



GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES Y MOVILIDAD SOSTENIBLE



RED DE INFRAESTRUCTURAS GEODÉSICAS

Servicio de Posicionamiento GNSS en Tiempo Real de España



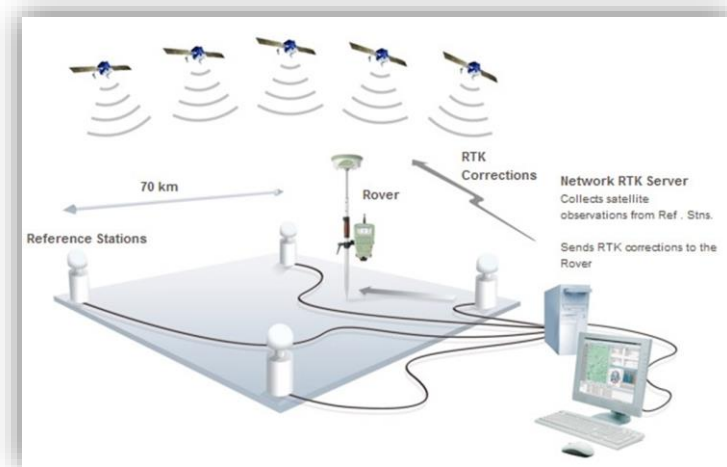
Experiencias de los Servicios de Posicionamiento GNSS en Tiempo Real, vigentes en la región SIRGAS y contribuciones a nivel global



José Manuel Serna [IGN, RIG]

9 de abril de 2024

WHAT IS SPTR? How can it help us?



cm accuracy
in real time!

- > 12500 users.
- > 750 simultaneous users daily.
- Many different activity areas.

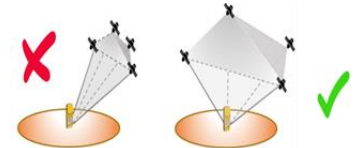
GNSS multiconstellation: why so important?

A multi-constellation receiver: GPS, GLONASS, GALILEO and BEIDOU.

The use of other constellations in addition to GPS, results in there being a larger number of satellites in the field of view, which has the following **benefits**:



- **Reduced signal acquisition time.**
- **Improved position and time accuracy.**
- Reduction of problems caused by obstructions such as buildings and foliage.
- **Improved spatial distribution of visible satellites**, resulting in improved dilution of precision.
- Redundancy is built into the solution. If a signal is blocked due to the working environment, there is a very high likelihood that the receiver can simply pick up a signal from another constellation, ensuring solution continuity.
- While extremely rare, if a GNSS system fails, there are other systems available.



To determine a position in **GPS-only** mode, a receiver must track a minimum of four satellites. In **multi-constellation** mode, the receiver must track five satellites, at least one of which must be from a satellite in the other constellation, so the receiver can determine the time offset between constellations.

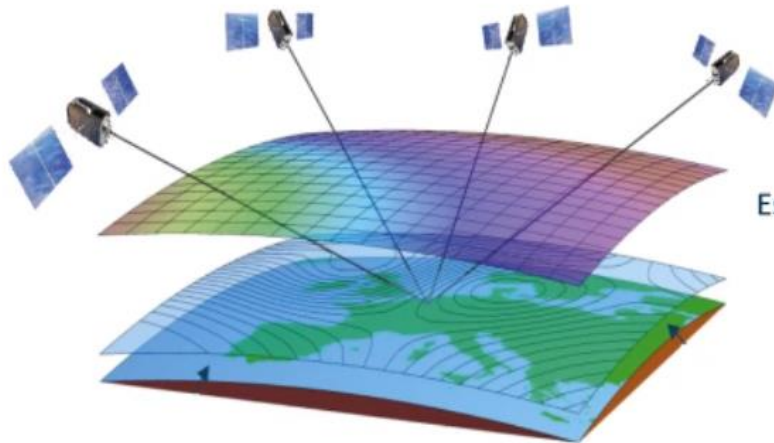
5-10m

1-2cm

mm

GNSS error sources

Accuracy



Corrected by Augmentation

Satellite error sources

- orbits (0.2 .. 5 m)
- atomic clocks (0.2 .. 10 m)
- Hardware code biases (0 .. 1 m)
- Hardware phase biases (0 .. 2 Pi)
- Satellite antenna PCV + GDV

Estimated by Rover (PPP / PPP-AR)
Or
Corrected by Augmentation
(Network-RTK & PPP-RTK)

Signal delays by

- Ionosphere (0,5 .. 100 m)
- Troposphere (0 .. 2 m)
- Water vapour (0 .. 0,5 m)

Corrected by Calibration

Receiver error sources

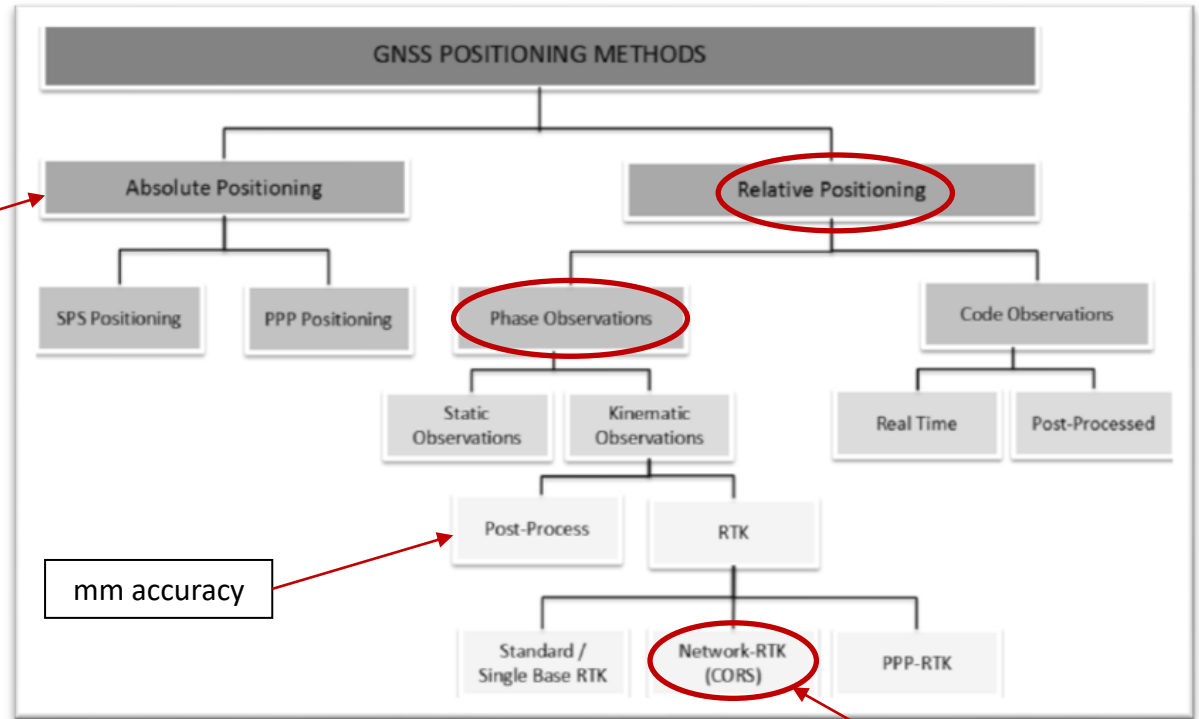
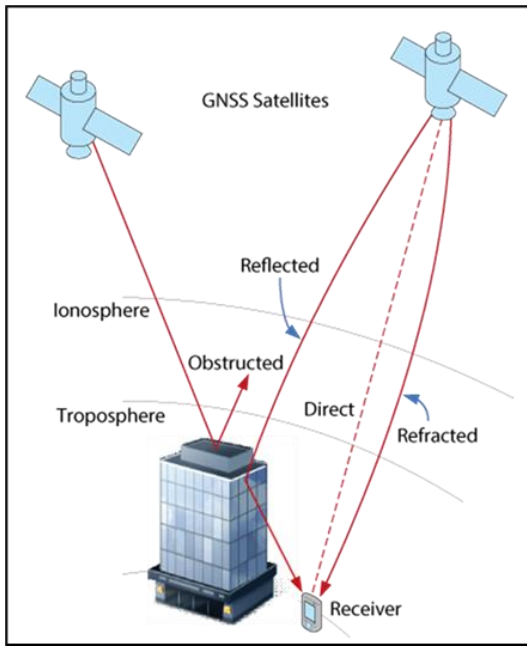
- Receiver Antenna (mm to m)
- Multipath Nearfield
- Multipath Farfield

Current Research

GNSS observation modes: accuracy thresholds

- Absolute or Relative.
- Code or phase.
- Static, kinematic
- Post-processing or **Real Time**.

SINGLE RX: 5-10m



mm accuracy

REAL TIME!

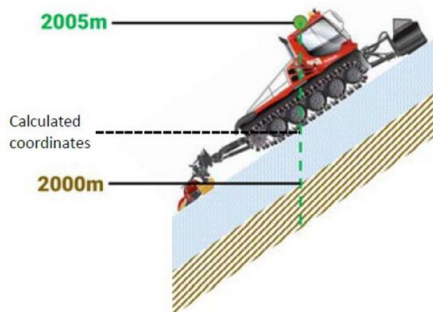
MULTIPLE RX: 1-2cm



GNSS APPLICATIONS

- *Cartography.*
- *Topography.*
- *Geodesy.*
- *Cadastral and property.*
- *GIS (Geographic Information System).*
- *Construction.*
- *Agriculture.*

Different levels of accuracy required



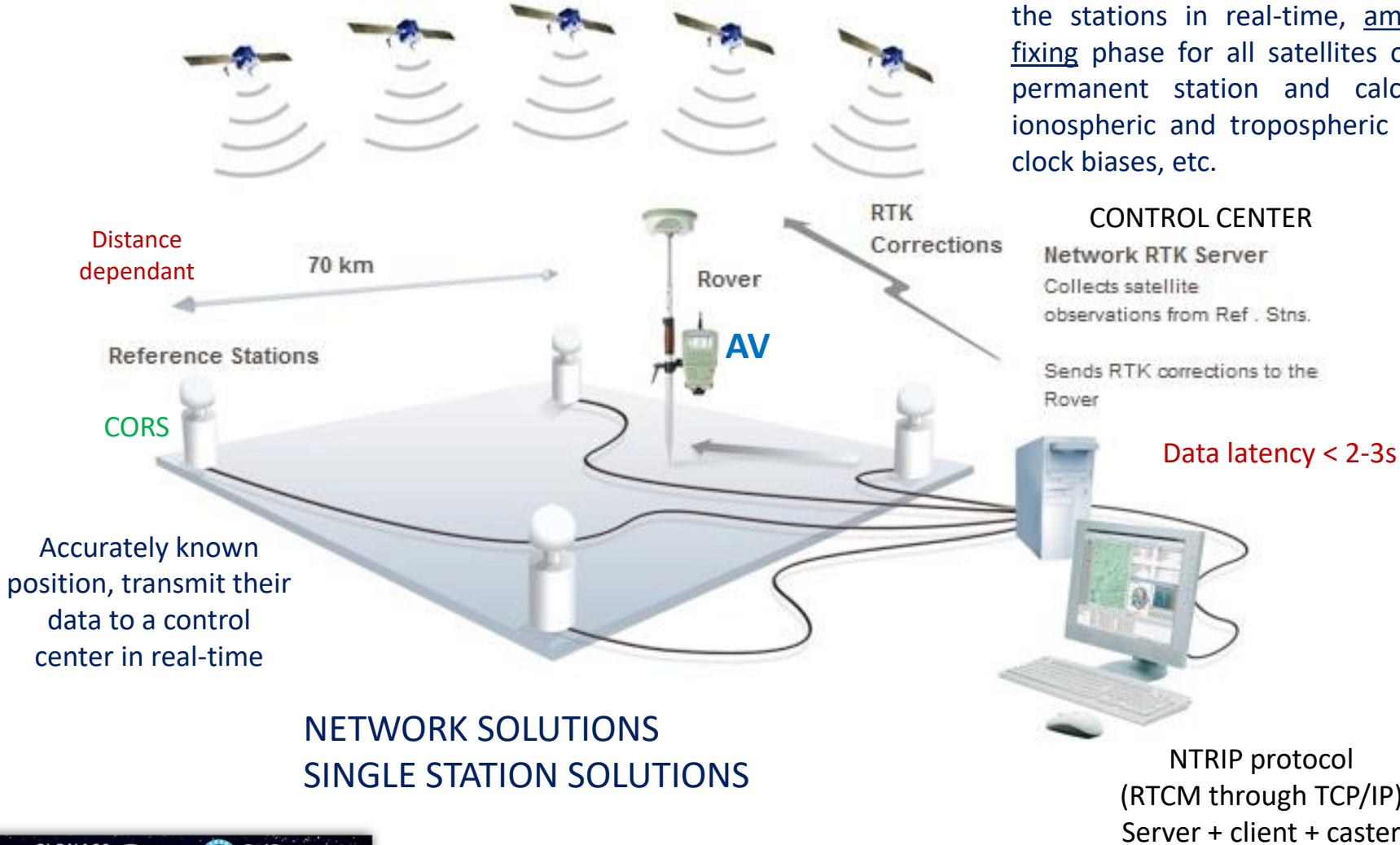
Future...TODAY!

- 5G
- **Autonomous navigation**
- ...



UAV Precise automated trajectories, fast convergence, accurate geo-tagging	Precision Agriculture Precise guidance, fast convergence for seeding and herbicides	Automotive Navigation for AD/ADAS Level 2 driving automation	Heavy Machinery Machine control, construction and mining environments	Service Robots Robotic lawnmower Unmanned service delivery	Specialty Vehicles Shared micro mobility that meets locality regulations

Network RTK (NRTK)



Receives and processes the data of the stations in real-time, ambiguity fixing phase for all satellites of each permanent station and calculating ionospheric and tropospheric delays, clock biases, etc.

Accurately known position, transmit their data to a control center in real-time

NETWORK SOLUTIONS
SINGLE STATION SOLUTIONS

NTRIP protocol
(RTCM through TCP/IP)
Server + client + caster



Network real time error modelling (ambiguities resolution).

The error modelling depends on the distance station-rover (baseline). Up to 80-100km.

Advantages:

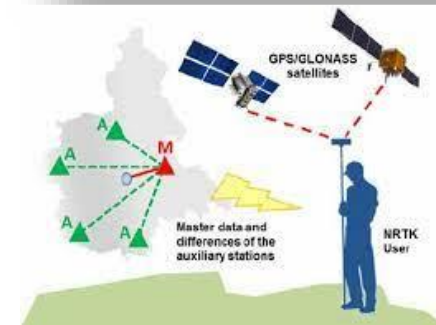
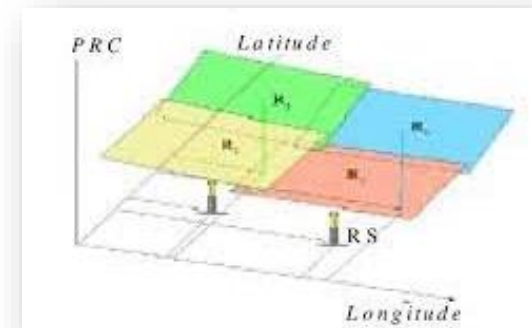
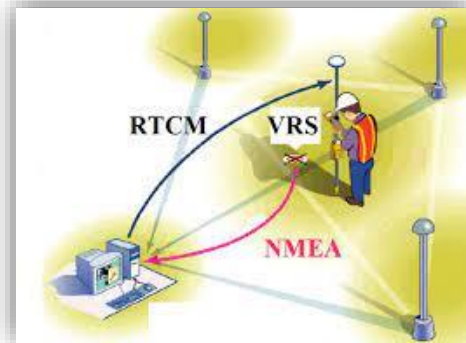
- **Only rover receiver necessary (no base station).** Network of reference stations.
- **Homogenous** accuracy in the network area (1-2cm), worse in height.
- 80-100km baseline (depending on the software).
- **Corrections availability and reliability improved.**
- **Not necessary to know the closest reference station.**

Drawbacks:

- Communications availability.

Main solutions:

- **VRS** (virtual reference station).
- **FKP** (Flächen Korrektur Parameter).
- **MAC** (master auxiliary concept).
- **CERCANA** and **SINGLE POINTS**.



- Read carefully **receiver** error messages to help understanding the problem.
- Incorrect **receiver setup parameters** (IP, port, mountpoint, user and password).
- **Reference station too far away.**
 - Difficulty to solve ambiguities.
 - Mainly when connected to single station corrections. Better using network solutions.
 - Higher time necessary to solve ambiguity.
- **Internet connection.**
 - Bandwidth: net overloading.
 - Poor internet coverage.
 - Interferences.
 - Cell jump.
- **Corrections latency** too high.
 - Time between GNSS signal generation and correction arrival to the rover (<3-4s).
- Monofrequency/low quality antenna in **low cost receivers** (smartphones, drones...).
- **Dark areas and moving rover** (cycle-slips, ambiguity fixing lost).
- **SPTN down, reference station down.**



CORE: IGN - ERGNSS network



122 stations

29 inside worldwide networks.

Multiconstellation

Others:

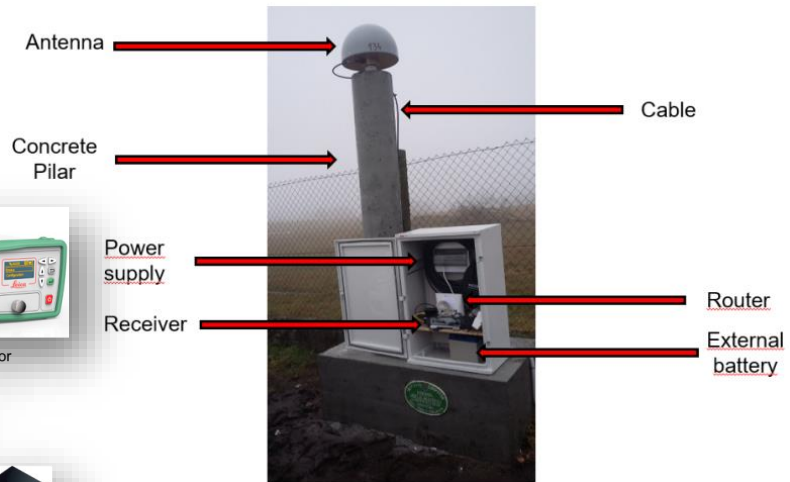
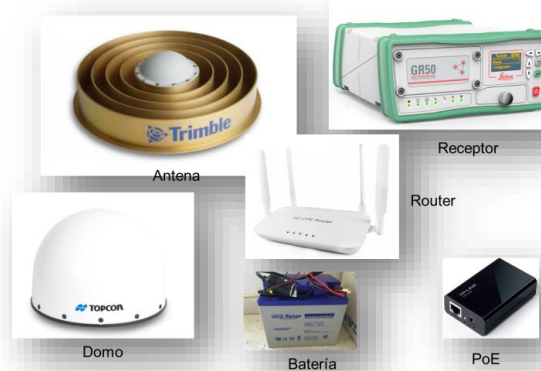
- CCAA
- Puertos del estado
- EUREF
- IGS

The performance of a NRTK infrastructure can be improved realizing a correct design of the network, in term of CORSS inter-distances and geometrical distribution. Considering the quality of the GNSS products used in a NRTK as precise ephemerids and the quality of algorithms devoted to estimate the phase ambiguity, inter-distances can be extended up to 100 kms.

Permanent stations network

- Antenna + receiver + communications system + power supply system.
- Good location (visibility, Multipath, RFI...).
- Stability, integrity.
- Antenna calibration.
- Antenna height nivelation.
- FTP: RINEX (hour, day).
- TCP/IP: real time.

Position known with very high accuracy



- Scientific reasearch: geodynamics.
- Reference frame stablishment.
- Atmospheric modelling.
- Network RTK.

ARP



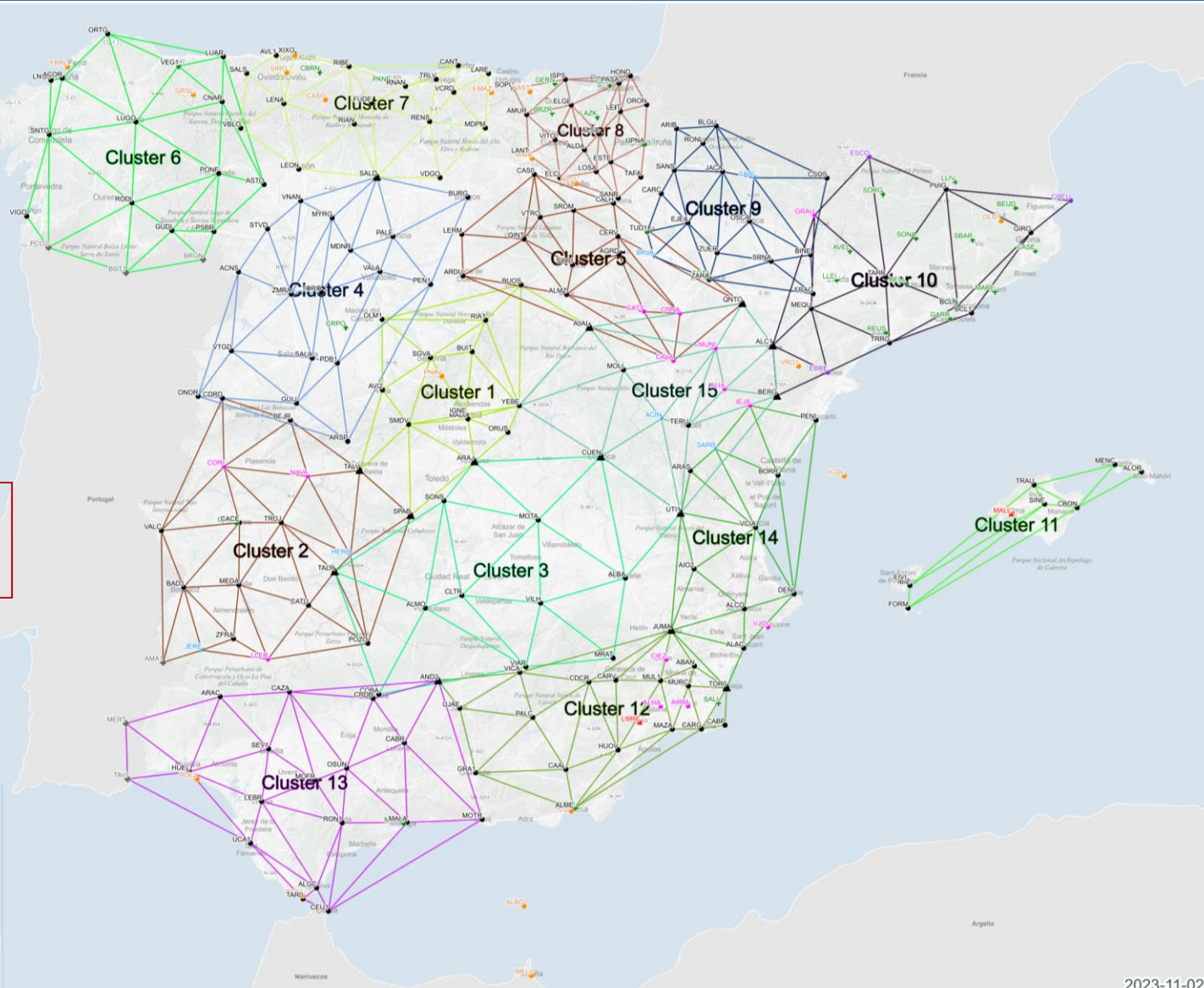
Subnetworks architecture

- Estandar, Δ múltiples cluster
- ◆ No usada en GN2
- Solo RED
- GPS-GLONASS
- Blacklist
- EUREF, sin mountpoint
- No Red, solo mountpoint
- ◆ Portugal
- NO USAR

CORS:268

**GPS
GLONASS
GALILEO
BEIDOU**

**Operative from late
2021**

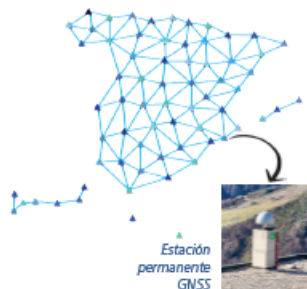




¿Cómo se asegura el servicio en toda España?

Con más de 250 estaciones de referencia

Comunidades Autónomas, Puertos del Estado e Instituto Geográfico Nacional (IGN) han puesto en común sus estaciones GNSS para proporcionar un servicio de posicionamiento de precisión para toda España que es suministrado por el IGN.



- **ERGNSS:** Red Geodésica Nacional de Estaciones de referencia GNSS del Instituto Geográfico Nacional
- **ARAGEA:** Red de Geodesia Activa de Aragón
- **ERVA:** Red de Estaciones de Referencia de Valencia
- **ITACYL:** Red de estaciones GNSS de Castilla y León
- **RAP:** Red Andaluza de Posicionamiento
- **REGAM:** Red de Geodesia Activa de la Región de Murcia
- **REP:** Red Extremeña de Posicionamiento
- **RGAC:** Red GNSS Activa de Cantabria
- **RGAN:** Red de Geodesia Activa de Navarra
- **RGAPA:** Red GNSS Activa del Principado de Asturias
- **RGE:** Red GPS/GNSS de Euskadi
- **RGM:** Red de estaciones GNSS de la Comunidad de Madrid
- **RIOJA:** Red de estaciones permanentes GNSS - La Rioja
- **XGAIB:** Xarxa de Geodesia Activa de les Illes Balears

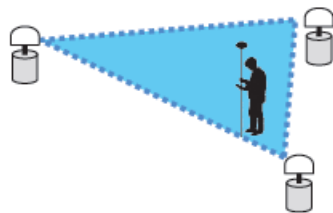
¿Qué ofrece el SPTR?

Si dispone de un dispositivo GPS/GNSS que admita correcciones a la posición y una conexión a Internet, puede utilizar cualquiera de los dos tipos de soluciones que ofrece el servicio:

Solución con el conjunto de red

Las correcciones enviadas son generadas a partir de modelos que se alimentan de los datos registrados por todas las estaciones permanentes de la red. El servicio ofrece varias técnicas para la generación de las correcciones, como son MAC, VRS, FKP o CERCANA.

Esta es la solución más recomendable dado que su precisión es homogénea en todo el territorio y no exige conocer la estación permanente más próxima a la ubicación del dispositivo GNSS.



Solución con estación única (punto simple)

Las correcciones son calculadas utilizando una única estación permanente de referencia. En este caso, el usuario ha de indicarla explícitamente.

Su precisión es menor a medida que el dispositivo GNSS se aleje respecto a la estación permanente de referencia. Por ello es recomendable utilizar la más próxima.



¿Cómo conectarse?

1

El acceso al servicio requiere registro previo para obtener un usuario y contraseña. Puede registrarse a través de la siguiente URL en su navegador:

<http://ergnss.ign.es/gnuserportal/>

O en su dispositivo móvil a través del siguiente código QR:



2

Dependiendo del tipo de solución que elija, deberá configurar su dispositivo GNSS con los parámetros requeridos:

Solución con el conjunto de Red

URL: ergnss-tr.ign.es

IP: 192.148.213.42

Puerto: 2101

Punto de montaje: Ejemplos válidos pueden ser cualquiera de los siguientes:

- **GPS+GLONASS+GALILEO+BEIDOU (RTCM3.2,MSM):** MAC3M, VRS3M, FKP3M, CERCANA3M
- **GPS+GLONASS (RTCM3.1):** MAC3, VRS3, FKP3, CERCANA3

Solución con estación única o punto simple

URL: ergnss-tr.ign.es

IP: 192.148.213.42

Puerto: 2102

Puntos de montaje (RTCM3.2,MSM): Nombre de la estación de 4 caracteres, seguido de 3M (ejemplos: IGNE3M, ALBA3M,...)



Userportal

Menu

- Home
- admin
- User Management
 - Profiles (all)
 - Administrator
 - Organization
 - User
 - Services
 - Reports
 - Exports
- Administration
 - Infos
 - Groups
 - Services
 - Areas
 - Streams
 - Networks
 - Casters
 - Settings

Administration - Streams

Mountpoint	Identifier	Format	Format Details	Carrier	Nav System	Country	Latitude	Longitude	Height	NMEA	Solut
ABAN3	ABAN	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	38,18000	-1,05000	207,8000	☑	0
ACAL3	ACAL	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	37,73000	-0,86000	67,4000	☑	0
ACIN3	ACIN	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	40,41000	-1,44000	1178,3500	☑	0
ACNS3	ACNS	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,70000	-6,35000	871,2500	☑	0
ACOR3	ACOR	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	43,36000	-8,40000	66,9000	☑	0
AGRD3	AGRD	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,85000	-1,93000	1010,8300	☑	0
AIO23	AIO2	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	39,06000	-1,06000	662,8690	☑	0
AIRM3	AIRM	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	37,81000	-1,13000	253,9900	☑	0
AJAL3	AJAL	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,22000	-2,27000	884,1700	☑	0
ALAC3	ALAC	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	38,34000	-0,48000	60,3500	☑	0
ALBA3	ALBA	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	38,98000	-1,86000	751,6800	☑	0
ALBO3	ALBO	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	35,94000	-3,03000	62,2600	☑	0
ALC13	ALC1	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,05800	-0,14530	397,6600	☑	0
ALCA3	ALCA	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,05800	-0,14530	397,6600	☑	0
ALDA3	ALDA	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,05800	-0,14530	397,6600	☑	0
ALGC3	ALGC	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,05800	-0,14530	397,6600	☑	0
ALHA3	ALHA	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,05800	-0,14530	397,6600	☑	0
ALIA3	ALIA	RTCM3	1004(1), 1006(10), 1008(30), 1012(1), 1019(120), 1020(120)	2	GPS+GLONASS	ESP	41,05800	-0,14530	397,6600	☑	0

- Users registration
- Administrator system management

<http://ergnss.ign.es/gnuserportal>

Servicio de Posicionamiento en Tiempo Real GNSS de España

Usuario/Email

Contraseña

INICIAR SESIÓN

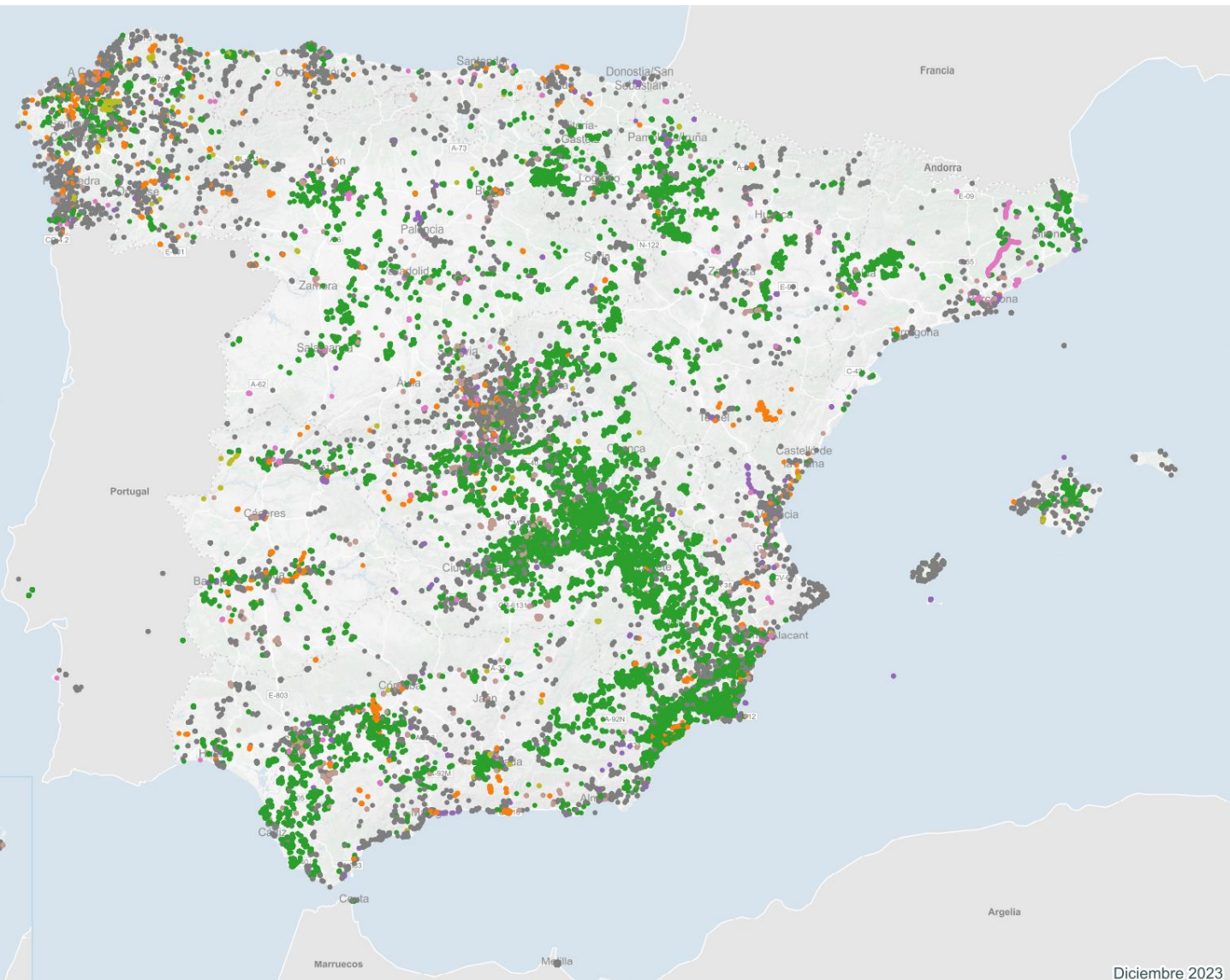
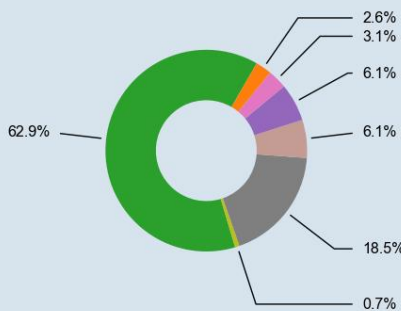
¿HA OLVIDADO SU CONTRASEÑA?

CREAR UNA CUENTA



SPTR users activity areas (December 2023)

- Agricultura - 62.9%
- Medio ambiente - 0.7%
- Topografía y cartografía - 18.5%
- Construcción - 6.1%
- Investigación - 6.1%
- UAV - 3.1%
- Otros - 2.6%



Monitoring and maintenance

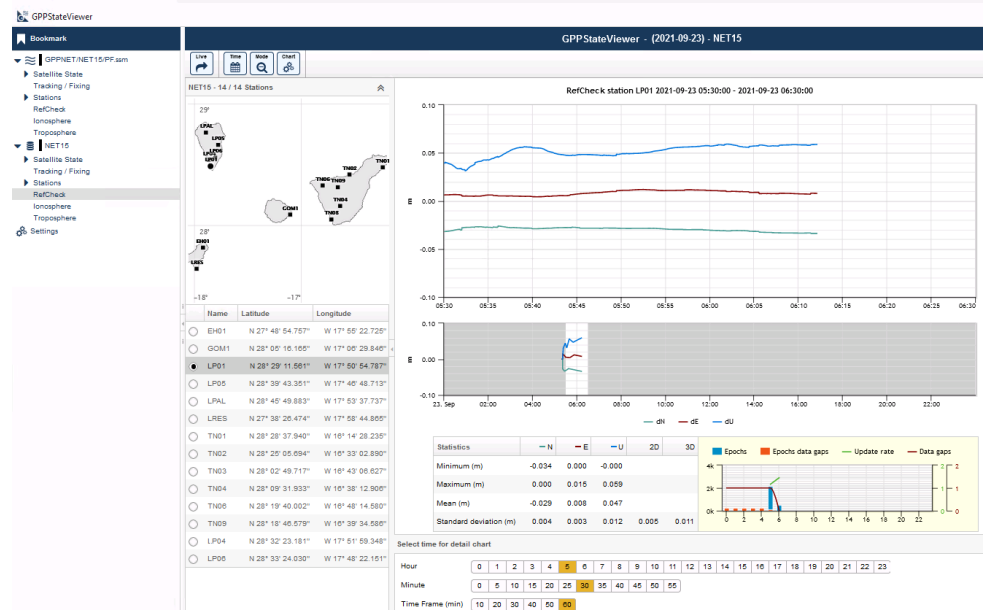
GNSMART2 tools

GNERROR, GNALERT, DFMON, GNIP, RXODELAY, CASTERS status

GNSMON

USERPORTAL

GPPStateviewer

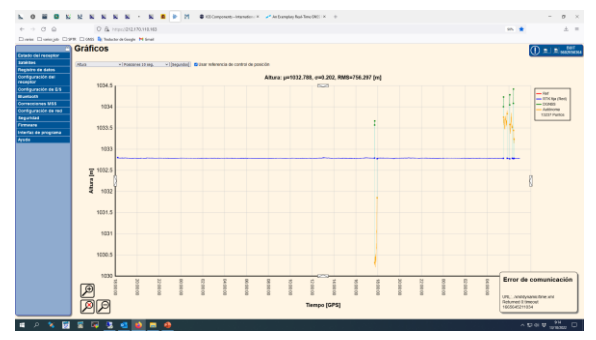
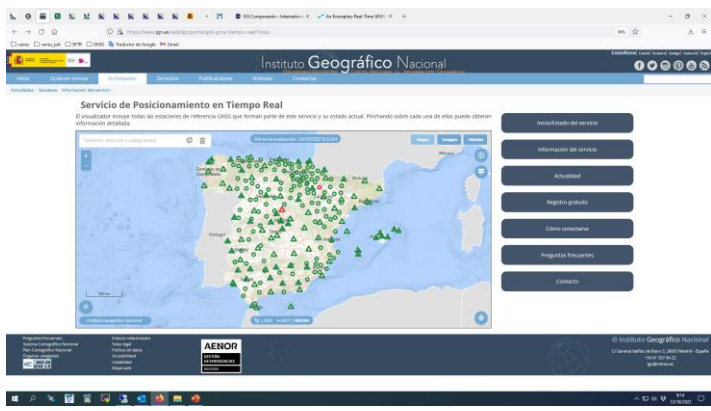


ERGNSS BASE STATIONS DATA MONITORING NETWORKS MONITORING

Laboratory Rx Field monitoring

VISOR_IGN

RTKNAVI - BNC



GPPReceiver

SPTR input_servers

To show the current status of the GNSMART system some Java web services are available. These web services must run within a Java servlet container. The GNSMART installer provides Apache Tomcat for this task. The GNSMART web services are provided as web archive files (*.war).



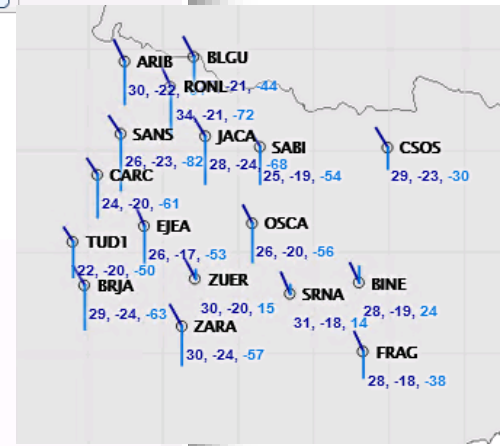
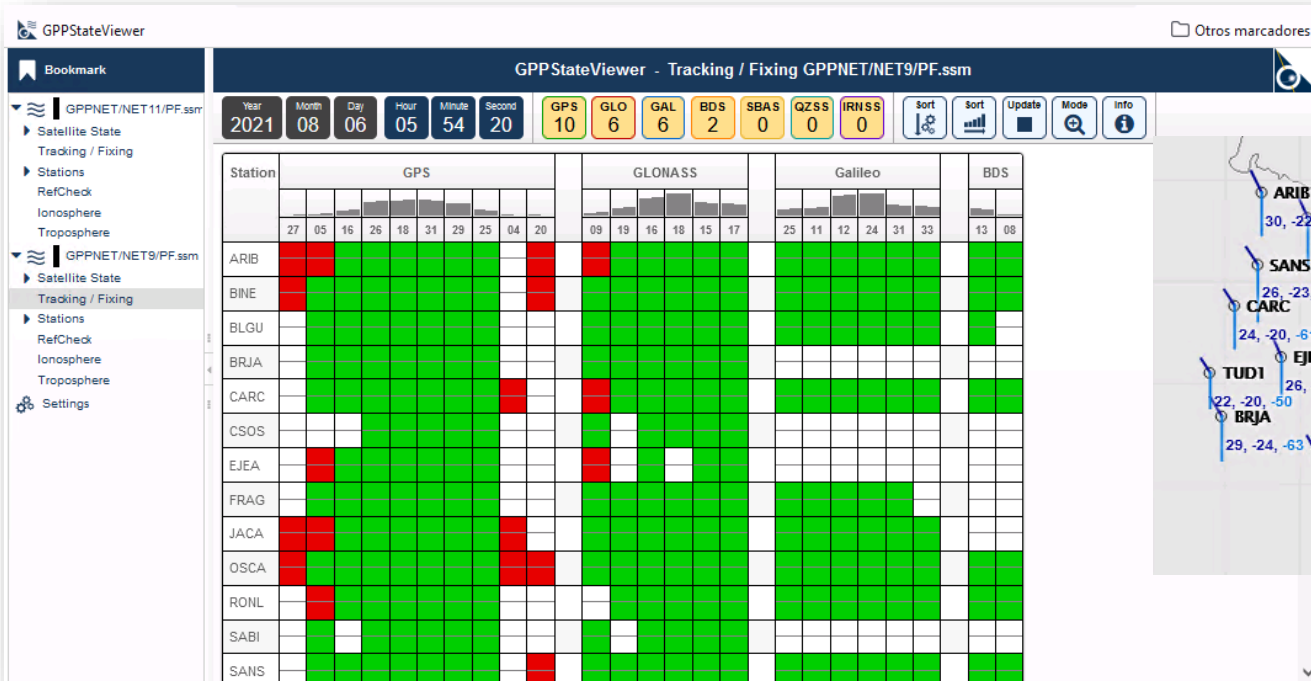
The screenshot shows the GPPReceiver web interface with the following components:

- Date:Time**: A box pointing to the date and time display (2021-08-06 05:50:22).
- Available SVs**: A box pointing to the satellite status indicators (OP1, QLO, QAL, etc.).
- Input CORS**: A box pointing to the left-hand menu listing various receiver stations.
- Signal strength (dBHz)**: A box pointing to the stacked bar charts showing signal strength for GPS, GLONASS, and Galileo satellites.
- Skyplots**: A box pointing to the circular skyplot maps for each satellite system.

More information: skyplot satellites information, pseudorange correction, observation details (pseudorange, phase, doppler, signal strength, loss of lock), receiver information.

GPPStateViewer

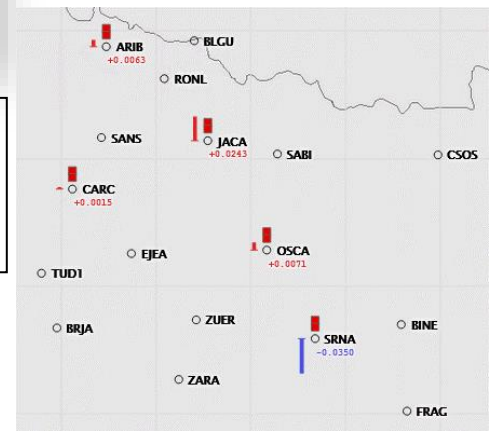
SPTR monitor_server



RefCheck

Tracking/fixing window

Ionosphere Troposphere info



Monitor system clusters:

- Stations ambiguity resolution for each satellite/each constellation.
- Refcheck, ionosphere, troposphere for each station.

SPTR: Network monitoring

- Rovers status/info
- CORS status/info

GNSMON

Filter by: 440 393 19 13 15 244 236 0 0 8

■ RTK Fixed
 ■ RTK Float
 ■ DGPS Mode
 ■ Not Fixed
 ● Online
 ● Single
 No Data
 Offline

Reference Station Details

General Information

Ref ID:	MOTA
RTCM ID:	
# SVs:	21
Latitude [°]:	N 39° 30' 11.55181"
Longitude [°]:	W 2° 52' 12.02939"
Height [m]:	779.8269 m
Net ID:	

Satellite State

All	GPS	GLO	GAL	BDS	SBAS	QZSS	IRNSS
21	10	6	5	0	0	0	0
17	7	5	5	0	0	0	0
4	3	1	0	0	0	0	0

● Tracked
 ● FKP
 ● No FKP

[Details](#)

Rover Details

General Information

Rov ID:	admin
GPUID:	
PGPPUID:	admin_5938_CASTER_IGN
Organization:	
Fix State:	4 - RTK with fixed Ambiguities
# SVs:	15
Latitude [°]:	N 41° 00' 02.18409"
Longitude [°]:	W 3° 38' 12.70662"
Height [m]:	1032.7830 m
HDOP:	0.7
Elapsed since last Msg. [s]:	1.0
NMEATypes:	1
Rover Ref ID:	0
User Agent:	NTRIP Trimble NtripClient/2.0
Address:	192.168.193.189:61761
GLONASS Bias Class:	TRM

Time

Browser Timezone: ISO-Date/Time Week/Second

Login: 2021-08-05 14:26:39

Last Message: 2021-08-06 06:07:01

Elapsed since Login: 15h 40' 21"

Elapsed since last Message: 00h 00' 10"

Timestamp in last Message: 06:06:42

Reference

Ref ID:	BUIT
Mode:	Single Station
Net ID:	
Latitude [°]:	N 41° 00' 02.18409"
Longitude [°]:	W 3° 38' 12.70666"
Height [m]:	1032.70050 m

RTCM

Out ID:	
Type:	RTCM3

True Reference

Latitude [°]:	N 41° 00' 02.18409"
Longitude [°]:	W 3° 38' 12.70666"
Height [m]:	1032.70050 m
True Distance [km]:	0.0

Satellite State

All	GPS	GLO	GAL	BDS	SBAS	QZSS	IRNSS
27	10	6	5	6	0	0	0
25	9	6	5	5	0	0	0
2	1	0	0	1	0	0	0

● Tracked
 ● FKP
 ● No FKP









[Details](#)

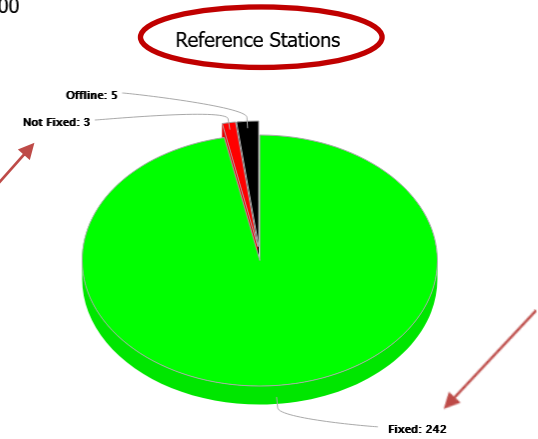
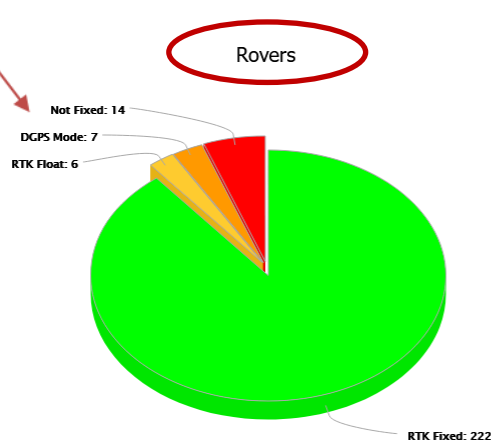
http://192.148.213.42:8009/gnsmon_servlet

SPTR: Network monitoring











GNSMON

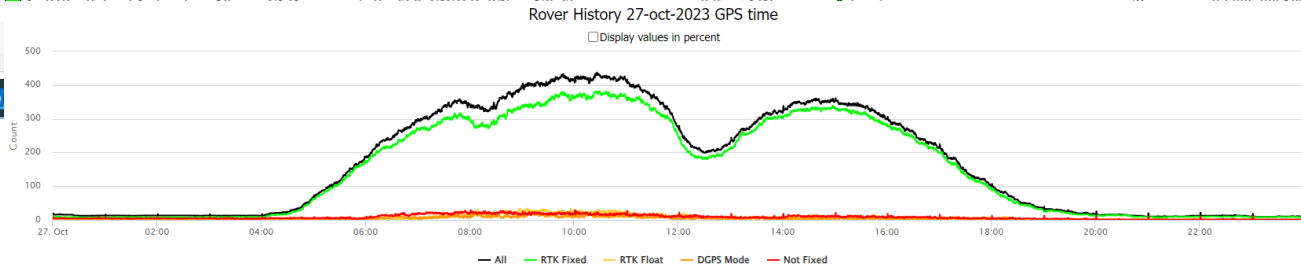
Status 01-ago-2022 8:31:57 GMT+02:00

-  Status
-  Map
-  Reference Stations
-  Rovers
-  Reference Station History
-  Rover History
-  Settings
-  Logout



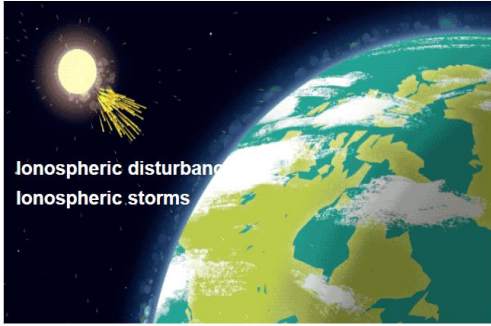
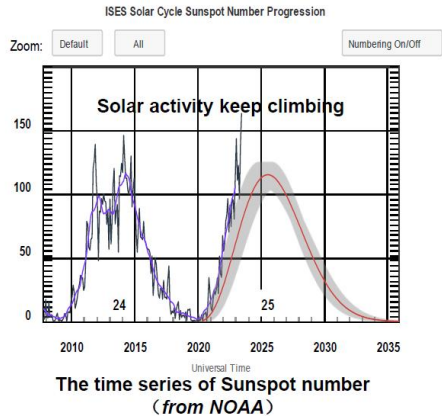
Rov ID	Status	# SVs	Ref ID	PGPPUID	Elapsed since Login [s]	Ela
7s180	4 - RTK with fixed Ambiguities	25	AIRM	7s180_523,CASTER_IGN	5484	1.0
8732	4 - RTK with fixed Ambiguities	12	TORR	8732_6730,CASTER_IGN	4146	1.0
abdenavarro	4 - RTK with fixed Ambiguities	12	PALC	abdenavarro_636,CASTER_IGN	6351	1.0
acana669	4 - RTK with fixed Ambiguities	17	VCIA	acana669_582,CASTER_IGN	643	1.0
acre	4 - RTK with fixed Ambiguities	7	BUOS	acre_73346,CASTER_IGN	523	0.6
acre	4 - RTK with fixed Ambiguities	12	MAL1	acre_73347,CASTER_IGN	394	0.0
acre	4 - RTK with fixed Ambiguities	10	YEB1	acre_73344,CASTER_IGN	2904	0.0
AFITTOVI	4 - RTK with fixed Ambiguities	11	MOTA	AFITTOVI_908,CASTER_IGN	3596	1.0
agricolartk	4 - RTK with fixed Ambiguities	12	CAST	agricolartk_73345,CASTER_IGN	6351	1.0
AGRIMENSOR	4 - RTK with fixed Ambiguities	12	CAST	AGRIMENSOR_73345,CASTER_IGN	6351	1.0

Ref ID	Status	Net ID	RTCM ID	# SVs	Elapsed since last Message	Map
ABAN	Fixed			17	0d 00h 00' 09"	
ACAL	Offline			17	46d 10h 30' 29"	
ACIN	Fixed			10	0d 00h 00' 09"	
ACNS	Fixed			24	0d 00h 00' 05"	
ACOR	Fixed			25	0d 00h 00' 11"	
AGRD	Fixed			25	0d 00h 00' 04"	
AIO2	Fixed			20	0d 00h 00' 08"	
AIRM	Fixed			17	0d 00h 00' 09"	
AGRI	Fixed			25	0d 00h 00' 12"	
AGRI	Fixed			25	0d 00h 00' 12"	



IONOSPHERE – SOLAR ACTIVITY

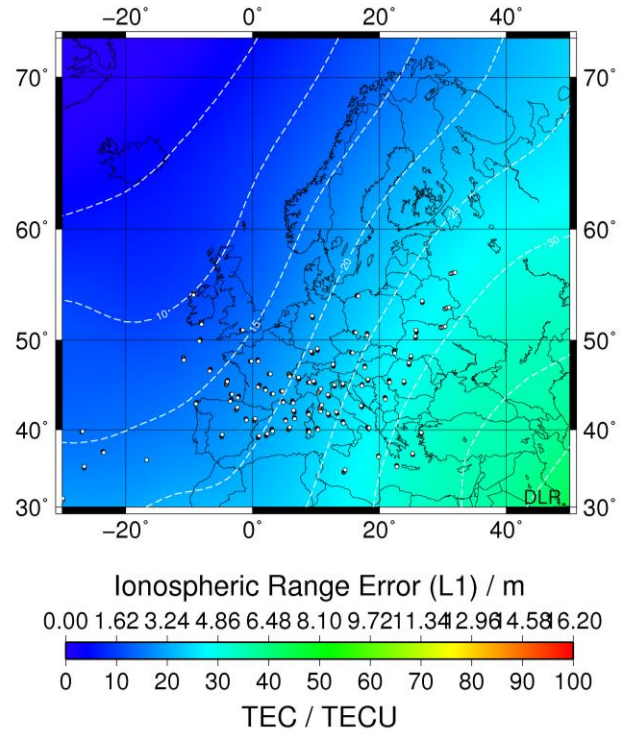
- The 25th solar cycle is approaching its peak year, which is expected to be **2024-2028**
- The **occurrence and amplitude of ionospheric anomalies** will be significantly increased



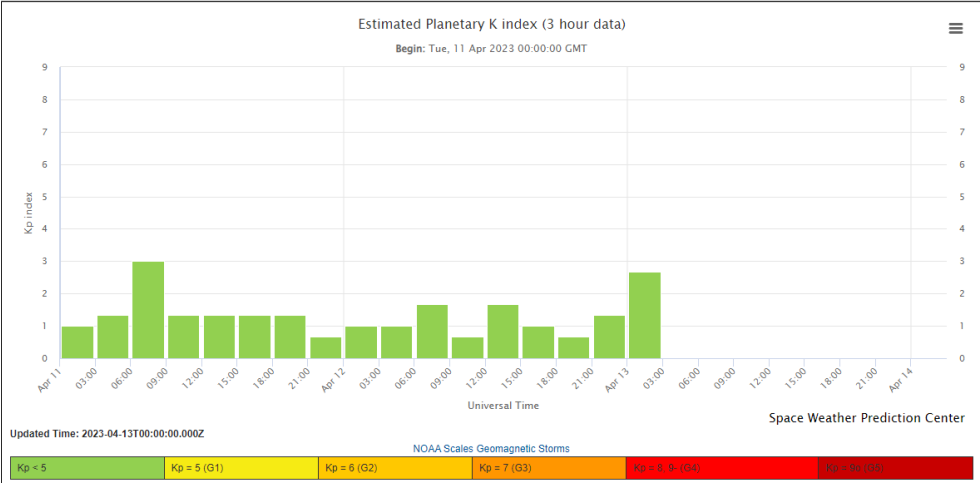
Solar activities is the main driver of ionospheric variations

Total Electron Content (TEC)

2023-04-13 05:45:00 UT



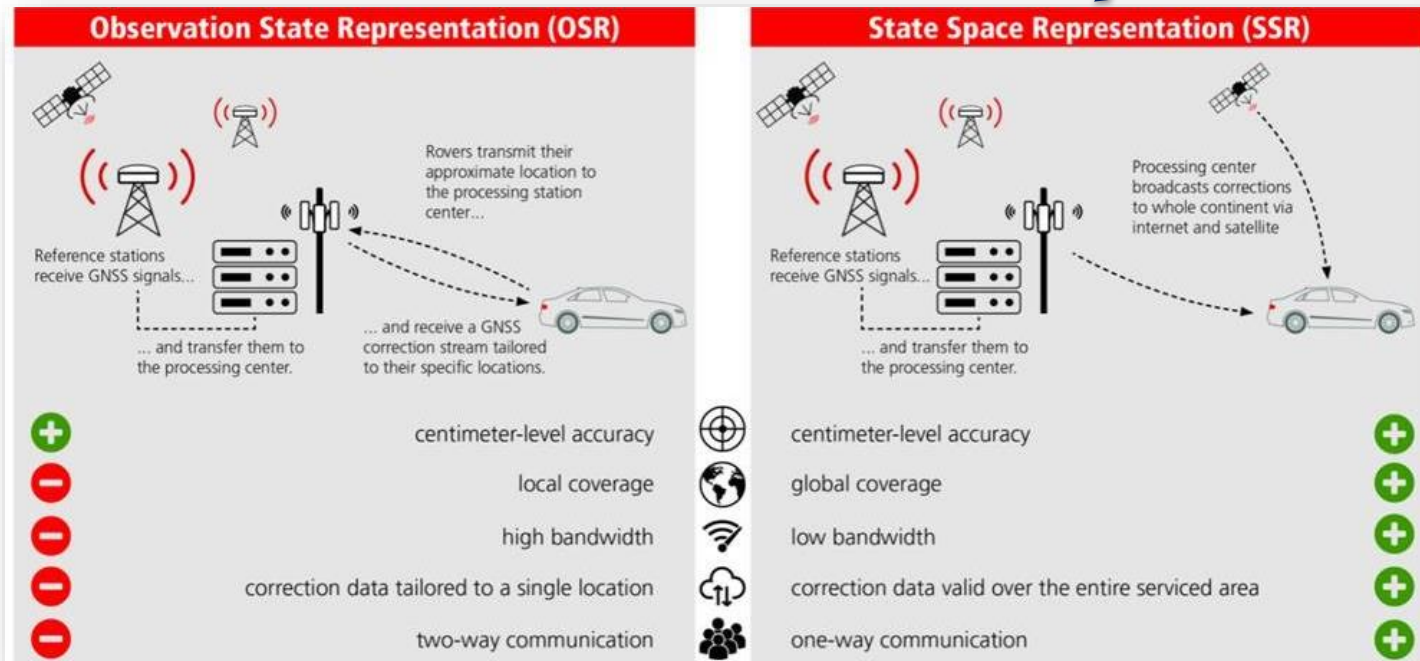
PLANETARY K-INDEX



IGN-SPTR FUTURE?

- Service in the state of the art (infrastructure, SW).
- Support spanish R&D teams to develop AVs technologies.
- SSR?
 - Global mass-market applications.
 - OSR: scaling up difficulties.
 - SSR: allows to broadcast GNSS corrections.
 - Broadcasting: NTRIP, Satellite, DAB+...

Our system already allows SSR



Geo++: **GNSMART**

<https://www.geopp.de/gnsmart/>



Trimble: **PIVOT**

<https://www.trimble.com/Real-Time-Networks/Trimble-Pivot-Platform.aspx>



Leica: **SPIDER**

<https://leica-geosystems.com/es-es/products/gnss-reference-networks/software/leica-gnss-spider>



Topcon: **TopNet+**

<https://www.topconpositioning.com/office-software-and-services/reference-network-software/topnet>



Norway: **CPOS**

<https://www.kartverket.no/en/on-land/posisjon/guide-to-cpos>



Kartverket

Germany: **SAPOS**

<https://www.sapos-bw.de/>



Sweden: **SWEPOS**

<https://swepos.lantmateriet.se/>



Finland: GNSS-Finland service

<https://gnss-finland.nls.fi/#/map>

Hungary: **GNSSnet.hu**

<https://www.gnssnet.hu/index.php?r=site%2Frealtime>

GNSS



REPUBLIC OF ESTONIA
LAND BOARD

Estonia: **ESTPOS**

<https://geoportaal.maaamet.ee/eng/Spatial-Data/Geodetic-Data/Geodetic-Networks/ESTPOS-p671.html>

Private companies GNSS correction services

Hexagon: **HxGN SmartNet**

<https://hxgnsmartnet.com/es-ES/home/services/Network-RTK>



Trimble: **VRS Now**

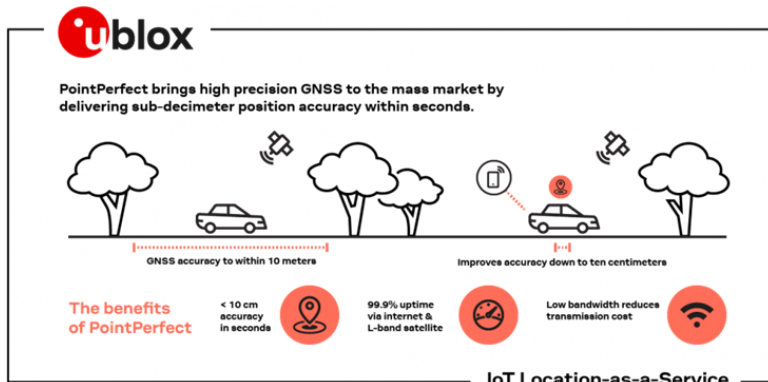
<https://www.allterra-iberica.es/wp-content/uploads/2019/01/ficha-tecnica-vrs-now-allterra-iberica.pdf>

Topcon: **TopNet Live**

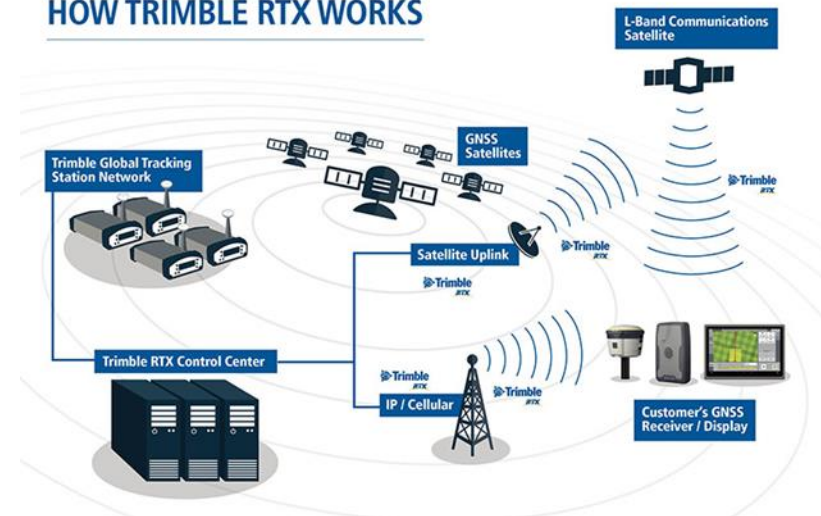
<https://www.topconpositioning.com/office-software-and-services/gnss-correction-services/topnet-live-corrections>

U-blox: **PointPerfect**

<https://www.u-blox.com/en/product/pointperfect>



HOW TRIMBLE RTX WORKS



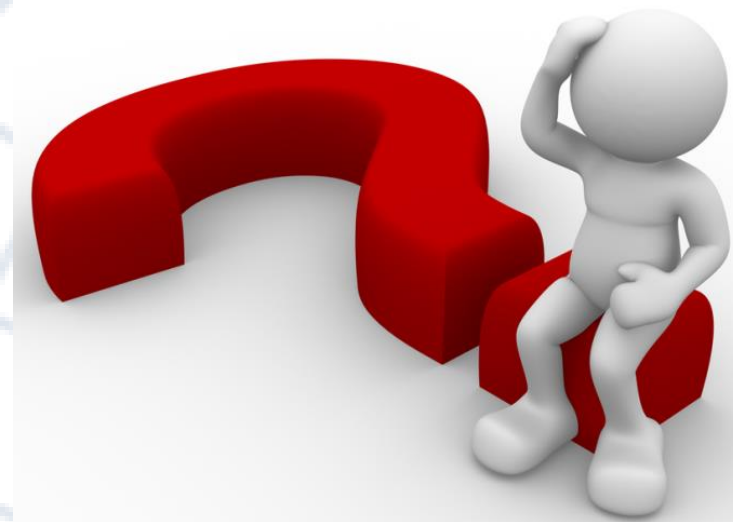


GOBIERNO
DE ESPAÑA

MINISTERIO
DE TRANSPORTES
Y MOVILIDAD SOSTENIBLE



*Thank you
¿Questions?*



SPTR web page:

<https://www.ign.es/web/ign/portal/gds-gnss-tiempo-real>

User Portal:

<http://ergnss.ign.es/gnuserportal>

Contact email:

buzon-geodesia@mitma.es