Statistical comparison of the temporal fluctuations of pulsating auroral luminosity and chorus wave intensity

Yuki Kawamura[1], Keisuke Hosokawa[1], Yasunobu Ogawa[2], Satoshi Kurita[3], Wygant John[4], Breneman Aaron[4], Bonnell John[5] Kletzing Craig A.[6]

[1]*UEC,* [2]*NIPR,* [3]*ISEE, Nagoya Univ,* [4]*Univ. of M innesota,* [5]*UCB,* [6]*Department of Physics and Astronomy, UoI*

Pulsating aurora (PsA) is a kind of diffuse aurora which switches on and off with a period ranging from a few seconds to a few tens of seconds by quasi-periodic electron precipitation from the magnetosphere. Previous studies have suggested that the temporal variation of PsA is caused by the wave-particle interaction between whistler-mode chorus waves and high energy electrons in the magnetosphere. Especially, it has been indicated that there is one to one correspondence between the amplitude variation of the chorus waves and the luminosity modulation of PsA. In the past, however, statistical studies on the correspondence between the periodicities of the chorus waves and PsA have not yet been conducted due to the lack of high time resolution satellite/ground-based measurements.

To compare the chorus wave amplitude and the luminosity variation of PsA in the statistical fashion and confirm the relationship between these two phenomena, we perform a statistical analysis of the periodicities of PsA and chorus waves by using high time resolution ground-based and satellite observations.

For this purpose, we make use of All-skyWATEC Imager (AWI) which has been operative in Tromso, Norway (69.6N, 19.2E) and EFW/EMFISIS sensors onboard the Van Allen Probes (VAPs) satellites. AWI is composed of small high sensitivity cameras (WAT-910HX), fish-eye lens, and optical filters which have different transparent wavelengths. All-sky auroral images are taken with a temporal resolution of 1-2 Hz. The two wave sensors onboard the VAPs provide so-called filter bank data (FBK data) which has a temporal resolution of 8 Hz. Because of its high time resolution data acquisition, the FBK data enable us to analyze the periodicity of burst of chorus.

In the statistical analysis, we have employed all-sky images taken from November 2010 to March 2013 in Tromso, and the EFW/EMFISIS FBK data obtained from June 2014 to January 2015. We computed the average and mode period of the main pulsation of PsA, and they were estimated to be 15.6 sec and 9.0 sec, respectively. We also derived the distribution of the modulation period which has two peaks at 7.0 - 12.0 s (Peak 1) and 14.0 - 21.0 s (Peak 2). We find that the periodicity of PsA is not dependent on their shape and luminocity. It was also indicated that the period of Peak 2 becomes slightly longer in the later MLT sector. Regarding the statistics of chorus burst, we analyzed a few chorus events by using the FBK data, and found that the periodicity of the chorus bursts shows good agreement with the periodicity of main pulsation derived by the current statistics. We will derive the average and mode period of chorus bursts and identify the distribution of periodicity in the statistical fashion.

In the presentation, we discuss the casual relationship between PsA and chorus burst based on the statistical results.