New Doppler Spectral Processing Technique for Identifying Atmospheric Signals from Radar Wind Profilers

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Radar Wind Profilers (RWP) operating at 915 MHz and 1290 MHz are widely used to observe the atmospheric wind fields by exploiting their Bragg echoes. While operating in a vertically pointing mode, the reported Doppler spectral moments during clear sky conditions yield important information about the turbulence within the Boundary Layer (BL). RWP observations collected during vertically pointing mode also yield un-attenuated and un-saturated estimates of radar moments during heavy precipitating conditions. Although scientifically useful, the RWP data suffers from contamination from non-atmospheric clutter, limiting its usefulness.

In this study we propose a new technique for removing clutter from RWP data, which uses a fuzzy logic algorithm that operates on the raw Doppler spectrum and data from other instruments. The RWP and other instruments are part of the Atmospheric Radiation Measurement (ARM) observing facility located near Lamont, Oklahoma. The fuzzy logic algorithm uses the Doppler spectral data as an input and calculates scores for clutter, atmospheric and ambiguous signals at each range gate and FFT velocity bin. Signal to Noise Ratio (SNR), mean Doppler velocity and Doppler spectrum width are then calculated using only the grid points with high atmospheric signal score. Data from the collocated ceilometer is used to identify clear sky conditions, while the vertical velocity reported by the Doppler lidar provide an additional constraint for the RWP measurements. Additionally, the planetary boundary layer (PBL) depth is calculated during clear sky convective periods using the RWP moment data. We will present the diurnal cycle of the PBL depth and vertical air motion statistics calculated during the summer months of 2012 and 2013.