



Solar cycle variations of the Cluster spacecraft potential and its use for electron density estimations

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Spacecraft potential measurements by the the Cluster electric field experiment (EFW) can be used to obtain plasma density estimates in regions of space where traditional measurements using plasma moments do not work. From the first years of Cluster operations, it became clear that the spacecraft potential varied with solar ultraviolet radiation and that a method using the spacecraft potential for electron density estimations would consequently change during the solar cycle. In this work, we have combined the Cluster EFW data with measurements of extreme ultraviolet radiation (EUV) from the TIMED spacecraft to demonstrate the close connection between solar radiation and spacecraft potential. We have also produced a new, improved method for estimation of electron density based on the EFW probe potentials. The improved version of this method makes it possible to get electron density data in the polar caps and the lobes of the magnetosphere year by year during a solar cycle.