An estimation of two-dimensional distributions of aurora electron energy parameters using aurora all-sky images

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Methods to estimate the characteristic energy and energy flux of aurora electrons from auroral intensities at two different wavelengths were established in the 1970s and have been used in various auroral studies [e.g. Rees and Lucky, JGR, p5181, 1974; Semeter et al., JASTP, p1981, 2001; Meng and Liou, GRL, 2002]. We have applied this technique to obtain two-dimensional distributions of the energy parameters from monochromatic auroral images observed by multi-color all-sky imagers. By using all-sky images, the energy parameters can be obtained within about a 500 km radius from an observatory.

From the energy parameters we can obtain the ionospheric conductance in the aurora. In combination with electric field maps obtained by SuperDARN this allows us to derive distributions of Joule and particle heating rates associated with auroral precipitation. Additionally, by using thermospheric neutral wind and temperature data from a co-located Fabry-Perot interferometer, we will be able to investigate responses of the atmosphere to auroral energy injections.

In this study we use the data from our two all-sky imagers installed at Poker Flat Research Range (PFRR) at the University of Alaska, Fairbanks. These instruments have operated for three winter seasons since October 2000. A summary of these images is available to the public at the following URL: http://salmon.crl.go.jp/.

As a first step we estimated the energy parameters using N2+ (427.8 nm) and OI (844.6 nm) images observed simultaneously, and compared them with particle precipitation data above Alaska obtained by the FAST satellite. The energy parameters obtained by the two different ways were comparable within a 170 km radius from PFRR. However, they were getting different outside of this area. We suggest that these errors are caused by the viewing geometry and vertical extent of the aurora emissions exemplified by a ray structure. We propose developing a technique to eliminate these errors and to make better estimations the energy parameters.