Statistical analysis of plasma density distribution in the plasmasphere by using the PWS system on-board the Akebono satellite

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The statistical analysis of the plasma density structure of the inner plasmasphere has been performed by using huge amount of the Akebono plasma wave data from 1989 to 1995. For statistical analysis, we made an average of plasma density structure with spatial resolutions of 0.01 earth radii.

During geomagnetically quiet periods (SYMH is larger than 0nT), the equatorial electron density gradually decreases with altitude, described by the formula of N=21,500∗Lˆ(-2.65) (/cc). The ratio of the standard deviation to the average electron density is 30-65%. This result indicates that the electron density decreases more rapidly than the result of the ISEE 1 satellite [Carpenter and Anderson, 1992]. However, this result does not decrease significantly at L=3 than the classical diffusive equilibrium theory [Angerami and Thomas, 1964]. The average electron density at the noon sector (from 0900 MLT to 1500 MLT) is higher than that at the midnight sector (from 2100 MLT to 0300 MLT) within the region that L is smaller than 1.4. It is probably due to the effect of increase of plasma density in the ionosphere by the solar EUV flux. However, in the region that L is larger than 1.4, any notable differences of the plasma density between the noon and midnight sectors was not detected. This result does not agree with the diffusive equilibrium theory. During geomagnetic storms (SYMH is smaller than -150nT), a density increase with 20-40% was found at L=2 compared with the quiet time profile.

In the future, it will become possible to obtain more accurate empirical plasmasphere model, when we take into account the effects of seasonal variation, solar activity and storm phases. Then it will become possible to understand the structure and dynamics of the cold plasma in the inner magnetosphere.