THE HALLOWEEN BLIZZARD OF 1979

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ABSTRACT

In late October and early November of 1979 a blizzard of intense proportions swept across the Great Plains from New Mexico to the Dakotas and western Minnesota. The storm was most intense across eastern Colorado and northwest Kansas, where traffic was halted and commerce came to a standstill.

On the following pages some of the important characteristics of this storm will be discussed. Attention will focus in particular on the important surface and upper-air features, and the relationship of the snowfall pattern to these features. Finally, discussion will center around the performance of the LFM during this storm.

1. INTRODUCTION

Over Halloween 1979 a blizzard of intense proportions swept across the high plains from the Oklahoma Panhandle across eastern Colorado and western Kansas to southwest Nebraska. Snow and wind created considerable havoc in these areas. Snow amounts generally ranged from 3 to 9 inches, but amounts near 1 foot were reported along the Colorado-Kansas border near Goodland, KS.

Additionally, wind gusts over 50 mph whipped the snow into large drifts bringing commerce and traffic to a standstill.

On November 1 the storm spread to the Dakotas and western Minnesota bringing similar (though less severe) problems to those areas.

Some important aspects of this storm will be discussed, along with significant upper-air and surface features. A relationship between the snow pattern and the various upper-air and surface features will be presented. The performance of the LFM during this storm will be discussed next. Finally, some of the more important findings will be summarized.

2. THE UPPER-AIR CHARTS

A. 300mb Chart

The 300mb chart was characterized by a strong jet maximum to the southwest and south of the digging short-wave trough on the 28th as it approached the Pacific Northwest coast. Initially the jet stream was oriented in an east-west direction. But as the short wave continued to dig and amplify, the jet stream ultimately became oriented in a north-south direction. This occurred just before the upper low turned eastward.

There was also significant cold-air advection at 300 mb through the 29th.

At 12Z on the 29th, a 125kt maximum appeared in the base of the trough near Winslow. This seemed to indicate that the upper system (which now had intensified to a closed low) had bottomed out and that a turn to the east or northeast was imminent. The lack of cold-air advection at the 500mb level west of the low also gave support to this conclusion. But a closer inspection of the upper-air charts revealed several important clues which indicated the upper low had not ceased digging.

A strong jet maximum in excess of 110 kt was still present west of the 300mb low. Additionally, although cold air advection had ceased at the 500mb level, significant cold air advection was present west of the 300mb low. Finally, a large area of significant height falls was present at 500 mb southeast of the low. These features suggested the upper low would continue to move to the southeast.

The strong jet maximum at Winslow was associated with a short wave rotating around the main low center.

The 500mb analysis valid for 00Z on

the 30th showed that the upper low had continued on a southeasterly track. Based on the wind reports from Denver and Grand Junction, a weak low had formed at 500 mb over north-central Colorado in response to the short wave which rotated out of Arizona during the preceding 12 hours.

As the primary jet maximum rotated to the south and southwest of the upper low, wind speeds increased to the east of the trough on the 30th and 31st. During this time the low turned to the east, then to the north. A 140-knot jet maximum appeared east of the 300mb low on the 31st as the system began its northerly track.

B. 500mb And 700mb Charts.

Fig. 1 depicts the track of the 500mb height fall center; Fig. 2 shows the track of the short wave and low center. Notice that the first significant height falls occurred in Idaho, well ahead of the short-wave trough position at 00Z on the 28th. It is possible that significant falls were located off the Pacific Northwest coast at that time, but of course they were not indicated on the charts. In any event, the height-fall center and short-wave trough were nearly in phase 12 hours later.

Weber (1) has found that 500mb cyclogenesis occurs north of the height-fall center and the tighter contour and thermal gradients. In addition, Weber states "... moderate height falls of (at least) 15 (150 meters) within a 12-hour period indicate that cyclogenesis has occurred or may occur shortly within the 500mb trough. Often, the height fall center will appear hours ahead of actual 500mb cyclogenesis. Generally, the height fall center moves inland over the West Coast with or slightly ahead of the trough. Cyclogenesis will appear to the north and usually within four degrees latitude of the height fall center 12 to 24 hours later" (2).

With few exceptions the 500mb pattern associated with the Halloween Blizzard evolved in accordance with Weber's findings. Cyclogenesis occurred within the area north of the

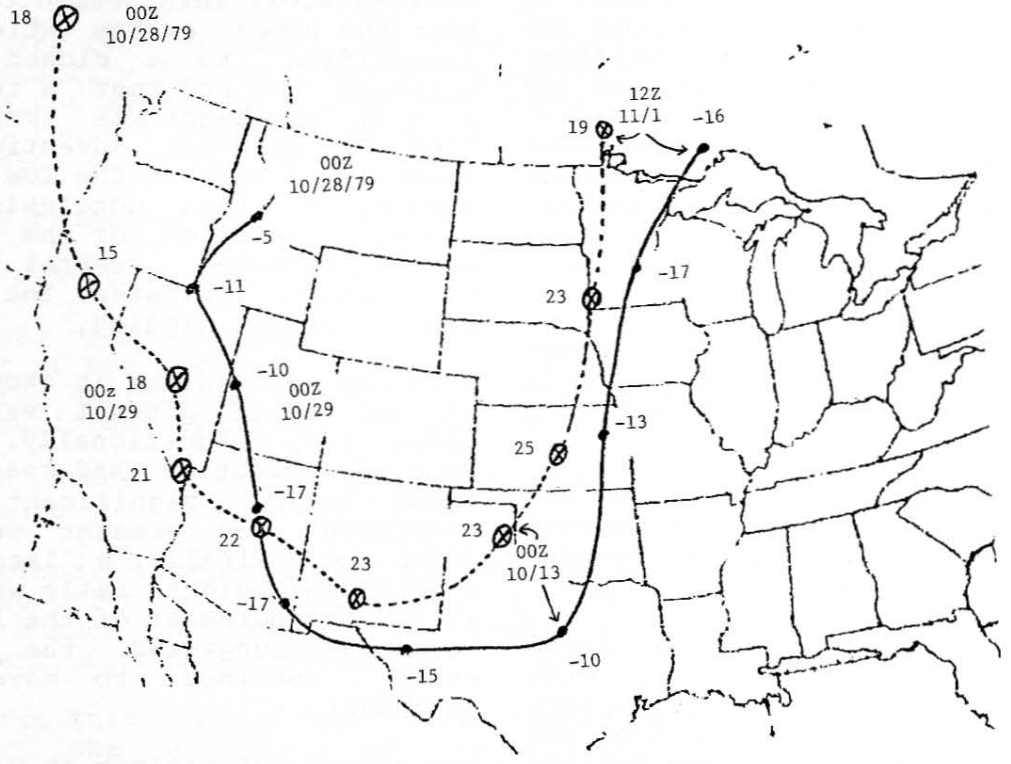

Figure 1. Comparison of the tracks of the 500mb height-fall center (solid line) and the vorticity maximum (dashed). Maximum vorticity and magnitude of the height-fall center are also indicated.

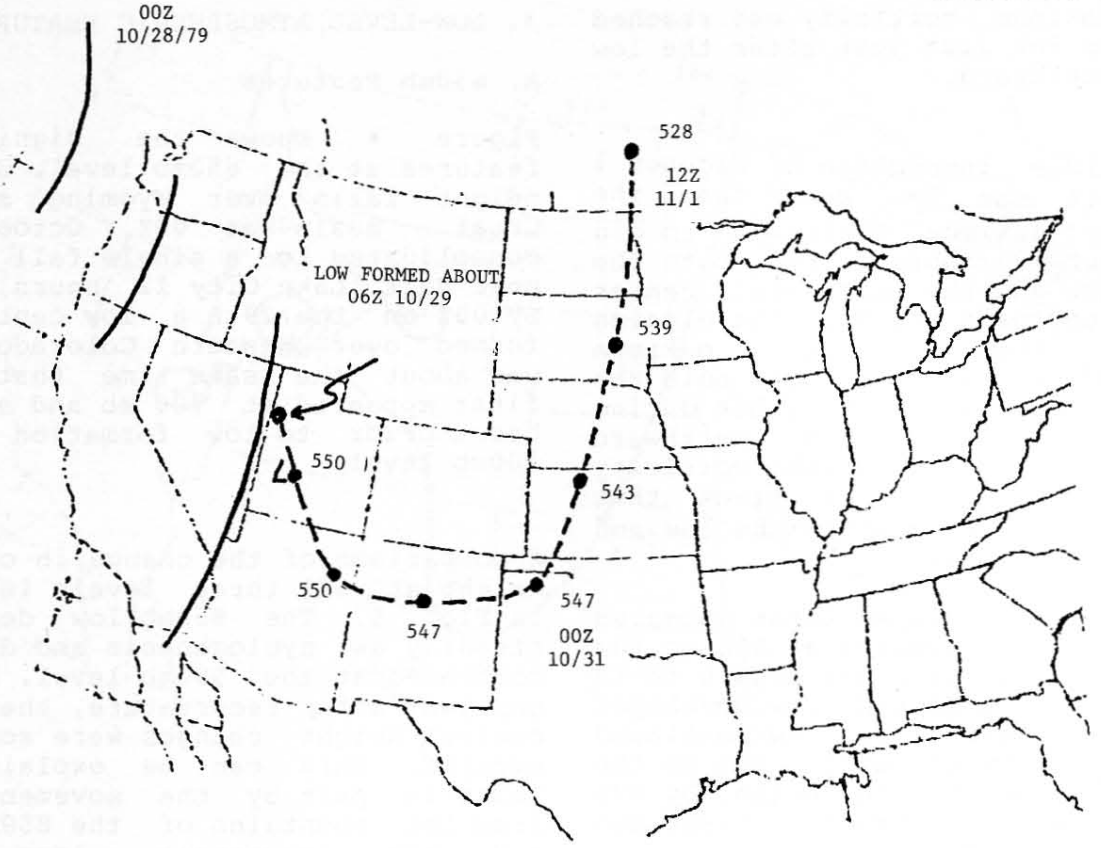

Figure 2. Track of the 500mb short wave trough and low center beginning 00Z October 28. Central height values of the low center are also indicated.

tighter contour and thermal gradients, and within 4 degrees latitude north of the height-fall center. Low development occurred some 30 to 36 hours after the height-fall center first appeared over Idaho. The 500mb pattern on the last analysis before low formation was quite similar to the examples shown by Weber (3), with the contour pattern roughly forming a right angle between the upstream and downstream parts of the trough. Height falls increased in magnitude during cyclogenesis over Utah. Falls of 170m were present over Arizona for a period shortly after a closed low formed.

Studies conducted by Weber indicate that height-fall centers turn easterly when either no change or a decrease in magnitude of the height fall center is observed. He has also found that the magnitude of height-fall centers is usually at a maximum during the period of 500mb low development, and that the magnitude will usually remain unchanged or will decrease while the fall center moves eastward within the bottom of the trough. Finally, he has found that the magnitude of height-fall centers increases while they move northeasterly (4). A check of Fig. 1 will show that the height-fall center associated with the Halloween Blizzard followed these rules quite well.

Around 00Z on the 31st the low began a turn to the north. In contrast to the earlier trends over Arizona, a significant decrease in height falls occurred over central Texas just prior to the northward turn of the low. At 12Z on the 30th a fall center of 150m was present east of El Paso.

But 12 hours later the fall center decreased to 100m and was located over central Texas. After the northerly track was established, the 500mb low deepened and the height-fall center increased in magnitude.

Figure 1 also shows a comparison of the tracks of the height-fall center and the vorticity maximum beginning with the 00Z October 28 positions. After a decrease in vorticity the first 12 hours, vorticity increased until after the low turned to the