Statistical study of auroral/resonant-scattering 427.8-nm emission observed at subauroral latitudes over 14 years

*Kazuo Shiokawa[1], Yuichi Otsuka[1], Martin Connors[2]

1. Institute for Space-Earth Environmental Research, Nagoya University, 2. Athabasca University

Auroral emission at 427.8-nm from N_2^+ ions is caused by precipitation of energetic electrons, or by resonant scattering of sunlight at high altitudes by N_2^+ ions. The latter often causes impressive purple aurora at high altitudes. However, statistical characteristics of auroral 427.8-nm emission have not well been understood. In this paper we report occurrence characteristics of high 427.8-nm emission intensities (more than 100 R) at subauroral latitudes, based on measurements by a filter-tilting photometer over 14 years (2005-2018) at Athabasca, Canada (magnetic latitude: ~62°). We divided the dataset into the elevation angles (θs) of the sun more than and less than -24° (shadow height of sunlight: 600 km) to separate the 427.8-nm emissions caused by resonant scattering of sunlight and those excited by auroral electrons, respectively. The occurrence rate of 427.8-nm emissions of more than 100 R is 10.6 % and 7.65 % for θs more than and less than -24°, respectively. The occurrence rate is high in the post-midnight sector, and increases with increasing geomagnetic activity, solar-wind speed, and density. The occurrence rate is highest in summer. A high occurrence rate was also observed in 2015-2018, from the maximum to the declining phase of the 11-year solar activity. Superposed epoch analysis indicates that the 427.8-nm emission exceeds 100 R when solar wind speed increases and solar wind density concurrently decreases, suggesting that the solar wind structures typically observed at the arrival of corotating interaction regions (CIR) can be responsible for the high 427.8-nm emission.

Keywords: 427.8 nm emission, resonant scattering of sunlight, purple aurora

