Auroral Fragmentation

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Auroal patches in diffuse auroras are very common features of auroras in the post-midnight local time. However, the processes to produce auroral patches have not been well understood. In this paper we show two examples of "auroral fragmentation" which is the process that rather uniform aurora is broken into several fragments to form auroral patches. These examples were observed at Athabasca, Canada (magnetic latitude: 61.7N), and Tromsoe, Norway (67.1N). The auroral fragmentation occurs as finger-like structures in auroral images with horizontal scale sizes of a few tens to a few hundreds kilometers at ionospheric altitudes and time scales of a few minutes to ten minutes. The structures tend to develop in north-south direction without any shear motion, suggesting that the pressure-driven instability in the balance between earthward magnetic tension force and the tailward pressure gradient force in the equatorial plane of the magnetosphere is the main driving force of the auroral fragmentation. Secondary fragmentation also occurs in east-west direction with smaller scales of a few tens kilometers. These observations clearly indicates that the auroral fragmentation associated with the pressure-driven instability is a process that creates auroral patches.