URSI-RCRS 2024, ARIES/GEHU, Bhimtal, India, 22 - 25 October, 2024

First results on the mesospheric echoing layers, winds and turbulence from the newly established 53 MHz radar at Haringhata, India

A. K. Patra[1], P. Pavanchaitanya[1], Ashik Paul[2], and P. Nandakumar[2]

[(1)]National Atmospheric Research Laboratory, Gadanki, India
[(2)]Institute of Radio Physics and Electronics, University of Calcutta, Kolkata, India
Corresponding Author: akpatra@narl.gov.in

We present the first results on the mesospheric echoing layers, winds and turbulence observed using a newly established 53 MHz active-phased-array radar system at Haringhata (22.93°N; 88.5°E, magnetic dip angle 36.2°N). The radar site is known for deep convection, thunderstorm and lightning activity. The radar is designed to function with a maximum peak-power-aperture product of 3.0×10^8 Wm^2 and is capable of observing the mesospheric echoes. Results show that mesospheric echoes come primarily from altitudes of 65-87 km. Echoes coming from the heights below 80 km are more continuous than their counterpart above 80 km, which are patchy in nature and highly strong at times. Signal-to-noise ratio (SNR) of the echoes are in the range of -15 to 10 dB below 80 km while they are -15 to 15 dB above 80 km. Spectral widths are 2-15 m/s below 80 km and 2-35m/s above 80 km. While SNR generally scales with spectral width, indicating the turbulence as the main driver for generating refractive index fluctuations causing radar echoes, the relationship between SNR and spectral width in the two height regions varies in detail, clearly indicating different underlying sources and dissipation processes of turbulence. The velocity field in the lower region often display highly organized quasi-period pattern. We have also captured some events showing rich echo structures accompanied with large wind shear, vertical velocity variations, and enhanced turbulence, which suggest the role of Kelvin–Helmholtz instability. The first results obtained using this new radar system will be presented, compared with those known from Gadanki MST radar and discussed.