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Solar-cycle variation of the plasmasphere observed from the Akebono PWS data

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Plasmaspheric density structures have been studied for a long time. Although it has been clarified that the density is roughly constant along field lines in the outer plasmasphere, field-aligned density distributions of the inner plasmasphere has not been studied intensively. Moreover, continuous observations longer than one-solar cycle have not been reported. Consequently, long-term variations of the plasmaspheric density over a solar cycle remain unknown. In this study, using electron density data based on plasma wave observations from the PWS experiments on board the Akebono satellite from 1989 to 2008, we conduct statistical analyses on variations of structures of the plasmasphere and plasmatrough. In order to investigate the latitudinal distribution of the electron density, we assumed that electron density distribution along field lines are described by a power law form N_e = $N_{e0}(LR_E/R)\alpha, where N_{e0}$ is the equatorial electron density. Using the dataset during geomagnetically quiet periods and altitude higher than 4000 km, we derived solar cycle variations of the equatorial density N_{e0} and field-aligned density distributions α. N_{e0} and α are almost constant for the solar cycle ($N_{e0} \approx$ 2000 cm^{-3} and α = 0 – 1) in the inner plasmasphere at L = 2.1 – 2.3, which distribution is close to diffusive equilibrium. In contrast, $N_{e0}\sim$200 cm^{-3} and α=0 – 1 at solar minimum which distribution is close to diffusive equilibrium and N_{e0} $\sim$30 cm^{-3} and α= 2 – 3 at the solar maximum which distribution is close to collisionless in the outer plasmasphere at L = 4.2 – 4.7.

Keywords: plasmasphere, electron density, akebono satellite, solar-cycle