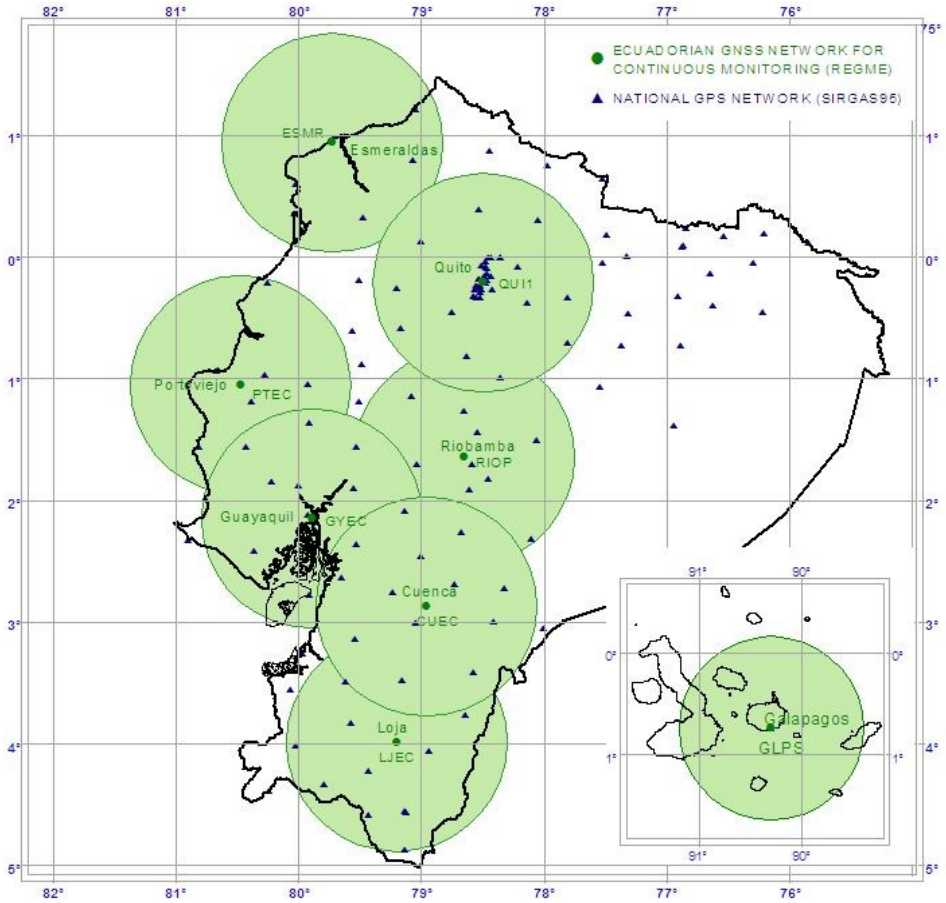
ESTABLISHMENT OF THE GNSS NETWORK OF CONTINUOUS MONITORING OF ECUADOR (REGME) AND THE GNSS DATA PROCESSING CENTRE OF ECUADOR (CEPGE).



Cisneros David, Leiva César, Bayas Miguel
CEPGE – Process of Geodesy
Military Geographical Institute of Ecuador

Geodesy For Planet Earth, IAG 2009, Buenos Aires
August 31 to september 04, 2009

INSTITUTO GEOGRAFICO MILITAR

SIRGAS

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CONCLUSIONS

GNSS NETWORK OF CONTINUOUS MONITORING OF ECUADOR (REGME)

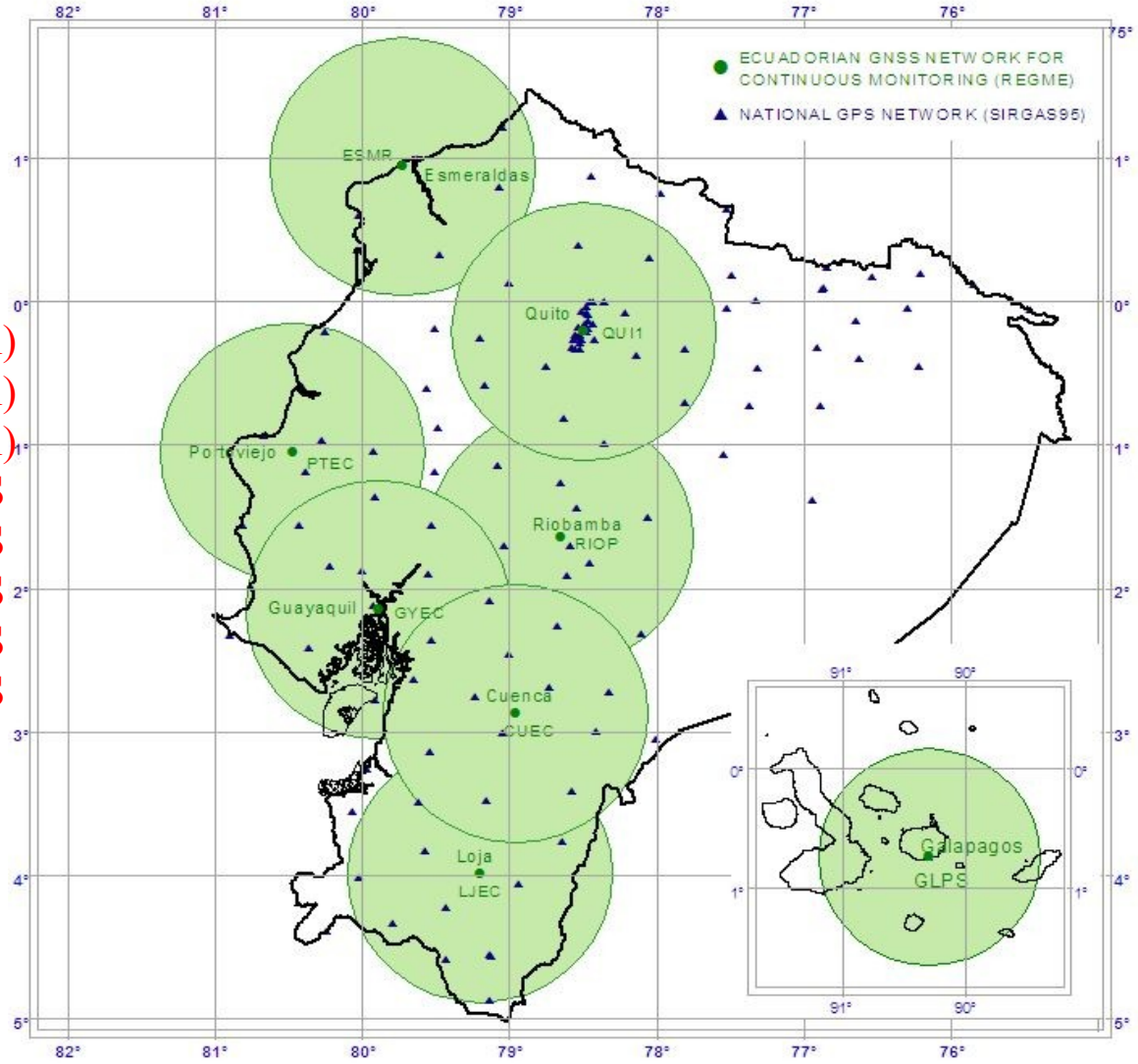
Introduction

The Military Geographical Institute (IGM), the Ecuadorian institution in charge of cartography, has as a main objective to establish a modern Geodetic Reference Frame compatible with modern measurement techniques such as Global Navigation Satellite Systems (GPS, GLONASS and Galileo).

With this objective in mind, IGM of Ecuador, in coordination with SIRGAS, has implemented REGME, according to IGS standards.

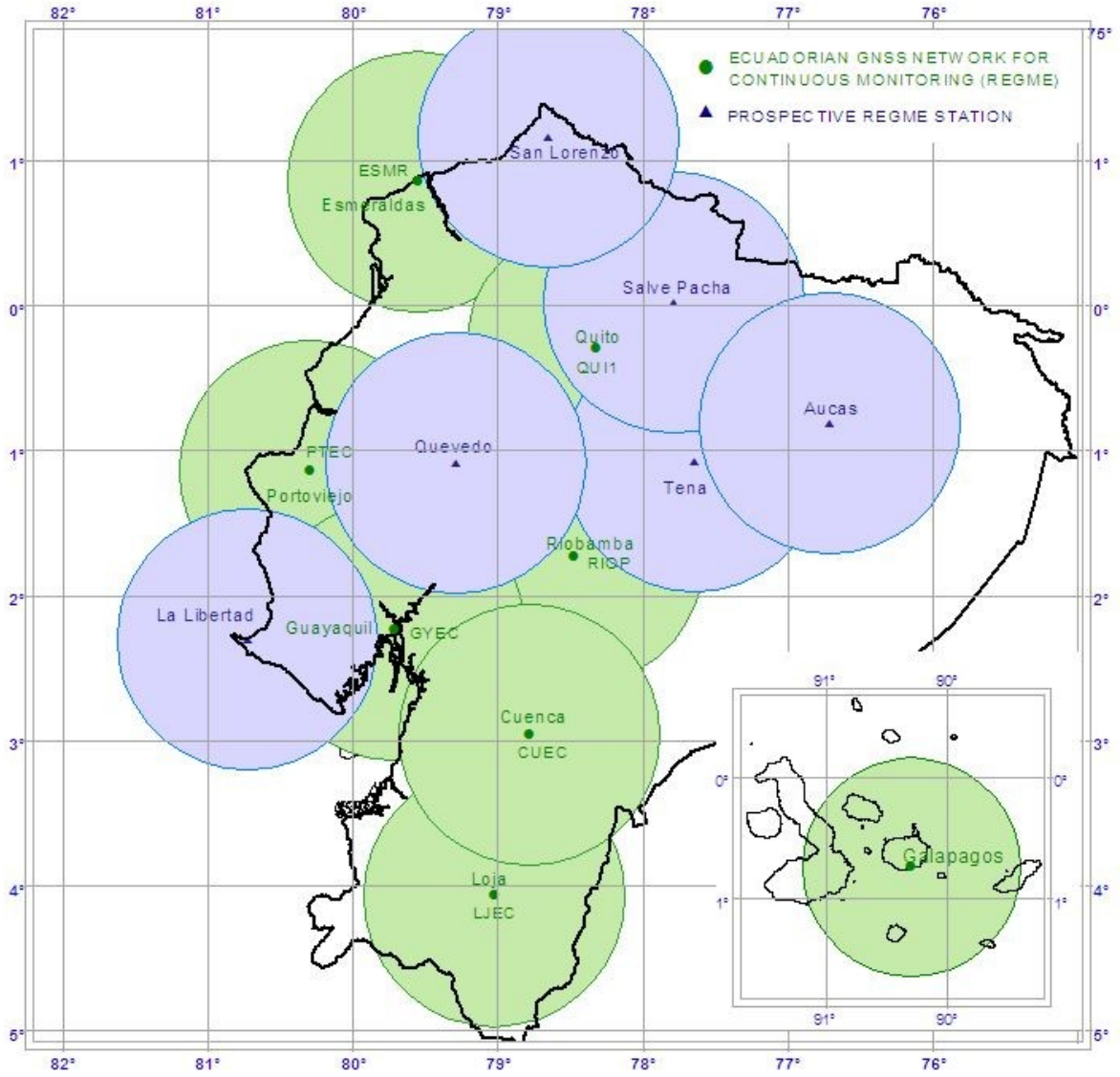
- REGME is currently composed of 8 stations:

– QUI1 (Quito)	GPS (IGS station)
– RIOP (Riobamba)	GPS (IGS station)
– GLPS (Pto. Ayora)	GPS (IGS station)
– PTEC (Portoviejo)	GPS+GLONASS
– GYEC (Guayaquil)	GPS+GLONASS
– CUEC (Cuenca)	GPS+GLONASS
– LJEC (Loja)	GPS+GLONASS
– ESMR (Esmeraldas)	GPS



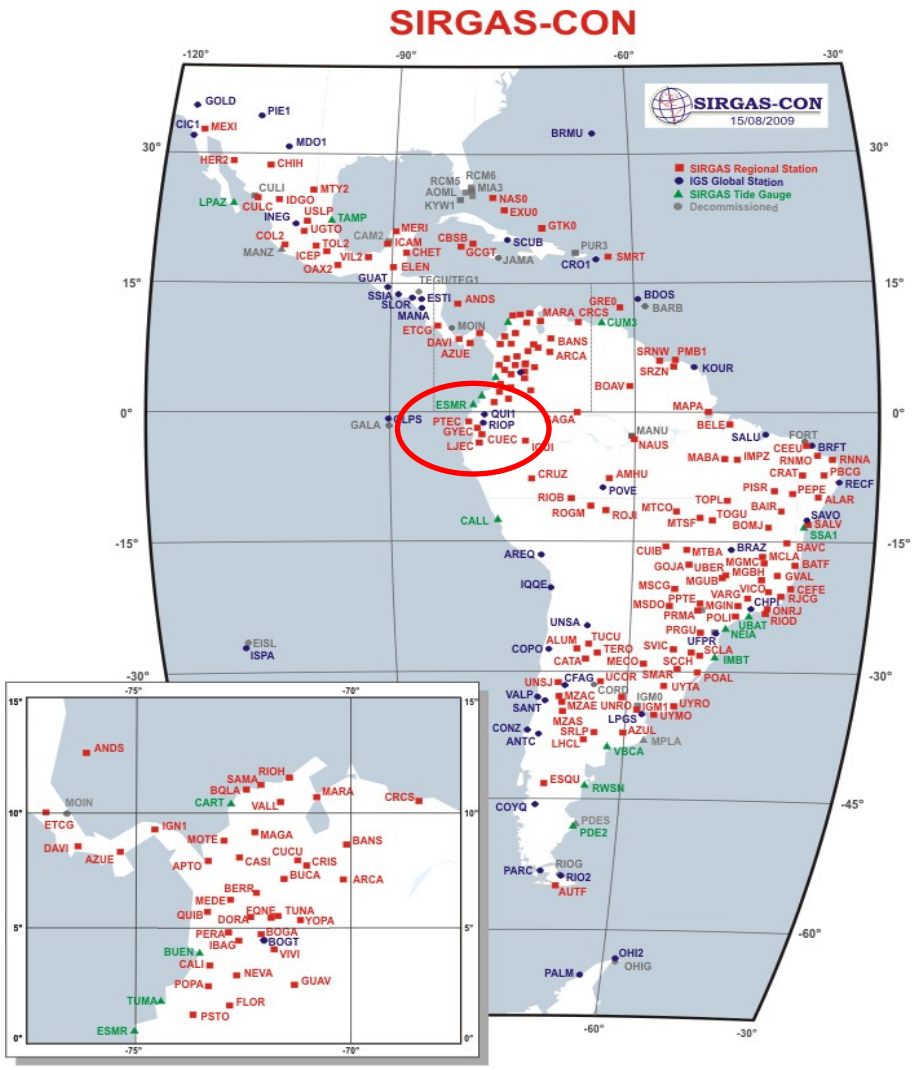
Future stations in 2009 and 2010

IGM, in collaboration with Geophysical Institute of Ecuador, has planned to install 6 station more.



REGME and SIRGAS-CON

REGME stations are also part of the continental network SIRGAS-CON and are officially processed by the German Geodetic Research Institute (DGFI) and the Brazilian Institute of Geography and Statistics (IBGE).



www.sirgas.org

Site selection

Consideration:

- Safety
- Access to Internet
- Stability
- Free of obstructions

Site selection

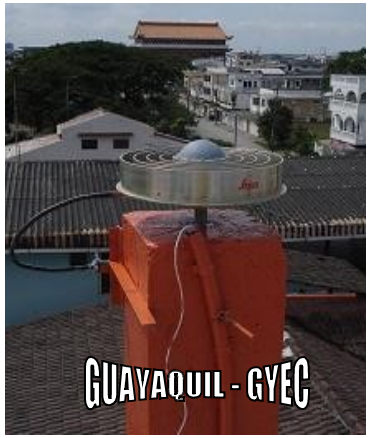
Additionally, a key feature of each site was to comply with a zero frequency external interference that could degrade the GPS signal quality, verified by a spectrum analyzer.

Monuments

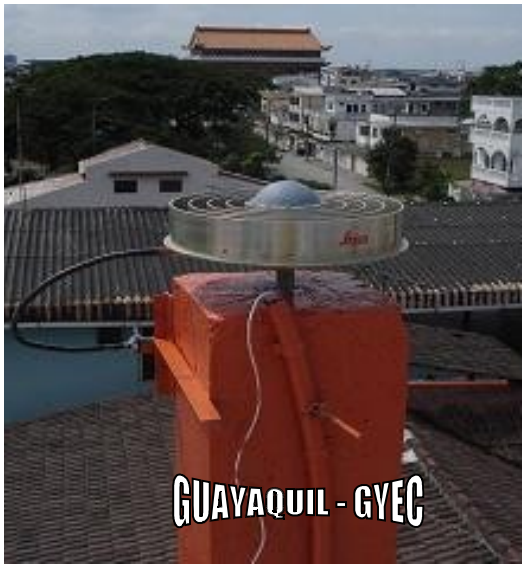
Concrete pillar

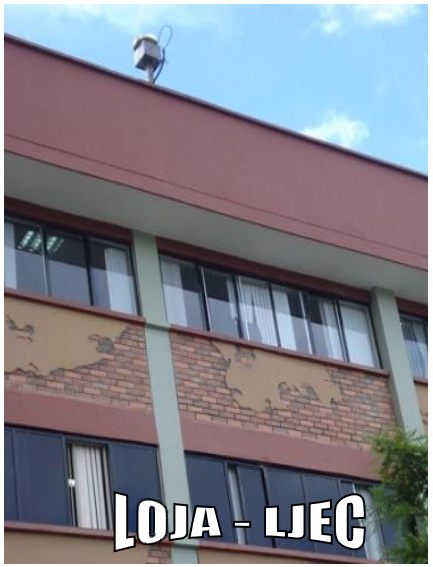
and

Steel structure



Force centering device
IBGE model





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INSTITUTO GEOGRAFICO MILITAR

SIRGAS

Station IGS code	Domes Number	Geographic Coordinates
GYEC	42007M001	Datum: IGS05, época: 2009.1 Latitud: 02º 08‘ 57.6847" S Longitud: 79º 53' 30.7143" W Altura Elipsoidal: 35.221 m
CUEC	42009M001	Datum: IGS05, época: 2009.1 Latitud: 02º 52' 59.8687"S Longitud: 79º 0' 8.9895" W Altura Elipsoidal: 2631.161 m
PTEC	42008M001	Datum: IGS05, época: 2009.1 Latitud: 01º 3' 28.9390" S Longitud: 80º 28' 28.4230" W Altura Elipsoidal: 63.450 m
LJEC	42010M001	Datum: IGS05, época: 2009.1 Latitud: 03º 59' 17.7375" S Longitud: 79º 11' 54.7351" W Altura Elipsoidal: 2143.522 m
RIOP	42006M001	Datum: IGS05, época: 2009.1 Latitud: 01º 39' 2.1439 " S Longitud: 78º 39' 3.9855 " W Altura Elipsoidal: 2817.197 m.
GLPS	42005M002	Datum: IGS05, época: 2009.1 Latitud: 00º 44' 34.7966 " S Longitud: 90º 18' 13.2128 " W Altura Elipsoidal: 1.799 m
QUI1	42003S003	Datum: IGS05, época: 2009.1 Latitud: 00º 44' 34.7966 " S Longitud: 90º 18' 13.2128 ‘‘ W Altura Elipsoidal: 1.799 m
ESMR	42011M001	Datum: IGS05, época: 2009.7 Latitud: 00 56 4.7333” N Longitud: 79 43 27.7425 W Altura Elipsoidal: 251.690 m

REGME coordinates

- REGME coordinates fixed weekly are available in: (http://www.sirgas.org/index.php?id=153)

ates > Constrained Weekly Solutions

SIRGAS-CON Constrained Weekly Solutions

Weekly coordinates aligned to the IGS05 reference frame for the **SIRGAS-CON** stations (SIRGAS-CON-C + SIRGAS-CON-D stations) are generated after combining the loosely constrained weekly solutions delivered by the **SIRGAS Processing Centres**.

The file names correspond to ***siryyPwwww***:

sir identifies the content of the file as a official SIRGAS product,
yy represent the last two digits of the year,
P stays for GPS technique,
wwww is the GPS week.

Files with extension **crd** contain the final weekly SIRGAS-CON coordinates. Files with extension **SUM** are the corresponding reports.

Reference Epoch	Week	Coordinates	Reports
2009-07-29 (2009.58)	1542	sir09P1542.crd	SIR15427.SUM
2009-07-22 (2009.56)	1541	sir09P1541.crd	SIR15417.SUM
2009-07-15 (2009.54)	1540	sir09P1540.crd	SIR15407.SUM
2009-07-08 (2009.52)	1539	sir09P1539.crd	SIR15397.SUM
2009-07-01 (2009.50)	1538	sir09P1538.crd	SIR15387.SUM
2009-06-24 (2009.48)	1537	sir09P1537.crd	SIR15377.SUM
2009-06-17 (2009.46)	1536	sir09P1536.crd	SIR15367.SUM
2009-06-10 (2009.44)	1535	sir09P1535.crd	SIR15357.SUM
2009-06-03 (2009.42)	1534	sir09P1534.crd	SIR15347.SUM

SIRGAS constrained combination for week 1542 (wrt igs09P1542) 27-AUG-09

LOCAL GEODETIC DATUM: IGS05 EPOCH: 2009-07-29 12:00:00

NUM	STATION NAME	X (M)	Y (M)	Z (M)	FLAG
6	ALAR 41653M001	5043729.6994	-3753105.5751	-1072966.9409	A
11	ALUM 41535M001	2253309.6628	-5206250.7777	-2911357.3273	A
18	APTO 41933S001	1460797.8608	-6147200.8077	868399.4839	A
19	ARCA 41909S001	2086018.6652	-5976299.5734	781400.5229	A
20	AREQ 42202M005	1942826.2105	-5804070.3453	-1796894.2383	A
24	AUTF 41515S001	1360918.9292	-3420457.9620	-5191175.2141	A
29	AZUE 41301M001	1049978.1805	-6229340.6447	876934.2220	A
30	AZUL 41529M001	2566993.1305	-4424962.8076	-3796807.7403	A
31	BAIR 41665M001	4659351.6400	-4174512.2262	-1242318.8659	A
34	BANS 42403M001	2132376.3595	-5935471.3350	948857.2728	A
37	BATF 41666M001	4677358.3194	-3889198.8419	-1911503.8981	A
38	BAVC 41669M001	4667609.3340	-4029356.5355	-1628384.8300	A
41	BDOS 43401M001	3143382.2578	-5359714.7826	1434875.8511	A
42	BELE 41622M001	4228139.0168	-4772752.1018	-155761.2527	A
43	BERR 41910S001	1703223.7003	-6104502.3270	716436.9527	A
47	BOAV 41636M001	3117452.1950	-5555487.8413	314480.8557	A
48	BOGA 41901M002	1744517.2953	-6116051.3500	512580.9717	A
50	BOGT 41901M001	1744398.9702	-6116037.3076	512731.7745	A
51	BOMJ 41612M001	4510195.8235	-4268322.3650	-1453035.1727	A
54	BRAZ 41606M001	4115014.0781	-4550641.5894	-1741443.9017	W
56	BRFT 41602M002	4985393.5230	-3954993.4365	-428426.6559	A
57	BRMU 42501S004	2304703.4225	-4874817.1961	3395186.9907	A
63	BUEN 41912S001	1430383.8719	-6200818.1689	428934.0286	A
67	CALI 41903S001	1483099.9481	-6193060.1932	373124.1070	A
68	CALL 42205M001	1387454.2021	-6081996.1927	-1324212.2112	A
73	CASI 41914S001	1613574.4269	-6107148.7837	880567.2080	A
75	CATA 41534M001	2302597.6635	-5117329.0742	-3022751.2692	A
76	CBSB 80402M001	1060277.1502	-5912339.4044	2137708.3891	A
79	CEEU 41602M003	4985392.7398	-3954993.3053	-428437.8492	A
80	CEFE 41637M001	4562488.4926	-3871935.8291	-2200001.4563	A
81	CFAG 41517S001	2016584.9118	-5050165.6544	-3323308.7203	A
84	CHET 40526M001	179584.7428	-6048080.6775	2010447.3531	A
85	CHIH 40525M001	-1552307.8522	-5382771.9626	3041779.7629	A
86	CHPI 41609M003	4164613.8891	-4162456.9095	-2445028.7534	W
90	CIC1 40508M002	-2433177.2411	-4845044.7579	3348295.9439	A
96	COL2 40524M001	-1427005.6477	-5852976.0530	2089088.9553	A
98	CONZ 41719M002	1492007.7425	-4887910.7260	-3803639.8601	W
99	COPO 41714S001	1907040.8475	-5337379.0332	-2916334.7724	A
106	CRAT 41619M001	4888826.0176	-4017957.4588	-798308.8934	A
107	CRCS 42401M001	2459721.8594	-5770508.8791	1155112.0793	A
108	CRO1 43201M001	2607771.2535	-5488076.6583	1932767.8439	W
110	CUCU 41904S001	1901228.7150	-6025504.3000	870700.5314	A
111	CUEC 42009M001	1215704.3307	-6255712.1901	-318818.9634	A
112	CUIB 41603M001	3430711.3952	-5099641.6871	1699432.8204	A
113	CULC 40529M001	-1733739.0308	-5528108.5980	2658500.5262	A
120	DAVI 41302M001	830823.7994	-6254882.4658	928363.0355	A

113	CULC	40529M001	-1733739.0308	-5528108.5980	2658500.5262	A
120	DAVI	41302M001	830823.7994	-6254882.4658	928363.0355	A
138	ESQU	41533M001	1498229.0632	-4432287.0863	-4321164.2524	A
140	ETCG	40602M001	645208.2861	-6249842.1780	1100399.5250	A
144	FLOR	41916S001	1585141.0855	-6175731.4538	179144.8819	A
147	FQNE	41936S001	1779063.7838	-6097672.8759	603896.7396	A
151	GCGT	80401M001	902661.6403	-5954125.6731	2093986.0121	A
153	GLPS	42005M002	-33801.4241	-6377516.5336	-82154.3469	W
158	GOJA	41654M001	3761502.4023	-4767353.0149	-1946325.8665	A
159	GOLD	40405S031	-2353614.4008	-4641385.3080	3676976.4157	W
164	GREO	43501S001	2961421.0669	-5486288.7366	1341394.3823	A
165	GTKO	43602S007	1919596.6266	-5620954.2447	2316053.9593	A
167	GUAT	40901S001	-56063.5594	-6174978.6780	1596665.2802	A
170	GVAL	41623M001	4490200.8030	-4036984.9750	-2048288.2810	A
171	GYEC	42007M001	1118628.4254	-6274783.8309	-237610.2718	A
176	HER2	40522M001	-1996004.0215	-5208674.5172	3082959.5475	A
190	ICAM	40514M002	-55248.6264	-6001113.5274	2152446.1832	A
191	ICEP	40531M001	-859277.4035	-5972129.1249	2067506.6595	A
192	IDGO	40532M001	-1469909.7075	-5640213.6076	2585866.5501	A
195	IGM1	41505M003	2751804.0506	-4479879.3285	-3598922.4815	A
196	IGN1	41303M001	1144297.0981	-6195649.8168	989518.5586	A
200	IMBT	41638M001	3714771.5479	-4221851.1268	-2999473.8246	A
201	IMPZ	41615M001	4289656.4116	-4680884.9565	-606347.2061	A
202	INEG	40507M001	-1260435.6919	-5788547.1299	2360340.0093	A
204	IQQE	41708S002	2034208.5687	-5629172.3230	-2196141.8184	A
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208	ISPA	41703M007	-1881703.3692	-5359979.8146	-2890599.2657	W
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240	LHCL	41518S001	2079355.6278	-4582903.4964	-3905925.6404	A
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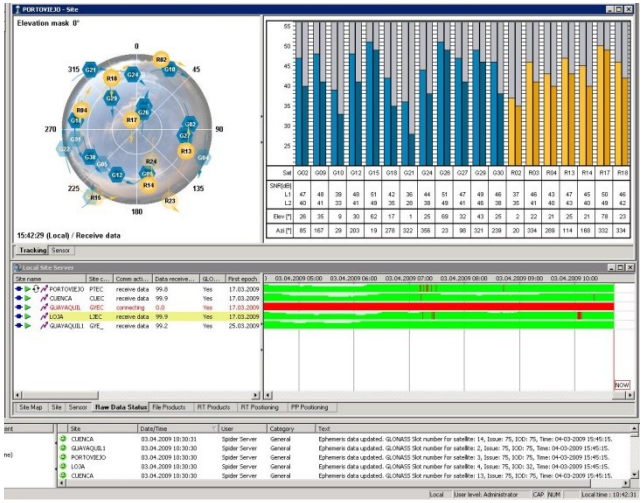
243	LPAZ	40521M001	-2022283.5259	-5461274.1326	2592317.1690	A
244	LPGS	41510M001	2780103.0139	-4437418.9532	-3629404.4758	W
245	MABA	41642M001	4156055.6313	-4801656.5280	-592100.5326	A
248	MAGA	41920S001	1654991.2462	-6074533.3497	1017358.6798	A
251	MANA	41201S001	407981.8673	-6222925.7029	1333528.9918	W
254	MAPA	41629M001	4005461.1327	-4963550.3351	5162.3537	A
256	MARA	42402M001	1976117.1878	-5948895.1226	1173592.2851	A
264	MCLA	41624M001	4404519.5914	-4235798.4372	-1823409.0599	A
266	MDO1	40442M012	-1329998.8343	-5328393.3713	3236504.1362	W
271	MERI	40520M001	39480.7447	-5957733.1181	2269335.1239	A
274	MEXI	40519M001	-2312591.0033	-4853743.6046	3419740.5183	A
275	MGBH	41667M001	4320741.8170	-4161560.5092	-2161984.1254	A
276	MGIN	41647M001	4076879.9504	-4270390.9571	-2407418.0137	A
277	MGMC	41624M002	4406284.9378	-4234092.8616	-1822973.6984	A
278	MGUB	41652M001	4019130.6128	-4504012.5856	-2055168.6869	A
288	MSCG	41649M001	3468912.0736	-4870550.4631	-2213735.4155	A
289	MSDO	41672M001	3404321.3237	-4828421.5850	-2396836.8797	A
290	MTBA	41663M001	3755485.2683	-4852853.5447	-1735109.1458	A
291	MTCO	41670M001	3553110.8345	-5161363.4763	-1187759.9312	A
294	MTSF	41655M001	3960733.8321	-4832787.7516	-1276215.0588	A
295	MTY2	40518M001	-1029483.5050	-5657637.2385	2750926.0979	A
296	MZAC	41503M001	1932262.7294	-5001226.5452	-3444667.8041	A
297	MZAE	41530M001	1987261.2657	-4955975.7307	-3477976.9463	A
298	MZAS	41528M001	1940230.2093	-4884145.4473	-3603203.6841	A
301	NASO	43607S001	1255070.7792	-5643661.8778	2684338.9798	A
302	NAUS	41614M002	3179409.3486	-5519130.6635	-334110.0528	A
304	NEIA	41620M002	3875254.9913	-4292588.7518	-2681108.6707	A
306	NEVA	41923S001	1617259.9729	-6161575.1481	324674.7155	A
323	OAX2	40517M001	-713483.0550	-6058316.0923	1861594.7020	A
325	OHI2	66008M005	1525811.9537	-2432478.2286	-5676165.5993	A
328	ONRJ	41635M001	4283638.3675	-4026028.8705	-2466096.7249	A
334	PALM	66005M002	1192671.9865	-2450887.6425	-5747096.0561	A
339	PBCG	41656M001	5125899.3997	-3711505.6507	-795650.4953	A
340	PDE2	41524M002	1754149.8850	-3921337.4316	-4698743.1234	A
344	PEPE	41650M001	4785329.9244	-4087942.5045	-1033193.8870	A
345	PERA	41905S001	1571418.6874	-6160208.4185	529446.4663	A
350	PIE1	40456M001	-1640916.9701	-5014781.2000	3575447.0717	W
353	PISR	41673M001	4629725.2708	-4272600.3230	-994572.5052	A
354	PMB1	43702S001	3626394.1415	-5206998.1435	643353.1590	A
357	POAL	41616M001	3467519.4229	-4300378.5848	-3177517.6293	A
360	POLI	41630M001	4010099.5220	-4259927.3564	-2533538.6894	A
362	POPA	41924S001	1477067.4530	-6200659.1079	270141.3363	A
364	POVE	41628M001	2774265.6126	-5662060.1567	-959415.8763	A
365	PPTE	41611M002	3687624.3693	-4620818.7156	-2386880.2627	A
368	PRGU	41671M001	3590927.1208	-4512405.6821	-2718013.2592	A
369	PRMA	41674M001	3610720.8310	-4611288.4350	-2518636.2314	A
370	PSTO	41925S001	1404951.7568	-6222655.0932	134028.6552	A
373	PTEC	42008M001	1055320.8004	-6289193.9715	-116986.5083	A
378	QUI1	42003S003	1272867.3542	-6252772.1287	-23801.7207	A
384	RECF	41617M001	5176588.6152	-3618162.1745	-887363.7969	A
389	RIO2	41507M006	1429907.8250	-3495354.8562	-5122698.6187	A
390	RIOB	41645M001	2373576.7777	-5817088.3888	-1096515.6542	A
391	RIOD	41608M001	4280294.8839	-4034431.2700	-2458141.2656	A
394	RIOP	42006M001	1255144.9657	-6253609.4466	-182569.8098	A
395	RJCG	41657M001	4450354.2547	-3913332.8240	-2350256.2686	A
396	RNMO	41664M001	5051170.1618	-3851509.5123	-574681.2782	A
397	RNNA	41668M001	5184572.5047	-3658358.2713	-644238.5265	A
400	ROJI	41658M001	2945010.5648	-5529377.0361	-1194259.2091	A
402	RWSN	41513M001	1956973.4407	-4217335.3439	-4351745.4621	A
403	SAGA	41639M001	2486243.7526	-5873685.3325	-15906.7138	A
404	SALU	41640M001	4566947.8832	-4443098.5201	-286674.6926	A
406	SAMA	41928S001	1704996.2163	-6020152.3126	1233459.2483	A
407	SANT	41705M003	1769693.6261	-5044574.1810	-3468320.8856	W
409	SAVO	41643M001	4870283.7448	-3864605.3107	-1418872.5042	A
410	SCCH	41659M001	3450305.4304	-4512731.6970	-2892128.1481	A
413	SCLA	41660M001	3606986.0519	-4345293.2757	-2956654.0986	A
415	SCUB	40701M001	1474538.0678	-5811243.2810	2168958.8389	W
424	SMAR	41621M001	3280748.4166	-4468909.7859	-3143408.5860	A
425	SMRT	43102S001	2743826.2151	-5410452.4474	1962823.0061	A

GNSS DATA PROCESSING CENTRE OF ECUADOR (CEPGE).

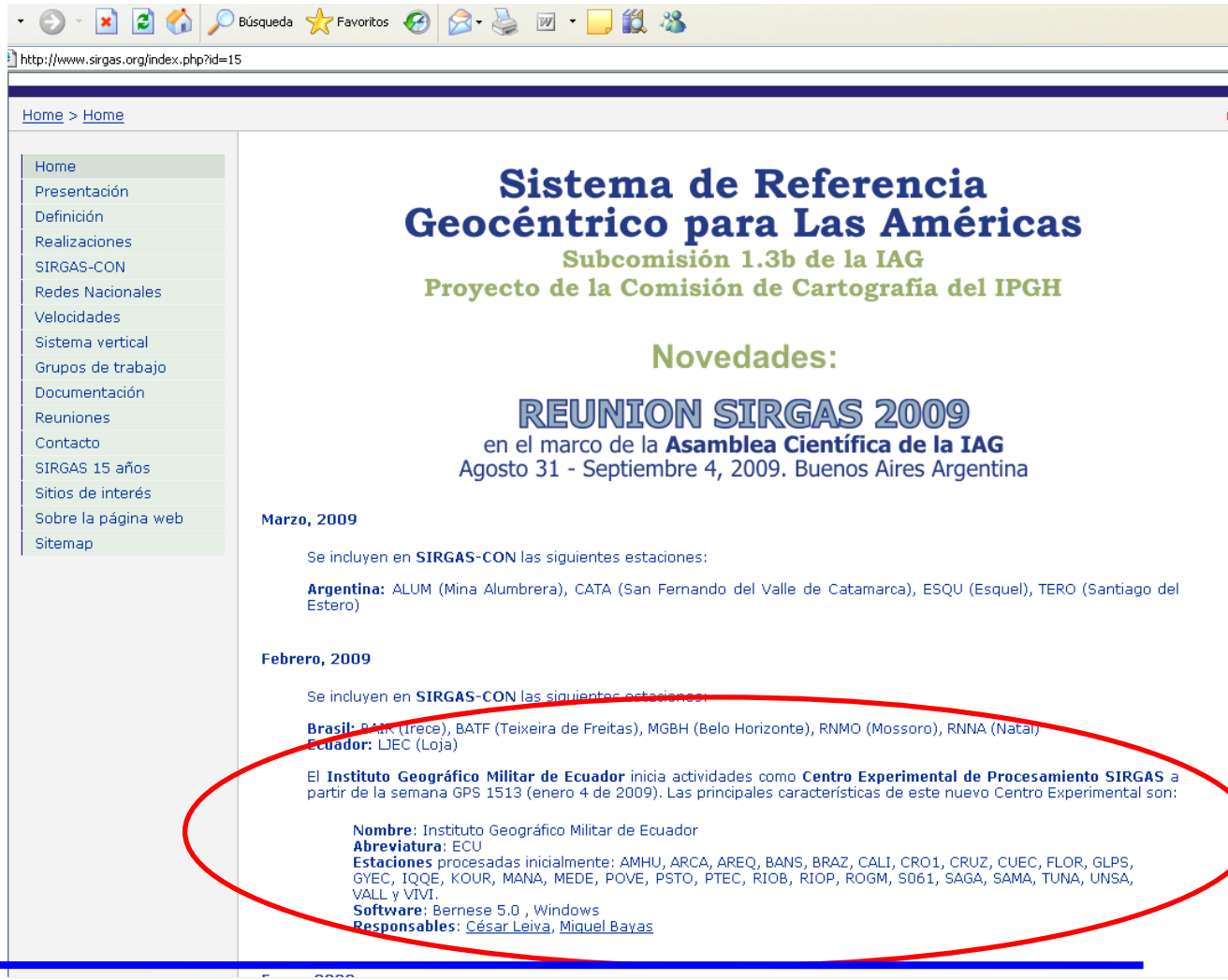
Introduction

- GNSS Data Processing Centre of Ecuador was created in 2008.
- CEPGE is equipped with the scientific Bernese software version 5.0, thanks to a cooperation agreement between the DGFI, the University of Bern, and the IGM.

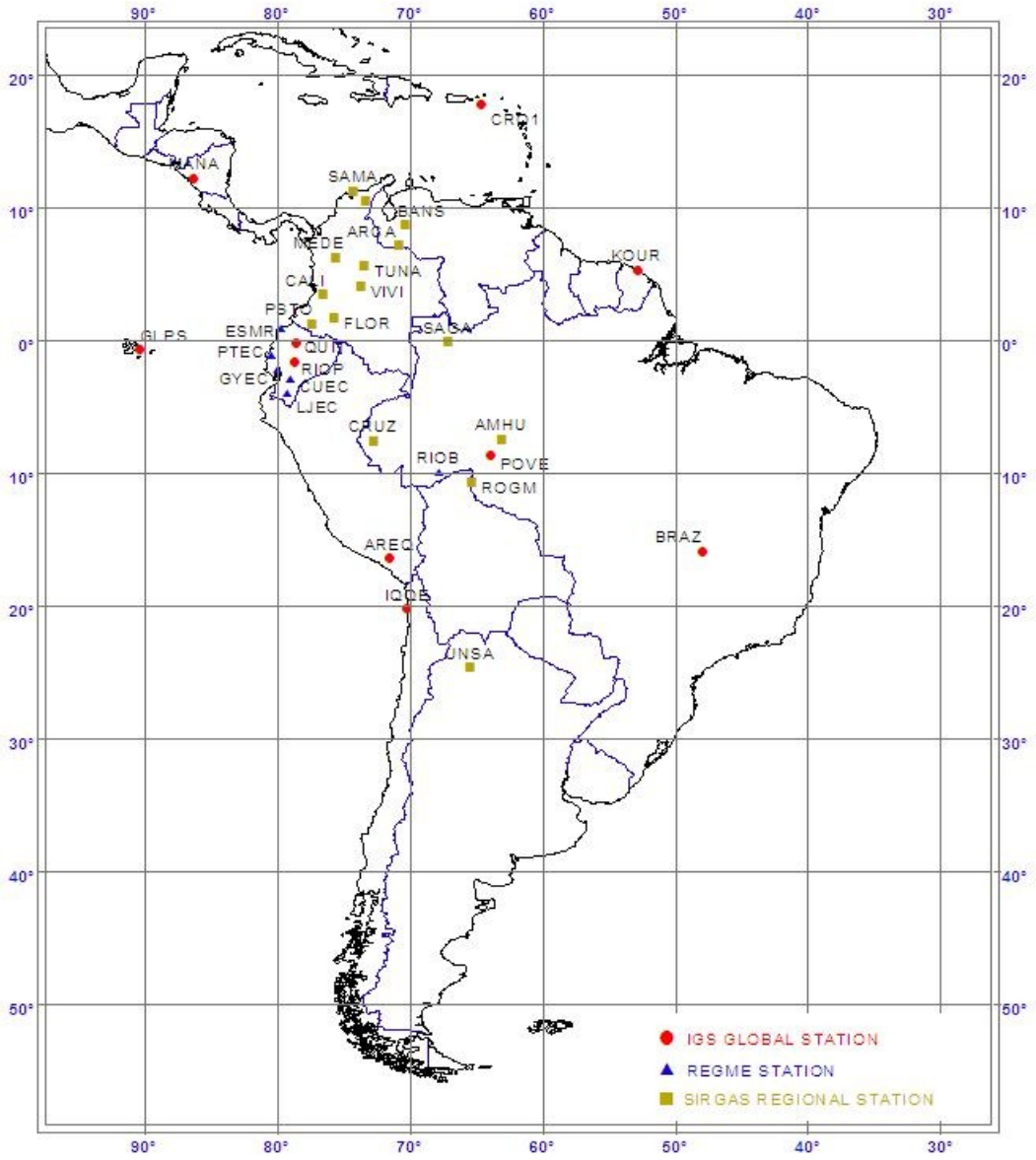


CEPGE and SIRGAS

At present, the CEPGE acts as a SIRGAS experimental processing centre since GPS week 1513 (January 4, 2009), within a year of training and strictly observance of the SIRGAS guidelines for processing, CEPGE is expected to become an official SIRGAS Analysis Center.



This centre processes 34 SIRGAS-CON stations and generates loosely constrained weekly solutions (sinex format) that are sent to SIRGAS for evaluation.



Network processed (1/2)

Nro.	Station	OMES umber	Status	Network	echa de Instalación	ncluida en el rocesamiento Semana GPS)	bicación
1	AMHU	41646M001	Inactivo	MBC	15/10/2007	- - - -	Humaita, Brasil
2	ARCA	41909S001	Activo	AGNA-ECO	04/08/2008	1513	Arauca , Colombia
3	AREQ	42202M005	Activo	GS	01/01/1993	1513	Arequipa, Peru
4	BANS	42403M001	Activo	EMOS	09/01/2006	1521	Barinas , Venezuela
5	BRAZ	41606M001	Activo	GS05/RBMC/ IBaC	03/03/1995	1515	Brasilia, Brasil
6	CALI	41903S001	Activo	AGNA-ECO	10/02/2004	1519	Cali, Colombia
7	CALL	42005M001	Activo	GN	03/07/2009	1542	El Callao,Lima, Perú
8	CRO1	43201M001	Activo	GS05	16/01/1994	1513	Saint Croix, USA
9	CRUZ	41641M001	Activo	MBC	22/03/2007	1516	Cruzeiro do Sul , Brasil
10	CUEC	42009M001	Activo	EGME	28/10/2008	1513	Cuenca , Ecuador
11	ESMR	42011M001	Activo	EGME	01/07/2009	1538	Esmeraldas, Ecuador
12	FLOR	41916S001	Activo	AGNA-ECO	02/11/2006	1513	Florencia , Colombia
13	GLPS	42005M002	Activo	EGME-IGS05	08/03/2002	1513	Puerto Ayora , Ecuador
14	GYEC	42007M001	Activo	EGME	20/06/2008	1513	Guayaquil , Ecuador
15	IQQE	41708S002	Activo	GS	01/01/2002	1513	Iquique , Chile
16	IQUI	42204M001	Activo	GN	26/06/2009	1542	Iquitos, Perú
17	KOUR	97301M210	Activo	GS	18/10/1992	1513	Kourou, France

Network processed(2/2)

Orden	Estación	DOMES Number	t Estatus	etwork	echa Instalación	ncluida rocesamiento Semana (GPS)	bicación
18	LJEC	42010M001	Activo	EGME	16/01/2009	1513	Loja , Ecuador
19	MANA	41201S001	Activo	IGS05	13/05/2000	1513	Managua, Nicaragua
20	MEDE	41921S001	Inactivo	MAGNA-ECO	24/07/2005	- - - -	Medellin , Colombia
21	POVE	41628M001	Activo	IGS/RBMC/RIBaC	14/10/2005	1515	Porto Velho , Brasil
22	PSTO	41925S001	Activo	MAGNA-ECO	14/07/2005	1513	Pasto , Colombia
23	PTEC	42008M001	Activo	REGME	30/10/2008	1513	Portoviejo , Ecuador
24	RIOB	41645M001	Activo	RMBC	21/03/2007	1515	Rio Branco , Brasil
25	RIOP	42006M001	Inactivo	REGME-IGS	08/04/1996	1513	Riobamba , Ecuador
26	ROGM	41651M001	Activo	RMBC	19/10/2007	1515	Guajara-Mirim , Brasil
27	QUI1	42003S003	Activo	REGME-IGS05	02/03/2005	1513	Quito, Ecuador
28	SAGA	41639M001	Activo	RMBC	03/05/2007	1515	S.G.da Cachoeira , Brasil
29	SAMA	41928S001	Activo	MAGNA-ECO	04/05/2006	1513	Santa Marta, Colombia
30	TUNA	41930S001	Activo	MAGNA-ECO	18/10/2005	1513	Tunja, Colombia
31	UNSA	41514M001	Activo	IGS05/RAMSAC	26/01/1995	1513	Salta , Argentina
32	VALL	41906S001	Activo	MAGNA-ECO	12/02/2004	1513	Valledupar, Colombia
33	VIVI	41931S001	Activo	MAGNA-ECO	05/07/2005	1515	Villavicencio, Colombia

Routine procedures in processing

Obtaining precise ephemerides and EOPs:

ftp://igscb.jpl.nasa.gov/pub/product/(GPSWeek)
ftp://cddis.gsfc.nasa.gov/gps/products/(GPSWeek)
ftp://garner.ucsd.edu/pub/products/(GPSWeek)

Obtaining global ionospheric models:

ftp://ftp.unibe.ch/aiub/CODE/(Year)

Obtaining RINEX observation:

IGS stations	ftp://cddis.gsfc.nasa.gov/gps/data/daily/
Brazilian stations	www.ibge.gov.br/home/geociencias/download/tela_inicial.php?tipo=8
Colombian stations	ftp://200.93.130.130/User_Password
Venezuelan stations	ftp://200.44.126.166/User_Password
Peruvian stations	ftp://129.187.165.2/User_Password
Ecuadorian stations	ftp://190.152.4.122 /User_Password

Obtaining satellite information

ftp://ftp.unibe.cc/aiub/BSWUSER50/GEN

SATELLIT.I05
SATELLIT
SAT2009.CRX

CEPGE, regulary reporting loosely constrained weekly solutions (in SINEX format) for the coordinates of the stations. These solutions are mutually evaluated by SIRGAS, IBGE and DGFI, in order to establish the reliability and quality of the calculations.


GALAPAGOS Island
Thank you very much!