

Automatic Processing of Ionograms Based on the Empirical Orthogonal Function (EOF) Analysis of Ionospheric Electron Density

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This paper proposes a new method for ionogram automatic processing based on the empirical orthogonal function (EOF) analysis. For a certain location, the height profiles of ionospheric electron density are represented as a series with adjustable coefficients composed of basis functions, which are derived from the EOF analysis of electron density profiles from International Reference Ionosphere (IRI) model or the measured ionograms. By adjusting the coefficients of the series and combining image matching technique, the resulting calculated trace as approximate as possible to the observed ionogram trace is obtained. Thus the ionogram trace and the related density profile are acquired simultaneously. To evaluate the performance of this method, the critical frequency (foF2) and peak height (hmF2) of F2 layer from manually scaled ionograms are compared with those from automatically scaled ionograms by the widely used Automatic Realtime Ionogram Scaler with True height (ARTIST) and our method respectively. The results show that this method has comparable acceptability and better universality and stability.