



# SATELLITE SYSTEM OF PRECISE POSITIONING OF THE REPUBLIC OF BELARUS



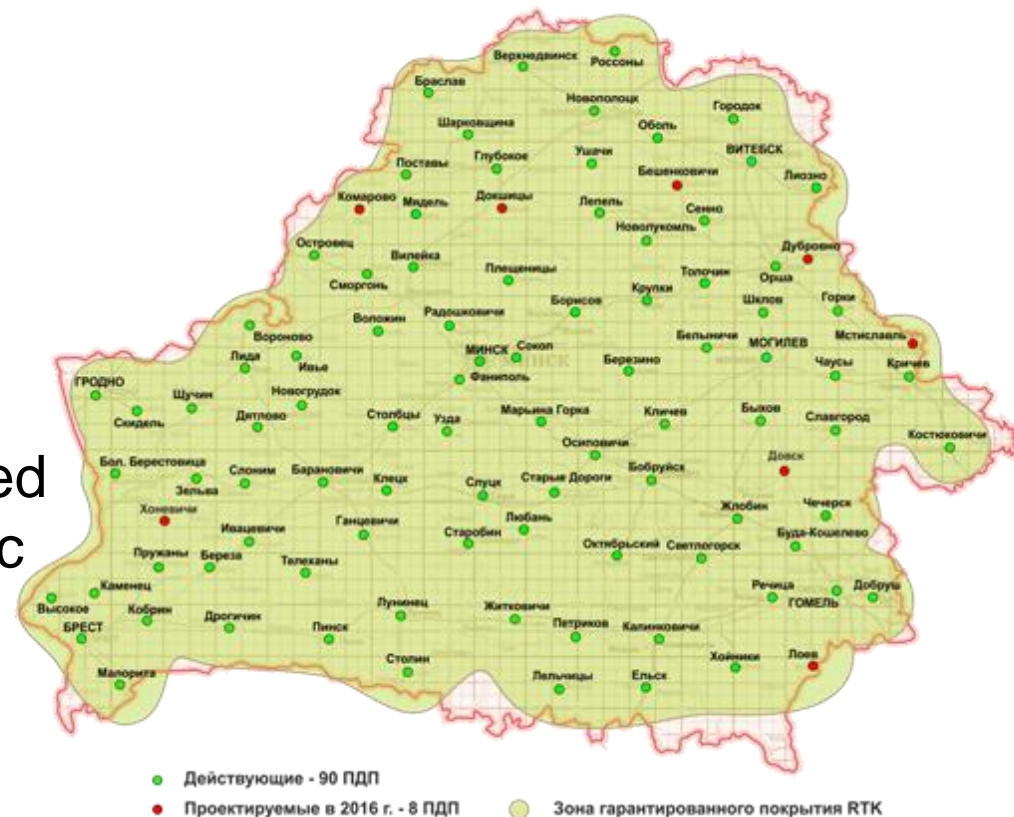
The main purpose of the use of **Satellite System of the Precise Positioning (SSPP) of the Republic of Belarus** are:

- obtaining the coordinates and heights of geodetic points and justification of topographical surveys,
- determination on the ground land borders, landmarks and turning points of boundaries of the city's limits
- obtaining coordinates of the images during aerial photography

SSPP includes 98 Continuous Operation Reference Stations (CORs), that provides 100% coverage of the territory of the Republic of Belarus.

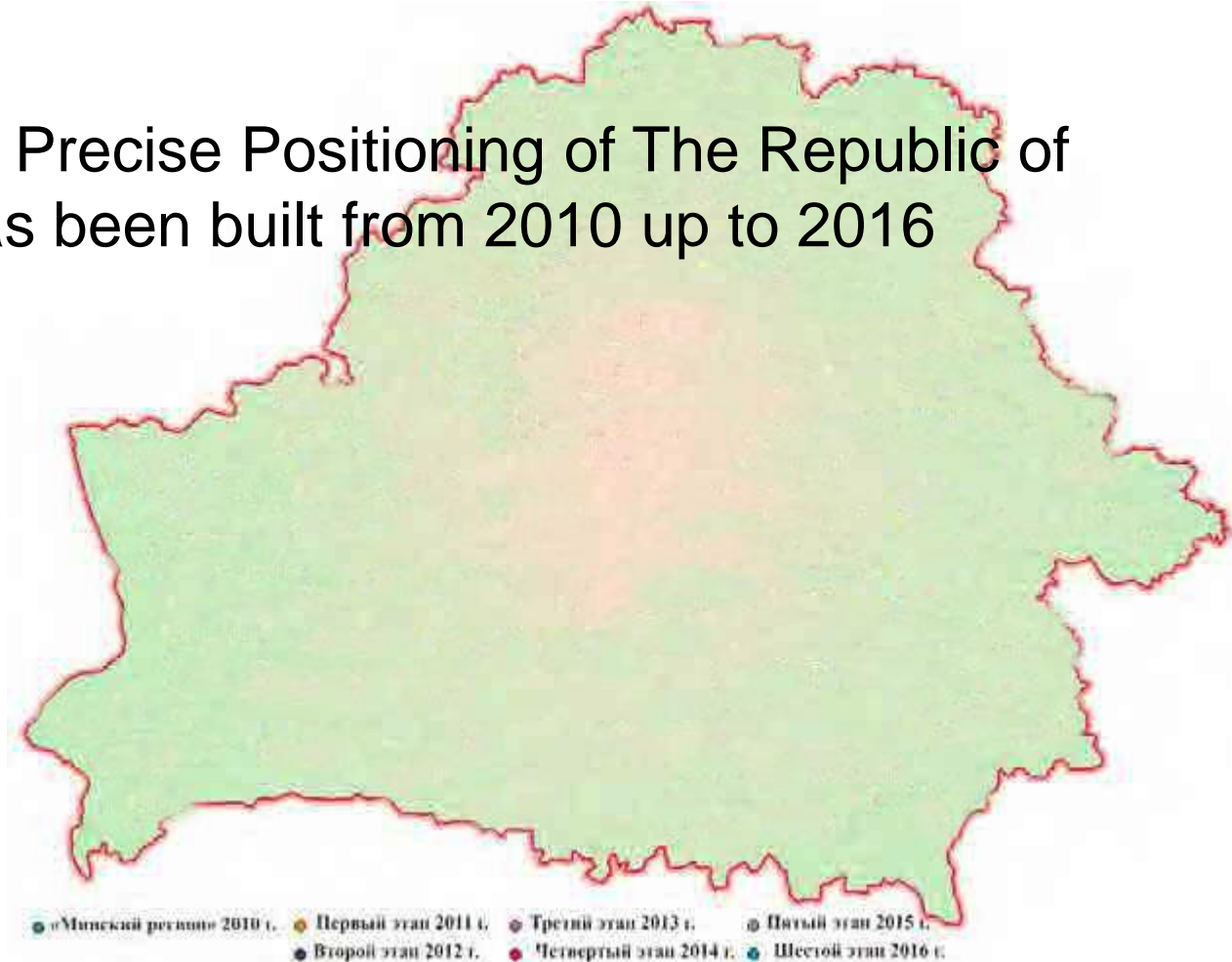
## Infrastructure

- The network of CORs located on the territory of the Republic of Belarus;
- Computing Centre (in Minsk);
- Consumer Service Center of SSPP;
- Communication channels for transmission of information between CORs, Computing Center and Consumer Service Center



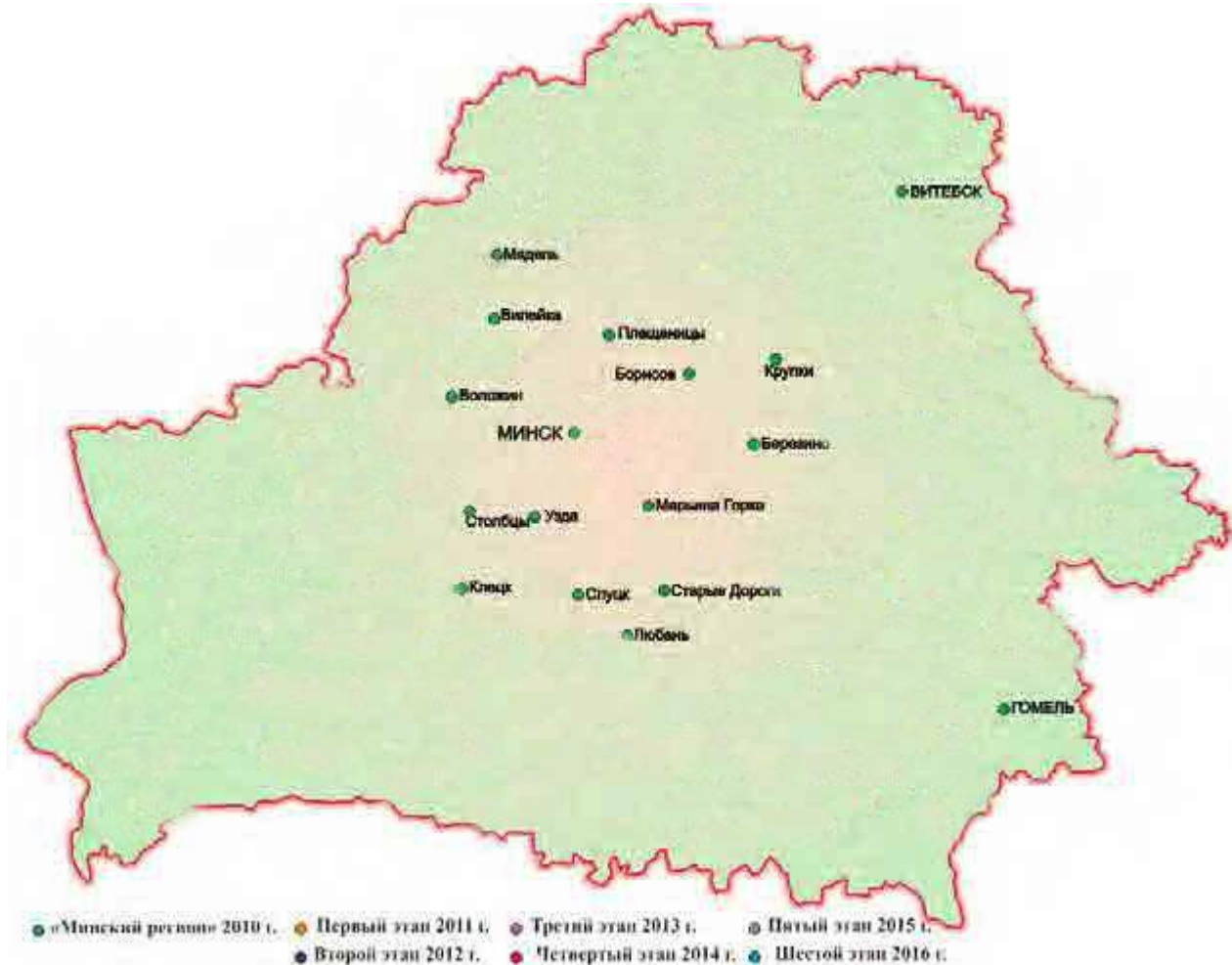


Satellite System of Precise Positioning of The Republic of Belarus (SSPP) has been built from 2010 up to 2016



# Stages of the SSPP Development

- **2010** – Minsk region (18 Continuous Operation Reference Stations and computing center);



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- **2013** – 1-st of the II order (15 CORSSs)





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- **2013** – 1-st of the II order (15 CORSSs)
- **2014** – 2-nd of the II order (10 CORSSs)



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- **2015** – 1-st of the III order (17 CORSSs)





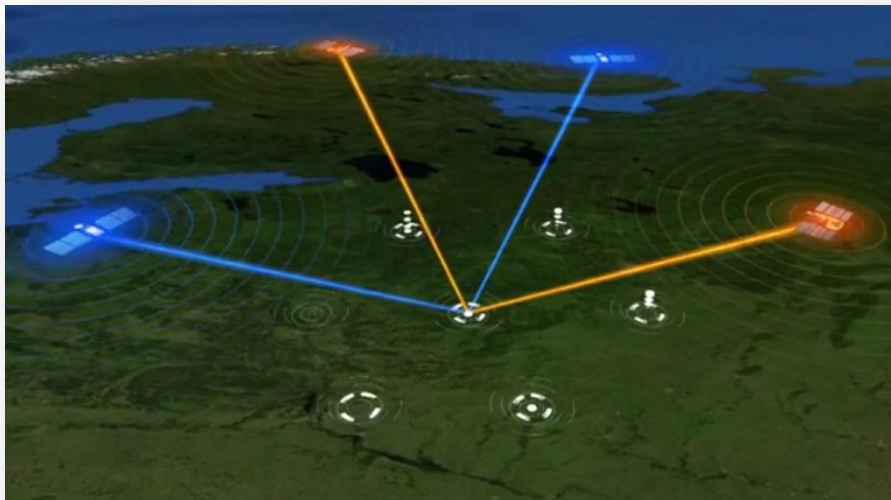
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- **2014** – 2-nd of the II order (10 CORSSs)
- **2015** – 1-st of the III order (17 CORSSs)
- **2016** – 2-nd of the III order (8 CORSSs)





Coordinates of geodetic points and terrain objects are presented in the following coordinate systems



- ITRS\* - (in the implementation ITRF2005\*\*) - for real-time mode;
- ITRS, SC-95\*\*\*, SC-63 or a local system - to the post-processing mode.

\* International Terrestrial Reference System

\*\* International Terrestrial Reference Frame

\*\*\* State System of Geodetic Coordinates (1963 and 1995)

## The accuracy and temporal characteristics of SSPP *in real time (Network-RTK service)*



- the ability to work with a satellite receiver at any location in the region;
- determination of the coordinates of objects in the ITRS (in implementation ITRF2005) in static mode with a mean square error of 2 cm horizontal and 3 cm in height

Receiver sends the coordinates to the navigation data center server using GSM channel where the software of the network RTK calculates the virtual base for receiver. RTK-correction is transferring to the receiver.

## The accuracy and temporal characteristics of SSPP *in post-processing mode*

- determination of the coordinates of points (points) in the ITRS (in implementation ITRF2005) in static mode with a mean square error of 1 cm horizontal and 2 cm in height at the observation time of 1 hour.



Data from CORSs are combining with the user data to calculate the location of the point.

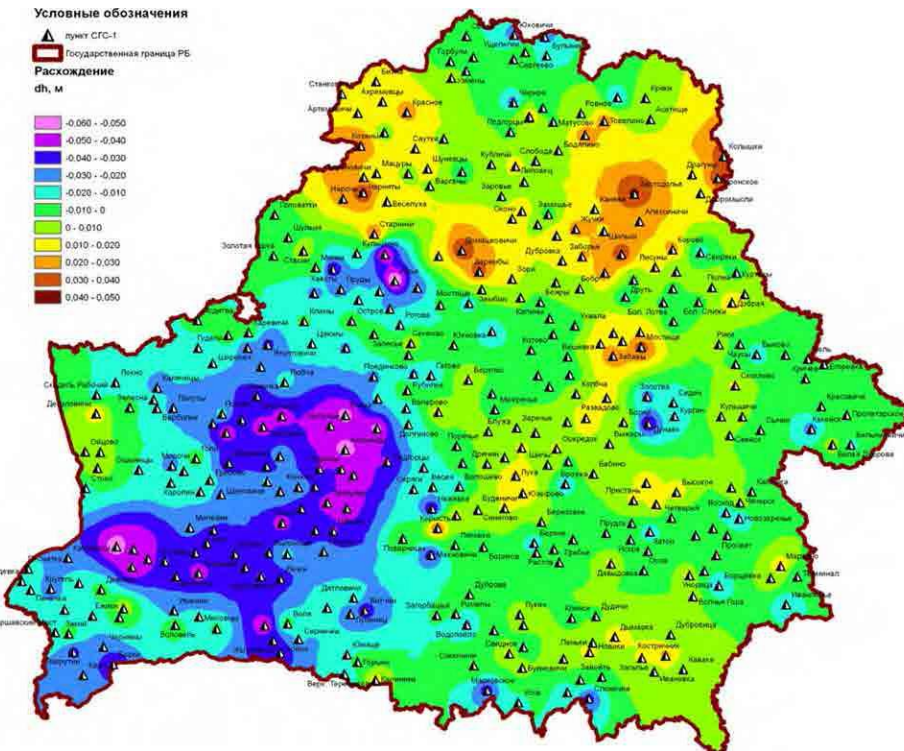


**Условные обозначения**

- ▲ пункт СГС-1
- ▭ Государственная граница РФ

**Расхождение**

ds, м



The total discrepancy of plane coordinates (in N and E) of SGN-1\* reference stations, realizing the ITRS and the SC-95 with the values calculated by CORS

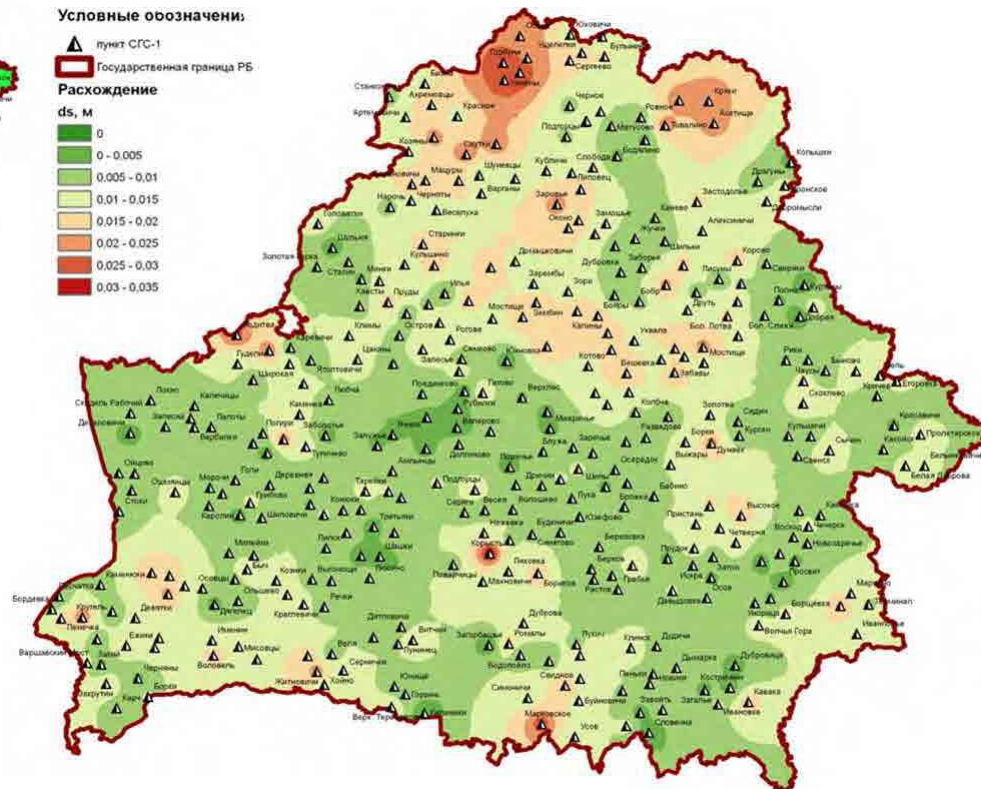
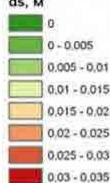


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**Расхождение**

ds, м



↑ The discrepancy between the heights of the SGN-1\* reference stations, which realize ITRS and SC-95 with the values calculated by CORS

\* Satellite Geodetic Network Class 1



## Application of Network (phase) Real-Time Kinematic RTK (centimeter accuracy):

- topographical, geological surveys, aerial and satellite imagery;
- deformation monitoring of buildings and structures, anthropogenic impact, etc.;
- geodetic support of exploration and mining, construction and operation gas and oil transport communications, pipelines, power lines and other engineering facilities;
- cadaster, land management;
- machines and mechanisms running.

## Network (code) differential global positioning system (DGRS) the RTK (meter / decimeter accuracy):

- navigation and positioning of vehicles;
- dispatching fire services, emergency, ambulance, police, road and rail transport;
- data for GIS;
- agriculture;
- forestry and others.



- SSPP-BY is a part of the state geodetic infrastructure, which reproduce all legitimate coordinate reference system in the State with high degree of accuracy in real-time
- It is also part of a subsystem for building and monitoring of navigation fields of *State Unified System of Navigation and Time Support (USNTS)*, so it complements functionally the global satellite systems (GNSS), GLONASS and GPS, as well as Galileo and BeiDou



- Republic of Belarus is open for further the development of the European Spatial Data Infrastructure through collaboration in the area of geographic information and the representation of the its members and their capabilities.
- As a member of EuroGeographics , “BELGEODESY” participates in policy developments, share knowledge and experience and collaborates to find solutions to common challenges.



UNOOSA



United Nations  
Office of Outer Space Affairs



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