動く red line カスプオーロラの水平プロファイル

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Horizontal profile of a moving red line cusp aurora

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Auroral emission at a wavelength of 630.0 nm (red-line) has a long radiative time. We have shown how this long radiative time controls the horizontal extent of a moving mesoscale aurora, which is typical of the cusp. Using high time resolution (4 s) observations by an all-sky imager at Longyearbyen, Svalbard, and observations by the EISCAT Svalbard Radar (ESR) pointing along the magnetic field direction, we examined the auroral emission enhancements obtained in the cusp during the interval of southward IMF on November 27, 2011. Simultaneous observations from the all-sky imager and ESR clearly show how auroral emission regions passed through the radar's field-of-view. When the front edge of the moving auroral structure intersected the radar's field-of-view, the ESR electron temperature was enhanced. A few minutes later, the ESR electron temperature dropped to the background level, indicating that the mesoscale electron precipitation region shifted away from the radar's field-of-view. At this time, the auroral emission in the radar's field-of-view decreased, but still had adequate intensities. These results provide evidence demonstrating that the moving cusp auroral emission occurs behind the electron precipitation region as well as inside that region. We have interpreted this feature semi-quantitatively using the equation of continuity of the density of the excited atomic oxygen. Our model indicates that the maximum intensity in the moving auroral structure occurs at a point along the trailing edge of the electron precipitation region, and that the velocity of that region is important for determining how the 630-nm aurora emissions extend horizontally.