



Swarm Modelling studies of the magnetic effect of low-latitude ionospheric F region currents

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High-resolution magnetic field measurements of the CHAMP satellite have provided evidence that there are considerable currents flowing at F region altitude even during the night when Hall and Pedersen conductivities are very small. The plasma pressure gradient (Lühr et al., 2003) and the Earth's gravity (Maus and Lühr, 2006) have been suggested as dominant forces driving these currents. In order to assess the impact of such currents at low and mid latitudes on Swarm magnetic field measurements, an ESA-sponsored model study was performed. With the help of the Coupled Thermosphere-Ionosphere-Plasmasphere (CTIP) model representative ionospheric conditions were simulated. Based on this "simulated world" environment the distribution of the various current types was calculated and the magnetic effects along representative Swarm orbits estimated.

The results are largely consistent with the propositions derived from CHAMP observations. For the first time, the spatial and local time distribution of the F region currents has been made visible on global scale. On the night side, strongest currents are found in the height range 300 to 600 km. Under solar maximum conditions magnetic effects of the order of 5 nT are obtained. With the help of the simulated environment it is possible to investigate the different current components independently. A very promising result is that the magnetic effect of the plasma pressure gradient currents can effectively be corrected by the approach proposed by Lühr et al. (2003).