Estimation of electron density using spacecraft potential and electron temperature

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It has been investigated that the relationship between the Geotail spacecraft potential and the electron density/temperature in the near tail regions during the period from November 1994 to March 1997. The empirical formula, which shown them, have been improved considering the electron temperature. Thus, it is possible to estimate electron density using spacecraft potential in the near tail regions. The amount of scatter of the measured value from the improved empirical formula is about +/-20%. But, the empirical formula can't use when spacecraft potential is less than 30V. In the other words, the empirical formula can't use when spacecraft potential is greater than 30V in the distant tail regions. In this study, we investigate the relationship between spacecraft potential and the electron density/temperature in the distant tail region. And we show estimate equation estimable electron density in all regions where Geotail satellite takes a flight. Electron density was estimated from plasma waves. Hereby, electron density almost corresponded with those estimated by the empirical formula when it is possible determine Cut-off frequency of CR (Continuum Radiation). But, when it is difficult to determine, electron density didn't accord with the empirical formula. And so, we investigate the relationship between the Geotail spacecraft potential and the electron density/temperature, in order to research the empirical formula. And we build basic database to do auto-detect of approximate magnetoshperic region using the Geotail spacecraft potential and the electron density/temperature. The regions measured by spacecraft will be possible to decide using the software onboard the spacecraft proposed by this study in the future missions.