Geophysical Research Abstracts
Vol. 12, EGU2010-3079, 2010
EGU General Assembly 2010

The climatology of low latitude ionospheric currents derived from CHAMP observations

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The multi-year data base of magnetic field and ionospheric measurements from the CHAMP satellite contain enormous potential to investigate the behaviour and the origin of currents in the E and F region ionosphere. Special advantage is drawn from the satellite's near polar orbit and the full data coverage over all longitudes and local times. This paper will present findings about two prominent features of the low latitude ionosphere: equatorial plasma irregularities and the equatorial electrojet (EEJ).
Equatorial plasma irregularities (commonly known as "bubbles") severely disturb the post sunset F region ionosphere and cause the strongest radio wave scintillations globally during solar maximum years. Using CHAMP vector magnetic field data, it was possible for the first time to show on a long term basis that equatorial plasma irregularities have signatures in all components of the magnetic field. The first ever global climatology of the occurrence rate of these magnetic signatures has been compiled. Such a data base of disturbed orbits is especially useful for core and crustal magnetic field modellers.
The magnetic field observations of CHAMP, Ørsted, and SAC-C were employed to develop a climatological model of the EEJ. Measurements of the EEJ and empirical values from electron density and thermospheric density and winds have in addition enabled the development of a climatological model of the equatorial electric field. These results provide excellent opportunity to investigate the seasonal/longitudinal characteristics of the EEJ and the influence of atmospheric waves on E region dynamics.