

A global model for day to day disturbance of F2-layer critical frequency

S. Shastri

Radio and Atmospheric Sciences Division

National Physical Laboratory

New Delhi 110012, India

E.mail : shashikala-shastri@yahoo.com

A new technique based on multivariate analysis is described which allows for the prediction of day to day disturbance in foF2 values characterized here by the probability of the daily foF2 values to deviate greater than a threshold (say > 20 %) from the corresponding median. The daily foF2 data for selected ionospheric stations covering a wide geographic latitudinal variation is divided in six blocks of four hour bins and analyzed for each month/hour bin separately. The multivariate coefficients are evaluated using two independent variates namely the smoothed sunspot numbers and the disturbance index (representative of geomagnetic variation derived from the planetary index Ap). An index 'ESSN' called herein the effective sunspot numbers is obtained from the multivariate coefficients and used as an intermediary index to predict the required probability of disturbance given by

'Prob. D' = X + Y x 'ESSN'.

'Prob. D' is the probability of daily foF2 values to deviate greater than 20% from the corresponding median. X and Y are the linear regression coefficients. The analysis shows clear dependence of probability of disturbance on latitude and season. A linear programming technique is used in this model to predict whether on any particular day the foF2 value for a chosen hour-bin is expected to be deviated greater than 20% from the median. The term 'Quietness' called herein for (100 – probability of disturbance) is used as an objective function in the linear programming and it is minimized, which is same thing as disturbance being maximized. By putting some constraints on the regression lines, the technique is able to obtain diagrammatically a region of feasible combinations of sunspot number and geomagnetic index which is representative of foF2 deviating greater than 20% from the median. This region is different for each location-month-hour-bin combination. It is expected that the model can serve as a short time updating algorithm for median foF2 values (predicted by the standard models).