Las Palmas de Gran Canaria Council Town Network Reference Frame Testing

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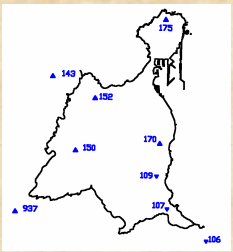
Official coordinates of Canary geodetic network (REGCAN95) are referred to ITRF (epoch 1994.9). During 2001-2002 years Las Palmas de Gran Canaria town council was carried out a municipal geodetic network (RTM) based in the official reference frame. As previous step, a 9 common points field campaign was carried out (October, 2001) using Leica System 500 receivers. GPS observations were processed using Bernese 4.2 software with MAS1 31303M002 CODE weekly coordinates hold fixed. To analyze the different reference frames involved, some transformations have been carried out. Process description, results and conclusions are presented in this paper.

CHARACTERISTICS OF THE ZONE

The Canary Islands make up an archipelago located in front of western African coast.



The municipality of Las Palmas de Gran Canaria, has an approximately surface of 100 km2. The municipality has 9 vertexes of the Net REGCAN95 with a half distance among vertexes of 3,5 km. Due to the drop density of existent vertexes, the city council decided to carry out a municipal topographical net.

The frame of reference of the Municipal Net of Las Palmas de Gran Canaria is the solution REGCAN95 [ref1]. Independently that REGCAN95 is a reliable solution, to official being, it is convenient to accomplish a same analysis of her, right now than the errors of the aforementioned solution will transfer directly the coordinates of the municipal net themselves.

The observations were carried out with 5 teams Leica SR530. The teams have been distributed in the following way:

SESION 1	SESION 2	SESION 3	SESION 4
175	175	109	109
143	937	937	106
152	152	107	107
170	170	170	170
150	150	150	150

GPS PROCESSING DESCRIPTION

Processing consisted of two steps:

1.-Link between MAS1 (31303M002) IGS Station and 150 REGCAN network station

Processing software	Bernese V4.2
Ephemeris	CODE weekly final orbits COD11342.EPH
Earth Rotation Parameters	CODE weekly final ERPs COD11347.ERP
Fixed Point Coordinates	CODE EUREF weekly coordinate solution (IGS97) week 1134, year 2001 epoch 2001-10-03 11:59:45
Antenna Phase Corrections	NOAA GPS antenna calibration
Slope distance	38022.2016 m
Observation Span Time	8 hours
Register Interval	30 seconds

2.-Radiation from 150 REGCAN network station to the rest of the selected REGCAN stations (175,143,152,170,,937,106,107,109)

Processing software	Bernese V4.2
Ephemeris	CODE weekly final orbits COD11342.EPH
Earth Rotation Parameters	CODE weekly final ERPs COD11347.ERP
Fixed Point Coordinates	0005 coordinates from step 1 (IGS97) week 1134, year 2001 epoch 2001-10-03 11:59:45
Antenna Phase Corrections	NOAA GPS antenna calibration
Slope distance	4332 m – 12368 m
Observation Span Time	1 hours – 5 hours
Register Interval	15 seconds

DESCRIPTION OF ANALYSIS

With the object of checking the precision of the aforementioned frame of reference REGCAN95 is convenient to accomplish an analysis of the solution, he comes from the following form:

STEP 1: THE COMPARISON OF THE COORDINATES OF ENTRY

STEP 2: COMPARISON OF COORDINATES IN ETRS89, EPOCA 1988.0

STEP 3: DETECTION OF SYSTEMATIC DISPLACEMENT

In order to justify the possible systematic differences in coordinates they have determined three changes of referential system:

- Helmert's transformation of seven parameters: translation, rotation and scale factor.

- Transformation for rotation and translation.

- Transformation for translation.

One comes to an end as from obtained results:

1. It is convenient to eliminate the point 175.

2. The more adjusted model corresponds to the third case, transformation for translation.

DIFFERENCE REGCAN95 - RED2001					DIFFERENCE REDCAN95 - RED2001 IN ETRS89 EPOCH 1989.0				
Point	dx	dy	dz	Total	Point	dx	dy	dz	Total
143	0.0182	0.1096	0.0937	0.1454	**143**	0.0233	0.0030	0.0441	0.0500
150	-0.0082	0.1244	0.0888	0.1531	**150**	-0.0031	0.0178	0.0392	0.0432
152	0.0470	0.1020	0.1130	0.1593	**152**	0.0520	-0.0047	0.0634	0.0821
170	0.0489	0.1104	0.1107	0.1638	**170**	0.0539	0.0038	0.0611	0.0815
175	0.0166	0.1400	0.0083	0.1413	**175**	0.0217	0.0334	-0.0413	0.0574
937	0.0367	0.1192	0.1026	0.1615	**937**	0.0418	0.0125	0.0530	0.0687
106	0.0544	0.1143	0.1412	0.1896	**106**	0.0595	0.0076	0.0916	0.1095
107	0.0472	0.1127	0.0953	0.1550	**107**	0.0523	0.0061	0.0457	0.0697
109	0.0322	0.0839	0.1181	0.1484	**109**	0.0373	-0.0227	0.0685	0.0812

CONCLUSION OF THE STEP 1:

The found differences are excessive for precision supposed for both coordinate groups: In REGCAN95 0,05 m and in RED2001 0,02 m. The obtained differences can should to:

- The passed span among two observations, what will be detected if both solutions compare in a same referential frame and a same epoch. Elects him ETRS89 (epoch 1989,0), granted that the EUREF defines it origin as system and epoch and the necessary transformation process establishes [REF2].

- To a real displacement of points.

- To errors of measurement and calculation in the campaigns of observation.

- A combination of the previous errors.

CONCLUSION OF THE STEP 2:

They have seen the found differences notably reduced, 0,16 m have exceeded ones to 0,06 m. They would be able to assume some differences of this order of magnitude within intrinsic precision of the own net. However, in the following step it is attempted detecting the presence of a systematic displacement.

CONCLUSION OF THE STEP 3:

The barycentre among two solutions is displaced:

- **0,013 m in the eastern direction**
- **0,034 m in the north direction**
- **0,060 m in vertical displacement.**

Causes can be:

1. Considering that each join about have origin one at different:

-MASP for REGCAN95, Class C (precision to 0,05 m [ref3]

-MAS1 for RED2001, Class A (precision to 0,01 m [ref3])

Exists the possibility that the displacement be due to the relative error among both points origin, since the origin for REGCAN95 comes from class C (to 5 cm).

2. The use of different instruments and methodology, as well as calculation followed in both campaigns (software, type of ephemeris, treatment of the troposphere error ...). This hypothesis is backed up in the fact that the component vertical of the translation is of 0,06 m, that can be due to the treatment of the troposphere delay in calculation.

FINAL REMARKS

The precision of the frame of reference of the solution REGCAN95 (ITRF93, epoch 1994,9) at the Municipal Net is adequate and according to the official information.

For the Municipal Net of Las Palmas de Gran Canaria, exists a systematic displacement in the frame of reference of the solution (ITRF93, epoch 1994,9), of the order of 0,03 m in planimetry and 0,06 m in altimetry.

It has settled down the methodology that allows referring the Municipal Net to EUREF. It also allows integrating future campaigns of observation of the Municipal Net in EUREF

With the described process Municipal Net constitutes a densification of EUREF. This fact is of great utility for distinct organisms (for example, the dedicated to aviation)

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