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Assimilation of FORMOSAT-3/COSMIC Radio Occultation Data for a Coupled Thermosphere-Ionosphere Model: A Case Study

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In this report, we represent the result of a 4-dimensional variational data assimilation (4DVAR) for TIE-GCM (thermosphere-ionosphere electrodynamics general circulation model) by using FORMOSAT-3/COSMIC radio occultation data, which is scheduled to launch at the end of March this year. The NCAR/TIE-GCM global circulation model is a self-consistently electrodynamic-coupled thermosphere and ionosphere model subjected by a few parameters and boundary conditions to describe the dynamic thermosphere and ionosphere. Global Positioning System (GPS) radio occultation signals received by a low earth orbit (LEO) satellite provide precisely measurement about the total electron content (TEC) along the signal paths to GPS satellites. We consider optimal use of FORMOSAT-3/COSMIC occultation total electron content data to obtain the relative accuracy parameters used in TIE-GCM by minimizing the difference between the model results and measurements. The parameters used in TIE-GCM such as solar flux, hemisphere power, cross-tail potential, diurnal and semi-diurnal tidal modes at lower boundary, ionic oxygen flux at upper boundary, and background ionization rates are assuming constant within an assimilation cycle. The cost function associated with 4DVAR is constructed as the function of the model parameters and then be minimized with respect to the parameters. We will present the simulation result of TIE-GCM and examine the applicability of the 4DVAR to the ionospheric response to the space weather effect.