EUREF Analysis Centres Workshop

A new ETRS89 realization in Spain

A. Barón (ICGC)
M. Blanco (ITACYL)
J.A.S. Sobrino (IGN)
M. Valdés (IGN)
J. Zurutuza (IECA)

GOBIERNO DE ESPAÑA MINISTERIO DE FOMENTO INSTITUTO GEOGRÁFICO NACIONAL

ICGC Institut Cartogràfic i Geològic de Catalunya

INSTITUTO TECNOLÓGICO AGRARIO Junta de Castilla y León Consejería de Agricultura y Ganadería

JUNTA DE ANDALUCIA Instituto de Estadística y Cartografía de Andalucía CONSEJERÍA DE ECONOMÍA Y CONOCIMIENTO

Motivation (I)

- Implementation of ETRS89 in Spain, by law 1071/2007.
- Relies on REGENTE passive network: 1.100 points.
- Frame: ETRF96, IBERIA95 campaign, jointly with Portugal, EUREF98 resolutions.
- Currently, access to ETRS89 through GNSS active networks.

REGENTE passive network.

EUREF Analysis Centres Workshop

A new ETRS89 realization in Spain

Motivation (II)

- Many of the frames/coordinates of permanent GNSS networks:
  - weren't consistent between each other nor in the same frame (ETRF05, ETRF00, ETRF??).
  - weren't observed in the same epoch nor covered same time span.
  - weren't homogeneously processed following guidelines (e.g. TWG).
  - aren't regularly updated (i.e. due to discontinuities or other changes in the network stations).
- As a result, the Superior Geographic Council decided to create a WG to harmonize and standardize an unique and common reference framework in ETRF00 for all public GNSS networks in Spain.

Processing Working Group

A call for participation was issued to all the public GNSS Network managers. The following ACs volunteered to participate in the ETRF2000 WG:

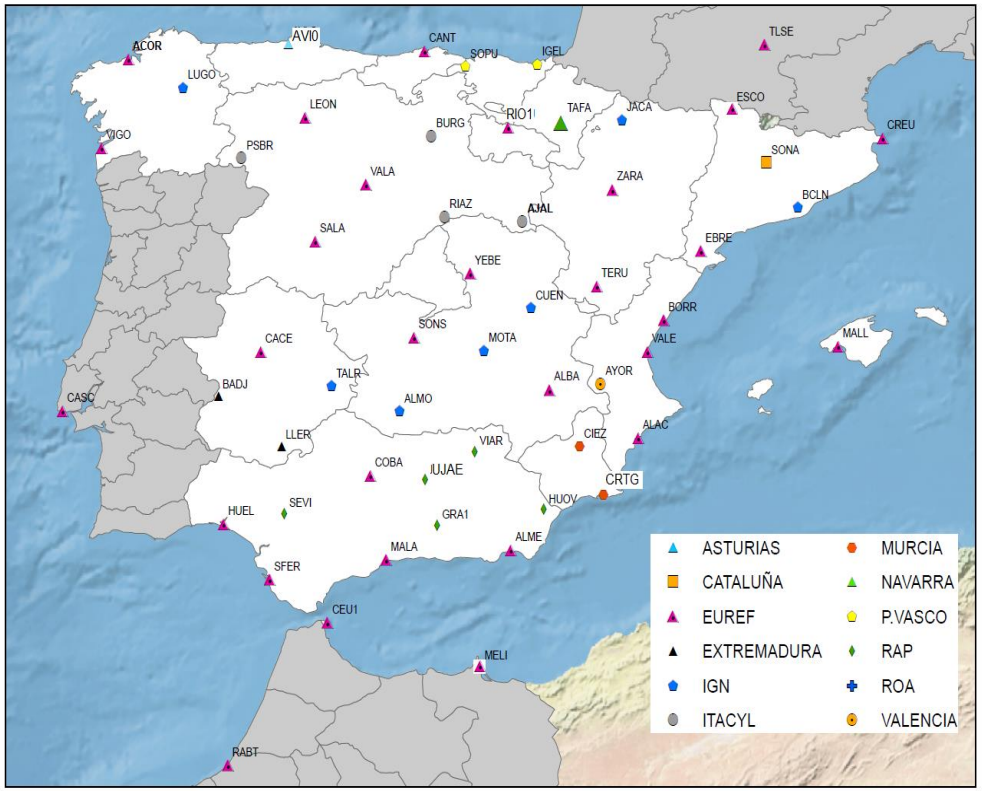
- Instituto Geográfico Nacional (IGN)
  - EUREF LAC since 2001, EPN-D, Repro1 & 2… BSW 5.2
- Institut Cartografic i Geologic de Catalunya (ICGC)
  - Submitting a solution to EPN-D, BSW 5.2
- Instituto de Estadística y Cartografía de Andalucía (IECA)
  - Submitting a solution to EPN-D as a sub-net of ARA, BSW 5.2
- Instituto Tecnológico y Agrario de Castilla y León (ITACYL)
  - GAMIT GLOBK, wide experience in GNSS processing

Processing options for each AC

	IGN	ICGC	IECA	ITACYL
SOFTWARE	BSW 5.2	BSW 5.2	BSW 5.2	GAMIT 10.6
SYSTEMS	GPS + GLONASS	GPS+GLONASS	GPS+GLONASS	GPS
SOLUTION TYPE	NETWORK	NETWORK	NETWORK	NETWORK
GNSS NETWORKS / STATIONS	aragea, catnet, ergnss, erva, itacyl, meristemum, rap, regam, rep, rgac, rgan, rgapa, rge, rioja, xgaib	aragea, catnet, ergnss, erva, meristemum, regam, rgan, rge	ergnss, catnet, rap, rep, rgan, rgapa, rioja	epn, itacyl
ORBITS	IGS	CODE	CODE	IGS
ANTENNAS	IGS08 + IND. CALIB.	IGS08 + IND. CALIB.	IGS08 + IND. CALIB.	IGS08 + IND. CALIB.
IERS	2010	2010	2010	Solid Earth tide IERS2003, Short period Earth orientation: IERS2010
GRAV. MODEL	EGM08	EGM08	EGM08	EGM08
TROPOSPHERE	VMF (1h)+GRAD (6h)	GMF (1h)+GRAD (24h)	VMF (1h)+GRAD (24h)	VMF1 (1h) + GRAD (24h)
IONOSPHERE	CODE (HOI included)	CODE (HOI included)	CODE (HOI included)	GMAP (2d & 3rd order) Magnetic field IGRF12
REF. FRAME	EPN	EPN	EPN	IGb08 orbits (loosely constrained)
OCEAN TIDES	FES2004	FES2004	FES2004	FES2004
ATM. TID. LOAD.	YES	YES	YES	YES
ELEV. MASK	3	3	3	5

Test campaign

- Previously to the processing, a test campaign was performed to check the consistency between ACs.
- About 60 IGS / EPN & no EPN stations selected.
- Period: Wk 1812 to 1815.
- RMS of unit weight for coor comparison: 0.8 mm.
- Test OK for continue!



Processing overview

- Include all “public” GNSS stations in Spain excepting Canary I.: 14 regional networks + national ERGNSS.
- Period: IGb08 full lifetime (17 Apr 2011 – 28 Jan 2017).
- Datum: IGS/EPN A (IGb08, EPN release C1934) in the area and surroundings: 50 stations (74 if we include discontiniuties) have been used for the datum alignment.
- Total non A class stations: 233 (286 if we include discontinuities).
- Processing follows EUREF recommendations, but each AC free to set different minor changes.
- Daily SNX files: each AC combines the daily solutions from the 4 ACs and seeks/cleans the outliers.
- Detection of outliers and discontinuities for the final combination of SNX.
- Final coordinates in IGb08 2017.0 and ETRF00 from daily SNX combination of all ACs.
- IGb08 and ETRF00 velocities estimation.
- Agreement between all networks managers to use the resulting frame.

SNX Combination

- 3 ACs performed combinations with the daily SNX.

  A) Daily level (we start with 4 SNX files):
  - SNX: convert to NQ0.
  - Check for equipment inconsistencies.
  - Outlier detection and removal.
  - Stack the 4 NQ0s in a daily file.

  B) Cumulative analysis (we start with all the previously combined daily NQ0s):
  - Set discontinuities -> agreed between ACs.
    - FODITS.
    - Time series (visual detection).
    - For EPN-A / IGS, oficial discontinuities are used.
  - Clean time series in case any error is detected.
  - Final NEQ stacking (cumulative of the combined daily):
    - CRD, VEL, datum alignement verification check…
    - Coordinate / velocity comparison between individual ACs combinations.

EUREF Analysis Centres Workshop

A new ETRS89 realization in Spain

Results (I): datum align. check (COMPAR)

(> 3 mm dif.)

STATION	#FIL	C	RMS	1	2	STATION	#FIL	C	RMS	1	2	STATION	#FIL	C	RMS	1	2
ACOR113434M001	2	N	1.21	-0.85	0.85	CANT213438M001	2	N	0.01	0.01	-0.01	EBRE213410M001	2	N	0.51	0.36	-0.36
		E	0.08	0.06	-0.06			E	0.45	-0.32	0.32			E	0.36	0.26	-0.26
		U	0.30	0.21	-0.21			U	0.37	-0.27	0.27			U	0.22	-0.15	0.15
ALAC113433M001	2	N	0.01	0.01	-0.01	CANT113438M001	2	N	0.57	-0.40	0.40	GAIA113902M001	2	N	2.50	-1.76	1.76
		E	0.42	0.30	-0.30			E	0.50	0.36	-0.36			E	1.76	-1.25	1.25
		U	0.03	0.02	-0.02			U	1.43	-1.01	1.01			U	2.49	1.76	-1.76
ALBA113452M001	2	N	0.10	-0.07	0.07	CASC113909S001	2	N	1.09	-0.77	0.77	GAIA213902M001	2	N	0.71	-0.50	0.50
		E	0.45	0.32	-0.32			E	0.47	-0.34	0.34			E	0.51	-0.36	0.36
		U	0.21	0.15	-0.15			U	0.89	0.63	-0.63			U	1.41	1.00	-1.00
ALME113437M001	2	N	0.78	-0.55	0.55	CEBR213408M001	2	N	0.18	-0.13	0.13	GRAS110002M006	2	N	0.64	0.46	-0.46
		E	0.31	0.22	-0.22			E	0.10	0.07	-0.07			E	0.18	-0.13	0.13
		U	0.28	0.20	-0.20			U	0.75	0.53	-0.53			U	0.60	0.42	-0.42
BELL313431M001	2	N	0.16	0.11	-0.11	CEBR113408M001	2	N	0.18	-0.12	0.12	HERT113212M010	2	N	0.56	0.40	-0.40
		E	0.01	0.01	-0.01			E	0.23	0.16	-0.16			E	0.63	-0.44	0.44
		U	1.42	-1.00	1.00			U	1.65	1.17	-1.17			U	0.53	0.37	-0.37
BELL213431M001	2	N	0.13	-0.09	0.09	CEU1113449M002	2	N	0.64	-0.45	0.45	HERT213212M010	2	N	1.01	0.72	-0.72
		E	0.62	-0.44	0.44			E	1.91	1.35	-1.35			E	0.78	-0.55	0.55
		U	3.97	-2.80	2.80			U	1.69	1.19	-1.19			U	1.03	-0.73	0.73
BELL113431M001	2	N	1.50	-1.06	1.06	CEU1213449M002	2	N	0.49	-0.34	0.34	HUEL113451M001	2	N	1.00	-0.71	0.71
		E	2.27	-1.60	1.60			E	1.47	1.04	-1.04			E	0.78	0.55	-0.55
		U	0.08	-0.06	0.06			U	0.76	-0.54	0.54			U	0.47	-0.34	0.34
BORR113480M001	2	N	0.10	0.07	-0.07	CEU1313449M002	2	N	0.44	-0.31	0.31	IENG112724S001	2	N	0.93	0.66	-0.66
		E	0.11	-0.08	0.08			E	0.97	0.68	-0.68			E	0.45	0.32	-0.32
		U	0.03	-0.02	0.02			U	1.67	1.18	-1.18			U	0.05	0.03	-0.03
BORR213480M001	2	N	0.12	-0.09	0.09	COBA113453M001	2	N	0.50	-0.36	0.36	IZAN131309M002	2	N	4.22	-2.98	2.98
		E	0.28	0.20	-0.20			E	1.25	0.88	-0.88			E	0.08	-0.06	0.06
		U	0.20	-0.14	0.14			U	3.47	-2.46	2.46			U	3.14	-2.22	2.22
BRST310004M004	2	N	0.22	-0.16	0.16	COBA213453M001	2	N	0.45	-0.32	0.32	LAGO113903M001	2	N	0.71	-0.50	0.50
		E	1.54	-1.09	1.09			E	0.51	0.36	-0.36			E	0.44	-0.31	0.31
		U	0.46	-0.33	0.33			U	0.95	-0.67	0.67			U	0.54	0.38	-0.38
BRST110004M004	2	N	0.06	-0.04	0.04	CREU113432M001	2	N	0.01	0.01	-0.01	LLIV113436M001	2	N	1.18	0.84	-0.84
		E	2.26	-1.60	1.60			E	0.30	-0.21	0.21			E	0.17	-0.12	0.12
		U	1.95	1.38	-1.38			U	0.82	-0.58	0.58			U	0.18	-0.13	0.13
BRST210004M004	2	N	0.31	-0.22	0.22	CREU213432M001	2	N	0.19	0.13	-0.13	LPAL181701M001	2	N	3.70	-2.62	2.62
		E	2.20	-1.55	1.55			E	0.10	0.07	-0.07			E	0.10	0.07	-0.07
		U	0.04	-0.03	0.03			U	0.29	0.20	-0.20			U	7.53	-5.32	5.32
CACE113447M001	2	N	0.30	-0.21	0.21	EBRE113410M001	2	N	0.41	0.29	-0.29	LROC110023M001	2	N	0.26	0.18	-0.18
		E	0.08	0.05	-0.05			E	0.64	0.45	-0.45			E	0.60	-0.42	0.42
		U	0.65	0.46	-0.46			U	0.85	0.60	-0.60			U	0.54	0.38	-0.38

... ...

RMS OF UNIT WEIGHT FOR COORDINATE COMPARISON : 0.00118

Results (I): datum align. check (HLM)

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
6	ACOR113434M001	I W	-1.66	-0.13	0.42
19	ALAC113433M001	I W	0.06	0.50	-0.06
21	ALBA113452M001	I W	-0.11	0.55	0.20
36	ALME113437M001	I W	-1.10	0.34	0.23
100	BELL313431M001	I W	0.23	-0.21	-2.09
118	BORR113480M001	I W	0.16	-0.27	-0.12
902	BORR213480M001	I W	-0.13	0.29	-0.38
903	BRST310004M004	I W	-0.33	-2.28	-0.74
148	CACE113447M001	I W	-0.42	-0.05	0.83
154	CANT213438M001	I W	0.03	-0.73	-0.62
906	CANT113438M001	I W	-0.88	0.62	-2.06
162	CASC113909S001	I W	-1.50	-0.99	1.05
174	CEBR213408M001	I W	-0.23	0.01	0.98
907	CEBR113408M001	I W	-0.23	0.17	2.26
177	CEU1113449M002	I W	-1.14	2.49	2.30
908	CEU1213449M002	I W	-0.62	1.99	-1.15
909	CEU1313449M002	I W	-0.82	1.17	2.25
910	COBA213453M001	I W	-0.55	0.65	-1.44
210	CREU113432M001	I W	-0.01	-0.61	-1.21
911	CREU213432M001	I W	0.32	0.05	0.30
243	EBRE113410M001	I W	0.65	0.83	1.07
912	EBRE213410M001	I W	0.78	0.37	-0.41
914	GAIA213902M001	I W	-0.90	-1.04	1.86
319	GRAS110002M006	I W	0.95	-0.36	0.74
343	HERT113212M010	I W	0.91	-1.00	0.55
915	HERT213212M010	I W	1.14	-1.31	-1.73
353	HUEL113451M001	I W	-1.39	0.98	-0.78
360	IENG112724S001	I W	1.42	0.37	-0.19
	RMS / COMPONENT		**0.98**	**0.98**	**1.36**
	MEAN		**0.00**	**0.00**	**-0.00**
	MIN		**-1.66**	**-2.28**	**-2.99**
	MAX		**2.84**	**2.49**	**2.99**

NUM	NAME	FLG	RESIDUALS IN MILLIMETERS		
414	LAGO113903M001	I W	-0.98	-0.84	0.56
435	LLIV113436M001	I W	1.68	-0.46	-0.37
448	LROC110023M001	I W	0.45	-0.94	0.67
458	MALA213443M001	I W	-1.42	1.30	-1.25
916	MALA113443M001	I W	1.83	0.27	-0.77
461	MALL113444M001	I W	0.34	0.43	0.20
488	MELI119379M001	I W	-0.66	1.21	2.26
544	NOT1112717M004	I W	2.10	0.33	1.09
591	PDEL131906M004	I W	-0.04	-1.57	-2.99
615	PRAT212760M001	I W	1.35	0.81	-0.49
918	PRAT112760M001	I W	0.81	1.41	-1.73
649	RIO1113448M002	I W	0.04	-0.45	-1.83
659	SALA113469M001	I W	-0.30	-0.17	1.47
681	SFER213402M004	I W	-1.22	-1.69	-0.91
919	SFER113402M004	I W	-1.38	-2.23	-1.46
699	SONS113446M001	I W	-0.18	0.42	0.03
740	TERU113487M001	I W	-0.02	-0.05	-0.32
920	TERU213487M001	I W	0.28	0.45	-0.29
921	TLSE310003M009	I W	0.21	-0.38	0.98
808	VALA113463M002	I W	-0.41	-0.37	-1.23
810	VALE113439M001	I W	-0.31	1.21	0.37
824	VIGO113450M001	I W	-0.54	-0.79	0.58
829	VILL213406M001	I W	-0.68	1.19	-2.29
846	WSRT113506M005	I W	2.84	-1.43	1.49
855	YEBE113420M001	I W	-0.25	0.40	2.48
860	ZARA113462M001	I W	0.17	0.08	2.99
869	ZOUF112763M001	I W	1.67	-0.58	-1.30

RMS OF TRANSFORMATION : 1.12 MM

TRANSLATION IN N	**:**	**-0.03**	**+- 0.15**	**MM**
TRANSLATION IN E	**:**	**0.10**	**+- 0.15**	**MM**
TRANSLATION IN U	**:**	**0.08**	**+- 0.15**	**MM**

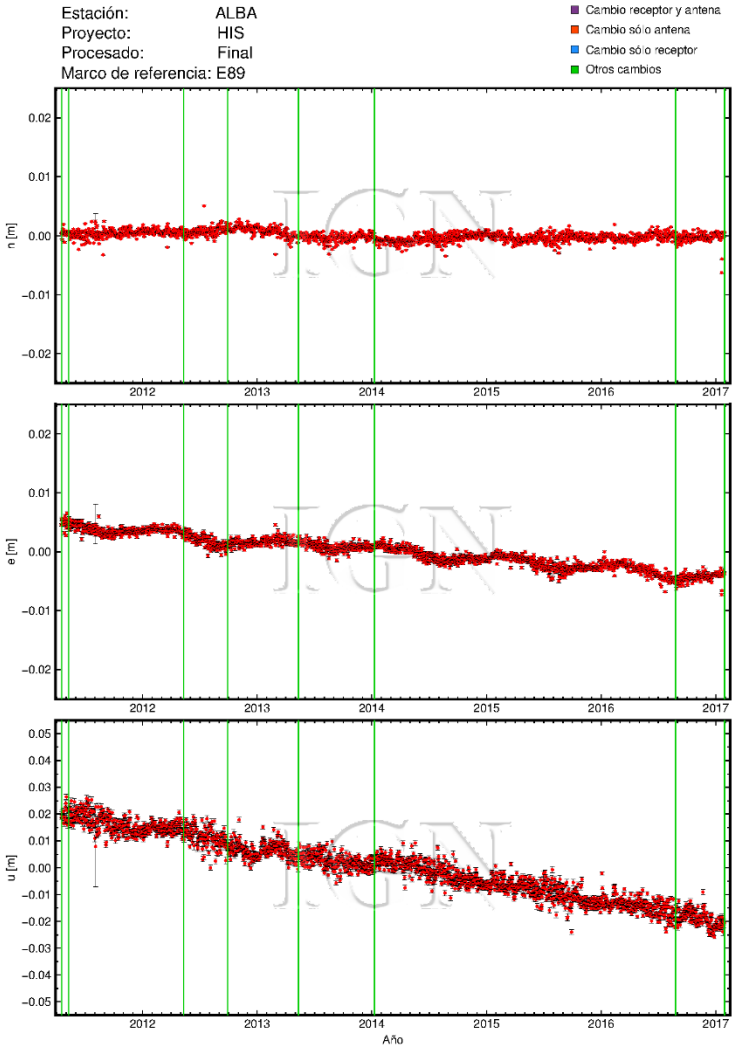
Results (II): CRD comparison between Acs comb.

(> 2 mm dif.)

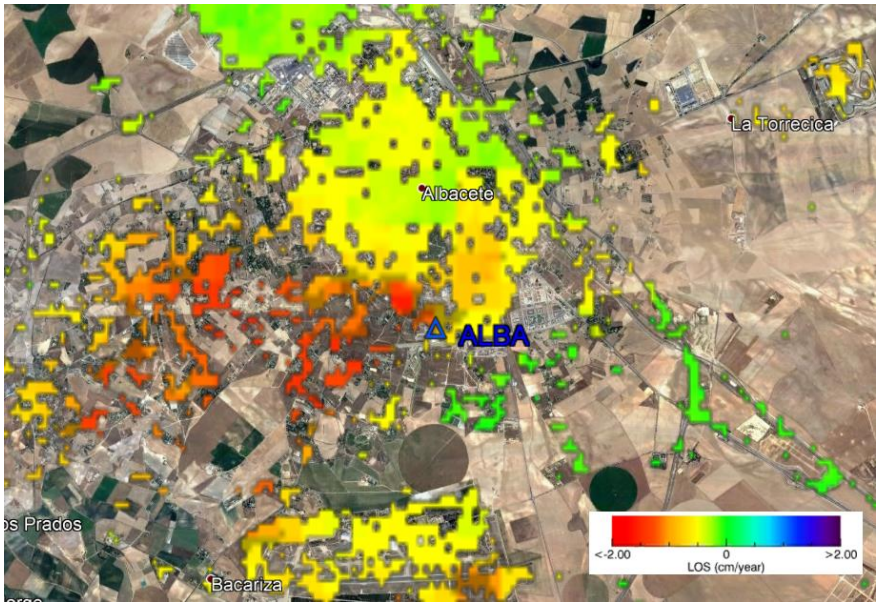
NUM	STATION	#FIL	C	RMS	1	2	3	STATION	#FIL	C	RMS	1	2	3	STATION	#FIL	C	RMS	1	2	3
	ABAN119430M001	3	N	0.11	-0.07	-0.06	0.13	ALCO113496M001	3	N	0.07	-0.07	-0.01	0.08	ARDU119348M001	3	N	0.15	-0.15	0.00	0.15
			E	0.09	0.04	0.07	-0.10			E	0.07	0.03	0.04	-0.08			E	0.20	0.00	0.20	-0.20
			U	0.12	-0.10	-0.04	0.14			U	0.06	-0.06	0.04	0.03			U	0.61	0.69	-0.26	-0.43
	ACAL119431M001	3	N	0.11	-0.10	-0.02	0.12	ALDA219383M001	3	N	0.31	-0.05	-0.28	0.33	ARIB119425M001	3	N	0.21	-0.13	-0.11	0.24
			E	0.09	0.05	0.05	-0.10			E	0.08	0.09	-0.08	-0.01			E	0.08	0.09	-0.06	-0.03
			U	0.14	-0.11	-0.04	0.15			U	1.07	0.95	0.22	-1.17			U	1.12	1.06	0.12	-1.18
	ACIN119378M001	3	N	0.12	-0.07	-0.07	0.14	ALGC113456M001	3	N	0.34	-0.30	-0.07	0.37	ARSP119309M001	3	N	0.04	0.04	-0.02	-0.03
			E	0.09	0.05	0.05	-0.10			E	0.25	0.05	0.22	-0.27			E	0.12	0.07	0.07	-0.14
			U	0.39	0.32	0.11	-0.43			U	0.91	-0.75	-0.25	1.00			U	0.18	-0.21	0.15	0.06
	ACNS119306M001	3	N	0.19	-0.09	-0.13	0.22	ALHA119433M001	3	N	0.14	-0.05	-0.10	0.15	ASTO219310M001	3	N	0.16	-0.11	-0.08	0.19
			E	0.14	0.08	0.08	-0.16			E	0.10	0.03	0.08	-0.11			E	0.12	0.14	-0.07	-0.07
			U	0.37	0.16	0.27	-0.42			U	0.24	-0.06	-0.21	0.26			U	0.45	0.20	0.32	-0.52
	ACOR113434M001	3	N	0.71	-0.41	-0.41	0.82	ALIA119376M001	3	N	0.11	-0.08	-0.05	0.13	AVEL313440M001	3	N	0.26	-0.28	0.22	0.06
			E	0.14	0.12	0.04	-0.16			E	0.08	0.06	0.03	-0.09			E	0.24	0.12	-0.28	0.16
			U	0.60	0.30	0.38	-0.69			U	0.50	0.44	0.10	-0.55			U	0.33	0.37	-0.12	-0.25
	AGRD219307M001	3	N	0.10	-0.11	0.04	0.07	ALME113437M001	3	N	0.39	-0.30	-0.14	0.44	AVI2219413M001	3	N	0.19	-0.20	0.18	0.03
			E	0.16	-0.02	-0.15	0.17			E	0.05	0.04	0.02	-0.06			E	0.17	0.20	-0.09	-0.11
			U	1.21	1.24	-0.06	-1.17			U	1.05	-0.70	-0.50	1.20			U	0.59	0.50	-0.65	0.14
	AIRM119432M001	3	N	0.11	-0.07	-0.05	0.12	ALMO119405M001	3	N	0.20	-0.22	0.14	0.09	AVIL119311M001	3	N	0.16	0.00	-0.16	0.15
			E	0.09	0.03	0.07	-0.10			E	0.23	-0.02	0.24	-0.22			E	0.22	0.13	0.12	-0.25
			U	0.26	-0.15	-0.16	0.30			U	0.17	-0.17	0.00	0.17			U	0.06	-0.05	-0.03	0.07
	AJAL119308M001	3	N	0.17	-0.13	-0.07	0.19	ALMR113437M002	3	N	0.19	-0.17	-0.03	0.20	AVLS119470M001	3	N	0.23	-0.14	-0.12	0.26
			E	0.12	0.12	-0.13	0.01			E	0.23	0.00	0.22	-0.23			E	0.10	0.09	0.03	-0.11
			U	0.91	0.91	-0.01	-0.91			U	0.41	-0.38	-0.04	0.43			U	0.55	0.49	0.11	-0.60
	ALAC113433M001	3	N	0.05	-0.05	-0.01	0.05	ALOR119485M001	3	N	0.07	-0.07	-0.00	0.07	AYOR113499M001	3	N	0.09	-0.10	0.01	0.09
			E	0.07	0.04	0.04	-0.09			E	0.08	0.07	0.02	-0.09			E	0.07	0.06	0.00	-0.07
			U	0.16	-0.07	-0.11	0.18			U	0.02	0.02	-0.02	0.00			U	0.06	-0.05	0.07	-0.01
	ALBA113452M001	3	N	0.12	-0.09	-0.05	0.14	ALSA119419M001	3	N	0.23	-0.10	-0.16	0.26	BADJ119401M001	3	N	0.29	-0.24	-0.09	0.33
			E	0.18	0.11	0.11	-0.21			E	0.08	0.09	-0.03	-0.06			E	0.14	-0.00	0.14	-0.14
			U	0.14	-0.12	-0.03	0.15			U	1.05	0.98	0.13	-1.11			U	0.12	-0.07	-0.07	0.14
	ALBO119481M001	3	N	0.78	0.03	-0.80	0.77	AMUR119388M001	3	N	0.31	-0.35	0.23	0.12	BCL1119482M001	3	N	0.05	-0.05	0.01	0.04
			E	0.59	0.55	-0.62	0.08			E	0.07	0.08	-0.06	-0.02			E	0.08	0.04	-0.09	0.05
			U	0.81	-0.93	0.59	0.34			U	1.02	0.91	0.20	-1.11			U	0.19	0.17	0.04	-0.21
	ALC1119370M002	3	N	0.34	-0.28	0.38	-0.10	ANDU113477M001	3	N	0.23	-0.17	-0.09	0.26	BCLN113412M001	3	N	0.06	-0.04	-0.02	0.06
			E	0.19	-0.09	0.22	-0.13			E	0.25	0.06	0.21	-0.27			E	0.02	-0.01	-0.01	0.02
			U	0.58	0.66	-0.40	-0.27			U	0.35	-0.40	0.14	0.25			U	0.26	-0.02	0.27	-0.25
	ALCA119370M001	3	N	0.09	-0.09	0.01	0.09	ARAC113467M001	3	N	0.27	-0.26	-0.02	0.27	BELL313431M001	3	N	0.10	-0.12	0.03	0.08
			E	0.05	0.06	-0.01	-0.04			E	0.16	0.12	0.05	-0.18			E	0.09	-0.04	-0.06	0.11
			U	0.25	0.19	0.09	-0.28			U	0.51	-0.28	-0.31	0.59			U	0.24	0.27	-0.07	-0.20

RMS OF UNIT WEIGHT FOR COORDINATE COMPARISON : 0.00077

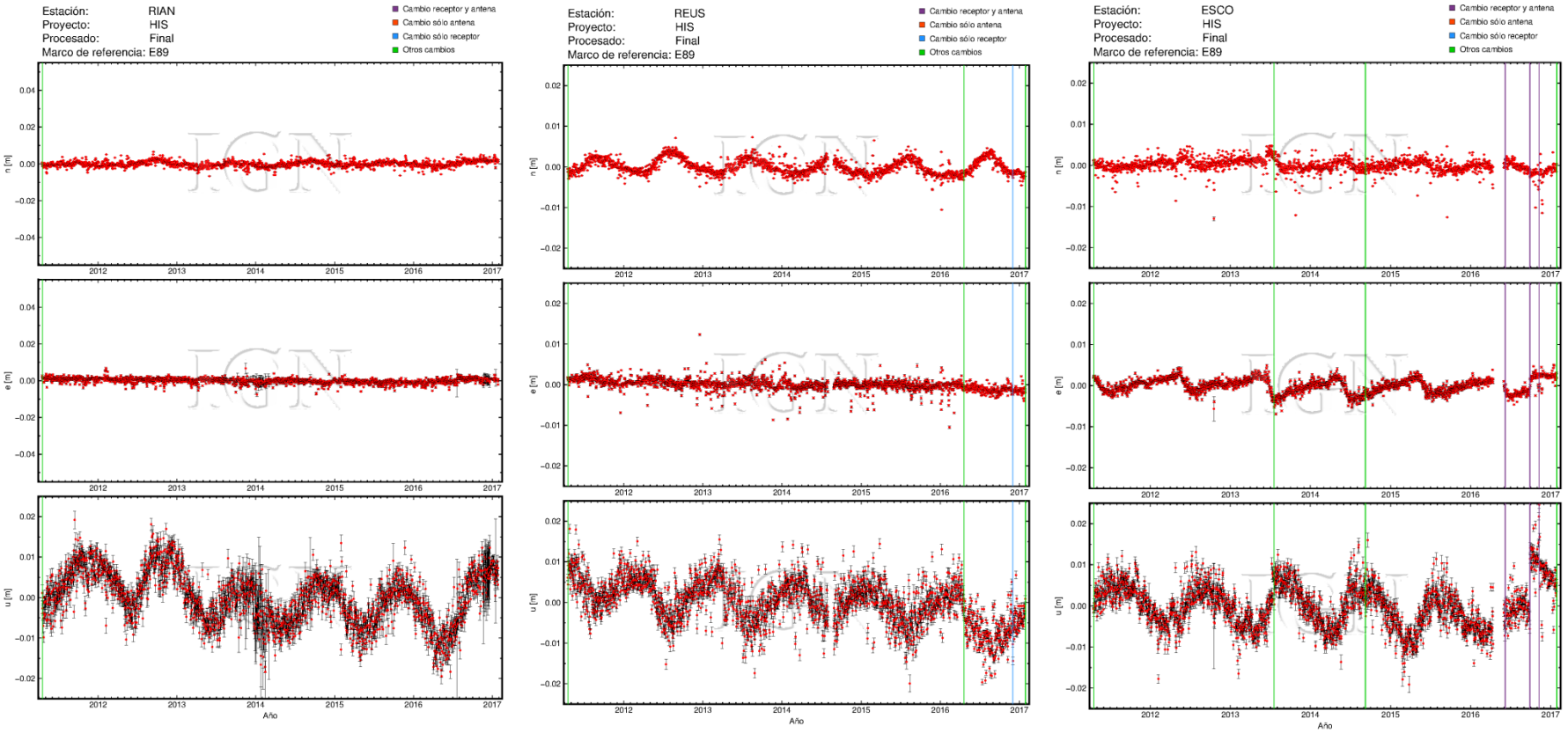
Results (III): time series & disc. (examples)



- ALBA (EPN) subsidence:
  - Estimated: -7.5 mm/yr (CATS, IGN).
  - EPN estimation: -6.8 mm/yr.
  - First ENVISAT InSAR analysis shows evidence of subsidence in a extense area (-9 mm/yr in ALBA).

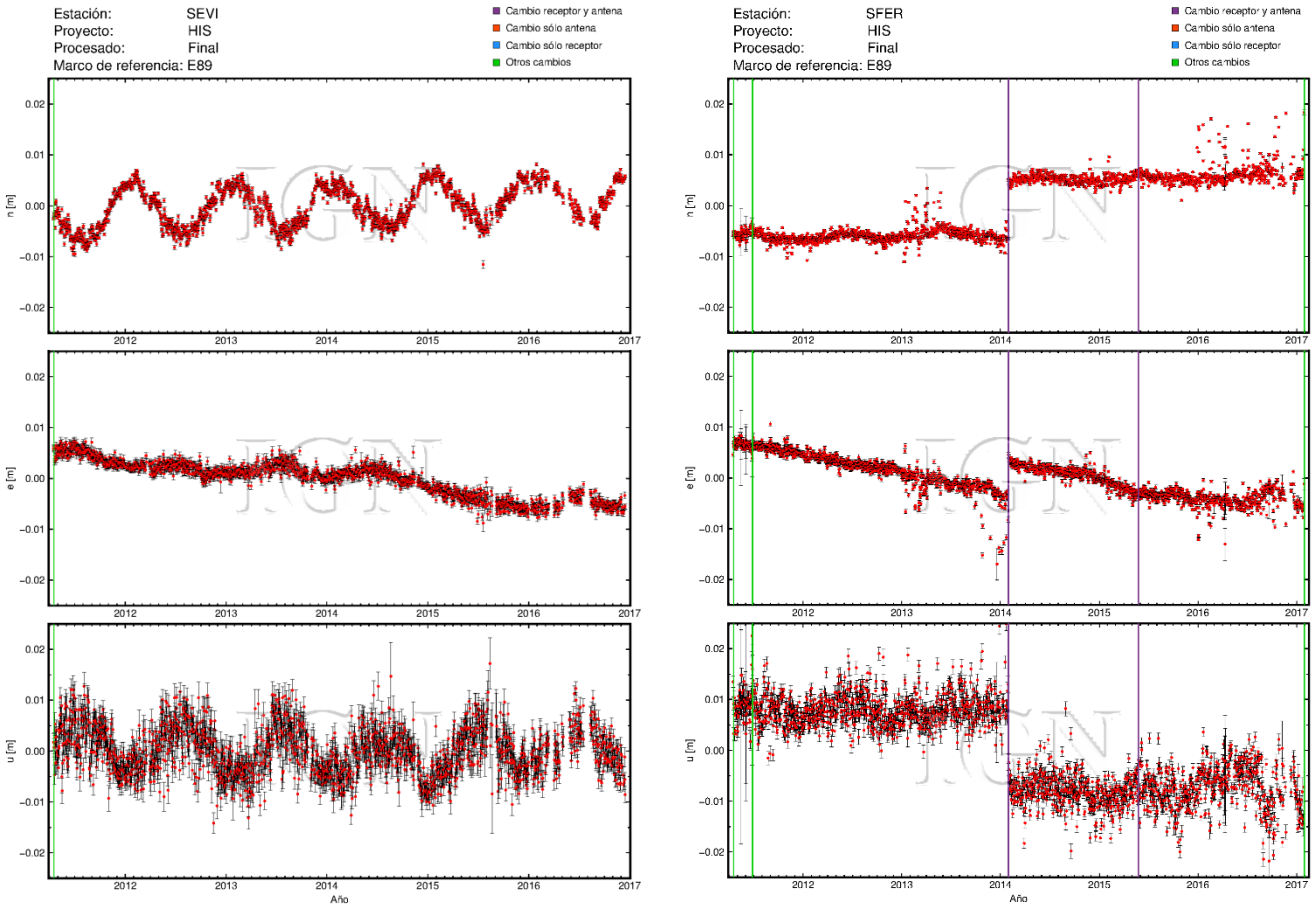


Results (III): time series & disc. (examples)



- Seasonal variations in Up: RIAN -> near a dam
  REUS
  ESCO -> snow, Pyrenees, 2500 m height

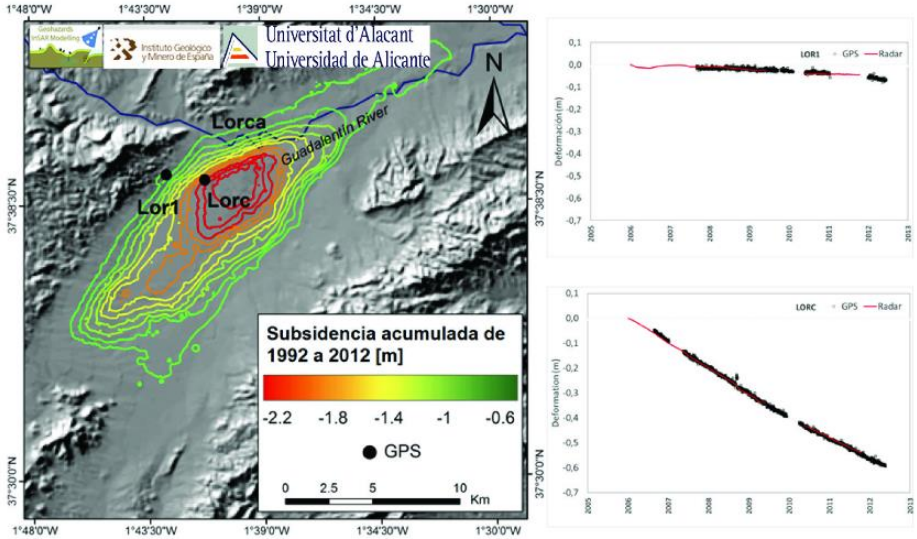
Results (III): time series & disc. (examples)

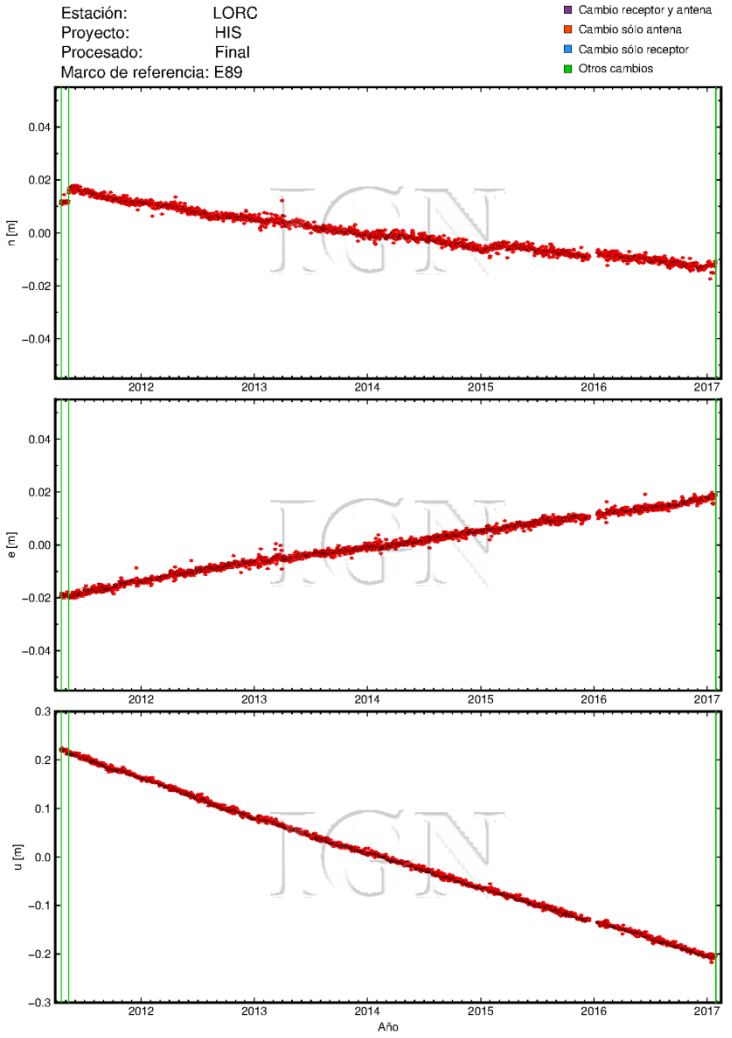


- Seasonal variations in N component (SEVI)
- Discontinuities due to an antenna change (SFER)

Results (III): time series & disc. (examples)

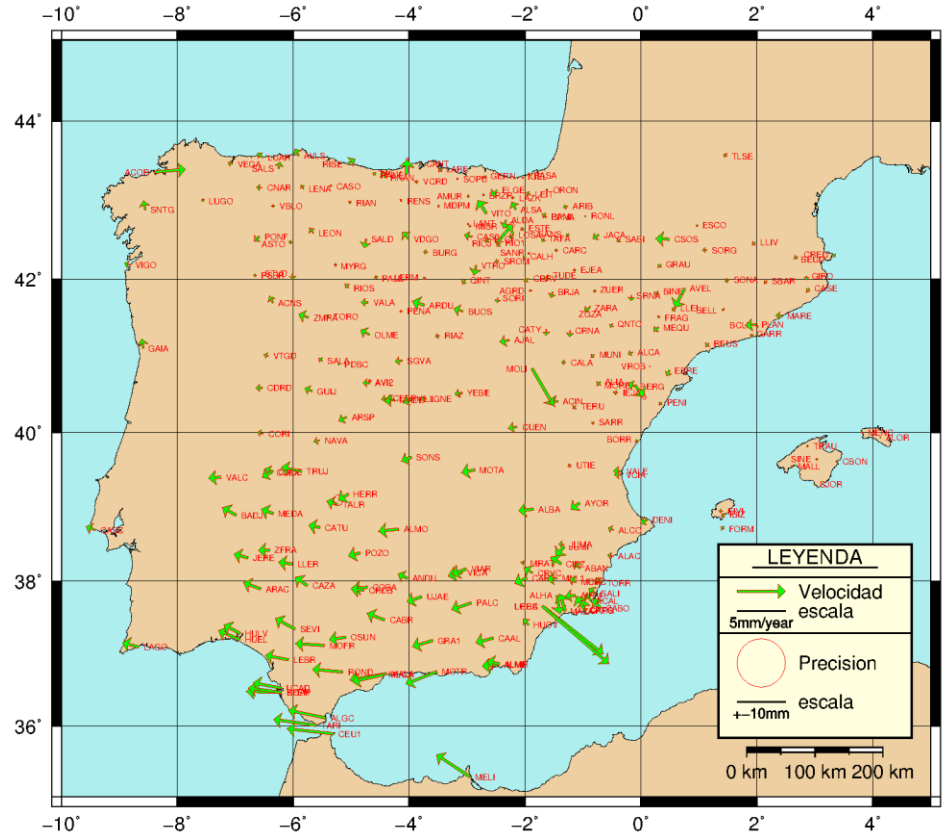
- Severe subsidence in LORC (SE Spain).
- -73 mm / yr Up.
- Checked with high precision levelling & INSAR.



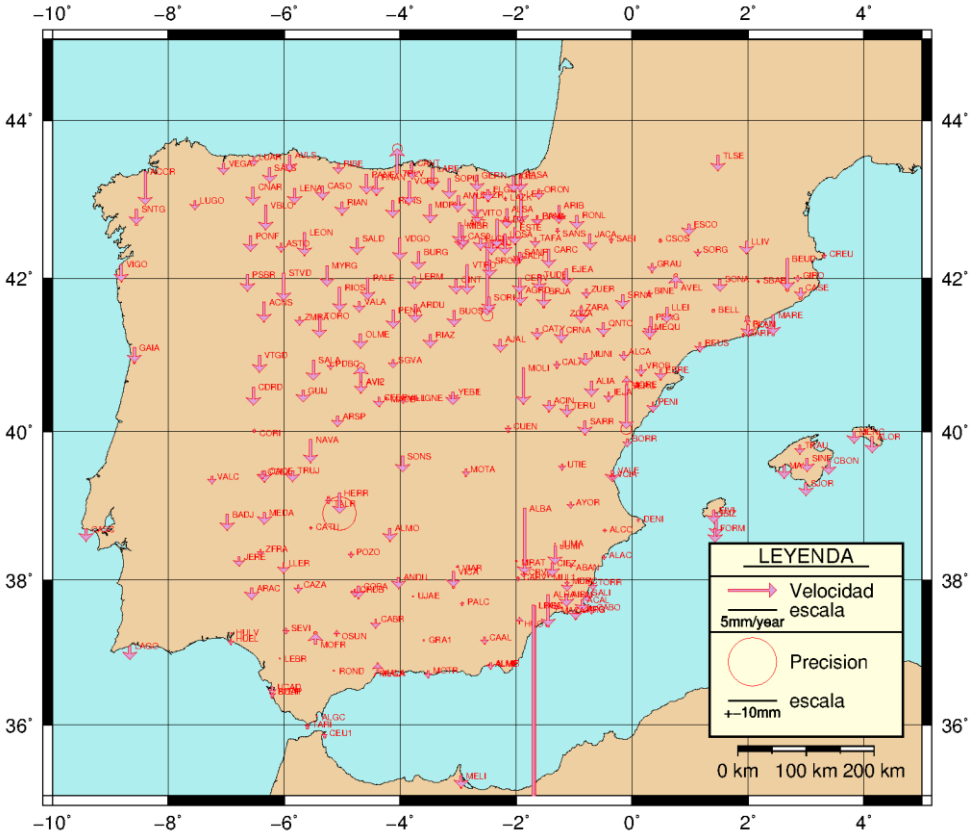


Results (IV): ETRF00 velocities

- ETRF00 velocities estimated with CATS (IGN)



Horizontal ETRF00 velocities



Vertical ETRF00 velocities

Results (IV): ETRF00 velocities

	EPN ETRF00 velocities			Estimated			Differences		
	VNorth	VEast	Vup	VNorth	VEast	Vup	ΔVNorth	ΔVEast	ΔVup
ACOR	-0,2	3,2	-3,0	0,3	3,2	-3,0	-0,5	0,0	0,0
ALAC	0,1	-0,6	-0,3	0,1	-0,5	-0,4	0,0	-0,1	0,1
ALBA	-0,2	-1,5	-6,8	-0,2	-1,5	-6,8	0,0	0,0	0,0
ALME	-0,4	-1,8	-0,6	-0,2	-1,7	-0,8	-0,2	-0,1	0,2
BELL	-0,1	-0,5	0,3	0,1	0,2	-0,1	-0,2	-0,7	0,4
BORR	-0,3	-0,1	-1,0	-0,4	0,1	-0,8	0,1	-0,2	-0,2
CACE	0,2	-0,8	-1,0	0,3	-0,8	-1,2	-0,1	0,0	0,2
CANT	0,0	-0,2	-0,4	0,1	-0,1	-1,6	-0,1	-0,1	1,2
CASC	0,1	-1,0	-0,7	0,3	-0,9	-1,2	-0,2	-0,1	0,5
CEBR	0,0	-0,6	-0,4	-0,1	-0,6	-1,0	0,1	0,0	0,6
COBA	-0,2	-1,2	-2,0	-0,1	-1,5	-1,2	-0,1	0,3	-0,8
CREU	-0,3	0,0	-0,5	-0,2	0,2	-0,4	-0,1	-0,2	-0,1
EBRE	-0,4	-0,3	-0,7	-0,6	-0,3	-1,0	0,2	0,0	0,3
ESCO	0,0	-0,4	-0,6	-0,1	-0,1	-1,2	0,1	-0,3	0,6
GAIA	0,2	-0,8	-0,9	0,9	-0,1	-1,6	-0,7	-0,7	0,7
HUEL	0,7	-2,3	-0,6	0,9	-2,2	-0,6	-0,2	-0,1	0,0
LAGO	0,5	-1,9	-1,1	0,4	-1,7	-1,4	0,1	-0,2	0,3
LLIV	-0,2	-0,2	-0,5	-0,3	-0,3	-1,3	0,1	0,1	0,8
MALA	-0,9	-3,4	0,2	-0,6	-3,8	0,9	-0,3	0,4	-0,7
MALL	-0,1	-0,3	-1,5	-0,1	-0,2	-1,4	0,0	-0,1	-0,1
RIO1	-0,5	-0,5	-1,3	-0,4	-0,4	-1,2	-0,1	-0,1	-0,1
SALA	0,2	-0,5	-2,2	0,3	-0,4	-2,1	-0,1	-0,1	-0,1
SFER	0,2	-4,0	-0,4	0,5	-3,4	0,2	-0,3	-0,6	-0,6
SONS	-0,3	-0,8	-1,6	-0,4	-1,0	-1,6	0,1	0,2	0,0
TERU	-0,2	-0,3	-1,1	-0,3	-0,3	-1,2	0,1	0,0	0,1
VALA	0,0	-0,6	-0,9	0,0	-0,7	-1,0	0,0	0,1	0,1
VALE	-0,1	-0,4	-1,4	0,0	-0,8	-1,1	-0,1	0,4	-0,3
VIGO	0,0	-0,5	-1,5	0,2	-0,6	-1,8	-0,2	0,1	0,3
VILL	-0,2	-0,4	-1,5	-0,3	-0,9	-0,5	0,1	0,5	-1,0
YEBE	-0,3	-0,7	-0,6	-0,2	-0,7	-0,9	-0,1	0,0	0,3
ZARA	-0,4	-0,5	-1,3	-0,4	-0,5	-1,6	0,0	0,0	0,3

ETRF00 velocities comparison of EPN-A stations in Iberian Peninsula (mm/yr)

Conclusions

- A new set of ETRF00 coordinates has been estimated for all the stations of Spanish GNSS public networks.
- It will constitute the ETRF00 frame in the country.
- Other products: discontinuities, time series, velocities…
- Consistent with EPN products, homogeneously processed, same time span…
- The resulting frame will be implemented as soon as posible in all the networks (national & regional).
- Almost all stations are integrated in EPN-D with up-to-date logsheets and IERS domes numbers.

Future works

- Validation by the EUREF GB (next symposium?).
- Continuous processing already underway by ICGC, IECA, IGN, ITACYL, but aiming to continue.
- Continuous updating of coordinates in case of exceeding an especific threshold.
- Permanently monitor the stations and report of inconsistencies to the station managers (already done by some AC).
- Weekly combination to check the frame.

Thank you for your attention

Our thanks to all institutions that provide public data:

- Instituto Geográfico Nacional (IGN) – ERGNSS network.
- Gobierno de Aragón – Instituto Geográfico de Aragón (ARAGEA).
- Gobierno de Cantabria – Red Geodésica Activa de Cantabria (RGAC).
- Gobierno de Euskadi – Red de Estaciones de Referencia GNSS de Euskadi.
- Gobierno de La Rioja – Red de estaciones permanentes GNSS.
- Gobierno de Navarra – Red Geodésica Activa de Navarra (RGAN).
- Institut Cartogràfic i Geologic de Catalunya (ICGC) – CatNet.
- Instituto Cartográfico de Valencia (ICV) – Red Geodésica Activa en Tiempo Real.
- Instituto de Estadística y Cartografía de Andalucía – Red Andaluza de Posicionamiento (RAP).
- Instituto Tecnológico Agrario de Castilla-León (ITACYL) – Red GNSS Castilla y León.
- Junta de Extremadura – Red Extremeña de Posicionamiento (REP).
- Principado de Asturias – RGAPA.
- Región de Murcia – Redes REGAM y Meristemum.
- SITIBSA – Xarxa de Geodesia Activa de les Illes Balears (XGAIB).