Doppler-radar observations of a prefrontal wind-shift line in the Southern Plains of the U. S.

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Pre-frontal wind-shift lines (Hutchinson and Bluestein 1998; Schultz 2004), which are found during the cold season in the Plains region of the U. S., are significant because they are often mistaken for fronts and because convection is sometimes initiated along them. Unlike a classical cold front, dryline, or outflow boundary, there is not always much, if any, contrast in temperature across a pre-frontal wind-shift line at the surface, while a strong surface temperature gradient may be found to the north and northwest in the absence of any wind-shift. It is thought that the wind shift is often related to lee trough formation as westerly winds descend in lee of the Rocky Mountains. Until now, little has been learned about the fine-scale structure of the prefrontal wind-shift line. This presentation documents close-range observations collected by RaXPol, a rapid-scan, mobile, polarimetric, X-band, Doppler radar (Pazmany et al. 2013), and an AERI (Atmospheric Emitted Radiance Interferometer) (Feltz et al. 2003) in Norman, Oklahoma, on 11 Nov. 2013. These observations show that the wind-shift line is marked by a fine-line echo, which is probably composed of biological scatterers, and that the vertical structure of the pre-frontal wind-shift resembles that of an “intrusion,” which is like an elevated gravity current that propagates inside a stratified fluid, rather than at the bottom of it.

References:

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