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Geomagnetic Storm Impact On GPS Code Positioning

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This paper deals with the geomagnetic storm impact on GPS code processing with using GIPSY/OASIS research software. 12 IGS stations in mid-latitude were chosen to conduct the experiment. These IGS stations were classified as non-cross correlation receiver reporting P1 and P2 (NONCC-P1P2), non-cross correlation receiver reporting C1 and P2 (NONCC-C1P2) and cross-correlation (CC-C1P2) receiver. In order to keep the code processing consistency between the classified receivers, only P2 code observations from the GPS satellites were processed. Four extreme geomagnetic storms October 2003, day of the year (DOY), 29, 30 Halloween Storm, November 2003, DOY 20, November 2004, DOY 08 and four geomagnetic quiet days in 2005 (DOY 92, 98, 99, 100) were chosen for this study. 24-hour rinex data of the IGS stations were processed epoch-by-epoch basis. In this way, receiver clock and Earth Centered Earth Fixed (ECEF) Cartesian Coordinates were solved for a per-epoch basis for each day. IGS combined broadcast ephemeris file (brdc) were used to partly compensate the ionospheric effect on the P2 code observations. There is no tropospheric model was used for the processing. Jet Propulsion Laboratory Application Technology Satellites (JPL ATS) computed coordinates of the stations were taken as true coordinates. The differences of the computed ECEF coordinates and assumed true coordinates were resolved to topocentric coordinates (north, east, up). Root mean square (RMS) errors for each component were calculated for each day. The results show that two-dimensional and vertical accuracy decreases significantly during the geomagnetic storm days comparing with the geomagnetic quiet days. It is observed that vertical accuracy is much more affected than the horizontal accuracy by geomagnetic storm. Up to 50 meters error in vertical component has been observed in geomagnetic storm day. It is also observed that performance of Klobuchar ionospheric correction parameters during geomagnetic storm days cannot guarantee the improving accuracy due to the ionospheric scintillation.