

GLONASS Status and Modernization

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**Civil GPS Service Interface Committee
Portland, Oregon
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РОСКОСМОС





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- Recent Events
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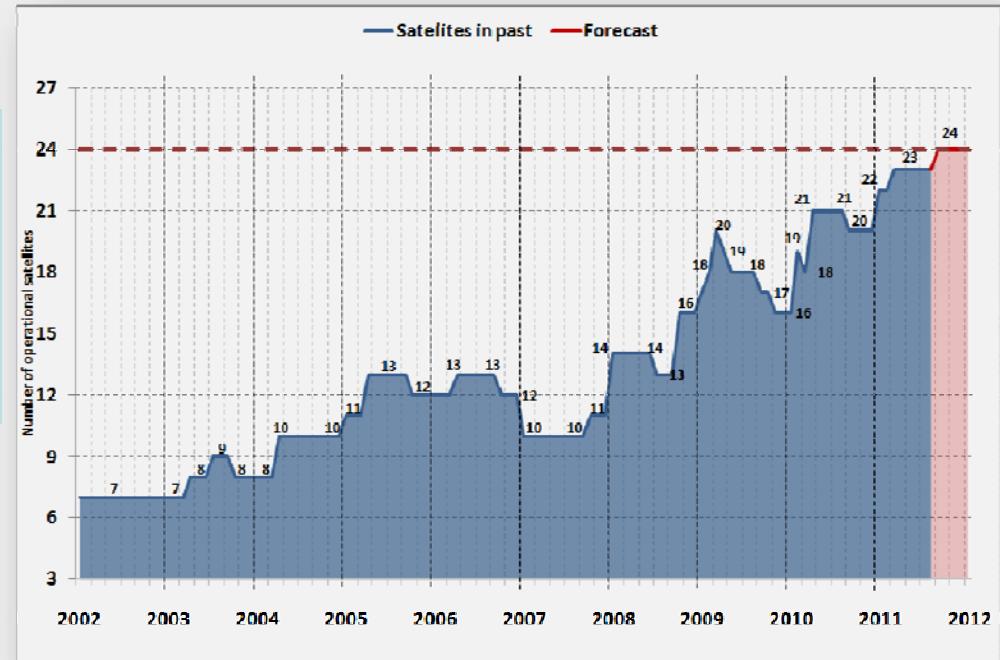
Constellation Status

19.09.2011



Number of operational satellites history

| | |
|----------------|-------|
| Total in orbit | 27 SV |
| Operational | 23 SV |
| In maintenance | 3 SV |
| Flight Test | 1 SV |



The constellation provides:

- Continuous navigation over Russia
- Practically global continuous navigation

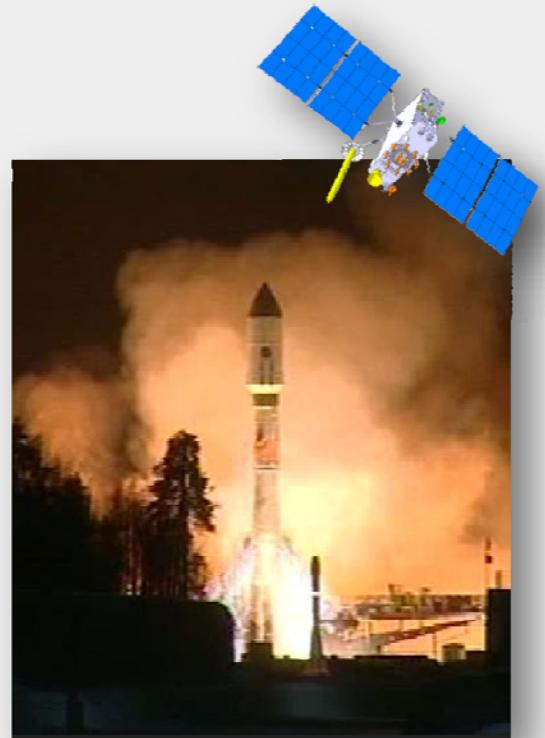


Recent Events



Last launches:

- **26.02.2011 the first GLONASS-K launch**



26.02.2011

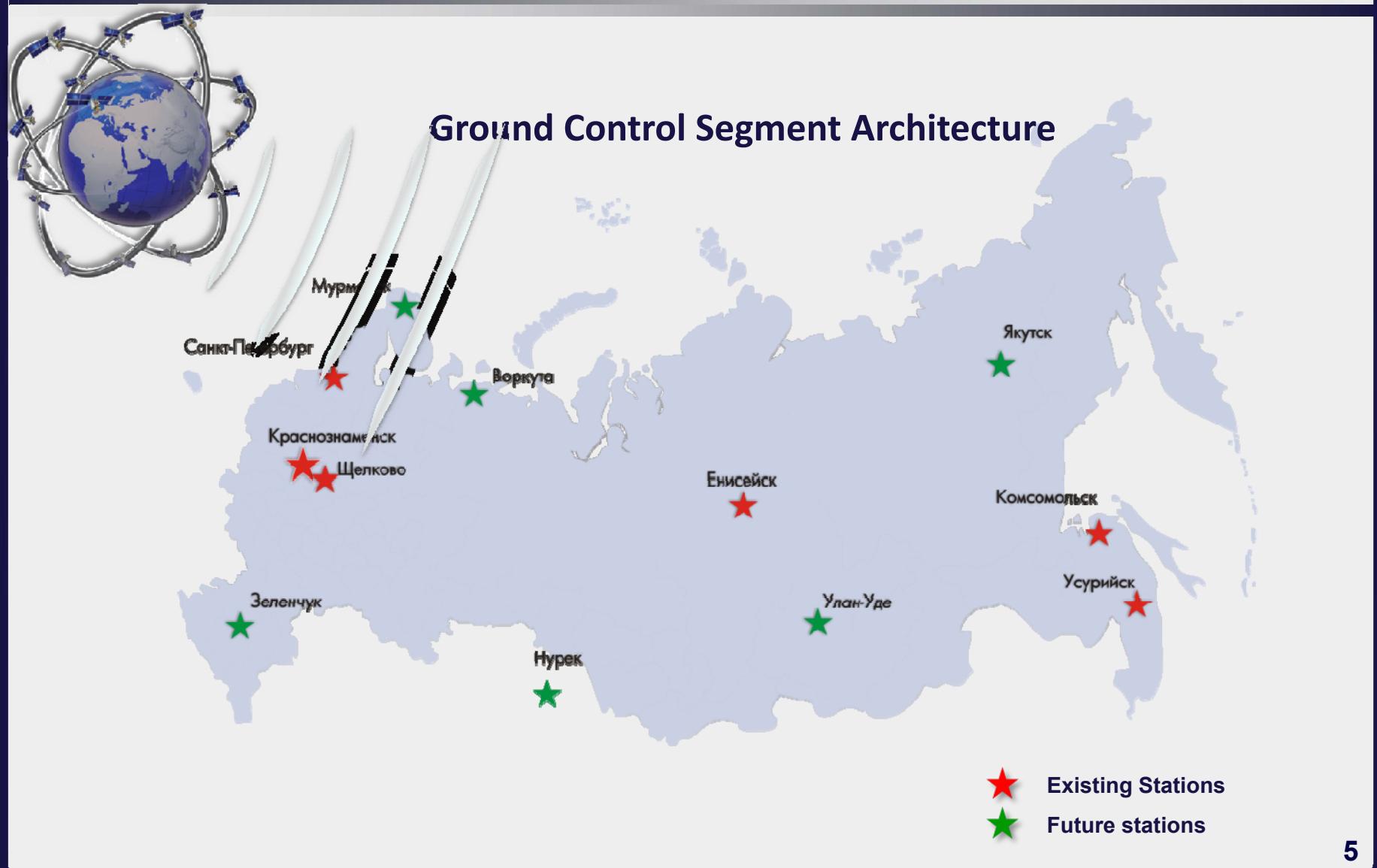
Next Launches in 2011:

- **1 GLONASS-M at October 1**
- **3 GLONASS-M at the end of October**
- **1 GLONASS-M in November-December**
- **1 GONASS-K by the end of the year**

Launch program of 2011 will ensure full constellation deployment and sustainment

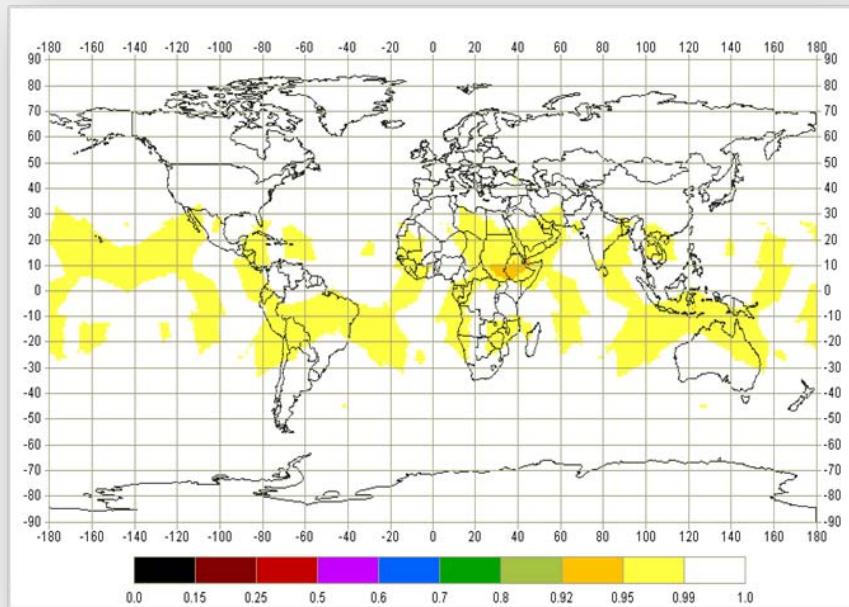


GLONASS Control Segment

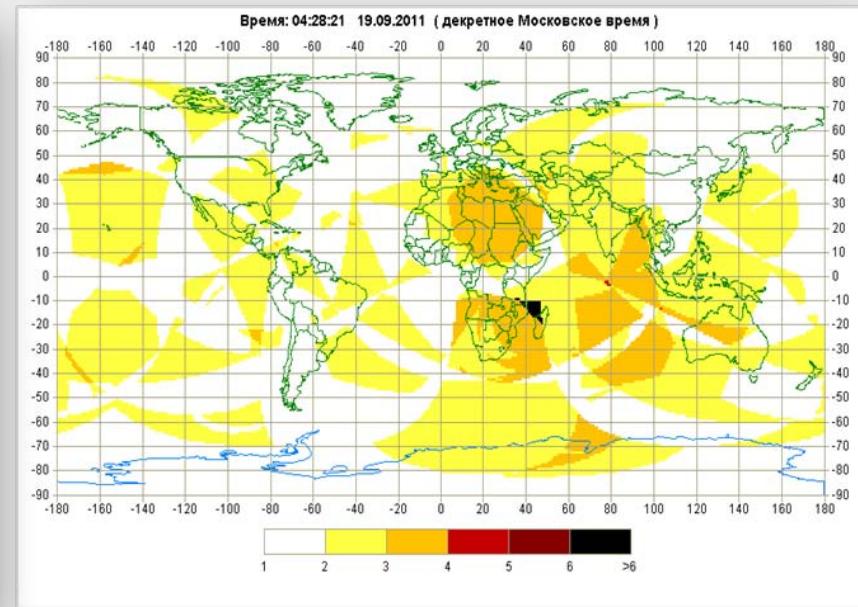


GLONASS Availability

(19.09.2011)



Average availability for a day

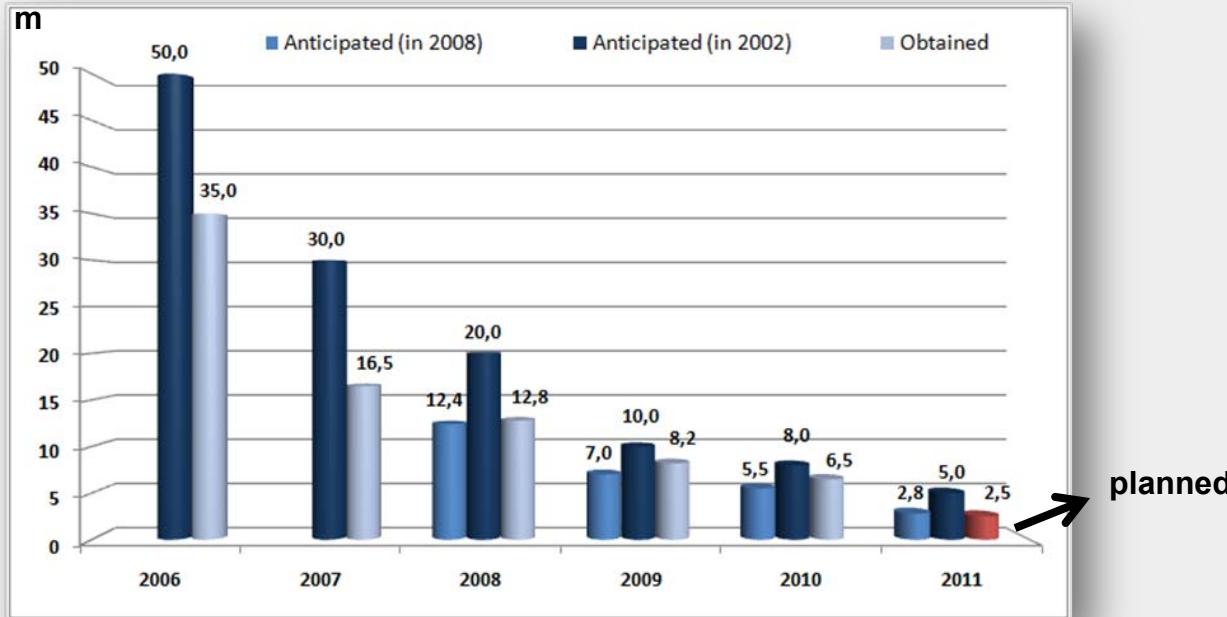


Instant availability (PDOP)

GLONASS global availability: 99.5% (PDOP<6, $\gamma>5^\circ$)

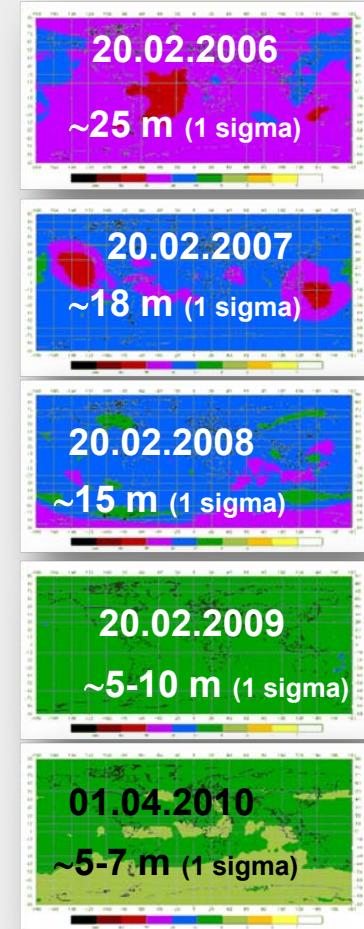
GLONASS Accuracy

- GLONASS accuracy has significantly improved over last five years
- Next improvement phase is expected by the end of 2011



GLONASS Accuracy

GLONASS position accuracy map





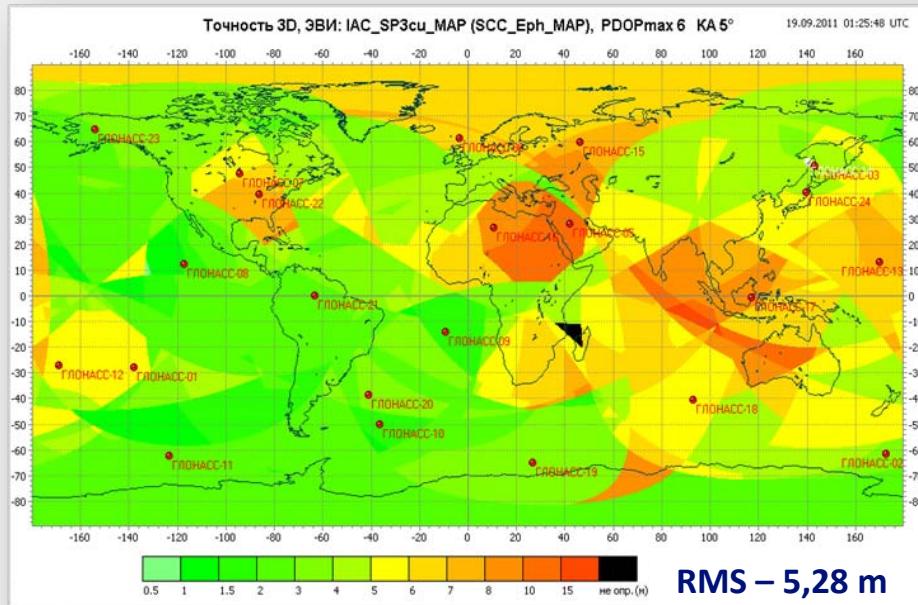
GLONASS Accuracy

19.09.2011



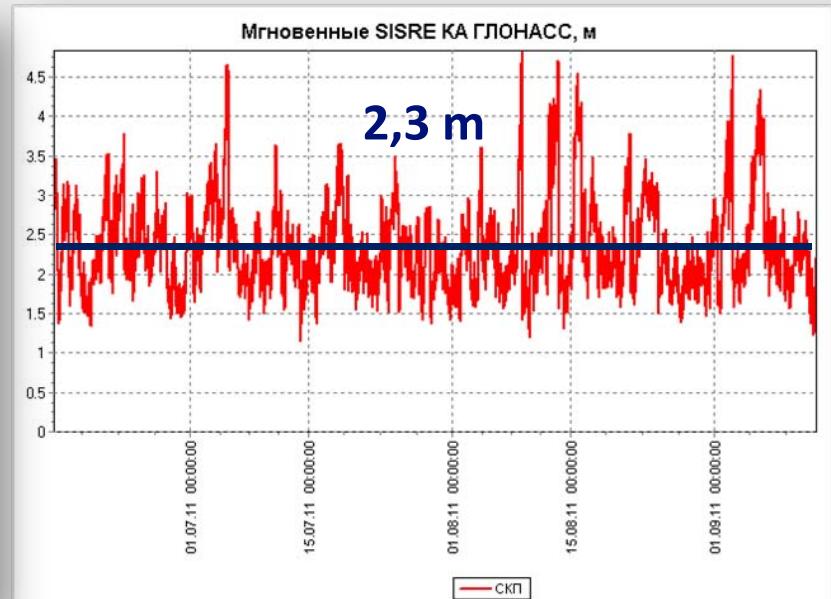
Instant accuracy (PDOP < 6, $\gamma > 5^\circ$)

19.09.2011



Instant GLONASS SISRE (1 sigma), m

15.06.2011 – 15.09.2011



stat.glonass-iac.ru



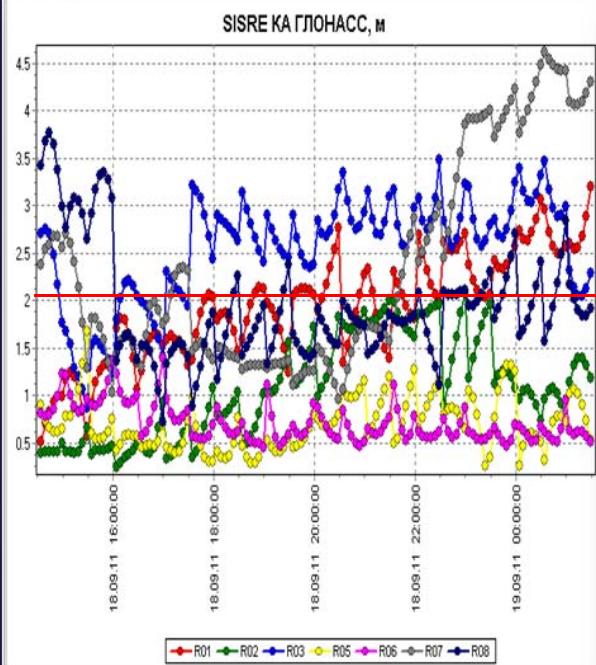
GLONASS Accuracy by Satellite

19.09.2011

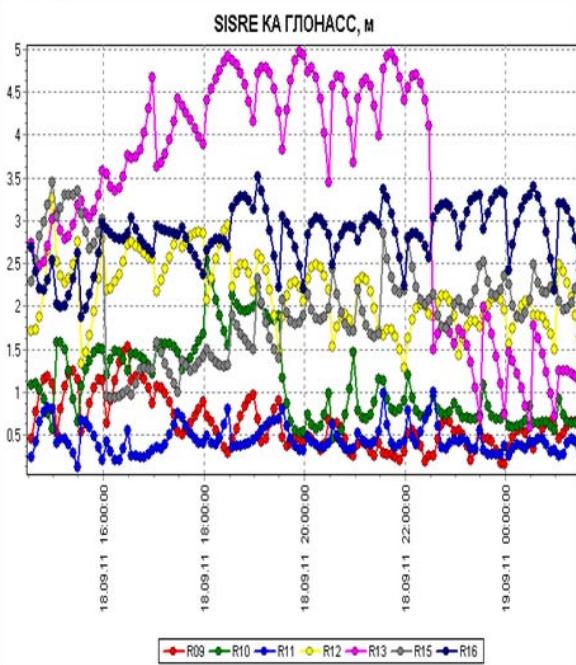


Signal In Space Range Error, m

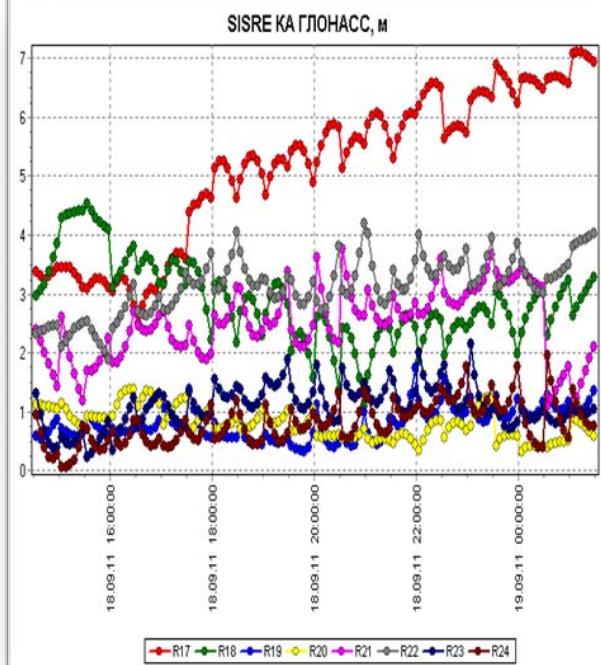
I plane



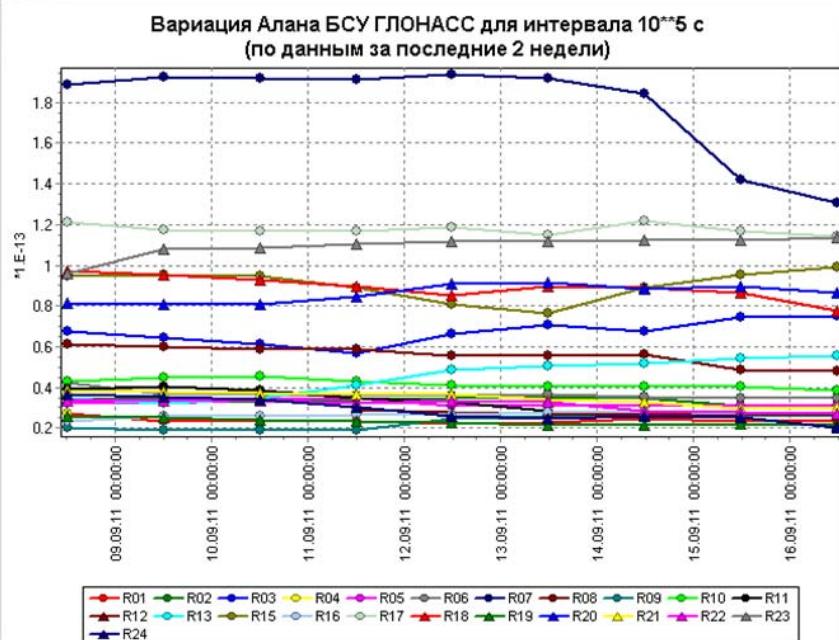
II plane



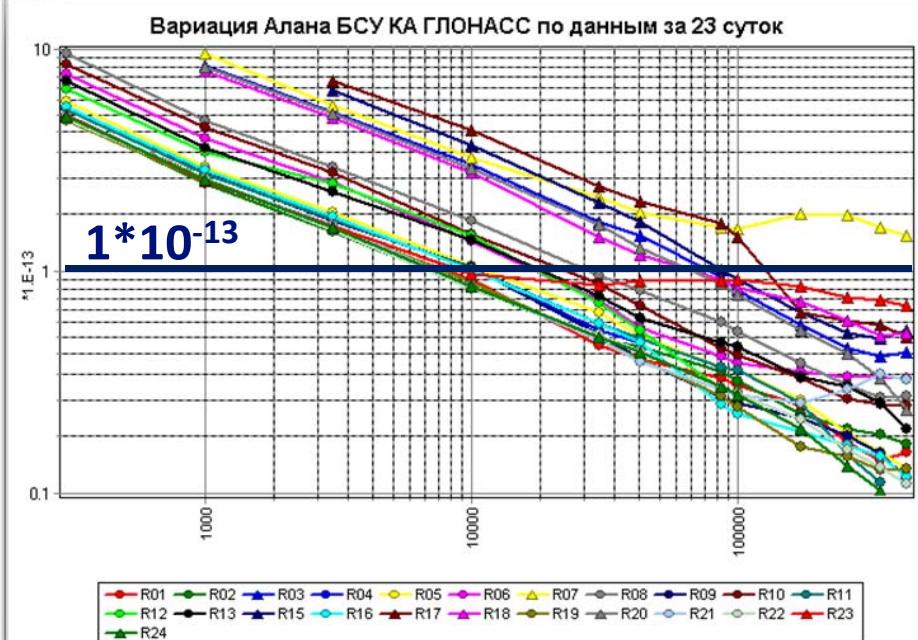
III plane



Alan variation (interval 100000 sec)



Alan variation (interval 23 days)



1982

2003

2011

2013-2014

"Glonass"

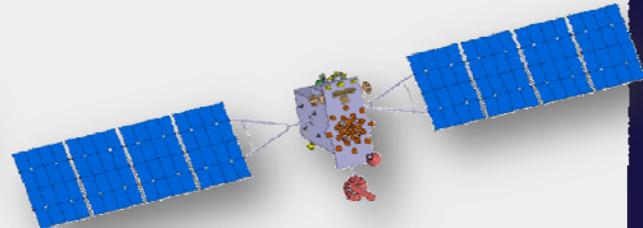
- 3 year design life
- Clock stability - $5*10^{-13}$
- Signals: L1SF, L2SF, L1OF, (FDMA)
- Totally launched 81 satellites
- Real operational life time 4.5 years

"Glonass-M"

- 7 year design life
- Clock stability $1*10^{-13}$
- Signals: Glonass + L2OF (FDMA)
- Totally launched 28 satellites and going to launch 8 satellite by the end 2012

"Glonass-K1"

- 10 year design life
- Unpressurized
- Expected clock stability $\sim 10...5*10^{-14}$
- Signals: Glonass-M + L3OC (CDMA) – test
- SAR

"Glonass-K2"

- 10 year design life
- Unpressurized
- Expected clock stability $\sim 5...1*10^{-14}$
- Signals: Glonass-M + L1OC, L3OC, L1SC, L2SC (CDMA)
- SAR

CDMA signals general structure already designed



GLONASS Signals Modernization



| | L1 | L2 | L3 | L1, L2 | Future | Status |
|--------------|---------------|---------------|--------------|------------------------|-------------------------|------------------------------------|
| “Glonass” | L1OF, L1SF | L2OF, L2SF | — | — | | Done |
| “Glonass-M” | L1OF, L1SF | L2OF, L2SF | — | — | | Done |
| “Glonass-K1” | L1OF, L1SF | L2OF, L2SF | L3OC test | — | | Done |
| “Glonass-K2” | L1OF, L1SF | L2OF, L2SF | L3OC | L1OC, L1SC, L2SC | | From №3 sat “Glonass-K” |
| “Glonass-KM” | L1OF, L1SF | L2OF, L2SF | L3OC | L1OC, L1SC, L2SC | L1OCM, L2OC, L5OC | Under development after 2015 |



FDMA signals



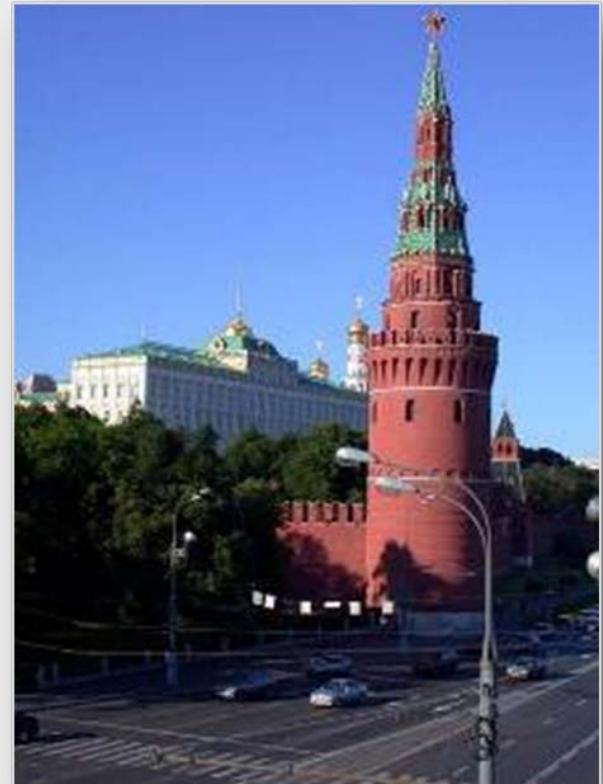
CDMA signals

Basic Documents:

- Presidential Decree, May 17, 2007
- GLONASS Federal Program
 - 2002 – 2011
 - 2012 – 2020 (under preparation)

Basic Principles

- GLONASS is a dual use system
- GLONASS free of charge worldwide
- GLONASS mandatory use for Russian critical infrastructure and governmental applications
- Promotion of GLONASS commercial use
- GNSS compatibility and interoperability



Federal GLONASS Program is a basis for GLONASS State Policy implementation

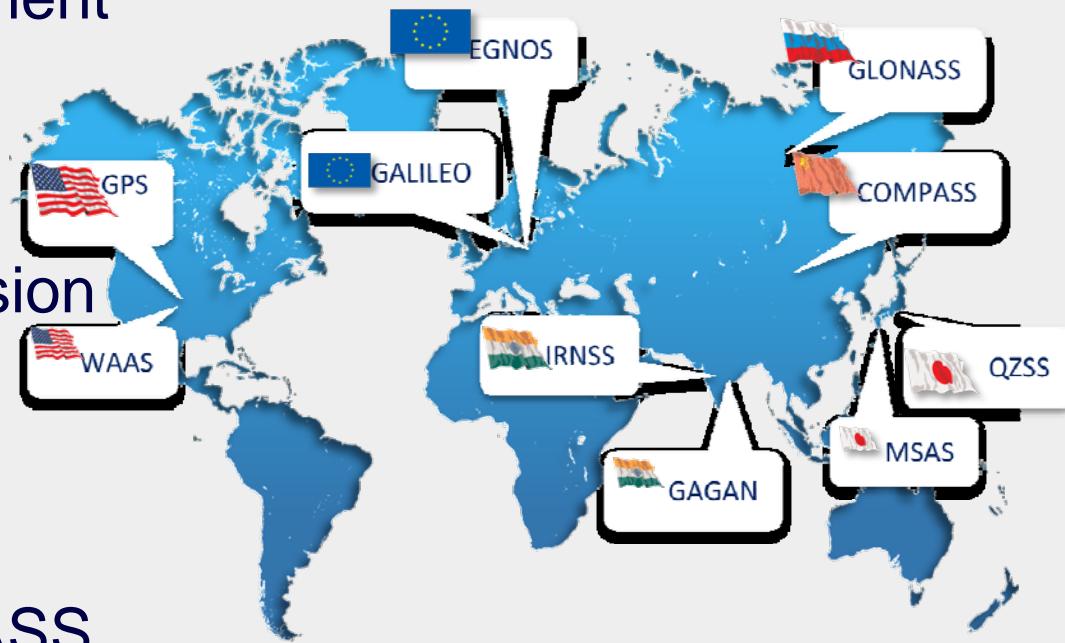
- GLONASS Program Concept prepared
 - GLONASS Program for 2012 – 2020 to be approved by the end of 2011
 - The Program objective is to make the GLONASS service
 - more **available**
 - more **accurate**
 - more **reliable**
 - more **robust**
- in the multi GNSS world



GLONASS Sustainment, Development and Use

International Cooperation

- GLONASS is an element of the global GNSS infrastructure
- Compatibility and Interoperability provision
- Development of common GNSS standards
- Promotion of GLONASS worldwide use for all user benefit

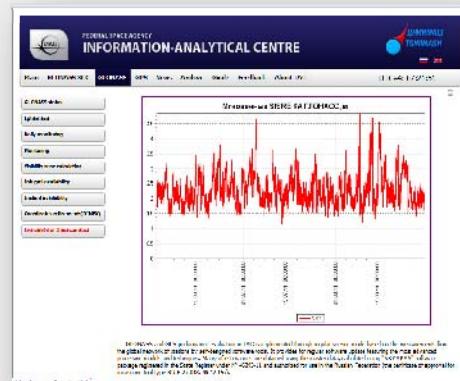
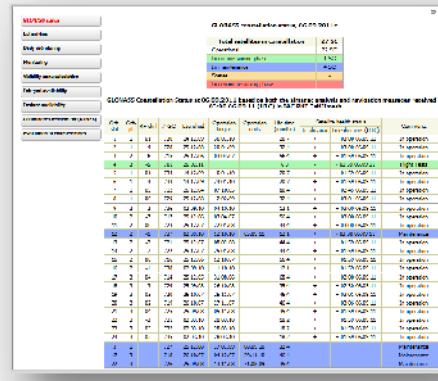
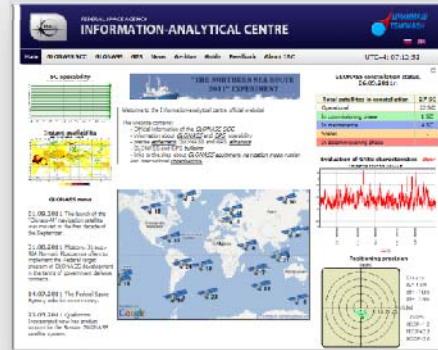




GLONASS Information Service



www.glonass-center.ru
[\(www.glonass-iac.ru\)](http://www.glonass-iac.ru)



News

GLONASS Status

GLONASS Performances



GLONASS Performance Estimates



The screenshot shows two main windows. The top window is titled 'Detailed analysis of the GNSS characteristics service' and displays a graph of 'Множественность СИСТЕМЫ ГЛОНАСС, %' (GLONASS system diversity percentage) over time, with values ranging from 0 to 45%. The bottom window is a login form for 'Detailed analysis of the GNSS characteristics service', requiring 'Login (Email)' and 'Password', with options for 'Remember me?' and 'Log in'.

- SIS Accuracy
- User Accuracy
- Availability
- Orbit accuracy
- Clock accuracy and stability
- Time scale difference estimates
- Geodesy reference difference estimates



GLONASS Feedback



GLONASS Feedback

FEDERAL SPACE AGENCY
INFORMATION-ANALYTICAL CENTRE

Main GLONASS SCC GLONASS GPS News Archive Guide Feedback About IAC UTC+4: 18:16:15

Feedback **Report a problem**

Your name*
Your email*
Your question*
 Enter the text from the image*

Please, report about any degradations, outages, other incidents or anomalies in the work of the GLONASS system.

www.glonass-center.ru
www.glonass-iac.ru

FEDERAL SPACE AGENCY
INFORMATION-ANALYTICAL CENTRE

Main GLONASS SCC GLONASS GPS News Archive Guide Feedback About IAC UTC+4: 18:19:31

Feedback **Report a problem**

To report about any degradations, outages, other incidents or anomalies* in the work of the GLONASS system please fill the form below**:

Notes: The information-analytical centre does not develop, control, nor repair the mapping software. If your message concerns the problems in the work of your car navigator (location norms, addresses or other mapping data) it is likely that your mapping software is outdated or obsolete. We suggest you contact the manufacturer of your navigator system.

Rules:
1) (*) Denotes a required field.
2) All personal data will be kept private and will only be used to contact you in the event that we need more information.
3) Please be as complete as possible.

1. Your name*
2. Email*
Date:
Time:
Select
Latitude Longitude City/Landmark
3. What was the start time and date of the outage?
4. Is the outage ongoing?
5. Where did the outage occur?*
6. User equipment (manufacturer, model, antenna etc.)
7. Installation type (aviation, marine, surveying, agriculture, transportation, timing)? Base:
8. Antenna elevation Above Ground level Above Sea level
L1 (1575.42 MHz) GPS
L2 (1227.6 MHz) GPS
L5 (1176.45 MHz) GPS
L1 (1602 MHz) GLONASS
9. Receivers frequency
10. How many satellites were being tracked at the time of the outage?
SLOT 01
SLOT 02
SLOT 03
11. Satellites being tracked at the time of the outage
12. Receiver being used at the time of occurrence
13. Additional information
D&D



Summary



- GLONASS Program is the high priority of the Russian Government policy
- GLONASS open service is free for all users
- GLONASS Program is in a progress, objective to be achieved by 2011
- GLONASS improvement is a major objective:
 - Performance to be comparable with GPS by the end of 2011
 - Full constellation (24 sats) by the end of 2011
- GLONASS will continue
 - Keep the GLONASS traditional frequency bands
 - Transmit existing FDMA signals
 - Introduce new CDMA signals
- New GLONASS Program (2012 – 2020) is under development to be approved by the end of 2011
 - State commitments for major performance
 - GLONASS sustainment, development, use
- International cooperation – make GLONASS as one of key elements of the international GNSS for worldwide use



Thank you for your attention!

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