Development of GNSS Positioning Technique for Improving Positioning Accuracy Under Urban Environments

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SUMMARY

Accuracy of GNSS positioning is easily degraded under severe conditions such as urban streets surrounding by tall buildings which block GNSS signals. In order to improve accuracy of GNSS positioning under such environments, we have selected four promising techniques from previous studies and improved them to develop new techniques for improving fixing rates at ambiguity resolution. First technique is cutoff mask which is developed from distribution of surrounding obstacles blocking GNSS signals. The distribution is identified from photos over the sky, and the elevation cutoff mask for the sites are individually developed and applied for GNSS positioning. Second technique is another cutoff mask which is also developed from distribution of surrounding buildings blocking GNSS signals. The distribution is identified from 3D maps of surrounding buildings. Third is quality check of observation data utilizing L1 and L2 Doppler observables. If the observation data contains noises such as multipath, L1 and L2 Doppler observables become inconsistent. Once the quality check detects inconsistency between L1 and L2 Doppler observables, the data is determined as bad observation and rejected. These three techniques enable observers to select proper satellites for more stable and accurate positioning by identifying and rejecting observation data of bad quality. The last technique is algorithm of ambiguity fixing utilizing Doppler observable. Once ambiguity is fixed, ambiguity of the next epoch can be resolved more stably in case the position at the epoch is appropriately estimated. Doppler observables are used for the estimation of the position at the next epoch. We report the status and first result of the development in the paper.