# RECENT ACHIEVEMENTS IN CHARACTERISING IONOSPHERIC AND MAGNETOSPHERIC FIELDS

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The recent magnetic field missions have brought about an enormous progress in the understanding of near-Earth external field structures and the description of their sources. Based on observations from Oersted, CHAMP and SAC-C a rather comprehensive picture of their temporal-spatial variability could be achieved. It is the first time that magnetic effects from the ring current and the magnetospheric tail currents could be separated. With that it became evident that part of the Sq current signature on ground is caused by the tail current.
In recent years more and more evidence has been presented for the significance of currents at F region altitudes where ion-neutral collisions are less important. These currents are driven predominantly by plasma processes. Among others, gravity and pressure gradient forces are acting on the charged particles. In particular, plasma irregularities like plasma bubbles cause detectable magnetic signatures. These F region currents are shown to flow also on the night side, and they cause magnetic fields of order 5 nT. Techniques have been developed for correcting to for first order the magnetic effect of plasma gradient currents. At low latitudes the effect of the F-region dynamo could be verified experimentally. This wind-driven generator sets up meridional current systems which peak around noon and sunset.
An appropriate method would be to model all the ionospheric currents self-consistently and predict the magnetic field corrections. The constellation mission Swarm is expected to provide the necessary observational input for such an approach.

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