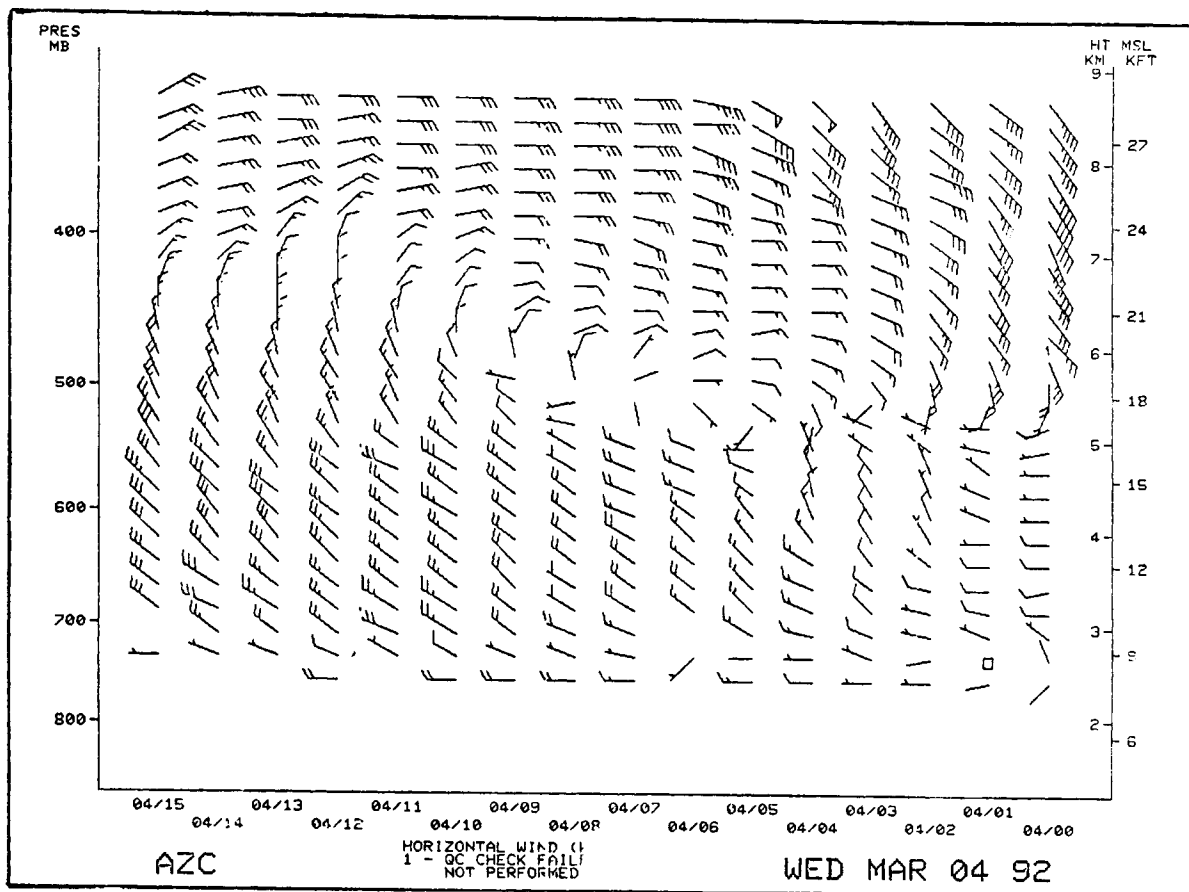


Technical Attachment

PROFILER PUZZLE

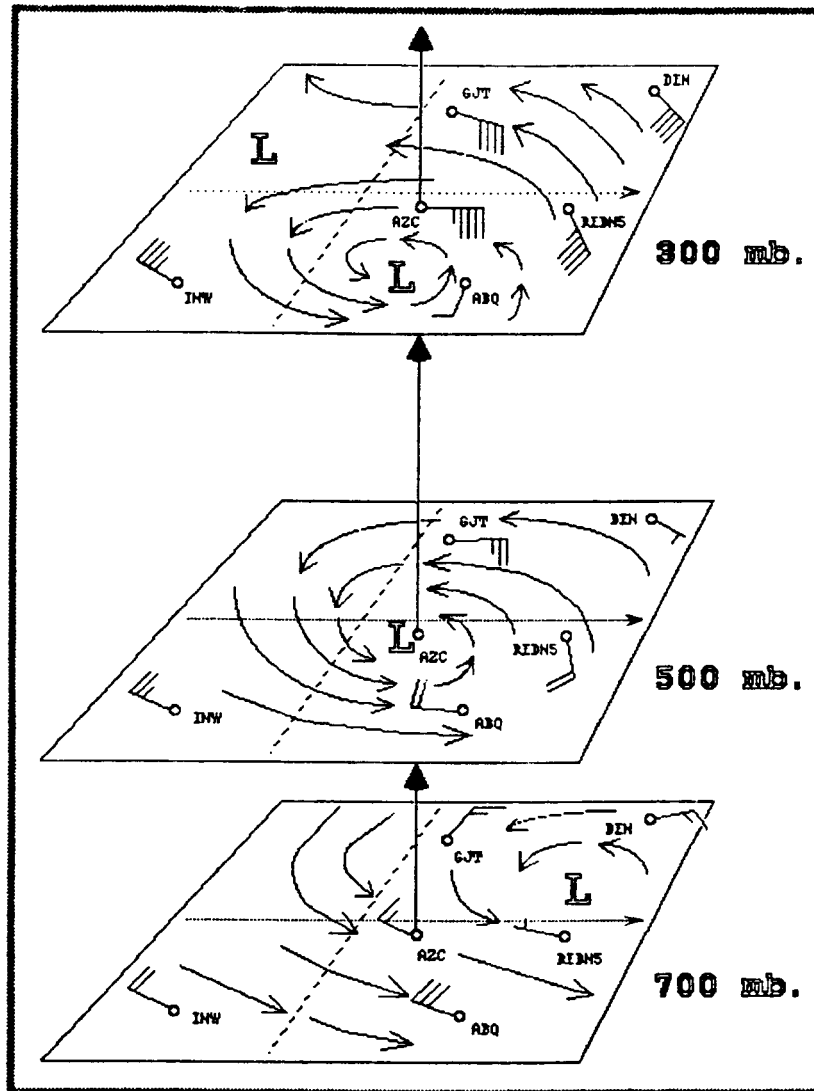
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Take a few minutes and study the profiler time section shown below. Note that time increases from right to left. Obviously, a feature of some significance passed over the Aztec, NM, profiler site during the day shown. How do you interpret this event, and what do you think the effects might have been?



In fact, this is an example of a dramatic mid-tropospheric low moving eastward over Aztec. A nearly vertically stacked low moved inland along the Southern California coast around 0000UTC on March 3, 1992. Twelve hours later, the system rapidly came apart in the lower levels, although a weak surface low was still observable. This is rather typical for low pressure systems which move eastward into the higher elevations of the western United States.

At around 0700UTC on March 4, the 500mb low center was nearly over the Aztec, NM, wind profiler (figure above). From the Aztec profiler time-series, several features of the vertical structure of the low can be deduced. Our interpretation is shown in the schematic below. The dotted line running east-west through Aztec shows the track of the low and the axis of the time section. At levels below about 500mb, low pressure was located north of the profiler site, as indicated by the westerlies at Aztec throughout the period when the system passed by. At levels above 500mb, the low center was located south of Aztec, as indicated by the upper level easterlies throughout the event. In other words, the axis of the low tilted from north to south with height. A closer inspection of the profiler winds suggests the tilt actually was toward the southwest from 700mb through 500mb, then the low was more vertically stacked above 500mb.



The slow passage of the low resulted in significant weather in the form of heavy rain over western New Mexico on March 3 at low elevations. For example, Silver City collected 0.84 inches and Glenwood had 0.77. Rain spread northward during the afternoon of the 3rd, and lasted much of the night. The Albuquerque NWS Forecast Office picked up 0.32 inches (almost the "normal" March total). Other parts of Albuquerque reported rains as heavy as 0.76 inches. An inch of wet snow was reported in Albuquerque above 6000 feet. Snow amounts of 2 to 6 inches were observed above 7000 feet on the 3rd.

After passage of the low through New Mexico, the entire system became quasi-stationary over extreme southeast Colorado on the 4th and 5th. Injection of Gulf of Mexico moisture into the system increased precipitable water values considerably, and this moisture was circulated across northern New Mexico, south and west of the low pressure system. Snowfall during this period was enhanced along the western slopes of the Sangre de Cristos; and by the time the snow ended late on the 5th, totals had reached 43 inches at Red River and 40 inches at Penasco (both northeast of Albuquerque)!

Snow amounts of this magnitude are not extremely rare in the higher elevations of New Mexico, but the vertical wind structure associated with this event was reversed from the "typical" heavy snowfall. Heavy snows often occur on the eastern (windward) slopes during cold air outbreaks east of the Rockies which initiate easterly winds at low levels. Snow does drift over the summits to give moderate amounts of snow immediately on the downwind sides of the mountain summits. During a typical heavy snow event in New Mexico, moist easterlies dominate the region below 600-700mb, with southwesterlies above 600mb, associated with an upper low moving through Arizona and western New Mexico. Typically, southwest to west flow strengthens upward to between 300 and 200mb.

Conversely, in the event described here, one can see an opposite vertical wind structure from inspection of the profiler observations. Deep westerlies extended through about 12,000 to 15,000 feet, which were capped above by easterlies which strengthened through 27,000 feet. The western slopes of the higher mountains were upslope in this event and experienced heavy snow, while the eastern slopes experienced downslope winds and light snowfall.

The community of Red River is situated at 8500 feet near the east end of a canyon that extends westward from the Rio Grande (5500 feet). Consequently, Red River (as well as Penasco and other nearby communities) is upslope to westerlies at ground level.

On March 4, the high temporal and vertical wind sampling by the Aztec profiler showed a clear evolution of vertical wind structure during a major snowfall in New Mexico. Such observations have given Albuquerque forecasters a new conceptual model of wind structure to watch for in the synoptic evolution of snow events during winter over New Mexico. Southwestward tilting low pressure systems from the surface through 400mb, with deep westerlies topped by upper level easterlies, characterize this system, indicating coldest air aloft (lowest thickness) is located slightly south of the 500mb low center.