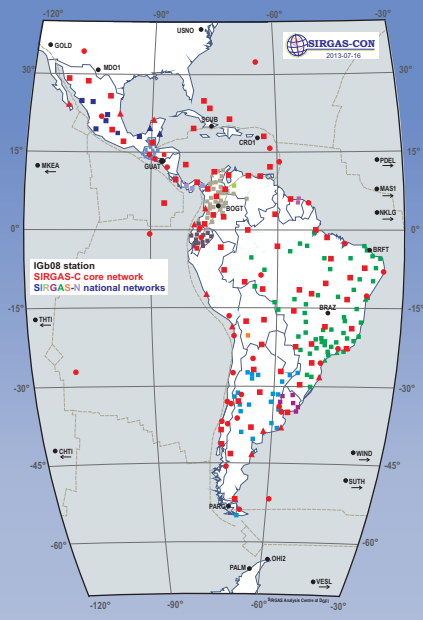
Recent activities of the SIRGAS Analysis Centre at DGFI

Laura Sánchez (sanchez@dgfi.badw.de)
Deutsches Geodätisches Forschungsinstitut (DGFI), Munich, Germany
IGS Regional Network Associate Analysis Centre for SIRGAS (IGS RNAAC SIR)

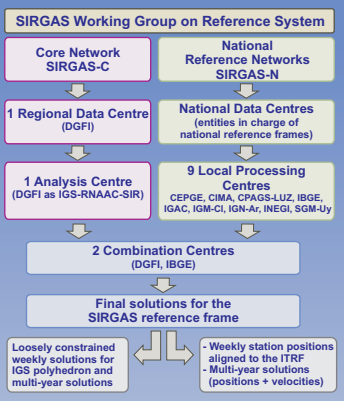
SIRGAS www.sirgas.org



The SIRGAS Reference Frame

The SIRGAS Reference Frame at present comprises **316 continuously operating GNSS stations**, distributed in **one core network (SIRGAS-C)**, primary densification of ITRF in Latin America, with a good continental coverage and stabile site locations to ensure high long-term stability of the reference frame; and the **national reference networks (SIRGAS-N)** improving the densification of the core network and providing accessibility to the reference frame at national and local levels. Both, the core network and the national networks satisfy the same characteristics and quality; and **each station is processed by three analysis centres**. This network includes 75 IGS stations, 140 GLONASS stations, 7 GALILEO stations and 69 stations with capability for data transmision in real time.

Routine analysis of the SIRGAS Reference Frame



The **SIRGAS-C core network** is processed by the **DGFI as IGS RNAAC SIR**, and the **SIRGAS-N national frames** are computed by the **SIRGAS Local Processing Centres: CEPGE (Ecuador), CIMA (Argentina), CPAGS-LUZ (Venezuela), IBGE (Brazil), IGAC (Colombia), IGM-Cl (Chile), IGN-Ar (Argentina), INEGI (Mexico), and SGM-Uy (Uruguay)**. Since January 2013, IGM-Cl acts as a SIRGAS Processing Centre and CIMA concentrates on the atmospheric modelling, without delivering more weekly solutions. The different SIRGAS Processing Centres follow the same standards for the computation of weekly solutions. INEGI-Mx and IGN-Ar work with the software GAMIT/GLOBK (Herring et al. 2010), all the other 7 centres use the Bernese GPS Software V. 5.0 (Dach et al. 2007). At the moment, all of them are updating the analysis software to meet the new standards released by the IGS for the reprocessing campaign 2. DGFI is applying the new processing standards and the Bernese GNSS Software V. 5.2 since July 2013.

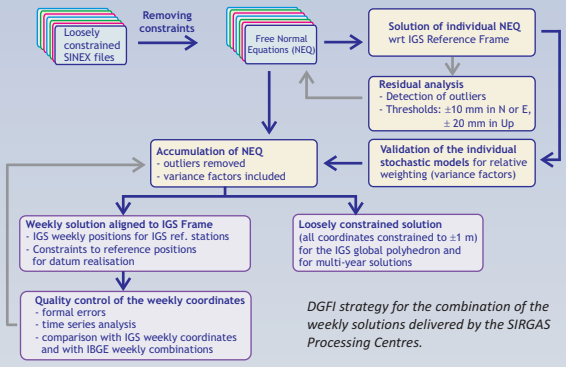
Weekly solutions of the SIRGAS Reference Frame

The weekly solutions delivered by the individual SIRGAS Processing Centres are integrated in a unified solution by the SIRGAS Combination Centres, DGFI and IBGE, to generate:

a) **Loosely constrained weekly solutions** for further combinations of the network (e.g. integration into the IGS polyhedron, computation of cumulative solutions, etc.). Based in these solutions, DGFI computes every year updated **multi-year solutions providing station positions and velocities** to estimate the kinematics of the reference frame and as support for applications requiring coordinate time-dependence.

b) **Weekly station positions** aligned to the same reference frame in which the IGS GNSS orbits are given; i.e. the IGS Reference Frame. These positions are applied as reference values for surveying applications in Latin America.

The DGFI (i.e. IGS RNAAC SIR) combination strategy corresponds to



DGFI strategy for the combination of the weekly solutions delivered by the SIRGAS Processing Centres.

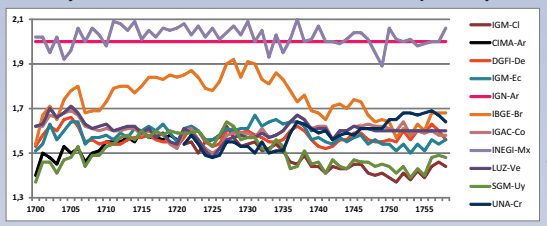
Experimental SIRGAS Analysis Centres

Experimental Analysis Centres are candidates to become SIRGAS Local Processing Centres. During a specified time period, they align their processing strategies to those required by SIRGAS and demonstrate their capacity for timely and continuously delivery of weekly solutions. Once they satisfy these requirements, they are appointed as official processing centres. Since the last week of December 2012, the **Centro Nacional de Procesamiento de Datos GNSS, Universidad Nacional, CNPDG-UNA of Costa Rica (UNA)** is under evaluation and the corresponding results are presented together with the results of the official processing centres. **The performance of CNPDG-UNA is in accordance with the other SIRGAS Analysis Centres** and therefore, it is recommended to install it as an official SIRGAS Processing Centre.

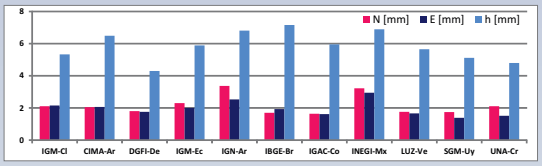
Quality control of the SIRGAS Reference Frame weekly solutions

The generation of the weekly SIRGAS products at DGFI includes a quality control at two levels: Firstly, the individual solutions delivered by the SIRGAS Processing Centres are analysed to establish their quality and consistency. This includes a survey about date of delivering, processed stations, log file observance, etc. Once the individual solutions are reviewed and free of inconsistencies, their combination is carried out by applying the procedure described above. Then, the second quality control concentrates on the results of this combination. Here, the main objective is to ascertain the accuracy and reliability of the weekly solutions for the entire SIRGAS network.

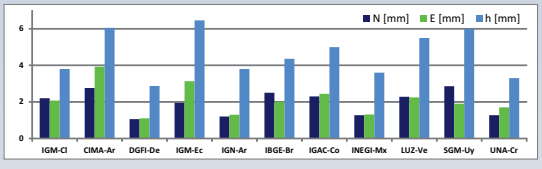
Quality control of the individual solutions (time span GPS weeks 1700 - 1758)



Mean standard deviations in [mm] of station positions after solving the SIRGAS individual solutions with respect to the IGS Reference Frame. These values represent the formal errors of the individual solutions.

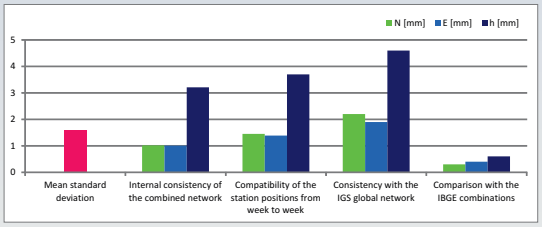


Mean RMS values for the weekly repeatability of station positions in the SIRGAS individual solutions.These values allow to assess the individual precision of the weekly solutions.



Mean RMS values after comparing the station positions between the SIRGAS individual solutions and the IGS weekly coordinates. These values indicate the reliability of the individual solutions.

Quality control of the combined SIRGAS solutions (time span GPS weeks 1700 - 1758)



The mean standard deviation for station positions after aligning the network to the IGS Reference Frame indicates the formal error of the final combination. The weekly coordinate repeatability after combining the individual solutions provides information about the internal consistency of the combined network.Time series analysis for station coordinates allows to determine the compatibility of the combined solutions from week to week.

The comparison with the IGS weekly coordinates indicates the consistency with the IGS global network. The comparison with the IBGE weekly combination fulfils the required redundancy to generate the final SIRGAS products.

Conclusions

The mean standard deviation of the combined solutions agrees quite well with those computed for the individual contributions, i.e. the quality of the individual solutions is maintained and their combination does not deform or damage the internal accuracy of the entire SIRGAS network. The coordinates repeatability in the weekly combinations provides an estimate of the **accuracy (internal consistency) of the weekly combinations of about ±1,0 mm in the horizontal component and about ±3,6 mm in the vertical one**. The RMS values derived from the time series for station positions and with respect to the IGS weekly coordinates indicate that **the reliability of the network (external precision) is about ±2,0 mm in the horizontal position and ±4,5 mm in the height**. The differences respect to the IBGE weekly combinations are within the expected level (less than 1,0 mm).

SIRGAS 2013 Meeting, Panama City, October 24 - 26, 2013