Nonlinear, Intermittent E-region Irregularities: What Do We Really Know?

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Abstract

One of the most fundamental challenges of ionospheric physics is to explain why the largest amplitude structures tend to move at phase speeds that do not exceed on average the linear theory threshold? To provide a solution one has to rely on nonlinear theory in order to study the development and evolution of nonlinear ionospheric structures. We propose to study the development and evolution of nonlinear, large-amplitude, intermittent E-region plasma structures. The results of a model based on the nonlinear coupling between three and four Farley-Buneman (FB) waves in three dimensions (3D) will be presented. We are able to recover the 2D results reported in the literature as a limit case in our study, and we are able to show that both the three-wave and the four-wave interactions play a significant role as far as nonlinear saturation mechanisms are concerned. We will also attempt to describe the impact of nonlinear FB structures on the electron anomalous resistivity and consequently on transport in general and heating in particular.

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