Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PEM31-P07 Room:Convention Hall Time:May 24 13:45-15:15

Electron properties of Inverted-V structures and their vicinities based on Reimei observations

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Electrons accelerated by the field-aligned potential difference are referred to as Inverted-V electrons. It is thought that fine structures of their energies and pitch angle distributions are due to electrostatic potential structures and their variations. Scientists have addressed outstanding problems such as how the potential difference is supported or how they are distributed along the magnetic field line. The purpose of this study is to understand how Inverted-V electrons are formed by focusing on not only Inverted-V regions but also their vicinities. The Reimei satellite for simultaneous observations of auroral particles and emissions with high temporal and spatial resolutions observed beam electrons at the edge of Inverted-V regions. At first their pitch angles are 0 to 20 degree. As Reimei moves toward the center of Inverted-V regions, their pitch angles broaden up to ˜120 degree, and their characteristic energy becomes higher. This electron beam is observed with non-accelerated diffuse electrons. To investigate electron properties around and in Inverted-V regions, we estimated the density and temperature of the source electrons. To observed electron energy fluxes we fitted the Maxwellian distribution for diffuse electrons and the accelerated Maxwellian distribution for Inverted-V electrons and electron beams.

An event observed on February 2, 2006 shows Inverted-V electrons with the width of ˜0.6 LAT at 73 ILAT and 0.4 MLT. At the high latitude of these electrons, diffuse electrons with energies of ˜400 eV and the isotropic distribution were observed. The estimated temperature and density of source diffuse electrons are ˜300 eV and ˜0.6/cc, respectively. In addition, those of energetic Inverted-V electrons are ˜300-˜400 eV and ˜0.1 /cc, respectively. For beam electrons, on the other hand, they are $<$100 eV and $<$0.1 /cc, respectively. These results indicate that source regions of diffuse electrons and energetic Inverted-V electrons are the magnetosphere such as the plasma sheet, and source electrons of the electron beam exist at altitudes of the topside ionosphere consisted of lower temperature electrons. To form electron beams, we figure out that a small amount of electrons are needed to supply into the acceleration region. From observations of auroral emissions, the poleward motion of the auroral arc with a low speed (˜0.5 km/s) was captured. Thus electron beams are likely explained by a drift of the electrostatic potential drop in the latitudinal direction. In other events, the similar signature of electron beams indicates that their source region is the topside ionosphere. Some static auroras, however, are also observed. In these cases, we consider that these ionospheric electrons are supplied into the potential drop due to the fallen bottom of equipotential planes toward lower altitudes. In this presentation, we will show some inverted-V events including diffuse electrons and electron beams and discuss about formations of electron beams.