



# Comparative Analysis of Ionospheric Models for Single-Frequency GPS Positioning in Algeria

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**Abstract:** The accuracy of single-frequency GPS positioning is significantly influenced by ionospheric delay, a major error source contingent on solar activity, season, local time, latitude, and geophysical conditions. This study evaluates the effectiveness of various ionospheric correction models in enhancing single-frequency GPS positioning accuracy in Algeria. We analyze four ionospheric broadcast models: the PS Klobuchar model, Beidou Klobuchar model, NeQuick (Galileo), and EGNOS ionospheric grid delays, comparing their performance against Global Ionospheric Maps (GIMs) from the International GNSS Service (IGS) in the IONosphere map Exchange (IONEX) format. The research focuses on four Algerian sites with latitudes ranging from 35.85°N (Oran) to 20.31°N (Djanet) and longitudes from -8.14° to 9.52°. These locations offer a diverse range of geophysical conditions, both within and outside the EGNOS service area. Real data from these sites were utilized to assess the models' performance.

The findings reveal a significant improvement in positioning accuracy when using the EGNOS ionospheric grid for sites within its service area, specifically Oran and Tindouf. Here, positioning accuracy ranged between 0.76m and 0.94m. In contrast, the accuracy for the PS Klobuchar, Beidou Klobuchar, and NeQuick models ranged from 1.15m to 1.48m. For sites outside the EGNOS service area, such as Djanet and In Guezzam, the Klobuchar and NeQuick models outperformed EGNOS, which is attributed to the absence of EGNOS Ranging Integrity Monitoring Stations (RIMS) in Algeria, resulting in positioning errors reaching up to 45.27m.

These results underscore the importance of selecting appropriate ionospheric models based on geographical location and availability of correction services. The study demonstrates the superior performance of the EGNOS model within its coverage area and highlights the limitations faced in regions lacking adequate monitoring infrastructure. This comparative analysis provides valuable insights for enhancing GPS positioning accuracy in similar geophysical environments.

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