On possibility of aurora particle acceleration triggered by ionospheric polarization field aligned current

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Ionospheric polarization field-aligned current (FAC), is one of the important elements to drive MI-coupled system from the ionosphere with upward Poynting flux accompanied by shear Alfven wave. Recently, Ohtani and Yoshikawa (2016) proposed model for the aurora intensification at the poleward boundary of the auroral oval.

They propose that the poleward boundary intensifications (PBIs) are initiated by ionospheric polarization due to fast polar cap flows, which are known to be well correlated with PBIs. The current continuity at the ionosphere can be described in two different ways, that is, the reflection of an Alfvén wave and the closure of Pedersen and Hall currents with field-aligned currents (FACs). Their results are consistent with the reported characteristics of PBIs, which are rather difficult to explain otherwise.

For more comprehensive understanding the PBIs, we need to explain how upward FAC excited by polarization process become trigger of aurora particle acceleration leading to the PBIs. We investigate this process by using Vlasov simulator considering aurora density cavity region, in which cold electrons from the ionosphere and hot beam electrons from the magnetosphere are coexisted. We obtained the initial result that at the temperature gradient region where cold plasma density from the ionosphere and hot plasma density from the magnetosphere, new type of Alfven wave that electron sonic wave and ion inertia motion are coupled each other, is excited. Nonlinear evolution of this new type of Alfven wave evolves quasi-static parallel electric field inside plasma density cavity region. We consider this parallel electric field would become important candidate for acceleration of aurora particle accompanied by PBIs.

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