# Magnetosphere-Ionosphere Coupling by Alfvén Waves at Sub-Auroral Latitudes

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Most investigations of magnetosphere-ionosphere coupling have focused on the auroral zone where strong field-aligned currents flow. The sub-auroral region, however, is a region of very low ionospheric conductivity, leading to strong plasma flows often called sub-auroral polarization streams (SAPS). This suggests that the interaction of Alfvén waves in this region may have different characteristics than this interaction in the high conductivity auroral zone. The ionospheric conductivity profile is critically important for ground observations of ultra-low-frequency (ULF) waves. At very low conductivity, Alfvén waves will be strongly damped, indicating that the ground magnetic field will be very weak. On the other hand, at high conductivity, the ionosphere can shield field-aligned currents, again producing only weak ground magnetic fields. Such behavior has been seen in statistical studies of the ground fields on the dayside (Obana et al., 2005). Simple models of this process (e.g., Yoshikawa et al., 2002; Sciffer et al., 2004) have shown that the ratio of the ground magnetic field to the incident magnetic field in the ionosphere rises to a peak as the Pedersen conductance is enhanced, but then decreases as the Pedersen conductance is increased further. This question is investigated using a three-dimensional numerical model of ULF wave propagation in the magnetosphere. These results are relevant to the relationship between ground magnetic fields and the magnetic fields measured by low-altitude orbiting spacecraft, and may assist in the understanding of magnetosphere-ionosphere coupling during the sub-auroral emission called STEVE (Strong Thermal Emission from Velocity Enhancement).

Obana, Y., A. Yoshikawa, J. V. Olson, R. J. Morris, B. J. Fraser, and K. Yumoto (2005), North-south asymmetry of the amplitude of high-latitude Pc 3–5 pulsations: Observations at conjugate stations, J. Geophys. Res., 110, A10214, doi:10.1029/2003JA010242.

Sciffer, M. D., C. L. Waters, and F. W. Menk (2004), Propagation of ULF waves through the ionosphere: Inductive effect for oblique magnetic fields, *Ann. Geophys., 22,* 1155.

Yoshikawa, A., Y. Obana, M. Shinohara, M. Itonaga, and K. Yumoto (2002), Hall-induced inductive shielding effect on magnetic pulsations, Geophys. Res. Lett., 29(8), 1266, doi:10.1029/2001GL013610.

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