

Natural Disaster Survey Report

**MAY 31, 1998 EASTERN NEW YORK AND
WESTERN NEW ENGLAND TORNADO AND
SEVERE WEATHER OUTBREAK**



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service, Albany, New York

PREFACE

Severe convective storms are one of the many destructive forces of nature. It is always a humbling experience to view the devastation first hand and a difficult experience to interview individuals who have lived through such a tragedy. Unfortunately, it is only through disasters such as this that the National Weather Service and the hazards community can fully assess its warning procedures and capabilities.

I would like to express my gratitude to the NWSFO Albany Disaster Survey Team for its objectivity in producing this survey report on the performance of the National Weather Service during this event.

**John T. Forsing
Director
National Weather Service Eastern Region
June 1998**

FOREWORD

This report on the May 31, 1998 Eastern New York and Western New England Tornado outbreak was prepared by a Disaster Survey Team from the National Weather Service Forecast Office at Albany, New York, after four days of field surveys and interviews.

The Disaster Survey Team is grateful to the many state and local officials who took time to share their impressions of events before, during, and after the storm's onslaught. The Team also appreciates the understanding and courtesy of the many citizens who consented to interviews while still trying to comprehend and deal with the disaster that struck their communities.

This document chronicles the storm system's approach to the region, its damage paths, and actions taken by National Weather Service forecasters. It attempts to accurately assess the National Weather Service's performance and to determine what further improvements are possible in forecasting and warning for severe convective storms.

The Disaster Survey Team

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ACRONYMS

AFOS	Automation of Field Operations and Services
ASOS	Automated Surface Observing System
BWER	Bounded Weak Echo Region
CESTM	Center for Environmental Science and Technology Management
COMET	Cooperative Program for Operational Meteorology, Education, and Training
CWA	County Warning Area
DAPM	Data Acquisition Program Manager
EAS	Emergency Alert System
EDT	Eastern Daylight Time
EOC	Emergency Operations Center
ET	Electronics Technician
NAWAS	National Warning System
NEXRAD	Next Generation Weather Radar
NOAA	National Oceanic and Atmospheric Administration
NWR	NOAA Weather Radio
NWS	National Weather Service
NWSFO	NEXRAD Weather Service Forecast Office
NWSO	NEXRAD Weather Service Office
NYSP	New York State Police
NYSPIN	New York State Police Information Network
PUP	Principle User Processor
SAME	Specific Area Message Encoder
SOO	Science and Operations Officer
SPC	Storm Prediction Center
SRM	Storm Relative Velocity Map
TVS	Tornadic Vortex Signature
WCM	Warning Coordination Meteorologist
WSR-88D	Weather Surveillance Radar - 1988 Doppler

Disaster Survey Team

After a severe weather event, a disaster survey team is often dispatched from the local NEXRAD (Next Generation Weather Radar) Weather Service Forecast Office (NWSFO) to evaluate the role played by the National Weather Service (NWS), provide an objective appraisal, and make findings and recommendations.

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EXECUTIVE SUMMARY

During the morning of May 31, 1998, a warm front moved quickly north across the region. Rapid destabilization occurred during the afternoon as a cold front pressed southeast into New York. Lines of severe thunderstorms formed and moved rapidly east across New York and Western New England. These storms became tornadic over Saratoga, Albany and Rensselaer Counties, New York, Bennington County, Vermont and Litchfield County, Connecticut. Straight line wind damage occurred across the NWSFO Albany County Warning Area (CWA). Cloud to ground lightning rates over the region reached an unprecedented 15,000 strokes per hour.

These storms resulted in 68 injuries but no fatalities, tens of millions of dollars in damage to homes and businesses, and extensive forest damage. Power was out to over 130,000 customers at the storm's peak, and 12,000 lacked power for over three days.

NWS warnings and advance notice of severe weather potential were recognized by the media and New York Governor, George E. Pataki, as playing a major role in preventing loss of life in eastern New York during the event. NWS warnings were relayed via the Emergency Alert System (EAS) and NOAA Weather Radio (NWR). Even after NOAA weather radio station WXL34 failed, though, WGY radio received NWS warnings on their wire service, and directly activated EAS with them. Warnings were also relayed to Emergency Operations Centers (EOC) via Amateur Radio.

Between May 31 and June 3, 10 survey teams from NWSFO Albany traveled across the affected areas to assess damage, and identify storm tracks and characteristics. Areal surveys were performed with WNYT Television and the New York State Police (NYSP).

Several factors contributed to preventing loss of life in this event. NWS forecasts began highlighting the severe potential as early as Saturday afternoon. The potential for tornadoes was highlighted further, early Sunday morning, in statements and a watch. During the event a total of 48 warnings were issued; 45 verified. Many of the tornado warnings were verified with straight-line winds. The warning for the Stillwater-Mechanicville tornado in Saratoga County had a lead time of 39 minutes.

The 48 warnings issued for this event were the most issued by this office for any single event in the last 20 years. Average lead time for all tornado warnings was 21 minutes, and for all warnings was 22 minutes. Local media effectively used program break-ins and crawlers for the numerous warnings, further heightening public awareness.

CHAPTER 1

HYDROMETEOROLOGICAL SETTING

During the morning hours of Sunday, May 31, 1998, a warm front moved rapidly north across New York and Western New England. Later in the day, upper level divergence rapidly increased, the 850 hPa jet increased to over 50 knots and helicity values increased to between 500 and 800 $\text{m}^2 \text{s}^{-2}$ in the highly sheared environment. Low level moisture increased rapidly as dew points rose from 8°C to 22°C during the day, resulting in rapid atmospheric destabilization.

Also during the morning hours, a Derecho moved across southern Ontario and decayed as it moved into the Adirondacks. It established boundaries which focused later convection. During the afternoon a cold front pressed southeast into western New York and a series of lines of thunderstorms formed ahead of it.

Thunderstorms developed explosively as they moved east across the region. Several of these storms became tornadic. The most long lived tornadic thunderstorm produced tornadoes in the Saratoga County towns of Halfmoon and Stillwater, the City of Mechanicville, and then moved across northern Rensselaer County, including the town of Schaghticoke and into Bennington County, Vermont. The tornado was classified F3, but east of the Hudson River damage was primarily F2.

An F2 tornado occurred in East Schodack, while an F1 tornado moved across the Albany International Airport and an F1 occurred in Litchfield County, Connecticut.

Major severe weather outbreaks such as this are not uncommon across the Northeast. Recent occurrences include July 3, 1997, July 15, 1995, May 29, 1995, July 20,21,24,25,26, 1994, July 5, 1992, May 2, 1992, August 28 1990, July 10, 1989, August 28, 1988, July 14, 1988, June 22, 1988 and July 26, 1986.

Finding 1.1

The tornadoes of May 31, 1998 were caused by scattered, supercell thunderstorms embedded within a squall line in a highly sheared environment. Most of the other severe thunderstorm wind damage was associated with a series of squall lines which moved across the region at speeds of 40 to 60 mph.

CHAPTER 2

STORM CHRONOLOGY

Maps of tornado tracks based on ground truth and aerial surveys of the damage paths appear in Appendix C, (Doppler Weather Surveillance Radar (WSR-88D) imagery in Appendix D, Damage photographs in Appendix E and detailed damage survey reports appear in Appendix F.

Halfmoon, New York to South Shaftsbury, Vermont Tornadoes

At 4:22 p.m. EDT, an F1 tornado touched down at Ushers Road in the Town of Halfmoon in Saratoga County, New York. The tornado had a ground speed of 45-50 knots as it moved due east into the City of Mechanicville. The tornado increased in intensity becoming an F3 multiple vortex tornado as it entered the Mechanicville city limits. Eyewitnesses reported a large vortex with three smaller vortices rotating around it. The tornado first destroyed the DiSiena Furniture Company at the corner of State Route 67 and Round Lake Avenue. The tornado then tracked over Viall Hill where much of a large housing development was devastated. It then moved down the east side of the hill into the Riverside area of the town of Stillwater, where many homes, businesses and several large warehouses were destroyed or sustained heavy damage.

The tornado crossed the Hudson River into Rensselaer County around 4:27 p.m. EDT, quickly decreasing in intensity from F3 to F2 with extensive tree damage and some building damage along Knickerbocker Road, Weir Road, Stillwater Bridge Road, Hemstreet Road, Verbank Avenue, along the Intersection of State Route 67 and State Route 40, Geary Road and Master Street in the Town of Schaghticoke. The tornado then followed the Hoosic River as it entered Valley Falls and moved through the northern portion of the town of Pittstown. The tornado maintained a damage swath of 0.6 mile wide, from Mechanicville to between Johnsonville and Millertown before taking on a discontinuous track through the higher terrain of Rensselaer County. Once the Tornado moved east of County Route 111, its path became discontinuous and the intensity decreased to F1.

The tornado path became continuous again in the Town of Hoosick and increased in intensity to F2 as it traveled along Eddy Road and Tate Road, where several farms received extensive damage. A 60 ton silo and barn were leveled at the Lukeland Dairy Farm on Tate Road where nine cows were killed. The tornado path width was approximately 400 yards wide at this point. The tornado decreased in intensity to F1 when it reached Cottrell Road in extreme

Northeastern Rensselaer County.

The Tornado then moved across the state line into North Bennington and South Shaftsbury following Route 67, where several thousand trees were damaged or sheared apart, and 20 to 25 homes sustained damage. The tornado ended two miles east of South Shaftsbury along Lower East Road.

East Schodack/Nassau Tornado

The tornado first touched down on Palmer Road about two miles east of Interstate 90. The East Schodack Fire Chief and crew observed a multiple vortex funnel north of the fire station at exactly 7:28 p.m. EDT. Tornadic damage was observed on Route 150, about a half mile south of Shiver Corners, where a solid brick house was surrounded by downed trees and power lines. Trees were downed in a crisscross pattern, and the few trunks left standing had been stripped of their leaves and small branches. About 20 yards west of that house, a barn was destroyed. The barn was reasonably well built, with a recent addition. The addition was completely demolished; siding and two by fours were scattered for nearly a mile through fields and woods. Estimated winds were 115 mph.

A tenth of a mile further north along Route 150, another house was pitted by small debris. A large hardwood tree in front of that house had been torn apart, and a small outbuilding behind the house was demolished. Across the street from this second house, another barn stood. It had only minor roof damage, but a two by four, from the barn mentioned above, had been driven into the south facing wall. Estimated winds were 100 mph.

Three quarters of a mile east of the above location, the damage path crossed Morris Road. An older house stood there, surrounded by large, downed or uprooted trees. One tree had fallen on an outbuilding, significantly damaging it. A garage across the road had its overhead door caved in by a falling tree. Estimated winds were 100 mph.

Three quarters of a mile further east, the damage path crossed North Schodack Road where a garage/barn was demolished. The walls had been knocked out from under the roof section, and the roof was on top of a pile of debris from the walls. Strips of roofing metal were in trees across the road. Several medium size trees had been knocked down across the road as well. Eyewitnesses, who lived a quarter mile south of the damage, described the approaching storm, and how they had taken a house full of baby shower guests to the basement as it approached. Estimated winds were 90 mph. Another three quarters of a mile east, we found tree damage in the middle of the forest. Estimated winds were 80 mph.

Further east at Millers Corners, a mile east of the last location visited, several dozen trees were downed. At a golf course a half

mile east of Millers Corners, a few dozen more trees were down. Just east of the golf course, North Nassau Road was blocked by large fallen trees. Near the intersection of North Nassau Road and Totem Lodge Road, another barn was destroyed, and a tractor moved from one side of a house to the other. Mr. Bornhorst, Nassau Fire Chief, said that the tree damage continued for approximately two more miles, crossing Pikes Pond, before dissipating at Alps Mountain. Estimated winds were 80 to 115 mph based upon Mr. Bornhorst's descriptions of the damage.

Albany Airport Tornado

A 50 yard wide swath of significant tree damage was found oriented in a west to east direction across Interstate 87, just south of Route 7. Additional damage was found for about 100 yards east of the interstate. The path of damage extended westward with occasional tree damage to near the Air National Guard facility at the Albany International Airport. Further west, this damage path was found to cross the Albany ASOS unit, where an 82 MPH wind gust was reported at 4:40 p.m. EDT.

Additional, scattered tree damage was found west of the airport; as far as one-half mile west of Memory Gardens Cemetery. The most widespread damage was near the Hilton Hotel where several trees were uprooted or sheared off. All the damage observed appeared to be along a straight path for the entire length.

An airport employee and contract observer, who was in the airport control tower during the event, observed a funnel cloud during the storm and augmented the ASOS observation to include this sighting. The employee reported the funnel cloud moved along, or very near, the damage path observed by the survey team. However, the employee stated that the funnel cloud was rain wrapped. The path length was three miles and path width 50 to 75 yards. The tornado was not on the ground continuously.

New Preston, Litchfield County, Connecticut Tornado

At approximately 9:30 p.m. EDT a rope funnel was observed at New Preston, Connecticut by the Litchfield County Skywarn Emergency Coordinator. A later survey located about a 50 foot wide and 0.25 mile long path facing Rock Hill, about 1.5 miles southwest of the village of Washington. Damage was to a forest, where all trees were knocked down. The damage path was in a west to east direction.

Finding 2.1

One tornadic thunderstorm produced two distinct tornadoes in a fairly continuous path of 30.5 Miles with a maximum width of 0.6 miles from Halfmoon, Saratoga County, New York, to South Shaftsbury, Vermont. The first Tornado track was F2-F3 in Saratoga County from the town of Halfmoon, through Stillwater, crossed the Hudson River and weakened to F1-F2 in Rensselaer County from the

town of Schaghticoke to Hoosick, 25.0 Miles in length. The second track was F1-F2 in Bennington County, Vermont from the town of Bennington to the town of Shaftsbury, 5.5 miles in length.

Finding 2.2

A tornado (F0-F2) touched down in East Schodack, Rensselaer County, and tracked in a northeasterly direction to Nassau. The track was 10 miles long, about 200 yards wide and had several breaks.

Finding 2.3

An F0 to F1 tornado moved along a three mile track in Colonie, Albany County. The tornado path began west of the airport, crossed airport property and moved east toward the Latham water towers before dissipating. The tornado was not on the ground continuously.

Finding 2.4

An F1 tornado path was 50 feet wide and moved along a track of .25 mile in New Preston, Litchfield County. The Tornado path crossed a largely wooded area.

Finding 2.5

The rationale supporting the issuance of 36 Tornado warnings during this event included numerous funnel cloud reports, a significant tornado across Saratoga County, frequent, high WSR88D gate to gate shear, WSR88D reflectivity characteristics and highly favorable environmental conditions. These included extreme helicity, large CAPE, and extreme Maglenta (Maglaras & LaPenta, 1997) values.

CHAPTER 3

PROVISION OF WARNINGS, FORECASTS AND NWSFO ACTIONS

Forecasts issued 3:00 p.m. EDT, Saturday afternoon, May 30, highlighted the potential for severe thunderstorms with damaging winds and large hail. Several statements issued around 4:00 a.m. EDT, May 31, highlighted the potential for isolated tornadoes, damaging winds of 60 to 80 mph, large hail, and one to two inches of rain. The Storm Prediction Center (SPC) outlooked New York and western New England as high risk areas for severe thunderstorms. Arrangements were made for additional staffing in anticipation of a major event. All the severe weather positions were staffed and SKYWARN was activated. Twelve staff members were on duty at the height of the event.

Electronics Technicians were called in during the morning to ensure the WSR-88D radar, archive II and other equipment were operating properly. A Tornado watch was issued at 8:12 a.m. by SPC for northern areas of New York. A statement was issued at 10:17 a.m. EDT emphasizing the threat, and another was issued at Noon, Sunday, highlighting "This is a dangerous situation" for all areas in the forecast area.

Six nowcast packages were issued during the late morning and early afternoon with three bullet nowcasts for the southern Adirondack area during the early afternoon.

The first of 48 severe weather warnings was issued for Hamilton and Herkimer Counties at 1:03 p.m. EDT. At 2:45 p.m. EDT, SPC issued a Tornado Watch for most of New York, south of the High Peaks, Southern Vermont, Berkshire County, Massachusetts, and Litchfield County, Connecticut.

The pace increased rapidly during the afternoon as several squall lines formed and raced east. During the afternoon and evening 36 Tornado Warnings, 12 Severe Thunderstorm Warnings, 19 Severe Weather Statements, four Special Weather Statements, four TAPS, four OPUs and 13 nowcasts, were issued; 45 of 48 severe weather warnings verified. Thirty-five of the 36 tornado warnings issued verified, but only seven tornadoes were confirmed. Two events of damaging thunderstorm winds and hail occurred without warnings. The Saratoga County tornado warning had a lead time of 39 minutes. Verification tables and issuances appear in Appendices A and B.

Office computers, the WSR-88D, and all other operational equipment operated normally with the following exceptions:

1. NWR station WXL-34 serving the Lake George - Saratoga Region, Eastern Mohawk Valley, Capital District, and Northern Catskills went off the air at about 5:35 p.m. EDT, and was off the air for the remainder of the event. The NWR outage was later determined to have been caused by lightning striking the phone line to the transmitter. Bell Atlantic was called; service was not restored until June 1.

2. At Approximately 5:00 p.m. EDT, the first of several power interruptions occurred at the Center for Environmental Science and Technology Management (CESTM) facility. While mainly affecting office lighting, the WXL-34 and backup NWR Specific Area Message Encoder (SAME) units failed. Meteorologist, Jonathan L. Blaes, reprogrammed the former Mt. Greylock Unit to serve the WXL-34 transmitter. Electronics Technician (ET), Michael P. Wilson, was called in to work on the SAME Unit and NWR outage. He remained on station, assisting staff with additional minor equipment problems. Other power interruptions occurred during the evening.

3. The Automation of Field Operations and Services (AFOS) crashed numerous times during the event. All functions were alternately being run on the A side or B side while attempts were made by ETs to restore full function. The A side asynchronous line multiplexer was locked up.

4. For 17 minutes between 4:24 p.m. and 4:41 p.m. EDT, AFOS had the wrong time. Warning dissemination was not affected.

5. The Binghamton WSR-88D Principal User Processor (PUP) console was down from 6:30 p.m. to 8:00 p.m. EDT. NWSFO Albany provided backup, advising Binghamton on storms in Chenango, Otsego and Delaware Counties.

6. The Weather Wire uplink failed between 9:00 p.m. and 10:00 p.m. EDT, however, service was supplied via the backup through the Buffalo NWSFO.

7. Several power outages occurred at the CESTM facility, leaving the office dark momentarily more than once. Impact was limited to lighting and possibly NWR.

Finding 3.1

Kenneth D. LaPenta and Jonathan L. Blaes issued a Tornado warning for Saratoga County at 3:43 p.m. EDT, Sunday, May 31, 1998. This warning provided residents of Mechanicville and Stillwater 39 minutes lead time of the F3 tornado which touched down at 4:22 p.m. EDT. A Severe Weather Statement was issued at 4:21 p.m. EDT, refining the tornado track. Many heard the warning on radio, TV, The Weather Channel or NWR, and took shelter. No fatalities occurred directly associated with the tornado, and most of those injured either did not require hospitalization, or were treated and released.

Finding 3.2

Forecasts, Statements and a Public Information Statement on Tornado Safety rules issued Saturday afternoon and early Sunday heightened awareness of the impending event. Issuances stressed the potential for Tornadoes, the danger of the situation, and advised actions to take.

Finding 3.3

On May 31, forecasters at NWSFO Albany, New York, issued 48 severe weather warnings, of which 45 verified with an average lead time of 22 minutes.

Finding 3.4

On May 31, forecasters at NWSFO Albany, New York, issued 12 Severe Thunderstorm Warnings of which 10 verified with an average lead time of 24 minutes.

Finding 3.5

Several times during the event, particularly between 6:30 p.m. and 8:00 p.m. EDT, forecasters at NWSFO Albany, New York provided information to the staff at NEXRAD Weather Service Office (NWSO) Binghamton, New York, concerning storms in their CWA.

Finding 3.6

When power transferred from commercial to generator in the CESTM facility, lights went out for several seconds. Also, after one of these interruptions the WXL-34 and backup SAME units failed.

Recommendation 3.6a

Install or modify office lighting to provide minimal lighting during power transfers at night.

Recommendation 3.6b

Ensure all NWR components are on UPS power.

Finding 3.7

NOAA Weather Radio station WXL-34 went off the air about 5:30 p.m. EDT and remained off the air throughout the rest of the event. The outage was due to lightning striking the telephone line to the

transmitter. Bell Atlantic was unwilling to jeopardize their technicians in the ongoing lightning storm, and was thus unable to restore service. The office received numerous complaints from the public, the media and emergency managers.

Recommendation 3.7

Explore more reliable or backup methods to send broadcast from office to NWR transmitters.

Finding 3.8

On May 31, forecasters at NWSFO Albany, New York issued 36 Tornado warnings, of which 35 verified based on the NWS verification criteria. Average lead time on tornado warnings was 21 minutes. However, only seven were verified by confirmed Tornadoes.

Recommendation 3.8

Conduct a study using the 48 warned storms from this event to develop methodologies which would allow forecasters to better discern between which thunderstorms were tornadic and which were not. Compare structure, shear, and other parameters of those storms which produced tornadoes with those that did not.

CHAPTER 4

DATA COLLECTION

Forecasters basis for heightening public awareness in statements and forecasts Saturday and early Sunday was the thorough use of gridded data, model sounding data, and application of the NWSFO Albany derived Maglenta Equation (Maglaras & LaPenta, 1997) to estimate tornadic potential. Model sounding and gridded data provided insight to the magnitude of helicity, the three dimensional wind fields, and was used as input to Maglenta Equation. Expectations for a major severe weather event were further supported by guidance from the SPC, particularly the placement of the region in the "High Risk" category.

The information that formed the basis for warnings was primarily the WSR-88D products, SKYWARN spotter and Amateur Radio reports and a thorough understanding by the Warning Desk staff of the meteorological environment evolving across the region.

Key factors leading to tornado warnings with positive lead times included Warning Desk (radar) operator experience, the culmination of knowledge obtained through extensive study of New York tornadic thunderstorms, training, occurrence during prime media time, and excellent SKYWARN spotter reports via Amateur Radio.

The Warning Desk operators during the event have been lead authors in several Cooperative Program for Operational Meteorology (COMET) projects and/or articles on Northeast U.S. tornado and severe thunderstorm events. They have shared their knowledge with all staff through articles and training guides including, "Supercells over Complex Terrain: The Great Barrington Tornado of 29 May 1995" (Bosart et al, 1996), "Radar Characteristics of the 15 July 1995 Northeastern U.S. Derecho" (LaPenta et al, 1998), "WSR88D Severe Thunderstorm Warning Guidelines" (LaPenta & Maglaras, 1996), "Forecasting Tornadic vs. Non Tornadic Thunderstorms" (LaPenta & Maglaras, 1995), and an ongoing review of the July 3, 1997 tornado event by Bosart, LaPenta & Quinlan.

Radar Observations

Halfmoon, NY to South Shaftsbury, VT Tornadoes

A tornado warning was issued for southern Herkimer, Fulton and Montgomery Counties at 3:24 p.m. EDT, based on high V/R Shear, reflectivity structures, receipt of a Tornado Vortex Signature (TVS) on the WSR-88D and use of the Storm Relative Map (SRM) product. At 3:40 p.m. EDT cell movement indicated this cell would reach Saratoga County shortly. Reports of damage and a possible tornado on the ground near Amsterdam were received about 3:40 p.m. EDT. A warning decision for Saratoga County was required. Based on these factors a Tornado warning was issued for Saratoga County at 3:43 p.m. EDT. As the storm moved into southwest Saratoga County, the high reflectivities persisted but the rotational velocity diminished. At 4:01 p.m. EDT, the mesocyclone began to intensify. By 4:07 p.m. EDT, the couplet was showing increasing rotational velocity and decreasing diameter with a shear of $.029 \text{ s}^{-1}$ at 1.5 degree elevation.

At 4:16 p.m. EDT, a Tornado warning was issued for Washington and Bennington Counties based on status of the Supercell over Saratoga County. Concern about the track crossing a triple point of counties resulted in warnings for two counties at 4:16 p.m. EDT, based on knowledge of the storm at that time. Further refinements of the track using AZRANWHIZ (Wiley,1993) software and WSR-88D storm track data resulted in issuance of a Severe Weather Statement for Saratoga County at 4:21 p.m. EDT, refining the tornado track, specifically mentioning Mechanicville and Stillwater. By 4:22 p.m. EDT, V/R shear reached $.07$ using the $.13$ nautical mile resolution product, and a Bounded Weak Echo Region (BWER) became much more sharply defined. V/R shears reached values comparable to those in the Memorial Day 1995 Berkshire County Tornado.

A Tornado Warning was issued for Rensselaer County at 4:30 p.m. EDT, and for Windham County, Vermont at 5:05 p.m. At 4:55 p.m. EDT, a Severe Weather Statement highlighted Tornadoes moving across Bennington County and listed areas in their path.

Albany Airport Tornado

At 4:10 p.m. EDT, a Severe Thunderstorm warning for Albany County was issued. At 4:35 p.m. EDT, it was upgraded to a Tornado warning based on a Supercell with BWER. At 4:40 p.m. EDT, the Automated Surface Observing System (ASOS) reported a gust of 82 mph, and a funnel cloud was observed by the contract weather observer and by Air Traffic Controllers, who were abandoning the control tower. At 4:45 p.m. EDT, a Severe Weather Statement highlighting dangerous wind gusts over Albany was issued with another at 4:49 p.m. EDT, highlighting tornadoes and winds over 80 mph moving into eastern Albany and Rensselaer Counties.

East Schodack Tornado

A Tornado warning was issued for Rensselaer County at 7:06 p.m. EDT, based on a strong velocity couplet in the northeastern part of the county. Shortly after warning issuance, a new mesocyclone formed over southern Albany County and intensified as it moved into southern Rensselaer County. At 7:32 p.m. EDT, V/R shear reached $.043 \text{ s}^{-1}$. During the time of the tornado, potential tornadic storms were moving out of Otsego and Delaware Counties into Greene and Ulster Counties. Severe Weather Statements were issued refining the Greene and Ulster County tornado warnings, but one was not issued refining the East Schodack tornadic thunderstorm.

Archive II data was recorded from this event, but only because Meteorologist, Carl S. Cerniglia, took the initiative early Sunday to have an ET repair the equipment at the radar site.

Spotter Reports

SKYWARN was activated at 5:35 a.m. EDT, with the morning Hazardous Weather Outlook. Data Acquisition Program Manager (DAPM) Steven R. Pertgen operated in a voluntary capacity to man the Amateur Radio SKYWARN base station, WX2ALY, at 9:00 a.m. EDT. Between 9:00 a.m. EDT, and Noon, Mr Pertgen coordinated and briefed SKYWARN ECs, and ensured nets were up. Reports began coming in around 1:00 p.m. Information was relayed to EOCs. After WXL-34 failed, Amateur Radio was used to provide warnings to the county EOCs. All warnings for Berkshire County, Massachusetts, as well as Bennington and Windham Counties, Vermont, were relayed to EOCs via ham radio. Often SKYWARN reports were coordinated in real time with data the Warning Desk Team had from the radar, leading to better lead time on warnings. All county SKYWARN networks were active with approximately 120 SKYWARN spotters. The Mt. Greylock repeater failed around 7:15 p.m. EDT. Communications were switched to simplex frequency for 20 minutes and then operations were shifted to the Pittsfield Emergency Management repeater. Some SKYWARN spotters sustained damage to their antennas and switched to mobile units. Many calls were received from SKYWARN spotters, by phone, including key reports of funnel clouds.

Finding 4.1

Cooperative research with UAlbany, COMET Projects, and independent research efforts by office staff, prepared them to recognize the threat of tornadoes early and convey it quickly to the public.

Finding 4.2

WSR-88D data, especially V/R shear structure, spotter reports, and Warning Desk operator experience and participation in research, were major factors contributing to the average 21 minute lead time for warnings with the event and the 39 minute lead time for the most damaging tornado.

Finding 4.3

After the failure of WXL-34, warnings were relayed to county EOCs via NWSFO Albany's SKYWARN Amateur Radio station, WX2ALY.

CHAPTER 5

DISSEMINATION, PREPAREDNESS AND PUBLIC RESPONSE

The warning process involves a series of interactive, mutually dependent actions in order to achieve its goal - to maximize the number of people who take timely action and appropriate protective behavior. The warning process can be viewed as an integrated warning system comprised of three functional components. These include a scientific or detection component, an emergency management or warning component, and a public response component. If any one of these components fails, the entire system can fail. In the case of severe weather, the NWS performs both scientific functions of detection, prediction, and emergency management functions of issuing formal warnings through a variety of communication channels.

Dissemination

All warnings during this event, prior to the failure of the transmission line to the Albany NWR transmitter, were disseminated via NWR, NOAA Weather Wire, National Warning System (NAWAS), and the New York State Police Information Network (NYSPIN). NWSFO Albany Meteorologist Intern, Robert J. Barton, successfully utilized the NWR SAME to activate the EAS in the affected areas. After the failure of the Albany NWR, local news radio station WGY, in a strong demonstration of public service by the private sector, voluntarily and without being asked, took the warnings off the NOAA Weather Wire and used their EAS encoder to relay them to other radio stations in the area. At the suggestion of the program director at WAMC radio, a plan is now being developed to provide the Albany NWR audio to WAMC via an existing telephone line, so that SAME/EAS messages can be entered into the EAS network even if the NWR transmitter is off the air.

Communication

The communication process involves two steps: (1) the communication of critical weather information by the NWS to emergency managers, the news media, and other agencies that are part of the public warning process; and (2) the communication of this information via emergency preparedness organizations and the media to those affected. The goal of effective communication is to maximize the number of people who take timely and appropriate protective action.

In the case of the May 31, 1998 tornado outbreak, these steps went satisfactorily. Survey team members interviewed over 50 people in the affected counties. All reported receiving the NWS Tornado Watches and Warnings via NWR, the Weather Channel, Commercial

Radio, Capital District television stations, or Amateur Radio. Follow up interviews with Al Dewey, Saratoga County Emergency Manager, and David Cook, Rensselaer County Emergency Manager, indicated a high level of appreciation for the job provided by NWS during this event.

In the aftermath of the event WTEN Television meteorologist Steve Caporizzo, recognized NWS's "wonderful work" and the fabulous performance of the Doppler radar. (Appendix F). In addition, that station presented a special program on the storm with numerous guests including New York State Governor, George E. Pataki, and NWSFO Albany Science and Operations Officer (SOO), Warren R. Snyder. Recognition and thanks were made of the NWS role on this program as well. A WNYT television crew invited the SOO to accompany them while they surveyed the damage via helicopter, and exceptional footage was obtained for this survey, as well as several interviews. The Warning Coordination Meteorologist (WCM), Richard J. Westergard, and the SOO were also interviewed by local newspapers for feature length articles about the event, how damage surveys are done, and the warning process. Numerous other staff members were interviewed for follow-up stories on this event.

Finding 5.1

In an article appearing in The Saratogian newspaper on Monday, June 1, three separate anecdotes were cited of people watching the sky after hearing watches and warnings, then going to the basement as they observed the storm approaching. In each of those cases, the homes were destroyed, but no one was seriously injured. In addition, a number of people interviewed by survey teams reported that they went to the basement as the storms approached because they had heard watches and warnings, and were frightened by the ominous clouds preceding the storms.

Finding 5.2

Failure of the telephone line to the NWR transmitter took the broadcast off the air, with no backup available, during a tornado outbreak.

Recommendation 5.2

The WCM at Albany should pursue the backup path for EAS activation as suggested by public radio station WAMC.

Finding 5.3

People in tornado affected areas reported receiving the NWS Tornado Warnings, however, as pointed out by several elected officials and emergency managers, a different time of day, when less people were watching television, might have turned out much differently.

Recommendation 5.3

The WCM at Albany should follow up with officials from local communities, who have taken this event as a wake up call, to help

them develop siren alert systems and perhaps to get weather radios into schools, hospitals, and other public places.

Finding 5.4

Generic watches and very specific warnings were enough to get people to watch the sky for threatening storms. But, most took action only when they saw threatening skies approaching.

Recommendation 5.4

Ongoing community preparedness initiatives should continue, making people aware of weather threats to their safety, and improving their understanding of weather bulletins. The goal should be to have people respond to a specific warning mentioning their location in about the same way that they responded to a sighting of green skies and approaching tornadoes.

CHAPTER 6

FINDINGS AND RECOMMENDATIONS

Finding 1.1

The tornadoes of May 31, 1998 were caused by scattered, supercell thunderstorms embedded within a squall line in a highly sheared environment. Most of the other severe thunderstorm wind damage was associated with a series of squall lines which moved across the region at speeds of 40 to 60 mph.

Finding 2.1

One tornadic thunderstorm produced two distinct tornadoes in a fairly continuous path of 30.5 Miles with a maximum width of 0.6 miles from Halfmoon, Saratoga County, New York to South Shaftsbury, Vermont. The first Tornado track was F2-F3 in Saratoga County from the town of Halfmoon, through Stillwater, crossed the Hudson River and weakened to F1-F2 in Rensselaer County from the town of Schaghticoke to Hoosick, 25.0 Miles in length. The second track was F1-F2 in Bennington County, Vermont from the town of Bennington to the town of Shaftsbury, 5.5 miles in length.

Finding 2.2

A tornado (F0-F2) touched down in East Schodack, Rensselaer County, and tracked in a northeasterly direction to Nassau. The track was 10 miles long, about 200 yards wide and had several breaks.

Finding 2.3

An F0 to F1 tornado moved along a three mile track in Colonie, Albany County. The tornado path began west of the airport, crossed airport property and moved east toward the Latham water towers before dissipating. The tornado was not on the ground continuously.

Finding 2.4

An F1 tornado path was 50 feet wide and moved along a track of .25 mile in New Preston, Litchfield County. The Tornado path crossed a largely wooded area.

Finding 2.5

The rationale supporting the issuance of 36 Tornado warnings during this event included numerous funnel cloud reports, a significant tornado across Saratoga County, frequent, high WSR88D gate to gate shear, WSR88D reflectivity characteristics and highly favorable environmental conditions. These included extreme helicity, large CAPE, and extreme Maglenta (Maglaras & LaPenta, 1997) values.

Finding 3.1

Kenneth D. LaPenta and Jonathan L. Blaes issued a Tornado warning for Saratoga County at 3:43 p.m. EDT, Sunday, May 31, 1998. This warning provided residents of Mechanicville and Stillwater 39 minutes lead time of the F3 tornado which touched down at 4:22 p.m. EDT. A Severe Weather Statement was issued at 4:21 p.m. EDT, refining the tornado track. Many heard the warning on radio, TV, The Weather Channel or NWR, and took shelter. No fatalities occurred directly associated with the tornado, and most of those injured either did not require hospitalization, or were treated and released.

Finding 3.2

Forecasts, Statements and a Public Information Statement on Tornado Safety rules issued Saturday afternoon and early Sunday heightened awareness of the impending event. Issuances stressed the potential for Tornadoes, the danger of the situation, and advised actions to take.

Finding 3.3

On May 31, forecasters at NWSFO Albany, New York, issued 48 severe weather warnings, of which 45 verified with an average lead time of 22 minutes.

Finding 3.4

On May 31, forecasters at NWSFO Albany, New York, issued 12 Severe Thunderstorm Warnings of which 10 verified with an average lead time of 24 minutes.

Finding 3.5

Several times during the event, particularly between 6:30 p.m. and 8:00 p.m. EDT, forecasters at NWSFO Albany, New York, provided information to the staff at NEXRAD Weather Service Office (NWSO) Binghamton, New York, concerning storms in their CWA.

Finding 3.6

When power transferred from commercial to generator in the CESTM facility, lights went out for several seconds. Also, after one of these interruptions the WXL-34 and backup SAME units failed.

Recommendation 3.6a

Install or modify office lighting to provide minimal lighting during power transfers at night.

Recommendation 3.6b

Ensure all NWR components are on UPS power.

Finding 3.7

NOAA Weather Radio station WXL-34 went off the air about 5:30 p.m. EDT and remained off the air throughout the rest of the event. The outage was due to lightning striking the telephone line to the transmitter. Bell Atlantic was unwilling to jeopardize their

technicians in the ongoing lightning storm, and was thus unable to restore service. The office received numerous complaints from the public, the media and emergency managers.

Recommendation 3.7

Explore more reliable or backup methods to send broadcast from office to NWR transmitters.

Finding 3.8

On May 31, forecasters at NWSFO Albany, New York issued 36 Tornado warnings, of which 35 verified based on the NWS verification criteria. Average lead time on tornado warnings was 21 minutes. However only seven were verified by confirmed Tornadoes.

Recommendation 3.8

Conduct a study using the 48 warned storms from this event to develop methodologies which would allow forecasters to better discern between which thunderstorms were tornadic and which were not. Compare structure, shear, and other parameters of those storms which produced tornadoes with those that did not.

Finding 4.1

Cooperative research with UAlbany, COMET Projects, and independent research efforts by office staff, prepared them to recognize the threat of tornadoes early and convey it quickly to the public.

Finding 4.2

WSR-88D data, especially V/R shear structure, spotter reports, and Warning Desk operator experience and participation in research, were major factors contributing to the average 21 minute lead time for warnings with the event and the 39 minute lead time for the most damaging tornado.

Finding 4.3

After the failure of WXL-34, warnings were relayed to county EOCs via NWSFO Albany's SKYWARN Amateur Radio station, WX2ALY.

Finding 5.1

In an article appearing in The Saratogian newspaper on Monday, June 1, three separate anecdotes were cited of people watching the sky after hearing watches and warnings, then going to the basement as they observed the storm approaching. In each of those cases, the homes were destroyed, but no one was seriously injured. In addition, a number of people interviewed by survey teams reported that they went to the basement as the storms approached because they had heard watches and warnings, and were frightened by the ominous clouds preceding the storms.

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APPENDIX A

Warnings Issued and Summary of Lead Time

Warning	Type	Time	Event	Lead Time
Herkimer	SVR	103-215 pm	X Not Verified	
Hamilton	SVR	103-215 pm	X Not Verified	
Herkimer (S)	SVR	309-410 pm	338 Frankfort, Dolgeville, Cedarville - trees down	+29
Montgomery	SVR	313-415 pm	342 Fonda - trees down	+29
Montgomery	TOR	324-425 pm	342 Fonda - trees down	+18
			344 Amsterdam -tomado west	+20
Herkimer (S)	TOR	329-430 pm	345 Mohawk - wind damage	+16
Fulton	TOR	329-430 pm	345 Gloversville - Trees and wires down Three houses /Two cars damaged, some may have occurred in later storms	+16
Saratoga	TOR	343-445 pm	415 Milton - 1" hail	+32
			416 Mechanicville - 60 mph	+33
			422-435 Stillwater - F2-F3 Tornado Extensive structural damage 28 injured sent to hospital 40 injured treated on scene 20 homes destroyed 25 homes with severe damage 10+ with moderate damage	+39
			420 Saratoga Springs - 1.75' hail	+37
			425-435 Mechanicville - tornado	+42
			435 Malta, Ballston Spa .75" hail	+52
Schoharie (N)	TOR	349-435 pm	410 Schoharie Village	+21
			430 Blenheim - trees down (time aprx)	+39
			432 Middleburgh - wind damage	+41
Albany	SVR	410-515 pm	438 Bethlehem Center - wind damage	+28
			440 Albany Airport - 82 mph gust	+30
			450 Colonie - wind damage	+40
Schenectady	SVR	410-515 pm	450 Rotterdam - trees down	+40
			450 Schenectady - trees down	+40
Washington	TOR	416-530 pm	430 Southern portion - trees down	+14
			445-500 White Creek - F1 Tornado	
Bennington	TOR	416-530 pm	432 Arlington - trees down	+16
			455 N Bennington - F1 Tornado	+39
			505 Bennington - trees down	+49

Rensselaer (N)	TOR	430-520 pm	445	East of Hoosic Falls- F2 Tornado at NY and VT border	+15
			450	Schaghticoke - trees down Trailers flipped over Damage also at Hoosick, Pittstown	+20
			500	Brunswick - trees down	+30
			505	E. Green bush -trees down	+35
Albany	TOR	435-530 pm	438	Bethlehem Ctr. - wind damage	+3
			440	Albany Airport - gusts 82 mph	+5
			440-445	Colonie - F0 Tornado 2 mile path length. Discontinuous wind damage. Funnel cloud observed by contract weather obsvr.	+5
			450	Colonie - trees down	+15
Schoharie	TOR	435-530 pm	X	Not Verified	
Schenectady	TOR	435-530 pm	450	Rotterdam- trees down	+25
			450	Schenectady - tree down	+25
Saratoga	SVR	443-515 pm	450	Mechanicville - trees down	+7
Greene	SVR	457-615 pm	500	Greenville - quarter size hail	+3
Windham	TOR	505-615 pm	542	Brattleboro - tornado observed	+37
Columbia	TOR	516-630 pm	510	Stuyvesant - 0.75" hail	-6
			510	Kinderhook- trees down	-6
			520	Chatham - trees down	+4
			526	Niverville - tree on house	+10
			531	Stuyvesant -1" hail	+15
Berkshire	TOR	516-630 pm	545	Pittsfield - 1.75" hail	+29
Rensselaer	TOR	516-630 pm	535	Nassau - trees down	+19
Herkimer	TOR	617-720 pm	625	Mohawk - trees down	+8
Fulton	TOR	617-720 pm	630	Gloversville - Trees and wires down	+16
Montgomery	TOR	617-720 pm	620-630	Root, Ames, Fort Plain Fonda, Amsterdam, Charleston - trees down	+8
Schoharie	TOR	629-715 pm	635	Richmondville - roof	+6
			645	Blenheim - dime size hail	+18
			647	Breakabeen	+18
Saratoga	SVR	645-745 pm	708	Mechanicville - wind damage	+23
Schenectady	SVR	645-745 pm	700	Duanesburg - trees down	+15
Albany	SVR	645-745 pm	716	Guilderland - tornado observed	+31
			708	Clarksville - tree down	+23
			711	New Scotland	+26
Greene	TOR	703-800 pm	733	Greenville - tree down	+30
			745	Catskill - dime size hail	+42
Rensselaer	TOR	706-805 pm	725	East Schodack - F2 Tornado Four miles of tree damage. Two barns destroyed	+19

Bennington	TOR	706-805 pm	742 715	Two homes with severe damage Stephentown - wind damage W Shaftsbury - 0.88 - 1.75 " hail	+36 +9
Washington	TOR	710-810 pm	735	Greenwich - numerous trees down	+25
Albany	TOR	710-805 pm	730	New Scotland - trees down	+20
Schoharie	TOR	710-805 pm	735	Schoharie- widespread damage	+25
Ulster	TOR	719-815 pm	800	Saugerties and other locations Wires down Time uncertain	+41
Windham	TOR	723-830 pm	755	Brattleboro - wind damage	+32
Columbia	TOR	732-845 pm	830	Hillsdale - wind damage	+58
Berkshire	TOR	732-845 pm	755 800 803	N.Adams - gusts 70 mph Great Barrington - hail Pittsfield	+18 +28 +31
Greene	TOR	750-835 pm	823 827	Catskill - 0.75" hail Catskill - 1.0" hail	+33 +37
Bennington	TOR	804-845 pm	830	Pownal, Shaftsbury - trees down Bennington	+26
Ulster	SVR	817-930 pm	900	Gardiner and other locations Wires down -time uncertain	+43
Columbia	TOR	836-930 pm	900	Copake - trees down	+24
Berkshire	TOR	836-930 pm	940 ?	South Lee - wind damage W Stockbridge - Funnel Cloud	+24 ?
Ulster	TOR	850-1005 pm	900	Gardiner and other locations Wires down -time uncertain	+10
Dutchess	TOR	850-1005 pm	900-1000	Widespread reports of downed trees, including towns of Rhinebeck, Red Hook, Clinton Comers, Stanford, Wappingers	+10
Litchfield	TOR	910-1015 pm	930 950	Tornado-F1 Confirmed New Milford - large limbs down	+20 +40

Events without warning:

Schoharie County

625 pm Jefferson, 0.50" -0.75" hail

625 pm Jefferson, Concrete silo destroyed

630 pm Blenheim, wind damage

Columbia County

510 pm Stuyvesant, 0.75" hail

510 pm Kinderhook, trees down

Tornadoes:

Saratoga	Stillwater / Mechanicville	422-435 422-435	F3 Tornado Confirmed Extensive structural damage 28 injured sent to hospital 40 injured treated on scene 20 homes destroyed 25 homes with severe damage 10+ with moderate damage
Rensselaer	Schaghticoke/ Hoosick	427-445	F2 Tornado Confirmed
Washington	White Creek	445-500 F1	Tornado Confirmed
Rensselaer	East Schodack	725	F2 Tornado Confirmed Four miles of tree damage. Two barns destroyed Two homes with severe damage
Albany	Colonie	440-445	F0 Tornado Confirmed 2 miles of discontinuous wind damage. Funnel cloud observed by contract weather observer.
Bennington	NY / VT border to N Bennington	445-455	F2 Tornado at NY / VT border Confirmed F1 Tornado at north Bennington
Litchfield	New Preston	930 pm	F1 Confirmed

APPENDIX B

ALL Products Issued from NWSFO Albany

May 30, 1998

300 pm	ALBZFP	Highlighting thunderstorms, some with very strong winds and hail.
954 pm	ALBZFP	"Thunderstorms may be accompanied by strong winds and Hail."

May 31, 1998

352 am	SPS	Headlining severe weather potential. "Isolated tornadoes are possible in eastern New York and western New England. Some severe weather is likely."
352 am	ALBZFP	"Some thunderstorms this afternoon <i>will</i> produce damaging winds...very heavy rain and some hail."
410 am	OPU	
427 am	PNS	Tornado safety rules
640 am	NOW	Bullet for Ulster / Dutchess
652 am	NOW	Bullet for Ulster / Dutchess / Berkshire / Columbia / Litchfield
812 am	SLSNY	Tornado watch 475
837 am	TAP	
839 am	NOW	Entire CWA - highlighting potentially damaging winds
848 am	ALBZFP	Updated for Tornado Watch 475
905 am	OPU	
935 am	NOW	Bullet for Hamilton
1017 am	SPS	Highlighting severe storm and tornado threat
1100 am	NOW	Highlighting potential severe weather across watch area
1110 am	ALBZFP	"Thunderstorms...producing damaging winds...very heavy rain and some hail. "
1112 am	NOW	Entire CWA
1200 pm	SPS	Update of previous SPS indicating this is a "dangerous situation"
1243 pm	NOW	
103 pm	SVR	Herkimer / Hamilton
136 pm	NOW	Entire CWA - Intense thunderstorms with potentially damaging winds likely this afternoon and evening
141 pm	SVS	Herkimer
215 pm	NOW	Bullet Greene / Columbia
218 pm	SVS	Hamilton

236 pm	SLSVT	Tornado Watch 478
245 pm	SLSNY	Tornado Watch 478
249 pm	NOW	Intense thunderstorms with potentially damaging winds are developing across Mohawk Valley / northern Catskills
305 pm	ALBZFP	"Thunderstorms with gusty winds and hail."
309 pm	SVR	Herkimer (S)
313 pm	SVR	Montgomery
317 pm	NPW	High Wind Warning for St. Lawrence Valley
324 pm	TOR	Montgomery
325 pm	SLSNY	Tornado Watch 479
329 pm	TOR	Herkimer (s) / Fulton
333 pm	NOW	Intense thunderstorms with potentially damaging winds are developing Lake George-Saratoga and southern VT
338 pm	SVS	Fulton Herkimer
340 pm	TAP	
343 pm	TOR	Saratoga / Fulton (Mech. / Stillwater Tornado)
344 pm	SVS	Montgomery
349 pm	TOR	Schoharie
402 pm	SVS	Montgomery
405 pm	NOW	Intense thunderstorms with potentially damaging winds are developing Hudson Vly and western New England.
410 pm	TAP	
410 pm	SVR	Albany / Schenectady
416 pm	TOR	Washington / Bennington
421 pm	SVS	Saratoga/ Washington (Specifically mentions Mechanicville and Stillwater)
430 pm	TOR	Rensselaer (N)
435 pm	TOR	Albany / Schenectady / Schoharie (N)
443 pm	SVR	Saratoga
445 pm	SVS	Albany
449 pm	SLSNY	Tornado Watch 481
450 pm	SVS	Albany/Rensselaer
455 pm	SVS	Bennington
457 pm	NOW	Greene
505 pm	TOR	Windham
516 pm	TOR	Columbia / Berkshire / Rensselaer
530 pm	SVS	Columbia / Berkshire
550 pm	SVS	Berkshire
616 pm	NOW	
617 pm	TOR	Herkimer / Fulton / Montgomery
629 pm	TOR	Schoharie
638 pm	LSR	
645 pm	SVR	Saratoga / Schenectady / Albany
654 pm	TAP	

655 pm	LSR	
703 pm	TOR	Greene
706 pm	TOR	Rensselaer / Bennington
710 pm	TOR	Washington
710 pm	TOR	Albany / Schoharie
719 pm	TOR	Ulster
723 pm	TOR	Windham
732 pm	TOR	Columbia / Berkshire
740 pm	SVS	Columbia / Greene
745 pm	SVS	Ulster
745 pm	SLSNY	Tornado Watch 485
750 pm	TOR	Greene
804 pm	TOR	Bennington
815 pm	SVS	Columbia / Berkshire
817 pm	SVR	Ulster
834 pm	LSR	
836 pm	TOR	Columbia / Berkshire
840 pm	OPU	
850 pm	TOR	Ulster / Dutchess
910 pm	TOR	Litchfield
935 pm	SVS	Ulster
950 pm	SLSNY	Tornado Watch 487
958 pm	LSR	
1014 pm	SPS	Cancel Tornado Watches
1054 pm	LSR	
1100 pm	FFA	Flood watch cancellation
1133 pm	OPU	
1132 pm	ALBZFP	"Scattered showers and thunderstorms ending."

June 1, 1998

1204 am	LSR	
410 am	LSR	
425 am	LSR	Correction

SVR and TOR products from NWSFO ALY

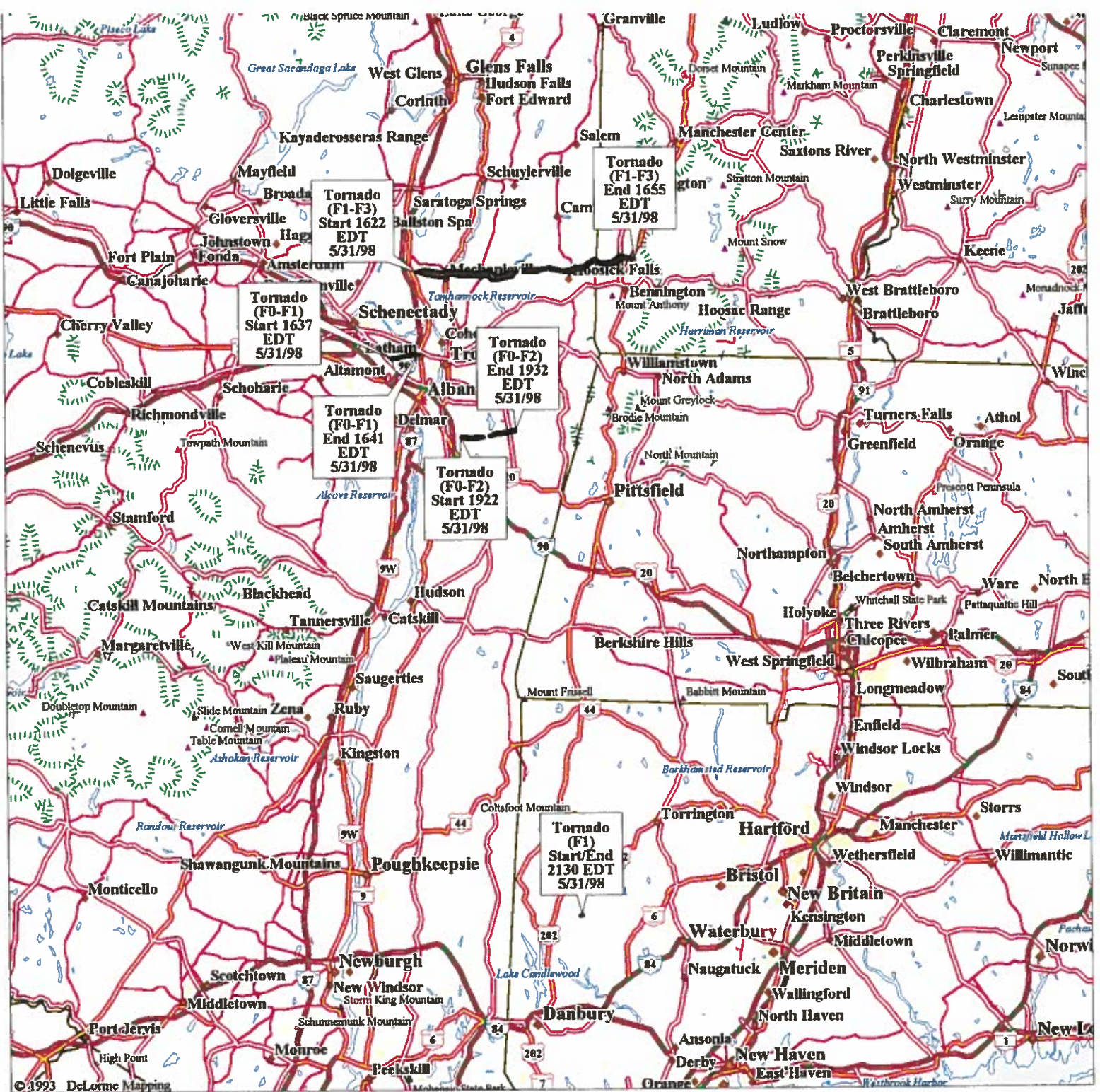
Warning	Type	Time
Herkimer Hamilton	SVR	103-215 pm
Herkimer (S)	SVR	309-410 pm
Montgomery	SVR	313-415 pm
Montgomery	TOR	324-425 pm
Herkimer (S) Fulton	TOR	329-430 pm
Saratoga	TOR	343-445 pm
Schoharie	TOR	349-435 pm
Albany Schenectady	SVR SVR	410-515 pm
Washington Bennington	TOR	416-530 pm
Rensselaer (N)	TOR	430-520 pm
Albany Schoharie (N) Schenectady	TOR	435-530 pm
Saratoga	SVR	443-515 pm
Greene	SVR	457-615 pm
Windham	TOR	505-615 pm
Columbia Berkshire Rensselaer	TOR	516-630 pm
Herkimer Fulton Montgomery	TOR	617-720 pm

Schoharie	TOR 629-715 pm
Saratoga Schenectady Albany	SVR 645-745 pm
Greene	TOR 703-800 pm
Rensselaer Bennington	TOR 706-805 pm
Washington	TOR 710-810 pm
Albany Schoharie	TOR 710-805 pm
Ulster	TOR 719-815 pm
Windham	TOR 723-830 pm
Columbia Berkshire	TOR 732-845 pm
Greene	TOR 750-835 pm
Bennington	TOR 804-845 pm
Ulster	SVR 817-930 pm
Columbia Berkshire	TOR 836-930 pm
Ulster Dutchess	TOR 850-1005pm
Litchfield	TOR 910-1015 pm

APPENDIX C

Tornado track maps

1. Overview
2. Halfmoon, New York to South Shaftsbury, Vermont
3. Albany International Airport, Albany, New York
4. East Schodack and Nassau, New York
5. New Preston, Connecticut.



LEGEND

- | | |
|------------------------|-----------------------|
| ■ Geo Feature | — State/Prov Boundary |
| ★ State Capitol | ■ Population Center |
| ◆ Town, Small City | — Major Street/Road |
| ◆ Large City | — Interstate Highway |
| ▲ Hill | — State Route |
| ▲ Park | — US Highway |
| ⊔ Interstate, Turnpike | □ Land Mass |
| ⊔ US Highway | □ Open Water |

Scale 1:1,200,000 (at center)

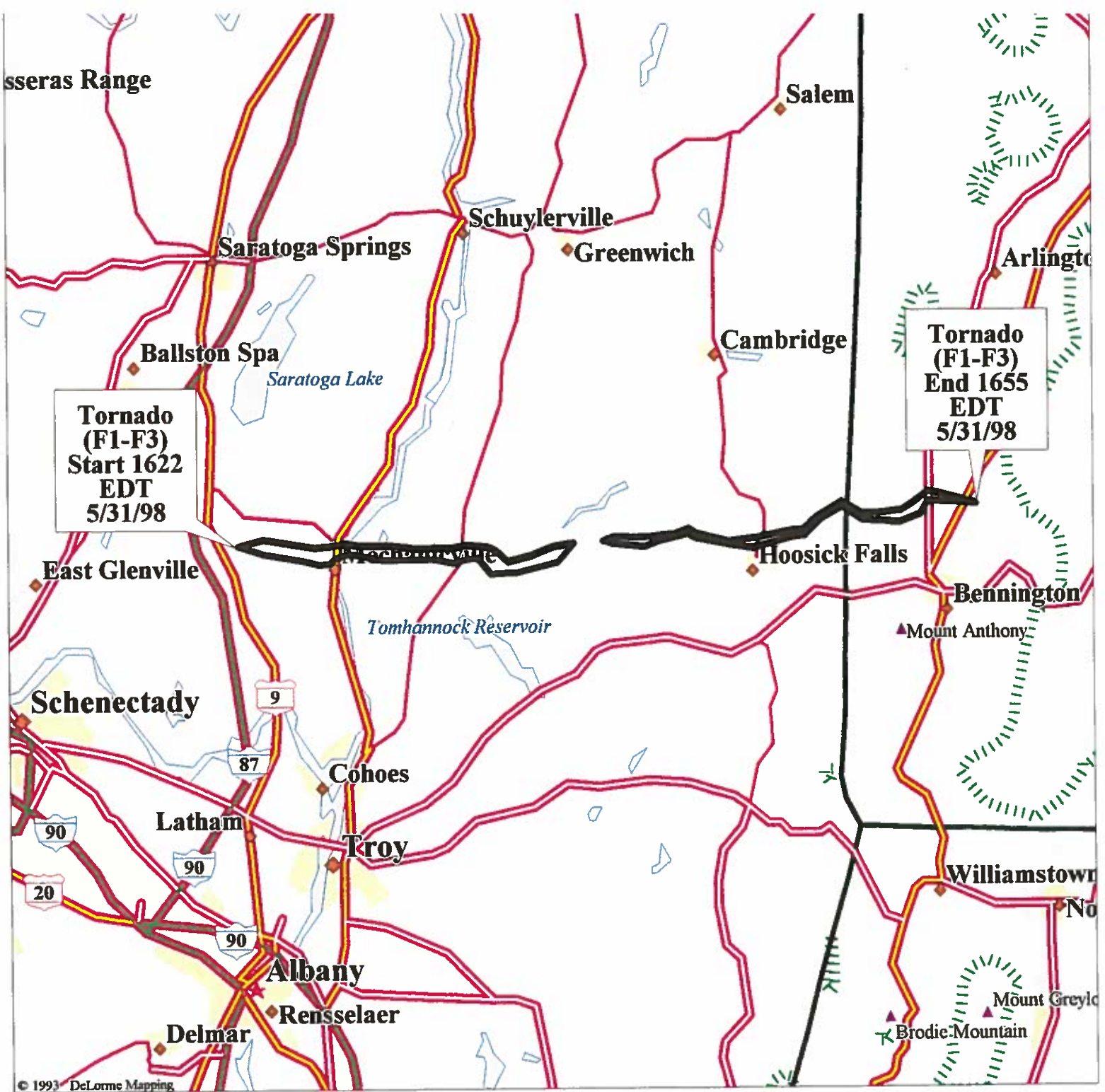
20 Miles

20 KM

Tornado Path Overview 5/31/98

Mag 9.00

Tue Jun 09 14:37:38 1998



LEGEND

- ★ State Capitol
- ◆ Town, Small City
- ◆ Large City
- ▲ Hill
- Interstate, Turnpike
- US Highway
- State/Prov Boundary
- Population Center
- Major Street/Road
- Interstate Highway
- State Route
- US Highway
- Land Mass
- Open Water
- Contours

Scale 1:350,000 (at center)

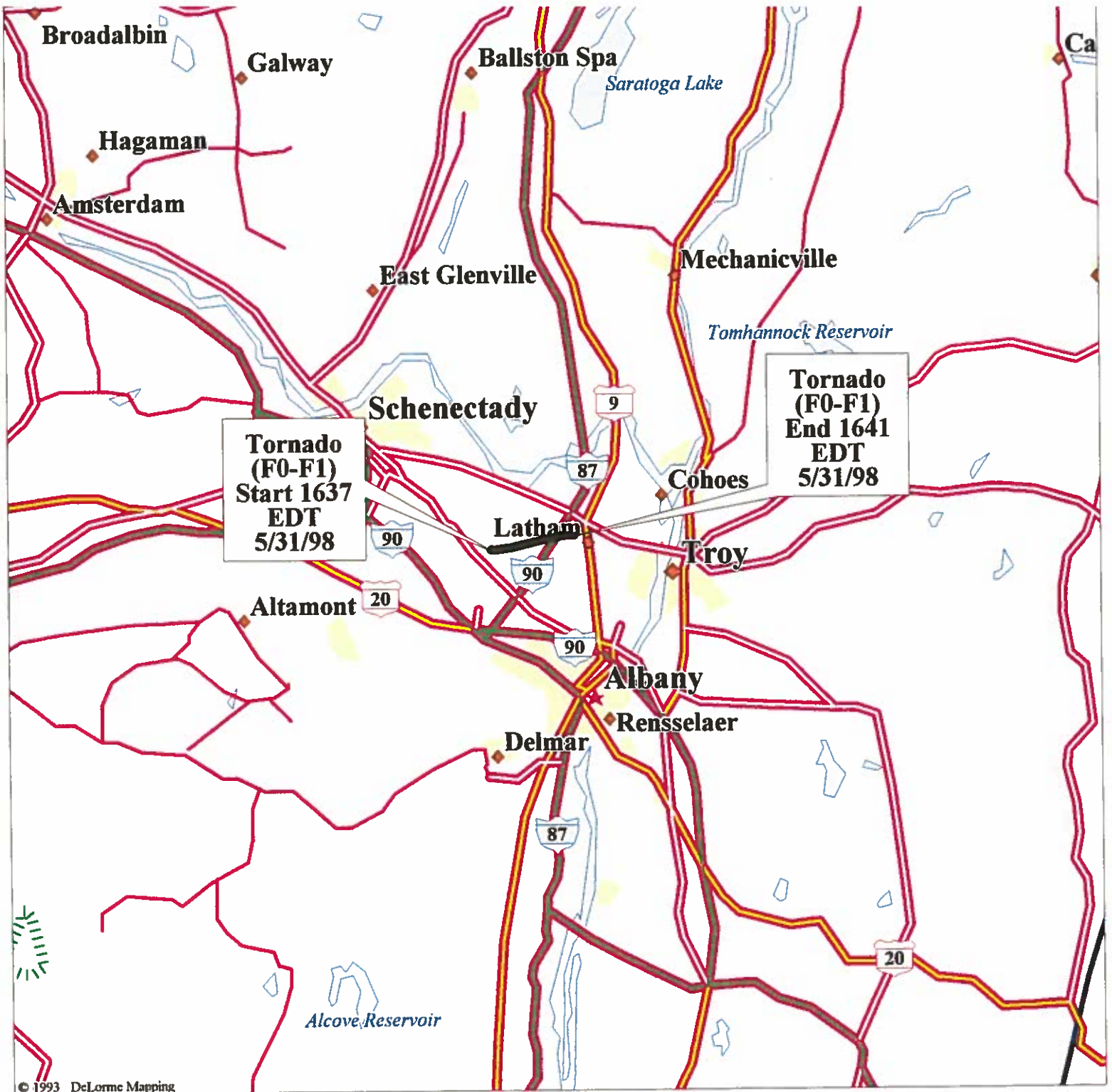
5 Miles

10 KM

Length 30.5 mi., Max. Width 0.6 mi.

Mag 10.00

Tue Jun 09 14:20:37 1998



© 1993 DeLorme Mapping

LEGEND

- ★ State Capitol
- ◆ Town, Small City
- ◆ Large City
- ☒ Interstate, Turnpike
- ☒ US Highway
- State/Prov Boundary
- Population Center
- Major Street/Road
- Interstate Highway
- State Route
- US Highway
- Land Mass
- Open Water
- ||||| Contours

Scale 1:350,000 (at center)

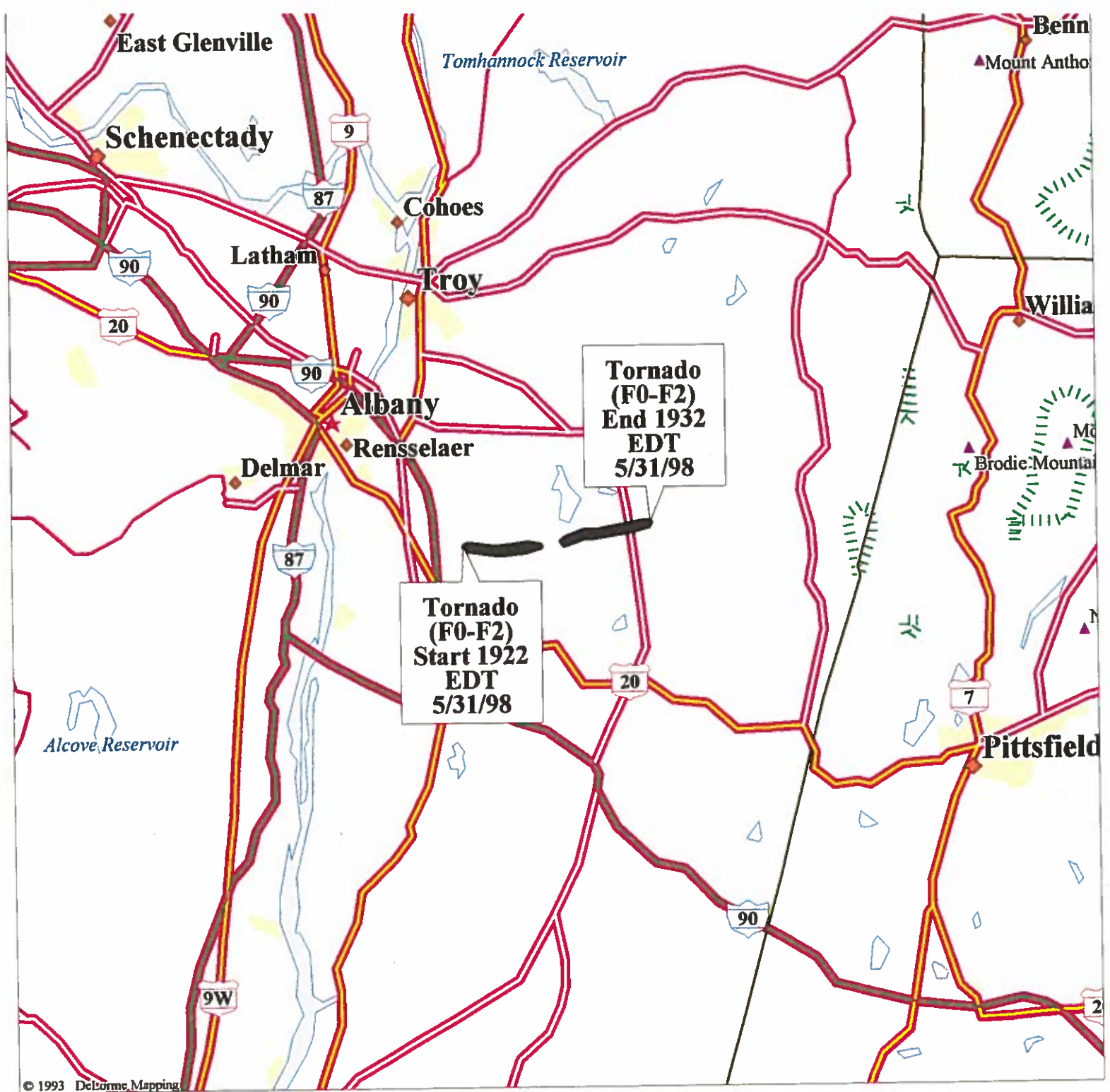
5 Miles

10 KM

Length 3.5 mi., Max. Width 75 yd.

Mag 10.00

Tue Jun 09 13:23:12 1998

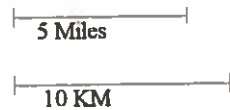


LEGEND

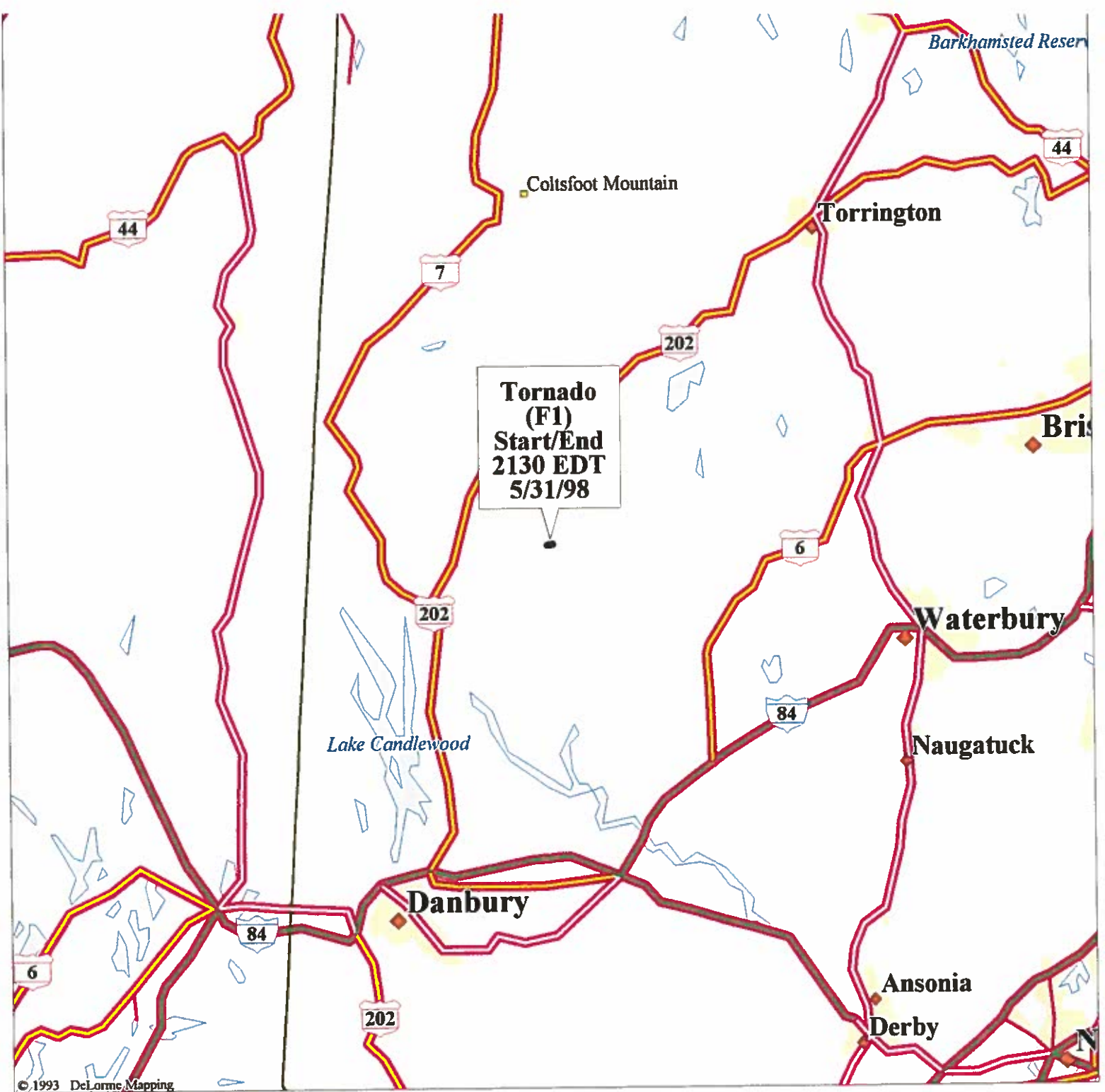
- ★ State Capitol
- ◆ Town, Small City
- ◆ Large City
- ▲ Hill
- Interstate, Turnpike
- US Highway
- State/Prov Boundary
- Population Center

- Major Street/Road
- Interstate Highway
- State Route
- US Highway
- Land Mass
- Open Water
- Contours

Scale 1:350,000 (at center)



Length 7.6 mi., Max. Width 200 yd.
Mag 10.00
Tue Jun 09 12:26:31 1998



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LEGEND

- Geo Feature
- ◆ Town, Small City
- ◆ Large City
- ☪ Interstate, Turnpike
- ☐ US Highway
- State/Prov Boundary
- Population Center
- Major Street/Road

- Interstate Highway
- State Route
- US Highway
- ☐ Land Mass
- ☐ Open Water

Scale 1:350,000 (at center)

5 Miles

10 KM

Length 0.25 mi., Max. Width 50 ft.

Mag 10.00

Tue Jun 09 13:48:45 1998

APPENDIX D

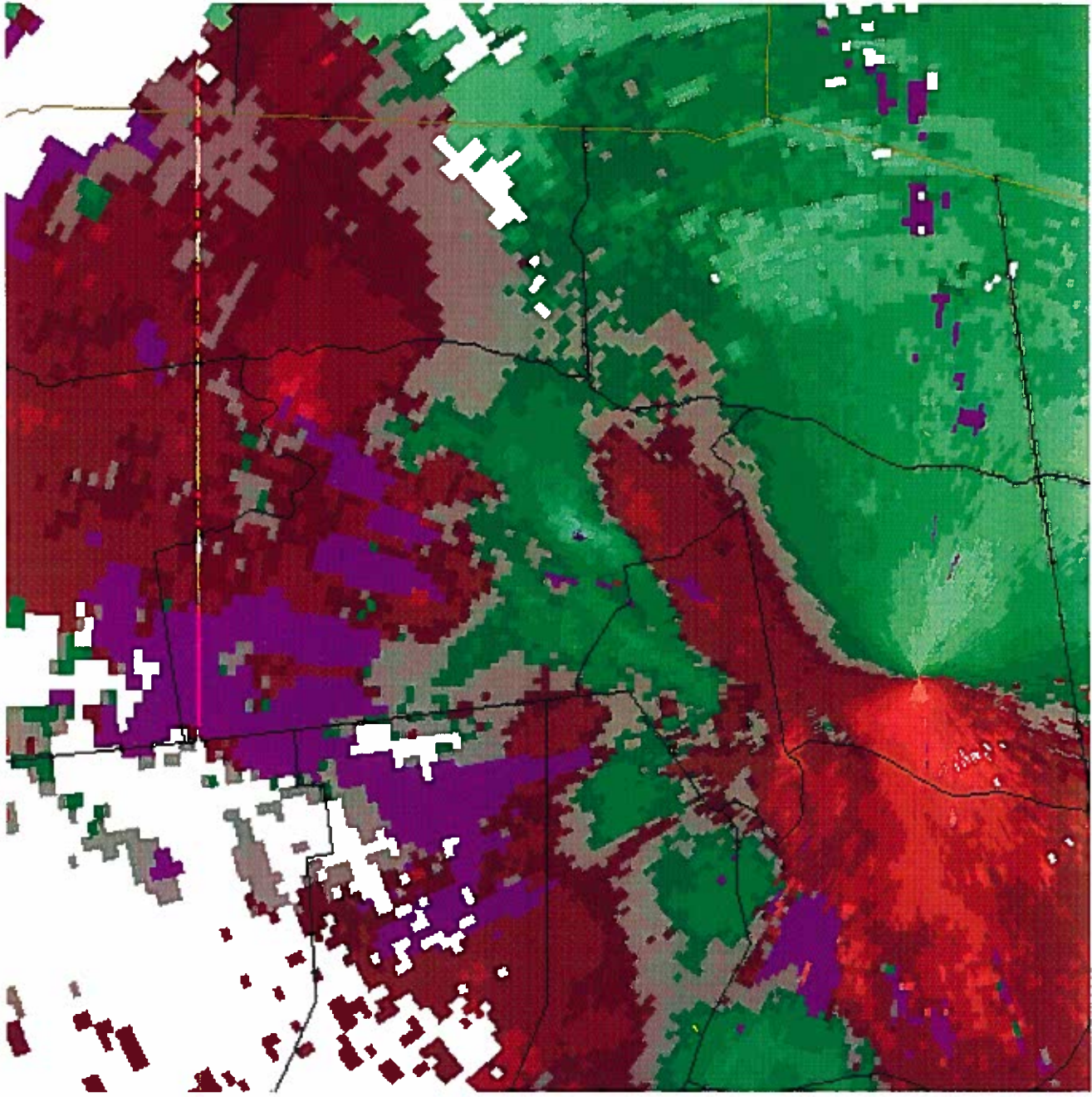
WSR88D Imagery from KENX

1. Relative Velocity Map, 0.5 Deg,.54 nm res, 20:12 UTC May 31, 1998
2. Relative Velocity Map, 0.5 Deg,.54 nm res, 20:17 UTC May 31, 1998
3. Relative Velocity Map, 0.5 Deg,.54 nm res, 20:22 UTC May 31, 1998
4. Base Reflectivity, 0.5 Deg,.54 nm res, 20:22 UTC May 31, 1998
5. V/R Shear chart derived from WSR88D, 2002 UTC through 2033 UTC

06/09/98 05:18
REL VEL MAP 56 SRM
124 NM :54 NM
05/31/98 20:12
RDA:KENX 42/35/09N
1907 FT 74/03/50W
ELEV= 0.5 DEG
MODE A / 11
CNTR 22DEG 22NM
MAX= -59 KT 56 KT
SRM:256DEG 50 KT



MAG=4X FL= 1 COM=1

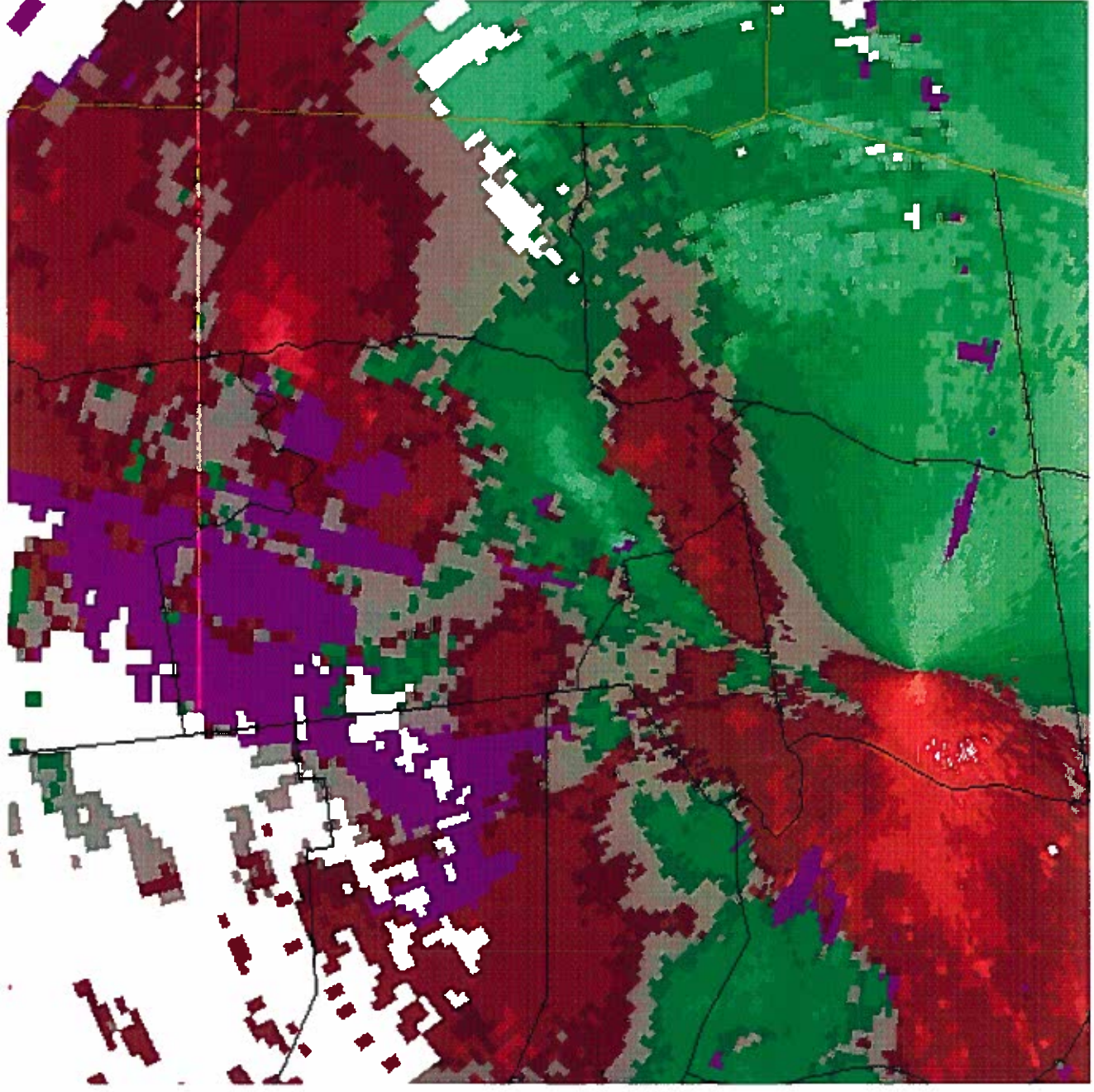


A/R <HOME> 345 DEG
3432FT 11 NM R
Q15 R 0431 R
DED RPG LINE 1
DISCONNECTED
09/0453 ARCHIVE
UNIT 1 READ DONE
HARDCOPY

06/09/98 05:21
REL VEL MAP 56 SRM
124 NM .54 NM
05/31/98 20:17
RDA: KENX 42/35/09N
1907 FT 74/03/50W
ELEV= 0.5 DEG
MODE A / 11
CNTR 22DEG 22NM
MAX= -71 KT 91 KT
SRM: 258DEG 50 KT



MAG=4X FL= 1 COM=1

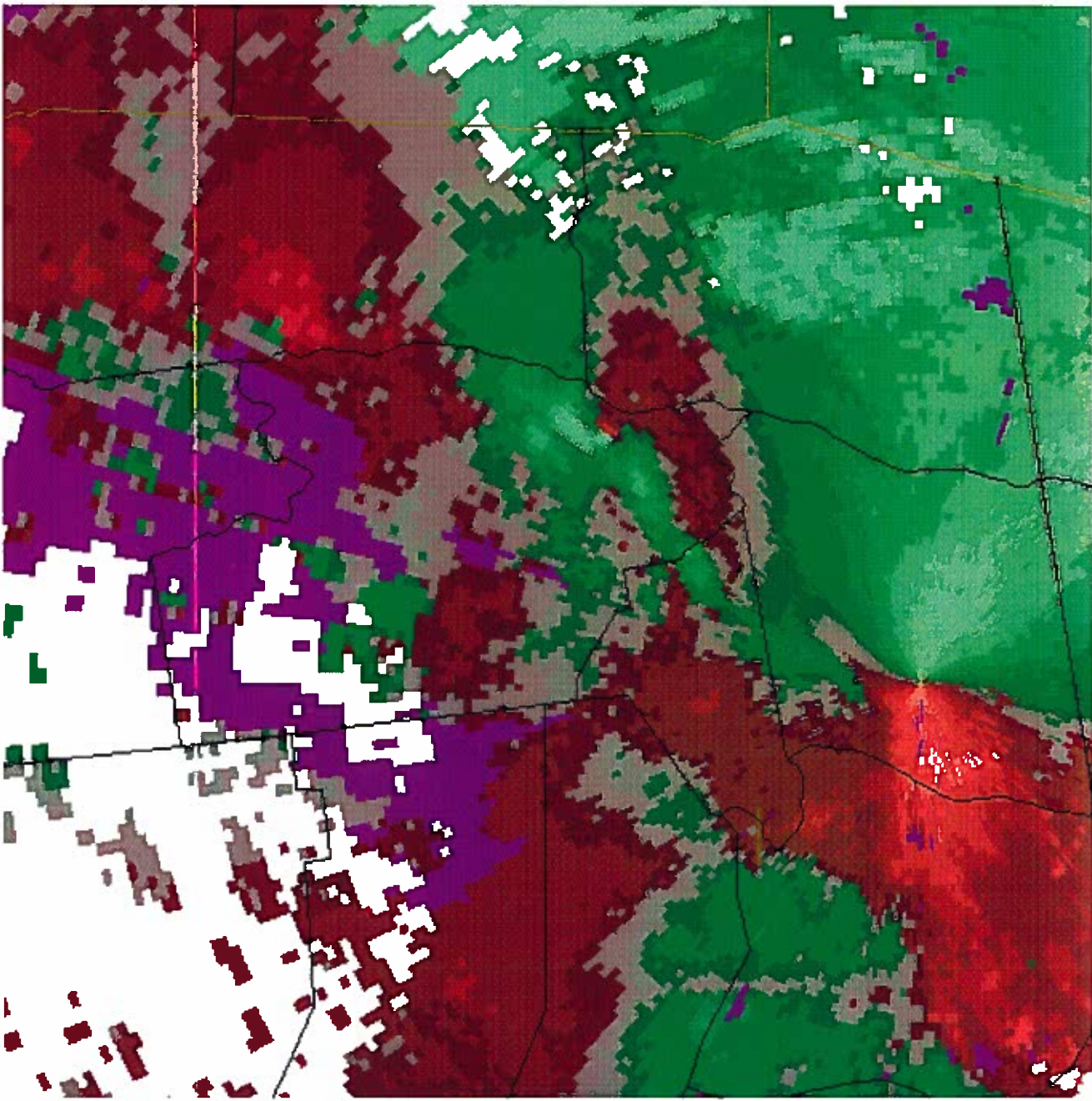


A/R (HOME) 345 DEG
3432FT 11 NM R
015 R 0431 R
DED. RPG LINE 1
DISCONNECTED
09/0453 ARCHIVE
UNIT 1 READ DONE
HARDCOPY

06/09/98 05:41
REL VEL MAP 56 SRM
124 NM .54 NM
05/31/98 20:22
RDA: KENX 42/35/09N
1907 FT 74/03/50W
ELEV= 0.5 DEG
MODE A / 11
CNTR 22DEG 22NM
MAX= -74 KT 111 KT
SRM: 259DEG 52 KT

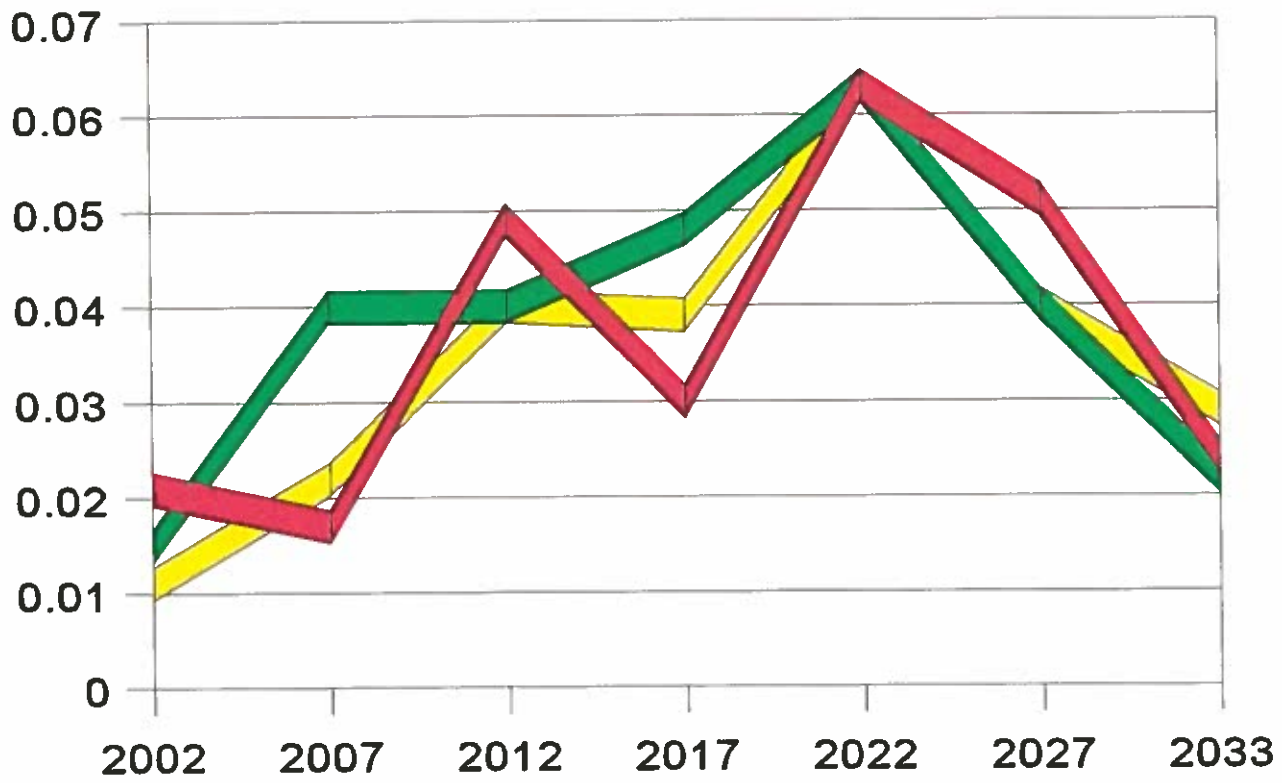


MAG=4X FL= 1 COM=1



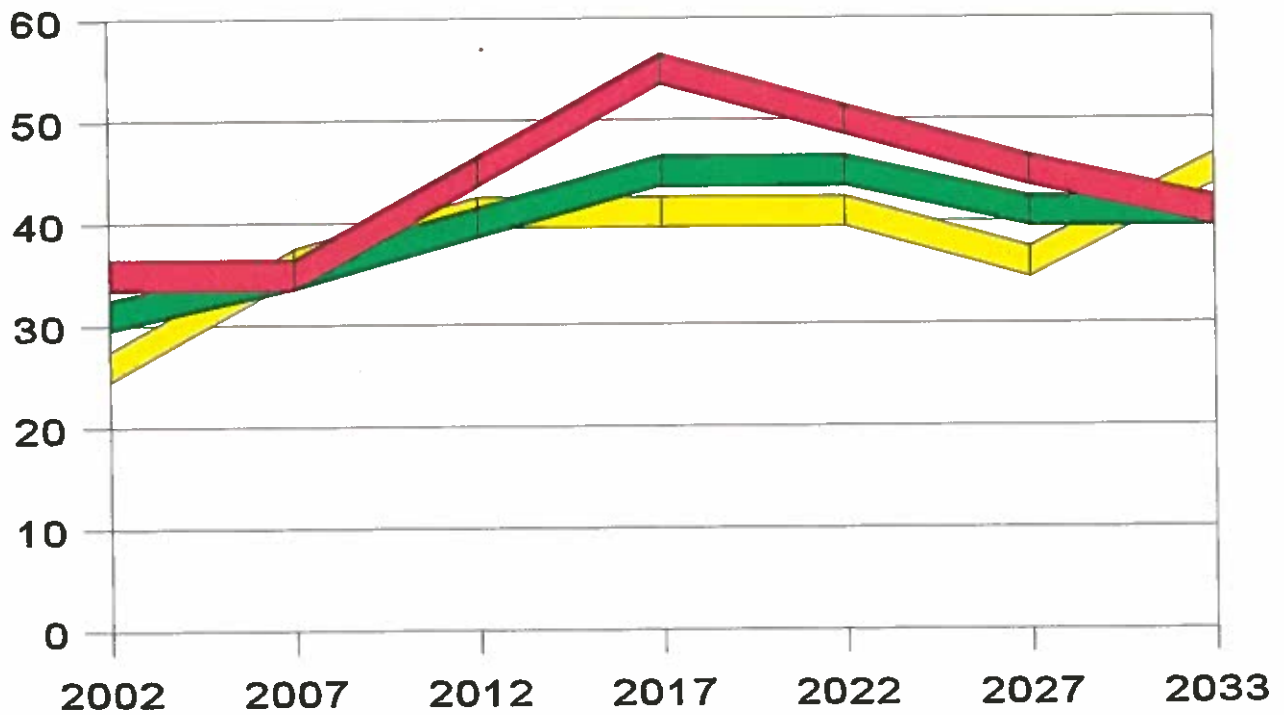
A/R (HOME) 345 DEG
3432FT 11 NM R
Q15 R 0431 R
DED. RPG LINE 1
DISCONNECTED
09/0453 ARCHIVE
UNIT 1 READ DONE
HARDCOPY

SHEAR - STILLWATER F3



0.5 1.5 2.4

PARENT MESO. ROT. VEL. KTS



0.5 1.5 2.4

APPENDIX E

Selected Damage Photographs



Photos of damage in Mechanicville and Stillwater, New York, except picture in lower right from Hoosick, New York.





Stillwater/Mechanicville F3 Damage
Photo Courtesy of New York State Emergency Management Office

APPENDIX F

Damage Survey Reports and Correspondence

1. Damage Survey Team 3 report, John S. Quinlan et al.
2. Areal Survey, Saratoga County Warren R. Snyder
3. Areal Survey, Mohawk Valley, Mark R. McKinley
4. Greene County Survey, Hugh Johnson IV
5. Schoharie, Southern Albany & Northern Greene Counties
Jonathan L. Blaes & George J. Maglaras
6. Albany County Airport, Maglaras et al.
7. Northern Columbia, Southeast Rensselaer County
8. WTEN Letter, Steve Caporizzo
9. Red Cross press release, April Stack
10. E-Mail to the Storm Prediction Center from Carol Hildreth

NWSFO ALBANY SURVEY TEAM #3

**Team Members Day 1: Carl S. Cerniglia, General Forecaster
John S. Quinlan, General Forecaster
Howard T. Silverman, Meteorological Intern
Timothy E. Scrom, Hydrometeorological Technician**

**Team Members Day 2: John S. Quinlan, General Forecaster
Howard T. Silverman, Meteorological Intern**

Field Survey Day #1

On Day 1 (Monday, June 1, 1998) the survey team assembled at the Command Center which had been set up at the Arvin Hart Fire Station in Stillwater around 800 a.m. Tim Scrom coordinated the travel and escorted the damage survey team to the hardest hit areas in the City of Mechanicville and the Town of Stillwater. We first viewed the damage on Viall Hill where numerous homes were destroyed. This was the hardest hit area in eastern New York during Sunday Afternoon, May 31, 1998. After an extensive survey of the damage, the survey team concluded that a strong F3 tornado had moved across Viall Hill at around 425 p.m. packing winds of 200 m.p.h. The survey team next traveled to the intersection of Round Lake Ave. and State Route 67 where the Di Siena Furniture Company had been destroyed. While viewing this damage, the survey team was able to view the hillside behind the Old Mechanicville Railroad Yard where numerous trees had been uprooted and twisted. Damage at the Di Siena Furniture Company appeared to be F2 as all of the buildings had expansive roofs which once removed allowed the tornado to devastate much of the inner walls. The last area visited in Mechanicville was an area known as Riverside where numerous old mill homes were devastated, De Crescente Distributing Company was badly damaged, a 350 foot smoke stack collapsed and the New York State Electric and Gas Hydro Facility was damaged. The damage in the Riverside area was due to an F3 tornado. The attached damage path map in Mechanicville is courtesy of NYSDEC who conducted a house by house damage survey.

The following statistics from Mechanicville are courtesy of Tim Scrom:

1 indirect fatality due to a heart attack
68 injuries - 25 transported for hospitalization, 43 treated at the scene
30 homes completely destroyed
80 homes with moderate or severe damage
37 properties condemned

The following eye-witness accounts were taken by the survey team:

John Curtiss (Mechanicville) - opened the front door of his house and saw a large black cloud coming in his direction as the door was yanked out of his hand and blown away at 426 p.m.

Mark Peteneau (Mechanicville) - looked out his back window and saw one large tornado

vortex with three smaller tornado vortices rotating around the larger tornado vortex at 425 p.m.

After departing Mechanicville, Howard and John continued on to the Town of Schaghticoke in Rensselaer County where they met with NYSP Tpr. Michael J. Anson. Tpr. Anson escorted the survey team during the remainder of Day 1. Large swaths of trees either uprooted or sheared off were observed along Knickerbocker Rd., Weir Rd., Stillwater Bridge Rd., Hemstreet Rd., Verbeck Ave., in the vicinity of the Intersection of State Route 40 and State Route 67, Geary Rd., Master St., Bell Rd. and Bunker Hill Rd. in the Town of Schaghticoke. The survey team interviewed the Weir Family who own a large farm on Weir Rd. They had NWR and heard the warning and went to the cellar before the tornado hit. They described hearing a loud roar as the tornado tore through their farm around 430 p.m. The tornado destroyed one silo and a barn at the Weir Farm. On State Route 40 just north of the Intersection with State Route 67 the roof of the Wiley Bros. Inc. Lumberyard in Schaghticoke was torn off with storage barns toppled and thousands of dollars of lumber carried away. According to the owner of the lumberyard, Matt Wiley, a portion of the main building ended up in Cambridge. Across the street from the lumberyard, several garages were destroyed along with extensive damage to a modular home. Along Verbeck Ave. the Czub Grain Farm sustained heavy damage as multi-ton grain bins were twisted and large pieces of farm equipment were toppled, including trucks and crop gathering combines. Two roofs were removed from homes along Geary Rd. as well as a chimney. Most of the damage in the Town of Schaghticoke was F2 with F3 damage confined to the area between Hemstreet Rd. and the Hudson River.

The tornado then dove southeast reaching the Hoosic River at Valley Falls then moved east across northern sections of the Town of Pittstown. Large swaths of trees either uprooted or sheared off were observed along many streets in the Village of Valley Falls as well as along State Route 67, Requate Rd., Cumo Rd., and County Route 111 between Johnsonville and Millertown. The tornado weakened in intensity from F2 to F1 and the path width decreased to 100 yards after this point as it traveled into the higher terrain of eastern Rensselaer County. The path of the tornado also became non-continuous as it skipped along Clum Rd., Marpe Rd., Barton Rd. and Nick Mush Rd. in the Town of Pittstown. Along Barton Rd. there was considerable roof damage to a trailer and a large tree fell on a house.

Next the tornado entered the Town of Hoosick with the damage swath becoming continuous once again. The tornado increased in intensity from F1 to F2 and the path width increased to 400 yards. Large swaths of trees either uprooted or sheared off were observed along Eddy Rd., New Rd., Tate Rd., State Route 22, Johnson Hill Rd., Stewart Rd., Cottrell Rd., Caretakers Rd., State Route 67 and Sodom Rd. Several homes lost their roofs along Eddy Rd. with the worst damage in the Town of Hoosick occurring at the Lukeland Dairy Farm on Tate Rd. where 9 cows died, a 60 ton cement silo collapsed and a 1.5 year old barn was destroyed. The roof of the family's home was partially removed and the south end of the house was caved in. Carlton Luke, owner of the farm, described the sky turning black as the storm approached and he and his family headed to the basement. They were aware a Tornado Warning was in effect, but had thought the storm would hit farther north. The Lukes' hunting dog survived the tornado after being picked up with his dog house and carried 300 yards. In addition a large metal silo at the farm sustained several large dents from debris hitting it. By the time the tornado reached Cottrell Rd. it had decreased to F1 in

intensity. The tops of several silos were sheared off and 17 cows were killed at the Cottrell Farm when power was turned back on Sunday Night with downed live wires still on the ground. The tornado moved from Rensselaer County into Bennington County east of the Bennington Monument.

We next traveled up Sodom Rd to State Line Rd. along the Washington/Bennington County Line. According to Laurie Olson of State Line Rd. in the Town of White Creek, a storm hit around 445 p.m. They were aware of the tornado warning and headed to the basement. A later storm which hit between 700 p.m. and 730 p.m. produced golf-ball size hail at their location. The damage in this area appeared to be from straight-line winds and extended only about a half-mile into Washington County.

Jim Williamson, owner of the State Line Farm in West Shaftsbury, VT reported that the sky turned green just before the storm hit. He was holding a picnic on that afternoon and remembered the scanner which one of the local fireman had broadcasting the tornado warning. He had all of his guests wait out the storm in the basement of his barn. Mr. Williamson also reported that thumb-nail size hail occurred with a later storm between 700 p.m. and 730 p.m and someone also reported seeing a funnel cloud at this time. He also measured 3.1 inches of rain for the day.

Field Survey Day #2

The survey team met up with Sgt. Gary Towne of the Bennington Police Dept. along State Route 67 at the New York-Vermont State Line at 845 a.m. on Day 2 (Tuesday, June 2, 1998). First we traveled down Harrington Rd. where we encountered damage approximately 2/10ths of a mile off of Route 67. We then traveled along Knapp Rd. where extensive tree damage occurred with trees uprooted and sheared off. At the home of Mary Kohler the survey team observed a barn destroyed, roof damage to the home and extensive tree damage. The occupants of the home went to the basement as the storm approached. Ms. Kohler also reported large hail with a second storm, but was unsure of the exact size. Numerous large trees were uprooted or sheared off along White Creek Rd., State Route 67, Hall St., West St., Church St., Mechanic St., Hawks Ave., Bank St., Overlea Rd., Paran Rd., McCarthy Acres Rd., and the Paran Acres Housing Development. Behind Whitman's Feed Store, just off State Route 67, at the Ed Barber residence a 100 year old Cut Leaf Maple crashed through the center of the house. Also a Fairbanks Trailer Truck was buckled, but standing behind Whitman's Feed Store. Between 1000 and 2000 trees were destroyed in North Bennington and according to Robert McWhorter, Village Trustee, at least 10 structures sustained significant damage. Mr. McWhorter had one complaint and that was that NWR was not working during the evening and without power, he was not able to get any updates on the storms. We explained to him about lightning knocking NWR off the air that evening and that they might consider installing a tornado siren to facilitate dissemination of tornado warnings to the public.

The tornado damage continued along Lake Paran. In addition to trees uprooted and sheared off, structural damage consisted of roof damage to homes, garage doors blown in, a camper was toppled and a pickup truck was moved 6 ft in the Lake Paran Housing Development. One of the residents, Fred Harrington, described the sound of the tornado as a freight train when it hit around

445 p.m. He had gone to the basement when he heard the tornado warning. He also observed quarter-size hail with a second storm which occurred approximately 30 minutes after the tornado. Some residents thought the storm was going to hit Manchester instead. One woman, Lynn Buak, was out walking when the tornado hit. She held onto the street sign at the corner of Lake Dr. and McGuire St. as the tornado lifted her feet off the ground and she became horizontal.

The tornado then continued east-northeast into South Shaftsbury where it also uprooted numerous trees and sheared the tops off of others. The hardest hit areas included Sycamore La., Holliday Dr., Colvin Ave., Meadow La., Cleveland Ave., State Route 7A, Ledgey Dr., Stevens Rd., Westview Pl., U.S. Route 7, East Rd., and finally Lower East Rd. where the tornado ended. Several homes in this area had their roofs removed or damaged. Sarah Keen, who lives on Holliday Dr., saw the sky turn green along with dime-size hail just prior to the tornado passage. Most of the tornado damage in Bennington County was F1 on the Fujita Scale with a few locations including the Lake Paran Estates sustaining F2 damage.

The survey team also found straight-line wind damage to the north of the tornado track which had occurred with a storm which was adjacent to the tornadic supercell. Straight-line wind damage was observed along White Creek Rd., Cold Spring Rd., Rollin Maddison Rd., Fred Maddison Rd., Horton Hill Rd., and Twitchell Hill Rd. Tim and Beth Pierce, SKYWARN Spotters, who live on Fred Maddison Rd. observed the storm as it hit around 445 p.m. Tim recorded a wind gust of 60 m.p.h. on his Davis Weather Monitor II at 446 p.m. The wind gust was probably 10-20 m.p.h. higher as the mounting bracket of the anemometer was turned 180 degrees. He also observed dime-size hail and a temperature drop to 60 degrees. Dime-size hail was also observed with a later storm which hit at 715 p.m. Tim's account of the storm fits the description of a downburst as he saw a white wall of wind hit his location as he looked out from the basement. The tree damage in this area was all in the same direction, oriented from west-northwest to east-southeast. The downburst track was several miles to the north of the tornado track.

The survey team believes the tornado track to be from Ushers Rd. in the Town of Halfmoon in Saratoga County, NY to Lower East Rd. in the Town of Shaftsbury in Bennington County, VT. No damage has been found further east in Southern Vermont from this tornadic supercell. Joe Armstrong, SKYWARN EC in Windham County, reported downburst wind damage in West Dummerston, VT and two funnel clouds which never reached the ground with a storm which hit the Brattleboro Area at 750 p.m.

Areal Survey of Stillwater Mechicville Tornado by Warren R. Snyder, Science Operations Officer. Survey taken aboard WNYT TV helicopter.

Tornado touched down in wooded area west of Mechanicville at 42 deg 54.7 min N 73 deg 044.8 W. Tree damage initially higher terrain, crosses field with little damage then damage to roofs and out buildings, (F1) areas extensive tree damage along RR tracks, (F2). Large brick building along tracks (apparently a train station or factory) is leveled, only part of one wall standing, rest just a pile of bricks. (F3) Path moved up a hill damaging about 5-6 houses with roofs ripped off, large trees town, extensive tree damage on windward side of hill. (42 deg 54.9 N, 73deg 42.4W)

Damage intensified rapidly as moves into village with roofs ripped off homes, all telephone poles blown down along rd, extensive tree damage (F2/F3), then moves to top of hill where one house totally leveled, another only the foundation remains and damage is extensive to adjoining houses. These were fairly substantial houses with foundations. (42 deg 54.9 N, 73 deg 41.6 W). Winds estimated around 200 mph.

Roofs and walls torn off homes across village, industrial and commercial buildings. Smokestack on one building 2/3 blown down and debris appeared to be single bricks. Path crosses Hudson River, tree damage (F3) on east shore at 42deg, 55.0 N 73 deg 40.4W and insulation from houses in Mechanicsville on east shoreline.

F2 tree damage with areas F3 east shore at 42 deg 54.9 N, 73 deg 38.8 W. Path fairly contiguous at 42deg 54.9N, 73deg 37.2 W total deforestation, Out buildings destroyed on farms 42deg 54.9 N, 73 deg 35.8 W. Path continues with F2 tree damage to 42 deg 54.8N 73deg 35.1W with path ending at 42deg 54.8 N 73deg 34.5 W.

Ground Survey East of Albany Airport -Surveyed 6pm Sunday 5/31/98

Tree down across Albany County Route 160 (Sicker Rd). Along Old Niskayuna Rd just south of Wade Rd several trees blown at 90 degree angles to each other just south of the Colonie Town Public Operations Center. At Sicker Rd and Runway Avenue, branches twisted off top of trees mostly blown in a southeast direction some to the south. Tree debris over TEAS Trucking Co in Industrial Area.

Forecast Office
251 Fuller Road, Suite B-300
Albany, New York 12203-3640

1 June 1998

MEMORANDUM FOR: Warren R. Snyder
Acting MIC

FROM: Mark R. McKinley *m.r.mckinley*
Aviation Program Leader

SUBJECT: Aerial Damage Survey

I met up with Franklyn Cole, Pilot from the New York State Police and Kurt Swartz from the Department of Environmental Conservation at the old Signature hangar. We then departed to the north from Albany International Airport and made a circuit over the Mechanicville area to Schaghticoke and back. The initial touchdown point was 42 degrees 54.7 minutes North, 73 degrees 33 minutes West and continued to a point at 42 degrees 54 minutes North, 73 degrees 44 minutes West.

It appeared that the western end of the damage path was either a suction swath or gustnado that quickly generated into the tornado with associated F3 (high end of range) damage. Maximum path width was estimated at 2000 feet with frequent 1500 foot widths. I took more than twenty aerial photographs of that and more importantly, Mr. Swartz activated the professional vertical survey camera from the Partenavia twin-engine aircraft. This is the same means that John Quinlan obtained aerial photographic documentation from the 1995 Derecho.

We then departed westbound for the Amsterdam vicinity to check the report of a tornado there and came up with no visible damage. We headed for Little Falls and the village of Mohawk, descending to 2200 feet and then to 1800 feet as stratocumulus continued to wedge us toward the ground. Given the lake effect cloudiness, Trooper Cole contacted Griffiss Approach Control and filed an IFR flight plan. We were instructed to climb to 3000 feet and were vectored to the runway 33 ILS final approach course and circled to land on runway 27.

After obtaining 60 gallons of fuel and a quick lunch, we departed back down the Mohawk Valley under VFR conditions and tried again to locate any damage near Mohawk. I did spot two trees that were adjacent to each other blown down near Ilion, but that was the extent of the damage.

We then proceeded to the north end of Schoharie County near Route 20, near the WSR-88D RDA to Selkirk and on into the East Schodack area, but again, no damage was detected. We then returned to Albany.

MEMORANDUM FOR: GENE AUCIELLO (METEOROLOGIST IN CHARGE)

FROM: HUGH W. JOHNSON IV (GENERAL FORECASTER NWSFO ALY)

RESULT OF SURVEY AT NEW BALTIMORE, GREENE COUNTY

Jonathan Blaes and I surveyed the damage around the New Baltimore area of northern Green County. We found extensive tree damage just to the west of Route 9W, very close to the Albany/Greene county border.

We talked to various individuals regarding the storm. They indicated the wind came up very quickly and most claim to hear a loud roaring sound. Two folks indicated dime to nickel sized hail fell before and possibly even immediately after the wind. There was a conflict on the timing of the wind, with eyewitnesses claiming the occurrence taking place anywhere between 645 and 715 PM Sunday evening. One lady did hear and see the warning on TV minutes before the storm took place. Several others took action and headed toward basements or interior of buildings when the wind arrived.

The swath of downed trees began to the west of Deans Mill road and was orientated in a East Northeast direction across Huckle Hill Road. The path was about half a mile long and approximately 200 yards wide. Dozens of maple trees were snapped or even uprooted. Poplar trees were also stripped of their bark in a few cases. A hemlock tree crashed into the roof of one home, and the weight of the it resulted in damage to a brick chimney wall. Also, a tree fell across a shed behind the damaged house, crushing the back end of it. Two cars were destroyed by fallen trees.

There was no structural damage as a direct result of the wind. No shingles were torn off any roofs despite the fact the at least four houses were in the direct path of the storm.

There were no fatalities or injuries.

The consensus between Jonathan and myself rule this storm as a Microburst resulting from a Supercell Thunderstorm. Peak wind gusts were estimated in the vicinity of 80 MPH. Most of the downed trees were blown in a relatively divergent pattern, with some minor twisting evident.

HWJIV/JLB

Schoharie, Southern Albany, & Northern Greene counties Investigation May 31, 1998

Jonathan Blaes
George Maglaras

During the course of our investigation, we interviewed residents, utility workers, highway department personnel, post office clerks, convenience store attendants, volunteer fire fighters, law enforcement officials, Greene County emergency management officials and employees of TEPCO where a funnel cloud was reportedly seen. Everyone we talked to was friendly and quite cooperative. Nearly all of them were aware of the potential severe weather situation on Sunday.

By far the most significant damage was across southeastern Albany County. Tree limbs and branches were observed in approximately 1 of every 5 properties. Even though this was the most significant damage it was not extensive. Downed trees were prevalent but not widespread. **All of the damage we observed was from straight line - non-tornadic winds.**

Schoharie County -

No indication of Tornadoes.

Scattered wind damage throughout the county, mainly small trees and limbs down.

Reports and Information Collected...

Possible wind damage in Sharon, time unknown, suspected it occurred in first storm.

Several trees blown down in Village of Schoharie at 410 PM.

Trees down in Blenheim at 430 PM.

Trees and wires down in Sharon, time unknown, suspected approx time 500 PM.

Sheet metal roof ripped off portion of farm structure in Richmondville at approx 635 PM.

Damage appeared to be blown N to NE from straight line winds.

Roof removed from cattle barn at approx 635 PM.

Damage appeared to be blown NE from straight line winds.

Several trees and tree limbs blown down in Jefferson, time estimated at 630-635 PM.

Small concrete silo destroyed in Gilboa, time estimated at 6-630 PM.

Dime size hail in Blenheim at 645 PM.

*** Unable to verify Schoharie TOR 435 - 530 PM. Closest report was at 430 PM in Blenheim - trees down.

Southern Albany County -

No indication of Tornadoes.

Scattered wind damage throughout the southern portions of the county.

Most widespread damage was across Bethlehem and Delmar.

Damage was widespread but not universal.

Reports and Information Collected...

Sporadic wind damage in Westerlo.

More widespread wind damage in Bethlehem and Delmar - trees and wires down.

Could not verify reports of funnel clouds in Selkirk.

During follow up phone call on 6/1/98, observer at TEPCO at approximately 710 to 715 PM reported a wall of wind but no funnel cloud. Earlier reports and information indicated information was from him (he was the only one on shift).

Northern Greene County -

No indication of Tornadoes.

Isolated wind damage was observed throughout northern Greene County. The damage was generally confined to small limbs and branches. A few larger limbs and trees were observed blown down.

Reports and Information Collected...

1.0" hail in Greenville covering the ground at 430 PM.

1.0" hail in Norton Hills at 500 PM.

Tree down in New Baltimore at 508 PM.

Tree down in Greenville at 733 PM.

Dime Size hail in Catskill at approx 745 PM.

*** Verified the following warnings...

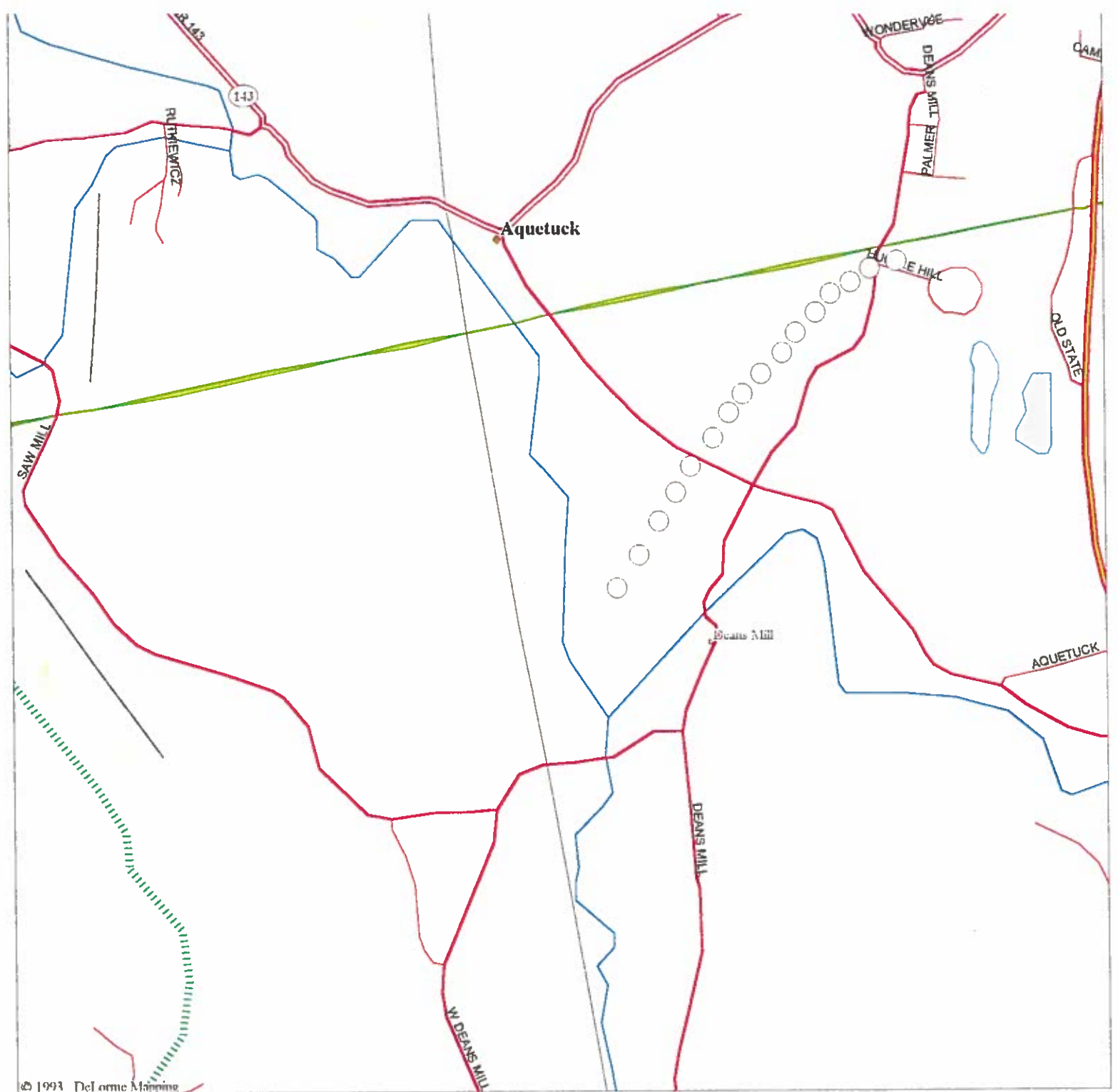
**Greene SVR 457 - 615 pm Quarter size hail (1.0"), Norton Hills, 500 PM
Tree down on Rte 144, New Baltimore, 508 PM**

Greene TOR 703 - 800 pm 1 inch hail, Catskill, 745 PM

George and I gathered the following information to verify previously unverified warnings in counties other than the ones we were initially sent to investigate.










Columbia TOR 836 - 930 pm Trees down, between Hillsdale / Copake, 8-9 PM

Berkshire TOR 836 - 930 pm Wind damage, South Lee, 840 PM



© 1993 DeLorme Mapping

LEGEND

-  State Route
-  Geo Feature
-  Town, Small City
-  County Boundary
-  Population Center
-  Street, Road
-  Major Street/Road
-  State Route
-  US Highway
-  River
-  Airfield
-  Utility (powerline)
-  Open Water
-  Contours

Scale 1:15,025 (at center)

1000 Feet

500 Meters

NEW BALTIMORE MICROBURST

Mag 15.00

Wed Jun 03 09.26.08 1998

STORM DAMAGE SURVEY REPORT

George Maglaras
Mark McKinley
Ken LaPenta

We began the survey along the eastern end of the suspected tornado path.

A 50 yard wide swath of significant tree damage was found oriented in a west to east direction across the Northway, just south of Route 7. We were able to find additional damage for about 100 yards east of the Northway. We traced the path of damage westward and were able to find occasional tree damage to near the Air National Guard facility at the Albany International Airport. If extended further west, this damage path was found to cross the Albany ASOS unit, where a 82 MPH wind gust was reported at 440 pm. We then searched areas west of the airport and found additional scattered tree damage as far west as about one-half mile west of the Memory Gardens Cemetery. The most widespread damage was near the Hilton Hotel where several were uprooted or sheared off. All the damage observed appeared to be along a straight path for the entire length.

An FAA employee who was in the airport tower during the event, was interviewed by Mark McKinley. This FAA employee had observed a funnel cloud during the storm and had augmented the ASOS observation to include this sighting. This employee reported that the funnel cloud moved along or very near the damage path that was observed by the survey team. However, the employee stated that the observation was very difficult to make due to the funnel cloud being rain wrapped.

Due to the very narrow and linear nature of the damage path, the wind gust reported by the Albany ASOS unit, and confirmation of a funnel cloud by a reliable FAA employee, we believe the observed damage to have been caused by a F0 to occasionally weak F1 tornado. The path length was 3 miles and path width 50 to 75 yard. The tornado was not on the ground continuously.

May 31st Severe Storm Survey of Northern Columbia & South Eastern Rensselaer County

I. Northern Columbia

Two thunderstorm tracks across the area with sparse damage reports. One was at approximately 5:15 PM and the other was ~7:30 PM.

Track 1 (5:15PM)

Began at Kinderhook Lake Dam with one tree down southeast; continuing east southeast to Maple and Main in the village of Niverville with some structural damage; Rose and Kinderhook streets in Niverville, tree tops of maple tree; next damage southeast to Cty Rte 17 and NY 66 at cemetery, one large (14") limb down; continuing east southeast to Rte 295 in East Chatham next to Methodist church, one limb (10") down; last damage sighted at Rte 295 and Black Bridge Rd with one large (24") limb down. No eyewitness reports of significant phenomena at the time of damage.

Track II (7:30PM)

Began at Plumb Tree Drive in Niverville, siding (5' X 12') ripped from southwest corner of residence; continuing southeast to Rte 28B, Niverville, 20" cherry tree twisted at ground level and maple tree behind house (west side) split; southeast to West Shore Drive in Niverville, one large tree topped (14") missing structure/power lines down; last damage sighted at Route 203 Niverville, by Electric Park Road one foot diameter ash tree down.

II. Southeast Rensselaer county

Several storms occurred in Rensselaer county. One of two storms in the Stephentown area caused considerable damage to trees and one farm building. Eyewitness accounts fix the time in between 6:30 and 8 PM. The damage began in the vicinity of one quarter mile south of West Road on Rte 22. It stretched north along Rte 22 for approximately 3 miles. The length of the path was from the base of the hills west of Rte 22, adjacent to West Road, to the base of the hills to the east of East Road (approximately 2 miles long). All eyewitness accounts mentioned rotation of clouds and green sky, with hail occurring at each site. The southeast corner of the damage area coincides with the same area that received significant damage during the July 3rd 1997 severe weather outbreak. The area is a north south oriented valley with relatively steep hills on either side.



June 10th, 1998

To All at the National Weather Service-Albany:

I know that this letter is long overdue, but I just want express my sincere thank-you for all the wonderful work that you all did on May 31st with the Severe Thunderstorms and of course the Tornadoes. The job that you all did with all your warnings and statements was absolutely amazing. The accuracy was at a level that I have never seen before. You enabled me and the other media outlets to get the information out to the public in a very timely manner that I think was the reason so many lives were saved and we prevented more injuries. The Doppler Radar was out of this world.....what a piece of equipment !

I hope that more people recognize the tremendous work that you all did. I know that I do and have said it many times on the news. Congratulations on a job well done....I hope that there is a state or government award that your office can receive for what you did on May 31st. We are lucky to have you as our National Weather Service !! It has always been my pleasure to work with all of you.

All My Best,



Steve Caporizzo

TV-10 Chief Meteorologist/Pet Connection

Author: W2FXJ@aol.com at EXTERNAL
Date: 6/3/98 9:01 AM
Priority: Normal
TO: Stephen Pertgen at W-ER-ALY
Subject: Fwd: New York Severe Weather Impact

June 1, 1998
03:30 am

Amateurs came out in force when severe weather hit the Capital District and beyond late Sunday afternoon. A line of successive storm cells pounded Albany and surrounding counties. Severe weather nets were begun in at least 6 surrounding counties, as well as in neighboring Vermont and Western Massachusetts. "Take cover" advisories were issued through the late afternoon and evening, and severe storm and tornado warnings were posted in outlying counties until as late as 2 am.

Albany National Weather Service's Steve Pertgen W2FXJ, operating under the Albany NWS call of WX2ALY, was heard on many area repeaters issuing the warnings and gathering reports. Most prevalent because of the tri-state area it covers was the 146.91 Mt. Greylock, Massachusetts repeater. The net, run by Don Horton N1ISB, was in high gear throughout most of the evening.

Other more localized nets were run in Rensselaer, Greene, Columbia, Schoharie, Schenectady, and Albany counties. One such net evolved in the city of Mechanicville, where 2 tornadoes touched down. Initial reports state that at least 15 homes were leveled, with much property damage to both residences and local businesses. What began as volunteer coordination by Jim Pickett N2RXB to assist police and fire personnel in the city of Mechanicville in Saratoga County, evolved into an operations net for Red Cross of Northeastern New York. John Farina WA2QCY, was grabbed up for NCS duty, and stayed with the net until conclusion at 1:48 am. Red Cross shelters were opened at three sites, two in Saratoga County and one in Rensselaer County. The shelters will house some 100 displaced residents for at least into Monday morning. Red Cross damage assessment will begin as soon as authorities declare the area safe for access, which is being hampered by downed trees and power lines. Although at least two dozen people were injured, no loss of life was reported.

April Stack K2ZCZ
Communications Officer
Red Cross of Northeastern New York
residence 518-786-6969
digital pager 518-343-6969

Red Cross Disaster Services
Because Help Can't Wait

Author: Gene Auciello at W-ER-ALY
Date: 06-8-98 08:37
Priority: Normal
TO: Mail List - #W-ER-ALY
Subject: Mechanicville, NY Tornado

All...

More kudos...this time from Gary Grice, Deputy Directo, SPC.

Gene

Forward Header

Subject: Mechanicville, NY Tornado
Author: Gary Grice at W-NSSL-SPC
Date: 6/7/98 11:08 AM

Gene,

Since your office issued the warning, this applies more to your office. Messages like this make it all worthwhile. Congratulations on a job well done. I enjoy working with you on the NWSH Reengineering Committee. I think we have a significant task, but it must be done for the good of the agency.

Gary

Forward Header

Subject: Mechanicville, NY Tornado
Author: Hildr711@aol.com at EXTERNAL
Date: 6/7/98 10:31 AM

Hi Gary,

I want to personally thank you and your staff at the SPC for helping to save the people of our small city from last Sunday's tornado. Thanks to your prompt warning, we had time to seek shelter. The path is a mere 2000 feet from my home, but our restaurant was hit. Damage was considerable, but nowhere near the damage to homes in our area. My brother-in-law saw the yellow sky and the houses being blown apart up on the hill, and quickly warned all customers to "hit the floor". He said then there was silence, followed by the most incredible ROAR (greater than a frieght train...being a railroad town we are familiar with that sound). The building shook violently, but held together. The front of his van was lifted to an almost vertical position, then set back down and was driveable with no damage.

No lives were lost and we consider ourselves extremely fortunate, in spite of the severe damage. Just walking through the damaged areas following the tornado, left me in total AWE. I've been teaching Earth Science for years, have seen numerous pictures and films, have read about tornadoes, etc....but seeing it first hand is truly believing the awesome power of nature.

I am an Atmosphere Education Resource Agent [AERA] with Ira Geer's Project Atmosphere group and received training at the NSWTC in Kansas City two summers ago. Please say hello and thanks to Joe Friday (no email address on your web page) for me. I still remember his tornado chicken photo...now I know! Also, hello and thanks to John Snow.

Thank you again for your efforts 'to protect people and property'. I am proud to have some association with the National Weather Service, NOAA, AMS, etc.
Carol Hildreth