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Plasma induced magnetic effects on Swarm satellites

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The three Swarm satellites were launched from Plesetsk, Russia in November 2013, with the mission to measure the goemagnetic field with unprecedented accuracy. These measurements in turn will help us better understand of the many contributions to the near-Earth magnetic field, from the Earth core, up to the ionosphere and magnetosphere. Each of the three satellites is equipped with a vector magnetometer, and an absolute scalar magnetometer located approximately 1.5 m apart. Ideally a consistency of order 20 to 50 pT, corresponding to the sensitivity of the instruments, is expected. Yet, it is found that, depending on the location and flying attitude, systematic discrepancies of order 1 nT or more can be found. Several models have been proposed to explain these differences, but some persist and remain elusive. One possible explanation for some of the differences has to do with the interaction between the Swarm satellites and nearby space environment, which would lead to a) perturbed plasma current densities, and induced currents in the satellites themselves, which would then be responsible for perturbed magnetic fields at the magnetometers. This hypothesis is tested with fully kinetic PTetra simulations of the interaction between Swarm and ionospheric plasma, under the conditions in which these unexplained discrepancies are observed. The simulations account for the full ˜10m length of the satellite, and realistic ionospheric plasma parameters. Simulation results are then used to assess satellite-plasma interaction induced magnetic perturbations at the magnetometers, as a possible explanation for observed discrepancies.

Author: Prof. MARCHAND, Richard (University of Alberta)

Presenter: Prof. MARCHAND, Richard (University of Alberta)

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