Case study of plasma structures in the magnetospheric midtail lobes

R. Koleva (1), J.-A. Sauvaud (2), A. Fedorov (2), V. Smirnov (3)

(1) Solar-Terrestrial Influences Laboratory, Bulgarian Academy of Sciences, Sofia, Bulgaria (2) Centre d'Etude Spatiale des Rayonnements, Toulouse, France, (3) Space Research Institute, Russian Academy of Sciences, Moscow, Russia (rkoleva@stil.acad.bg)

The magnetospheric tail lobes are vast regions between the plasma sheet and the mantle, filled with very rarefied and low temperature plasma. Apart from this tenuous plasma, distinct plasma structures are often observed. We use data from the ion and electron spectrometers aboard the INTERBALL Tail Probe satellite (IB-1) to study the characteristics of the enhanced plasma fluxes in the midtail lobes -27Re$<$X$<$-10Re. As the magnetotail lobes are magnetically connected with the polar cap we separated the observations according the substorm activity and analysed representative cases for the following four groups: i) high substorm activity during the whole lobe observation and preceding sequence of substorms; ii) moderate substorm activity and similar preceding conditions; iii) quiet conditions before and during the first part of the observations and then intensive substorms; iv) quiet conditions, after prolonged quiet period. In the lobe regions with enhanced electron populations several different morphologically plasma regimes could be observed, during all geomagnetic conditions, but with different intensity and occurrence: 1) Small scale (typically observed for several to 20 min) structures of electrons and ions with plasma sheet characteristics. 2) Structures similar in duration, but with characteristics typical for the boundary layers. The electron fluxes are field aligned and counterstreaming, the ions exhibit preferential flow directions, either tailward or sunward. 3) Large-scale regions of enhanced electrons with energies up to 200 eV and current density insufficient to produce any diamagnetic effect. The fluxes are field aligned but not balanced; the flows are intensified during geomagnetically disturbed periods. Usually ions are missing, however there are several cases when ions with energies up to 100 or 200 eV are present, tailward flowing, so lack of ions could be due to the high spacecraft potential. Structures of type (1) and (2) could be embedded in these structures. These regions are observed during several hours, IB-1 typically encounters one structure over distance up to 10Re in X, 2-3Re in Ygsm and ˜ 0.5 - 1.5Re in Zgsm directions. Structures of type (1) have been studied on base of INTERBALL ion data by Grigorienko et al (Ann. Geophys, 2001), and several case studies on structures of type (2) in the distant tail (e.g. Baker et al., GRL, 1997) and in the midtail (Santolik et al., Adv. Space. Res, 1999) have been reported. We focus on the characteristics of structures type (3) and discuss their possible origin, using supporting evidence from the low-apogee INTERBALL Auroral Probe satellite, the IB-1 subsatellite Magion-4 and empirical models.