

# ARA-DAC Weekly Analysis Result: 1899 (GFA)

## Technical Report

**GPS Week: 1899 (GFA)**

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

ARA-DAC details:

Contact person: J. Zurutuza

Contact mail: [geodesia@aranzadi.eus](mailto:geodesia@aranzadi.eus)

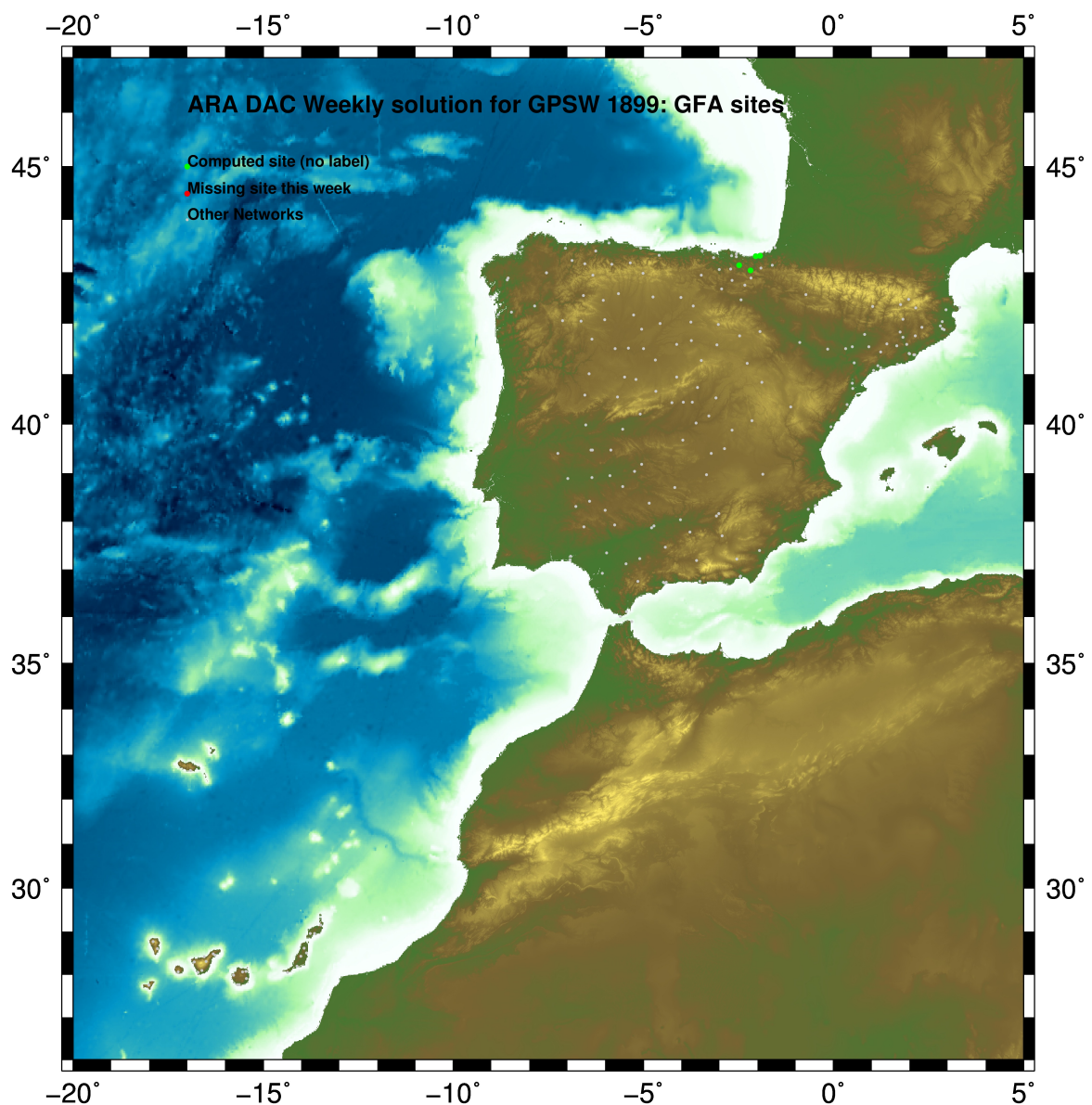
Report generated on 2016/06/12 at 14:11:28



## 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 2016 Jun 12 14:11:19

Fig.1: Computed Sites for GPS Week1899 (GFA)

### 3 Main Computation Parameters

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

- Reprocessing: 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, L1 and L2; 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
- Modelled observable: Double differences of carrier phase in QIF or L3 combinations (respectively for ambiguity resolution in baseline mode, and final network solution). In the final network solution the double differenced data are sampled at 180 sec. intervals.
- Ground antenna phase center calibrations: Group APCV used from the PCV\_COD.I08 file and individual calibrations from EPNC\_08.ATX. EPN\_A class sites (CRD + VEL) IGB08 used to define the reference frame. If individual calibrations, other from these, are available, they are also included in the analysis.
- Troposphere:
  - 3 deg elev. cutoff; elevation dependent weighting
  - VMF1\_DRY mapping function. ZPD parameters are estimated using WET 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:  $3\sigma$  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 Wideline (WL) AR for baselines shorter than 6000km, a Melbourne-Wuebbena wide-lane and narrow-lane AR is computed.
  - Phase-Based Wideline (L5) 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 L1/L2 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 IGb08

The Reference Frame considered in this section is IGb08.

```

ARA LAC 1899 WEEK COMBINATION: PRECISE ORBITS                                12-JUN-16 12:27
-----
LOCAL GEODETIC DATUM: IGb08                EPOCH: 2016-06-01 12:00:00

NUM  STATION NAME          X (M)          Y (M)          Z (M)          FLAG
-----
 77  ELGE 19353S001        4657557.43640  -202241.53004  4338991.83662  A
101  IGEL 19352S001        4645951.46434  -165574.55836  4352550.38678  A
108  LAZK 19354S001        4666098.37704  -178186.24848  4330463.64277  A
144  PAS2 19351S001        4644909.09234  -156645.12464  4353623.04451  A
145  PASA 19351S001        4644909.09513  -156645.12442  4353623.04608  A
    
```

### 5.2 ETRS89 Coordinates

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

```

ETRF2000 COORD. wk 1899                                                    12-JUN-16 12:27
-----
LOCAL GEODETIC DATUM: ETRF2000        EPOCH: 2016-06-01 12:00:00

NUM  STATION NAME          X (M)          Y (M)          Z (M)          FLAG
-----
 77  ELGE 19353S001        4657557.76373  -202242.01709  4338991.45453  A
101  IGEL 19352S001        4645951.79638  -165575.04424  4352550.00588  A
108  LAZK 19354S001        4666098.70637  -178186.73628  4330463.26036  A
144  PAS2 19351S001        4644909.42539  -156645.61040  4353622.66377  A
145  PASA 19351S001        4644909.42818  -156645.61018  4353622.66534  A
    
```

### 5.3 Mean and Daily Repeatabilities

In this section, the mean and daily repeatabilities of the sites are shown. Repeatabilities refer to the IGb08 solution and are given with respect the Local fram (North-East-Up).

```

ARA LAC 1899 WEEK COMBINATION: PRECISE ORBITS                                12-JUN-16 12:27
-----
Station          #Days  Weekday  Repeatability (mm)
              0123456      N      E      U
-----
ELGE 19353S001   7  XXXXXXX  0.95  1.11  4.42
IGEL 19352S001   7  XXXXXXX  1.27  0.64  5.11
LAZK 19354S001   7  XXXXXXX  0.79  0.90  3.83
PAS2 19351S001   7  XXXXXXX  0.91  0.72  5.68
PASA 19351S001   7  XXXXXXX  0.68  0.85  5.58

Comparison of individual solutions:
-----
ELGE 19353S001  N  0.95  -1.25  -0.53  -0.87  -1.20  0.00  1.14  -0.24
ELGE 19353S001  E  1.11  0.25  0.26  2.38  0.11  0.18  0.27  -1.19
ELGE 19353S001  U  4.42  -2.14  -0.42  -0.98  -5.16  -6.30  -6.46  -1.86
IGEL 19352S001  N  1.27  0.64  -1.33  -2.53  0.64  0.28  0.38  -0.67
IGEL 19352S001  E  0.64  0.23  0.22  1.32  0.45  0.03  0.50  -0.37
IGEL 19352S001  U  5.11  -1.07  0.22  0.96  -7.91  -6.39  -5.73  -4.30
LAZK 19354S001  N  0.79  0.16  -0.46  0.34  -1.04  -0.75  0.04  -1.33
LAZK 19354S001  E  0.90  0.30  0.13  -0.49  1.13  -0.21  1.78  -0.07
LAZK 19354S001  U  3.83  -3.26  -1.70  -4.99  -4.67  -1.93  -2.89  -3.97
    
```

PAS2	19351S001	N	0.91	0.58	-1.22	-1.54	-0.07	0.26	0.13	-0.81
PAS2	19351S001	E	0.72	0.38	1.06	1.01	-0.40	-0.09	0.78	-0.30
PAS2	19351S001	U	5.68	-0.57	0.17	1.96	-4.12	-10.17	-7.05	-4.40
PASA	19351S001	N	0.68	0.19	-0.63	-1.48	-0.19	-0.14	-0.16	-0.31
PASA	19351S001	E	0.85	0.27	0.91	1.69	-0.43	-0.24	0.54	-0.25
PASA	19351S001	U	5.58	0.95	-1.13	1.18	-3.83	-9.62	-6.35	-5.95

## 5.4 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: IGb08  
 RESIDUALS IN LOCAL SYSTEM (NORTH, EAST, UP)

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
1	ACOR 13434M001	I W	-0.71	0.02	3.80
2	ALAC 13433M001	I W	0.12	0.30	-0.36
3	ALBA 13452M001	I W	0.57	0.61	-0.66
4	ALME 13437M001	I W	-1.67	0.25	3.35
6	BRST 10004M004	I W	0.46	-3.74	-2.76
7	CACE 13447M001	I W	-0.47	-0.34	4.11
8	CANT 13438M001	I W	0.79	-1.41	-1.72
9	CEU1 13449M002	I W	1.12	2.43	7.82
10	COBA 13453M001	I W	0.92	-0.61	-1.24
12	EBRE 13410M001	I W	2.14	-0.59	-2.78
14	FUNC 13911S001	I W	-0.18	0.18	-2.98
16	HUEL 13451M001	I W	-0.59	1.65	0.04
17	IZAN 31309M002	I W	-1.22	0.06	-3.67
18	LLIV 13436M001	I W	3.17	-3.10	-5.13
19	LPAL 81701M001	I W	-1.68	-0.48	-4.55
20	LROC 10023M001	I W	1.20	-2.52	1.79
21	MALA 13443M001	I W	-3.95	3.18	-1.31
22	MALL 13444M001	I W	0.50	-0.70	-0.15
25	PDEL 31906M004	I W	-3.14	-2.04	-4.65
26	RABT 35001M002	I W	0.13	0.28	-2.61
27	RI01 13448M002	I W	-0.37	0.20	1.20
28	SALA 13469M001	I W	0.11	-0.24	6.84
29	SCOA 10088M002	I W	-0.65	-1.08	-0.27
30	SONS 13446M001	I W	0.50	1.65	0.35
31	TERU 13487M001	I W	1.63	9.13	-3.19
32	VALE 13439M001	I W	-0.26	1.15	-0.56
33	VIGO 13450M001	I W	-0.06	-3.15	3.89
34	VILL 13406M001	I W	-0.63	0.15	0.26
35	YEBE 13420M001	I W	0.42	0.01	3.44
36	ZARA 13462M001	I W	-0.32	-0.52	0.34
37	ZIMM 14001M004	I W	2.10	-0.73	1.36
	RMS / COMPONENT		1.44	2.28	3.24
	MEAN		0.00	0.00	-0.00
	MIN		-3.95	-3.74	-5.13
	MAX		3.17	9.13	7.82

NUMBER OF PARAMETERS : 3  
 NUMBER OF COORDINATES : 93  
 RMS OF TRANSFORMATION : 2.43 MM

## 5.5 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                9087161
NUMBER OF UNKNOWNNS                   134975
NUMBER OF DEGREES OF FREEDOM          8952186
PHASE MEASUREMENTS SIGMA              0.00100
SAMPLING INTERVAL (SECONDS)           180
VARIANCE FACTOR                       2.057263646465564
```

Helmert Transformation Parameters With Respect to Combined Solution:

```
-----
                Translation (m)                Rotation (")
Sol  Rms (m)   X      Y      Z      X      Y      Z      Scale (ppm)
-----
  1   0.00212  0.0029 -0.0008 -0.0018 -0.0000  0.0001 -0.0000  -0.00016
  2   0.00152  -0.0041  0.0058  0.0086 -0.0001 -0.0003  0.0001  -0.00018
  3   0.00164  0.0089  0.0149 -0.0041 -0.0002  0.0003  0.0005  -0.00051
  4   0.00212  -0.0301 -0.0318  0.0250  0.0005 -0.0012 -0.0009  0.00086
  5   0.00225  -0.0260 -0.0267  0.0216  0.0005 -0.0011 -0.0008  0.00083
  6   0.00252  -0.0018  0.0130  0.0010 -0.0003 -0.0001  0.0003  0.00039
  7   0.00200  -0.0179 -0.0267  0.0234  0.0003 -0.0009 -0.0008  -0.00040
```

Statistics of individual solutions:

```
-----
File      RMS (m)      DOF  Chi**2/DOF  #Observations authentic / pseudo  #Parameters explicit / implicit / singular
-----
  1      0.00148      1252938      2.19                1271967      3      570      18462      0
  2      0.00141      1288874      1.99                1308610      3      588      19151      0
  3      0.00140      1299782      1.96                1319326      3      588      18959      0
  4      0.00139      1279904      1.93                1299957      3      591      19465      0
  5      0.00137      1282132      1.87                1301991      3      594      19268      0
  6      0.00152      1261444      2.31                1281748      3      591      19716      0
  7      0.00145      1283623      2.11                1303562      3      585      19357      0
```

## 6 Equipment

### 6.1 Receiver List

Serial numbers not shown.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__ FIRMWARE___
ELGE  A   1 P 16:150:00000 16:156:86370 LEICA GR10      -----
IGEL  A   1 P 16:150:00000 16:156:86370 LEICA GR10      -----
LAZK  A   1 P 16:150:00000 16:156:86370 LEICA GR10      -----
PAS2  A   1 P 16:150:00000 16:156:86370 TPS NET-G3A    -----
PASA  A   1 P 16:150:00000 16:156:86370 LEICA GR10      -----
```

### 6.2 Antennas

Serial number ONLY provided in case individual calibrations are available.

```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__
ELGE  A   1 P 16:150:00000 16:156:86370 LEIAR25.R4      LEIT -----
IGEL  A   1 P 16:150:00000 16:156:86370 LEIAR20         LEIM -----
LAZK  A   1 P 16:150:00000 16:156:86370 LEIAR25.R4      LEIT -----
PAS2  A   1 P 16:150:00000 16:156:86370 LEIAR20         LEIM 73034
PASA  A   1 P 16:150:00000 16:156:86370 LEIAR20         LEIM 73034
```

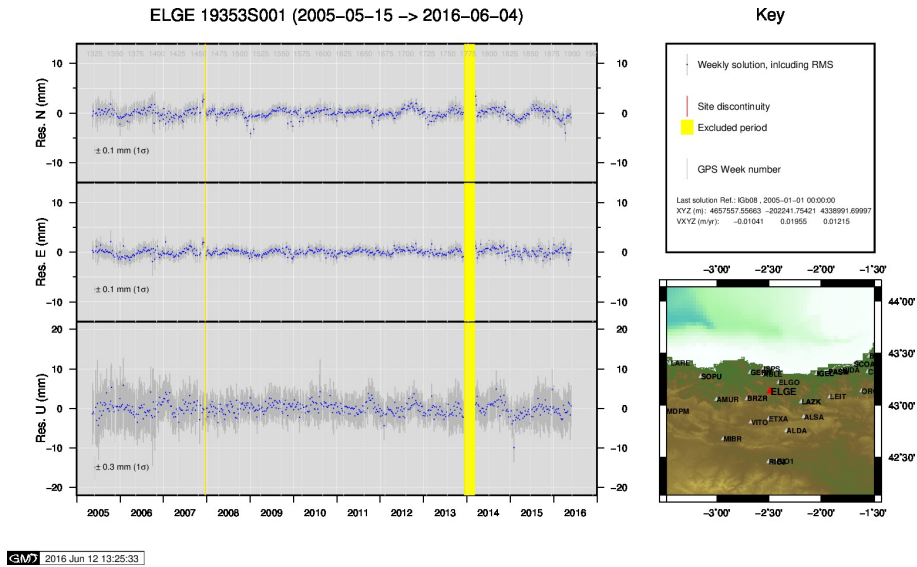
### 6.3 Eccentricities

*										
*SITE	PT	SOLN	T	DATA_START__	DATA_END_____	AXE	UP_____	NORTH___	EAST_____	ARP->BENCHMARK(M)_____
ELGE	A	1	P	16:150:00000	16:156:86370	UNE	0.0000	0.0000	0.0000	
IGEL	A	1	P	16:150:00000	16:156:86370	UNE	0.0000	0.0000	0.0000	
LAZK	A	1	P	16:150:00000	16:156:86370	UNE	0.0000	0.0000	0.0000	
PAS2	A	1	P	16:150:00000	16:156:86370	UNE	0.0000	0.0000	0.0000	
PASA	A	1	P	16:150:00000	16:156:86370	UNE	0.0000	0.0000	0.0000	

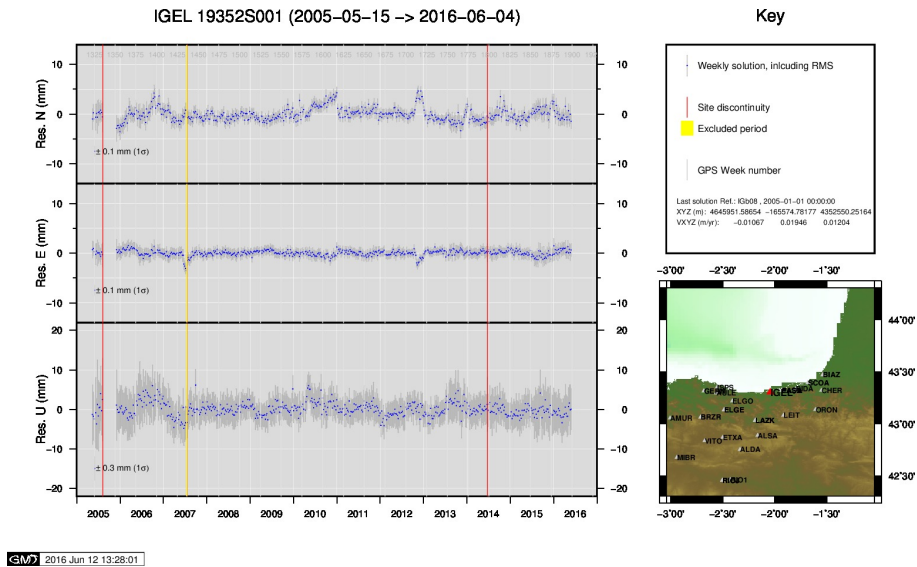


## 7 Cumulative Time Series

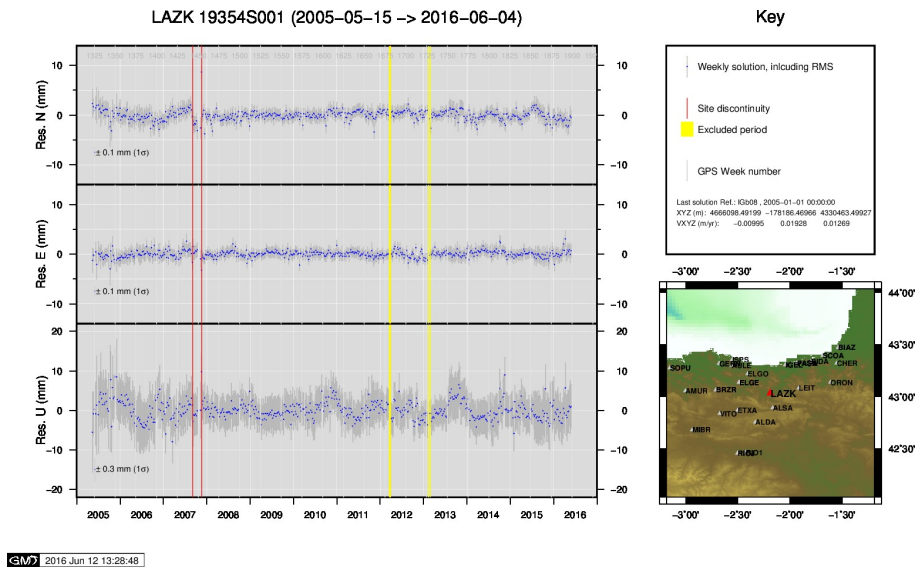
Time series of stations. Latest plots at: <http://geolabpasaia.org/gnss/ARA-net/TSeries/>, or click on the caption of each image.



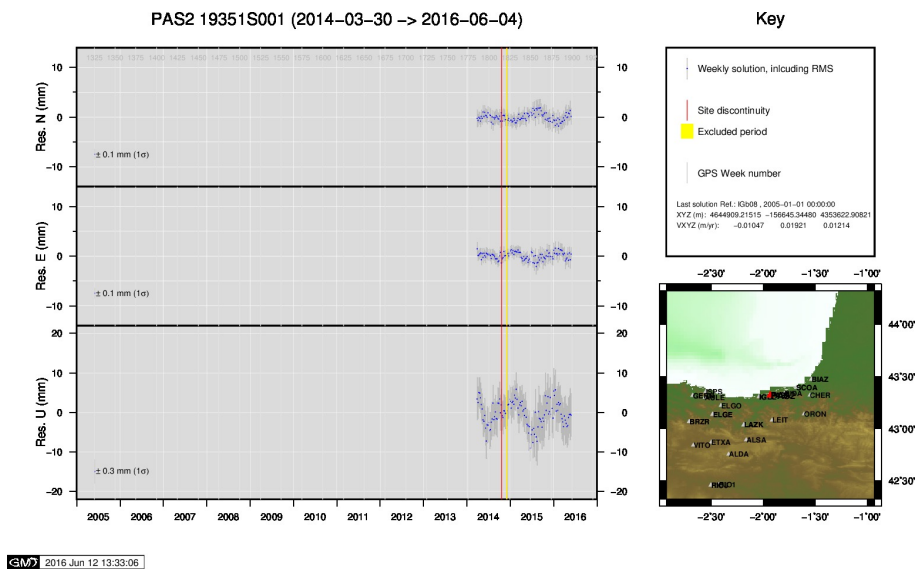
1 ) ELGE



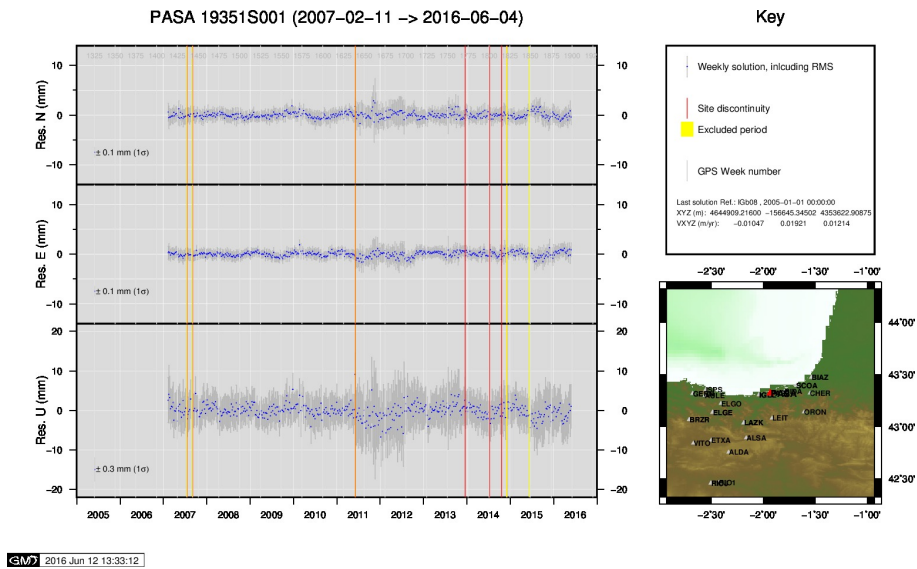
2 ) IGEL



3 ) LAZK



4 ) PAS2



5 ) PASA