Influence of interhemispherical asymmetries in the ionospheric conductivity on high-latitude Pc 4˜5 pulsations

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It has been generally recognized that shear Alfven waves, propagating along the geomagnetic field line and being reflected from the ionosphere in both hemispheres, form standing waves along field line. This phenomenon is called field line resonances (FLRs), as a rough analogy to the resonance on a stretched string.

The field line eigenfrequency (i.e., the FLR frequency) is expected to be a function of the field line length, magnetic field intensity, and mass density along the field line according to the stretched string analogy, because the velocity of shear Alfven waves is affected by the magnetic field intensity and the plasma mass density along the field lines. Thus temporal and latitudinal variations in the field-line eigenfrequency (FLR frequency) are potentially caused by increases or decreases in the field-line length, the magnetic field intensity, and the mass density along the field line. To distinguish between temporal and spatial variations in the FLR frequency and obtain a better understanding of the physical mechanisms of geomagnetic pulsations under the in_uence of these parameters, it is important to monitor the FLR frequency from the ground on a continuous basis. In the present work, we introduce diurnal variations in the FLR frequency identified by analyzing the data from Antarctic and Icelandic sites individually. Most of these variations agree with diurnal variations estimated by numerically solving the standing Alfven wave equation with the assumption of the infinite ionospheric conductivities at both ends. The magnetospheric magnetic field was given by the T04 model, and the mass density distribution along the field line was assumed to follow a power-law model.

However, other case studies show step-like variations in the FLR frequency. These variations are so far from diurnal variations estimated by the numerical analysis. At high latitudes, interhemispheric asymmetries in the ionospheric conductivity may cause the occurrence of oscillations with a specific field-aligned structure like as the free- and fixed-end reflection. In the present work, we discuss the observed step-like diurnal variations in the FLR frequency due to the interhemispheric asymmetries in the ionospheric conductivity, and show the diurnal variations estimated by numerical analysis using a the semi-empirical model of the ionospheric conductivity.