



Study of the plasma density derivation in tenuous plasma regions using spacecraft potential data under active control from the Cluster spacecraft

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Variations of the floating spacecraft potentials has been typically used to derive plasma density measurements, complementing the measurements from plasma detectors and plasma wave experiments. All spacecraft of the Cluster mission are equipped with instruments to control the spacecraft potential in order to minimize the spacecraft charging effects. Although the operation of those instruments increases the accuracy of electric field and plasma measurements, it does not allow a direct use of the spacecraft potential variations to derive plasma densities. In this work we develop a new method for performing spacecraft potential reconstructions of the controlled data to uncontrolled values in order to recover the plasma density information. Our method involves deriving a global photoelectron curve using data from spacecraft with no active spacecraft potential control and assuming that the same curve governs the environment near the spacecraft with spacecraft potential control. This is a reasonable assumption to make, especially when the spacecraft are not in large distances with each other. The current work focuses on reconstructions in the magnetotail region and the region focusing on the period between August to October 2003, while results from the periods August-Autumn of 2001, 2002 and 2004 are also presented. The results and the methods developed for this work can be applied for any future missions that have instruments that control the spacecraft potential, such as the upcoming Magnetospheric Multiscale Mission (MMS).