E115-027 Room: 201B Time: May 17 9:30-9:45

Solar Proxies Pertinent to Constructing Empirical Ionospheric Total Electron Content Model

Takashi Maruyama[1]

[1] NICT

Solar proxies and indices specifying extreme ultraviolet irradiance that affects the ionospheric total electron content (TEC) were examined through the training of an artificial neural network (ANN). TEC database was constructed from a dense GPS receiver network over Japan (GEONET) for the period from April 1997 to March 2008 that covered a whole 11-year solar activity cycle. In previous empirical models of upper atmospheric parameters, such as the International Reference Ionosphere (IRI) model and the Mass Spectrometer and Incoherent Scatter (MSIS) thermospheric model, 10.7-cm solar radio flux and/or sunspot number (SSN) are commonly used as proxies determining the solar activity. In the present study, the ANN training for predicting TEC (a target parameter) was done by including new solar proxies/indices that were based on direct measurements of solar X-ray/EUV/UV flux, as well as the traditional indices F10.7 and SSN, in the input space of the ANN. The new proxies are E10.7 (an averaged flux over the wavelengths from 1 to 105 nm), XE10.7 (an averaged flux over the wavelengths from 1 to 40 nm), and M10.7 (the core-to-wing ratio of the Mg II 280-nm line). All the above three proxies are expressed in a similar way to F10.7 by a least square calculation assuming a linear relationship with the F10.7 radio flux. Root mean square errors (RMSEs) of TEC were compared after the training was completed using a variety of combinations of the input parameters and found that E10.7 was the best proxy as anticipated from the definition and some proxies augment it. The best result or smallest RMSE of TEC was obtained by the combined use of a long-term (81-day) mean of SSN and short- (3- and 7-day), and long-term (27-day) means of E10.7. There were no advantages in using F10.7 and XE10.7 to augment E10.7. Also found was a delayed response of TEC to the irradiance changes. The lag time was about two days irrespective of the proxy used. One-day delay has been reported for thermospheric density variations in response to solar irradiance changes. The excess one day lag might be due to the plasmaspheric refilling process because the ionization process should be a quick response to the changes in EUV flux and thermospheric conditions.