Ion distribution function in the near-Earth plasma sheet observed by Geotail: statistical study by model fitting method

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In this study, we will survey the ion distribution function in the near-Earth plasma sheet statistically by using the model fitting method in order to understand the transportation, heating and mixing process of the plasmas which originate in the plasma sheet, ionoshere and solar wind. We have used the three-dimensional distribution function obtained by the Low Energy Particl Instrument (LEP) onboard the Geotail satellite. The data period from September 14, 1993 to April 30, 2001 is used for the statistical study.

We fitted the observed ion distribution function to the following two models: First model is the kappa distribution function for the typical hot plasmas in the plasma sheet. Second, we assumed the kappa distribution (hot component) with the Maxwell distibution (cold component) in order to model the mixed state. The best model is selected by checking the reduced chi square.

We have investigated the statistical profiles of ion distribution function in the XY plane classified into the northward and southward IMF cases. Two component (kappa + Maxwell) plasmas are often observed in the near-Earth region especially in the dusk side. As for the hot component, it turned out to be cold and dense in the northward IMF case which is consistent with the past study (Terasawa et al. 1997). Dawn-dusk asymmetry in the power low index is observed which is also consistent with the previous works by Imada et al., 2002 and Wang et al., 2006. Another notable characteristic was the strong temperature anisotropy (Tperp/Tpara ˜1.5) in the near-Earth region especially in the flank (Hasegawa et al., 2003, Nishino et al., in press). The cold component is dense in the flank region and the temerature anisotropy (Tpara/Tperp greater than unity) is often observed.

We will report on how the density and temperature profiles of hot and cold component dependent on the solar wind parameters. We will also investigate the difference between the solar maximum and minimum period and discuss the origin and transportation, heating and mixing process of the cold component in the plasma sheet.