

# Simultaneous observation of ion upflow events by an all-sky spectrograph and ESR

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Filed-aligned ion upflow is often observed in association with transient plasma heating in the polar topside ionosphere where the dominant species of ion is O<sup>+</sup>. Although velocities of ion upflow are always smaller than the escape velocity, ion upflow must play an important role as a plasma source for the ion outflow. Recently, the soft electron precipitation is considered to be a dominant source of energy for ion upflow. On the other hand, the soft electron precipitation causes OI630nm and OII732/733nm auroral emissions. Relationship between ion upflow associated with soft electron precipitation and these auroral emission is not clear yet. In order to clarify the relationship among these auroral emissions, electron temperature enhancement, and upward ion velocity, we have compared EISCAT Svalbard Radar(ESR) data and auroral spectral data obtained by the Aurora Spectrograph(ASG) both at Longyearbyen. By using these data, we have investigated ion upflow events on December 8, 2001. Results are summarized in the following.

1. Ion upflow events during a period from 0727 to 0930 UT, were simultaneously associated with increased electron temperature observed by ESR and enhanced OI630nm and OII732/733nm emissions observed at the magnetic zenith except near 0830UT.

2. The time variation of ion upflow velocity is in accord with that of soft electron precipitation which is obtained by model calculation based on the observed by intensity ratio of OI630nm to OI557.7nm. Furthermore, ion upflow velocity and electron temperature increase with decreasing average energy of precipitating electrons.

3. Electron pressure gradient force estimated by the ESR data is correlated well with ion upward velocity, suggesting that the ambipolar electric field plays an important role for this event.

4. Electron heating rate obtained by model calculation increases with decreasing average energy of precipitating electron above -300km altitude. This calculation result is consistent with the result of anti-correlation between average energy of precipitating electron and electron temperature.

In addition to the above result, we will discuss the ion upflow event observed near 0830UT which is not in accord with soft electron precipitation obtained by the model calculation.