

A derivation of basic formalism of the Schumann resonance considering finite electrical conductivity of the solid earth

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The frequency characteristics of the Schumann resonance of the geoelectromagnetic field have been analytically derived with an approximation that the solid earth is a perfect conductor. This approximation is, however, qualitatively inconsistent with observational facts that horizontal electric field variations in the ELF band are recorded in magnetotelluric surveys. Based on the frame of the internal geoelectromagnetism, assuming a simple space that the solid earth is a homogeneous sphere with a finite electrical conductivity, together with a homogeneous insulating spherical shell representing the atmosphere and an infinite homogeneous sphere with a finite electrical conductivity representing the ionosphere, the mathematical expression of the Schumann resonance in the 3-layer earth is derived. In the presentation, the frequency characteristics of 3 components of the TM wave excited by a radial electric current element are shown.

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