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Effect of changing ionization on the low frequency waves in the collisional ionosphere

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The lower part of the Earth's ionosphere is weakly ionized whereas upper ionosphere is completely ionized. In the E region and lower F region of the Earth neutral – plasma collision plays important role and therefore the investigation of the collisional, non-ideal magnetohydrodynamic (MHD) effects are important. There are three regimes in which non-ideal MHD effects may operate. Ambipolar — When the magnetic field can be regarded as frozen in the plasma and drifts with it through the neutrals; Ohmic — When neutrals stop the ionized particle from drifting with the field, and, Hall — When electrons and ions are well coupled or partially coupled to the field. Therefore, propagation of the waves in the medium can be studied in any of the three regimes. The Earth's ionosphere undergoes rapid change over a very short scale length and the ratio of neutral to the plasma density changes with increasing height. Further, this ratio is also nonuniform along the radial direction as well. Therefore, the relative drift velocity between the neutral and plasma particle changes with changing ionization in both radial as well as vertical direction. We investigate the propagation of the wave in such a medium and show that the gradient in the ratio of neutral to the plasma density severely modifies the wave properties. The results are discussed in the context of observed wave structure in the medium.