Application of Modified Jones 3-D Ray Tracing Program To Developed Ionospheric Delay Model

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ABSTRACT

.
Application of Global Positioning System (GPS) for ionospheric sensing is now the subject of worldwide interest. In addition to this application, it has also been used widely in ionospheric study to model the electron content whilst the GPS signals propagate through the ionosphere. It is important to eliminate all the error due to propagation of the GPS signals through the ionosphere. In this paper, accurate determinations are first made of the ionosphere-induced errors in differential GPS (dGPS) for a short baseline, then these results are used to provide a method of modeling and correcting these errors. Very precise ray paths for both group and phase were determined utilizing a modified Jones 3-D ray tracing program, which includes the effect of the geomagnetic field together with a Nelder–Mead algorithm to home in precisely on the satellite to earth station path. NeQuick is a quick-run model particularly tailored for trans-ionospheric applications that allows one to calculate the electron concentration at any given location in the ionosphere and thus the total electron content (TEC) along any ground-to-satellite ray-path by means of numerical integration. The use of base exponential functions considerably improves the ray tracing accuracy, which is essential. The developed model is a function of elevation angle and TEC. An ionospheric error correction model should be made applicable to any location including the low-latitude region. A good ionospheric model that best matches the local and regional area is necessary to optimise ambiguity resolution for phase measurement and to obtain the most precise positioning.

Keywords: ionosphere, dGPS, TEC, NeQuick

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