

The impact of sub-auroral polarization streams on GPS-based navigation systems

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Analysis of GPS phase fluctuations in conjunction with regional total electron content (TEC) maps, in-situ measurements of sub-auroral polarization streams (SAPS) from several DMSP spacecraft supported by ionosonde measurements and TIMED GUVI images obtained during the intense magnetic storm of November 8, 2004, have indicated the tremendous impact of large ionospheric velocities on GPS-based navigation systems within the mid-latitude region in the North American sector. The major difference between this superstorm and the others observed during the October-November, 2003 events is the absence of appreciable storm-enhanced density gradients, with the mid-latitude region being entirely engulfed by either the auroral oval or the ionospheric trough within which the SAPS were confined during the local dusk to nighttime hours. This shows that it is possible to disable GPS-based navigation systems for more than ten hours even in the absence of appreciable TEC gradients, provided an intense flow channel is present in the ionosphere during nighttime hours.