Recent activities of the IGS Regional Network Associate Analysis Centre for SIRGAS (IGS RNAAC SIRGAS)

Laura Sánchez (lm.sanchez@tum.de)
Deutsches Geodätisches Forschungsinstitut der Technischen Universität München (DGFI-TUM), Munich, Germany

The SIRGAS Reference Frame is composed currently by 389 continuously operating GNSS stations and it comprises two hierarchy levels: a core network (SIRGAS-C) providing the primary link to the global ITRF; and national reference networks (SIRGAS-N) improving the geographical density of the reference stations and ensuring the accessibility to the global reference frame at national and local levels. The SIRGAS reference stations are processed by 10 SIRGAS Processing Centres (CEPGE Ecuador, CNPDG-UNA Costa Rica, CPAGS-LUZ Venezuela, DGFI-TUM Germany, IBGE Brazil, IGAC Colombia, IGN Argentina, IGM Chile, INEGI Mexico, SGM Uruguay), who generate loosely constrained weekly solutions to be integrated in a unified solution for the entire network. The individual solutions are combined by the SIRGAS Combination Centres: DGFI-TUM and IBGE. As responsible for the IGS Regional Network Associate Analysis Centre for SIRGAS (IGS RNAAC SIRGAS), DGFI-TUM processed the entire SIRGAS network since June 1996 until August 2008. Now, DGFI-TUM supports SIRGAS by

1) processing the SIRGAS-C core network (Fig. 1)
2) combining the core network with the national reference networks (Fig. 2)
3) ensuring that the SIRGAS processing strategy conforms the IERS standards and IGS guidelines (Fig. 3)
4) developing strategies to guarantee the reliability of the reference frame through time, this includes
   - estimation of the reference frame kinematics (Fig. 4)
   - evaluation of the seismic impacts on the reference frame (Fig. 5)
   - modelling crustal deformation in the SIRGAS region (Fig. 6)
5) making available the SIRGAS products via www.sirgas.org and ftp.sirgas.org.

This report summarizes the main activities carried out by DGFI-TUM as IGS RNAAC SIR during the last year.

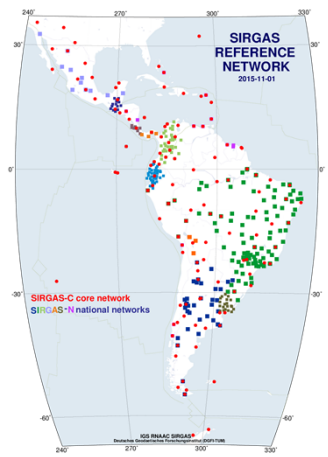
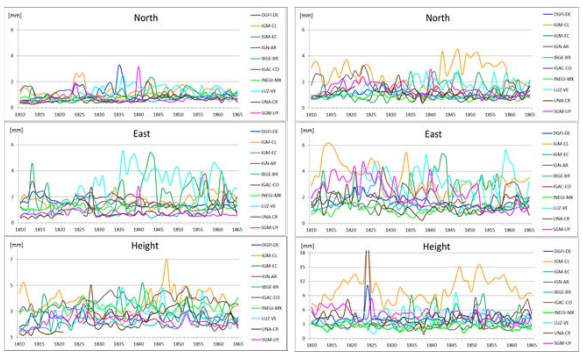
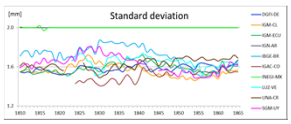


Fig. 1 – Core and national networks within the SIRGAS Reference Frame

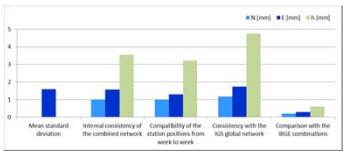


Time series of the RMS of the station position residuals for each analysis centre with respect to the SIRGAS weekly solutions. Outliers in the LUZ-VE series for the East component have to be further studied.

Time series of the RMS of the station position residuals for each analysis centre with respect to the IGS weekly solutions. This comparison allows to assess the accuracy of the individual solutions; i.e. about ±2 mm in the North and the East, and ±5 mm in the height . Outliers in the IGM-CL and LUZ-VE series have to be further studied.



Standard deviation of station positions after solving the individual solutions with respect to the IGS Reference Frame. These values represent the formal errors of the individual solutions. Processing Centres applying the Bernese GNSS Software present values about ±1.6 mm, while Processing Centres using GAMIT/GLOBK have values of ±2,0 mm.



Quality evaluation of combined SIRGAS solutions: 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 ±1.2 mm in the horizontal component and about ±3.5 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 ±1.5 mm in the horizontal position and ±4.0 mm in the height. The differences respect to the IBGE weekly combinations are at the expected level (less than 0.5 mm).

Fig. 2 - Quality control of the individual solutions delivered by the SIRGAS Analysis Centres as well as of the combined solutions computed by the IGS RNAAC SIRGAS (time span GPS weeks 1810 – 1865).

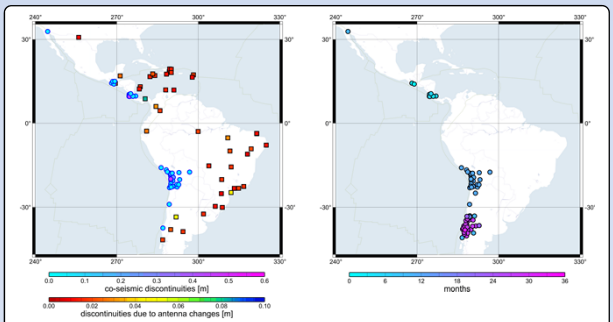


Fig. 5 – Station discontinuities (left) and post-seismic relaxation movements (right) identified in the SIRGAS region from March 2010 to April 2015.

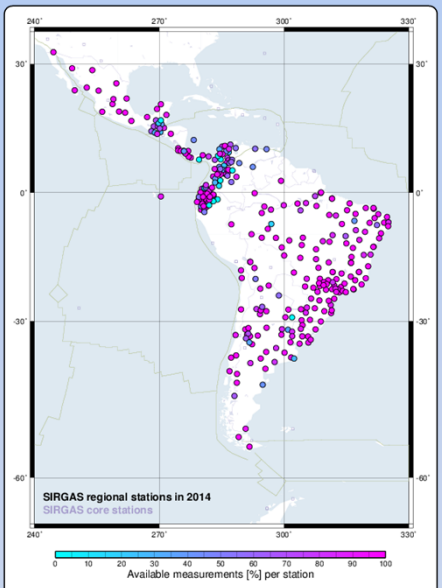


Fig. 3 – Inventory for the second SIRGAS reprocessing. It is necessary for computing all daily and weekly normal equations of the reference frame applying the new IERS and IGS guidelines. This inventory was performed from 1997 until 2014; as an example the RINEX availability for the year 2014 is shown.

Fig. 4 – Multiyear solution SIR15P01. It covers the time span from 2010.2 to 2015.2, includes 303 stations and refer to the IGb08, epoch 2013.0. Its accuracy is estimated to be ±1.8 mm in the horizontal position, ± 3.5 mm in the vertical position, ± 1.0 mm/a in the horizontal velocities and ± 1,2 mm/a in the vertical velocities.

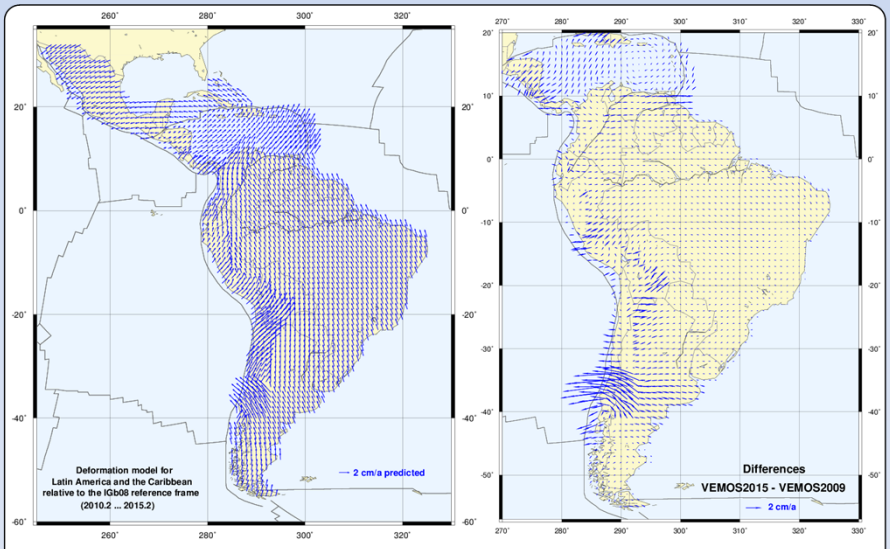


Fig. 6 – Post-seismic deformation model VEMOS2015 and its comparison with the pre-seismic model VEMOS2009.

Further reading

Sánchez L., Drewes H., Brunini C., Mackern M.V., Martínez-Díaz W.: SIRGAS core network stability. IAG Symposia 143, 10.1007/1345_2015_143, 2015

Sánchez L.: SIRGAS Regional Network Associate Analysis Center Technical Report 2014. In: Jean Y., Dach R. (Eds.) International GNSS Service Technical Report 2014, 101-110, IGS Central Bureau, 2015

Sánchez L., Drewes H., Schmidt M.: A post-seismic deformation model after the 2010 earthquakes in Latin America. EGU2015, Vienna, Austria, 2015-04-15

Sánchez L., Drewes H. : Quality control Post-seismic crustal deformations after the 2010 earthquakes in Latin America. IUGG2015, Prague, Czech Republic. June 22 - July 2, 2015.

Sánchez L., Drewes H., A.L. da Silva, M.A. de Almeida Lima, C. Brunini, V. Cioce, D. Cisneros, J.G. Gasca Moncayo, H. Guagni, M.V. Mackern, J. Moya Zamora, I. Parada, P. Sandoval, O.A. Suárez Rojas: SIRGAS: the core geodetic infrastructure in Latin America and the Caribbean. IUGG2015, Prague, Czech Republic. June 22 - July 2, 2015.