Application of the GPS worldw de network n the study of global ionospheric storms

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Ionospheric storm dynamics as a response to the geomagnetic storms is a very complicated global process involving many different mechanisms. Strong ionospheric storms may cause a global scale disturbance of communication systems and severely disorder the entire space environment. Studying ionospheric storms will help us to understand the energy coupling process between the sun and earth and possibly also to effectively forecast space weather changes. Such a study requires a worldwide monitoring system. Past ionospheric measurements are mostly based on a single chain of stations, or individual radar and usually required a long period for data collection. Researchers in the past were forced to organize their findings from these stations to obtain a global picture. The worldwide GPS network, for the first time, makes near real-time global ionospheric TEC measurements a possibility. Based on these measurements, global ionospheric TEC maps are generated with time resolution from 5 min to hours. Using these maps, we can analyze the global evolution of ionospheric storms on temporal and spatial scales, which have been difficult to study before. We have developed a differential mapping technique (DMT) which computes the percent change of a storm time map relative to an average of quiet time maps. We have studied several past magnetic storm events and have identified one clear type of storm, in which the traveling ionospheric disturbance (TID) causes an ionospheric perturbation, propagating at a speed of ~460 m/s from high latitudes (60° N) to low latitudes (30° N) in ~2 hours. These preliminary results suggest that it may be possible to identify certain types or features of ionospheric storms in its early stages by using (near) real-time GPS global measurements. The GPS global network appears to be a powerful tool for studying the global pattern and evolution process of the entire ionospheric perturbation.

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