ATMOSPHERIC WAVELETS

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Abstract:

Wind Profile detection of a Mesosphere,Stratosphere,Troposphere Radar (MST radar) signal meant the measurement of Dopplers of the signal due to scattering of the atmospheric elements. Atmospheric Radar signal means the signal received by the Radar due to the back scattering property of the atmospheric layers – stratified or turbulent. The back-scattered signal from the atmospheric layers is very small in terms of power with which it was emitted. The received back-scattered signals otherwise called as Radar returns are associated with Gaussian noise. The noise dominates the signal as the distance between the Radar and the target increases and this leads to a decrease in Signal to Noise ratio. This makes the detection of the signal in the prescribed noise difficult. The detection of the signal Doppler in such dominated noise forms the primary part of the paper. After the detection of signal, the signal has to be estimated. The estimation of the signal frequency and the signal power forms the second part of the paper. The atmospheric radar data used for testing the proposed wavelets pertains to NMRF, Gadanki in the state of Andhra Pradesh, India.The wavelet families like Symlets, Coiflets, Daubechies, etc., have their own specifications like filter coefficients, reconstruction filter coefficients etc. All the wavelets may not be entirely useful for processing all types of signals. Some signals demand wavelets having certain special characteristics. Atmospheric radar signal is one such signal associated with large amounts of noise. The noise characteristics of atmospheric signals are different from those of other signals. In order to improve the signal processing capabilities of the atmospherics signals a new family of wavelets have been proposed and named as ATMOSPHERIC WAVELETS, in short called ‘Atmoslets’ named after the field of signal processing they are used.

The following are filter coefficients of the Atmospheric Wavelets which satisfy the criteria to be wavelet filter coefficients:

Atm1: [0.0013 -0.0002 -0.0106 0.0027 0.0347 -0.0192 -0.036 0.2577 0.5496 0.3404 -0.0433 -0.1013 0.0054 0.0224 -0.00047 –0.0024]

Atm2: [0.2352 0.5706 0.3252 -0.0955 -0.0604 0.0024]

Atm3: [0.0013 -0.0002 -0.0106 0.0027 0.0347 -0.0192 -0.0367 0.2577 0.5496 0.3404 -0.0433 -0.1013 0.0054 0.0224 -0.0004 -0.0024]

Atm4: [-0.0514 0.2389 0.6029 0.2721 -0.0514 -0.0111]

Atm5: [-0.0027 0.0055 0.0166 -0.0465 -0.0432 0.2865 0.5613 0.3030 0.0508 -0.0582 0.0244 0.0112 –0.0064 –0.0018 0.0008 0.0003 -0.0001 0.0000]

Atm6: [0.0006 -0.0012 -0.0052 0.0114 0.0189 -0.0575 -0.0397 0.2937 0.5531 72 -0.0471 -0.0680 0.0278 0.0177 -0.0108 -0.0040 0.0027 0.0009 -0.0004 -0.0002 0.0000 0.0000 -0.0000 -0.0000

The improvement in SNR achieved by Denoising using the Atmospheric wavelets is demonstrated ·Because of improved SNR it is possible to detect the echoes and thus predict and detect the wind profile more accurately even under noisy conditions and in the presence of strong interference.