Meridional distributions of proton plasma and pressure-driven currents in the nightside inner magnetosphere: Arase observations

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We examine the averaged meridional distributions of proton plasma parameters and pressure-driven currents in the nightside (20–04 h magnetic local time) ring current region during disturbed times (-80 < SYM-H* < -40 nT) using ion measurements covering energy range of 10–180 keV by the Arase satellite. Because the Arase satellite has a large inclination orbit of 31°, it covers the absolute value of magnetic latitude (|MLAT|) range of 0–40° and the radial distance of < 6 Re. We find that the plasma pressure decreases significantly with MLAT. The plasma pressure on the same L^* shell at 30°<|MLAT|<40° is about 10–60% of that at 0°<|MLAT|<10°, and the percentage of decrease is larger on lower L^* shells. The pressure anisotropy which is defined by the perpendicular pressure divided by the parallel pressure decreases with radial distance and shows a weak dependence on |MLAT|. The magnitude of the plasma beta at 30°<|MLAT|<40° is one or two order smaller than that at 0°<|MLAT|<10°. The relative plasma pressure distribution predicted from the magnetic strength and anisotropy is roughly consistent with the observed plasma pressure for L^*=3.5–5.5. The azimuthal pressure-gradient current derived from the plasma pressure distribution spreads over ~-20° |MLAT|, while the curvature current is limited in ~0–10° |MLAT|. We suggest that the latitudinal dependences should be taken into account when considering a temporal evolution of ring current particles from L distributions of successive orbits.

Keywords: meridional distributions, plasma pressure, pressure-driven currents, Arase satellite