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CENTRAL REGION TECHNICAL ATTACHMENT 91-21

WHAT DO YOU FORECAST WHEN THE STORM IS OVER?
A CASE STUDY OF THE WINTER STORM IN THE COLORADO MOUNTAINS ON MARCH 31, 1985

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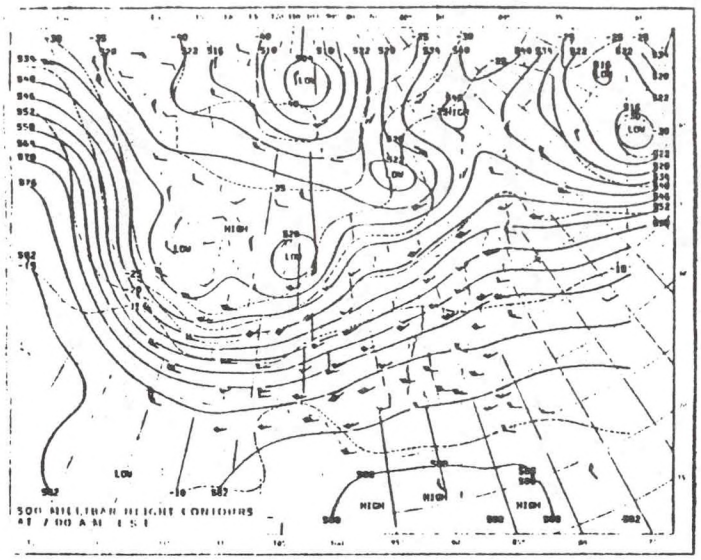
A slow moving winter storm progressed across Colorado on March 27-30, 1985. Storm Data reports over the 4-day period of the storm indicated that most Colorado mountain areas received 1 to 3 feet of new snow. The Denver Post reported 66 inches of new snow on Wolf Creek Pass in the San Juan mountains of southwestern Colorado. The storm was also a major snow producer for the Colorado Eastern Plains with up to 2 feet of new snow reported on the Palmer Divide and in the eastern foothills. New snow measuring 16 inches fell at the Colorado Springs airport.

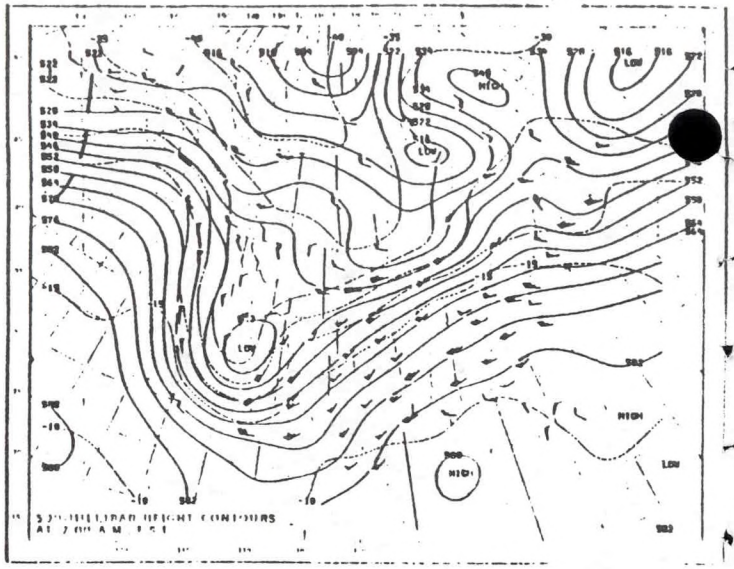
The storm was a "classic winter storm" for Colorado. It was produced by a strong negatively tilted "digging" upper trough over the U.S. West Coast which developed into a major long wave trough over the central Rocky Mountains. The upper low closed off at both 700 and 500 mb levels near the Four Corners area of southern Utah and southern Colorado before moving to the northeast over the central Great Plains and into the upper Midwest (see Figure 1). By nightfall on March 30, 1985, as the storm moved to the northeast, snow had ended over Colorado with the exception of some lingering snow showers over the higher mountains.

So, what do you forecast when the storm is over? Most people think a period of generally "fair" and dry weather would be in store for all of Colorado after the passage of this major winter storm. However, that was not to be the case. An astute weather forecaster would have predicted another winter storm for the Colorado mountains on the next day.

As the closed upper low moved to the northeast and the upper ridge built over the West Coast, the central Rocky Mountains came under the influence of increasing northwest flow aloft. When this strong northwest flow aloft contains adequate moisture, orographic snow or showers will occur over the Colorado mountains. However, in this case the northwest flow aloft not only contained substantial moisture but a vigorous embedded short wave trough with associated jet stream wind maximum and cold air aloft. This short wave trough moved rapidly out of southwestern Canada and impacted the Colorado Rockies on March 31, 1985 (see Figures 1 and 2).



THURSDAY, MARCH 28, 1985



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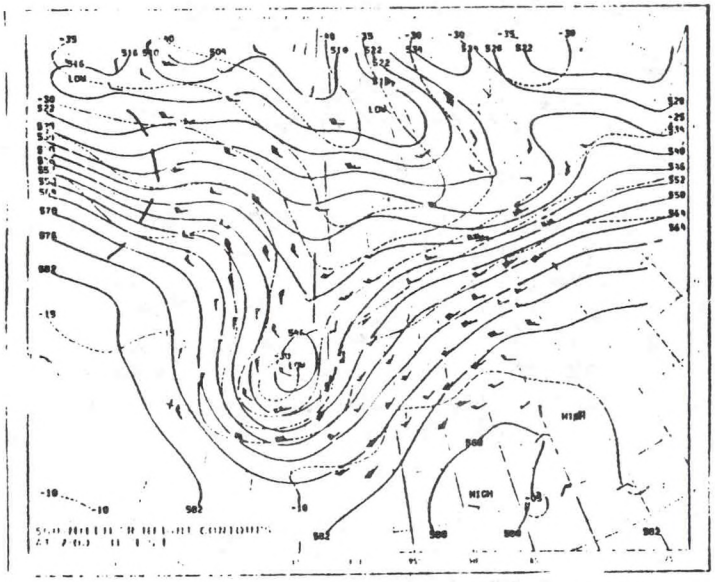

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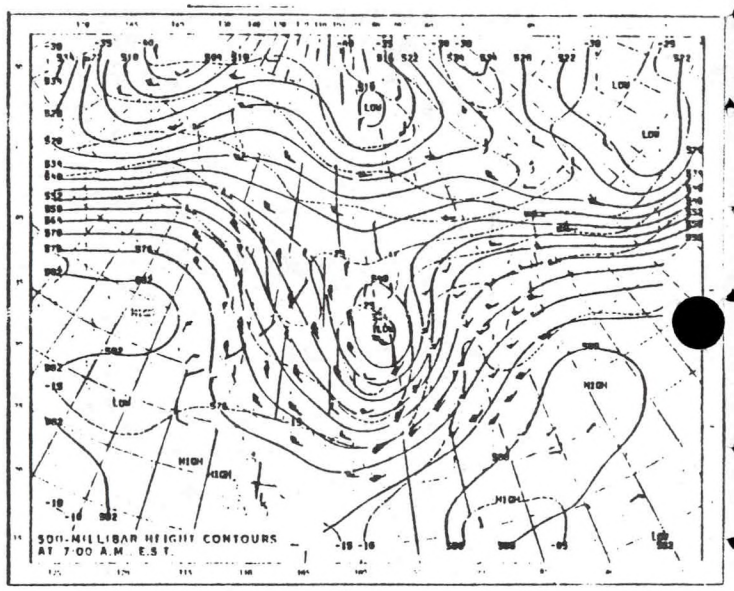

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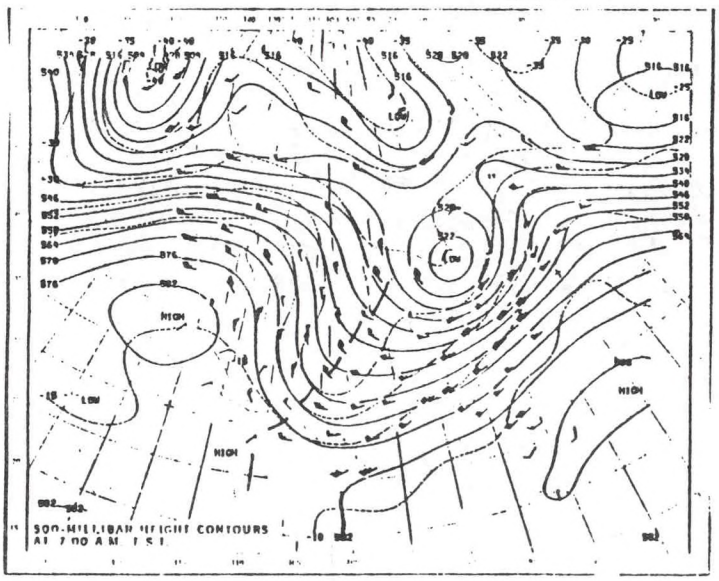
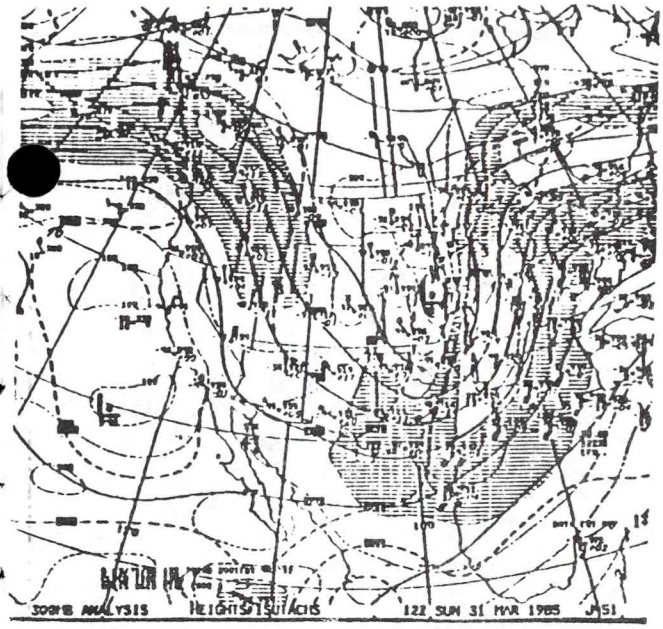


MONDAY, APRIL 1, 1985

UPPER TROUGH ASSOCIATED WITH
SECOND STORM INDICATED
BY DASHED LINE

12Z 500 MB DATA EACH DAY

FIGURE 1



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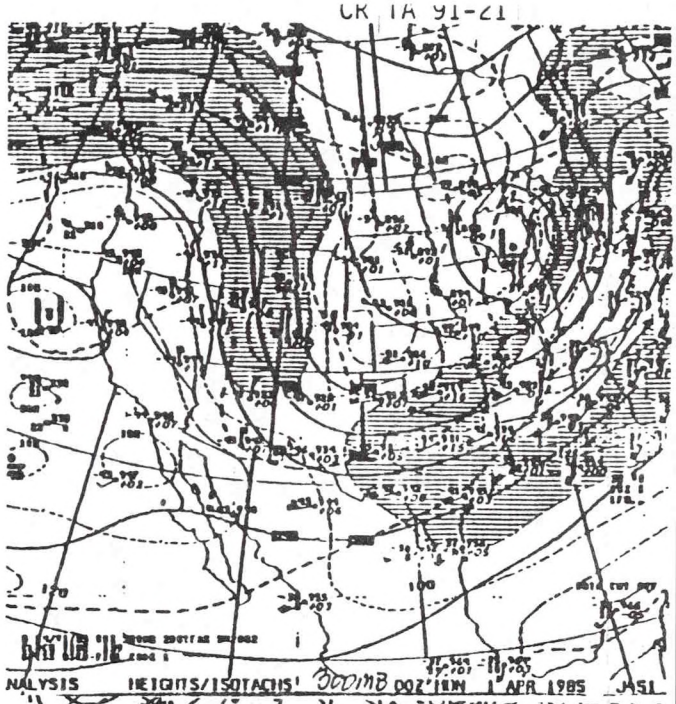
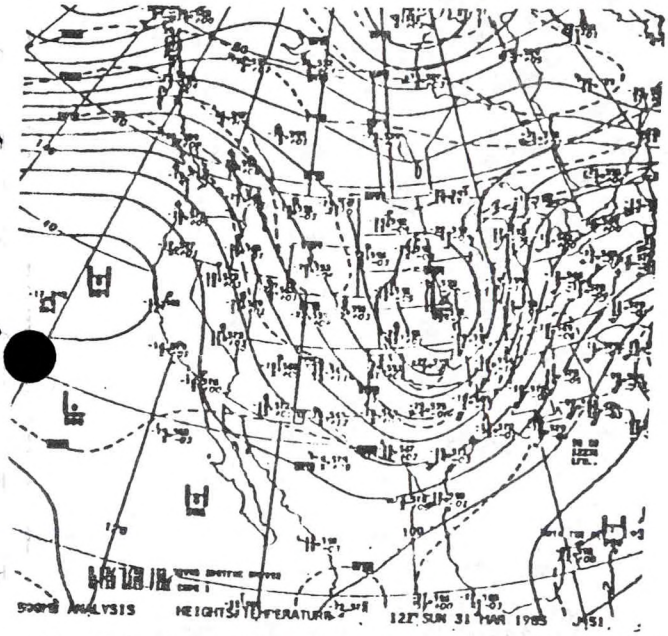
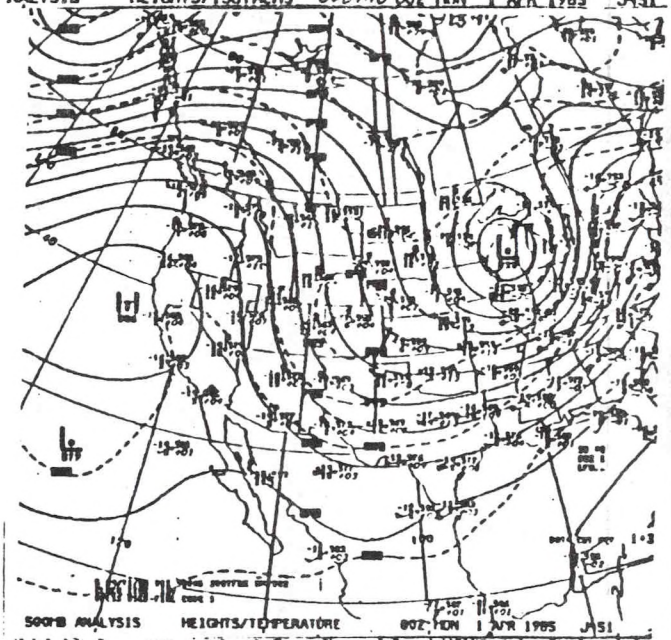
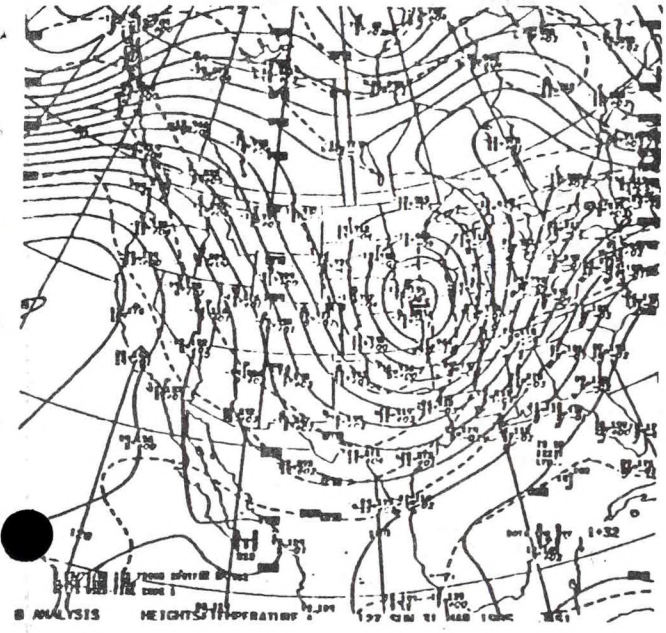




500 MB





700 MB

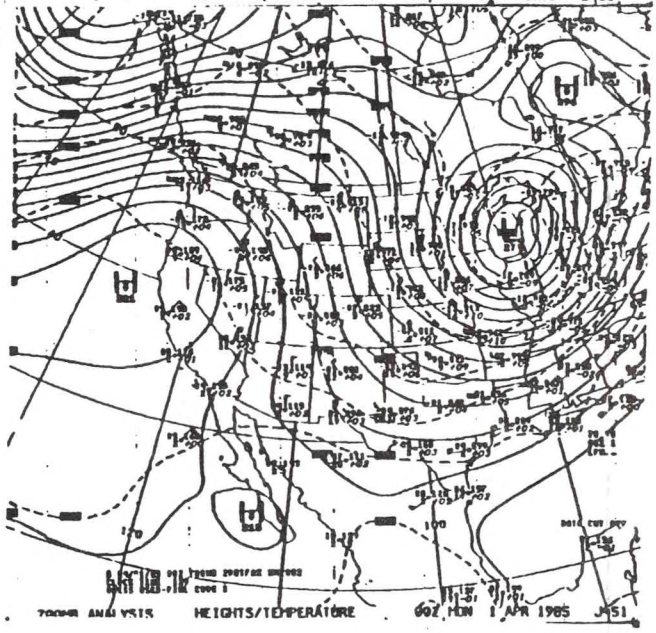


FIGURE 2

12Z SUN 31 MARCH 1985

3

00Z MON 1 APRIL 1985

This second winter storm in less than a week produced strong winds, heavy snow, and blizzard conditions mainly over the higher elevations of the northern and central Colorado mountains. Loveland Pass over the Continental Divide west of Denver was closed by the storm as was eastbound I-70 over Vail Pass. The Denver Post reported that during the peak of the storm "driving was a nightmare on Interstate 70" near the Eisenhower Tunnel west of Denver. This was a Sunday when many people were returning to Denver after a skiing weekend in the mountains. The Colorado Avalanche Information Center documented that Arapahoe Basin ski area, also along the Continental Divide west of Denver, reported visibility reduced to ten feet in snow, blowing snow and winds 20 to 35 mph with gusts to 55 mph. Loveland Basin and Valley ski areas near the east portal of the Eisenhower Tunnel on I-70 reported 19 inches of new snow with 14 inches of that 24 hour total occurring during the daytime hours on Sunday. Also, from a total of 19.5 inches of new snow from both storms at the Arapahoe Basin ski area, west of Denver, 11 inches fell on March 31st.

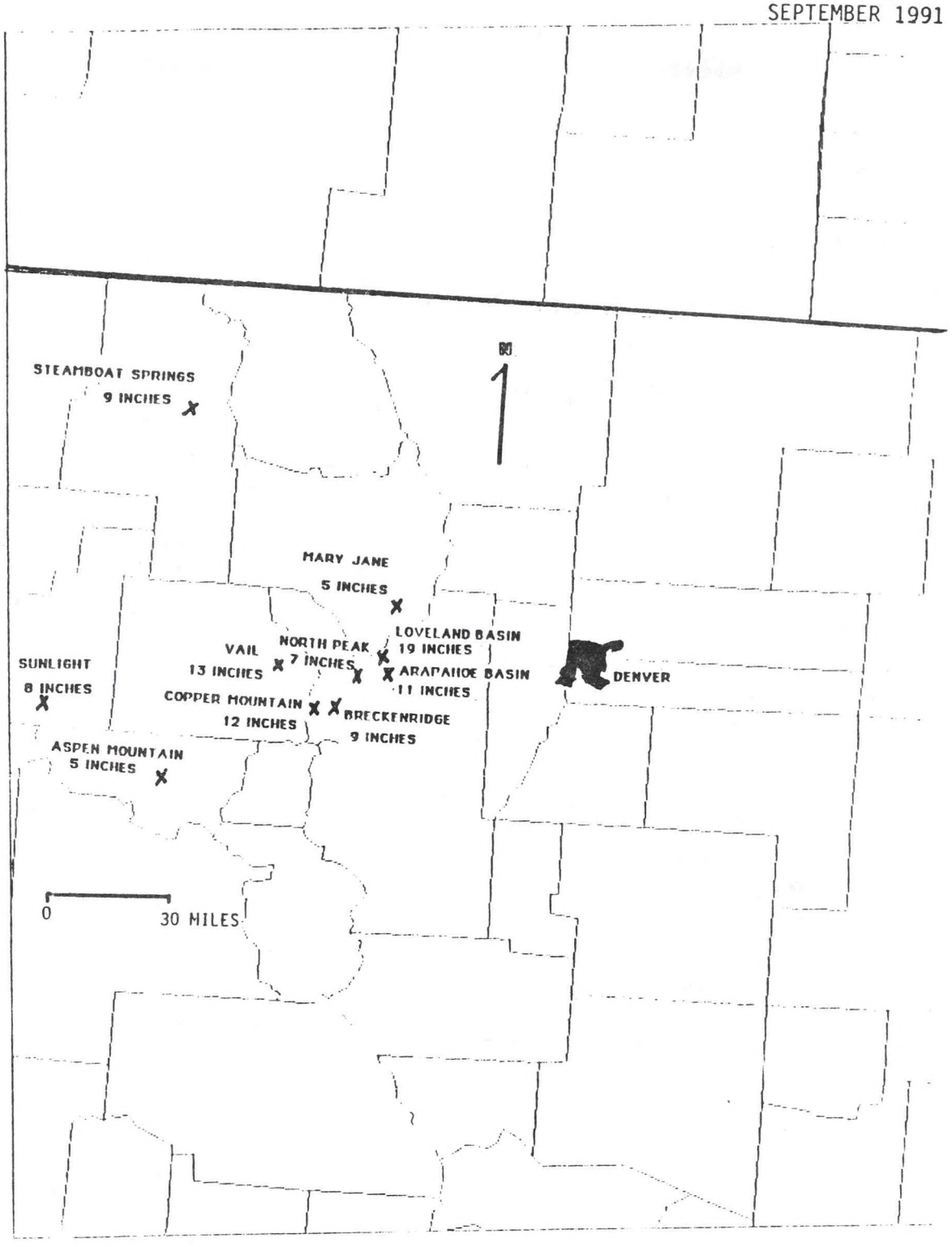
Berthoud Pass ski area, also west of Denver, reported poor visibility in snow and blowing snow and northwest winds 25 to 45 mph with gusts 40 to 55 mph. Beaver Creek ski area located west of Vail reported snow and blowing snow with northwest winds 20 to 30 mph gusting to 50 mph. Winter Park ski area northwest of Denver reported snow and wind gusts to 45 mph.

Twenty people were injured, although none seriously, when a Trailways bus slid off an icy and snowpacked U.S. Highway 40 at Hot Sulphur Springs, in the northern Colorado mountains.

Other 24 hour snowfall amounts on March 31, 1985 included:

Aspen Mountain	5 inches	
Breckenridge	9 inches	
Copper Mountain	12 inches	(ALSO SEE FIGURE 3
Keystone	5 inches	FOR LOCATIONS OF
North Peak	7 inches	SKI AREAS.)
Steamboat Springs	9 inches	
Sunlight	8 inches	
Vail	13 inches	
Mary Jane	5 inches	

Overall, this storm had the greatest adverse effect on Colorado mountain areas above 9,000 feet MSL. For the most part, mountain valleys were not seriously impacted by the strong winds and heavier snow that occurred over higher elevations.



24 HOUR SNOWFALL AMOUNTS MARCH 31, 1985

FIGURE 3

There are a couple of meteorologically significant lessons to be learned from this case study:

(1) After a major winter storm moves east of Colorado, forecasters should not be lulled into thinking the storm is over, but should become immediately aware of the potential for orographic snowfall in the Colorado mountains as the polar front jet stream migrates northward over the state.

(2) Even weak dynamics combined with strong orographics and adequate moisture can produce a significant winter storm in the Colorado mountains. This second winter storm produced more wind and blowing snow than the initial, more dynamically strong "classic" storm. Even the snow amounts from the second storm were more impressive considering the shorter duration of the snowfall.

References

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