ARA-DAC Weekly Analysis Result: 1898 (GFA)

Technical Report

GPS Week: 1898 (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_D Project.

2 Map of Computed Sites
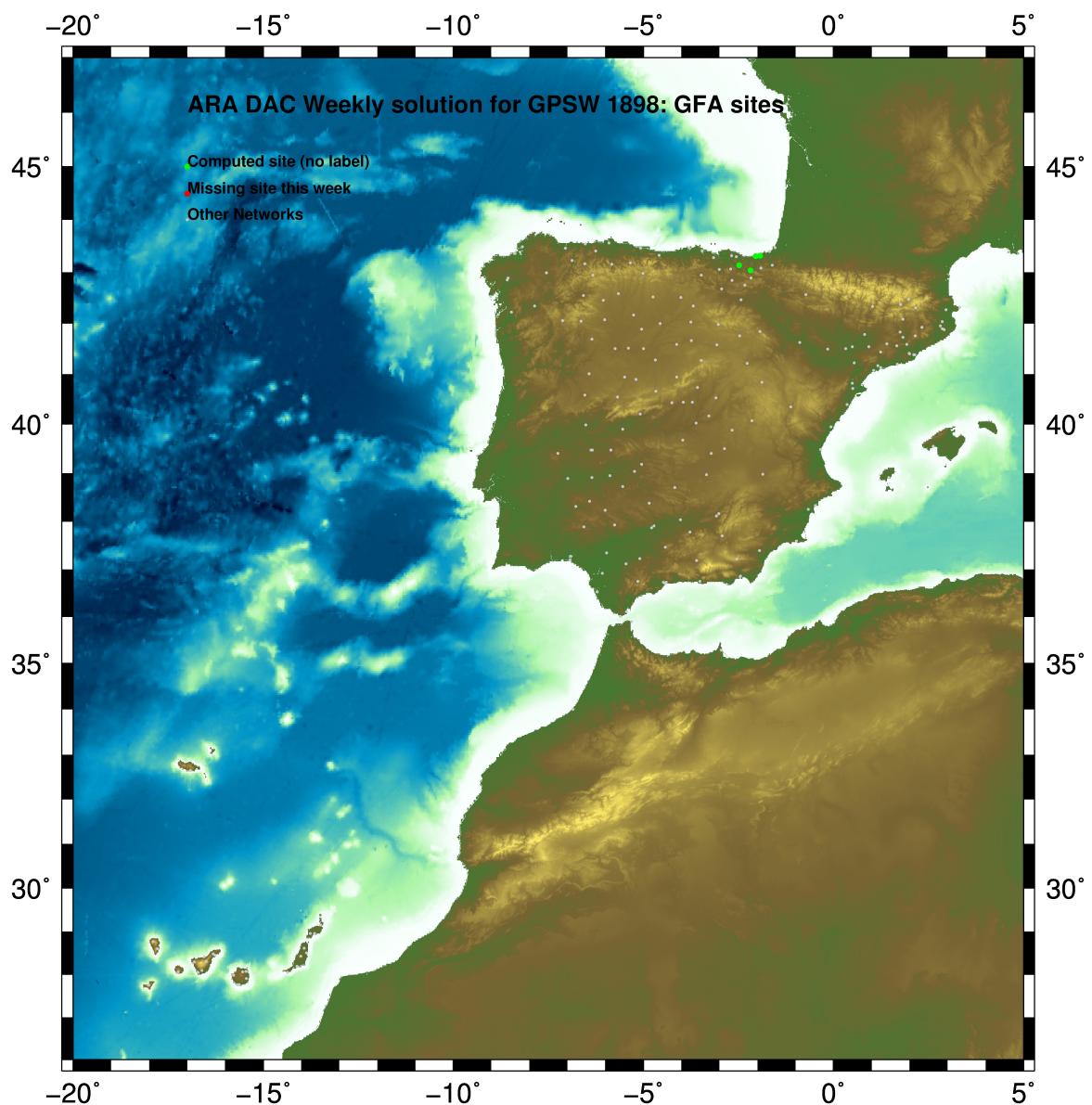
Fig.1: Computed Sites for GPS Week1898 (GFA)

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 fiel 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*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 (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 1898 WEEK COMBINATION: PRECISE ORBITS               05-JUN-16 11:51
----------------------------------------------------------------------------
LOCAL GEODETIC DATUM: IGb08            EPOCH: 2016-05-25 12:00:00

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

 77  ELGE 19353S001    4657557.43382  -202241.53179  4338991.83593    A
101  IGEL 19352S001    4645951.46279  -165574.56000  4352550.38800    A
108  LAZK 19354S001    4666098.37623  -178186.25031  4330463.64314    A
144  PAS2 19351S001    4644909.09124  -156645.12686  4353623.04586    A
145  PASA 19351S001    4644909.09292  -156645.12657  4353623.04652    A
```

5.2 ETRS89 Coordinates

European **T**errestrial **R**eference **S**ystem, **1989** (**ETRS89**) is realized by ETRF2000 (Boucher and Altamimi, 2011).

```
ETRF2000 COORD. wk 1898                                      05-JUN-16 11:51
----------------------------------------------------------------------------
LOCAL GEODETIC DATUM: ETRF2000         EPOCH: 2016-05-25 12:00:00

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

 77  ELGE 19353S001    4657557.76096  -202242.01847  4338991.45408    A
101  IGEL 19352S001    4645951.79463  -165575.04551  4352550.00734    A
108  LAZK 19354S001    4666098.70536  -178186.73773  4330463.26097    A
144  PAS2 19351S001    4644909.42409  -156645.61225  4353622.66536    A
145  PASA 19351S001    4644909.42577  -156645.61196  4353622.66602    A
```

5.3 Mean and Daily Repeatabilities

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

```
ARA LAC 1898 WEEK COMBINATION: PRECISE ORBITS               05-JUN-16 11:51
----------------------------------------------------------------------------
                    Weekday   Repeatability (mm)
Station      #Days  0123456    N      E      U
----------------------------------------------------------------------------
ELGE 19353S001   7  XXXXXXX   1.08   0.84   2.54
IGEL 19352S001   7  XXXXXXX   0.84   0.92   1.17
LAZK 19354S001   7  XXXXXXX   0.92   0.90   2.20
PAS2 19351S001   7  XXXXXXX   1.33   0.80   3.83
PASA 19351S001   7  XXXXXXX   1.09   0.88   1.95


Comparison of individual solutions:
-----------------------------------
ELGE 19353S001   N   1.08   -1.68  -0.13   1.58  -0.09  -0.04   0.38  -1.21
ELGE 19353S001   E   0.84    1.80  -0.08   0.56  -0.72   0.28   0.21   0.07
ELGE 19353S001   U   2.54   -0.92  -2.16   4.05   1.01  -1.31  -3.62   0.90
IGEL 19352S001   N   0.84   -1.52  -0.35  -0.06   0.18   1.10  -0.75   0.09
IGEL 19352S001   E   0.92    1.00   0.10   0.89  -0.94  -0.76   0.81   1.08
IGEL 19352S001   U   1.17    0.80  -0.95   0.88   1.01  -0.68  -2.00  -0.67
LAZK 19354S001   N   0.92    0.47  -0.32   0.71  -1.60   0.82  -0.92  -0.45
LAZK 19354S001   E   0.90    1.06  -0.15   1.44  -0.76  -0.56   0.86   0.14
LAZK 19354S001   U   2.20   -0.86  -0.96  -1.05   3.61   1.13  -3.45  -0.04
```

```
PAS2 19351S001   N    1.33    -2.68    0.69    1.16   -0.33    0.84   -0.91   -0.13
PAS2 19351S001   E    0.80     1.25   -0.63    0.95    0.10    0.46   -0.63    0.58
PAS2 19351S001   U    3.83     6.69   -3.46   -3.59   -0.84    3.18   -0.52   -2.75
PASA 19351S001   N    1.09    -1.49    0.26   -0.58   -0.35    1.90   -0.86    0.03
PASA 19351S001   E    0.88     1.21    0.41    1.47   -0.18   -0.80   -0.39    0.29
PASA 19351S001   U    1.95     2.74   -2.08   -0.01   -1.13    1.95   -0.39   -2.39
```

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  |  |
      ---------------------------------------------------------------
      |     |                |     |                             |  |
      |   6 | BRST 10004M004 | I W |    0.27   -3.01   -1.03 |  |
      |   9 | CEU1 13449M002 | I W |    1.50    3.11    6.20 |  |
      |  12 | EBRE 13410M001 | I W |    1.33    1.12   -0.02 |  |
      |  14 | FUNC 13911S001 | I W |   -0.39   -0.26   -0.78 |  |
      |  18 | LLIV 13436M001 | I W |    2.51   -1.31   -2.63 |  |
      |  19 | LPAL 81701M001 | I W |   -1.48    0.18   -4.45 |  |
      |  20 | LROC 10023M001 | I W |    0.31   -1.72    2.02 |  |
      |  25 | PDEL 31906M004 | I W |   -1.87   -3.45   -1.28 |  |
      |  26 | RABT 35001M002 | I W |   -0.68    1.60   -4.06 |  |
      |  29 | SCOA 10088M002 | I W |   -1.56   -0.14   -2.01 |  |
      |  34 | VILL 13406M001 | I W |   -0.63    1.44   -0.74 |  |
      |  35 | YEBE 13420M001 | I W |   -1.06    1.95    4.46 |  |
      |  37 | ZIMM 14001M004 | I W |    1.75    0.49    4.34 |  |
      |     |                |     |                             |  |
      ---------------------------------------------------------------
      |     | RMS / COMPONENT |    |    1.41    1.94    3.32 |  |
      |     | MEAN            |    |    0.00    0.00    0.00 |  |
      |     | MIN             |    |   -1.87   -3.45   -4.45 |  |
      |     | MAX             |    |    2.51    3.11    6.20 |  |
      ---------------------------------------------------------------
```

```
NUMBER OF PARAMETERS  :     3
NUMBER OF COORDINATES :    39
RMS OF TRANSFORMATION :    2.37 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                   6737668
 NUMBER OF UNKNOWNS                        103004
 NUMBER OF DEGREES OF FREEDOM             6634664
 PHASE MEASUREMENTS SIGMA                 0.00100
 SAMPLING INTERVAL (SECONDS)                  180
 VARIANCE FACTOR                 2.363226965682855
```

Helmert Transformation Parameters With Respect to Combined Solution:

		Translation (m)			Rotation (")			
Sol	Rms (m)	X	Y	Z	X	Y	Z	Scale (ppm)
1	0.00224	0.0050	0.0029	-0.0036	-0.0001	0.0002	0.0001	0.00007
2	0.00185	0.0107	0.0096	-0.0160	-0.0002	0.0006	0.0002	0.00030
3	0.00174	0.0185	-0.0004	-0.0187	0.0001	0.0009	0.0001	-0.00030
4	0.00222	0.0110	0.0074	-0.0136	-0.0001	0.0006	0.0002	-0.00025
5	0.00201	-0.0133	-0.0139	0.0173	0.0002	-0.0007	-0.0004	-0.00040
6	0.00187	-0.0209	-0.0063	0.0176	0.0001	-0.0009	-0.0002	0.00060
7	0.00235	0.0163	0.0259	-0.0062	-0.0006	0.0005	0.0007	-0.00056

Statistics of individual solutions:

File	RMS (m)	DOF	Chi**2/DOF	#Observations authentic	/ pseudo	#Parameters explicit	/ implicit	/ singular
1	0.00165	947314	2.71	962432	3	453	14668	0
2	0.00146	961190	2.12	976355	3	456	14712	0
3	0.00154	951973	2.39	967145	3	453	14722	0
4	0.00152	951896	2.31	966974	3	453	14628	0
5	0.00147	948175	2.17	962841	3	447	14222	0
6	0.00148	921217	2.21	936324	3	444	14666	0
7	0.00161	950232	2.58	965597	3	447	14921	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 16:143:00000 16:149:86370 LEICA GR10          ----- -----------
 IGEL  A    1 P 16:143:00000 16:149:86370 LEICA GR10          ----- -----------
 LAZK  A    1 P 16:143:00000 16:149:86370 LEICA GR10          ----- -----------
 PAS2  A    1 P 16:143:00000 16:149:86370 TPS NET-G3A         ----- -----------
 PASA  A    1 P 16:143:00000 16:149:86370 LEICA GR10          ----- -----------
```

6.2 Antennas

Serial number ONLY provided in case individual calibrations are vailable.
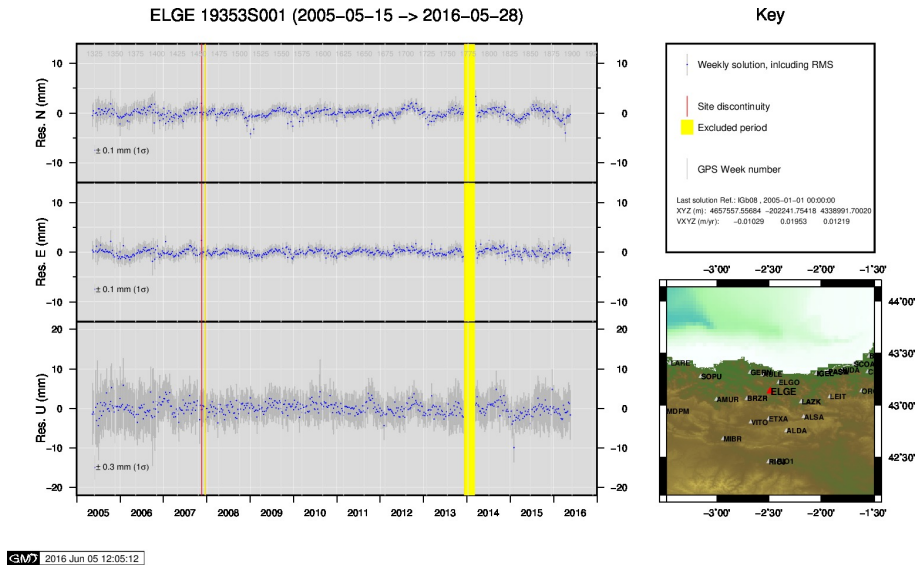
```
*SITE PT SOLN T DATA_START__ DATA_END____ DESCRIPTION_____ S/N__
 ELGE  A    1 P 16:143:00000 16:149:86370 LEIAR25.R4      LEIT -----
 IGEL  A    1 P 16:143:00000 16:149:86370 LEIAR20         LEIM -----
 LAZK  A    1 P 16:143:00000 16:149:86370 LEIAR25.R4      LEIT -----
 PAS2  A    1 P 16:143:00000 16:149:86370 LEIAR20         LEIM 73034
 PASA  A    1 P 16:143:00000 16:149:86370 LEIAR20         LEIM 73034
```
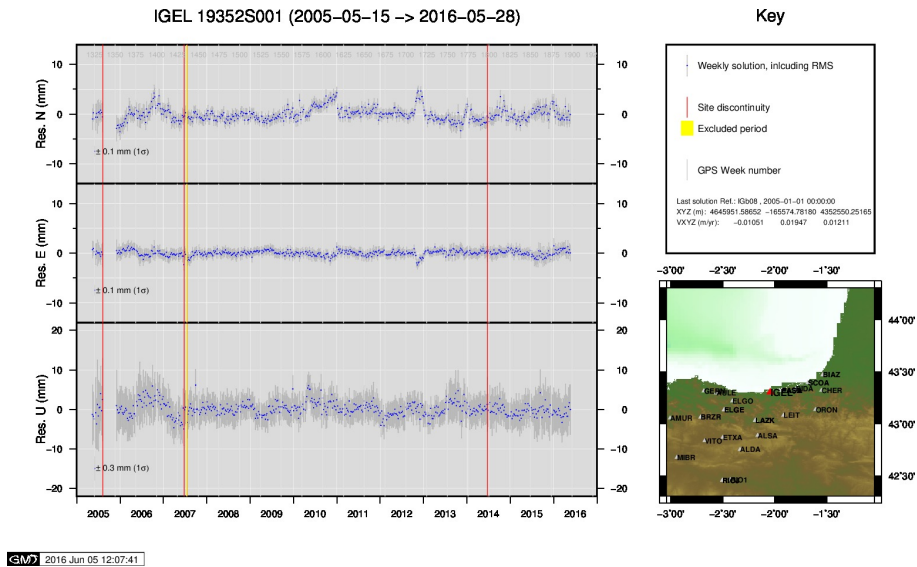
6.3   Eccentrities

```
*                                      UP_____ NORTH___ EAST____
*SITE PT SOLN T DATA_START__ DATA_END____ AXE ARP->BENCHMARK(M)_____
 ELGE  A    1 P 16:143:00000 16:149:86370 UNE   0.0000   0.0000   0.0000
 IGEL  A    1 P 16:143:00000 16:149:86370 UNE   0.0000   0.0000   0.0000
 LAZK  A    1 P 16:143:00000 16:149:86370 UNE   0.0000   0.0000   0.0000
 PAS2  A    1 P 16:143:00000 16:149:86370 UNE   0.0000   0.0000   0.0000
 PASA  A    1 P 16:143:00000 16:149:86370 UNE   0.0000   0.0000   0.0000
```
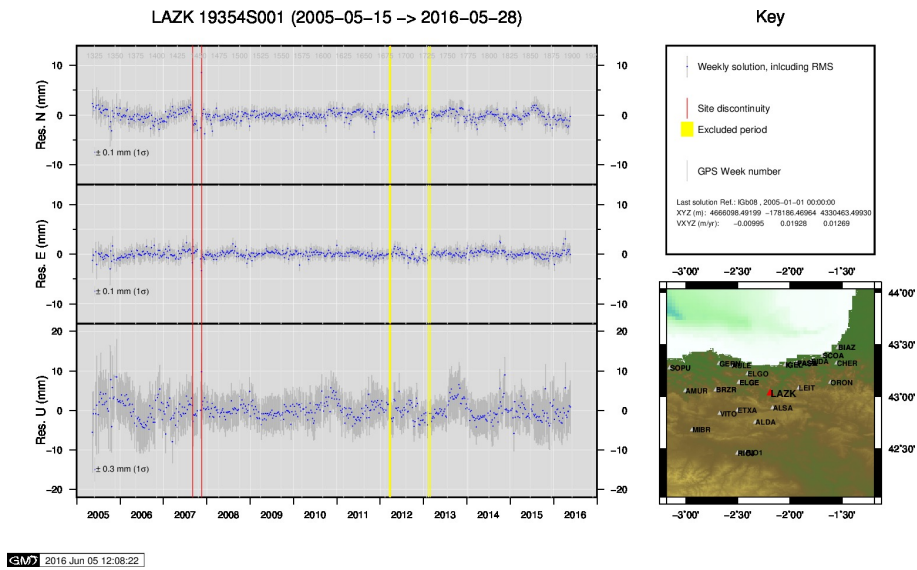
7 Cumulative Time Series

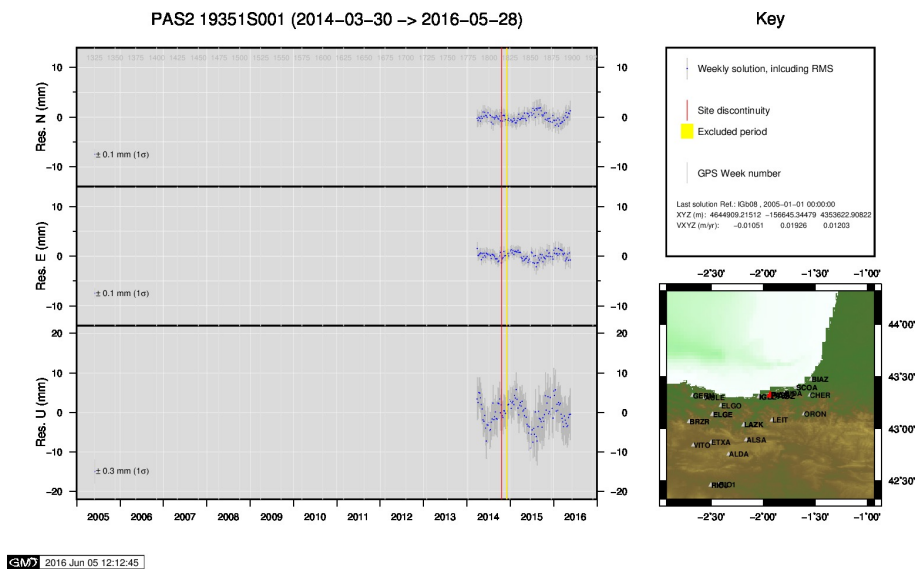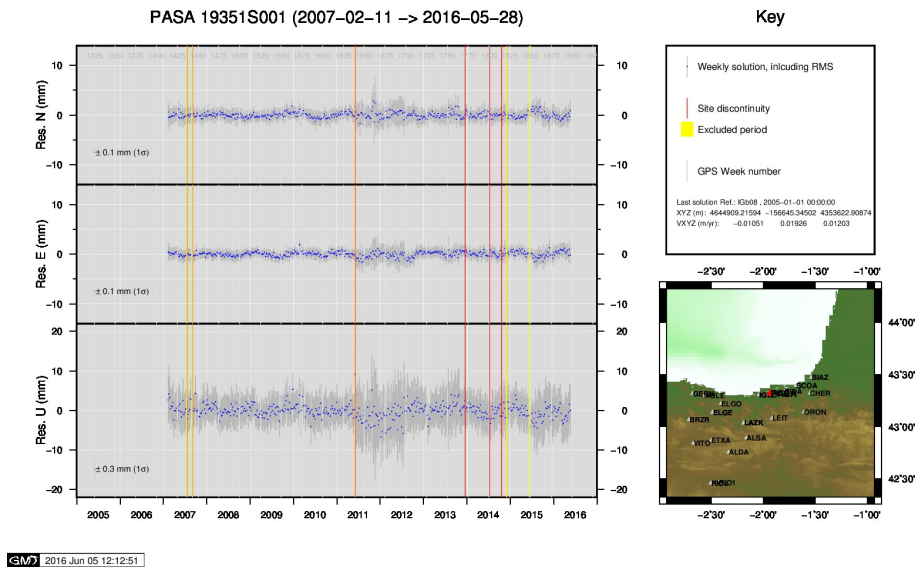Time series of stations. Latest plots at: http://geolabpasaia.org/gnss/ARA-net/TSeries/, or click on the caption of each image.

1) ELGE

2) IGEL

3) LAZK

4) PAS2

5) PASA