



Spacecraft charging model for the calibration of the low frequency electric field measurements on TARANIS

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Although spacecraft charging in LEO is generally regarded as insignificant because the cold dense ionospheric plasma prevents the development of strong potential differences, scientific satellites carry very sensitive instruments, which measurements may be impacted by the charging of the spacecraft. In order to assess the effect of the spacecraft charging on the measurements ONERA has developed SPIS (Spacecraft Plasma Interaction System) software, in which different numerical schemes are implemented, but none is perfectly fitted to perform very low noise simulations for satellites in ionospheric plasma within an admissible computation time. In this paper, a perturbative PIC-df method coupled to an analytic estimate of the plasma moments is proposed. This results in having the advantages of the analytic methods in term of statistical noise and computational resources without suffering from some of their limitations.

These results are then used for simulating TARANIS satellite which will be launched in 2018 in a quasi-polar earth orbit with the mission to detect and study different phenomena associated with atmospheric storms. We focus in particular on the calibration of the low frequency electric field measurements (IME-BF instrument) and of the ion probe carried by the probe.