

Chapter 15: Great Plains Blizzards



Photo: Bill Koch, Collection of Dr. Herbert Kroehl, NGDC

- Blizzard
- Colorado Low and Blizzard
- Alberta Low and Blizzard



Ingredients of Severe Blizzard

(1) Extremely cold air

→ originates on the plains of west-central Canada

(2) Strong wind

→ provided by extratropical cyclone

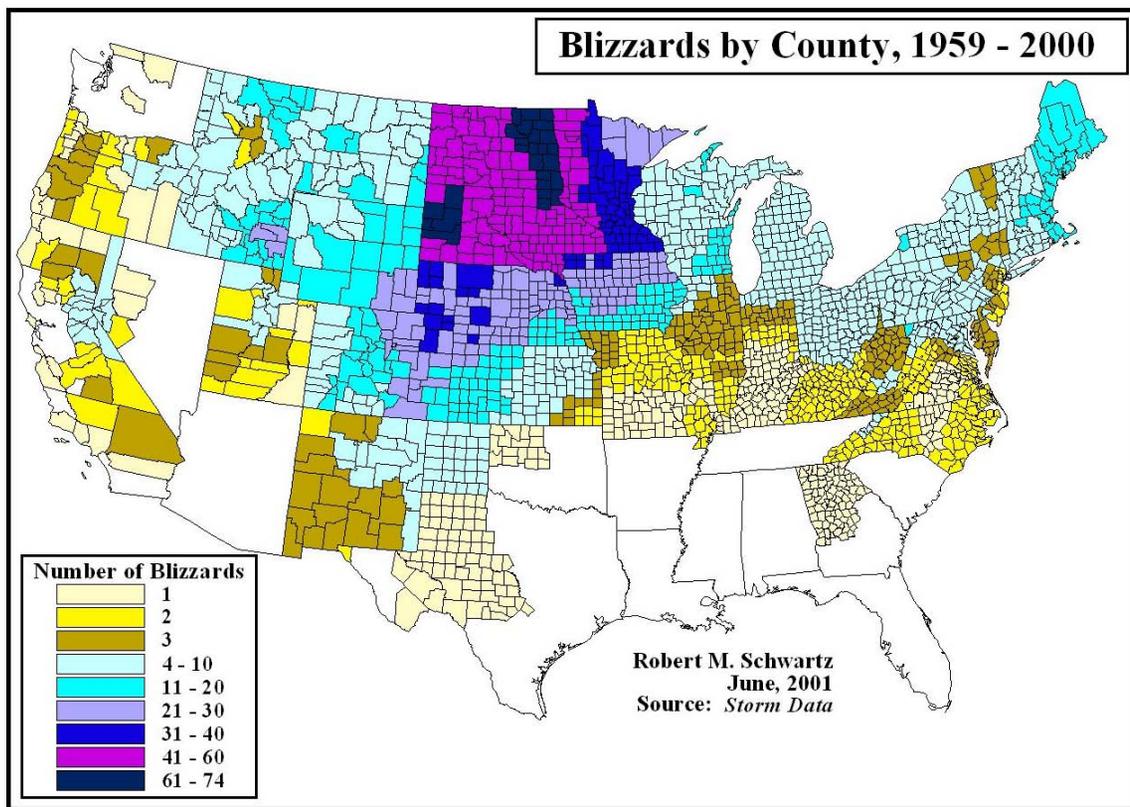
(3) Heavy snow

→ provided by extratropical cyclone

- ❑ Most of these cyclones develop over two locations east of the Rockies: Eastern Colorado and the plains of Alberta.
- ❑ Either Colorado cyclones or Alberta Clippers can lead to blizzard conditions.
- ❑ The worst blizzards occur with Colorado cyclones because of greater snowfall and stronger winds.



Blizzard

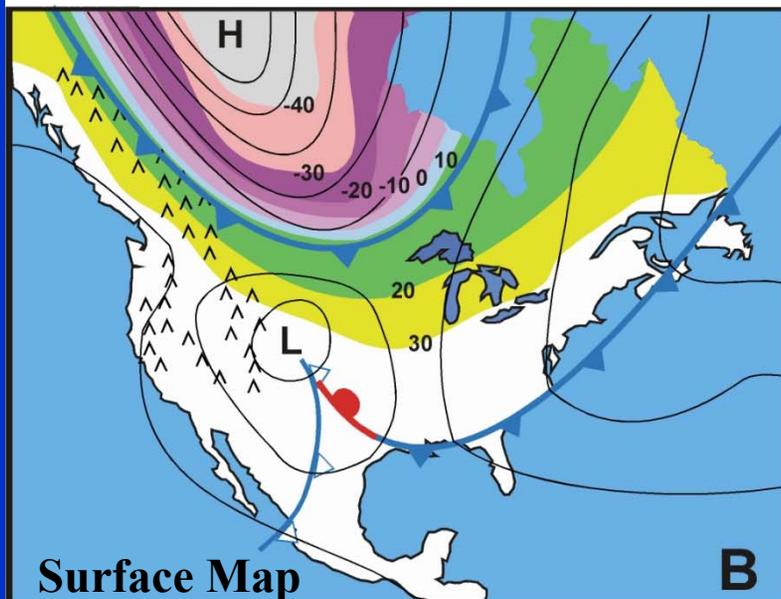
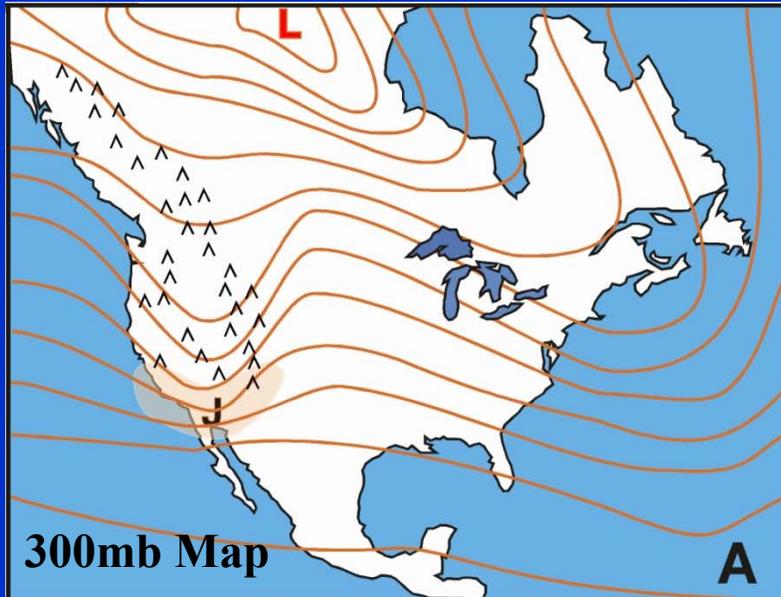


- ❑ The National Weather Service issues a blizzard warning when winds are expected to exceed 35 mph (30 knots), and falling or blowing snow will reduce visibility to less than a quarter of a mile for at least three hours.
- ❑ Although cold air is a key component of all blizzards, we do not use specific temperature criteria to define a blizzard.

- ❑ Blizzards can occur virtually anywhere in the northern half of the United States, they occur with the highest frequency over North and South Dakota, Minnesota, Nebraska, northern Iowa, and eastern Colorado.



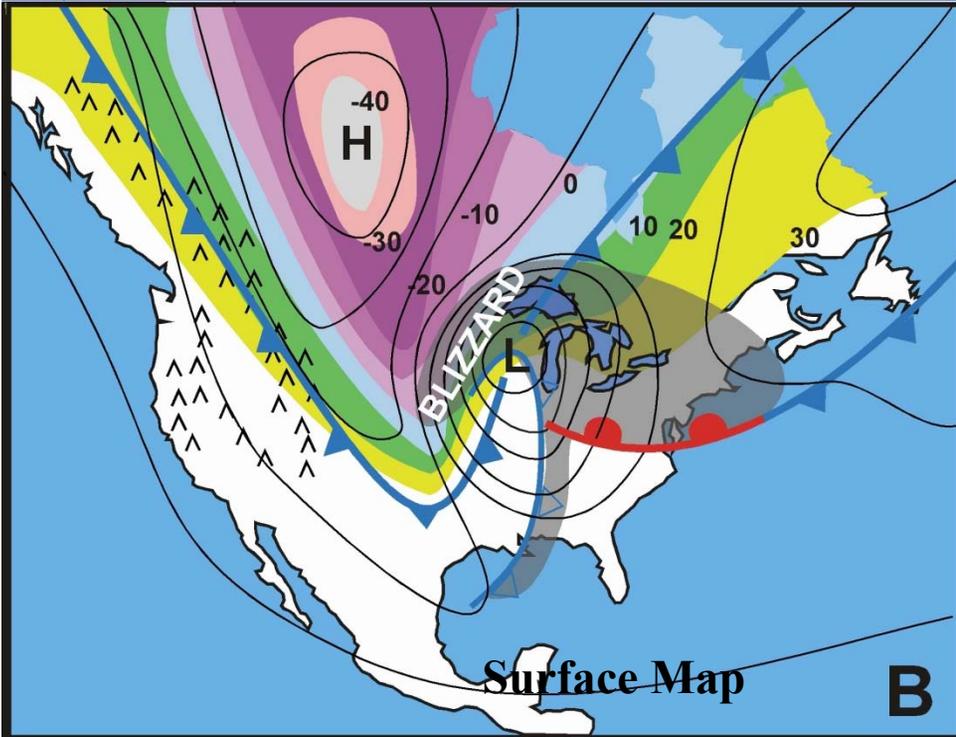
Colorado Cyclone and Blizzard (1)



- ❑ For blizzard conditions to develop within Colorado cyclones, bitter cold air and associated high pressure must already be in place over the Canadian plains at the time a cyclone is developing.
- ❑ This cold airmass is behind an arctic front approaching Canada.
- ❑ As the cyclone moves eastward, the arctic cold air moves southward and approaches the cyclone center.



Colorado Cyclone and Blizzard (2)



- ❑ As the cyclone progresses northeastward and intensified, extremely strong pressure gradient develops on the northwestern side of the cyclone.
- ❑ These pressure gradients drive the bitterly cold air southward west of the cyclone center, creating the strong, cold winds of blizzard.

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- ❑ As a cyclone progress through its life cycle, warm air rising east of the upper-front and over the warm front becomes wrapped around the northwest side of the low-pressure center, producing a band of clouds and precipitation around the northwest side of the cyclone.
- ❑ Condense snow crystals fall into the arctic air below .

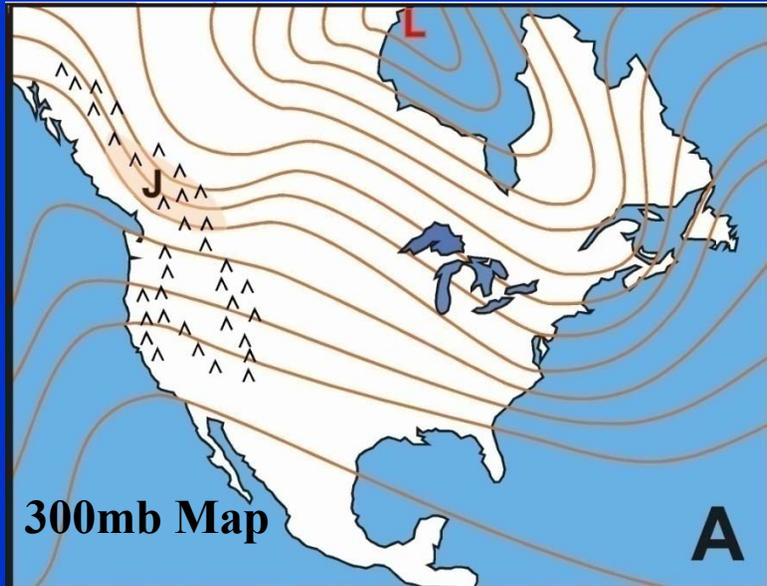


Topography Factor

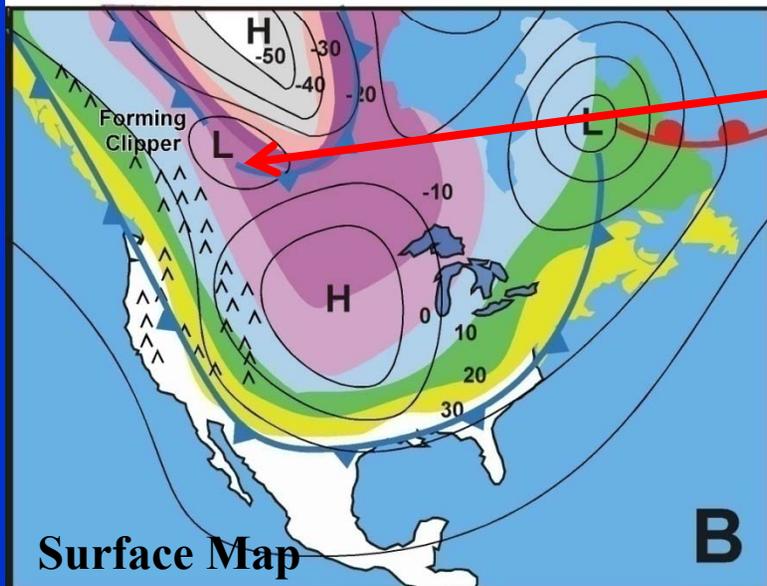
- ❑ A second factor creating snow north and west of the Colorado cyclone center has to do with the topography over which the cyclone is moving.
- ❑ The Mississippi River Valley is less than 500 feet (0.15km) above sea level, while the plains in the eastern Colorado just east of the Rockies are about 5000 feet (1.6 km) above sea level.
- ❑ Air flowing westward north of a cyclone must climb the slope of the topography and cool down more due to adiabatic cooling.
- ❑ The topography-induced cooling enhances the cloud formation and snowfall rates.



Alberta Clipper and Blizzard (1)



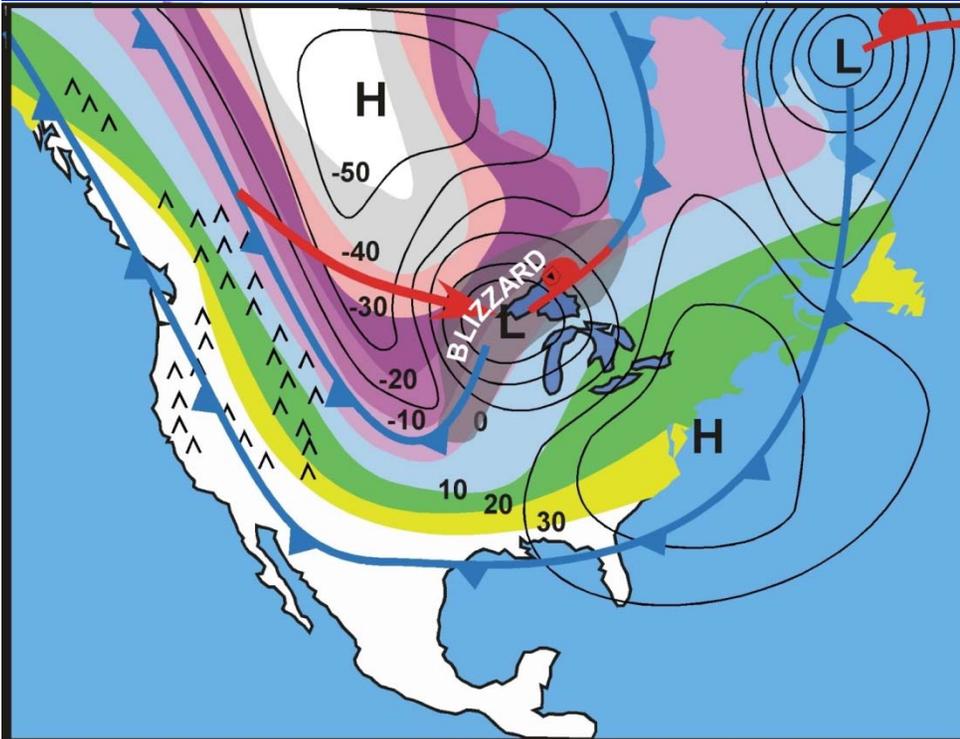
- Alberta Clipper cyclones typically develop after cold air is over northern United States and the jetstream over Canada and the northern US is oriented from northwest to southeast.



Alberta Clipper



Alberta Clipper and Blizzard (2)



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- ❑ Strong winds to the northwest of the cyclone are again driven by the pressure gradients between the arctic high pressure and the cyclone center.

- ❑ When the Clipper cyclone forms and move southeastward across Canada and into the Great Lakes region, a new arctic front moves southward to the west of the low-pressure center.
- ❑ Bitterly cold airs can be found behind this front.
- ❑ Alberta Clippers produce less snow than Colorado cyclones, typically two to five inches.
- ❑ Most of the snow forms in air lifted along and over the advancing arctic front.

