

Importancia de la incorporación de estaciones SIRGAS en la red global del Servicio Internacional GNSS (IGS)

Importance of the incorporation of SIRGAS stations into the global network of the International GNSS Service (IGS)

Laura Sánchez (lm.sanchez@tum.de)

IGS Regional Network Associate Analysis Centre for SIRGAS (IGS RNAAC SIRGAS)

Deutsches Geodätisches Forschungsinstitut

Technische Universität München (DGFI-TUM)

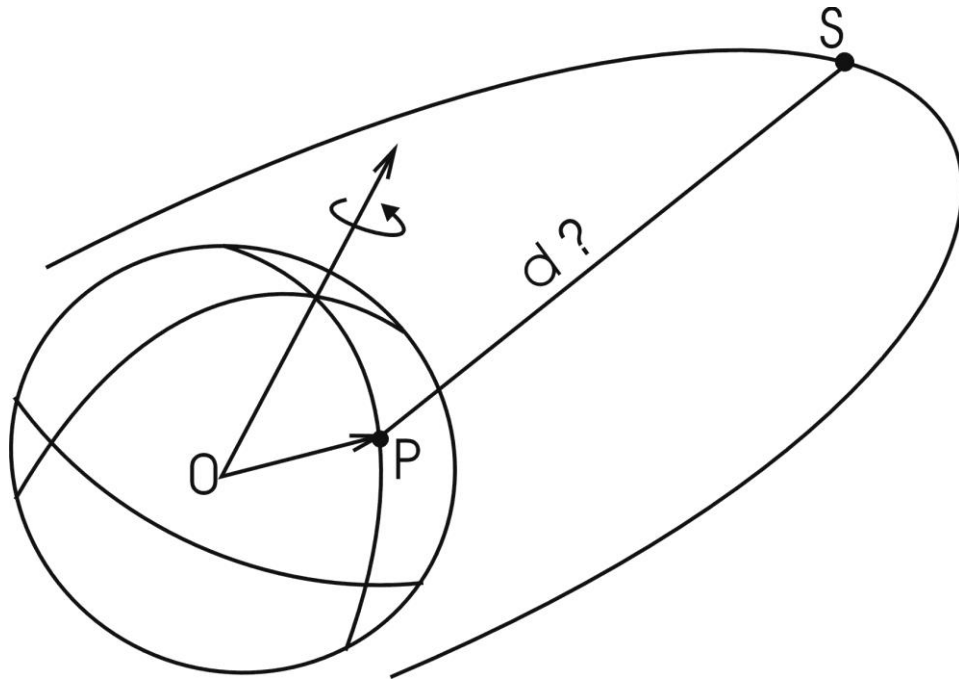
Alemania / Germany



Taller SIRGAS “Instalación y operación de estaciones GNSS permanentes”

2022-08-31

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 - Posicionamiento GNSS
 - Órbitas satelitales
 - Influencia del error orbital en posicionamiento GNSS relativo
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Con las técnicas de Geodesia Espacial se busca determinar la posición (o movimiento) de un punto (u objeto) sobre la superficie terrestre a partir de la observación de cuerpos "extraterrestres" (distancias a satélites, direcciones a estrellas o fuentes de radio - quasares).

Space Geodesy techniques seek to determine the position (or movement) of a point (or object) on the Earth's surface from the observation of "extraterrestrial" bodies (distances to satellites, directions to stars or radio sources - quasars).

Las técnicas de posicionamiento y navegación apoyadas en satélites (GNSS) utilizan microondas para medir la distancia entre satélites y receptores → **Medición: Tiempo de viaje de la onda ($s = v t$)**

Satellite-supported positioning and navigation (position and velocity) techniques (GNSS) use microwaves to measure the distance between satellites and receivers → Measurement: Wave travel time ($s = v t$)

Las coordenadas cartesianas geocéntricas del receptor GNSS se derivan a partir de las distancias medidas → **Requerimiento: Posición de los satélites (órbitas o efemérides)**

Geocentric Cartesian coordinates of the GNSS receiver are derived from the measured distances → Requirement: Known satellite positions (orbits or ephemerides)

Tiempo de salida de la onda ⇒ Reloj del satélite *Output time of the wave ⇒ Satellite's clock*

Tiempo de llegada de la onda ⇒ Reloj del receptor *Arrival time of the wave ⇒ Receiver's clock*

→ Tiempo del satélite ≠ tiempo del receptor *Time at the satellite ≠ Time at the receiver*

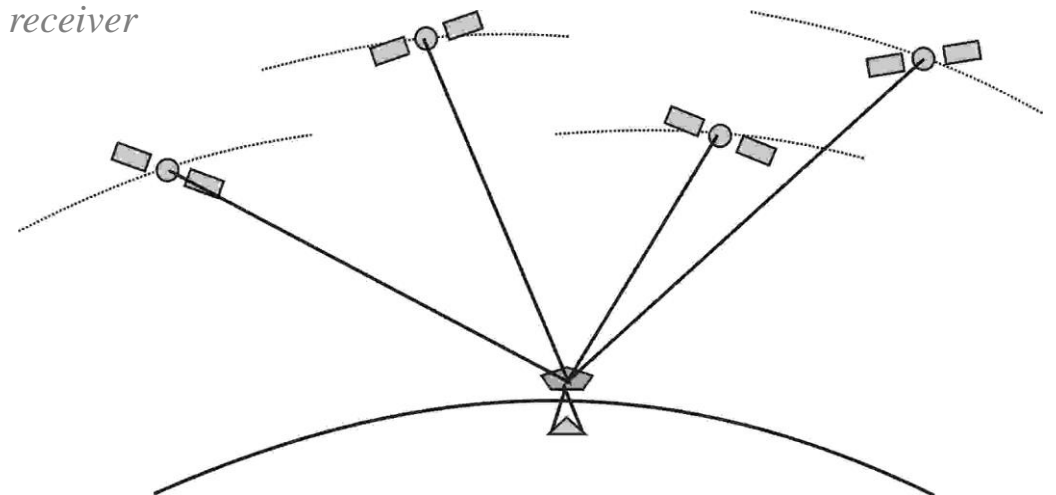
→ **Pseudo distancias** *pseudo ranges*

Incógnitas

- coordenadas cartesianas geocéntricas de la estación [X, Y, Z]
- diferencia (desincronización) de los relojes

Unknowns

- *geocentric Cartesian station coordinates [X,Y,Z]*
- *clocks' time difference (de-synchronisation)*

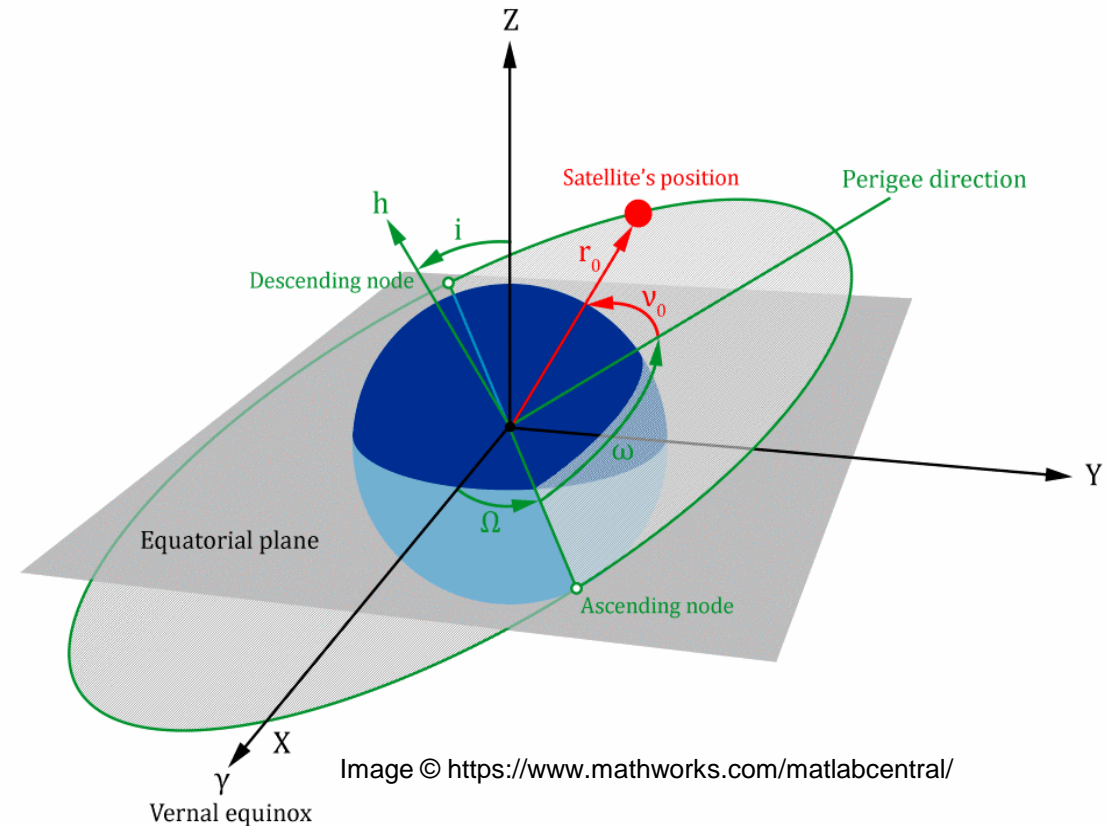


En general, las órbitas de los satélites pueden determinarse en dos pasos:

- 1) Cálculo de la órbita ideal (normal o Kepleriana)
- 2) Cálculo de las perturbaciones en la órbita ideal

In general, satellite orbits can be determined in two steps:

- 1) Determination of the ideal (normal or Keplerian) orbit.*
- 2) Determination of the perturbations in the ideal orbit*

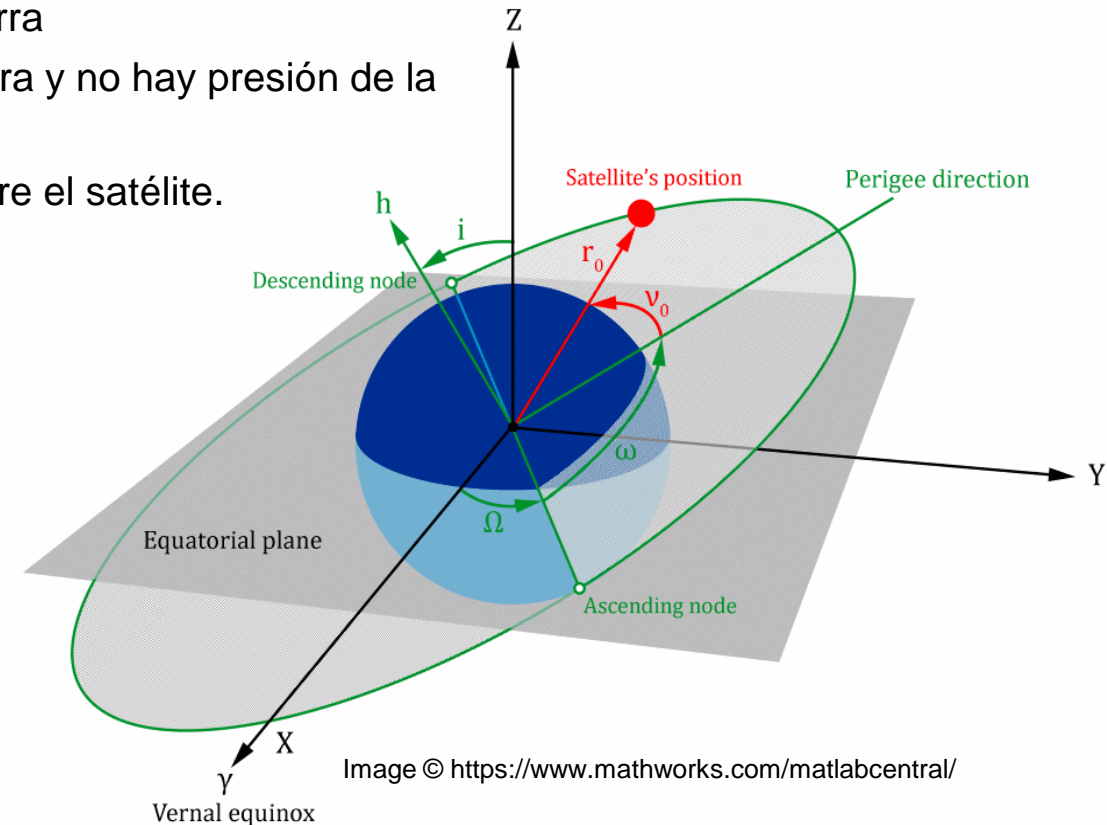


Órbitas normales

- Los satélites se mueven en un plano orbital fijo en el espacio, la trayectoria que describen es una elipse y en uno de sus focos está en el geocentro.
- La Tierra se considera como un punto masa o una esfera con densidad de masas radial constante
- La masa del satélite es insignificante en comparación con la de la Tierra
- El movimiento del satélite es en el vacío, no hay efecto de la atmósfera y no hay presión de la radiación solar
- No hay fuerzas gravitacionales diferentes a la terrestre actuando sobre el satélite.

Normal orbits

- *Satellites move in a fixed orbital plane in space, the trajectory they describe is an ellipse and at one of its foci is at the geocentre.*
- *The Earth is considered as a point mass or a sphere with constant radial mass density*
- *The mass of the satellite is negligible compared to that of the Earth.*
- *The motion of the satellite is in vacuum, there is no effect of the atmosphere and no solar radiation pressure.*
- *There are no non-terrestrial gravitational forces acting on the satellite.*



Órbitas reales o perturbadas

Perturbaciones gravitacionales:

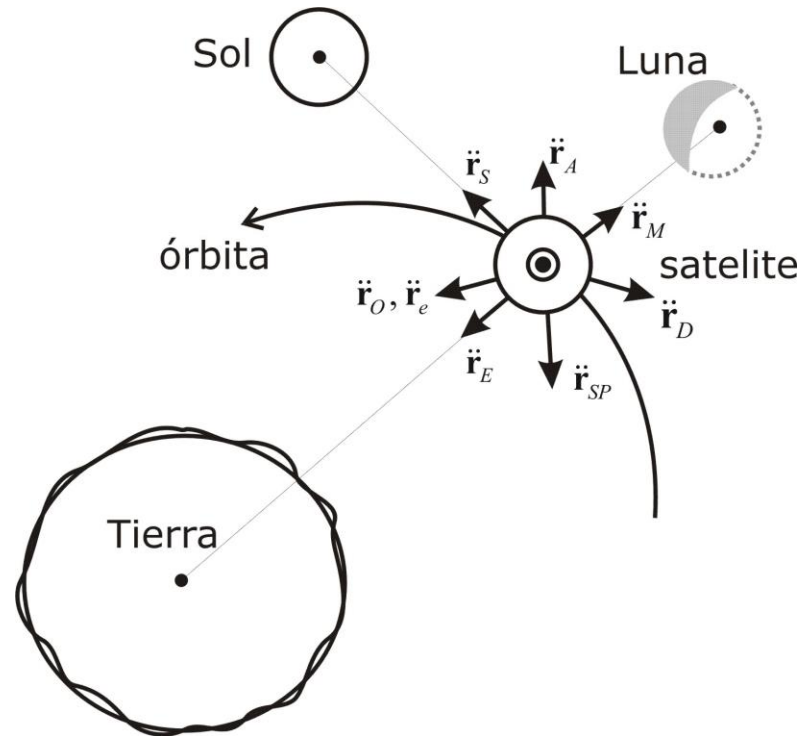
- Aplanamiento y distribución heterogénea de masas de la Tierra
- Atracción gravitacional de otros cuerpos celestes
- Mareas terrestres y oceánicas

Perturbaciones no gravitacionales:

- Carga atmosférica
- Presión de la radiación solar reflejada por la Tierra (albedo)

Otras perturbaciones:

- Resonancia
- Fricción con las partículas de la alta atmósfera
- Radiación térmica del satélite
- Interacción electromagnética con el campo geomagnético
- Influencia del polvo interplanetario, etc.



Real or disturbed orbits

Gravitational perturbations:

- *Earth's flattening and heterogeneous mass distribution*
- *Gravitational attraction of other celestial bodies*
- *Terrestrial and oceanic tides*

Non-gravitational perturbations:

- *Atmospheric loading*
- *Pressure of solar radiation reflected by the Earth (albedo)*

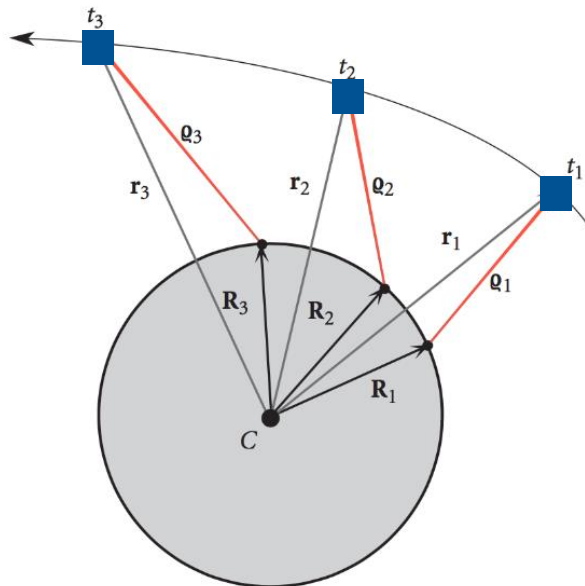
Other disturbances:

- *Resonance, Friction with particles in the upper atmosphere, Thermal radiation from the satellite, Electromagnetic interaction with the geomagnetic field, Influence of interplanetary dust, etc.*

Introducción *Introduction*

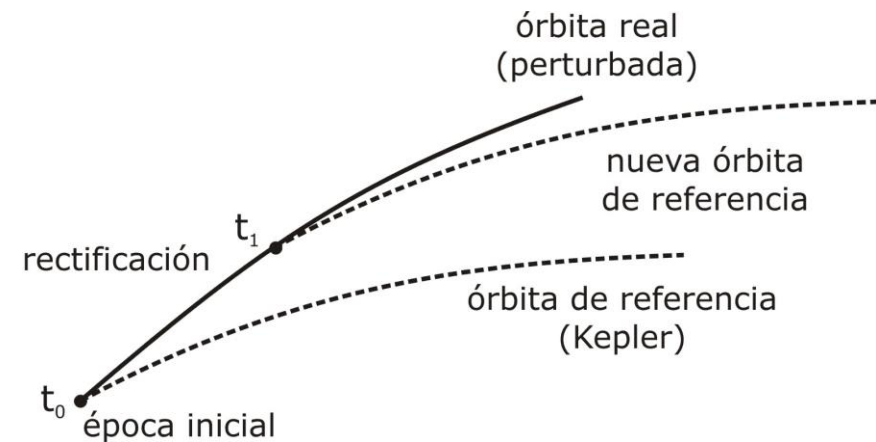
Las perturbaciones de las órbitas normales se determinan a partir de mediciones GNSS y estaciones terrestres de referencia (con coordenadas cartesianas geocéntricas conocidas con alta precisión).

The perturbations of the normal orbits are determined from GNSS measurements and reference ground stations (with high-precise Cartesian geocentric coordinates).



Con las perturbaciones conocidas se rectifica (corrige) la órbita normal.

With the known perturbations the normal orbit is rectified (corrected).



Influencia del error orbital en posicionamiento GNSS relativo

Influence of orbital error on relative GNSS positioning

Las efemérides transmitidas en el mensaje de navegación son órbitas normales con algunas correcciones. Actualmente, su precisión se estima en: GPS: 0.6 m; GAL: 0.2 m; BDS: 1 m; GLO: 2 m (ver Montenbruck et al. 2018, <https://doi.org/10.1016/j.asr.2018.03.041>).

Broadcast ephemeris usually are normal orbits with some corrections. At present, their accuracy is estimated to be: GPS: 0.6 m; GAL 0.2 m; BDS: 1 m; GLO: 2 m (see Montenbruck et al. 2018, <https://doi.org/10.1016/j.asr.2018.03.041>).

Error de la órbita <i>Orbit error</i>	Longitud de la línea base <i>Baseline length</i>	Error en la línea base <i>Error en la línea base</i>
2.5 m	10 km	1 mm
2.5 m	100 km	10 mm
2.5 m	1000 km	100 mm
0.25 m	100 km	1 mm
0.25 m	1000 km	10 mm
0.05 m	100 km	- mm
0.05 m	1000 km	2 mm

IGS: International GNSS Service

Nace como respuesta al uso y generación no estandarizados de datos GPS a finales de los 1980s e inicios de los 1990s, especialmente en proyectos de geodinámica.

It was born as a response to the non-standardised use and generation of GPS data in the late 1980s and early 1990s, especially in geodynamics projects.

La motivación inicial es la generación de efemérides satelitales precisas, junto con parámetros de orientación terrestre e información de los relojes de los satélites GPS, que sirvieran de apoyo al procesamiento confiable de levantamientos GPS.

The initial motivation is the generation of accurate satellite ephemerides, together with Earth orientation parameters and GPS satellite clock information, to support reliable GPS survey processing.

1990-03: La Asociación Internacional de Geodesia (IAG) establece un grupo de trabajo para “**explorar la posibilidad de establecer un servicio de GPS**”.

The International Association of Geodesy (IAG) establishes a working group to "explore the possibility of establishing a GPS service".

1990-04: El grupo de trabajo se convierte en **Comité de la IAG para la planeación de un servicio GPS** de uso civil.

The working group becomes the IAG Committee for the planning of a GPS service for civilian use.

1992-06/09: Experimento de medición y procesamiento de una red GPS distribuida globalmente (20 estaciones).

Experiment with measurement and processing of a globally distributed GPS network (20 stations)

IGS: International GNSS Service

1992-11: Comienza una **prueba piloto** del IGS

Pilot test of the IGS begins

1993-08: La IAG **aprueba** y apoya el establecimiento del IGS dentro de la IAG

The IAG approves and supports the establishment of the IGS within the IAG

1994-01: Comienza el **funcionamiento** en propiedad del IGS: **International GPS Service for Geodynamics**

*It begins the proper operation of the IGS: **International GPS Service for Geodynamics***

1999-06: Cambia de nombre a **International GPS Service**

*Renamed to **International GPS Service***

2005-03: Cambia de nombre a **International GNSS Service**

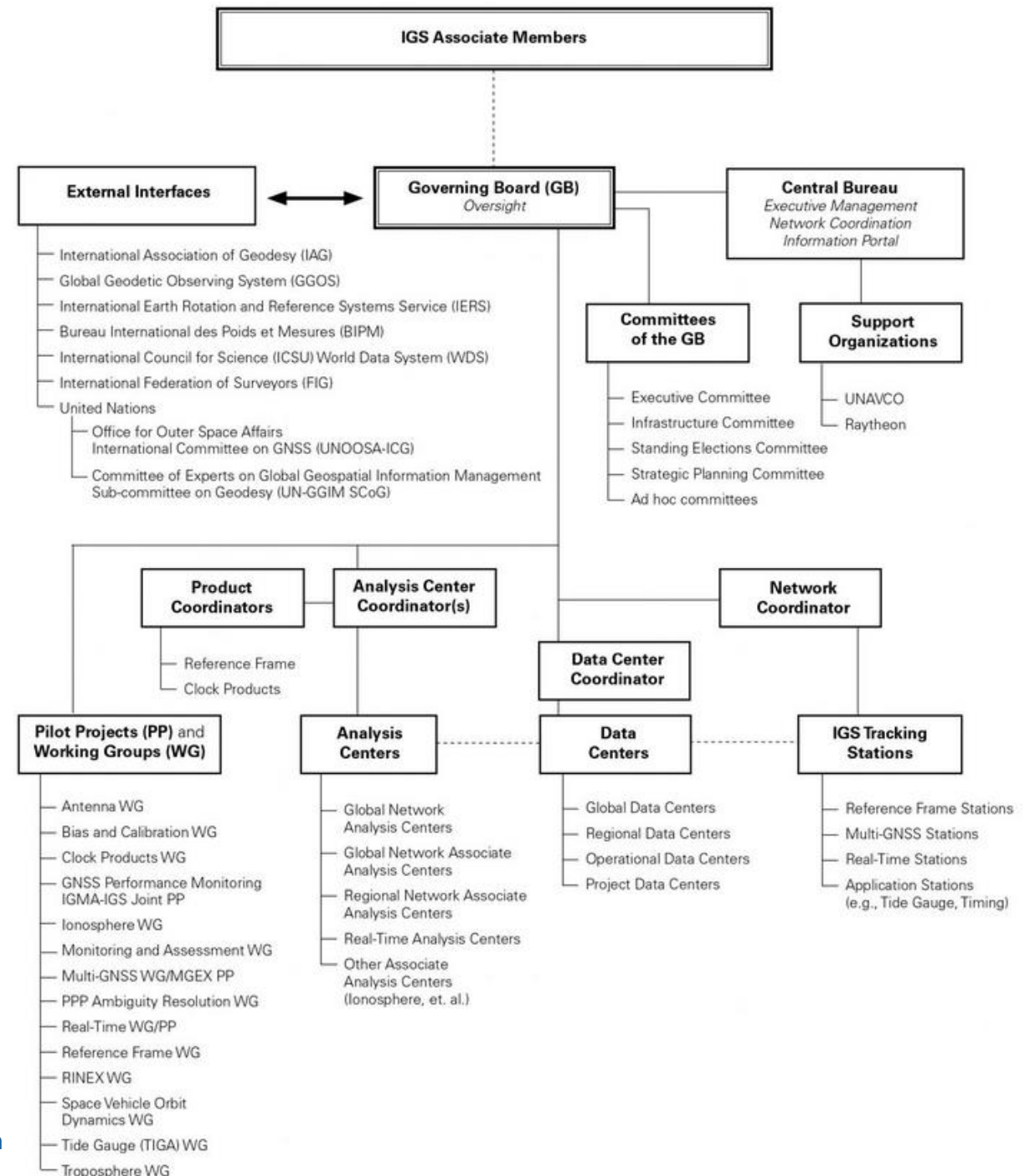
*Renamed to **International GNSS Service***

Estructura actual del IGS

Current IGS structure

<https://igs.org/>

- Contribución voluntaria y con recursos propios de cerca de 350 organismos, universidades e instituciones de investigación en más de 115 países/regiones.
- Una red global con 512 estaciones GNSS.
- Productos de alta calidad para el procesamiento de GNSS y basados en GNSS
- Todo ello de forma gratuita.
- *Voluntary contribution of about 350 self-funding agencies, universities, and research institutions in more than 115 countries/regions.*
- *A global GNSS network with 512 stations.*
- *High-level quality products for GNSS processing and based on GNSS*
- *All this for free!*



Órbitas y correcciones a los relojes satelitales del IGS

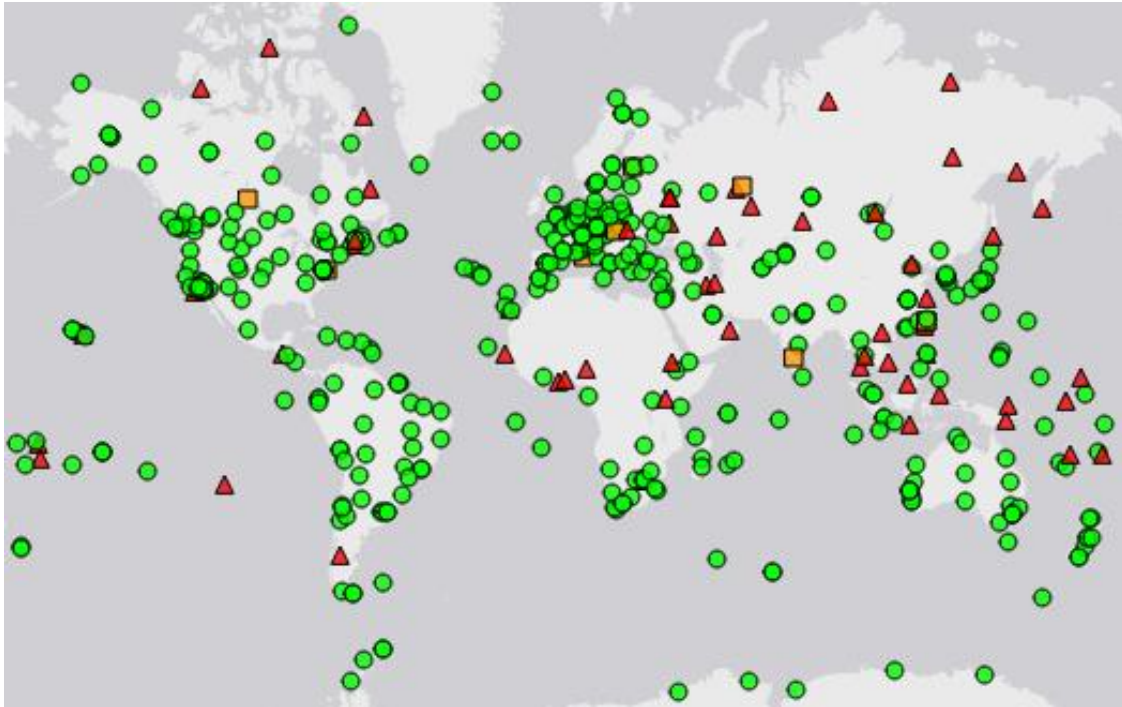
IGS satellite orbits and clocks (<https://igs.org/products/>)

GPS	Type	Accuracy	Latency	Updates	Sample Interval
Broadcast	orbits	~100 cm	real time	—	daily
	Sat. clocks	~5 ns RMS ~2.5 ns SDev			
Ultra-Rapid (predicted half)	orbits	~5 cm	real time	at 03, 09, 15, 21 UTC	15 min
	Sat. clocks	~3 ns RMS ~1.5 ns SDev			
Ultra-Rapid (observed half)	orbits	~3 cm	3 – 9 hours	at 03, 09, 15, 21 UTC	15 min
	Sat. clocks	~150 ps RMS ~50 ps SDev			
Rapid	orbits	~2.5 cm	17 – 41 hours	at 17 UTC daily	15 min
	Sat. & Stn. clocks	~75 ps RMS ~25 ps SDev			5 min
Final	orbits	~2.5 cm	12 – 18 days	every Thursday	15 min
	Sat. & Stn. clocks	~75 ps RMS ~20 ps SDev			Sat.: 30s Stn.: 5 min

GLO	Type	Accuracy	Latency	Updates	Sample Interval
	Final	~3 cm	12 – 18 days	every Thursday	15 min

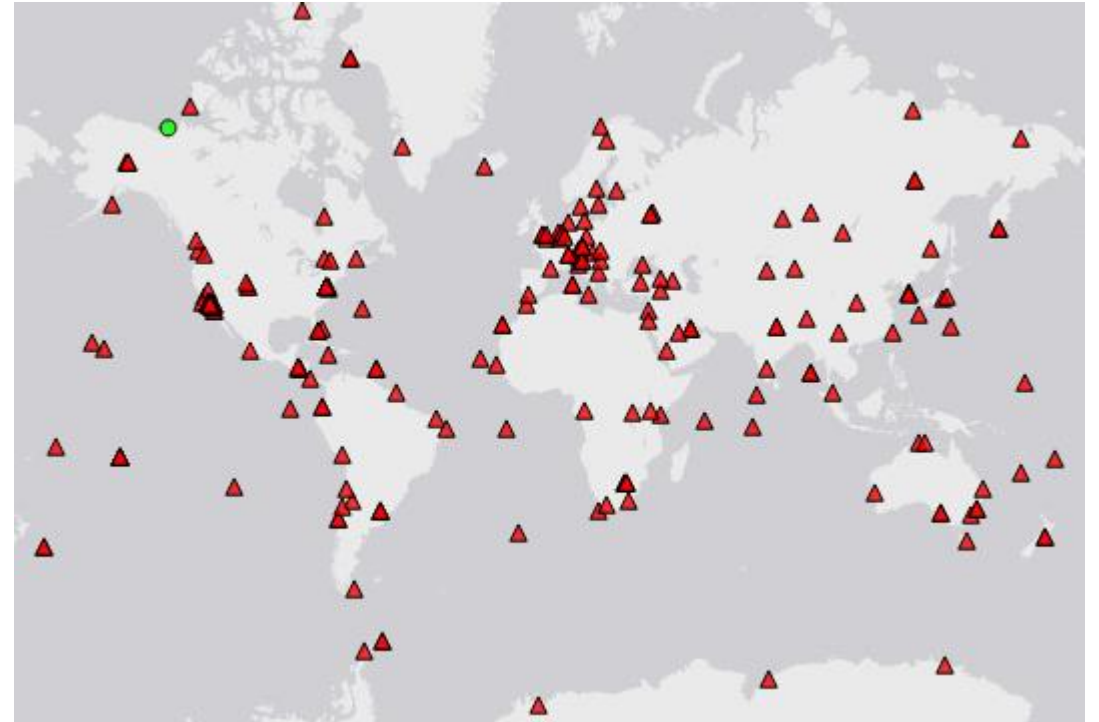
Red global del IGS

Global IGS network



Red actual, <https://igs.org/network/>, 2022-08-30

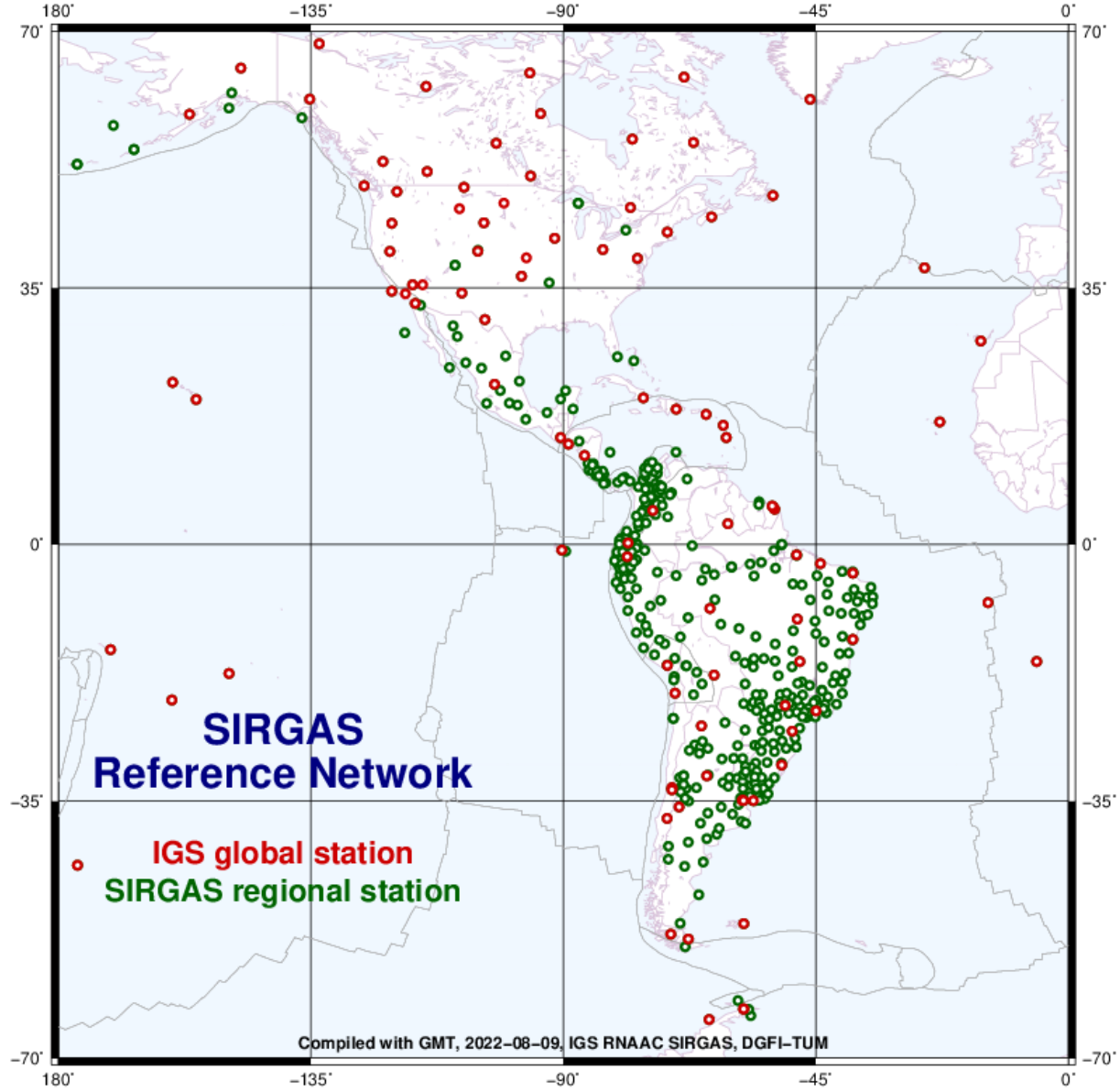
Current network, <https://igs.org/network/>, 2022-08-30



Estaciones dadas de baja, <https://igs.org/network/>, 2022-08-30

Decommissioned stations, <https://igs.org/network/>, 2022-08-30

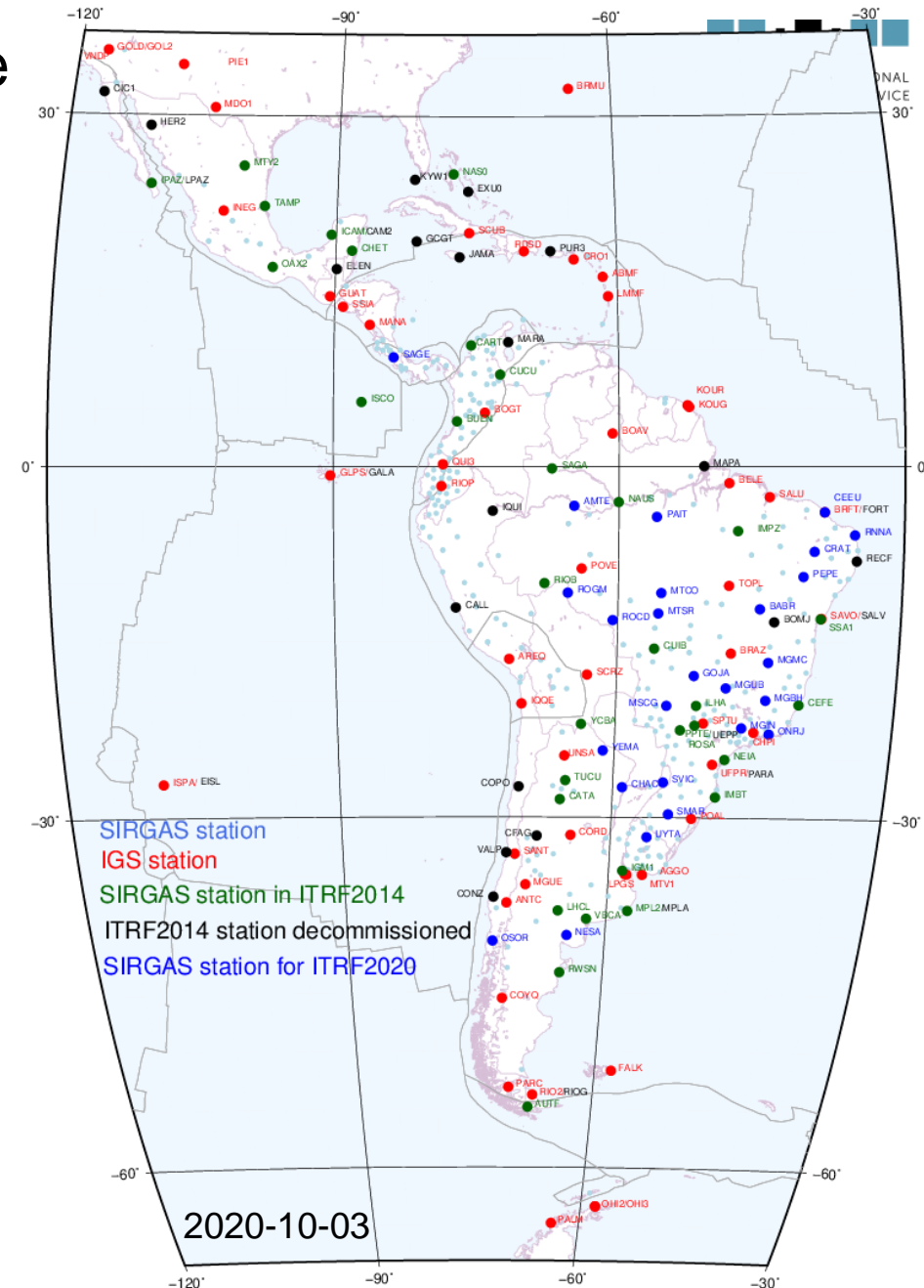
Estaciones IGS en la Región SIRGAS *IGS stations in the SIRGAS region*



Estaciones IGS en Latinoamérica y El Caribe

IGS Stations in Latin America and the Caribbean

- Los Centros de Análisis del IGS procesan más estaciones que las IGS “oficiales”.
- Cada vez que se programa un reprocesamiento de la red IGS (como contribución para una nueva solución del ITRF), el IGS pregunta a SIRGAS qué estaciones pueden ser agregadas al reprocesamiento.
- Esas estaciones adicionales son “informales”, se incluyen en el ITRF, pero no están incluidas oficialmente en el IGS.
- *The IGS Analysis Centres process more stations than the "official" IGS.*
- *Whenever a reprocessing of the IGS network is scheduled (as a contribution to a new ITRF solution), the IGS asks SIRGAS which stations can be added to the reprocessing.*
- *These additional stations are "informal", they are included in the ITRF, but are not officially included in the IGS.*





- There was very strong agreement that the existing network needs to expand to better support the generation of IGS products and community needs.
- Improvement on a fully multi-GNSS network is needed since only 150 of the 512 stations track all signals (e.g., dual-frequency BDS-3)
- Following input from the community at the 2022 workshop, develop a roadmap to enhance the IGS tracking network to meet the shifting user needs.

Ventajas de tener más estaciones SIRGAS en la red IGS

IGS Stations in Latin America and the Caribbean

- Mayor cantidad de estaciones de referencia IGS/ITRF, no solo para mejorar órbitas y relojes satelitales y EOPs, sino también para el ajuste de la red continental SIRGAS y el ajuste de las redes nacionales de referencia
 - Posibilidad de utilizar los servicios IGS en tiempo real aún sin tener un *caster* nacional
 - Interacción con el IGS para mantenerse actualizado en técnicas de observación y análisis GNSS
 - Contribución al Marco de Referencia Geodésico Mundial promovido por la Organización de las Naciones Unidas
 - Promoción y argumentación frente a los Gobiernos Nacionales para obtener respaldo en el mantenimiento de las redes nacionales de referencia
-
- *An increased number of IGS/ITRF reference stations is desirable, not only for improving satellite orbits and clocks and EOPs, but also for the adjustment of the continental SIRGAS network and the adjustment of national reference networks*
 - *Possibility to use IGS services in real time even without having a national caster*
 - *Interaction with the IGS to keep up to date with GNSS observation and analysis techniques*
 - *Contribution to the Global Geodetic Reference Frame promoted by the United Nations*
 - *Advocacy and argumentation with National Governments to obtain support for the maintenance of national reference networks*

Cómo proponer la adición de una estación SIRGAS al IGS

How to propose the addition of a SIRGAS station to the IGS

Existe una guía de 2015 que resume la instalación, configuración y entrega de datos (<https://igs.org/station-resources/#site-guidelines>). Esta guía se está actualizando. Se espera que la nueva versión esté lista a finales de 2022 o comienzos de 2023. Las condiciones generales son:

- La estación debe estar incluida en SIRGAS (marco de referencia regional)
 - Monumentación estable y perdurable (ver presentación de Annie)
 - Está registrada en el banco de datos del IERS (Servicio Internacional de Rotación Terrestre y Sistema de Referencia): código de 4 caracteres y domes number
 - Sus equipos están contenidos en los estándares del IGS (<https://files.igs.org/pub/station/general/> rcvr_ant.tab, antenna.gra, igs.atx)
 - Dispone de metadatos → site log file (ver presentación José Antonio)
 - Existe un seguimiento del comportamiento de la estación (continuidad y calidad)

There is a 2015 guide outlining installation, configuration and data delivery (<https://igs.org/station-resources/#site-guidelines>). This guide is being updated and the new version is expected to be published in late 2022 or early 2023. The general conditions are:

- *The station must be included in SIRGAS (regional reference frame):*
 - *Stable and enduring monumentation (see Annie's presentation).*
 - *It is registered in the IERS (Int. Earth Rotation and Reference Systems Service) database: 4-character code and domes number.*
 - *Its equipment is contained in the IGS standards (<https://files.igs.org/pub/station/general/> rcvr_ant.tab, antenna.gra, igs.atx)*
 - *Its metadata is documented appropriately → site log file (see José Antonio's presentation).*
 - *There is a monitoring of the station's performance (continuity and quality).*

Cómo proponer la adición de una estación SIRGAS al IGS

How to propose the addition of a SIRGAS station to the IGS

- La estación debe ser multi constelación: GPS y GLO no son suficientes, también se necesita GAL y BDS
 - Ángulo de elevación debe ser 5° o menos (preferible 0°)
 - Los satélites “unhealthy” deben rastrearse
 - Deben grabarse la mayor cantidad de observables (frecuencias y códigos) posibles
 - Los archivos RINEX diarios deben estar a 30s, pero también se aceptan archivos horarios a 1s
 - Los RINEX deben ir en formato 4.x y se recomienda reportar los archivos generados por el receptor mismo (ver presentación Sonia)
 - Para tiempo real, el stream de datos se direcciona en el receptor directamente al caster igs-ip.net, preferiblemente en formato RTCM3.3, e.g. tipos de mensaje 1077, 1087, 1097, 1127
-
- *The station must be multi-constellation: GPS and GLO are not enough, GAL and BDS are also needed*
 - *Angle of elevation should be 5° or less (preferably 0°)*
 - *Unhealthy satellites must be tracked*
 - *As many observables (frequencies and codes) as possible should be recorded*
 - *Daily RINEX files should be at 30s, but hourly files at 1s are also acceptable*
 - *RINEX files should be in 4.x format and it is recommended to deliver the files generated by the receiver itself (see Sonia’s presentation)*
 - *For real time, the data stream is routed in the receiver directly to the caster igs-ip.net, preferably in RTCM3.3 format, e.g. message types 1077, 1087, 1097, 1127*

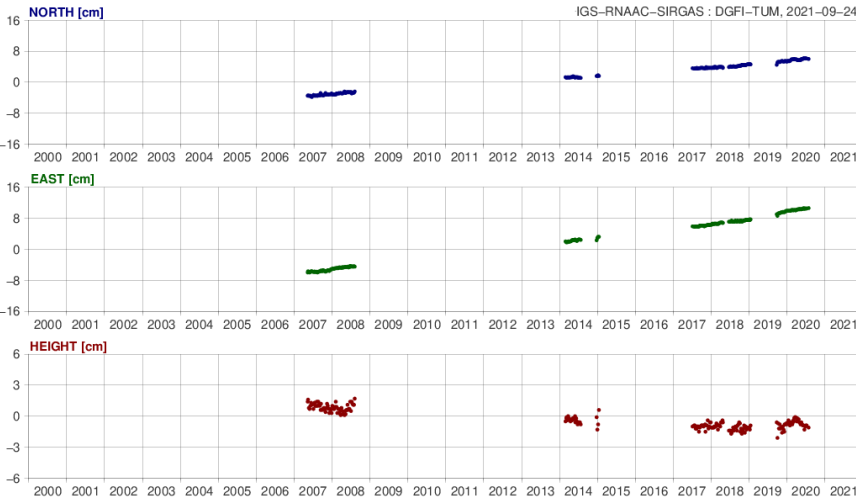
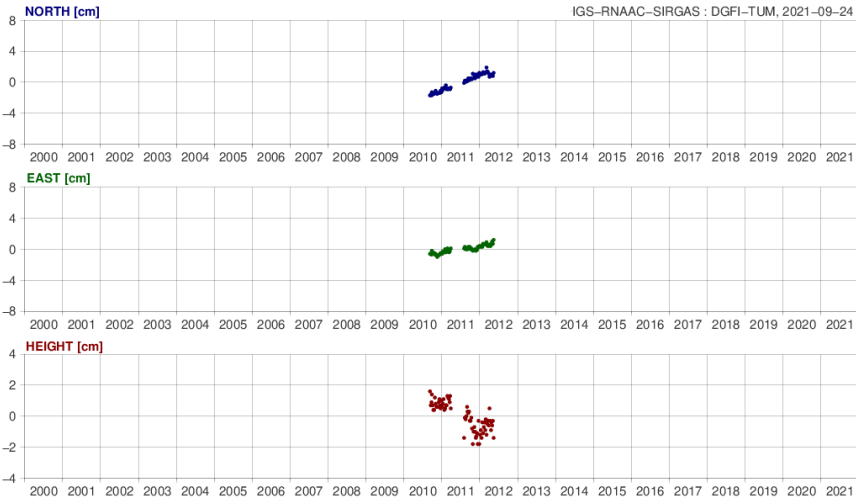
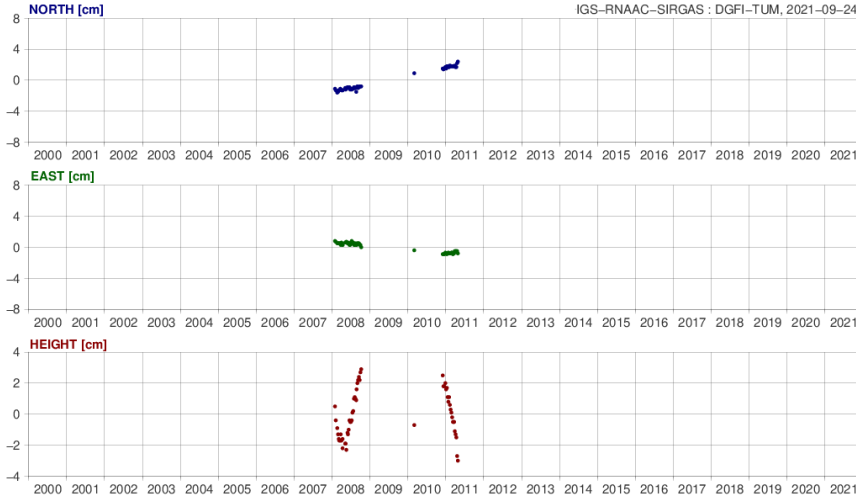
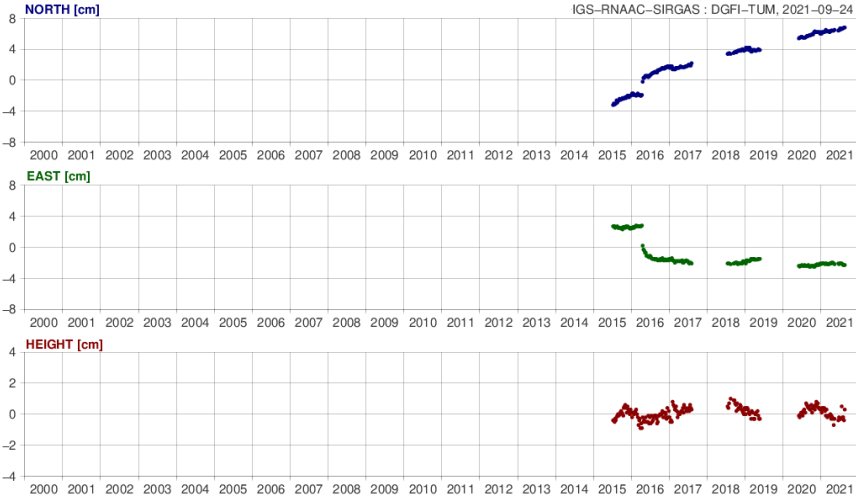
Cómo proponer la adición de una estación SIRGAS al IGS

How to propose the addition of a SIRGAS station to the IGS

- Firmware en los receptores debe mantenerse actualizado (ver presentación de Sonia)
 - Debe evitarse el cambio de equipos y la manipulación de la antena
 - Los datos de la estación deben ser libres de costo, los RINEX correspondientes estarán disponibles en los Centros de Datos del IGS y cualquiera podrá bajarlos y utilizarlos
 - Se espera que la estación pueda contribuir al menos en dos o tres soluciones del ITRF (~ 15 años)
 - La estación debe ser de operación continua, sin muchas interrupciones
-
- *Firmware in the receivers should be kept up to date (see Sonia's presentation)*
 - *Change of equipment and manipulation of the antenna should be avoided*
 - *The station data should be free of charge, the corresponding RINEX will be available at the IGS Data Centres and anyone will be able to download and use them*
 - *The station is expected to be able to contribute to at least two or three ITRF solutions (~ 15 years)*
 - *The station should be of continuous operation, without many interruptions*

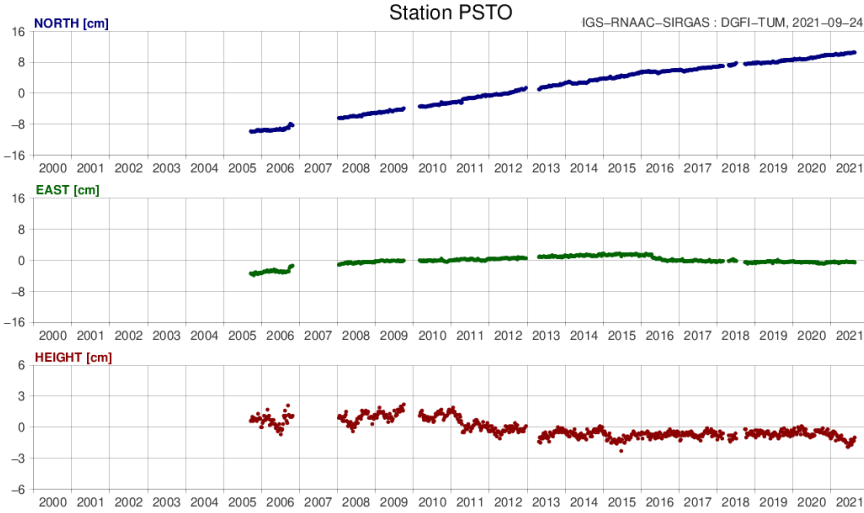
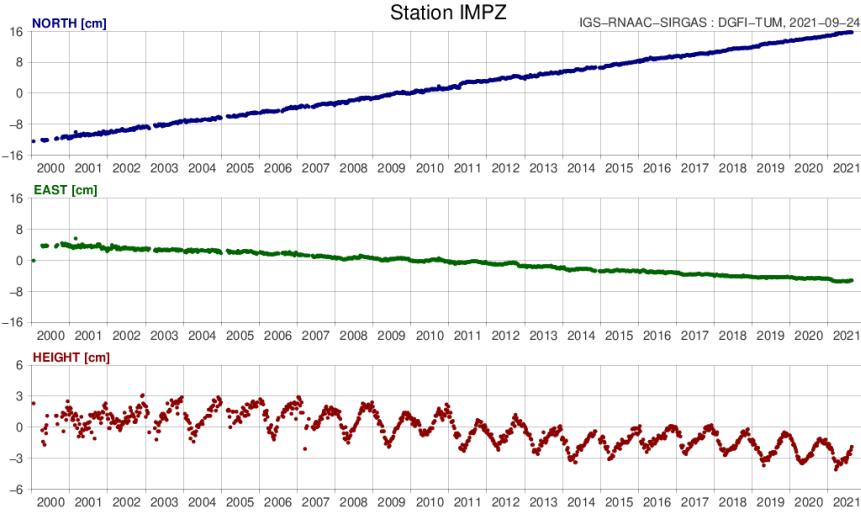
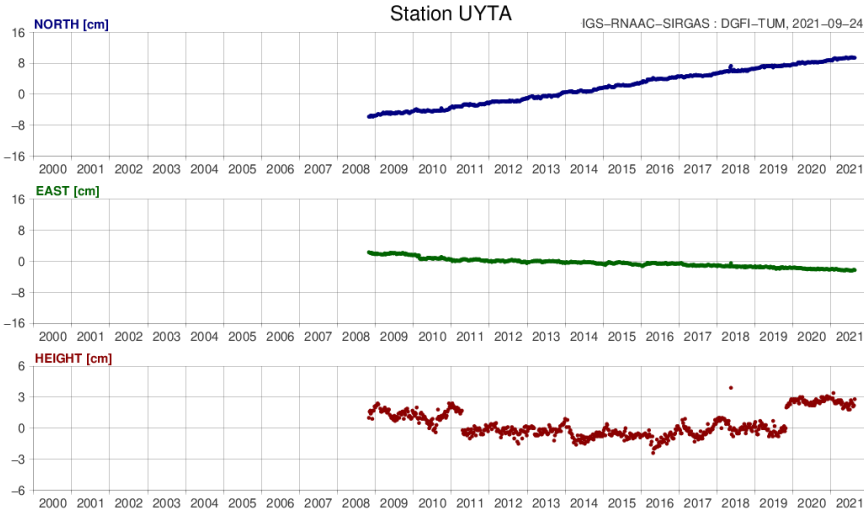
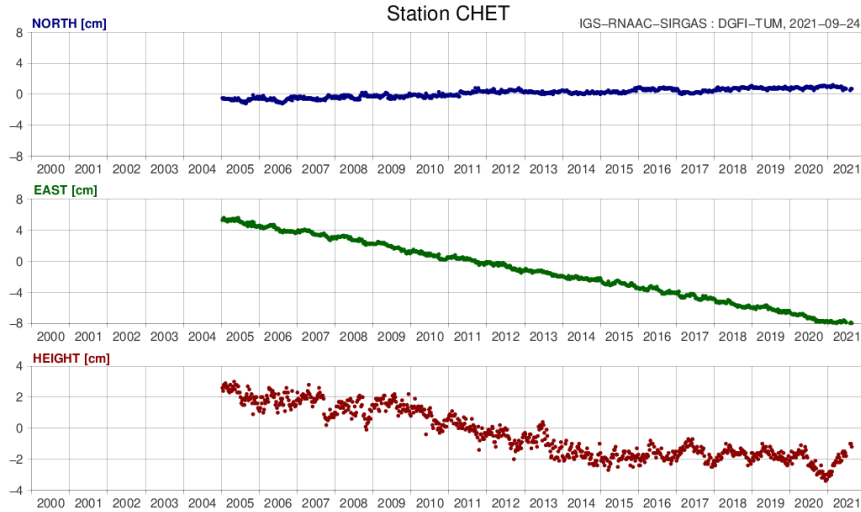
Cómo proponer la adición de una estación SIRGAS al IGS

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Cómo proponer la adición de una estación SIRGAS al IGS

How to propose the addition of a SIRGAS station to the IGS

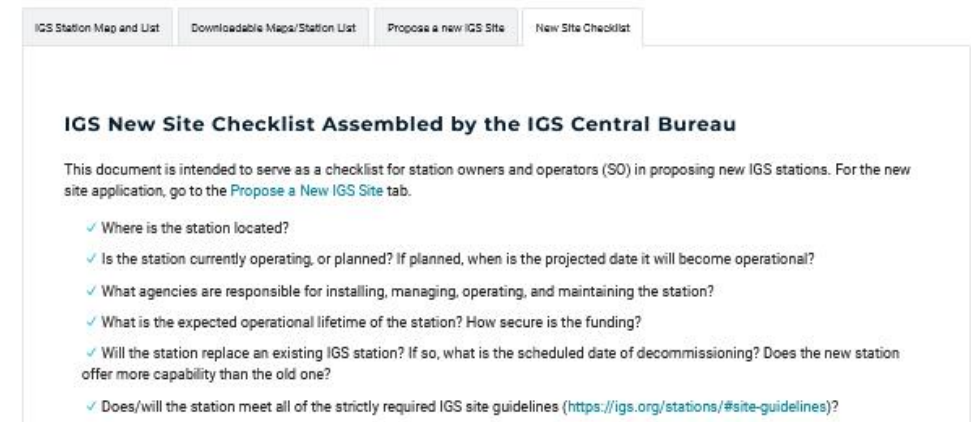


Cómo proponer la adición de una estación SIRGAS al IGS

How to propose the addition of a SIRGAS station to the IGS

Una vez la estación esté instalada, funcionando y siendo procesada en SIRGAS

- Se sigue la lista de control disponible en <https://igs.org/network/#new-site-checklist>



A screenshot of the IGS New Site Checklist page. The page has a navigation bar with four tabs: "IGS Station Map and List", "Downloadable Maps/Station List", "Propose a new IGS Site", and "New Site Checklist". The "New Site Checklist" tab is active. The main content area has the heading "IGS New Site Checklist Assembled by the IGS Central Bureau". Below the heading is a paragraph: "This document is intended to serve as a checklist for station owners and operators (SO) in proposing new IGS stations. For the new site application, go to the [Propose a New IGS Site](#) tab." Below this are six checklist items, each with a green checkmark icon:

- ✓ Where is the station located?
- ✓ Is the station currently operating, or planned? If planned, when is the projected date it will become operational?
- ✓ What agencies are responsible for installing, managing, operating, and maintaining the station?
- ✓ What is the expected operational lifetime of the station? How secure is the funding?
- ✓ Will the station replace an existing IGS station? If so, what is the scheduled date of decommissioning? Does the new station offer more capability than the old one?
- ✓ Does/will the station meet all of the strictly required IGS site guidelines (<https://igs.org/stations/#site-guidelines>)?

Once the station is installed, functioning and being processed in SIRGAS

- *The checklist available at <https://igs.org/network/#new-site-checklist> is followed.*

Cómo proponer la adición de una estación SIRGAS al IGS

How to propose the addition of a SIRGAS station to the IGS

Una vez la estación esté instalada, funcionando y siendo procesada en SIRGAS

- Se sigue la lista de chequeo disponible en <https://igs.org/network/#new-site-checklist>
- Se diligencia el formulario disponible en <https://igs.org/network/#propose-new-site>
- Se remiten algunos archivos RINEX diarios para evaluación por parte del IGS

Once the station is installed, functioning and being processed in SIRGAS

- *The checklist available at <https://igs.org/network/#new-site-checklist> is followed*
- *The form available at <https://igs.org/network/#propose-new-site> is filled in*
- *Some daily RINEX files are submitted for evaluation by the IGS.*



IGS Station Map and List Downloadable Maps/Station List Propose a new IGS Site New Site Checklist

Interested in providing a station for the IGS?

To initiate the application, review the guidelines listed on [New Site Checklist](#) or the [IGS Web Proposing New Stations \(Updated 2021\)](#) document and complete the online application below.

Agency or Organization *

Name *

Prefix First Middle Last Suffix

Email 1 *

Email 2

Phone *

Evaluación IGS de posibles nuevas estaciones

IGS assessment of potential new stations

CIQE00CRI

IGS Station Proposal



Proposal

Prepared by: Markus Bradke (MB),
David Maggert (DM),
Peter Steigenberger (PS)

Date Prepared: 2022-01-19

Last Update: 2022-01-19

More Information: <https://files.igs.org/pub/station/pendinglogs/CIQE00CRI/>

Status:

- Accepted on YYYY-MM-DD
- Pending
- Rejected on YYYY-MM-DD

Proposed by: Alvaro Alvarez Calderon (gnss.ignrn@rnp.go.cr)

Agency: IGN-RN

Date Proposed: 2021-12-01

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Station Assessment

General (Pending)

Component	Status	Notes
Regional Network		
Is the station located in the footprint of a regional network?	<input checked="" type="checkbox"/>	SIRGAS
If yes, did the station get assessed by the regional network operator?	<input type="checkbox"/>	
CORS Classification		
Is the station co-located?	<input type="checkbox"/>	
Does the station fill a geographic need?	<input checked="" type="checkbox"/>	
Is the station equipped with a H-Maser?	<input type="checkbox"/>	
Does the station already provide an extended time series (minimum 5 years)?	<input checked="" type="checkbox"/>	Installed 2014

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Monumentation (Pending)

Component	Status	Notes
Monument		
Is the station located on a stable geodetic monument?	<input checked="" type="checkbox"/>	
Is the monument attached to bedrock?	<input type="checkbox"/>	Attached to building
Antenna Mount		
Does the mount lock the antenna in place to maintain orientation and level?	<input type="checkbox"/>	
Does the mount <u>allow that the antenna can be removed and returned within 0.5 mm and 1° of its original location and orientation?</u>	<input type="checkbox"/>	

Metadata (Pending)

Component	Status	Notes
IGS Site Log		
Is the IGS site log complete and up-to-date?	<input type="checkbox"/>	
Does the IGS station have a unique 9-character station identifier?	<input checked="" type="checkbox"/>	
Does the IGS station have a unique IERS DOMES Number?	<input checked="" type="checkbox"/>	
Have pictures of the antenna installation in the four cardinal directions been provided?	<input checked="" type="checkbox"/>	
GDPR compliant?	<input type="checkbox"/>	
RINEX Header vs IGS Site Log		
Station Name+Domes Number match?	<input checked="" type="checkbox"/>	
Antenna+Radome+SNR match?	<input checked="" type="checkbox"/>	
Antenna Eccentricities match?	<input checked="" type="checkbox"/>	
Receiver+SNR+Firmware match?	<input type="checkbox"/>	Firmware mismatch (5.33 vs 5.37)
Coordinates in XYZ <u>match</u> within 5 metres?	<input type="checkbox"/>	41 m offset
GDPR compliant?	<input checked="" type="checkbox"/>	

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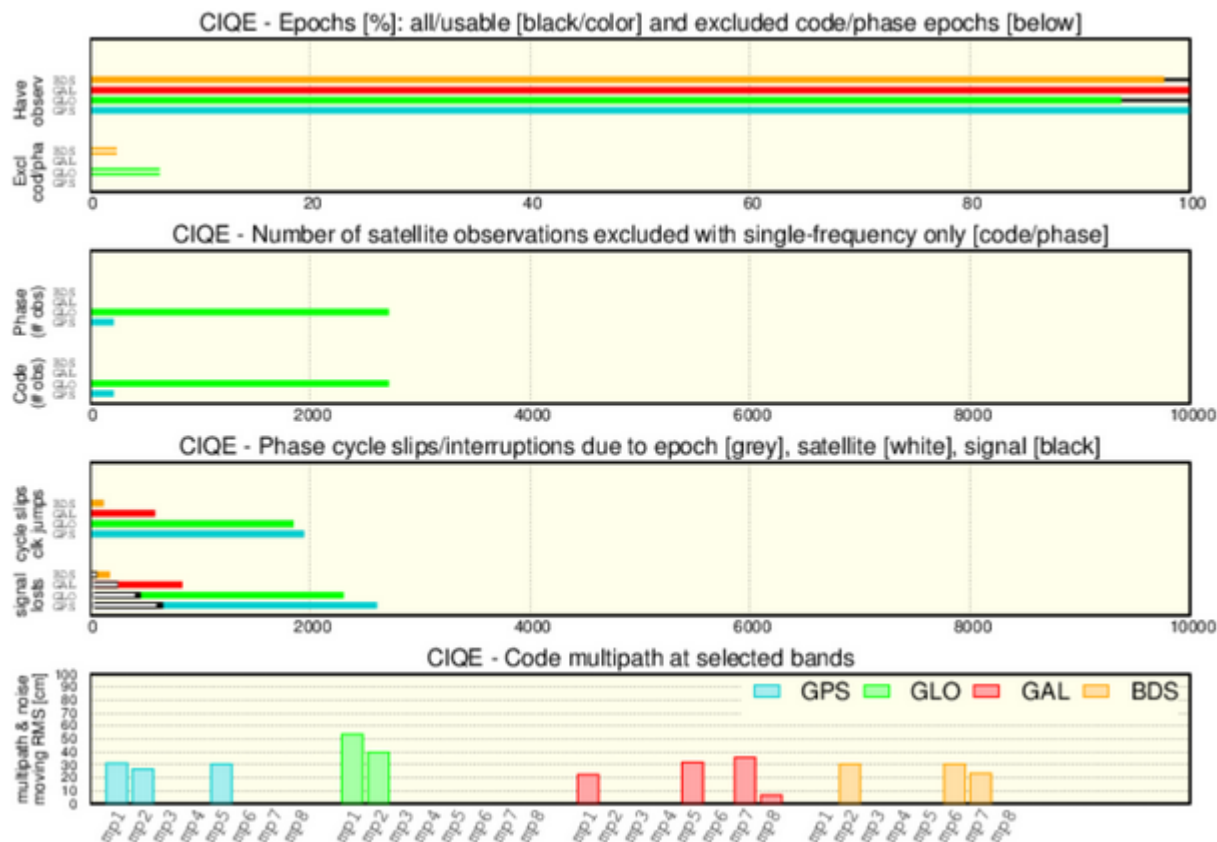
Data (Pending)

Component	Status	Notes
Data Format/Tracking		
Has sample data been provided?	<input checked="" type="checkbox"/>	
The station provides data in RINEX v.3?	<input checked="" type="checkbox"/>	3.04
Does the station provide hourly data?	<input type="checkbox"/>	
Does the station provide daily data?	<input checked="" type="checkbox"/>	
Is the station multi-GNSS (at least GREC)?	<input checked="" type="checkbox"/>	GREC
Does the station provide data in real-time?	<input checked="" type="checkbox"/>	
Has the latest receiver firmware been installed?	<input checked="" type="checkbox"/>	No, Trimble NETR9 5.33 Recommended 5.45

Data Quality		
Have all available satellite systems been tracked?	<input type="checkbox"/>	C = 15 (GEO/IGSO missing) E = 22 G = 29 R = 22
Is the All-in-view tracking activated?	<input type="checkbox"/>	Unhealthy satellites missing (E14, E18, R11, ...)
Have all available signals been tracked?	<input type="checkbox"/>	GLO G3 missing, GAL E6 missing BDS B1 missing, BDS B5 missing
Is the multipath non-suspicious?	<input checked="" type="checkbox"/>	
Is the elevation mask below 5°?	<input checked="" type="checkbox"/>	0°
Are the number of observations above 95°? 5° Elevation	<input type="checkbox"/> All <input checked="" type="checkbox"/> GPS <input checked="" type="checkbox"/> GLO <input checked="" type="checkbox"/> GAL <input type="checkbox"/> BDS	BDS: 50%
Does the station have a low number of cycle slips (<1 per 1000 observations)?	<input type="checkbox"/>	
Is the C/N0 of all signals sufficient?	<input type="checkbox"/>	

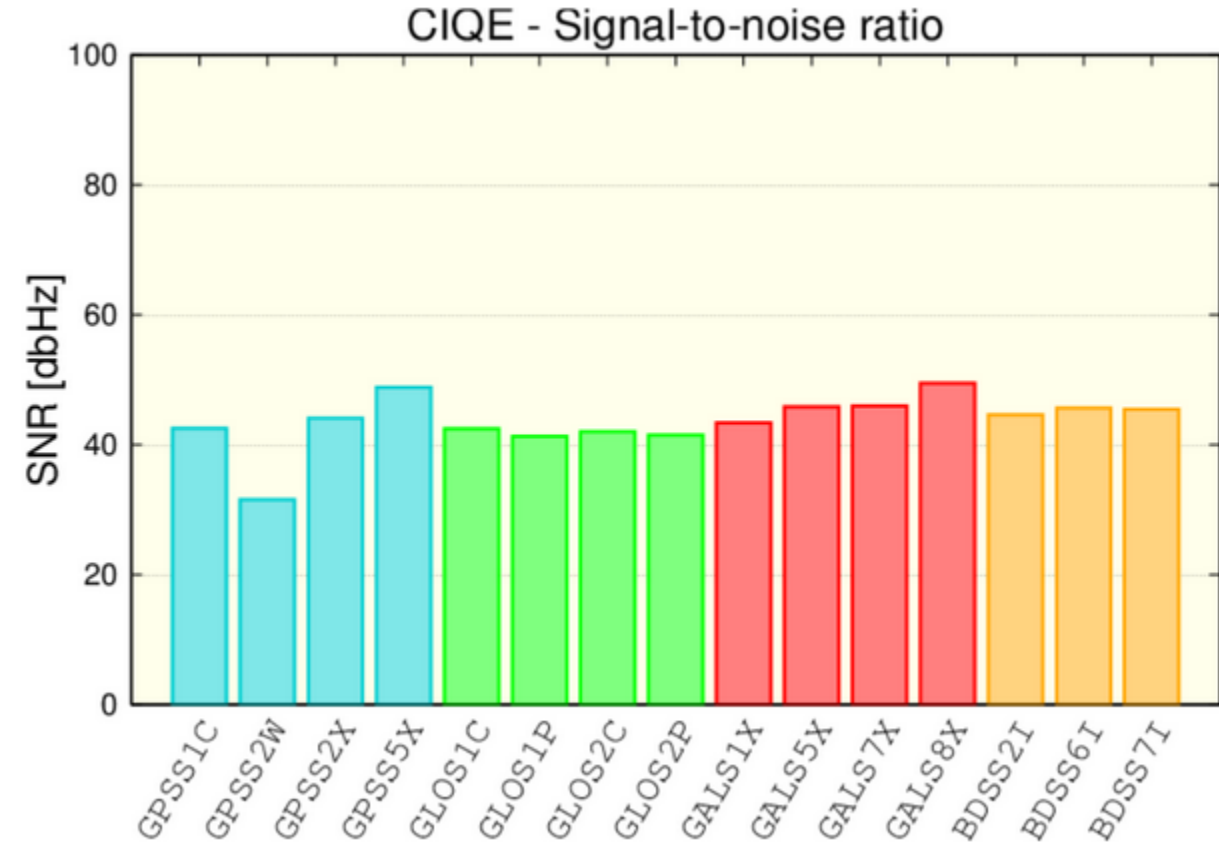
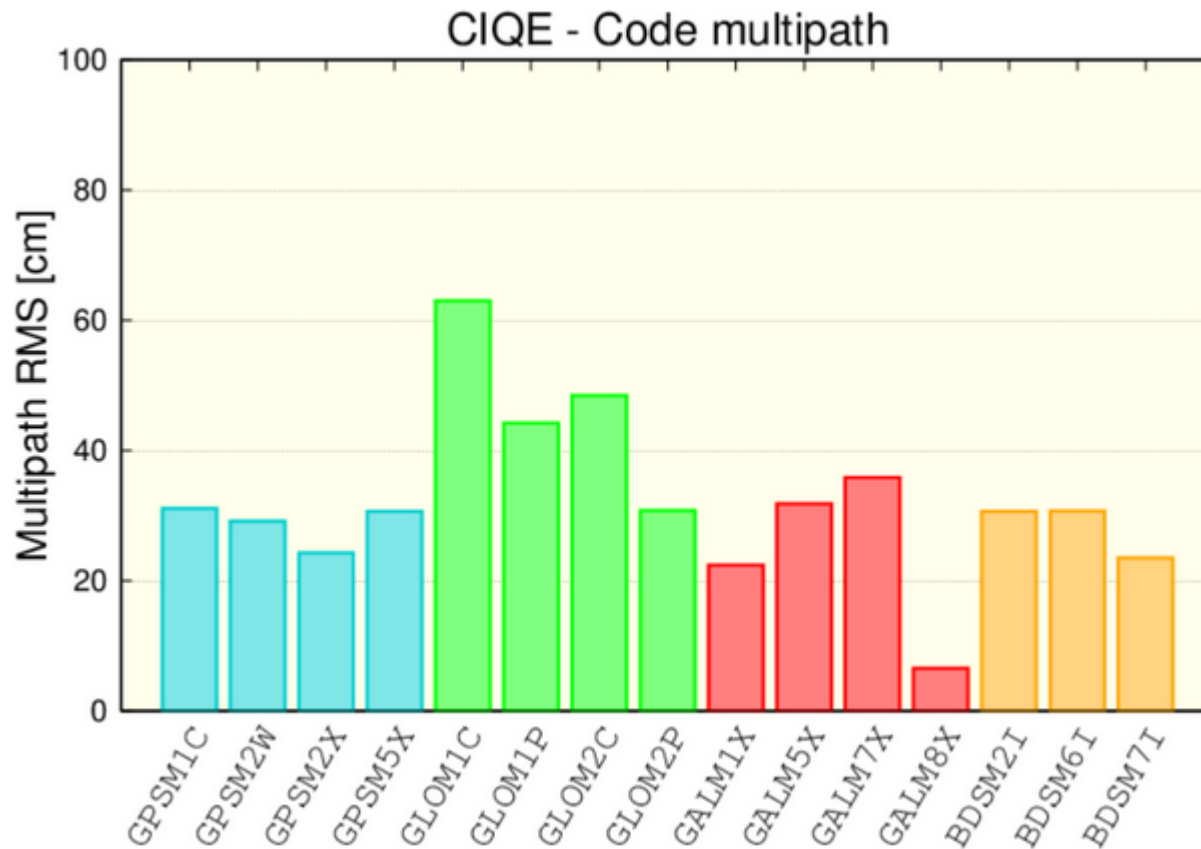
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Recommendations

- Install latest stable firmware 5.45
- Activate tracking of unhealthy satellites
- Activate missing signals (if available)
- Update site log or RINEX header
- Fix filename

Key Issues

- GLO signal G3 missing
- GAL signal E6 missing
- BDS signals B1/B5 missing
- BDS GEO/IGSO satellites are missing
- Low number of observations for BDS (50% for elevation 5°)
- Unhealthy satellites missing (E14, E18, R11, ...)
- Firmware mismatch (5.33 vs 5.37)
- Coordinates between RINEX and sitelog differ by 41 m
- Filename needs to be RINEX 3 compliant

Posibles estaciones IGS en Latinoamérica y El Caribe?

Potential IGS stations in Latin America and the Caribbean?

