Simultaneous ground-satellite observation of dayside pulsating aurora

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Pulsating aurora (PsA) is a type of diffuse aurora which shows quasi-periodic modulation of luminosity. It has been known that PsA is usually observed during the late recovery phase of substorms in a magnetic local time (MLT) sector extending from the post-midnight to dawn. Previous studies indicated that PsA originates from quasi-periodic precipitation of electrons, which are scattered by whistler mode chorus waves near the equatorial plane of the magnetosphere. Most of the previous studies of PsA are focused on observations on the nightside and dawnside. However, recent studies, for example Han et al. (2015), indicated that PsA is observed even on the dayside (from the morning to the noon sector) at high-latitudes slightly below the cusp region. Those studies presented the MLT distributions of such Dayside-PsA (D-PsA) events, but detailed characteristics of D-PsA, such as its pulsating period and the origin of its temporal variation, have not yet been clarified. To reveal such properties of D-PsA, we have used optical data obtained from the all-sky WATEC imagers (AWIs, Ogawa et al., 2019) in Longyearbyen, Norway (78.1N˚,16.04˚E), whose temporal resolution is 1 Hz for the green-line (557.7 nm) observations. In addition, to observe chorus waves in the magnetospheric counter part of the DPsA region, we made use of wave data from the THEMIS satellite located near the equatorial plane of the magnetosphere. To verify the association between chorus wave and D-PsA, we investigated a D-PsA event in 25 minutes from 0720 to 0745 UT on December 10, 2018. This D-PsA event was observed by AWI and THEMIS simultaneously. Through direct comparison of the auroral luminosity from AWI with the chorus intensity from THEMIS, and additional cross-correlation analyses, we confirmed that there is a one-to-one correspondence between the brightness variation of D-PsA and the intensity modulation of chorus wave, which is very similar to the situation of PsA on the nightside and dawnside. To highlight the difference between PsAs on the nightside and dayside, we derived the distribution of pulsating period of D-PsA by applying the Stockwell transform to 6 events of D-PsA seen in Longyearbyen. From this statistical analysis, we found that the typical period of D-PsA is relatively longer (the peak was located at 35 sec) than that of nightside PsA. According to these results, we suggest that the driver of electron precipitation causing D-PsA is again whistler mode chorus waves in magnetosphere; thus, the mechanisms is similar to that of the nightside PsA. However, the prominent difference in the pulsating period of D-PsA means that the property of dayside chorus wave differs from that on the nightside to dawn side.

Keywords: Pulsating aurora, Chorus wave, Dayside aurora

