

## Guidelines for the Coordination of the SIRGAS Continuously Operating Network (SIRGAS-CON)

Version 1.4. March 13, 2017  
(Previous release: Version 1.3. August 1, 2013)

### **Changes/additions:**

**March 2017:** Some Internet links are updated.

**August 2013:** Some Internet links are updated.

**July 2011:** CPAGS-LUZ: Centro de Procesamiento y Análisis GNSS SIRGAS del Laboratorio de Geodesia Física y Satelital de la Universidad del Zulia (Venezuela) changes to CPAGS-LUZ: Centro de Procesamiento y Análisis GNSS SIRGAS de la Universidad del Zulia (Venezuela)

**January, 2010.** Annexes 1 and 2, listing the names of the SIRGAS-CON station Operational Centres and National Data Centres, are excluded. This information is now available and up-to-date at the SIRGAS web site [www.sirgas.org](http://www.sirgas.org).

**January, 2009.** Two Operational Centers for SIRGAS-CON stations are added: “Dirección General de Catastro, Ministerio de Hacienda y Finanzas, Gobierno La Pampa (DGC La Pampa), Argentina” and “Universidad Técnica Particular de Loja (UTPL), Ecuador”

*This document describes the components of the SIRGAS Continuously Operating Network (SIRGAS-CON), their responsibilities, and their relationship. It was prepared by the SIRGAS-WGI and complemented with suggestions sent by SIRGAS colleagues who carefully read its content. This support is highly appreciated.*

*In order to keep this document up-to-day, we thank you for sending comments, questions, and suggestions to Víctor Cioce, president of the SIRGAS-WGI: Reference System ([vcioce@fing.luz.edu.ve](mailto:vcioce@fing.luz.edu.ve)).*

SIRGAS was initially realised by two GPS campaigns, one in 1995 (SIRGAS95) with 58 stations, and one in 2000 (SIRGAS2000) with 184 stations. Today, SIRGAS is realised by a network of continuously operating GNSS stations with precisely known coordinates (referred to a specific reference epoch) and their changes with time (station velocities). At present, this SIRGAS Continuously Operating Network (SIRGAS-CON) is composed by more than 400 permanently operating GNSS sites, see [www.sirgas.org](http://www.sirgas.org). The operational performance of SIRGAS-CON is based on the contribution of more than 50 organisations, which install and operate the permanent stations and voluntarily provide the tracking data for the weekly processing of the network. Since more and more Latin American countries are qualifying their national reference frames by installing GNSS continuously operating stations and these stations shall be consistently integrated into the continental reference frame, the SIRGAS-CON network comprises:

- a) One core network (SIRGAS-C), primary densification of ITRF in Latin America, with a good continental coverage and stable site locations to ensure high long-term stability of the reference frame.
- b) 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.

The loosely constrained weekly solutions computed for the national networks are combined with the core network to get homogeneous precision for station positions and velocities in a continental level. The main products of SIRGAS-CON are:

- loosely constrained weekly station positions in SINEX format to be included into the IGS polyhedron and for the computation of multiyear solutions;
- weekly station positions aligned to the ITRF for practical applications in Latin America;
- multiyear solutions (positions + velocities) for practical and scientific applications requiring time-dependent positioning.

The SIRGAS Working Group I (Reference System) is responsible for the general guidance of the SIRGAS-CON activities. Analysis strategies, policies, and priorities within the network are defined in accordance with the SIRGAS Executive Committee in order to take into account the necessities of the national reference frames (coordinated by the SIRGAS Working Group II: SIRGAS at national level) and the SIRGAS unified vertical reference system (coordinated by the SIRGAS Working Group III: Vertical Datum). The SIRGAS-WGI specially coordinates the relationship between tracking station operators, data centres, and analysis centres, distributing the corresponding standards and guidelines, and controlling the quality, reliability, and opportunity of the SIRGAS-CON products. It also conducts the process for the incorporation of new stations in the network.

The main components of the SIRGAS-CON network are:

- Operational Centres (OC)
- National Data Centres (NDC)
- Regional Data Centre (RDC)
- Processing Centres (PC)
- Combination Centres (CC)
- Network Coordinator

**Operational Centres (OC):** are those organisations responsible for the adequate functioning of one or several GNSS continuously operating stations (i. e. a local or national network). The existing SIRGAS Operational Centres are listed at <http://www.sirgas.org/index.php?id=180&L=2>. They are in charge of (see also “*Procedure for becoming a SIRGAS-CON station*”)

1. Setting up and operating the permanent GNSS tracking receivers and antennae on suitable geodetic markers;
2. Data validation, conversion of raw data to Receiver Independent Exchange Format (RINEX), data compression (in Hatanaka format), and data upload to a data centre through the Internet within the two days following the observation date;
3. Keeping and providing updated site log files for each station to the Network Coordinator;



4. Opportunely informing the National Data Centres and the SIRGAS Processing Centres about stations with tracking problems. For this purpose, the SIRGAS Mail Exploder must be used (see <http://sirmail.dgfi.tum.de/>).

**National Data Centres (NDC)** are those institutions responsible for the data management of a particular (local or national) network. They make observational data available to all users, including the SIRGAS Processing Centres. The existing SIRGAS National Data Centres are listed at <http://www.sirgas.org/index.php?id=180&L=2>. They are in charge of (see also “*Procedure for becoming a SIRGAS-CON station*”)

1. Collecting the observational data of continuously operating GNSS stations belonging to a national reference frame;
2. Making these data available to the SIRGAS Processing Centres through the Internet, preferably by means of a FTP server, within the two days following the observation date;
3. Opportunely informing to the SIRGAS Processing Centres about stations with interruptions in the RINEX data flow. For this purpose the SIRGAS Mail Exploder must be used (see <http://sirmail.dgfi.tum.de/>).
4. If the corresponding Operational Centre does not do it, make data validation, conversion of raw data to Receiver Independent Exchange Format (RINEX), data compression (in Hatanaka format), and data upload to a data centre through the Internet within the two days following the observation date;
5. If the corresponding Operational Centre does not do it, keep and provide updated site log files for each station to the Network Coordinator.

Note: For many of the national reference networks the National Data Centres are identical with their Operational Centre, in these cases they perform responsibilities of Operational Centres as well.

**Regional Data Centre (RDC)** is responsible for collecting and storing in a long-term basis the observational data of the stations processed by the IGS-RNAAC-SIR (IGS Regional Network Associate Analysis Centre for SIRGAS). Since the GPS week 1495 (August 31, 2008), it takes care of the observational data corresponding to the SIRGAS-C core network. The SIRGAS Regional Data Centre currently operates at the DGFI-TUM (*Deutsches Geodätisches Forschungsinstitut, Technische Universität München*, Germany). The Regional Data Centre as well as the Processing Centres cannot provide observational data of the SIRGAS-CON stations to third parts without authorisation of the corresponding Operational Centre or National Data Centre.

**Processing Centres (PC):** perform routine analysis of selected SIRGAS-CON sites (i.e. the SIRGAS-C core network or one or various SIRGAS-N national networks) and generate loosely constrained weekly solutions for station positions. The SIRGAS-C network is processed by the IGS-RNAAC-SIR (i.e. DGFI-TUM, Germany). The SIRGAS-N networks are computed by the SIRGAS Local Processing Centres, which at present are: CEPGE: Centro de Procesamiento de datos GNSS del Ecuador, Instituto Geográfico Militar (Ecuador), CNPDG-UNA: Centro Nacional de Procesamiento de Datos GNSS, Universidad Nacional (Costa Rica), CPAGS-LUZ:



Centro de Procesamiento y Análisis GNSS SIRGAS de la Universidad del Zulia (Venezuela), IBGE: Instituto Brasileiro de Geografia e Estatística (Brazil), IGAC: Instituto Geográfico Agustín Codazzi (Colombia), IGM-CL: Instituto Geográfico Militar (Chile), IGN-Ar: Instituto Geográfico Nacional (Argentina), INEGI: Instituto Nacional de Estadística y Geografía (México), SGM-Uy: Servicio Geográfico Militar (Uruguay).

The individual solutions are combined into final SIRGAS products (loosely constrained weekly solutions, epoch coordinates and cumulative solutions including station velocities) and made available to the users through the SIRGAS web site ([www.sirgas.org](http://www.sirgas.org)). The SIRGAS Processing Centres are responsible for:

1. Delivering free (loosely constrained) network daily and weekly solutions to the SIRGAS Combination Centres in SINEX (Software Independent Exchange) format within the three weeks following the observation date. The SINEX files must include all *a-priori* constraints that had been introduced in the parameter estimation procedure;
2. Following rules and guidelines set up by the IGS (International GNSS Service) and the specific SIRGAS processing options defined by the SIRGAS-WGI in the document “*Guidelines for SIRGAS Analysis Centres*”;
3. Subscribing to the SIRGAS Mail Exploder in order to get updated information about station events reported by the Operational Centres and the National Data Centres. Instructions for subscription are available at <http://sirmail.dgfi.tum.de/>;
4. Subscribing to the IGS Station Exploder and to the IGS Mail Exploder to be permanently informed about changes in the IGS global stations and major announcements relevant to the entire IGS community. Instructions for subscription are available at <http://www.igs.org/mail>.

**Combination Centres (CC):** are responsible for combining the loosely constrained weekly solutions for the SIRGAS-N national networks with the corresponding solution for the SIRGAS-C core network. At present, the SIRGAS Combination Centres are DGFI-TUM and IBGE. Their main responsibilities are (see “*Guidelines for SIRGAS Analysis Centres*”):

1. To compare the weekly solutions (station coordinates in SINEX format) generated by the individual Processing Centres and to combine them into a SIRGAS-CON unified solution including all tracking stations (core SIRGAS-C + national SIRGAS-N stations);
2. To eliminate from the individual Processing Centre solutions those stations with coordinates extremely deviated from the combined solution;
3. To monitor the Processing Centre solutions and to formulate whatever actions are necessary to ensure the routine generation of consistent sub-network solutions. This must be carried out in agreement with the Network Coordinator;
4. To provide loosely constraint weekly solutions in SINEX format, weekly coordinates aligned to the ITRF, and multiyear solutions (coordinates + velocities) based on the weekly combinations. Weekly results need to be available within the four weeks following the observation date;



5. To report the main results after comparing the station coordinates between the individual solutions as given in the submitted SINEX files, including un-weighted RMS values of each Processing Centre with respect to the combined solution;
6. To perform time series analysis of the station coordinates to identify and correct jumps and outliers found in the time series;
7. To inform the Network Coordinator about station irregularities that show up at the combination level;
8. To appoint investigators for special problems related to deviating results.

DGFI-TUM, as IGS-RNAAC-SIR, is responsible for delivering loosely constrained weekly station positions in SINEX format to the IGS (in order to include SIRGAS-CON in the global polyhedron) and for generating multiyear solutions (coordinates + velocities) for all SIRGAS-CON stations (core SIRGAS-C + national SIRGAS-N stations).

Note: SIRGAS Processing Centres and SIRGAS Combination Centres can also be identified as SIRGAS Analysis Centres.

**Network Coordinator:** is responsible for the general management of the SIRGAS-CON network. The Network Coordinator corresponds to the SIRGAS-WGI President and can also be identified as the SIRGAS-CON Coordinator. His main responsibilities are:

1. To be in permanent and close contact with the SIRGAS-CON components (Operational Centres, National Data Centres, Regional Data Centre, Processing Centres, and Combination Centres) assisting in whatever is necessary;
2. To guarantee the availability of an updated log file for each SIRGAS-CON station;
3. To check log files provided by Operational Centres and National Data Centres;
4. To yearly request updated log files to all participating Operational Centres and National Data Centres;
5. To decide, in agreement with the SIRGAS Executive Committee, the inclusion (or exclusion) of a permanent station into SIRGAS;
6. To indicate each SIRGAS Processing Centre which SIRGAS-CON stations shall process;
7. To inform, through the SIRGAS Mail Exploder, the addition of new stations to SIRGAS, including the SIRGAS Processing Centres responsible for its computation;
8. To design procedures and to promote the necessary actions to improve the activities of the SIRGAS-CON components;
9. To inform the SIRGAS-CON components about the IGS standards and to coordinate their introduction into the SIRGAS-CON activities;
10. To coordinate the generation, updates, and adequate application of processing strategies;
11. To coordinate and to monitor the data flow through the SIRGAS-CON components;
12. To keep updated, in the SIRGAS FTP site, the necessary files for an homogeneous processing of the SIRGAS-CON stations, i.e. absolute phase centre variations, receiver/antenna table for all stations, antenna heights, etc.;



13. To assist those institutions that want to become a SIRGAS Processing Centre. They shall initiate as Experimental Processing Centres and satisfy the SIRGAS-CON analysis requirements to be considered as official SIRGAS Processing Centres (see “***Guidelines for SIRGAS Analysis Centres***”). The test period is at least one year. The acceptance or refusal of a new SIRGAS Processing Centre will be defined in accordance with the SIRGAS Executive Committee;
14. To request to all participating Processing (official and experimental) Centres as well as Combination Centres a yearly report;
15. To prepare a yearly report about the SIRGAS-CON activities to be presented to the SIRGAS Directing Council;
16. To organise workshops and meetings dealing with different aspects of the SIRGAS-CON network;
17. To propose and collaborate with new projects and studies related with the adequate operation, analysis, and product generation of the SIRGAS-CON network.