1.2.2 WIND PROFILER DATA IN A MESOSCALE EXPERIMENT FROM A METEOROLOGICAL PERSPECTIVE

Edward J. Zipser

National Center for Atmospheric Research*
Boulder, Colorado 80307

John Augustine and John Cunning

Weather Research Program, Environmental Sciences Group
NOAA, Boulder, Colorado 80303

During May and June of 1985, the Oklahoma-Kansas Preliminary Regional Experiment for STORM-Central (OK PRE-STORM) was carried out, with the major objectives of learning more about mesoscale convective systems (MCSs) and gaining experience in the use of new sensing systems and measurement strategies that will improve the design of STORM-Central. Three 50-MHz wind profilers were deployed in a triangular array with sides about 275 km (Figure 1). There will be great interest in learning whatever we can from the profiler data from these sites, especially in relation to mesoscale weather systems. It is far too soon to report any results of this effort, for it has barely begun. The purpose of this paper is to show some examples of the data, some of the surrounding "conventional" data, to discuss some of the issues important to meteorologists in evaluating the contribution of the profiler data.

We concentrate on the case of 10-11 June 1985, featuring a major squall line system which crossed the dense observing network from northwest to southeast, passing the Liberal site about 2230 GMT/10 June, the McPherson site about 0100 GMT/11 June, and Wichita about 0300 GMT/11 June. Radar and satellite data show that the system was growing rapidly when it passed Liberal, and was large and mature when it passed through McPherson and Wichita. Figure 2 gives the radar depiction of the system during this stage, with the McPherson site in the intense convective echoes near the leading edge at 01 GMT and in the stratiform precipitation at 03 GMT.

Figure 3 (Liberal) and Figure 4 (McPherson) show the profiler wind data for a 9-hour period encompassing the squall line passage at each site. (Ignore obvious noisy data, which is not the subject of discussion here; the two systems have different antenna systems and sizes, different processing algorithms, and were passed by different parts of the storm system.) Both systems were unable to function during the 60-90 minutes of most intense thunderstorms. However, both clearly captured the major wind features ahead of and, more interestingly, in the mesoscale stratiform precipitation region which forms the rear half of the system. These include the northerly winds at low levels, the increased southerly component in the upper troposphere (mostly obscured by noise at McPherson) and a midlevel "jet" of inflow from the rear, sloping downward from northeast to southeast (upward with time). The same features are observed at nearby radiosonde sites, with Wichita chosen for illustration (Figure 5). It is appropriate to compare times at Wichita with those 2 hours earlier at McPherson to account for the later passage over Wichita.

The increased time resolution of the profiler data is extremely important in mesoscale research. One well-known problem is the difficulty of covering the lowest kilometer -- in this case as in others, the wind structure here is

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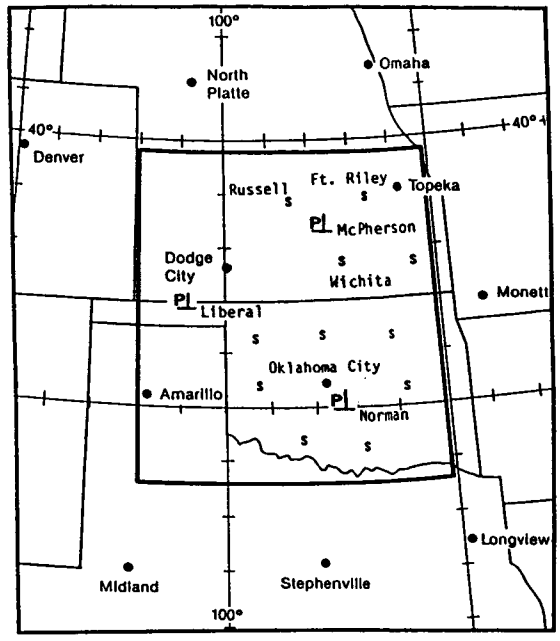

Figure 1. Location map for the wind profiler network in OK PRE-STORM, marked by "P" at Liberal, McPherson, and Norman. National Weather Service rawinsonde sites are given by black dots, and supplemental sites by "S"; those surrounding the McPherson site are named.

crucial to understanding the system. It is encouraging that the profiler appears to be defining the midlevel jet in a disturbed region; it will be important to establish reliability of the profiler data in the anvil outflow region nearer the tropopause, in view of the large area covered.

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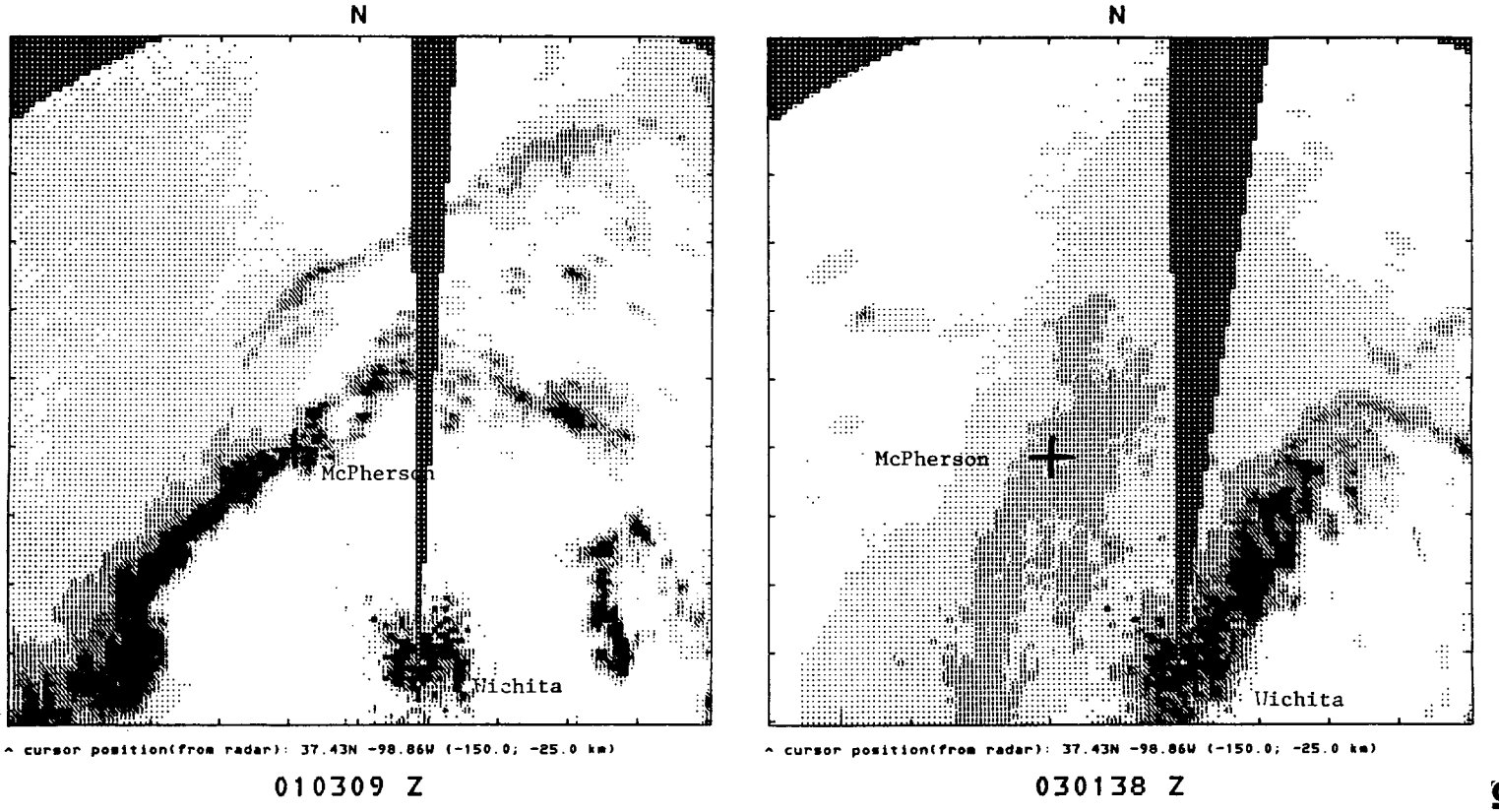

Figure 2. Digitized reflectivity display for the Wichita radar, located in the center of the ground clutter near the bottom of each frame. Each frame covers 256 x 256 km; the cross locates the McPherson site about 100 km northwest of Wichita. Lightest shading is above an 18 dBZ threshold; then at 30, 40, and 50 dBZ thresholds.

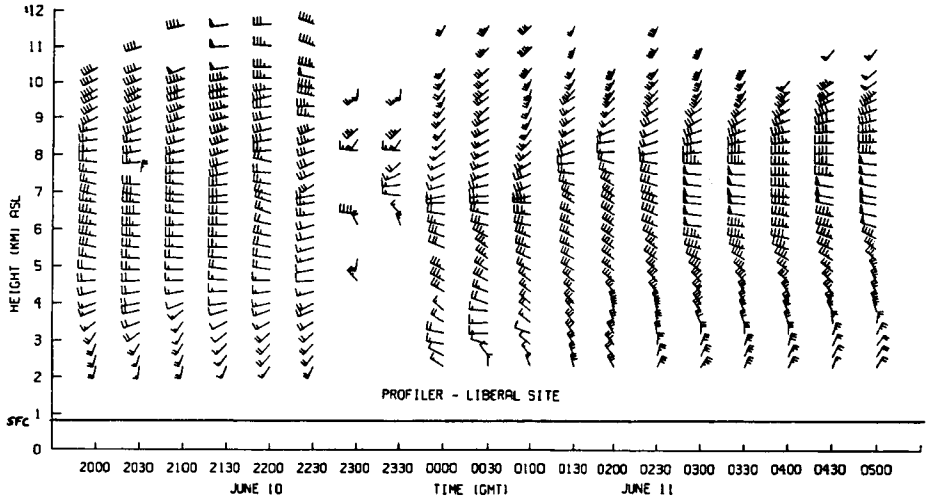

Figure 3. Time-height cross section of the Liberal wind profiler data. Each full barb is 5 m s^{-1}, each half-barb 2.5 m s^{-1}, and each flag 25 m s^{-1}.

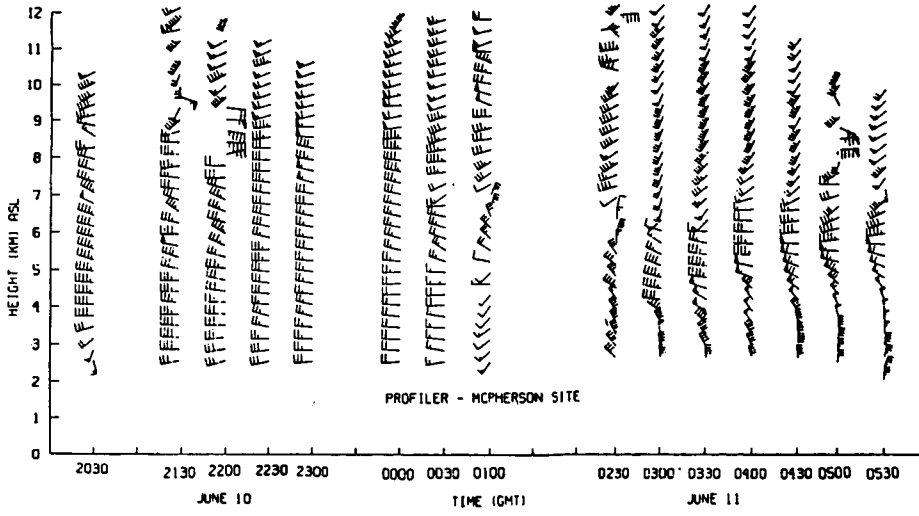

Figure 4. Time-height cross section of the Wichita radiosonde wind data. Legend for winds as in Figure 3.

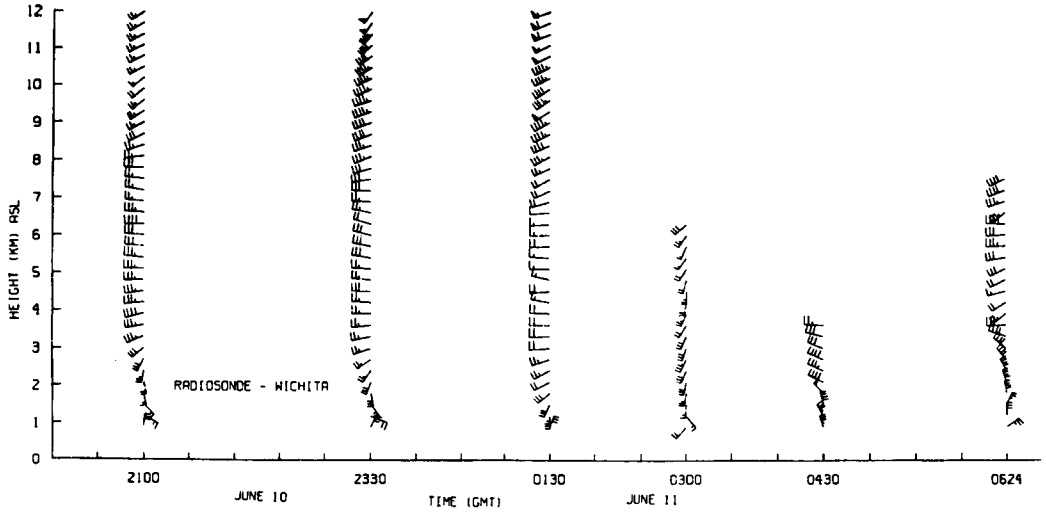

Figure 5. Time-height cross section of the Wichita radiosonde wind data. Legend for winds as in Figure 3.