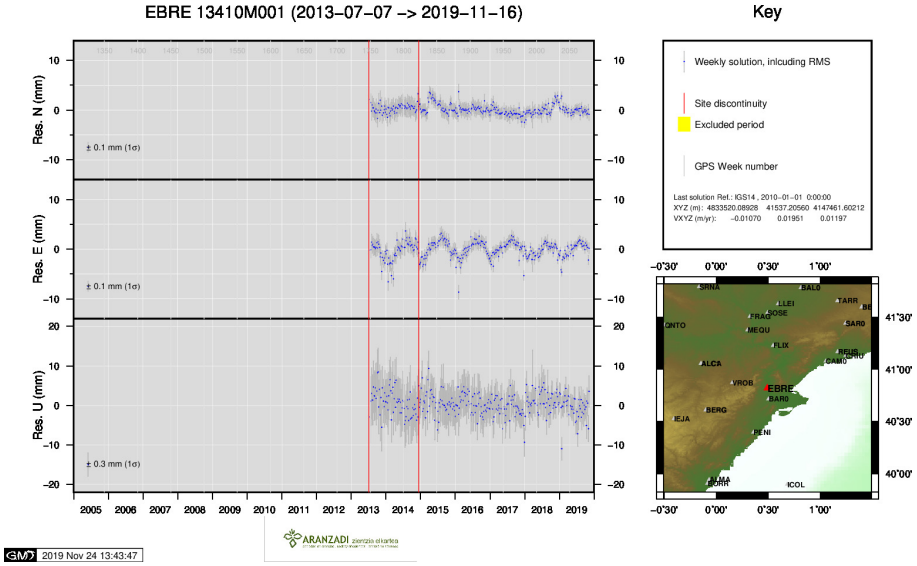
6) CACE



7) CANT



8) CHER



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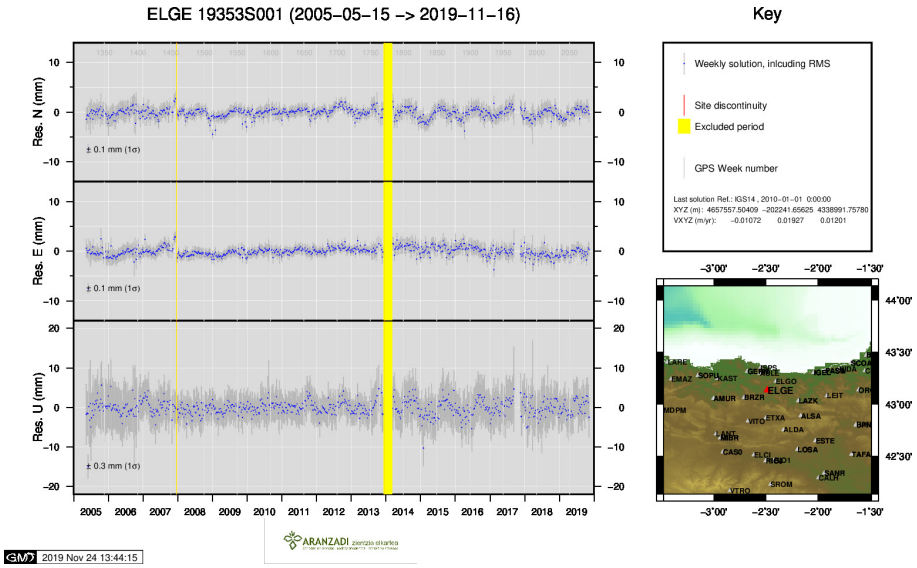

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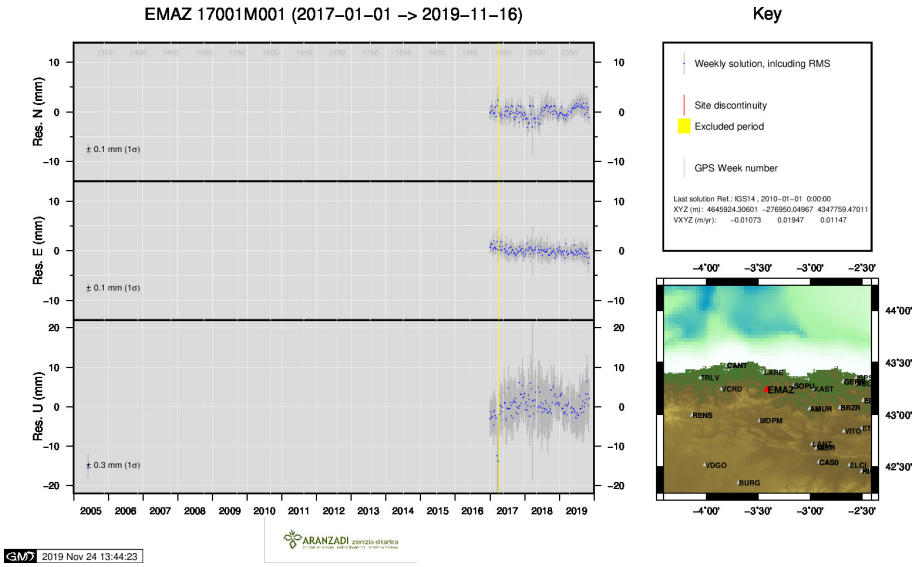

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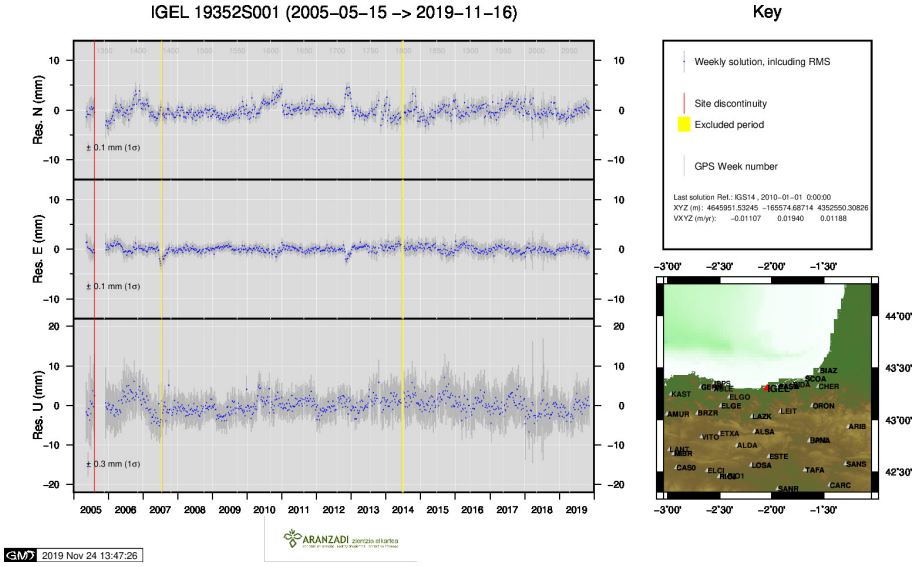

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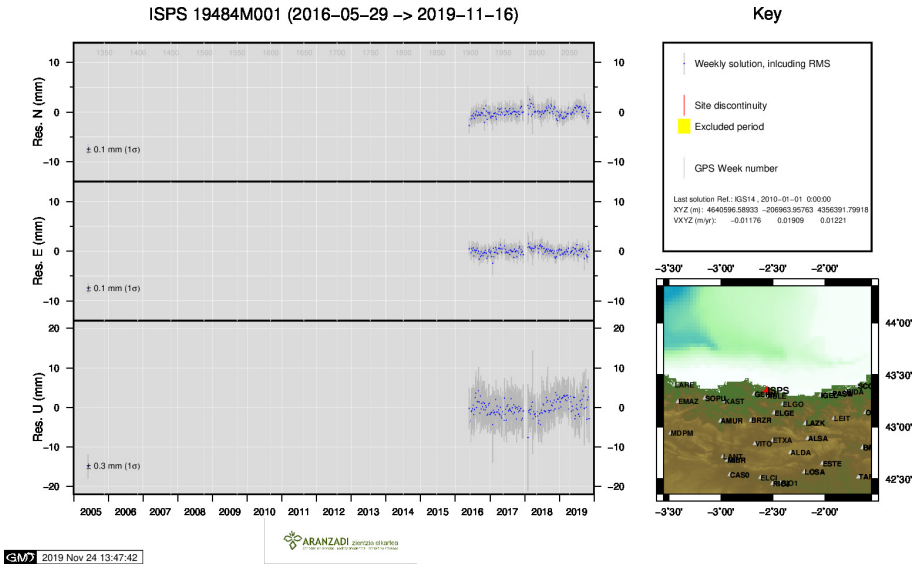

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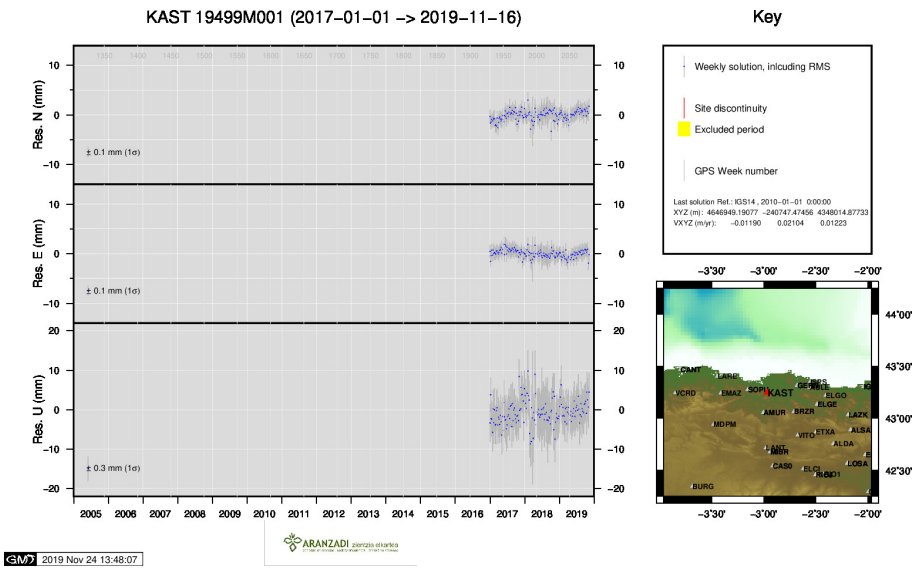

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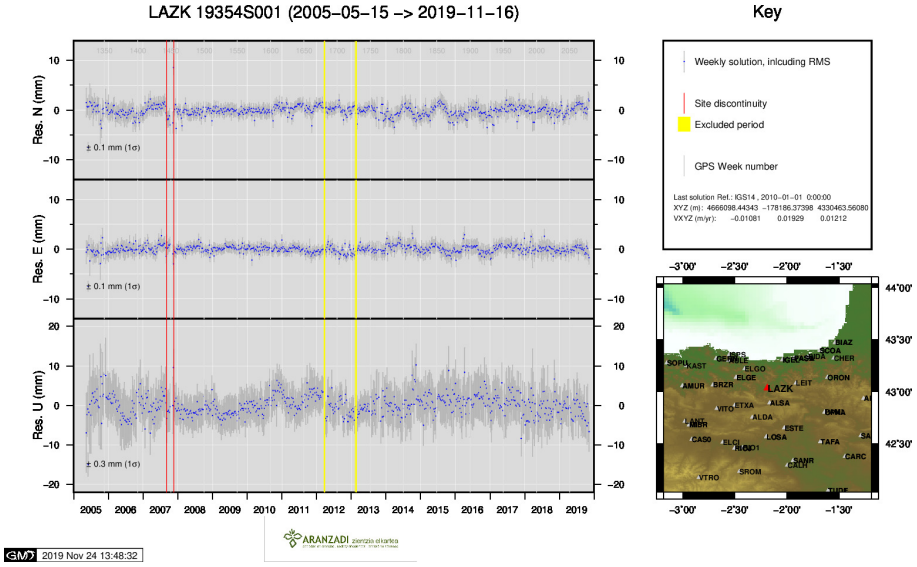

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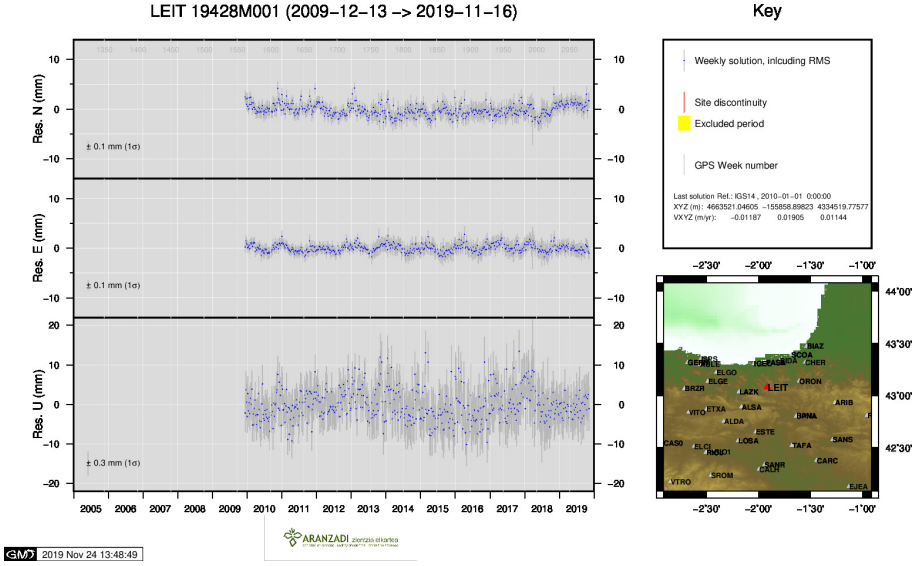

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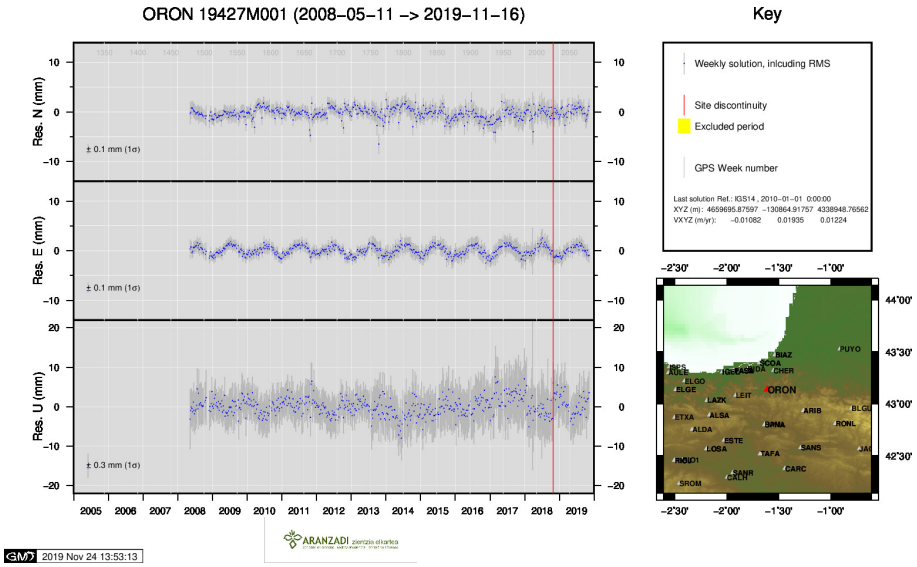

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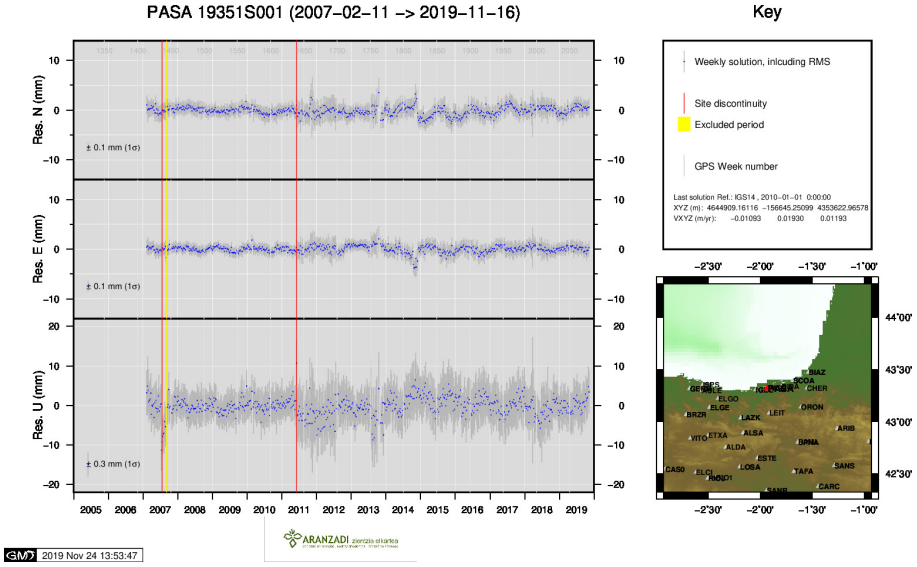

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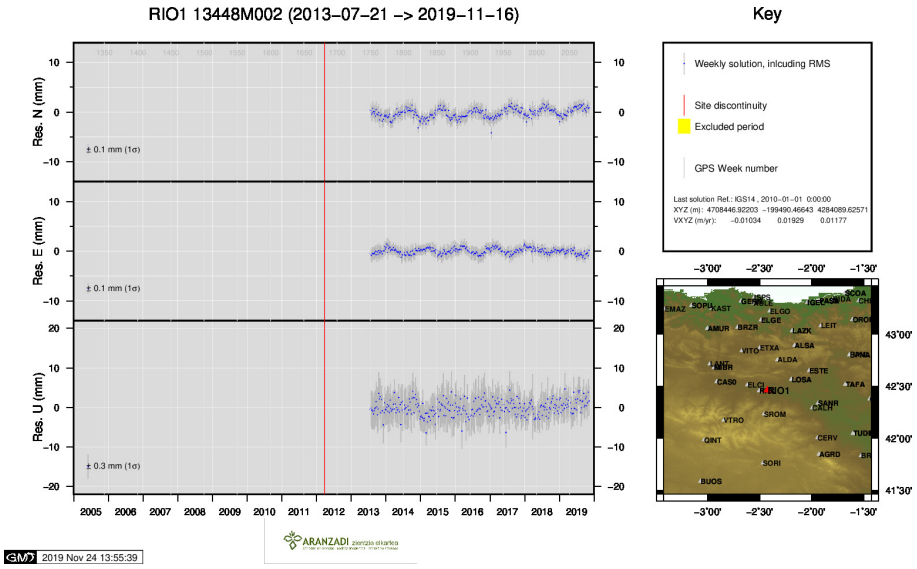

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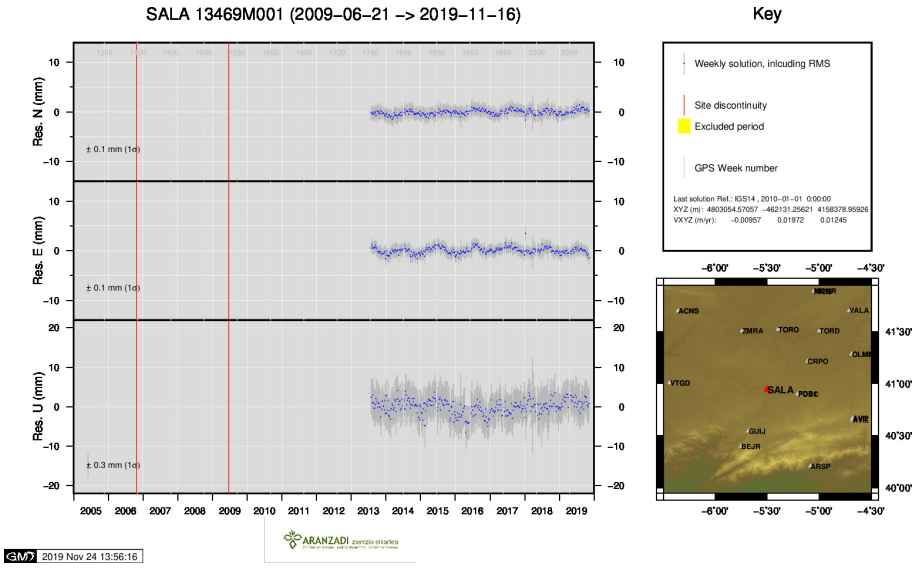

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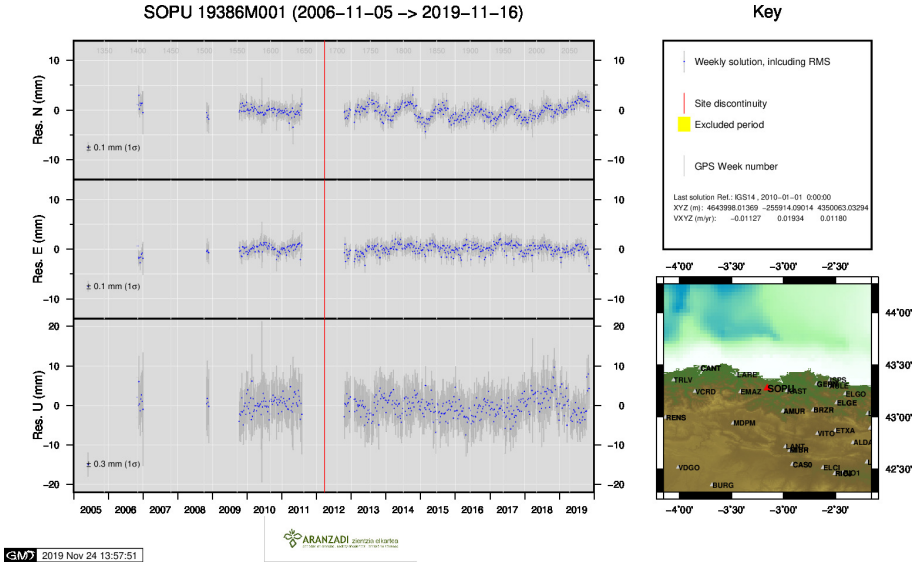

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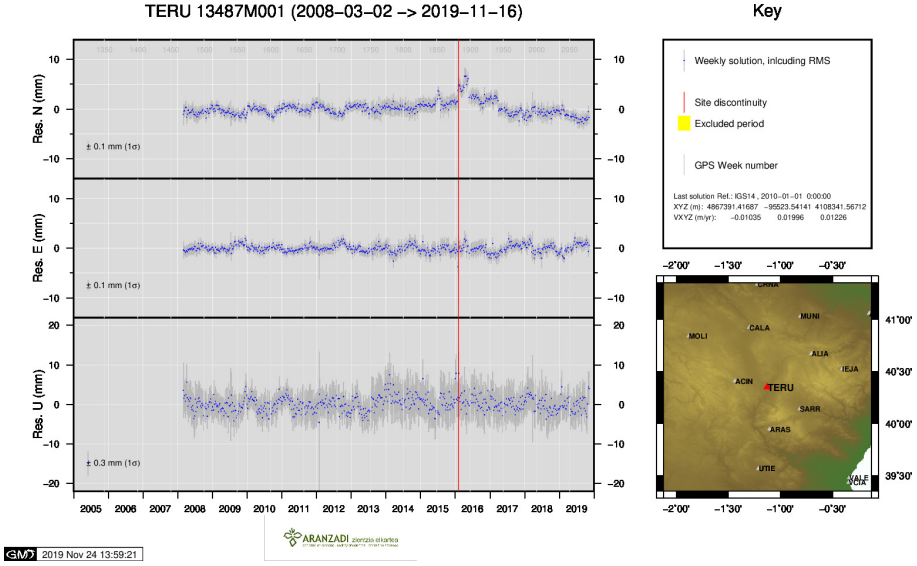

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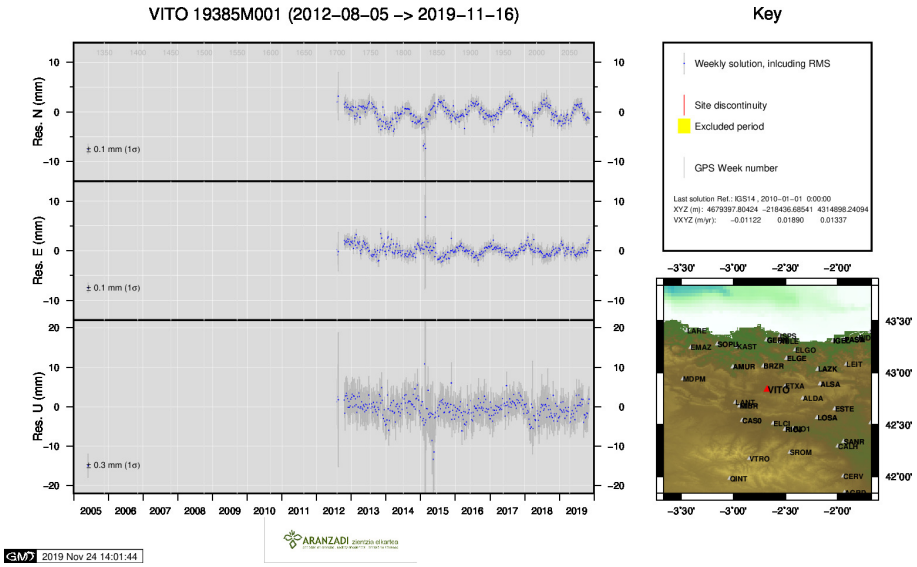
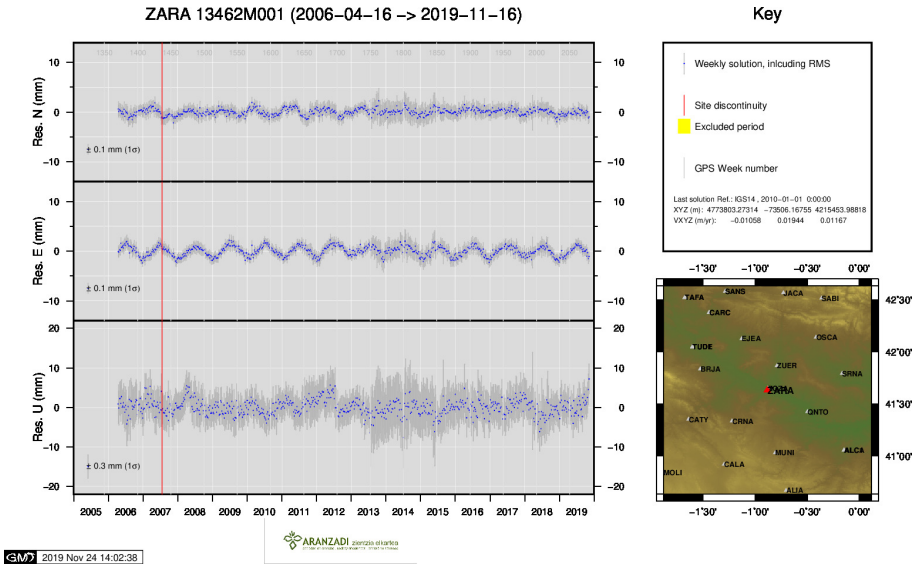


23) VITO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Res. E (mm)
Res. U (mm)
± 0.1 mm (1σ)
± 0.1 mm (1σ)
± 0.3 mm (1σ)
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2019 Nov 24 14:02:38
Key
Weekly solution, inlcuding RMS
Site discontinuity
Excluded period
GPS Week number
Last solution Ref.: IGS14 , 2010–01–01 0:00:00
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TAFA
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EJEA
OSCA
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ZUER
SRNA
ZARA
QNTO
CATY
CRNA
MUNI
ALCA
CALA
MOLI
AUA

24) ZARA