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Performance of Taiwan Ionospheric Model (TWIM) in Single-Frequency Differential GPS Positioning

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Differential Global Positioning System (DGPS) is one of the common techniques using GPS positioning. One of its main advantages is the removal of clock biases of GPS satellites which greatly improves position accuracy. With this, only differential atmospheric (ionospheric and tropospheric) errors, receiver clock biases and measurement noise mainly remain and can be removed using various models. This study focuses on the differential ionospheric delay and the effect of its correction to DGPS positioning. Being the major source of error in GPS L1 pseudorange, this ionospheric delay is determined using a three-dimensional phenomenological ionospheric model called the TaiWan Ionospheric Model (TWIM). TWIM is derived from GPS radio occultation measurements of the Formosat3/COSMIC program. This error is removed from the pseudorange observations, which is then used to perform single-difference DGPS positioning. A network of 10 GPS receivers across Taiwan is used as both test and reference receivers in doing the differential positioning. The network has a maximum horizontal baseline of 400 km. It has been shown that TWIM can provide sub-meter positioning and can provide better positioning than other models such as Klobuchar and GIM. TWIM can also reduce the dependence of positioning accuracy to baseline length and solar flux for a 24-hour survey.