

GNSS technology scientific applications and space weather researches in educational process of Moscow State University of Geodesy and Cartography

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United Nations Fifteenth Meeting of the International Committee on Global Navigation Satellite Systems (ICG) Meeting of the Working Group C

29 - 30 September 2021 Vienna

Moscow State University of Geodesy and Cartography



1779-2021

Moscow State University of Geodesy and Cartography

Moscow State University of Geodesy and Cartography (MIIGAiK) is one of the oldest educational institutions in the Russian Federation which has been founded in 1779.



- In 2010 MIIGAiK became an official partner of the Bologna club and actively supports and promotes the idea of the Bologna process, which targets at the approximation and harmonization of higher education systems of European countries with the aim of creating a common European Higher Education Area (EHEA).
- Annually, the hundreds of specialists in areas of cadastre, cartography, construction, space technology graduate from university to be employed in Russian Federation and abroad.

MIIGAiK Educational Activity in High-Precision GNSS technology

Courses list:

- "Global navigation satellite systems" for GF PG (3 course)
- "Special methods of applied geodesy" for GF PG (4 course)
- "High-precision satellite systems in applied geodesy" for GF PG (5 course)
- "Satellite systems and positioning technologies" for GF GiDZ (3 course)
- "Global navigation satellite systems and their application in geodesy and cartography" for SP IF (4 course)
- "Modern methods of engineering and geodetic work" for masters GF
- "Methods and means of satellite positioning of optical-electronic systems" for masters of the faculty of optical-information systems and technologies.



MIIGAIK Survey GNSS Equipment Laboratory and Field Testing With the Involvement of Students and Post-graduates

Students and PhD students master skills in basics of radio navigation, electrical engineering, geophysics while becoming advanced specialists in the areas of programming and global navigation satellite systems technologies.

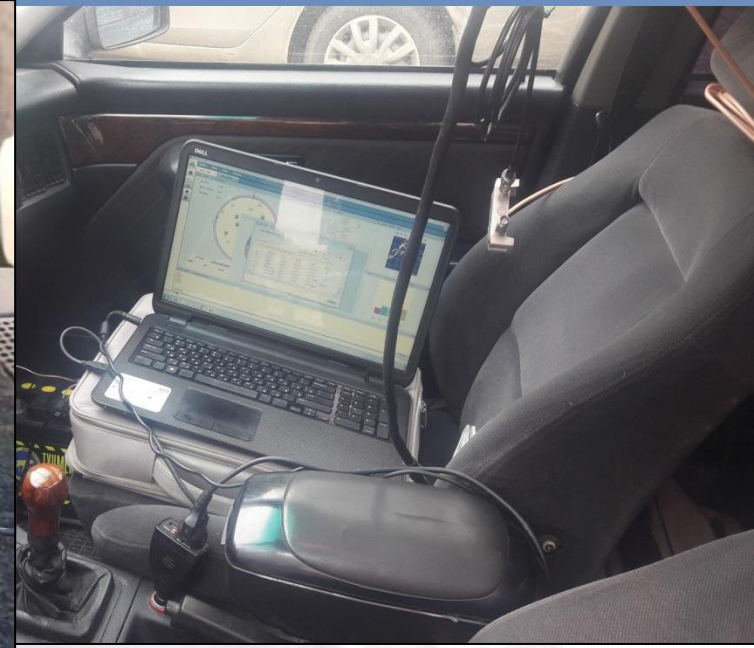


External Educational Activity of MIIGAİK Republic Kyrgyzstan, Siberian and Ural regions

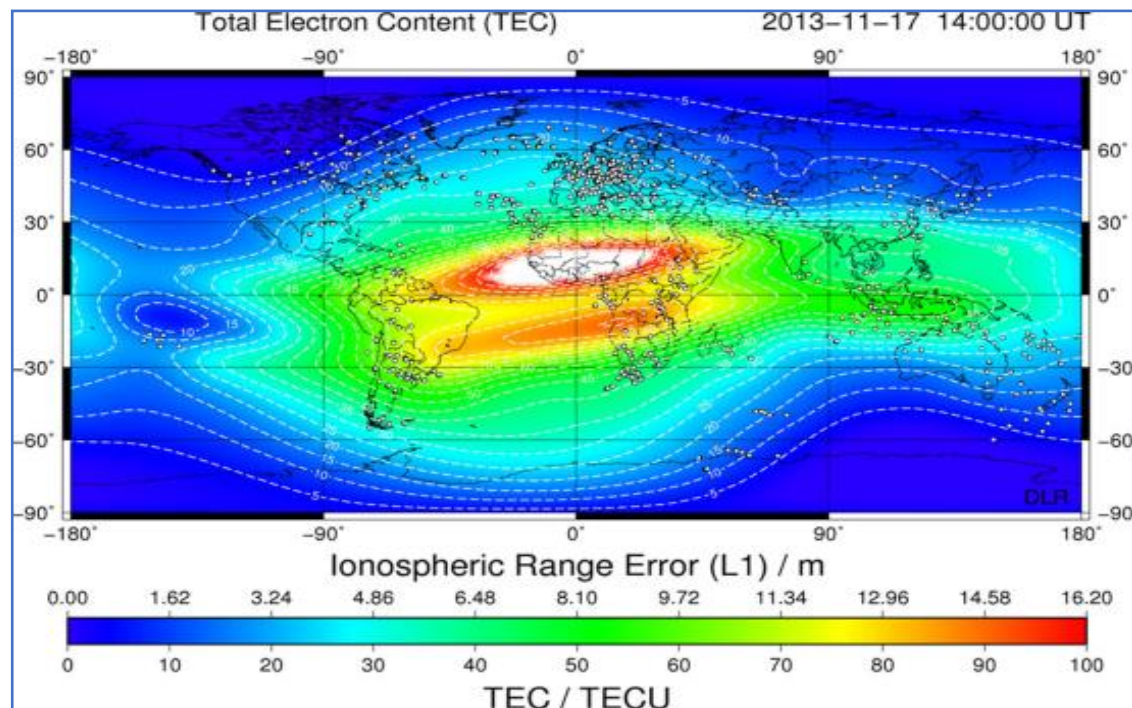
International and interregional cooperation included the monitoring of linear objects in RTK mode, as well as the training of local personnel in RTK modes for field surveying and executive filming of various objects.



INS / GNSS navigation



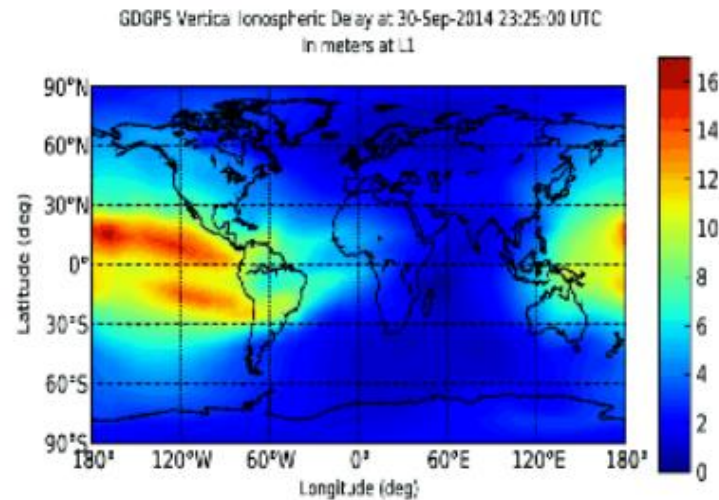
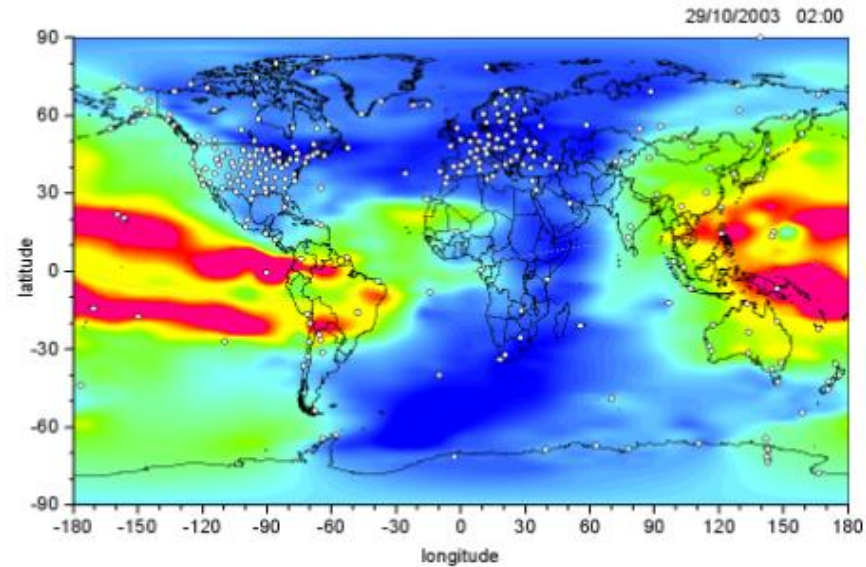
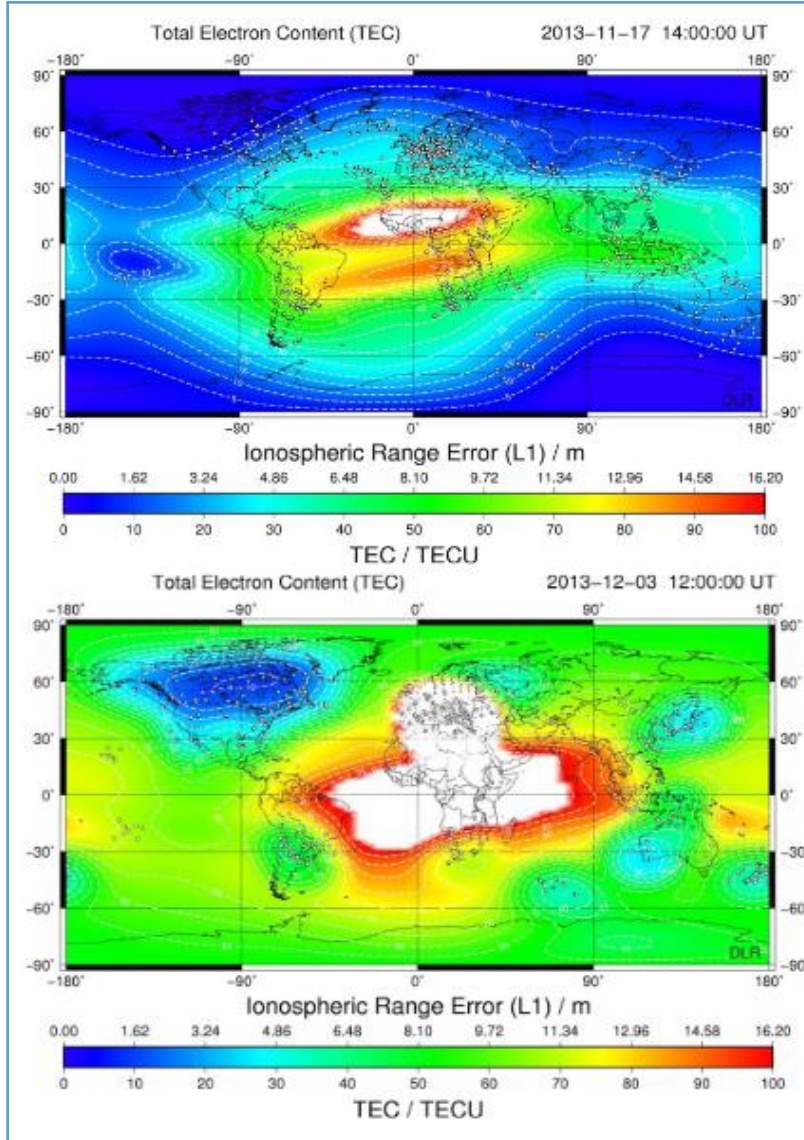
University has a set of educational and scientific laboratories operating within the framework of MIIGAIK. The "Geospace Technologies" center was established at the Academic Council of MIIGAIK meeting on November 23, 2007.



Scientific Objectives

1. Application of Global Navigation Satellite Systems (GLONASS, GPS, BEIDOU, GALILEO) and their Augmentation Systems
2. Physics of propagation of the navigational radio signal
3. Measurement error theory
4. Inertial navigation
5. Geodetic monitoring by means of GNSS measurements
6. Algorithms for mathematical processing of the GNSS measurements results
7. Methodology of the establishment of the geodetic network using GNSS measurements
8. GNSS software solutions research & development
9. GNSS hardware solutions research & development

Ionospheric parameters monitoring



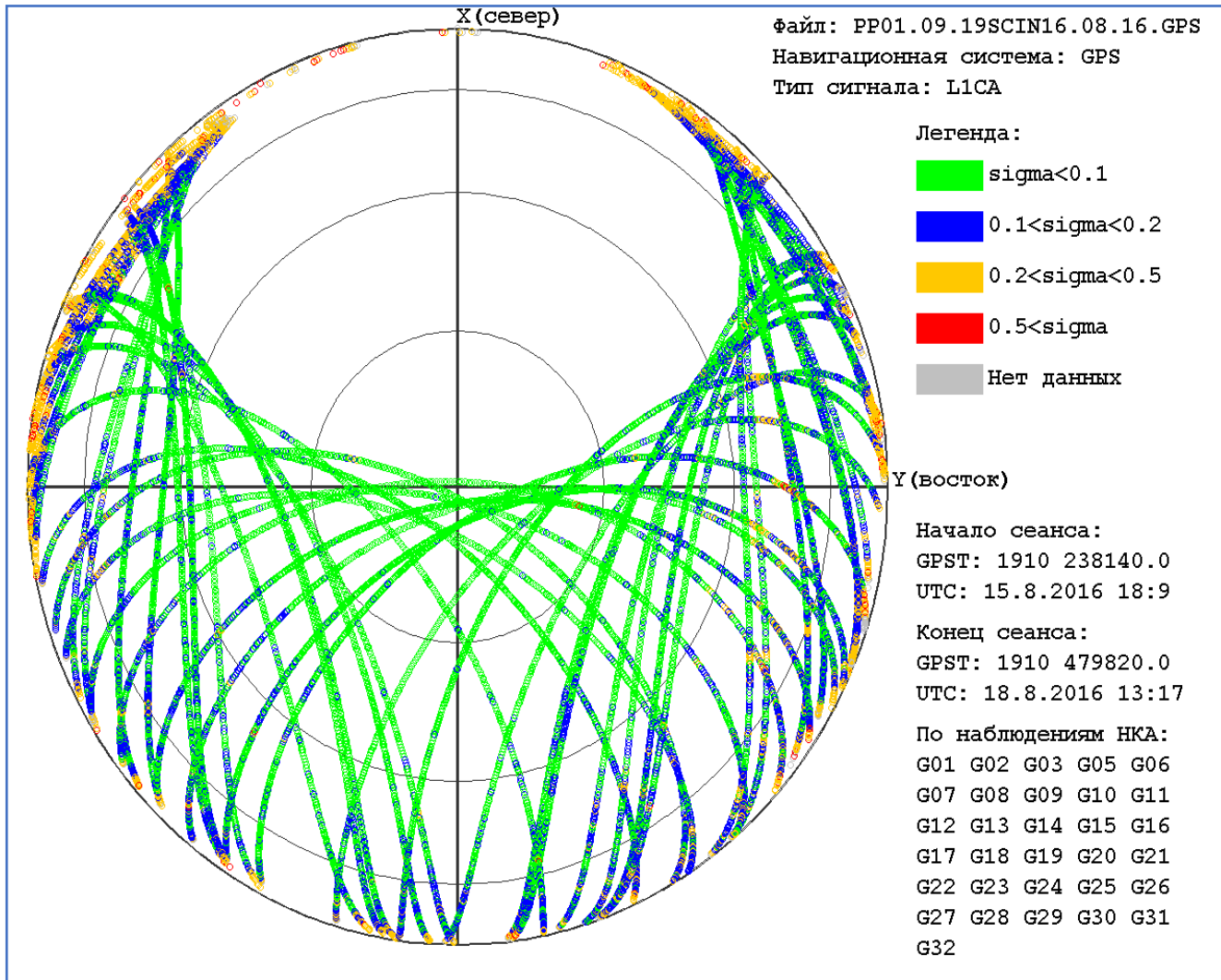
Ionosphere Research

Total Electron Content (TEC)

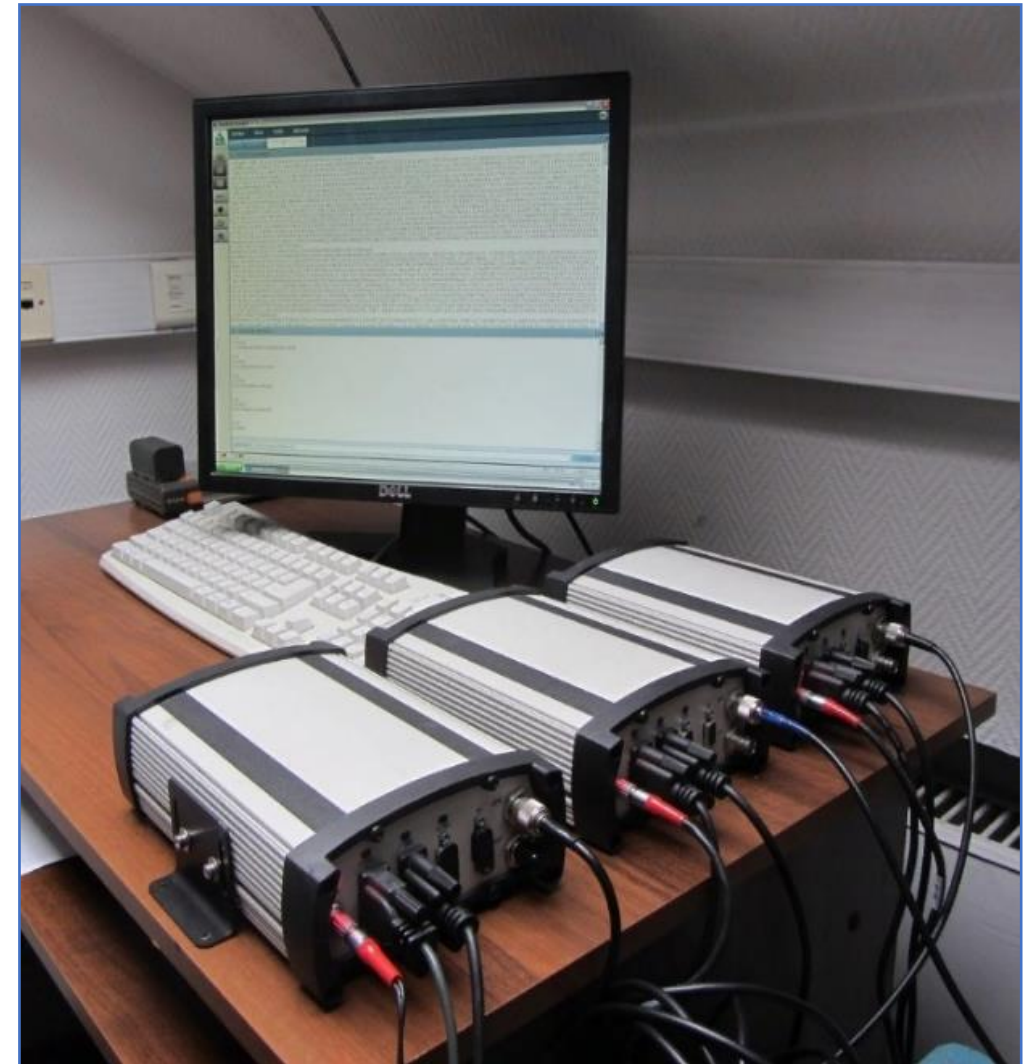
- Measure of present electric charge of the ionosphere
- Total number of free electrons along a path between two points
- TECU is mainly influenced by the amount of irradiance received by earth's atmosphere
- TEC build up: Day Yme (more irradiance)
- TEC discharge: Night Yme

Scintillation Index Analysis

GNSS

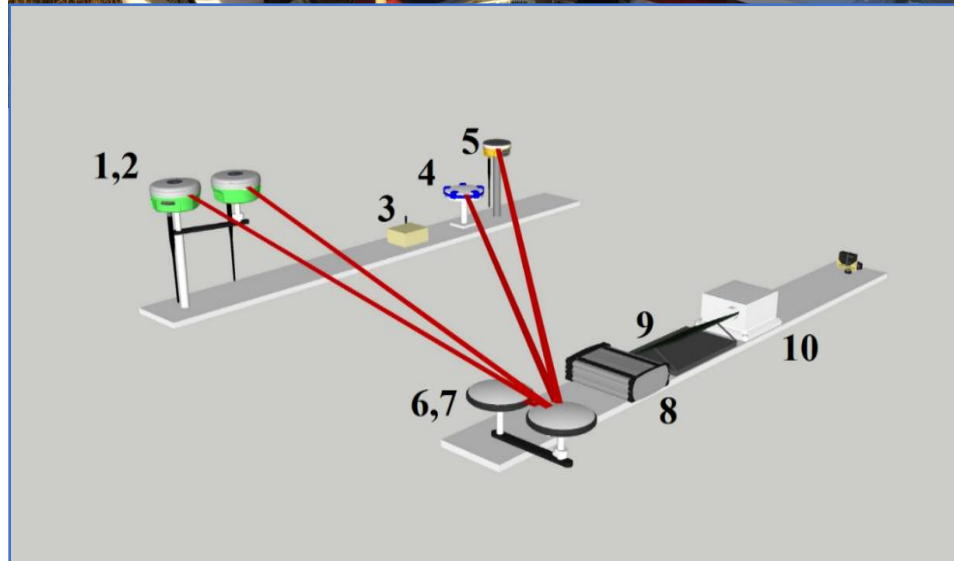
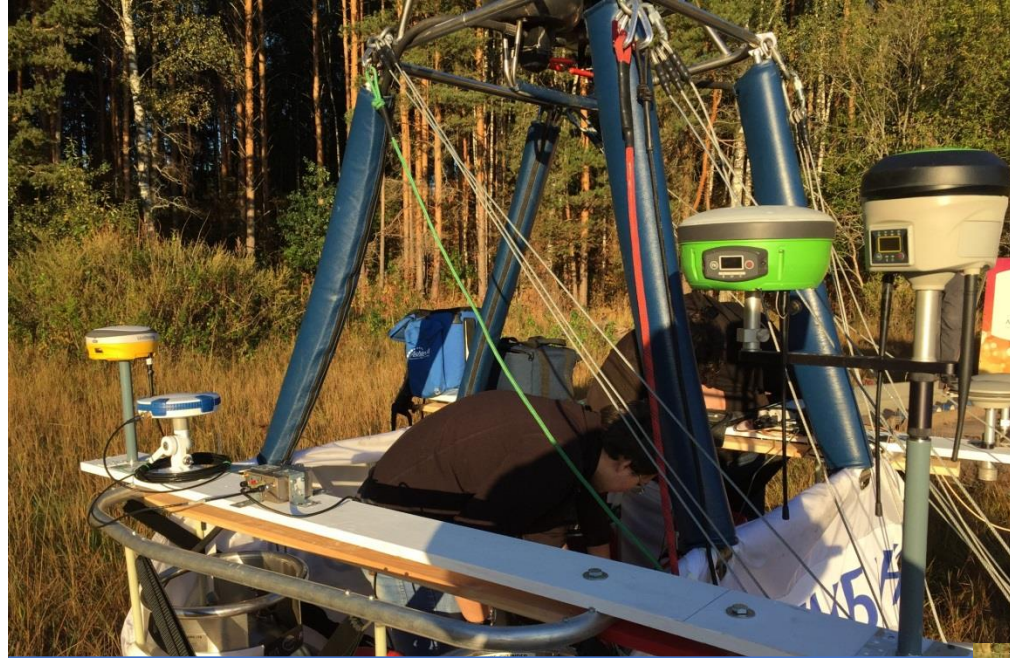
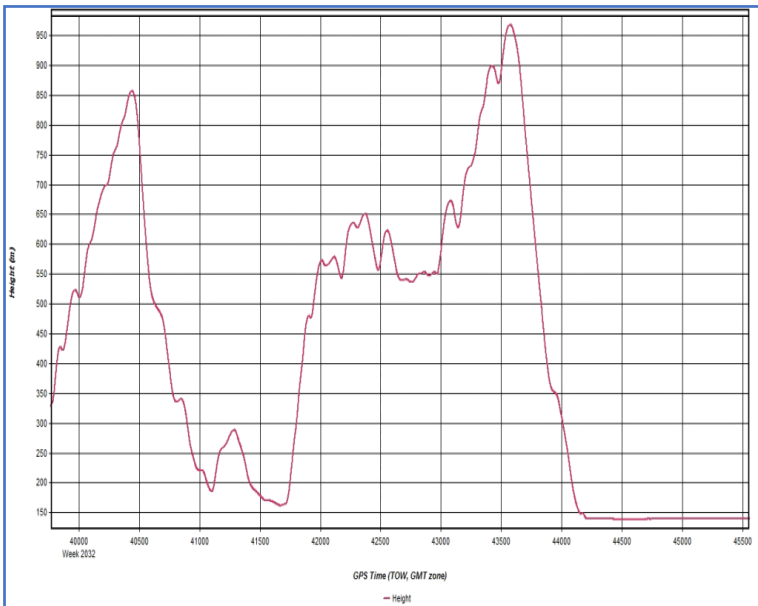


Ionospheric station stand



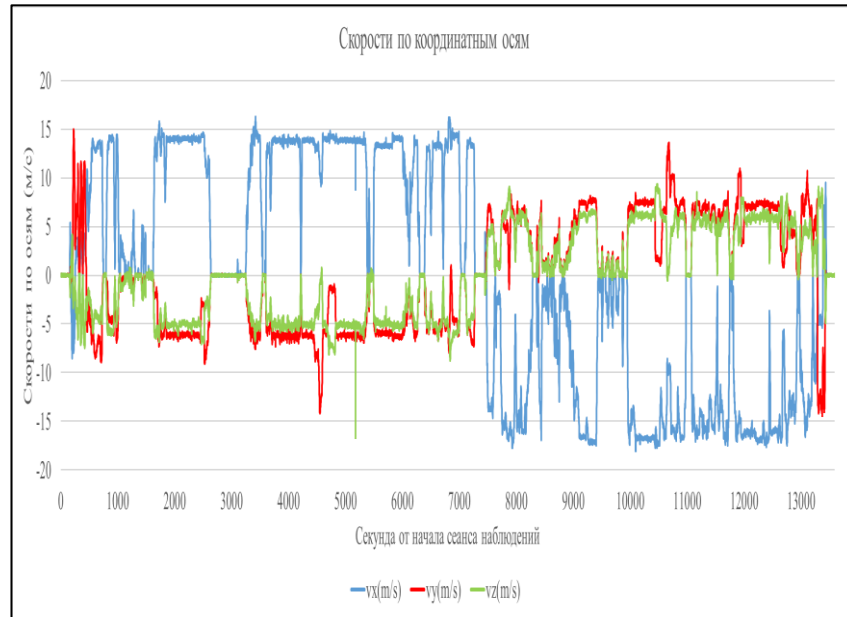
Aerodynamic Research using multifunctional stand-alone measuring unit

Special attention have to be paid to the change in the basis in space in kinematic positioning. The object's height and speed are monitored. The use of an ionospheric station makes it possible to obtain an ionospheric map of a local area.



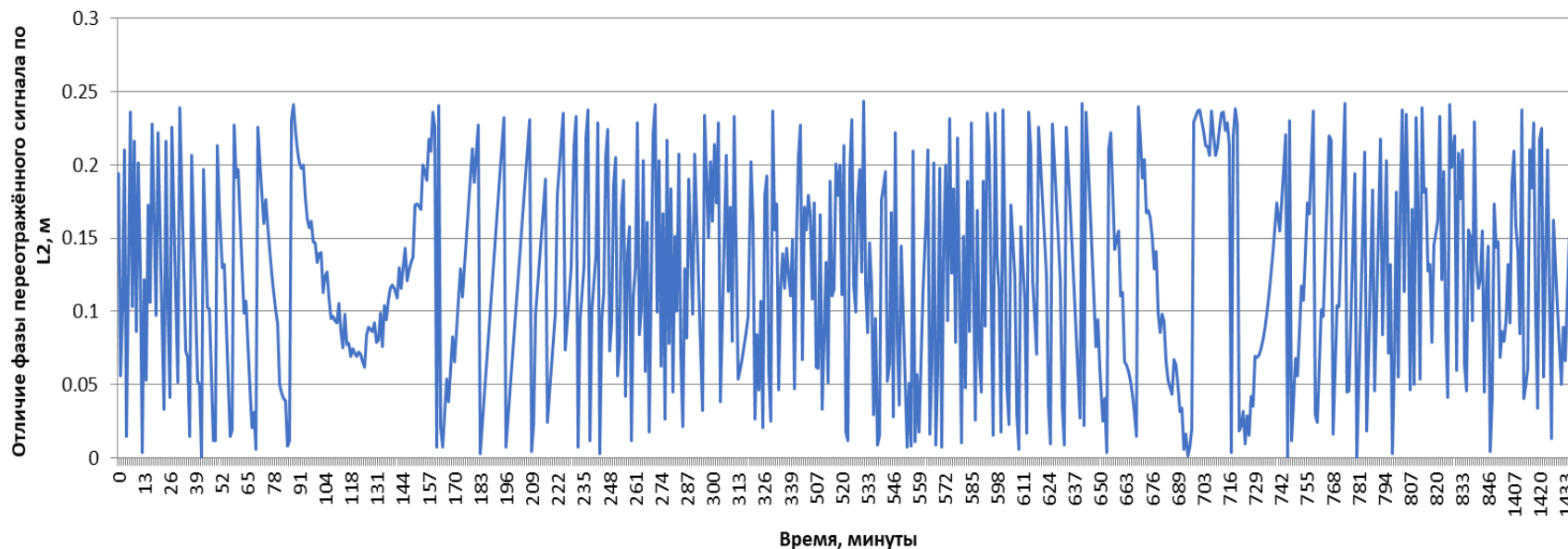
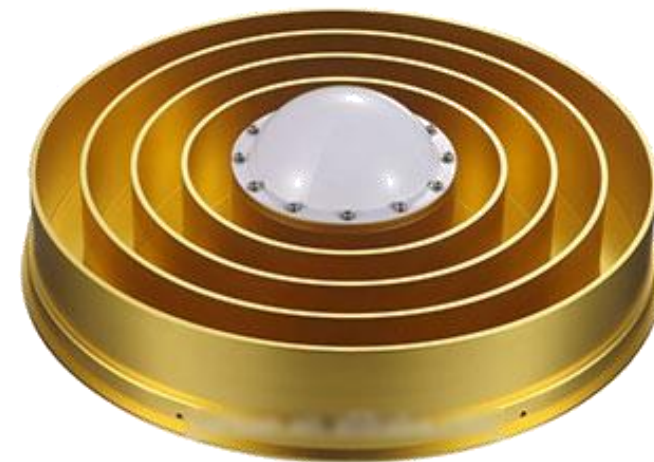
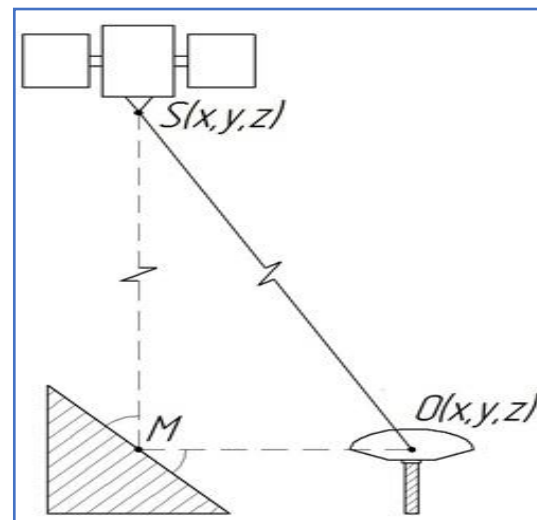
INS / GNSS navigation

In order to test geodetic satellite equipment, GNSS signal cinematic studies are carried out in conjunction with inertial systems. Within the framework of this direction, "Geospace Technologies" center MIIGAiK cooperates and interacts with other leading universities of the Russian Federation, in particular the Bauman University.



Multipath Effects Study

The special stand with a metal surface reflecting navigation signals to the tested NovAtel 702GGG antenna was used for this experiment; to the reference frequency generator - the NovAtel GPStation-6 receiver. The "Choke Ring" type NovAtel 750GNSS reference antenna was located in the alignment of the reflecting surface, the antennas were connected to the NovAtel DL-V3 and NovAtel ProPak-V3 receivers, which was connected to the NovAtel GPStation-6 reference frequency generator



Conclusion

- ✓ Moscow State University of Geodesy and Cartography successfully implemented the process of involvement of the students and post-graduates to resolving the scientific tasks during the GNSS basics study classes. Young scientists research in different areas, such as the combination of INS/GNSS, ionospheric research, multi-beam effects, Precise Point Positioning, etc.
- ✓ MIIGAiK prepares for the introduction and promotion of the GNSS applied technology studies and research in several Russian technical universities. GNSS may be successfully implemented in a wide spectre of areas as the basis course for the improvement of a primary university specialization.
- ✓ MIIGAiK conducts the cooperation with higher educational establishments and industrial enterprises. Specializations are being prepared and constantly modernized for the training and retraining of highly qualified personnel (specialists, bachelors, masters and postgraduate students) for various fields of the Russian economy.



Thank you!



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