Comparison of the long-term incoherent scatter radar ionospheric temperature data at low-middle latitudes with the TIEGCM model

Jiuhou Lei (1), A. D. Richmond (1), R.G. Roble (1), W. Wang (1), B. Emery (1), and Shun-Rong Zhang (2)

(1) High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado, USA (2)Haystack Observatory, Massachusetts Institute of Technology, Westford, Massachusetts, USA

The National Center for Atmospheric Research Thermosphere-Ionosphere-Electrodynamics General Circulation Model (NCAR TIEGCM) is one of a few models which self-consistently solve a set of equations for the neutral upper atmosphere and ionosphere. Validation and improvement of this model are important for scientific research and space weather applications. As part of this work, the theoretical electron and ion temperatures (Te and Ti) from the TIEGCM model are compared with the long-term incoherent scatter radar observations at Millstone Hill (42.6 N, 71.5 W; 53.1 magN), St. Santin (44.6 N, 2.2 E; 39.5 magN), MU (34.8 N, 136.1 E; 25.0 magN) and Arecibo (18.3 N, 66.75 W; 29.0 magN), respectively. The comparisons are performed at low and high solar activity conditions and for three seasons: equinox, summer and winter. The observations show that the diurnal, seasonal, and solar cycle variations of ionospheric temperatures depend on height and latitude. The model can reproduce these variations well along with some interesting characteristics of the ionospheric temperatures except that the evening peak of the modeled electron temperature is much weaker and its morning peak is stronger in winter than the observations. The seasonal and solar activity variations of the ionospheric temperatures can be interpreted in terms of the corresponding dependence on the electron density.