Total electron content forecast model over Japan using a machine
learning technique

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Forecasting ionospheric condition is important for space weather operation, especially for
predicting propagation delay of the radio waves in the ionosphere. National Institute of
Information and Communications Technology (NICT), Japan, develops an ionospheric forecasting system
of total electron content (TEC) in addition to a TEC monitoring system. Although several empirical
and theoretical models have been developed in a decade, no model is available for forecasting TEC
over Japan. Our purpose is to accomplish an operational TEC model over Japan using an artificial
neural network technique which is developed by Maruyama [2007]. In our model, absolute TEC values
for each day over Japan were projected on a two-dimension TEC map, that is, a local-time and
latitudinal map. Then the time-latitudinal variation was fitted by using the surface harmonic
function. The coefficients of the expansions were modeled by using a neural network technique. For
the learning process, we used absolute TEC value from 1997 to 2014. The input parameters are
proxies of the season, the solar activity, and the geomagnetic activity. Thus, daily
two-dimensional TEC maps can be obtained for any days when the input parameters are available. We
used input parameters which are provided in real-time by some institutes and achieved one-day TEC
prediction over Japan.

Keywords: machine learning, total electron content, TEC forecast