ACUMEN: INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH
ISSN: 3060-4745 IF(Impact Factor)10.71 / 2025 Volume 3, Issue 2

GNSS TEXNOLOGIYALARIDAN FOYDALANISHDA ANIQLIK MUAMMOLARI VA ULARNI BARTARAF ETISH YO‘LLARI

Usmonov Said Furqat o‘g‘li
Termiz davlat muhandislik va agrotexnologiylar universiteti
Assistant o‘qituvchisi
joinsaid0897@gmail.com
Doniyeva Sabrina Odinaqul qizi
Termiz davlat muhandislik va agrotexnologiylar universiteti talabasi
sabrinadoniyeva0@gmail.com

Abstract: This article provides a scientific analysis of accuracy issues encountered in the use of Global Navigation Satellite Systems (GNSS). The effects of the ionosphere and troposphere, multipath signal propagation, satellite geometry, and receiver hardware errors are considered as the main influencing factors. In addition, the role of differential correction methods, RTK technology, and modern data processing algorithms in improving positioning accuracy is discussed. The research findings contribute to the development of practical recommendations for the effective application of GNSS technologies in geodetic and engineering activities.

Keywords: GNSS, GPS, GLONASS, Galileo, accuracy, RTK, differential correction, ionosphere, multipath, geodesy.

In modern geodesy and cartography, Global Navigation Satellite Systems (GNSS) play a strategically important role. Today, systems such as the Global Positioning System (GPS), GLONASS, and Galileo enable the determination of highly accurate coordinates of points on the Earth's surface. These systems are widely used not only in geodesy and cartography but also in transportation logistics, aviation, maritime navigation, agriculture, and emergency management.

Global Navigation Satellite Systems consist of a complex technological infrastructure that includes satellites orbiting the Earth, ground control stations, and user receivers. Each satellite transmits precise time and orbital parameter information. A receiver determines three-dimensional coordinates (X, Y, Z) and time by processing signals from at least four satellites. Therefore, precise time measurement based on atomic clocks plays a crucial role in the performance of GNSS.

In recent years, the multi-GNSS approach has developed significantly, allowing simultaneous use of signals from multiple satellite systems. This improves not only positioning accuracy but also the reliability and continuity of measurements. Particularly in engineering geodesy, high-precision construction, deformation monitoring, and large infrastructure projects, millimeter-level accuracy is required. Consequently, studying the sources of GNSS measurement errors and improving error mitigation techniques remains an important scientific and practical task.

Conclusion

GNSS technologies have become an essential part of modern geodesy. Systems such as the Global Positioning System (GPS), GLONASS, and Galileo enable highly accurate coordinate determination. However, atmospheric effects (ionosphere and troposphere), multipath phenomena, and satellite geometry can negatively affect measurement accuracy. Differential methods, RTK technology, and multi-frequency receivers help reduce these errors significantly. In the future, multi-system integration and advanced algorithms are expected to further improve positioning accuracy.

References

1. Hofmann-Wellenhof, B., Lichtenegger, H., & Wasle, E. (2008). *GNSS – Global Navigation Satellite Systems*. Springer.
2. Kaplan, E. D., & Hegarty, C. J. (2017). *Understanding GPS: Principles and Applications*. Artech House.
3. Leick, A., Rapoport, L., & Tatarnikov, D. (2015). *GPS Satellite Surveying*. Wiley.
4. Teunissen, P. J. G., & Montenbruck, O. (2017). *Springer Handbook of Global Navigation Satellite Systems*. Springer.