

## Chapter 1: Introduction

Prediction and detection of downbursts in thunderstorms has long been a challenge for operational meteorologists. Downbursts, and their associated wind shear, have been found to play a role in a number of aviation accidents (Fujita 1985). In addition, the associated wind damage at ground level can reach a level comparable to an F3 tornado on the Fujita scale of tornado intensity (Fujita 1985).

A number of studies (e.g., Srivastava 1987; hereafter S87) have found that hydrometeor characteristics in the downdraft column can be key to the initiation and strength of a downburst. In particular, S87 found melting hail is a major contributor to downward accelerations in wet microbursts. Unfortunately, using conventional radar to deduce hydrometeor characteristics is, at best, difficult. In particular, to discriminate between rain, hail, or a mixture of the two over small scales requires knowledge about particle size distributions that are typically unknown to the radar operator.

Fortunately, a Polarimetric Radar (PR) can be employed to partially solve this problem. Deduction of bulk hydrometeor characteristics is possible by examination of the differences in scattering and propagation characteristics between pairs of radar pulses with orthogonally-oriented electric fields. The quality of weather research PRs has improved in recent years, as has our understanding of PR signatures of meteorological echoes and their relation to hydrometeor type.

Enough progress in each arena has been made that upgrades to the national NEXRAD Network may now be considered (Zrnic 1996). An operational proof-of-concept test, known as the Joint Polarization Experiment (JPOLE) is taking place in central Oklahoma (Schuur 2001). This will be the first opportunity for operational meteorologists to use PR information in warning decision making. Therefore, the

opportunity exists to use PR products in the prediction and detection of downbursts. Can the deduction of hydrometeor type with a polarimetric radar be combined with our knowledge of downbursts to improve severe thunderstorm warnings?