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STORM TRACKS THAT PRODUCE SNOWFALL IN COLUMBUS, OHIO

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Introduction

Differences in total snowfall amounts for a particular storm can vary greatly over small distances and are related to an interaction of dynamic meteorological processes. This study attempts to relate a few of these interactions to the amount of snowfall received in Central Ohio. A check list has been developed to assist forecasters to recognize snow events in Central Ohio. The check list also provides a quick estimate of snowfall amounts based on climatology.

Procedure

Storms from 1983 to 1988 were categorized by snowfall amounts of 1-3.4 inches and 3.5-6 inches in Central Ohio. This was done to differentiate between heavy snow as defined by ROML ER-10-88 and the frequent storms that produce light snows (1-3 inches). Tracks of various meteorological parameters were plotted. These included 1). Surface lows 2). 850 mb. lows 3). Vorticity Maxima, and 4). the 500 mb. Height Fall Center (HFC). The tracks were measured for closest approach to Columbus and the direction from which the storms originated. From these groupings four basic storm tracks were identified (southern, southwest, west and northwest).

Characteristics of Storm Types

Southern (5 Cases)

Southern storms form over the Gulf of Mexico or the Southeastern states and travel northeastward along the Southeast and Mid-Atlantic coasts. Occasionally these storms have a primary low passing north of Columbus while a secondary low develops just east of the Appalachians and moves northeastward.

Characteristics:
-Surface lows pass 120-430 nm. southeast of Columbus with pressures 1010-1020 mb.
-850 mb. lows pass 20-130 nm. southeast of Columbus and follow a southwest type track.
-Vort max approaches from the west or southwest and passes 20-40 nm. north or 50-100 nm. south of Columbus and ranges from 14 to 22.

Southwest (10 Cases)

The surface low forms to the lee of the Rockies in Southeastern Colorado and moves to the Missouri Bootheel and across Northern Kentucky or Southern Ohio. These storms produced some of the "heavier" snows (7 out of 10 produced amounts 2" or more) due to a combination of warm advection, high moisture content, and a receding high providing a good overrunning surface.

Characteristics:
-Surface low passes 40 to 180 nm. south of Columbus.
-Snow usually begins at CMH when the surface low is between the southwest and northeast corners of Arkansas or 450-660 nm. southwest of the city.
-850 mb. low passes 40-180 nm. south of Columbus following the same path as the surface low.
-Vort max ranges from 10-16 tracking from Oklahoma to Kentucky and passing 0-120 nm. south of Columbus. Occasionally the max tracks northwest of the city resulting in amounts 2" or less.
-Snow usually begins in CMH when the max reaches Eastern Oklahoma or Northeastern Texas or 660-840 nm. southwest of Columbus.
-HFC follows the same path as the vort max and passes 0 to 200 nm. south of the city.

West (3 Cases)

Western storms are not well organized and usually have weak pressure centers or none at all. They generally produce amounts 2" or less. This is the result of a fast moving northwesterly flow aloft quickly generating a weak surface low in Kansas and moving it eastward across Central Missouri and across Northern Kentucky.

Characteristics:
-Surface low passes 60-90 nm. south of Columbus with pressures 1010-1020 mb. Storms lacking a surface low produced amounts 2" or less.
-Snow begins in Columbus when the surface low is between Western Illinois and Western Indiana or 180-360 nm. west of CMH.
-850 mb. low tracks 20-70 nm. north of Columbus.
-Vort max moves southeastward from the Northern Plains or Great Lakes across Illinois and Indiana to Kentucky. The max passes 40-100 nm. south of CMH and ranges from 16-24.
-Snow usually begins in Columbus when the vort max is between the west-central and east-central borders of Illinois or 220-400 nm. west of Columbus.
-HFC parallels the vort max track passing 20-150 nm. south of the city.

Northwest (13 Cases)

By far these storms have the highest frequency of producing heavy snow at Columbus and 9 out of 11 storms produced amounts 2" or more. They are more organized and have stronger support passing closer to the city than other types. By the time they reach the Ohio Valley surface pressures are generally less than 1000 mb. enabling a strong flow of gulf moisture into the system.

Characteristics:
- Surface lows move southeastward from Eastern South Dakota through Northern Kentucky 20-170 nm. south of Columbus.
-Snow begins at Columbus when the low is between Western Illinois and Indiana or 180-360 nm. west of Columbus.
-850 mb. low tracks over or just to the north of Columbus.
-Vort max moves southeastward from Montana to Central Iowa and across Southern Illinois into Southern Ohio or Central Kentucky passing 30-180 nm. south of Columbus.
-Snow usually begins in Columbus when the Vort Max is between West-Central Illinois and Indiana or 220-400 nm. west of Columbus.
-HFC parallels the vort max track passing 30-150 nm. south of the city.

Summary

The attached check list shows the range of distances of the parameters on closest approach to Columbus and the magnitude of them at that time. After forecasters have determined the tracks of these parameters, they can compare them with the check list to quickly determine the snowfall potential based on the 1983 to 1988 study period. The check list will be tested and refined during the winter of 1989-90.

General Checklist to determine 1-3"
or 4-6" at Columbus
Period of study: 1983-1988

1-3" (25 storms)

Surface Low
-- 30 to 180 nm. south of CMH from the west.
Average: 110 nm.

850 mb. Low
-- 120 to 190 nm. south of CMH from the west.
Average: 150 nm.
0 to 70 nm. south of CMH from the west
Average: Over CMH

Vorticity Maxima
-- 20 to 80 nm. south of CMH from the southwest.
Average: 80 nm.
180 to 220 nm. south of CMH from the northwest.
Average: 180 nm.

Vort Max Strength -- 16 to 20.

Height Fall Center (HFC)
-- 30 to 180 nm. south of CMH.
Average: 150 nm.

Height Fall Center Strength -- -09 to -17 dm.

4-6" (6 storms)

Surface Low
-- 90 to 180 nm. south of CMH.
Average: 100 nm.

850 mb. Low
-- 10 to 30 nm. north of CMH.
Average: Over CMH

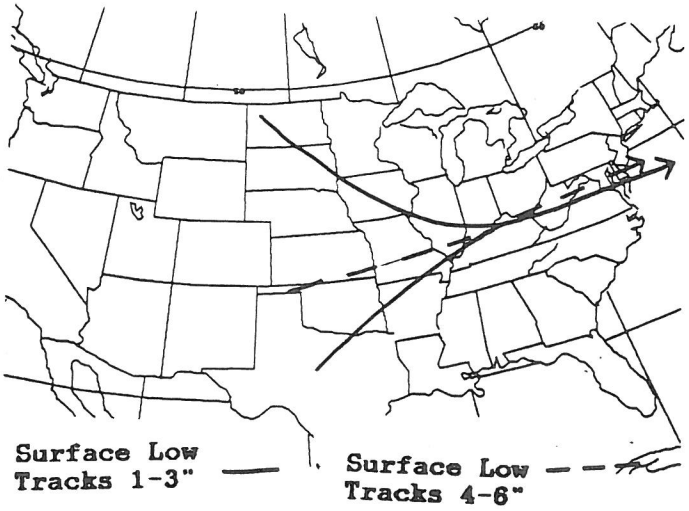
Vorticity Maxima
-- 30 to 60 nm. south of CMH.
Average 60 nm.

Vort Max Strength -- 18 to 26.

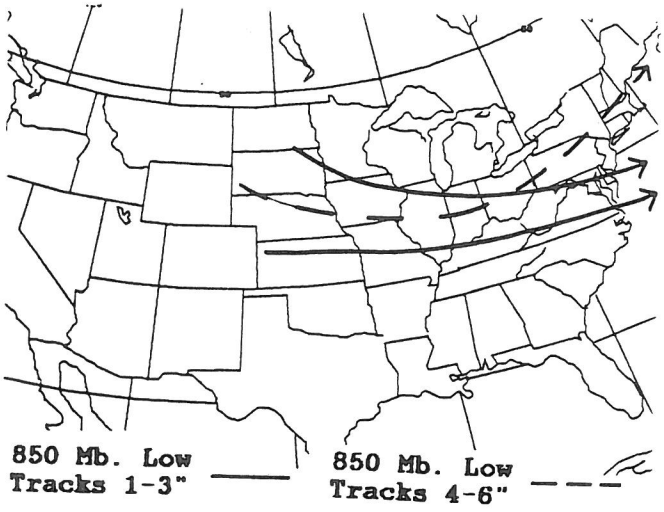
Height Fall Center (HFC)
-- 20 to 30 nm. south of CMH.
Average: 30 nm.

Height Fall Center Strength -- -08 to -20 dm.

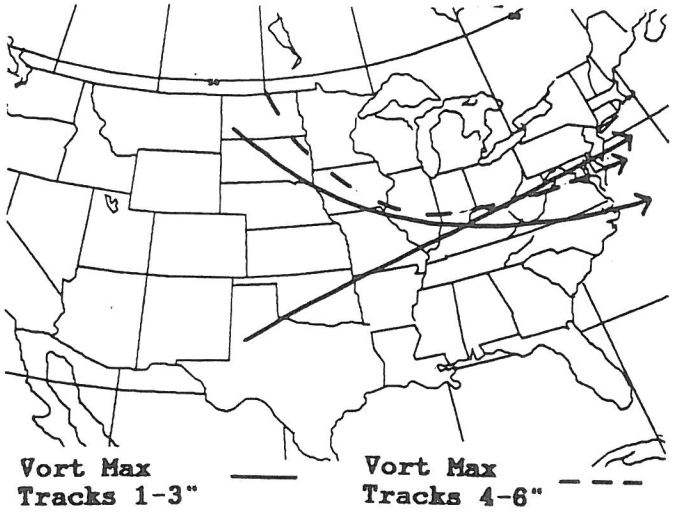
****Criteria valid for 1000-500 mb.
thickness of 540 dm. and 850 mb.
temperature <0 C.



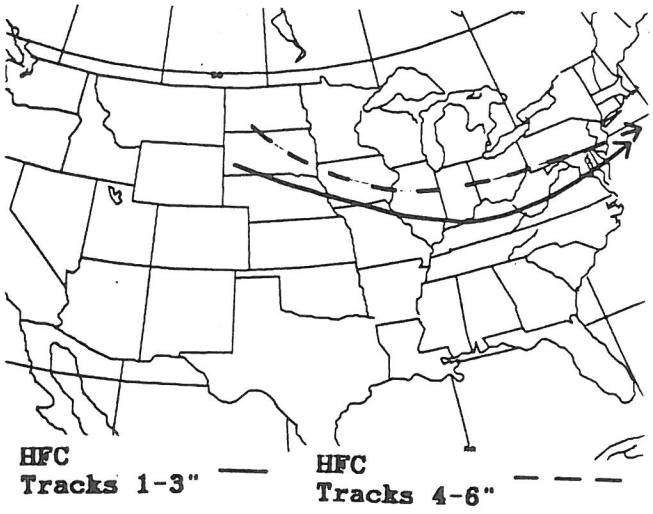
Surface Low
Tracks 1-3" ——
Surface Low
Tracks 4-6" – – –



850 Mb. Low
Tracks 1-3" ——
850 Mb. Low
Tracks 4-6" – – –



Vort Max
Tracks 1-3" ——
Vort Max
Tracks 4-6" – – –



HFC
Tracks 1-3" ——
HFC
Tracks 4-6" – – –