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Algorithm Development to Generate Ionospheric Delays based on GPS Carrier Phase Measurements

Chang-Moon Lee, Jihye Won, and Kwan-Dong Park
Dept. of Geoinformatic Engineering, Inha University, Incheon, Republic Of Korea (cm_lee@inha.edu / +82-32-863-1506)

The ionosphere is a shell of electrons and electrically charged atoms and molecules that surrounds the earth, stretching from a height of about 50 km to 1000 km. The electron contents refract GPS (Global Positioning System) signals, and this phenomenon affects the quality of the GPS positioning accuracy. Therefore, ionospheric delays have to be generated and then it must be reflected in GPS positioning algorithm for obtaining precise positioning results. The GPS code pseudo-range is mostly used at existing algorithms for generating ionospheric delays. However the code pseudo-range cannot generate precise results, because it has lots of noises. In this study, the L1 and L2 carrier phase measurements were used to generate improved ionospheric delays. The carrier phase measurement is known as fairly reliable, compared with the code pseudo-range. However, the measurement can contain cycle slips which are discontinuities in the measured number of cycles. Therefore, as preprocessing for this process, the cycle slip was detected by using the geometry-free linear combination and was corrected by curve fitting algorithms. And an algorithm based on the LAMBDA (Least squares AMBiguity Decorrelation Adgustment) technique was implemented for an integer ambiguity resolution of an ionospheric delay equation. The implemented algorithm was verified by comparing the results with those from existing algorithms. Computed ionospheric delays using previously stated methods and ionospheric delays from conventional ionospheric models such as GIM (Global Ionosphere Maps), and KASI RIM (Korea Astronomy and Space Science Institutes Regional Ionosphere Model) were applied in positioning algorithm. And then the performance of each algorithm was evaluated in terms of positioning accuracies.