Geophysical Research Abstracts, Vol. 6, 05105, 2004
SRef-ID: 1607-7962/gra/EGU04-A-05105

IONOSPHERIC SPACE WEATHER EFFECTS MONITORED BY SIMULTANEOUS GROUND AND SPACE BASED GNSS SIGNALS

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Space weather effects can degrade accuracy, reliability and availability of global navigation satellite systems (GNSS). On the other hand, well established ground based and innovative space based GNSS measurements offer the unique chance for a permanent monitoring of the electron density structure of the global ionosphere / plasmasphere up to about 20000 km height.
We discuss several space weather effects in the ionosphere such as strong perturbations in plasma density and distribution. To analyze these space weather effects we use 30s sampled measurements provided by the global GPS ground tracking network of the International GPS Service (IGS). Furthermore, to get a comprehensive view on ionospheric perturbations during some selected space weather events we analyze simultaneous GPS measurements onboard the CHAMP satellite.
Whereas the ground based measurements show strong horizontal redistribution of plasma during ionospheric storms, the spaceborne measurements on CHAMP indicate a severe vertical redistribution of the ionospheric plasma during the selected events. The role of dynamical forces as meridional winds and electric fields is discussed.
The results demonstrate that ground and space based GNSS measurements provide an excellent tool for monitoring the space weather impact on GNSS applications. A direct correlation between space weather events and phase degradation of GNSS signals for positioning has been found in 1 Hz sampled GPS and GLONASS data in the course of strong geomagnetic storms.