

High-resolution correlation analysis between VLF/ELF chorus waves and pulsating aurora observed at Athabasca, Canada

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We investigate dynamic switching of arrival time difference between pulsating aurora intensity and chorus waves which were observed on 7 February 2013 at Athabasca in Canada ($L=4.4$), using a crossed-loop antenna and a narrow field-of-view EMCCD camera. Power spectra of pulsating auroral intensity and chorus wave intensity at 1.5-2.5 kHz show a same pulsation period at 0.1-0.15 Hz. Arrival time difference between pulsating aurora intensity and chorus waves are evaluated by using cross-correlation analysis. We found that two patterns of arrival time difference switches with a time scale of a few tens seconds. One pattern shows that electrons reached ionosphere later than the associated chorus waves with a delay time of 2 s, consistent with the theoretical value for south-going electrons reflected at the ionosphere in the southern hemisphere. The other pattern shows that electrons reached ionosphere earlier by 4.5 s than the associated chorus waves, consistent with the theoretical value for south-going chorus waves reflected at the ionosphere in the southern hemisphere. These results firstly show that interaction process of high-energy electrons and chorus waves are changing with a time scale of a few tens seconds.

Keywords: pulsating aurora, chorus waves, Wave-particle interactions, ground-based observation