

# Feed forward neural network based ionospheric model for the East African region

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## Abstract

In this paper, a neural network based regional ionospheric model is developed using GPS-TEC data from 01 January 2012 to 31 December 2015. For this purpose, nine GPS station TEC data in the time intervals 2012 to 2014 were used to determine model parameters. TEC data obtained in various years and geographical locations which are excluded in the training time are used to validate the performance of the model. For the first case, TEC data from each station in the year 2015 is used to validate the performance of the model. In the second case, GPS observations at Metu, Robe, and Serb stations are used to investigate the model's performance in the year 2012, 2014 and 2013-2014, respectively. In both cases, to validate the accuracy and quality of the model, GPS-TEC values were compared with the predicted TEC. The results indicate that the proposed model can capture most of the spatio-temporal variations of the regional TEC. The present model reproduces the observed hourly TEC with RMS values that lie around 3 to 6.05 TECU at different geographical locations for both one hour and one day ahead prediction. For one day ahead prediction, a comparison of the NN method using NeQuick 2 model outputs with GPS derived measurements have also been conducted. The results indicate that the NN TEC model proposed has a good performance in representing TEC variations compared to climate NeQuick 2 model.

*Keywords:* Ionosphere, GPS-TEC modeling, Neural network,  
Bayesian regularization

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