



Prediction of D Region Characteristics using Nonlinear System Identification Technique applied to VLF/LF Transmitter Data

H. Santosa^{(1), (2)} and Y. Hobara*⁽¹⁾,

(1) Department of Computer and Network Engineering,
The University of Electro-Communications,
Chofu-city, Tokyo, Japan, e-mail:hobara@ee.uec.ac.jp

(2) University of Bengkulu, Bengkulu, Indonesia

The terrestrial ionosphere from D-region (60 km) to F-region (500 km) plays an important role in radio wave propagation between the Earth and ionosphere. Properties of the D layer (the lower end of the ionosphere) is effectively obtained by receiving VLF/LF transmitter signals. Although, the ionospheric condition varies both in time and space due to various external forcings from the atmosphere and space weather parameters, quantitative information of contributions influencing the ionosphere from every external forcing parameter have not understood well. In this paper nonlinear autoregressive with exogenous input and neural network is applied first time to identify the ionospheric characteristics based on the VLF radio wave propagation. One step ahead prediction of the daily nighttime means of VLF electric amplitude in three different latitude paths and two receiving stations by using NARXNN has been carried out. The relative contribution to the ionospheric conditions (VLF electric amplitude variability) from every external forcing has been revealed. Moreover, the proposed model extends for multi-step ahead prediction to evaluate the performance of prediction accuracy for five and ten days ahead. Physical interpretation of relative contribution to the ionospheric conditions from major external forcing parameters have been made.