

Relation between auroral luminosity Pc 5 oscillations and Poynting flux of ULF wave Pc 5 oscillations

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It is well known that optical Pc 5 oscillations in aurora are frequently observed during a recovery phase of a substorm. In this paper we try to examine how much energy can Poynting flux of ULF wave Pc 5 oscillations generate in the magnetotail and whether is it enough to excite aurorae at the ionospheric altitude or not? Data used in this study are simultaneous measurements on the ground with all sky imagers from the Time History Events and Macroscale Interactions during Substorm (THEMIS) Ground Based Observatories (GBOs) and in situ with the THEMIS satellites, -A, -D and -E traversed in the early morning side plasma sheet. The result is as follows; Poynting flux calculated by using electric and magnetic field perturbations of typical Pc 5 oscillations observed in the plasma sheet near the magnetic equator is a value of $5 \sim 10$ micro Watt/m², which corresponds to $10 \sim 20$ mW/m² at the ionospheric altitude. This value is revealed to be about 10 times of the least energy ~ 1 mW/m² for the excitation of aurora at the ionospheric height. Therefore, we can suppose that Pc 5 field-line resonant oscillations have an energy enough to produce auroral luminosity oscillations in the ionosphere. In addition auroral luminosity Pc 5 oscillations are clearly seen in the limited periods, not continuously, which occur corresponding to isolated enhancement of Poynting flux of Pc 5 oscillations in the magnetotail. This observation supports the idea that Poynting flux energy of Pc 5 oscillations seem to be deeply related to auroral luminosity oscillations.

Keywords: Aurora, Pc 5 oscillation, Substorm, Field line resonance