Guest Editorial

A national symposium titled, “Current trends in Atmospheric Research including Communication and Navigation aspects [CARCAN-2012]” was conducted jointly by the Research & Development Center and Department of Electronics & Communication of Vignana Bharathi Institute of Technology (VBIT) during 21-22 December 2012 at Hyderabad. The scope of the conference was quite broad and ranged from wireless network and satellite based communication/navigation to digital signal processing and complex dynamics of the middle atmosphere. The Global Navigation Satellite System (GNSS) is an advanced new system, which helps users all over the world to navigate with higher precision and accuracy. Indian Space Research Organization (ISRO) has taken a lead in developing various systems to cater to the needs of navigation in India. Several atmospheric phenomena affect and degrade the accuracy of navigation, positioning and timing of these systems. So, a wide and exciting area of research is open for scientists and technologists to study various atmospheric processes like ionospheric and tropospheric delays, equatorial anomaly, coupling among different atmospheric regions through chemistry and complicated dynamics, wave-wave interaction, etc.

Several papers related to these issues were presented in CARCAN-2012. Senior scientists from various national laboratories and universities delivered invited talks and presented papers. Out of these, 11 papers relevant to structure and dynamics of the middle atmosphere are selected for bringing out a special issue on “Improved understanding of the structure and dynamics of the middle atmosphere and its response to various geophysical phenomena”. The special issue contains contributions from both young and experienced scientists and is expected to benefit the scientific and engineering community all over the world.

These papers cover a wide range of ongoing research and important findings on the dynamics and structure of the middle atmosphere. The impact of short period gravity waves in modulating the thermal structure of the upper tropospheric and lower stratospheric (UTLS) region have been reported using MST radar and GPS radiosonde measurements simultaneously. The research findings also show the generation of long period gravity waves due to tropical easterly jet, which further modulates the temperature gradient.

Solar eclipse induced effects on the thermal structure and composition of the atmosphere have been presented using the satellite data from COSMIC GPS RO and SABER. A significant enhancement in the water vapour content and refractivity of the lower and middle troposphere has been observed. The response of the atmospheric temperature is found to be different at different altitudes. Above 40 km, cooling is observed up to an altitude of 70 km. An increase in ozone concentration is found throughout the middle atmosphere except near 30 km. Large changes in the structure of temperature profile during another solar eclipse event has also been reported for the first time (~15 K at 36 km altitude). The effects of cyclones on atmospheric parameters and dynamics have been studied. The rain drop size distribution measured by disdrometer at one site is found to vary in different cyclonic storms. More observational sites are required to find the spatial variability of microphysical characteristics of tropical cyclones. Analyzing four earthquake events, an effort has been made to associate earthquake and precipitation close to the epicenter. The authors relate the rainfall anomaly to the changes in surface heat flux around the epicenter region, which controls the water vapour transportation in the atmosphere and this, in turn, could give rise to rainfall anomaly.

Results of atmospheric coupling have been discussed in one paper, which is derived from the studies based on the campaign “Coupling Process in Equatorial Atmosphere (CPEA)”. A temporal evaluation of radar reflectivity with convection has been reported in this paper. Analyzing five convective events

over the Indonesian region and two over the Indian region, authors have come to the conclusion that the vertical wavelengths of gravity waves mostly dominate in the range of 1 – 3 km between 10 and 20 km altitudes immediately after the passage of convective storms over the radar sites. At both locations, the vertical wavelengths of gravity waves increased gradually after the convection moved away from radars. The dominant wave periods at Gadanki were observed to be shorter (~10–20 min) as compared to those observed at Koto Tabang (~30–50 min). The study of gravity waves has been extended to higher heights by using OH rotational temperature and lidar data. The Rayleigh lidar results indicate that saturation of wave amplitudes and wave breaking, due to convective instability, are the potential mechanisms for occurrence of Mesopause Inversion Layer (MIL).

Study of long period waves like Madden Julian Oscillation (MJO) has also been reported for a tropical station using MST radar observations. MJO in two period bands 4–7 weeks and 10–13 weeks has been observed. The amplitudes in meridional wind were found to be much less than in zonal wind. A significant inter-annual and intra-seasonal variability of the oscillation has been observed.

A technical paper to design and fabricate two crossed dipole Yagi antenna has been presented. This paper clearly describes right from design simulation to fabrication of the antenna and will help young researchers interested in fabrication. The antenna can receive satellite signal in VHF/UHF band, which can be utilized to estimate total electron content (TEC) through Faraday rotation technique.

The Guest Editor would like to thank the reviewers for spending their valuable time and efforts to review the papers, which helped in improving the quality of the special issue of the journal.

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