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Event and statistical studies on energy and pitch angle distribution properties of electrons in Inverted-V structures

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Inverted-V electrons are accelerated by field-aligned potential difference. It is thought that these fine structures of their energy and pitch angle distribution are due to electrostatic structures and their variations. Lin and Hoffman(1979) investigated the time variations of flux ratio of downward electron component to perpendicular electron component in the Inverted-V region. There are, however, also the results which are inconsistent with the acceleration process due to field-aligned potential difference. For example, Whalen and Daly(1979) showed that the pitch angle distributions of precipitating electrons are field-aligned near the edge of an auroral arc, while they are isotropic pitch angle distributions at the center of the arc. These variations of pitch angle distributions are very interesting in terms of the existence of an additional acceleration mechanism but there are few data focused on the fine scale pitch angle distributions of Inverted-V electrons. It is also important to compare auroral emissions to pitch angle distributions for more advanced understandings of auroral acceleration region. We used the data based on Reimei simultaneous observations for auroral particles and emissions with high spatial and time resolutions in our study.

In this presentation, we will summarize statistically the variation patterns of the energy and pitch angle distribution in the Inverted-V region. We found the characteristic variations of pitch angle distribution. Energy fluxes of downward electrons are distinguished at the edges of Inverted-V structures. It is difficult to understand that electrons are accelerated along the magnetic field at these regions because the electric field is perpendicular to the magnetic field. As REIMEI moves toward the center of Inverted-V region, perpendicular energy fluxes of electrons increase and their characteristics energies increase at the same time. These signatures also exist even when field-aligned electrons by the inertial Alfven wave acceleration are not observed.

We estimated the origin of collimated electrons at the edges of Inverted-V structures and find that it is the ambient electrons existing at the altitudes of the acceleration region. These electrons are continuously supplied in the acceleration region. We analyzed the relations of these electrons and type of auroras at the edges of Inverted-V structures considering the effect of the electrostatic field-aligned potential drop. The statistical studies show that collimated electrons are observed despite types of discrete auroras. If we only think the effect of electrostatic field-aligned potential drops, we consider that the electrostatic field-aligned potential drop exists in the polar magnetosphere.