Southward propagating auroral structure in meso-micro scale obtained from ground-based multiple observations at Poker Flat Research Range

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We have carried out ground-based observations with a narrow field of view (fov) camera, all-sky camera, and photometer at Poker Flat Research Range between Nov. 2011 and Mar. 2012 to study aurora dynamics associated with plasma physical process in the inner edge of plasma sheet and outer radiation belt. An Electron Multiplying Charge Coupled Device (EMCCD) camera, a main instrument of us, is optimized to investigations of both temporal and spatial characteristics of pulsating auroras (PAs) in micro-meso scale. It has a narrow fov (49 deg. × 49 deg.), corresponding to 110 km × 110 km at altitude of 110 km, and high sampling rate up to 100 frames per second [*Nishiyama et al*., 2012]. Also using data from all-sky camera, we can compare auroral structures in micro-meso to global scale. A photometer is designed to measure photon count rate with two wavelengths (N_2 670.5 and O 844.6 nm) simultaneously.
In this presentation, we will report an event related to substorm on Dec. 1st, 2011. Solar wind velocity continued 450 km/s during the day. An isolated substorm occurred around 1200 UT, and AE index reached 300 nT on the same time. South propagating aurora, with patchy structure and temporal scale of about 100 km, appeared in our fov 20 minutes after this break up. Key findings in this event can be summarized as follows.
[1] A large-scale auroral structure (~100 km) with 4 - 6 s pulsation and propagation southward appeared at 1220 UT, 20 min. after breakup.
[2] This aurora consisted of a few sub-structures with 5-30 km width and strong 2.4-2.5 Hz modulations, and they had independent back and forth motions in the large-scale structure.
[3] The scale of the large structure corresponds to MHD scale in the magnetic equator, but the spatial scale of sub-structures is very close to proton gyro radius. Therefore, the spatial and temporal characteristics of the sub-structures are expected to manifest violation of MHD approximation [e.g., *Ebihara et al*., 2010].
[4] Estimated propagation velocities to the horizontal directions inside the patches are almost corresponding to Alfven speed, which suggests standing fast mode waves are related to generations of precipitation.

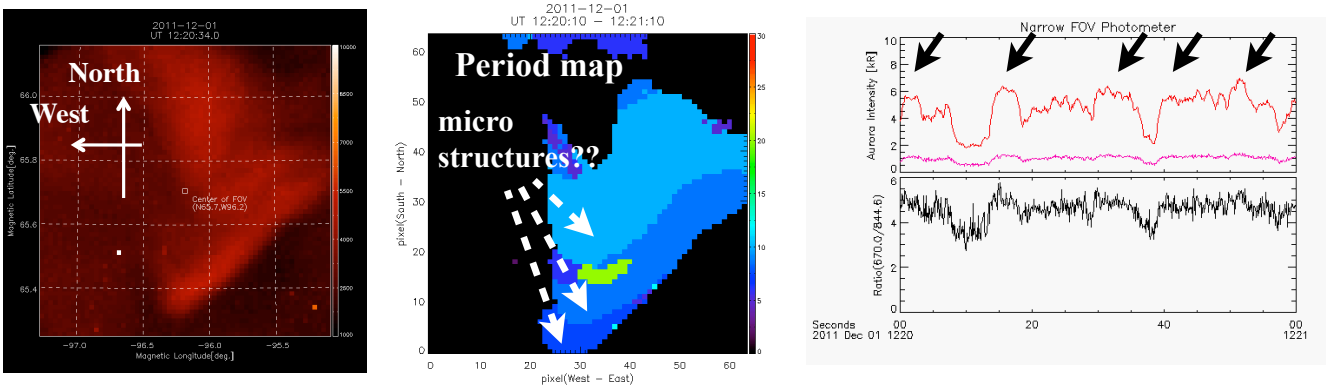

Figure 1. (Left) An image of the propagting aurora obtained from the narrow field of view EMCCD camera around 1120 UT on December 1st, 2011. (Center) An image which shows repetition periods estimated by FFT analysis for 1-min data. (Right) Auroral intenisty variations (N^2 670.5 nm and O 844.6 nm) and the ration between two wavelengths as a function of time, obtianed from the photometer poyting the local magnetic zenith.

References

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