E112-015 **Room: 201A** **Time: May 19 14:15-14:30**

Electron number density models based on the Akebono wave data

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Empirical models of electron number density Ne from topside ionosphere to 2.6 Re both in plasmasphere and in the polar region have been developed based on the long-term plasma wave data obtained by the Akebono satellite.

In the plasmasphere, local Ne can be derived from resonance frequency of UHR waves. Ne profile along field line deduced from statistical analysis of in-situ Ne data in geomagnetically quiet state is well fitted to calculated profile based on the diffusive equilibrium (DE) model. However, the electron temperature assumed in the DE model calculation was larger than that reported by Kutiev et al. [2002] based on the Akebono TED. The plasmapause location shows strong dependence on geomagnetic activities. The correlation between Lpp, L value of plasmapause location, deduced from the Akebono Ne data and geomagnetic indices such as Kp and Dst was statistically investigated. The relation between Lpp and Kp based on the Akebono datasets is quite similar with that reported by Maynard and Chen [1975] but different from that reported by O'Brien et al [2003]. Furthermore the statistical analysis results show that Dst is more correlated with Lpp than Kp, which was also pointed out by O'Brien [2003]. Based on the above results, data-driven model of global plasmaspheric Ne structure are now being developed.

In the polar region, local Ne can be derived from upper limit frequency of whistler-mode auroral hiss. It was shown by the statistical analysis based on the Akebono Ne datasets that Ne in the polar region depends on not only geomagnetic conditions but also on solar zenith angle in the polar ionosphere and solar activity [Kumamoto et al., 2006]. The Ne in sunlit polar region is about 3 times larger than Ne in the dark polar region. The Ne during solar maximum is about 6-8 times larger than Ne during solar minimum. There found a transition of geopotential scale height in the vertical profile of Ne in the polar region: Below the transition geopotential scale height is about 400 km, while it is about 900 km above the transition. Transition height also depends on solar zenith angle and solar activity. It is 4000 km in dark polar region during solar minimum while it becomes larger than 7000 km in other conditions. The Ne profile in each condition was fitted with exponential function model, or a simple static pressure equilibrium model. The solar zenith angle and solar activity dependence of polar Ne are also seen in the polar Ne profiles reported in the previous studies while it has never pointed out by the authors. Ambient plasma density is important control factor of AKR. The long-term Ne variation in the polar ionosphere and magnetosphere is probably responsible for seasonal and solar cycle dependence of AKR [Kumamoto et al., 2003]. Storm-time polar Ne distributions are also investigated based on the Akebono Ne data. Enhancement of polar Ne during storms shows more distinct structure in the dayside than in the nightside, which suggests that dense ionosphereic plasma are upwelling from the cusp region during geomagnetic storms.