

Southwestern Lower Michigan Lake Effect Snow December 5th – 8th, 2010

Heavy lake effect snow began Sunday, December 5th and continued into Wednesday, December 8th. More than a foot of snow piled up along the Lake Michigan shore near Muskegon south to Holland and Saugatuck. Some places in western Ottawa and Allegan Counties saw close to two feet of snow, as did parts of eastern Mason County.

Perhaps the most remarkable aspect of this event was the very persistent north-northwest wind direction during the three day period from Sunday to Tuesday. This resulted in a nearly stationary snow band and a very sharp snowfall gradient across western Ottawa and central Allegan County (Fig. 1), where snow totals rapidly decreased from nearly two feet to a couple inches moving east across the counties.

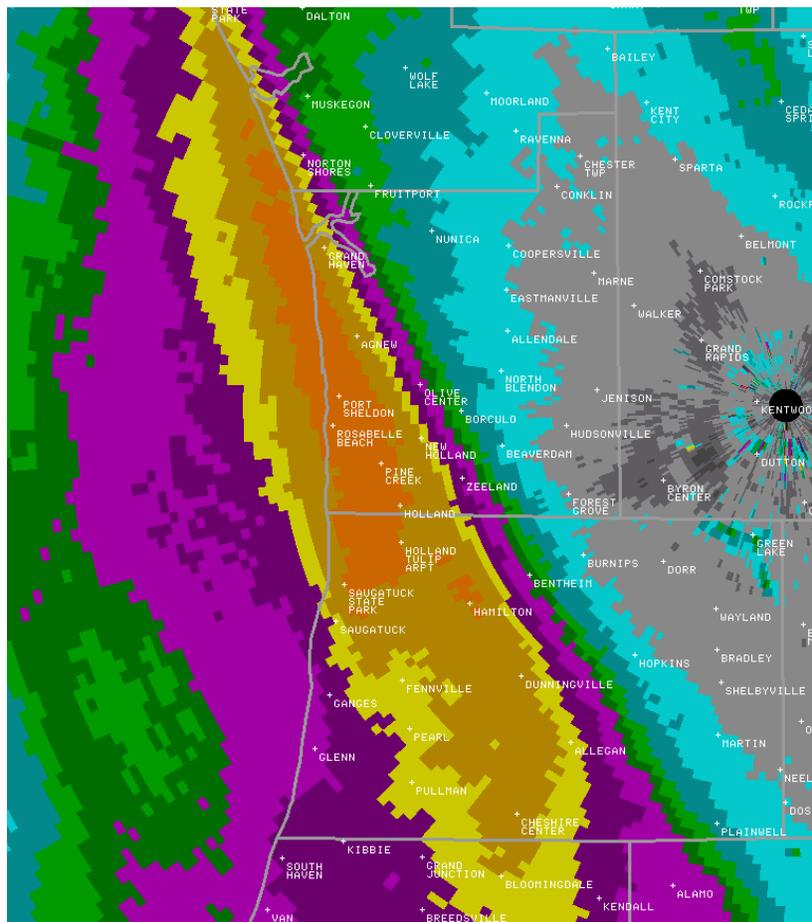


FIG. 1. Radar estimated precipitation. Largest values are orange and smallest values are gray.

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As highlighted in Fig. 2, there were three areas where a relatively large amount of snowfall occurred. The first and largest area was in far Southwest Lower Michigan where the persistent band captured in Fig. 1 occurred. The second significant area occurred near and just east of Ludington. No observations were received close to the lakeshore in this area, so it's possible that heavy snowfall extended farther west. The third significant area was located over Central Lower Michigan extending south into Clare County.

Persistent low level winds from the northwest blew in a direction that can be seen from the orientation of the snow bands in Fig. 3. Research has shown that as winds blow across Lake Superior, the air is preconditioned with moistening and warming even before reaching Lake Michigan. This preconditioning can be inferred with the Lake Effect snow bands over the northern Upper Peninsula.

The strong bands that developed around Traverse City were likely helped further by a slightly increased fetch across Lake Michigan and low level wind convergence resulting from the shape of the bays. This band extending into interior Lower Michigan is what contributed to the higher snow totals around and north of Clare County.

The large persistent band over far Southwest Lower Michigan was helped by preconditioning and a long fetch across Lake Michigan, which allowed even more modification of the air. Precipitation also was enhanced due to the sharp contrast between the plume of relatively warm, moist air moving southeast off Lake Michigan and the colder, drier air over interior Lower Michigan. Not only did this boundary help produce more snow, but it resulted in a very sharp east to west gradient in snowfall totals.

Preconditioning likely also played a role with the area of significant snow around Ludington. Neither the Grand Rapids radar nor the Gaylord radar was able to detect snow in this area (Fig. 3). This happens frequently in winter because the radar beam always is higher above the ground with increasing distance from the radar, and lake effect snow clouds tend to be relatively shallow. As a result the beam shoots over the top of the snow bands.

More details about the snowfall reports can be found in the summary Local Storm Report product at the end of this document.

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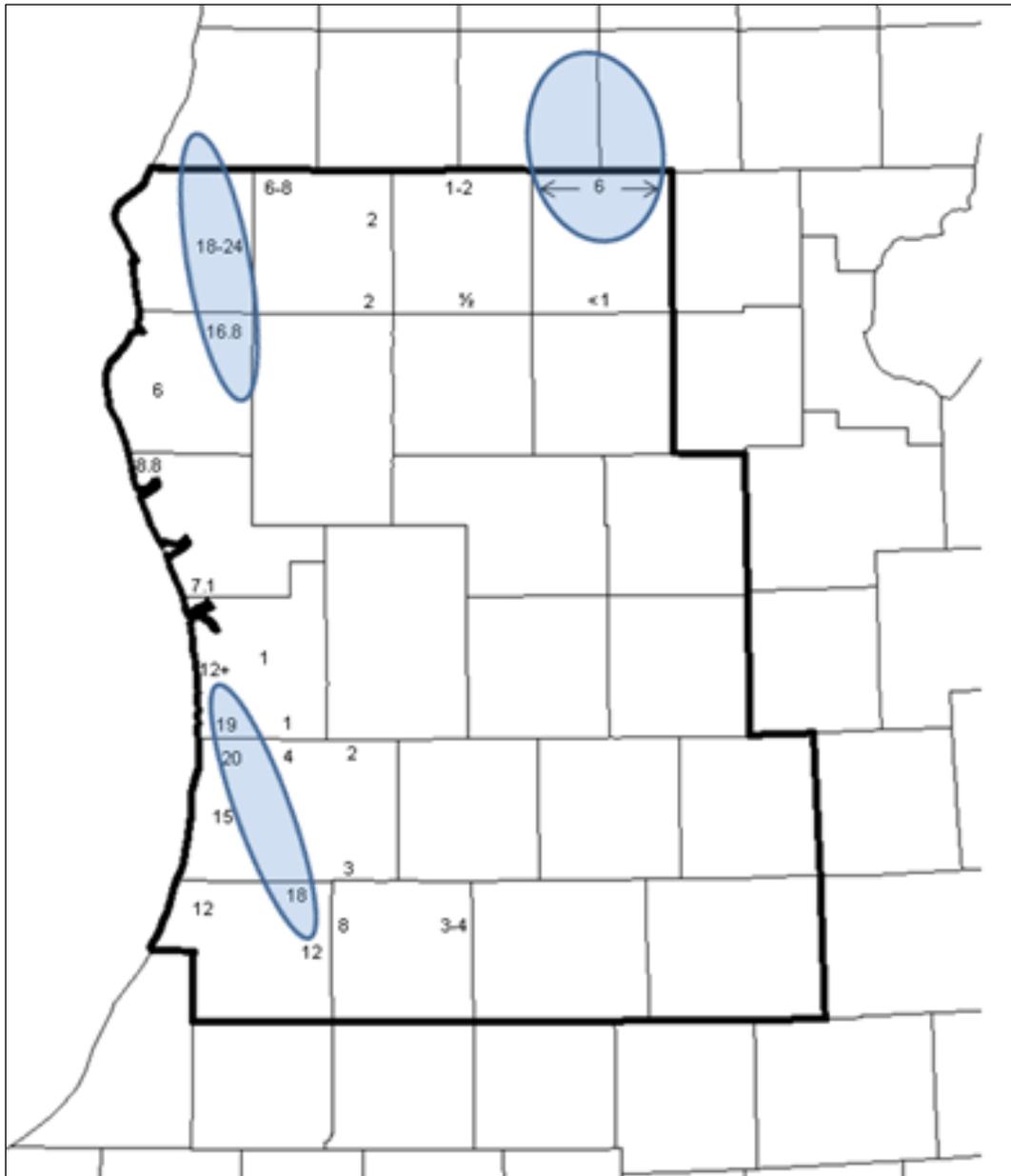


FIG. 2. Reported snow totals and highlighted areas of concentrated snowfall (shaded in blue).

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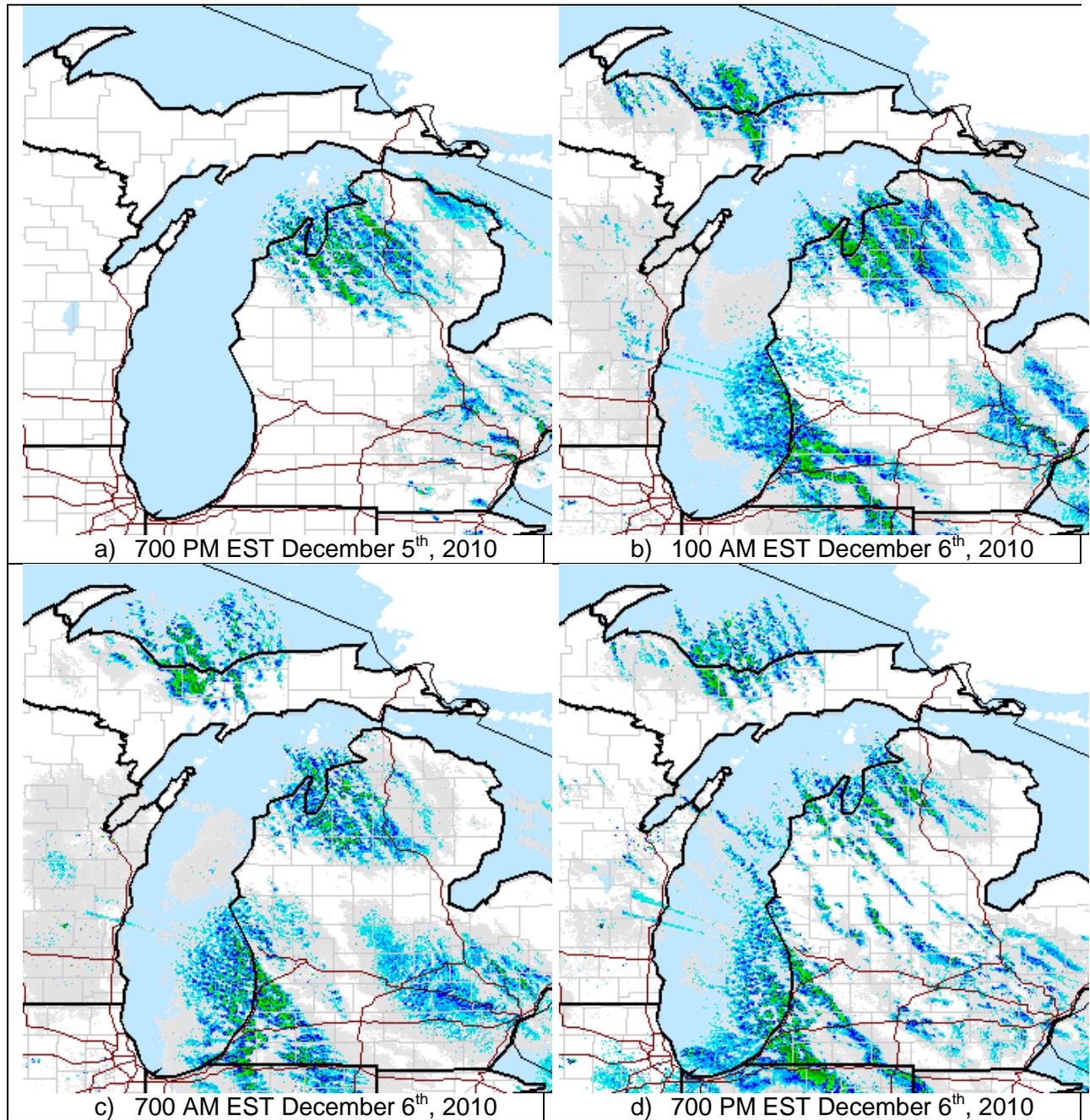


FIG. 3. Radar reflectivity at selected times for the western Great Lakes Region.

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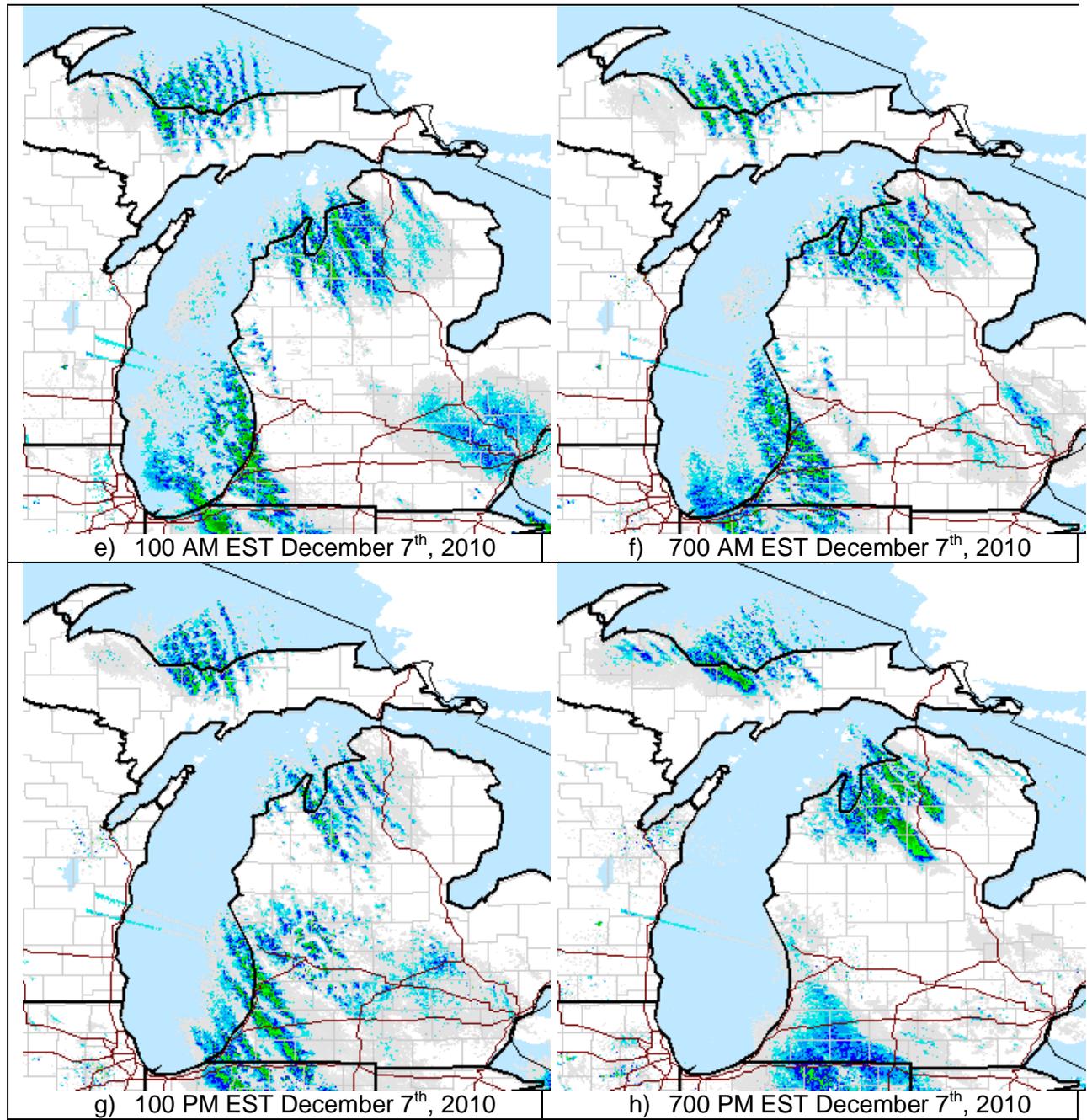


FIG. 3. (cont)

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PRELIMINARY LOCAL STORM REPORT...SUMMARY
NATIONAL WEATHER SERVICE GRAND RAPIDS MI
1210 PM EST WED DEC 08 2010

..TIME...	...EVENT...	...CITY LOCATION...	...LAT.LON...
..DATE...	...MAG....	..COUNTY LOCATION..ST..	...SOURCE....
..REMARKS..			
0500 PM 12/07/2010	SNOW E2.0 INCH	TUSTIN OSCEOLA	44.10N 85.46W MI DEPT OF HIGHWAYS
OSCEOLA COUNTY ROAD COMMISSION AND MDOT ESTIMATES AN INCH OR TWO OF SNOW FELL ACROSS THE NORTHERN PORTION OF OSCEOLA COUNTY WITH EVEN LESS ACROSS THE SOUTH. THESE TOTALS ARE STORM TOTAL SNOWFALL FROM SUNDAY MORNING INTO TUESDAY.			
0500 PM 12/07/2010	SNOW E2.0 INCH	BRISTOL LAKE	44.10N 85.58W MI DEPT OF HIGHWAYS
STORM TOTAL SNOWFALL ESTIMATED BY LAKE COUNTY ROAD COMMISSION.			
0500 PM 12/07/2010	SNOW M3.8 INCH	BALDWIN LAKE	43.90N 85.85W MI DEPT OF HIGHWAYS
STORM TOTAL SNOWFALL FROM SUNDAY MORNING THROUGH TUESDAY. MEASURED AT THE LAKE COUNTY ROAD COMMISSION.			
0500 PM 12/07/2010	SNOW E15.0 INCH	8 SW BALDWIN LAKE	43.82N 85.96W MI DEPT OF HIGHWAYS
ESTIMATED REPORT FROM LAKE COUNTY ROAD COMMISSION EMPLOYEE. REPORT IS FROM FAR SOUTHWEST CORNER OF COUNTY WEST OF BIG STAR LAKE.			
0500 PM 12/07/2010	SNOW E15.0 INCH	3 S BRANCH LAKE	43.90N 86.04W MI DEPT OF HIGHWAYS
SNOW ESTIMATED FROM ROAD COMMISSION EMPLOYEE. SNOW IS STORM TOTAL FROM SUNDAY MORNING THROUGH TUESDAY.			
0500 PM 12/07/2010	SNOW E7.0 INCH	IRONS LAKE	44.14N 85.92W MI DEPT OF HIGHWAYS
LAKE COUNTY ROAD COMMISSION ESTIMATES THAT 6 TO 8 INCHES FOR SNOW FELL FROM SUNDAY THROUGH TUESDAY AT IRONS.			
0500 PM 12/07/2010	SNOW E2.0 INCH	CHASE LAKE	43.89N 85.64W MI DEPT OF HIGHWAYS
STORM TOTAL SNOWFALL ESTIMATED BY THE LAKE COUNTY ROAD COMMISSION. TOTAL IS FROM SUNDAY THROUGH TUESDAY.			
0830 PM 12/07/2010	SNOW E5.0 INCH	DIGHTON OSCEOLA	44.09N 85.35W MI BROADCAST MEDIA
ESTIMATED STORM TOTAL OF 4-5 INCHES OF SNOW SINCE EARLY SUNDAY.			
0514 AM 12/08/2010	SNOW M18.0 INCH	BLOOMINGDALE VAN BUREN	42.38N 85.96W MI CO-OP OBSERVER
STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.			
0600 AM 12/08/2010	SNOW M19.0 INCH	4 NNE HOLLAND OTTAWA	42.84N 86.08W MI COCORAHS
STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.			

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0700 AM SNOW 2 SE SCOTTVILLE 43.93N 86.25W
12/08/2010 M7.2 INCH MASON MI CO-OP OBSERVER

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.

0700 AM SNOW 8 NW MONTAGUE 43.50N 86.47W
12/08/2010 M8.8 INCH OCEANA MI COCORAHS

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.

0700 AM SNOW 4 NNE PAW PAW 42.27N 85.86W
12/08/2010 M12.6 INCH VAN BUREN MI COCORAHS

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING. HIGHEST
REPORTED TOTAL DURING A PERIOD WAS 8.0 INCHES FROM 7AM
SUNDAY TO 930AM MONDAY.

0700 AM SNOW 4 SSE MUSKEGON 43.17N 86.22W
12/08/2010 M7.1 INCH MUSKEGON MI OFFICIAL NWS OBS

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING AT MUSKEGON
COUNTY AIRPORT.

0810 AM SNOW 6 SW KALAMAZOO 42.22N 85.68W
12/08/2010 M8.9 INCH KALAMAZOO MI COCORAHS

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.

0915 AM SNOW PLAINWELL 42.44N 85.64W
12/08/2010 M3.0 INCH ALLEGAN MI TRAINED SPOTTER

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.

0950 AM SNOW 12 E LUDINGTON 43.96N 86.21W
12/08/2010 E24.0 INCH MASON MI COUNTY OFFICIAL

ROAD COMMISSION ESTIMATES 18 TO 24 INCHES STORM TOTAL
SNOWFALL BETWEEN 8 AND 12 MILES INLAND FROM LAKE MICHIGAN
IN THE EASTERN PORTION OF THE COUNTY SINCE SUNDAY
MORNING. NEW SNOW OVERNIGHT WAS 6.0 INCHES.

1019 AM SNOW 5 SE HOLLAND 42.73N 86.06W
12/08/2010 E20.0 INCH ALLEGAN MI TRAINED SPOTTER

ESTIMATED STORM TOTAL SNOWFALL OF 18 TO 20 INCHES SINCE
SUNDAY MORNING.

1033 AM SNOW KALAMAZOO 42.28N 85.59W
12/08/2010 M2.0 INCH KALAMAZOO MI TRAINED SPOTTER

STORM TOTAL SNOWFALL.

1049 AM SNOW LEOTA 44.14N 84.89W
12/08/2010 E6.0 INCH CLARE MI DEPT OF HIGHWAYS

CLARE COUNTY ROAD COMMISSION ESTIMATES 3 INCHES OF SNOW
FELL ON SUNDAY AND ANOTHER 3 INCHES ON MONDAY. 6 INCH TWO
DAY TOTAL WAS COMMON ACROSS THE FAR NORTHERN PART OF THE
COUNTY. LITTLE TO NO SNOW FELL IN THE SOUTH. ROAD
CONDITIONS THROUGH THE EVENT WERE REPORTED TO BE GOOD.

1059 AM SNOW MOLINE 42.74N 85.66W
12/08/2010 M2.0 INCH ALLEGAN MI TRAINED SPOTTER

STORM TOTAL SNOWFALL.

1111 AM SNOW PORT SHELDON 42.90N 86.20W
12/08/2010 E18.0 INCH OTTAWA MI COUNTY OFFICIAL

STORM TOTAL SNOWFALL.

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1111 AM SNOW 2 NE HOLLAND STATE PARK 42.80N 86.18W
12/08/2010 E18.0 INCH OTTAWA MI COUNTY OFFICIAL

LOCATION IS APPROXIMATE. STORM TOTAL SNOWFALL ESTIMATED
BY ROAD COMMISSION.

1130 AM SNOW FENNVILLE 42.59N 86.10W
12/08/2010 M15.0 INCH ALLEGAN MI FIRE DEPT/RESCUE

STORM TOTAL SNOWFALL REPORT BY THE FENNVILLE FIRE
DEPARTMENT.

1130 AM SNOW LAWRENCE 42.22N 86.05W
12/08/2010 E12.0 INCH VAN BUREN MI COUNTY OFFICIAL

STORM TOTAL SNOWFALL.

1136 AM SNOW SHELEBY 43.61N 86.36W
12/08/2010 E6.0 INCH OCEANA MI COUNTY OFFICIAL

ESTIMATED STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.

1150 AM SNOW 2 E HAMILTON 42.68N 85.97W
12/08/2010 E4.0 INCH ALLEGAN MI TRAINED SPOTTER

STORM TOTAL SNOWFALL SINCE SUNDAY MORNING.