ABSTRACT

The atmosphere is a layer of gases surrounding the earth that is retained by its gravity. As atmosphere protects life in the Earth, there is need for monitoring it at regular intervals. Monitoring of atmosphere remotely is possible by using weather radars. Monitoring is done by transmitting a pulse of signal and analyzing received echo from atmospheric layers. As received signal is very weak, it is necessary to employ signal processing techniques. Detection of the signal component in the presence of noise is the main study in signal processing. Atmospheric Signal Processing deals with the processing of the signals received from the atmosphere by using atmospheric radar.

In this work, the signals processed have been obtained from the Mesosphere-Stratosphere-Troposphere (MST) Radar. Detection of the buried signal in the noise forms the primary part of the proposed study. The MST Radar facilities are located at different parts of the world including National Atmospheric Research Laboratory (NARL), Gadanki, India. As a non-parametric method, this work proposes to investigate the various variable window parameters that effect the SNR values of the received atmospheric signal.

The significance of using data weighting window with the DFT plays an important role in resolving the frequency components of the signal buried under the noise. The application of Fast Fourier Transform (FFT) to a finite length data gives rise to leakage and picket fence effects. Weighting the data with suitable windows can reduce these effects. In this work the variation in the SNR with respect to the variable window parameter is analyzed and optimum value of window parameter is proposed for different types of windows.
In the present work variable windows like Kaiser window, Gaussian window, Dolph-Chebyshev window and Tukey window are applied to MST Radar data and improvement in Signal to Noise Ratio (SNR) are investigated. As the SNR fluctuating, this SNR is divided in to two parts as Mean Value Above Zero(MVAZ) and Mean value Below Zero(MVBZ). The variation of MVAZ and MVBZ are studied for different values of window shape parameter and optimum value is determined. The MVAZ and MVBZ are studied for Dolph-Chebyshev window, Kaiser window, Gaussian window and Tukey window. Performances of these windows are compared and the window which gives better SNR improvement in case of MST radar atmospheric signals is determined. Finally using optimum values of shape parameter, the data of radar is processed so that the signal can be detected at higher heights where signal is weak.