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Quasi-periodic spatial modulation of pulsating aurora

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A quasi-periodic intensity modulation of pulsating auroras has been considered to be formed by pitch-angle scattered electrons with whistler-mode chorus waves, because the intensity modulation is consistent with the time scale of chorus elements. A 2-D simulation study showed the latitudinal displacement of chorus elements from the magnetic field line, and the Cluster satellites observed oblique propagations of chorus waves close to the equator. These oblique chorus waves may be seen as the quasi-periodic spatial modulations of the pulsating aurora in the ionosphere. The purpose of this study is to examine the oblique propagation of chorus elements as a possible mechanism of the spatial modulations of the pulsating aurora. We used data obtained by a highly sensitive sCMOS camera installed at Poker Flat Research Range (PFRR) in Alaska from February to April 2014. The imaging sensor of 2048 x 2048 pixels and the narrow field of view of 15 x 15 degrees enable us to identify the smallest auroral structure ever observed. The field of view approximately corresponds to 27 km x 27 km at 100 km altitude, and the spatial resolution is ˜52 m when 4 by 4 binning is used. From the initial analysis of a magnetic storm event on February 19, 2014, we found several events of spatial variations of small-scale (5 km across on average) elongated patches during the ON-phase of the main pulsating patch. The typical propagation speed of the small elongated patches is an order of 50 km/s at the 100 km altitude, which corresponds to an order of 1000 km/s in the magnetosphere. In the presentation we add some more storm events to show statistical results of the propagation directions and the speed, the scale-size, and the periodicity of small-scale pulsating auroral patches to compare with the simulated results of chorus wave-electron interactions which may form the spatial variations of pulsating patches in the ionosphere.