

Coupling between field-aligned currents and the Earth-ionosphere waveguide-Excitation of the TM₀ mode waves-

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Instantaneous transmission of the polar electric field to the equator has been explained by means of the TM₀ mode waves in the Earth-ionosphere waveguide (Kikuchi and Araki, 1979). The TM₀ mode waves are excited by a transverse magnetic field below the ionosphere, which is due to field-aligned currents (FACs) in the magnetosphere. The excitation of the TM₀ mode waves is in conflict with the Fukushima's theorem (Fukushima, 1976), in which magnetic fields due to the FACs and ionospheric currents cancel each other below the ionosphere. In this paper we show that a pair of FACs produce a horizontal magnetic field below the ionosphere, while a single FAC assumed in the Fukushima's theorem does not. The pair of FACs thus excites the TM₀ mode waves in the Earth-ionosphere waveguide, which transmits electric field from the magnetosphere to the equatorial ionosphere.