

Characteristic feature of plasma irregularity obtained in ICI sounding rocket campaign

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ICI-3 (Investigation of Cusp Irregularities) campaign was conducted in December 2011, to study a better description of plasma instabilities and wave phenomena related to Reversed Flow Events (RFEs) in the cusp ionosphere. In this campaign, sounding rocket was launched at Ny-Alesund in Svalbard, and intercepted the dayside cusp aurora region as expected. Among science instruments onboard, a purpose of Fixed Bias Probe (FBP) is to measure electron current incident to its spherical probe with high time resolution for investigating plasma irregularity with a spatial scale from 1 m to 100 m. The FBP successively identified existence of the small-scale electron density irregularity during the flight.

Power spectrum analysis was applied to the incident electron current, which is basically proportional to the electron density, with an interest in understanding characteristic feature of the spatial scale in the irregularity. In fact, the data obtained in this campaign are appropriate to investigate altitudinal variation of the frequency characteristics because the rocket was staying almost in the irregularity region through its flight.

As a result of spectrum analysis of the electron density variation, it is clearly found that spectral power with 10 meter scale increases with altitude. However, it should be noted that spectral power tends to increase with the background density if the irregularity is contained at a constant rate in the background density. Therefore, spectral amplitude normalized by the background density was used to investigate the altitudinal dependence. Our analysis indicates that normalized amplitude of the density irregularity with 1-10 m scale is most significant at altitudes between 100 and 150 km, while the one with 100 m scale is almost constant independently of altitude. In particular, it is noticeable that the amplitude of electron density irregularity has a small local maximum in the frequency of 100-200 Hz (corresponds to decameter spatial scale) at 100 km altitude. Such feature is not found at other altitudes. The electron density irregularity with such a scale can be a target of HF backscatter radar echoes.

We will discuss altitudinal variation of the density irregularity in more detail.

Keywords: Sounding rocket, plasma irregularity, ionosphere, Cusp, electron density