Performance Review

Winter Storm January 29-31, 2002

Central Region Headquarters

Event Overview

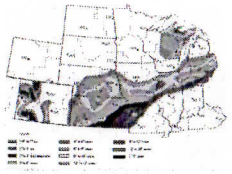
From January 29-31, 2002, a major winter storm of ice, sleet, and snow traversed a large portion of Central Region (CR) from southern Colorado east across Kansas, Missouri, to Illinois; and northeast across Nebraska, Iowa, Wisconsin, northern Indiana, and Michigan. Ice accumulations of one to three inches resulted in the most significant impact with downed trees causing power outages. Hardest hit with respect to damage, were Kansas and Missouri including metropolitan Kansas City. Storm damage was mainly due to power outages. Seventy-eight counties were affected across the two states and over one million people were without power for several days. Around a half million customers were without power in central Illinois and northern Indiana, and over 265,000 in southeast Michigan including metropolitan Detroit and Ann Arbor. Snowfall of 6 to 10 inches was common from southern Colorado across western and northern Kansas, central and eastern Nebraska, northern Missouri, eastern Iowa, northern Illinois and Indiana, eastern Wisconsin to southern lower Michigan and the Upper Peninsula (UP); with some totals up to 16 inches in the plains, 17 inches in the UP, and over 20 inches in the mountains (Figure 1). O'Hare Airport in Chicago cancelled 30 percent of its flights and had delays of a few hours on remaining flights. The Kansas City International airport was also severely impacted with numerous flight cancellations and delays of several hours. Some carriers cancelled all flights on Wednesday, January 30, due to significant ice buildup and/or depletion of de-icing fluid. School closings were widespread across the Central Region.

There was an estimate of up to 10 deaths in traffic accidents across the affected 9-state area. It is likely many accidents were curtailed due to the advance warning of the storm allowing road crews to treat the streets prior to its onset, and also because few people were on the road since schools and businesses were closed. In southern Illinois where heavy rain caused flooding, one death occurred as a stranded motorist abandoned her car in a swollen creek. She was carrying her granddaughter, lost her footing, and the child was swept away and drowned.

Synopsis

A cold, upper level trough positioned over the Pacific Coast Saturday, January 26, 2002, progressed slowly eastward pushing a surface cold front across the Rockies into the plains states. The front became nearly stationary from south central Kansas to Lake Huron by 6 a.m. CST, Monday, January 28, while the upper level trough deepened over the Southwest United States. High pressure over Canada brought a shallow layer of cold arctic air behind the surface front. An area of low pressure developed along the front near the Kansas-Oklahoma border from January 28 through January 30. The surface front drifted slowly southeast to a path from southeastern Missouri to southern Indiana by the morning of January 30. The low moved northeastward along the front reaching eastern Lower Michigan Friday, February 1, 2002. The upper level trough finally forced the system eastward out of Central Region Friday, February 1, 2002.

Z # USUS. , _ Figure 1 Storm Total Freezing/Frozen Precipitation



As the storm system progressed eastward, warm, moist air from the Gulf of Mexico was lifted over a shallow dome of cold air resulting in abundant precipitation. Up to 28 inches of snow fell in the mountains of southwest Colorado. In an area up to 250 miles north-northwest of the front where the surface temperature hovered near the freezing mark, a band of up to three inches of freezing precipitation fell from southeastern Kansas across Kansas City to central Illinois to the Detroit, Michigan area. Further north, precipitation fell completely as snow with amounts accumulating in excess of 16 inches at some locations. South of the front, rainfall of two to three inches caused flooding in southeastern Missouri, southern Illinois, Indiana, and western Kentucky.

Service

As early as Thursday afternoon, January 25, Hazardous Weather Outlooks from several Kansas and Missouri Weather Forecast Offices (WFOs) mentioned the possibility of snow in the 5-7 day outlook period. WFO Dodge City highlighted "a major change in the weather is expected mid week" and stated, "...snow, sleet and freezing rain will all be possible by late Tuesday and into Wednesday and Wednesday night." As the system approached from the west, WFO forecasters at Grand Junction, Colorado issued an Area Forecast Discussion (AFD) that identified the system's slow progression due to the intensification of the upper level trough. This intensification would result in high winds through Sunday, and forecasters correctly opted to hold precipitation off until Monday-Tuesday. In addition their AFD stated, "Emergency Managers in northeast Utah and northwest Colorado should maintain a heightened level of weather awareness today and tonight due to southwest winds increasing to 25 to 35 mph with gusts to 50 mph over the eastern Uinta Mountains and the mountains around Steamboat Springs."

On Saturday, January 26, WFOs in Topeka, Kansas and Kansas City (Pleasant Hill) highlighted their Hazardous Weather Outlooks marking the drastic change from record warmth to the return of winter. Topeka wrote, "Unseasonably warm weather will be around the area over the weekend...with record or near record high temperatures. However...winter will make its return the beginning of next week...as sharply colder air is expected to overspread the area starting Monday night. The cold weather should last into Friday. Accompanying the cold air will be a chance for freezing rain...sleet and snow...Tuesday into Tuesday night. Kansas City called for "an extended period of rain...freezing rain...sleet and snow for eastern Kansas and all of Missouri Tuesday afternoon through Thursday" and added, "at this time...it appears the most significant precipitation...including ice and snow accumulations...will occur south of a line from Paola...through Warrensburg to Boonville. Regardless...areas north of this line...including the Kansas City...Saint Joseph...Leavenworth areas...stand a good chance of seeing snow and ice accumulations in the Tuesday night into Thursday time period." This statement had excellent detail and proved to be quite accurate. Further to the northeast, the Detroit office included the

following in a statement issued on Saturday, January 26:

> ...WINTER WEATHER TO RETURN THIS WEEK...
> DISPATCHERS...PLEASE NOTIFY YOUR EMERGENCY MANAGERS.
>
> THREAT...
> Colder weather will return to southeast Lower Michigan early this week. With dropping temperatures and Gulf of Mexico moisture expected to advance northeast... this will be bringing snow and the possibility of freezing rain into the region late Wednesday and Thursday.

Senior forecaster, Fred Keyes, of Detroit commented it was the first time in his 30-year National Weather Service (NWS) career that he forecast freezing rain, five days in advance. Relatively new tools, the Eta-XX model and forecast soundings, were used to help make this decision. The Eta-XX is a
locally run version of the workstation Eta model projected to 7 days. A description of their use is noted in the following excerpt from Mr. Keyes' AFD Saturday afternoon, January 26:

> "If you look at the soundings another story comes to light. We can see that this will be a shallow airmass with all the cold air initially below 850mb. The soundings from the Eta-XX over the southern counties have the temperatures below freezing from the surface up to just below 850mb... with an above freezing layer from there through 750mb. MRF soundings similar... but they do not have the detail that the eta-xx shows. If this verifies then we could have a freezing rain event for Wednesday afternoon and part of Wednesday night. A complicating factor is that the Canadian model is slower in bringing out the southwest system by 24 hours. If the Canadian model would verify the freezing rain/snow event would be delayed until the Thursday/Friday time frame."

Similarly, WFO Grand Rapids, MI, issued a Hazardous Weather Outlook Saturday morning which stated, "[the] system has the potential to bring to southwest Michigan a significant winter weather event that would include freezing rain...sleet and heavy snowfall".

These statement excerpts are excellent examples of the type of "heads up" information provided with this storm. Many customers commented that information was abundant and early. One Emergency Manager told a WFO that for the first time ever, he went to the grocery store before the winter weather began. He attributed this to the numerous statements leading up to the event, increasing his confidence in the forecast.

Finding 1: The Hazardous Weather Outlook was an excellent vehicle to provide Emergency Managers and the general public an early "heads up" to forecast hazards.

Snowfall began in western Colorado Monday night, January 28. As the upper trough deepened, snowfall of 10 to 20 inches accumulated with isolated amounts over two feet. Winter Storm Watches preceded 12 of the 18 warnings with one day's lead time. Lead time to warnings averaged 22 hours. As the trough kicked out of the Rockies January 29-30, precipitation spread

into Kansas and Nebraska. Freezing rain and sleet began Tuesday afternoon and evening, January 29, from south central Kansas to west central Missouri and spread eastward to central Illinois. Ice accumulated up to three inches before ending Thursday morning in this prolonged overrunning precipitation event. Snow began Wednesday morning, January 30, from western Kansas and southern Nebraska eastward across southern Iowa, northern Missouri, northern Illinois and Indiana to southern Michigan. The snowfall intensified Wednesday afternoon and evening, accumulating 6 to 12 inches by Thursday afternoon in this band north of the surface front. Winter Storm Watches preceded the heavy snow and ice by an average of 36 hours (three forecast periods).

Overnight Wednesday night, January 30-31, as the surface low moved along the front and warm air rose over the shallow cold air mass, snow changed to freezing rain in northern Illinois just south of Chicago, across northern Indiana to Detroit, Michigan. Thursday evening, January 31, lake effect snow developed over east central Wisconsin and the Upper Peninsula of Michigan, accumulating up to 12 inches of snow in WFO Green Bay's area, and 17 inches in Marquette's area. As the surface low moved across the southern portion of Lake Michigan, thundersnow was reported in Grand Rapids area with snowfall rates of one to two inches per hour. Further south from southeastern Missouri across southern Illinois and Indiana, two to three inches of rain resulted in minor to moderate flooding.

This complicated weather event was handled quite well by the affected WFOs and the North Central River Forecast Center (NCRFC). For example, the AFD issued early Tuesday morning, January 29, by the Detroit office noted the likelihood of a heavy snow event Wednesday and Wednesday night. Detroit also commented that the Eta model solution of warmer temperatures aloft was preferred due to the expected strong warm air advection, and made the decision to mention snow changing to freezing rain. This was coordinated with surrounding offices. Snow did indeed change to freezing rain Wednesday night-Thursday in the Detroit area.

Initial meteorological model forecasts placed the storm track and heavier band of snow further south of where it actually fell. WFO Milwaukee, WI noted the heavier snowfall was in a narrow band coincident with strong upper level (300 mb) divergence associated with the favored right rear quadrant of a 180-190 knot jet maximum. This was not picked up well by the computer models until the 1200 UTC run on Wednesday, January 30. WFO Green Bay noted the actual surface low at 1800 UTC Thursday, January 31 was 150 miles northwest of where the Eta model (1200 UTC run) placed it for that same time. Similarly on January 31, WFO Marquette noted the surface low in numerical model guidance was in error by more than 100 miles. The actual track of the surface low placed central Upper Michigan in a favorable position for heavy snow, while the model guidance suggested substantially less snowfall. By integrating upper air and satellite data the morning of the 31st, forecasters at Marquette noted the progressive upper level jet steak associated with a long wave trough over the Southwest United States was much stronger than forecast by the models. Utilizing wind profiler data, forecasters were able to track this feature's evolution across the plains providing additional confidence to deviate from model guidance and issue the necessary warnings. Senior forecaster, Kevin Crupi, coordinated these findings with the Hydrometeorological Prediction Center (HPC) for their insight and concurrence. HPC supported their approach and proved a valuable sounding board with this complicated forecast.

Finding 2: Complexity of the event, synoptic scale heavy precipitation coupled with mesoscale surface waves, was reduced due to the excellent support provided by respective national centers.

Short term forecasts were used well to add pertinent information not contained in other products. One example from WFO Des Moines, IA stated:

> ...WINTER WEATHER ADVISORY CONTINUES THROUGH THIS EVENING... A 40 mile wide band of moderate to heavy snow centered along a line through Fort Dodge to near Adair will produce about 2 inches of snowfall as it moves east at 25 mph. This band will affect the Interstate 35 corridor between 9 and 11 pm with very low visibility and poor driving conditions. This band will continue east of Interstate 35...reaching Waterloo by 1 am. Snow should be ending or at least tapering to flurries west of a line from Algona to Council Bluffs by 9:30 pm...and by 11 pm along a line through Fort Dodge and Atlantic.

NCRFC was pro-active in using 72 hours of forecast precipitation in their products instead of the typical 24 hours. The accurate forecast of 2.5-2.75 inches provided lead time of 3.5 to 7.5 days to actual flooding.

Finding 3: High winds behind the front caused more tree limbs to break in areas that had significant ice accumulations. Several offices mentioned this danger in statements and short term forecasts.

Finding 4: Several WFO Area Forecast Discussions showed forecaster conservatism stating "too early to issue a watch" looking ahead to the fourth period. WFO Pleasant Hill (Kansas City) issued a watch Monday afternoon for the fourth period (Wednesday) which was key to their long lead time. The watch was issued almost 12 hours earlier than surrounding offices. It should be noted this decision was coordinated with surrounding offices using the telephone and instant messaging capabilities, however, surrounding offices were hesitant to issue a watch that early even though they were confident of the forecast. WFO Pleasant Hill senior forecaster, Suzanne Fortin, made a difficult decision to break from the group and issue a watch 12 hours before surrounding offices. This was done because 1) WFO-collaborated confidence indicated a watch would likely be required beyond the 3rd forecast period, 2) surrounding offices shared Pleasant Hill's high level of confidence in the collaboration chat room and during phone discussions, 3) the potential destructive nature of the storm was high and they felt responsible to give the large metropolitan area of Kansas City as much time to prepare as possible. WFO Pleasant Hill coordinated this decision with surrounding offices via the internet chat room.

Recommendation: When collaborative confidence is relatively high, WFOs should issue watches (and warnings) with as much lead time as possible. NWS directives support the issuance of a winter storm watch to four periods preceding the event. NWS directives support the issuance of a winter storm warning up to three periods prior to the event. CR policy restricts issuance of warnings to no more than two periods preceding the event. CR should update their policy to be the same as the NWS Directives, and explore the possibility of removing the limitations on when to issue watches and warnings.

Action: Central Region Headquarters (CRH) will update winter storm policy directives to agree with NWS directives on the issuance of watches and warnings. CRH will also explore the possibility with the other NWS regions and national headquarters regarding removal of limitations on when to issue watches and warnings.

Finding 5: Many offices did not delay winter storm warnings until issuance of main forecast package as has been common in the past. Once the decision was made to warn, no information was withheld, and warnings were disseminated with an extra two to four hours lead time vs. the traditional method of issuing winter storm warnings at a specific forecast package time.

Finding 6: Although snow was indicated on radar across northern Wisconsin during the afternoon of January 31, staff at WFO Green Bay, WI stated they made very few phone calls to spotters (before the afternoon zone package). Additional calls were not made because visibilities at area airports were 1 ½ miles or higher, and neighboring WFO, LaCrosse, WI, indicated that snowfall reports from their spotters were generally under two inches.

Recommendation: Phone calls to county spotters and local officials should be made when there is any question as to the amount and intensity of snow. In this case, reports during the afternoon may have resulted in the issuance of an advisory prior to the eventual warning. Similar calls apply to all weather hazards.

Action: Meteorologists In Charge (MICs) should review the Weather Service Operations Manual (WSOM) C-42 section 6.8 and 6.9 with their staffs and encourage collection of snowfall data to monitor the ongoing weather situation, and apply similar requirements for all weather hazards. MICs and Warning Coordination Meteorologists (WCMs) should explore the expansion of spotter networks.

Finding 7: Many offices commented that extra effort was made to provide Public Information Statements or Local Storm Reports with snowfall reports. Comments from the media show this effort was appreciated.

Finding 8: WFO Green Bay, WI stated the Rapid Update Cycle (RUC) model and satellite " nowcasting" techniques were invaluable in the proper diagnosis of the weather situation and subsequent upgrade to a Winter Storm Warning.

Staffing

Most offices were staffed well during the event as it was anticipated several days in advance. Staffs at WFOs Pleasant Hill (Kansas City), Northern Indiana, and Detroit, MI; the RFC in Pleasant Hill, and CRH were impacted losing power in their homes, in some cases for up to a week in the Kansas City area. CRH coordinated with the Kansas City WFO and Missouri Basin River Forecast Center in Pleasant Hill, MO, in an effort to provide assistance to affected employees. The staffs managed to deal with the personal crisis as well as continue to report to work. This was an excellent example of service above self.

Performance Measures

During the January 28-31 time period, Winter Storm Warning criteria was met at 24 of the 38 WFOs in Central region. Average lead time for Winter Storm Warnings issued by these 24 offices was 15 hours, 25 minutes. Probability of Detection was 0.96, and False Alarm Rate averaged 0.12. Of the 414 recorded winter storm events, 81% were preceded by a watch and 4% were not warned. Average lead time attributed to all Winter Storm Watches was approximately 38 hours. Warning lead time for the WFOs covering the hard-hit metropolitan areas of Chicago, Detroit and Kansas City averaged 15 hours 42 minutes. Lead time to watches in those metropolitan areas averaged approximately 40 hours. A breakdown of the verification statistics by office and regional average can be found in Appendix A.

Public Response

Public response to the National Weather Service handling of the January 28-31 storm was very positive. Many media outlets and emergency managers complimented the NWS on the amount of lead time given. The few number of traffic accidents was attributed to the lead time which allowed the road crews to prepare. Schools had a day's lead time to close in a timely and efficient manner. In many instances, schools closed before the first snow or freezing rain began which is testament to their confidence in NWS forecasts. Area Forecast Discussions were stated as being extremely helpful by the media. Actual comments from the pubic can be found in Appendix B.

Finding 9: Area Forecast Discussions were found to be extremely helpful to the media during the ice storm.

Storm Impacts

Nearly two million people were without power for several days. In Kansas and Missouri, up to 1000 people were still without power two weeks after the storm. The Federal Emergency Management Agency approved over two million dollars in disaster assistance for 78 counties in Kansas and Missouri. Most of the claims were to assist uninsured or under-insured persons who were unable to stay in their homes due to loss of heat and electricity and had to find alternative living accommodations until power was restored. Some of the claims were also for assistance in minimal repairs to make the home habitable. The ice storm also caused an estimated $20 million damage to forested areas in the Kansas City area. Overall damage in Kansas, Missouri, Indiana, and Michigan was estimated in the hundreds of millions of dollars. In Morton, Illinois, a power line fell on a house, started a fire, and burned the home to the ground. Some basements flooded due to loss of power to sump pumps.

NWS employees in the Kansas City, Northern Indiana, and Detroit offices were significantly impacted by the power outages. Some in Kansas City were without power for up to a week. Central Region Headquarters coordinated with the Kansas City WFO and Missouri Basin River Forecast Center in Pleasant Hill, MO, in an effort to provide assistance to affected employees. All employees independently worked out their own arrangements.

Software Problems

Finding 10: Some zone forecasts were delayed when the Graphical Forecast Editor (GFE) gridded snow accumulations would not transfer to the Interactive Guidance Revisor (IGR), forcing manual entry of amounts. This was reported to NCF who were aware of the bug. It is addressed in AWIPS maintenance release 5.1.2.2.

Finding 11: IGR would not create phraseology to reflect precipitation phase transition. It created "rain and snow," but did not accommodate "rain changing to snow." This phraseology is supported in AWIPS build 5.2.1.

Finding 12: Manual modifications to worded forecasts were required to mitigate the problems cited above and other software deficiencies. However, manual edits are lost when updates are generated with the Interactive Forecast Preparation System (IFPS). This problem is also addressed the AWIPS maintenance release 5.1.2.2, however, Central Region IFPS focal point advised against manual editing of products to ensure consistency.

Finding 13: The Universal Generic Code (UGC) for Winter Storm Warnings (WSW) coded ending time is the time to expect the next product update, not the time the warning expires. However, some media programs decode the ending time as the expiration time only. When a WSW was not updated prior to the product ending time, some cable television systems discontinued broadcasting the warning.

Recommendation: Ensure NWS forecasters understand NWS policy that the purge time of a segmented product such as the WSW, reflects when the next update will be issued, not the expiration time of the event (unless it is the cancellation statement).

Action: MICs should review the Weather Service Operations Manual (WSOM) C-42 OML 4-98 section VI. B. regarding product purge time versus expiration time.

Finding 14: Difficulties with the Watch Warning Advisory application caused a county advisory to be lost in the software while the same advisory for an adjacent county was upgraded to a warning.

Hardware Problems/Equipment Outages

Hardware Problems/Equipment Outages are described in Appendix C.

Appendix A
WFO verification Statistics for the Winter Storm, January 28-31, 2001

WFO	WFO Location	State	# WSWs Issued	# WSWs verified	# WSWs not verified	# events not warned	# events	# WSWs preceded by watch	Total Lead Time (LT) (hours)	POD	FAR	AVG Lead Time (hours)
			A + C	A	C	B	A + B			A/(A+B)	C/(A+C)	LT/(A+B)
DDC	Dodge City	KS	27	27	0	2	29	10	825	0.93	0.00	28.45
DMX	Des Moines	IA	28	16	12	3	19	28	264	0.84	0.43	13.89
DTX	Detroit	MI	17	17	0	0	17	17	156	1.00	0.00	9.18
DVN	Quad Cities	IA	36	31	5	0	31	36	644	1.00	0.14	20.77
EAX	Kansas City	MO	44	44	0	0	44	44	921	1.00	0.00	20.93
FSD	Sioux Falls	SD	8	8	0	1	9	0	26	0.89	0.00	2.89
GID	Hastings	NE	30	30	0	0	30	25	438	1.00	0.00	14.60
GJT	Grand Junction	CO	14	12	2	0	12	6	167	1.00	0.14	13.92
GLD	Goodland	KS	13	13	0	2	15	10	312	0.87	0.00	20.80
GRB	Green Bay	WI	22	17	5	0	17	0	75	1.00	0.23	4.41
GRR	Grand Rapids	MI	19	18	1	0	18	18	190	1.00	0.05	10.56
ICT	Wichita	KS	26	26	0	0	26	26	652	1.00	0.00	25.08
ILX	Central Illinois	IL	17	9	8	0	9	9	106	1.00	0.47	11.78
IWX	Nrn Indiana	IN	20	20	0	2	22	20	236	0.91	0.00	10.73
LBF	North Platte	NE	0			2	2	0	0	0.00		0.00
LOT	Chicago	IL	24	18	6	0	18	18	162	1.00	0.25	9.00
LSX	St. Louis	MO	18	11	7	0	11	11	8	1.00	0.39	0.73
MKX	Milwaukee	WI	1	1	1	1	2	0	6	0.50	0.50	3.00
MPX	Minneapolis	MN	9	8	1	2	10	0	24	0.80	0.11	2.40
MQT	Marquette	MI	5	5	0	1	6	0	46	0.83	0.00	7.67
OAX	Omaha	NE	36	32	4	0	32	24	534	1.00	0.11	16.69
PUB	Pueblo	CO	10	6	4	0	6	6	177	1.00	0.40	29.50

SGF	Springfield	MO	6	6	0	0	6	6	6	1.00	0.00	1.00
TOP	Topeka	KS	23	23	0	0	23	23	406	1.00	0.00	17.65
CR	Central Region		453	398	56	16	414	337	6381	0.96	0.12	15.41

Appendix B
Customer/Partner Response

WFO Wichita, KS (ICT)
Comments from Emergency Managers

"Warnings were all good. Barton County pre-treated all bridges and stop signs on Tuesday night based upon the weather reports. I think the reports were timely considering this was a snow event and it seems like they are always hard to predict.", Amy Miller, Barton County.

"Your forecasts were excellent and right on the money. It enabled us to pass the information along to the critical personnel who would most be affected (fire, EMS [Emergency Managers], law enforcement) as well as alerting our county departments well ahead of time."

"Great job."

Jim Lazelle, Emergency Manager for Arkansas City and area hit with significant accumulations of ice, stated the numerous products leading up to the storm convinced him to go to the grocery store prior to the onset of the weather. This was the first time he had ever done that.

WFO Detroit, MI (DTX)

"DTX AFD's should get the AFD of the year award! Excellent detail with the meteorology...." - Paul Gross, WDIV-TV Detroit (NBC).

"Your AFD's are great with detail and meteorology. The RDF [Revised Digital Forecast] is a wonderful product..." - Dave Rexroth, WXYZ-TV Detroit (ABC).

"You guys nailed the forecast!" - Marc Breckinridge, Director, Washtenaw County Emergency Management (Ann Arbor).

Wayne County Road Commission and many of the local media outlets called the WFO to thank them for the long lead time.

WFO Chicago, IL (LOT)

WGN TV meteorologist, Tom Skilling, called WFO to commend the staff for a "great job [with] lead time...warnings ... all good".

Chicagoland Television, CLTV, local news broadcaster, Rick DiMio, made a point of calling the WFO to compliment the excellent service.

WFO Kansas City (Pleasant Hill), KS (EAX)

Emergency Manager, Mike Karl, had high praise for NWS performance during ice storm. "Great job...no negatives! We have a strong relationship with Pleasant Hill...especially like the new graphics on the web."

All Kansas City television stations called the office to commend NWS staff for issuing watch much earlier than is typical. Many newscasts praised the early warning which allowed communities to prepare to respond.

WFO Dodge City, KS (DDC)

School district in Dodge City, KS area commented they were happy to get advanced lead time. They made plans for school closings one day before the weather began.

WFO Green Bay, WI (GRB)

Steve Brown, WJFW, Rhinelander: "I think your office did a good job with nowcasts and releasing public information statements with snowfall totals. I used your snow total statement to make a graphic for my 5 & 10 pm weathercasts on Friday. I enjoy sharing info with your office. I always find your discussions useful, so I don't mind helping out at all."

Mike Breunling, WSAW, Wausau: "...I was glad at the quick decision to issue the Winter Storm Warning from GRB."

Kevin Usealman, WLUK, Green Bay: "The only comment that I am hearing is the last minute adjustment for the Winter Storm Warning caused some confusion. That's the breaks though, I suppose, it happens to all of us. On the other hand, I think it was better that you caught the trend developing when you did than not at all."

WFO Marquette, MI (MQT)

On the 11 p.m. news broadcast Jan 31, the chief Meteorologist on the local NBC affiliate credited the National Weather Service for doing an excellent job in getting the warning out and correctly forecasting the event, which previously had looked like it would stay to the south and east of the forecast area.

The Mining Journal (Marquette's daily newspaper):"Despite the heavy snow and poor visibility as northeast winds gusted up to 32 miles an hour, state police reported no motor vehicle accidents during the event, likely due to motorists heeding the warnings and advisories."

Appendix C
Hardware Problems/Equipment Outages

Please refer to Appendix D for Definition of Acronyms

WFO Topeka, KS (TOP)

All systems operated normally, with the exception of the ASOS wind sensors at Emporia and Lawrence, which froze up toward the end of the event. Emporia had no wind reports from after 8 p.m. CST, January 30 until 1 p.m. CST January 31. Lawrence winds were out for 2.5 hours around noon Thursday, January 31.

WFO Des Moines, IA (DMX)

NOAA Weather Radio in Des Moines was on low power due to ice on the tower on 1/30/01.

Had problems transmitting information to DTN Rest Area Monitors. The Data Acquisition Program Manager is working on the problem for future events. Message was finally sent to DTN via e-mail and not by file transfer.

ASOS outages during the event included:

1/29/02 Estherville, IA - Priority 1, multi wind sensor errors.
1/30/02 Estherville, IA - Priority 2, present weather sensor, multiple errors.
Mason City, IA - Priority 1, present weather sensor, multiple errors.

WFO Detroit, MI (DTX)

Most systems operated normally. The AWIPS WAN became briefly unstable at the event onset, but this was monitored well by the NCF and did not impact operations. The AWIPS SBN dish accumulated snow and ice for a brief period during the event which degraded signal reception at the WFO. ASOS wind sensors at Detroit, Ann Arbor, Ypsilanti, and Adrian all froze during the event. An additional two people were required to launch the 00 UTC 1 February radiosonde due to the accumulation of ice in the launching area.

WFO Kansas City (Pleasant Hill), MO (EAX)

Most office systems functioned normally during the event. Radar went to emergency power Tuesday afternoon, January 30 and remained on the generator until Monday February 4, 2002 as commercial power was not deemed stable enough during this time period. The facility switched to emergency power midday Wednesday as power outages increased in area, and remained on generator through Monday, February 4. Prior to the storm, on Monday, January 28, it was discovered that the generator transmitter switch was not operating properly. The switch was repaired and worked fine during the ice storm. AWIPS satellite dish handled icing well. NWWS satellite dish was out of service Wednesday morning, January 31 due to malfunction of de-icer. DynCorp determined dish and de-icer pads needed to be replaced. Repair was

completed Wednesday, February 6. Numerous ASOS icing problems at all nine ASOS sites. More significant problems occurred at MCI, OJC and IXD. MCI (Kansas City International airport) was considered a high priority and electronics technicians went to the site during the storm and took care of the icing problems. The other sites, much more distant from the office, were not visited physically due to dangerous conditions during the initial ice storm. The technicians were able to clear errors remotely for those sites during the day of the ice storm. During the days to follow they visited sites physically to clear ice from wind towers and visibility sets as needed. The Maryville NWR transmitter was out of service Wednesday, January 30 from 10 a.m. to 1:45 p.m. CST due to a transmitter site problem.

WFO Hastings, NE (GID)

Weather sensor on Grand Island, NE, ASOS malfunctioned. No other problems.

WFO Dodge City, KS (DDC)

All systems worked well. WSR-88D rainfall estimates were high where mixed phase precipitation occurred and light in areas which received heavy snowfall. The AWIPS WAN was in dial backup mode from about 9:00 p.m. CST January 30 through 6:05 a.m. January 31.

WFO Chicago, IL (LOT)

Several ASOS failures such as a tipping bucket due to icing. WSR-88D was useful for defining transition area from frozen to liquid/freezing precipitation and its movement.

WFO Wichita, KS (ICT)

NWR outage at Erie, KS, occurred due to power and telephone company services being out of service from ice storm Wednesday, January 30, and was back in service Thursday evening, January 31.

WFO Central Illinois (ILX)

Based upon the one significant icing event during the evaluation period, the ASOS ice accretion test equipment at Peoria, IL performed well.

WFO North Webster, IN (IWX)

Radar went to emergency power 7 a.m. EST, Thursday morning, January 31 and remained on the generator until 4:30 p.m. EST Friday, February 1. The RDA had to be manually restarted by an electronic technician Thursday morning. The facility was switched to emergency power numerous times Thursday. The SBN lost power Thursday afternoon and evening. The NWR at North Webster went off the air early Friday morning, February 1, but was returned to service by 7 a.m. EST Friday (not related to the weather). Office phones were out of service around 5:30 a.m. Friday morning and returned to service about 9:30 a.m. Friday. Many of the ASOS sites

required maintenance due to wind equipment or tipping buckets freezing up, or freezing rain sensors failing.

WFO Springfield, MO (SGF)

Joplin ASOS wind sensor froze otherwise no NWS equipment outages. A fiber optic cut in the Kansas City area Wednesday night, January 30, resulted in the loss of the Internet for a portion of the event.

WFO St. Louis, MO (LSX)

UIN and COU ASOS wind instruments failed due to icing between 3 and 4 a.m. CST, January 30.

The 800 telephone line into the office failed sometime during the early morning hours of Wednesday, January 30. This line is used by many observers to call in precipitation reports. The local telephone company was very unresponsive to the outage. The problem was not fixed until Thursday afternoon, January 31. Because of this outage, office personnel had to make many calls to observers to get precipitation reports.

WFO Paducah, KY (PAH)

The Evansville leased radar was out of service from late Tuesday, January 29, until Wednesday, January 30, due to an AT&T communications issue.

Appendix D
Definition of Acronyms

AFD	-	Area Forecast Discussion
ASOS	-	Automated Surface Observing System

ASOS location names

MCI	-	Kansas city, MO (International Airport)
OJC	-	Olathe, KS (Johnson County Executive Airport)
IXD	-	Olathe, KS (New Century Airpark)
UIN	-	Quincy, IL
COU	-	Columbia, MO

AVG	-	Average
AWIPS	-	Advanced Weather Information Processing System
CR	-	Central Region
CRH	-	Central Region Headquarters
DTN	-	Data Transmission Network
EM	-	Emergency Manager
FAR	-	False Alarm Rate
GFE	-	Graphical Forecast Editor
HPC	-	Hydrometeorological Prediction Center
IFPS	-	Interactive Forecast Preparation System
IGR	-	Interactive Guidance Revisor
MIC	-	Meteorologist in Charge
MRF	-	Medium-Range Forecasts
NCF	-	Network Control Facility
NCRFC	-	North Central River Forecast Center
NWR	-	NOAA Weather Radio
NWS	-	National Weather Service
NWWS	-	NOAA Weather Wire Service
OML	-	Operations Manual Letter
POD	-	Probability of Detection
RDA	-	Radar Data Acquisition
RDF	-	Revised Digital Forecast
RUC	-	Rapid Update Cycle
SBN	-	Satellite Broadcast Network
UGC	-	Universal Generic Code
UP	-	Upper Peninsula
UTC	-	Coordinated Universal Time
WAN	-	Wide Area Network
WCM	-	Warning Coordination Meteorologist
WFO	-	Weather Forecast Office
WFO locations		(see appendix A)
WSOM	-	Weather Service Operations Manual

WSR-88D	-	Weather Surveillance Radar-88 Doppler
WSW	-	Winter Storm watch/warning/advisory