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Temporal evolution of low-energy electron precipitation in longitudinally elongated moving cusp auroras

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When the interplanetary magnetic field has a southward component, precipitation of low-energy electrons is enhanced in the cusp region above the ionosphere. Within the cusp, particularly in its high-latitude portion, the precipitation is further intensified in elongated structures that extend longitudinally. These regions often exhibit dynamic motion lasting several minutes, with some drifting poleward. Ground-based observations of the 630-nm aurora show that such longitudinally elongated precipitation regions typically extend a few hundred kilometers, and can occasionally reach lengths of 400 km or more. Low-altitude satellite observations have demonstrated that enhanced precipitation of electrons with energies below a few hundred eV is responsible for the intensification of the 630-nm cusp aurora. However, the temporal evolution of the moving electron precipitation region remains difficult to resolve from only satellite measurements. We have recently developed a methodology that incorporates the GLOW model (including the Meier model of electron precipitation) with 630-nm all-sky auroral images to derive the two-dimensional distribution of the differential energy flux of low-energy electrons within a roughly circular region with a diameter of approximately 1400 km centered on the aurora observation point. In the present study, this methodology is applied to moving cusp auroras that extend longitudinally over ˜400 km. We analyzed 630-nm auroral images obtained from an all-sky imager at Svalbard and identified several events of longitudinally elongated moving cusp auroras. Using the aforementioned method, we investigated the temporal evolution of the electron differential energy flux within these regions. The results consistently revealed a characteristic temporal sequence: a rapid enhancement of the flux, followed by a quasi-stable phase, and then a monotonic decrease. The significance of this temporal sequence is discussed in the context of Alfvénic electron acceleration processes occurring in higher-altitude regions above the aurora.