



Preface

**Studies on mesosphere, thermosphere and ionosphere
from equatorial to mid latitudes – Recent investigations
and improvements – Part 1**

Investigations on mesosphere, thermosphere and ionosphere system are areas of increasing prominence since they are sensitive indicators of climate change and affect satellite-based technologies which have an important role in contemporary life. Compared to the one at high latitudes, the equatorial and low-latitude ionosphere exhibit strong spatio-temporal variability in the presence of really complex electrodynamic processes like among others the Equatorial Ionization Anomaly and the Equatorial Spread-F. In addition to this significant quiet-time variability, space weather events cause severe perturbations of the upper atmosphere through solar wind-magnetosphere-ionosphere coupling. Studies to achieve a comprehensive understanding on global characteristics of the thermosphere-ionosphere system are of vital importance to develop efficient models to meet the accuracy requirements of satellite-based communication and navigation applications. Further, the current 24th solar cycle is associated with several unique features, such as the deep and prolonged minimum, and the lowest maximum of the past hundred years, which triggered an increased interest to understand the upper atmospheric variability under such extreme and peculiar conditions.

To bring out the recent findings on mesosphere, thermosphere and ionosphere on a common platform, a special issue has been called for, inviting appropriate articles from scientists all over the world. An overwhelming response has been received with a total of more than 100 submissions with principal authors spread over 28 countries. A rigorous review process has been carried out with most of manuscripts reviewed by more than two reviewers. Due to the large number of papers, it was decided to present the special issue in two parts. A total of 29 papers accepted by 30 June 2017 are presented as Part-1 in this issue. Further accepted papers will be published as Part-2, which is expected to be printed in Vol. 61, 2018.

Nowadays, global as well as regional GNSS receiver networks are being developed evolutionarily along with

the new satellite constellations and ground based networks using radio and optical techniques, facilitating the generation of efficient databases with increased spatio-temporal resolution. In this regard, the studies presented in this special issue are based on observations from a wide variety of networks and instruments such as: GNSS receiver networks (IGS, GIM, RBMC-IBGE, EPN, UNAVCO, GAGAN), Ionosonde networks (DID, GIRO, Net-TIDE), satellite missions (FORMOSAT-3/COSMIC, C/NOFS, DMSP, TIMED/GUVI, Dynamic Explorer 2, AURA MLS, ACE), Magnetometer networks (INTERMAGNET, IIG), HF Doppler sounders, the MEXART radio telescope, and All-Sky cameras. Papers in this issue are organized according to the following five topics: (1) Recent findings and new developments in upper atmosphere monitoring; (2) Ionospheric scintillations and spread-F; (3) Ionospheric empirical modeling; (4) Space weather events; (5) Lower, upper atmosphere and ionospheric interactions.

Scientific findings in this issue present latest results, new ideas and indicate future directions to better understand the mesosphere, thermosphere and ionosphere variability. Some of the aspects discussed include: Short and long term variations of TEC including winter and annual anomalies during solar cycle 24; Spatio-temporal characteristics of upper transition height; Review of studies based on Doppler sounders; Ionospheric scintillations-climatology, modeling, directional analysis and power spectral features at VHF, L & S bands; Connection between the time sequence of IMF-Bz changes and the development of Spread-F; Advances in ionospheric empirical modeling using NeQuick, NeQuick2, IRI-2012 & 2016 through data ingestion approach; Regional empirical modeling using locally adapted NeQuick, neural network methods, empirical orthogonal functions; Implications of height dependent sunrise and sunset on ionospheric processes and modelling; Thermospheric and ionospheric response to

space weather events including the St. Patrick's Day storm of March 2015; Observations and simulations of the lower, upper atmosphere and ionospheric interactions and consequent perturbations.

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