Compressional MHD wave transport in the boundary region between cold and hot plasmas

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When the magnetotail is disturbed by an impulsive input such as the substorm onset, compressional magnetohydrodynamic (MHD) waves play an important role in delivering perturbed energy and exciting various wave modes and currents. The plasmasheet, in which relatively hot plasmas exist, is surrounded by relatively cold plasmas at the plasma sheet boundary layer (PSBL) and the equatorial plasmasphere. Since the Alfven speed significantly varies near these regions, the compressional waves are expected to undergo mode conversion by inhomogeneity at the boundary between cold and hot plasma regions. We investigate how the initial compressional MHD wave energy is reflected, transmitted, and absorbed across that boundary by adopting the invariant imbedding method (IIM) which gives the exact reflection, transmission, and absorption coefficients without any theoretical approximations for given frequencies and wave numbers. The IIM method is very useful in quantifying the reflection and transmission of compressional waves in the sense that we can calculate how much fast mode wave energy is delievered into shear Alfven waves or field-aligned currents. Our results show that strongly localized absorption occurs at the boundary region. This feature suggests that localized field-aligned currents can be impulsively excited at such boundary regions by any compressional disturbances, which is highly associated with impulsive auroral brightening at the substorm onset. We compare our results with previous studies in cold inhomogeneous plasmas.