Integration of the reference frame of El Salvador into SIRGAS (SIRGAS-ES2007.8)

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Introduction

The reference frame of El Salvador (*Red Geodésica Básica Nacional de El Salvador*) is a GPS base network of 38 stations (Fig.1). It was measured by the GG-IGCN using differential GPS positioning in partial sub-networks and in 36 daily sessions between October and December 2007. Most of the reference stations (28) were determined together with a secondary control point in order to ensure the long-term stability of the network.

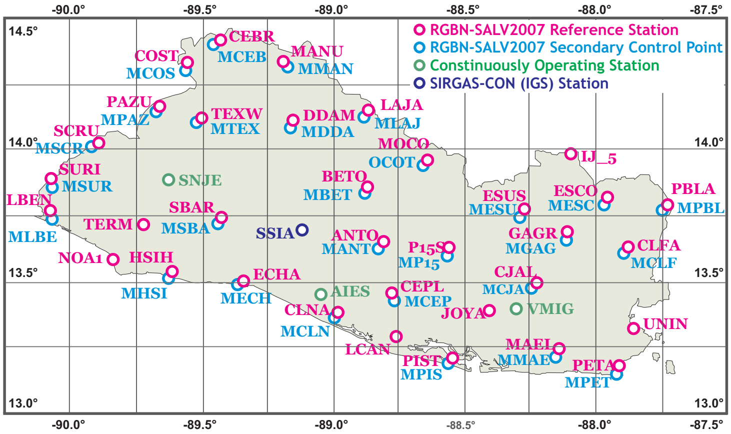

Fig. 1. National reference frame of El Salvador (Red Geodésica Básica Nacional de El Salvador, SIRGAS-ES2007.8)

Integration into SIRGAS

To provide a reliable reference frame, compatible with the GNSS technologies, the Salvadorian basic geodetic network shall guarantee consistency with the reference frame in which the GNSS orbits are computed, i.e. the ITRF. This consistency is achieved by integrating this network into the continental reference frame SIRGAS, which is the densification of the ITRF in Latin America and the Caribbean. So, for datum definition and control purposes, the observational data were processed together with 25 reference stations of the SIRGAS Continuously Operating Network (SIRGAS-CON) (Fig. 2). Consequently, this solution is called SIRGAS-ES2007.8: SIRGAS El Salvador2007.8 and, as SIRGAS is the regional ITRF densification, SIRGAS-ES2007.8 is the national SIRGAS densification in El Salvador.

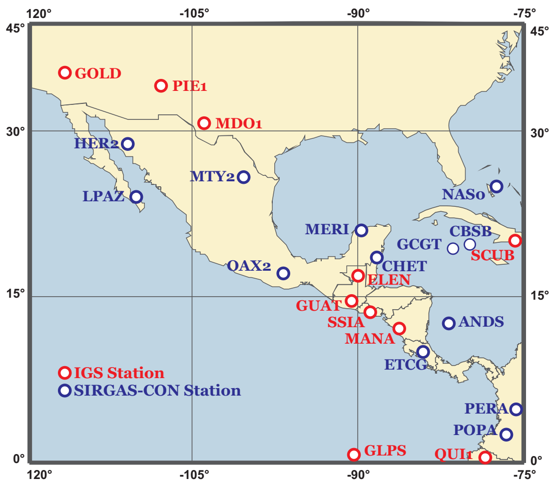

Fig. 2. SIRGAS-CON stations selected for the datum definition in the computation of the Salvadorian reference frame SIRGAS-ES2007.8

Data analysis

The GPS data were processed by DGFI within the SIRGAS-WGII (Geocentric Datum) activities. The analysis strategy is based on the double difference approach (Bernese Software V5.0, Dach et al. 2007), including the following characteristics:

1) Satellite orbits, satellite clock offsets, and EOPs are fixed to the combined weekly IGS solutions;
2) Absolute calibration values for the antenna phase centre corrections published by the IGS are applied;
3) L1 and L2 phase ambiguities are solved following the quasi ionosphere free (QIF) strategy;
4) Periodic site movements due to ocean tide loading are modeled according to the FES2004 model;
5) Zenith delay due to the tropospheric refraction (~wet part) is estimated at a 4 hours interval within the network adjustment. The Niell dry mapping function is applied to interpolate the a priori zenith delay (~dry part) modeled using the Saastamoinen approach.

In a first step, free solutions for the daily sub-networks are computed applying the above characteristics. Then, these partial networks are combined in the normal equation level into a unified solution. Daily station sessions with large residuals in the final combination (> ± 20 mm in N or E, and > ± 30 mm in Up) are reduced from the normal equations.

Results

The final solution aligned to the SIRGAS reference frame is computed with datum constrained to the selected SIRGAS-CON stations (Fig 2). The weights of the reference coordinates are inversely proportional to the internal precision of the GPS measurements (±1E-04 m in the Bernese Software). The final positions of SIRGAS-ES2007.8 refer to the IGS05 (IGS realization of ITRF2005) and they are valid for the mean epoch of the total time span in which the observations were carried out, i.e. 2007.8 (November 7, 2007). The precision of coordinates at the reference epoch is estimated to be ±7 mm for the horizontal component and ±20 mm for the vertical one.

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