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Electron density enhancement events in magnetic flux tubes

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The knowledge of thermal plasma concentration, acceleration and heating mechanisms is very important for many applications in magnetospheric physics. To understand processes in magnetosphere it is necessary to know the dynamics of thermal plasma motion both across and along the magnetic field, and its acceleration to higher energies. However, a detailed and quantitative assessment of the various processes which drive the ion outflows still appears to be a very wide and open question. Along with well known but poorly investigated “polar wind” - ionospheric ions escape along magnetic field line driven solely by pressure gradients of electrons and ions, there are several mechanisms providing additional heating of electrons and their primary escape, what, in its turn, produces field-aligned electric field working as “ion exhauster” for low energy ionospheric ions. Experimental data analysis allows underline some of them. First, the flux tube convection over dayside cusp vicinity and its long stay there driven by IMF By component sharp variations is considered. Suggested model adequately describes convection pattern and is in a good agreement with experimental data. Another very interesting mechanism is a terminator passage by magnetic flux tube due to large-scale convection, where sharp photo-ionization in F-layer takes place. Simulating of this effect by means of multi-ion time-dependent quasi-MHD model of flux tube density evolution TUBE-7 illuminates its significant contribution to flux tube filling dynamics by ionospheric ions. Detailed description of such localized effects and their following inclusion to global models of seems to be a proper way to increase the level of our knowledge on ionosphere-magnetosphere coupling processes.