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Electron dynamics associated with ion outflows above the polar cap

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During periods of northward IMF Bz, CLUSTER observed acceleration structures above the polar cap at relatively high altitudes (5-6 Re). These structures involve outflowing ion beams similar to those observed in auroral zone in presence of field-aligned potential drops. Above the polar cap, the electron population presents various signatures. Accelerated electrons at energies of the hundred or so eV are sometimes observed simultaneously with the ion accelerations. From the analysis of both ion and electron populations, we estimate the potential distribution along magnetic field lines. It is shown that it can cover an extended altitude range along the magnetic field lines from the ionosphere up to higher altitudes than the spacecraft. The measurements at the 4 spacecraft allow to compute the size and the motion/stationarity of these structures. Finally, between the ion acceleration structures, CLUSTER detected the presence of outflowing electrons at energies lower than 100 eV. In conditions of Northward Bz, the polar cap appears as a very structured region which can play an important role in the plasma exchanges with distant regions of the magnetosphere.