On the dispersion relation of the field line oscillation coupled to the near field on the ionosphere

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It is theoretically known that the shear Alfven wave incident on the ionosphere generates the near fields. The near fields have the two type of the spatial structure: one is divergent, which corresponds to the TM atmospheric waveguide mode, and the others are rotation, which correspond to the fast magnetosonic mode and atmospheric TE waveguide mode. We consider about dispersion relation of the field line oscillation interacting with these near fields. The field line oscillation has the dispersion perpendicular to the magnetic field, because of the redistribution of ionospheric divergent current by these near fields. The nature of dispersion will be clarified, such as dependence group velocity on the time and spatial structure, and on the ionospheric conductivities.