Palm Sunday Tornado Outbreak – April 11, 1965

60th Anniversary

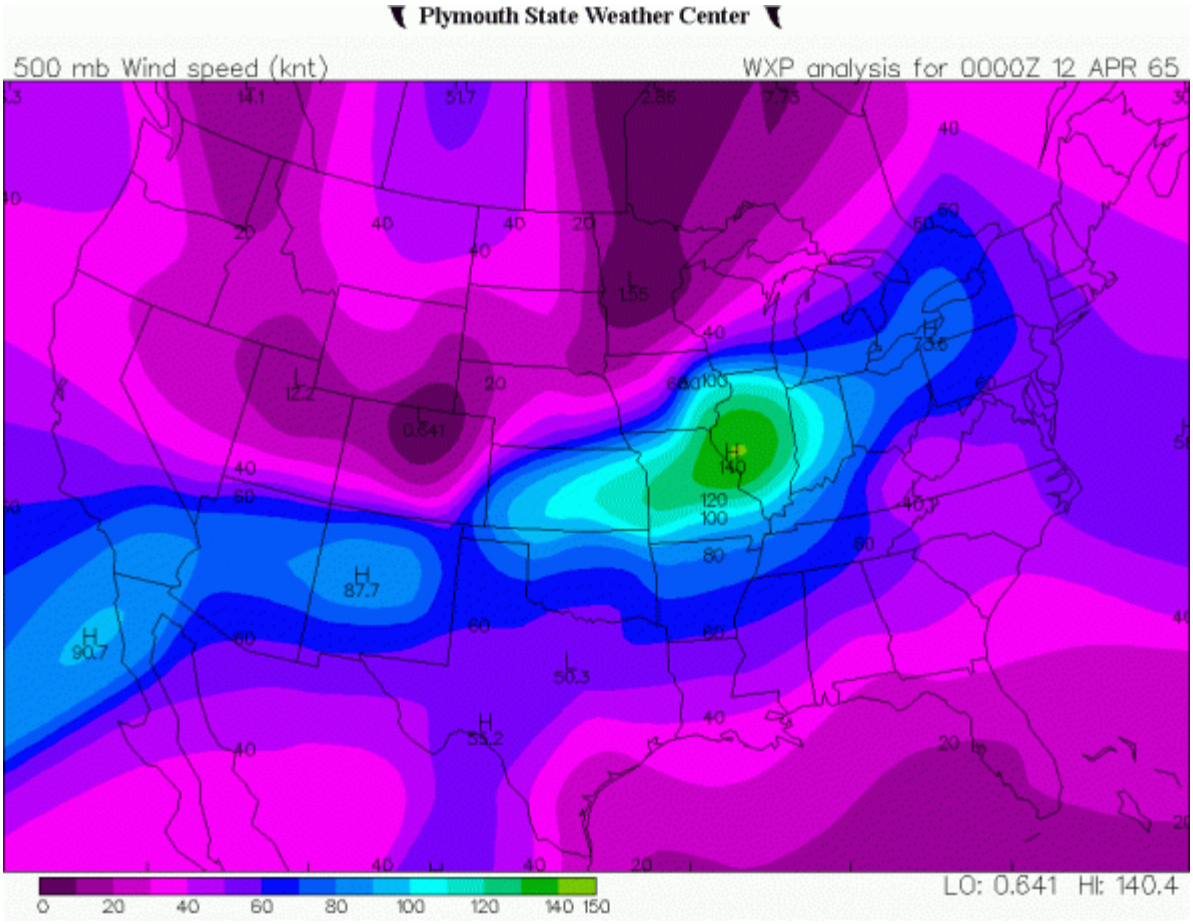
Summary by John Haase Meteorologist/Forecaster

NOAA/National Weather Service Quad Cities IA/IL

Across the upper Midwest, March of 1965 was cold, snowy and miserable. The month began with blizzard conditions across the region on March 2, bringing heavy snow and a biting 50 mph winds. Another, more significant blizzard would follow on St. Patrick's Day, March 17. Several feet of snow buried the region, while 60 mph winds whipped the landscape and blew the powdery snow into vast drifts tall enough to bury cars along the streets. In many locations, 1965 ranked among the top-20 coldest and snowiest Marches on record. A respite would not come until the first week of April, when a surge of warm air brought unseasonable warmth and temperatures into the low 70s. The warmth would not last long, however, as another arctic air mass settled over the region on the 8th with temperatures slipping back to the 30s and 40s.

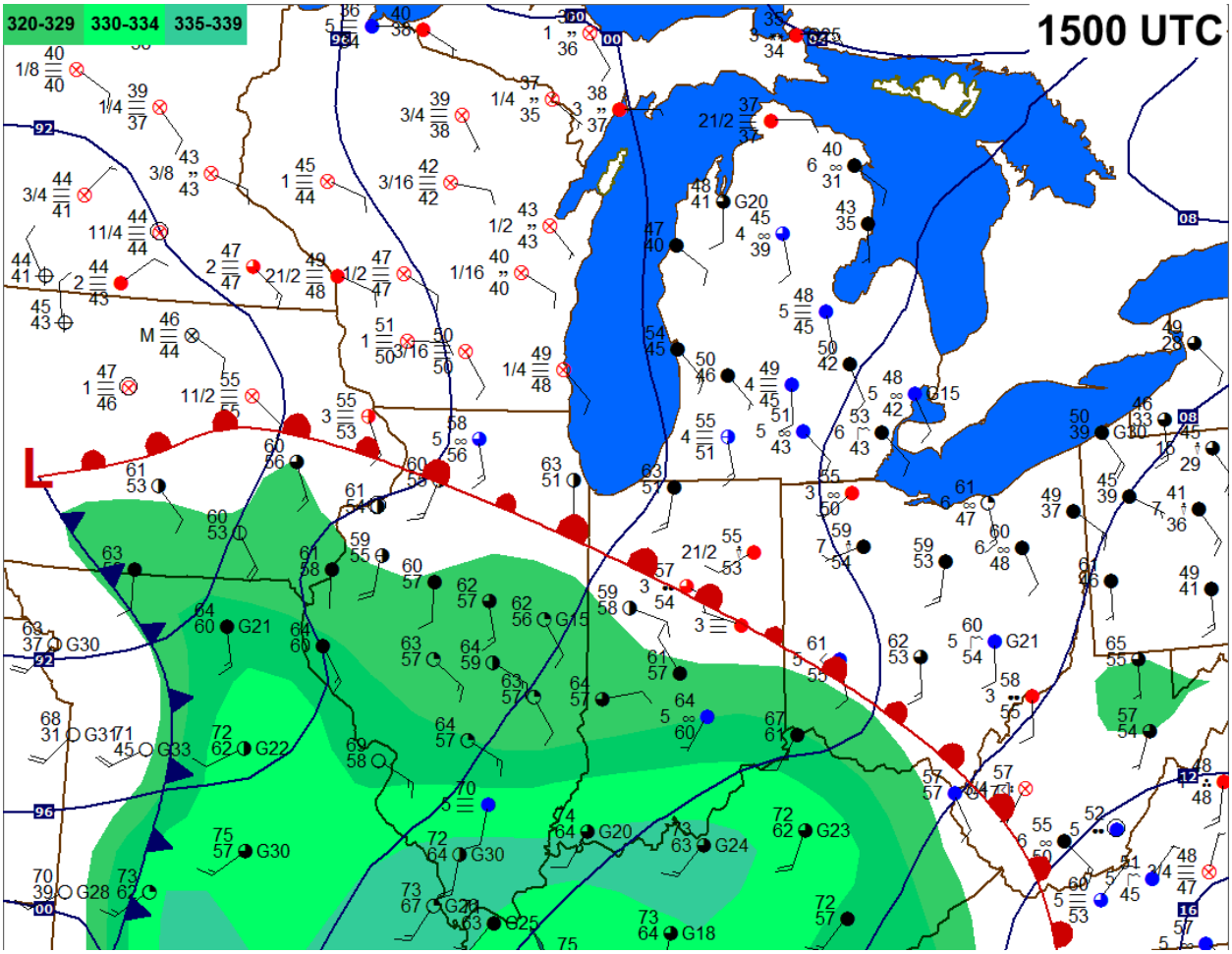
By Palm Sunday weekend, low pressure was edging toward the Midwest, drawing in warm, humid air from the Gulf of Mexico and pulling a mass of cold and extremely dry air behind it. A 25-knot southerly low-level jet combined with stretches of clear skies and sunshine to rocket temperatures into the mid-70s to around 80 across the warm sector. With unseasonably high dewpoints in the 60s, residents throughout the region headed outside to enjoy the first beautiful spring day of the year. In some areas, the heat grew to become oppressive. In the words of retired police chief Warren Hale of Milan, Michigan; "The day was so warm and wonderful. The family and I decided go on a picnic in the Irish Hills, because it was too stifling in the house. The heat and humidity drove us crazy so we had to just get away from it all."

Unknown to all outside the meteorological community, a nearly unprecedented atmospheric setup was approaching from the west-southwest. The U.S. Weather Bureau had been tracking a large, complex storm system moving toward the middle of the country from the Pacific Northwest. When weather offices throughout the Southwest and Central Plains released their morning weather balloons on Sunday, the rawinsonde data that they received was disconcerting. Winds near the 500 mb level, about 18,000 ft., were exceptionally strong. Stations across a broad swath of the Midwest reported winds well in excess of 100 knots. An absolute maximum of 159 knots (183 mph) was detected over Dodge City, Kansas. By the time all observations had been taken, analyzed and prepared into charts, the larger picture had fully come into view. An extremely strong jet stream was digging into the heart of the Midwest, and rounding its base was an extraordinarily intense jet streak with a core of 140 knot winds.

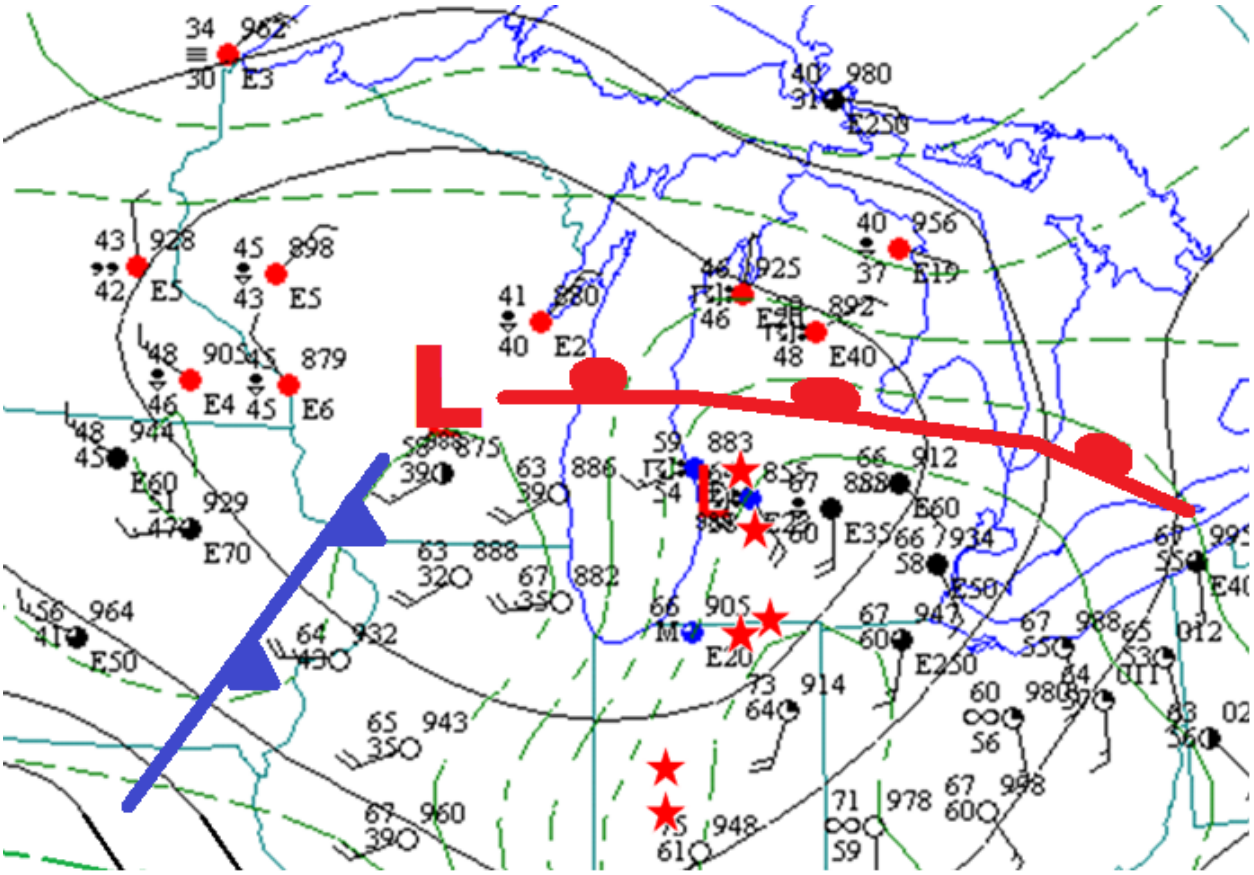


A chart showing observed wind speeds at the 500 mb level on April 11, 1965. Note the intense jet streak located over the Midwest, with an absolute maximum of 140 knots over west-central Illinois.

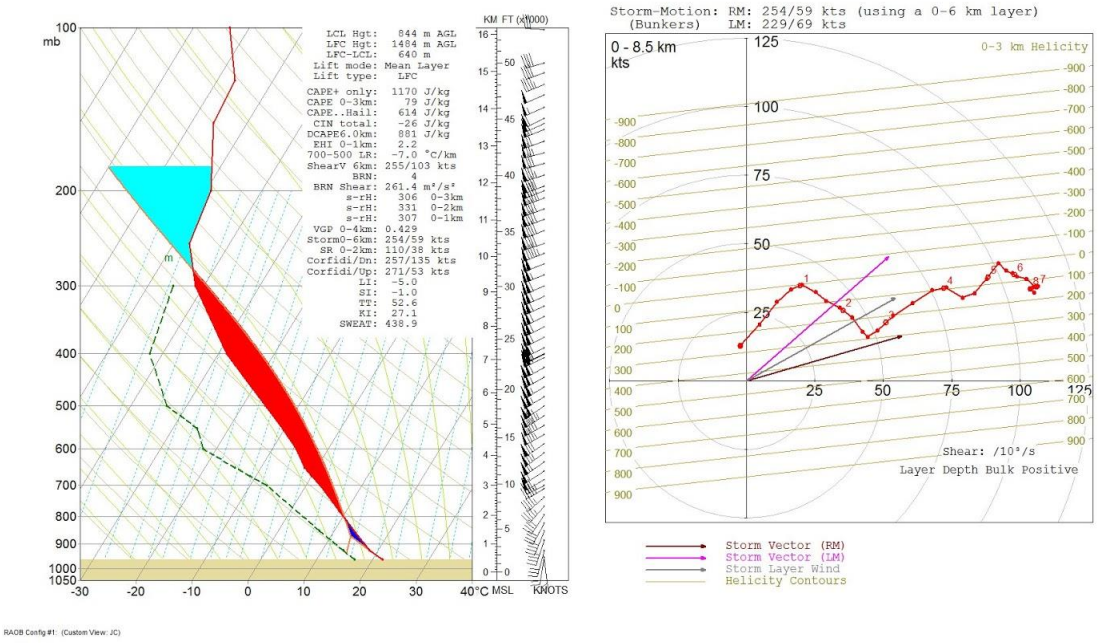
Hand-analyzed surface map for 12 am on April 11.



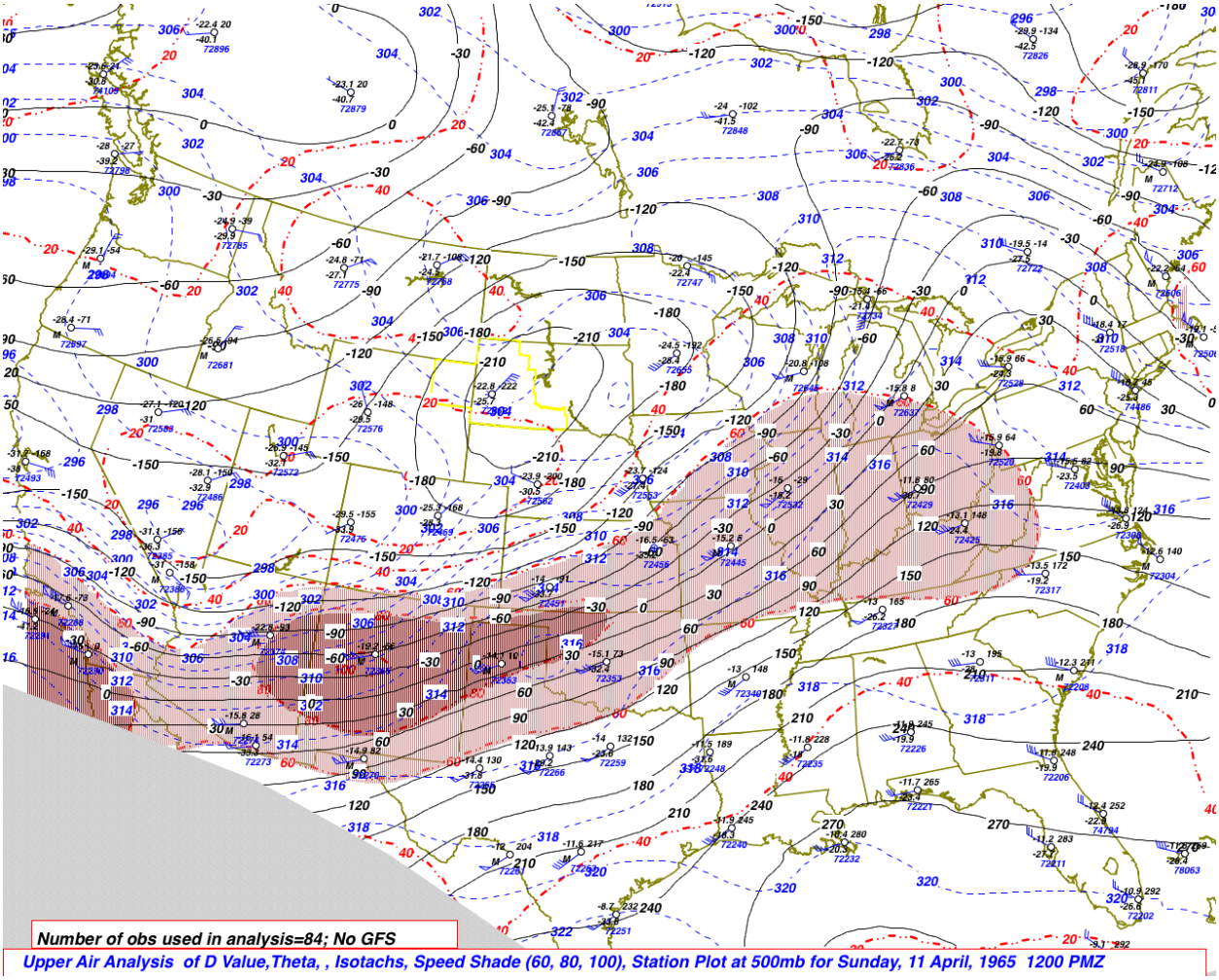
Surface map at 15z April 11, 1965



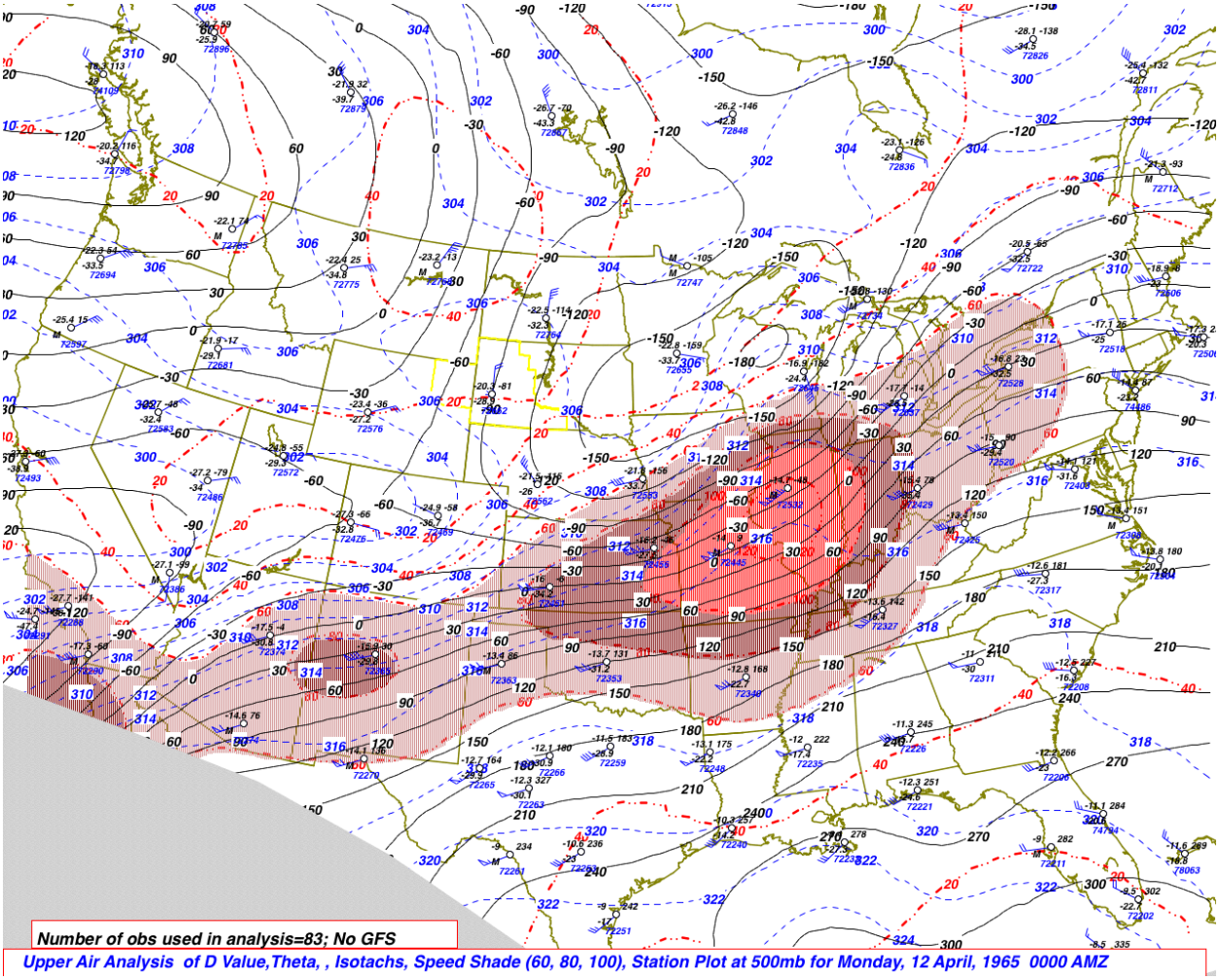
The weather map at 7 PM on April 11, 1965 shows the low pressure center over Wisconsin and a warm front north of Grand Rapids. The red stars show the locations of tornadoes in Indiana and Michigan.



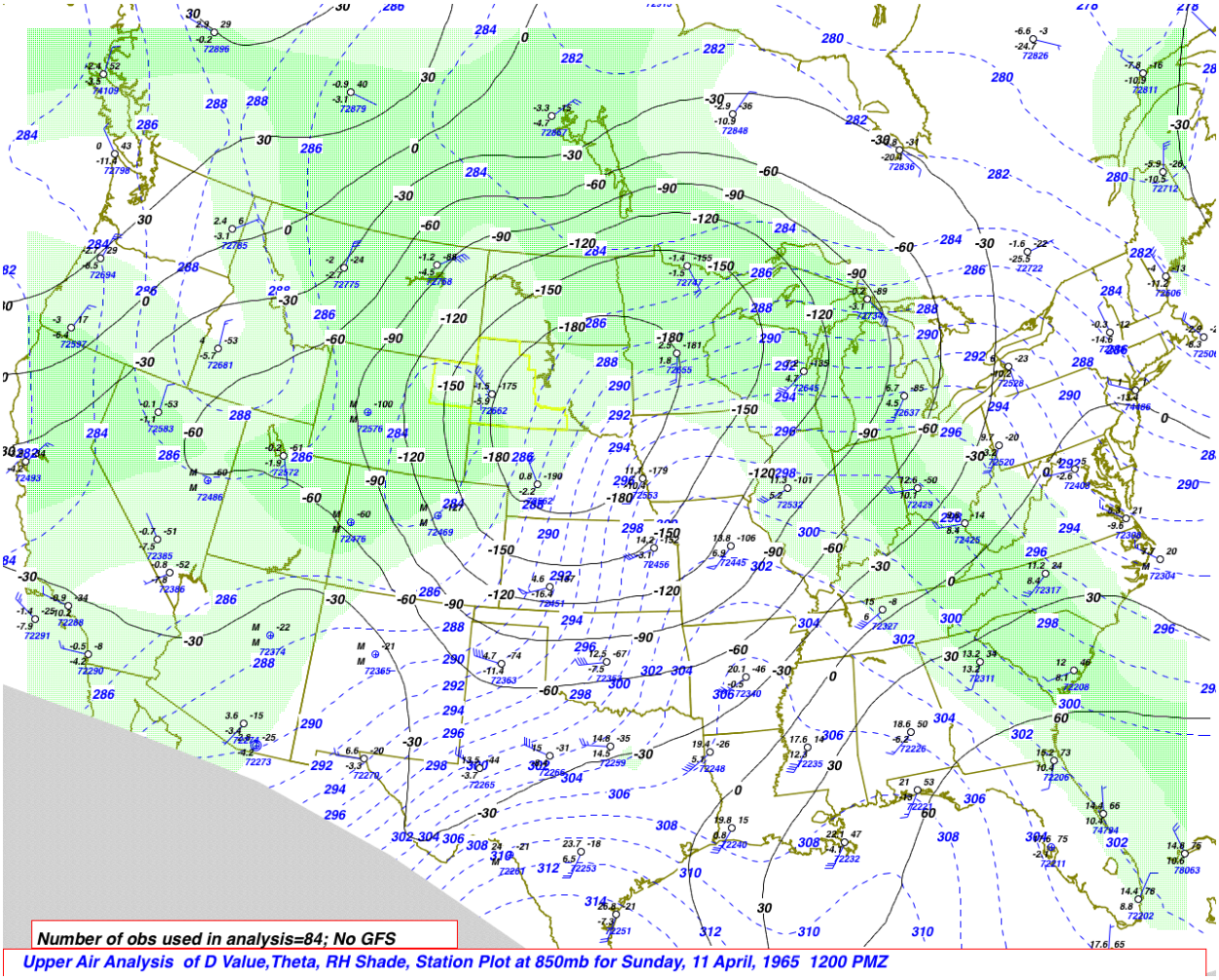
Synthesized sounding for KSBN (South Bend, IN). 23Z surface data was combined with merged sounding data from Peoria, IL (KPIA) and Flint, MI (KFNT) and then blended with NCEP-NCAR reanalysis data (50% each) at available levels to further improve the sounding data.



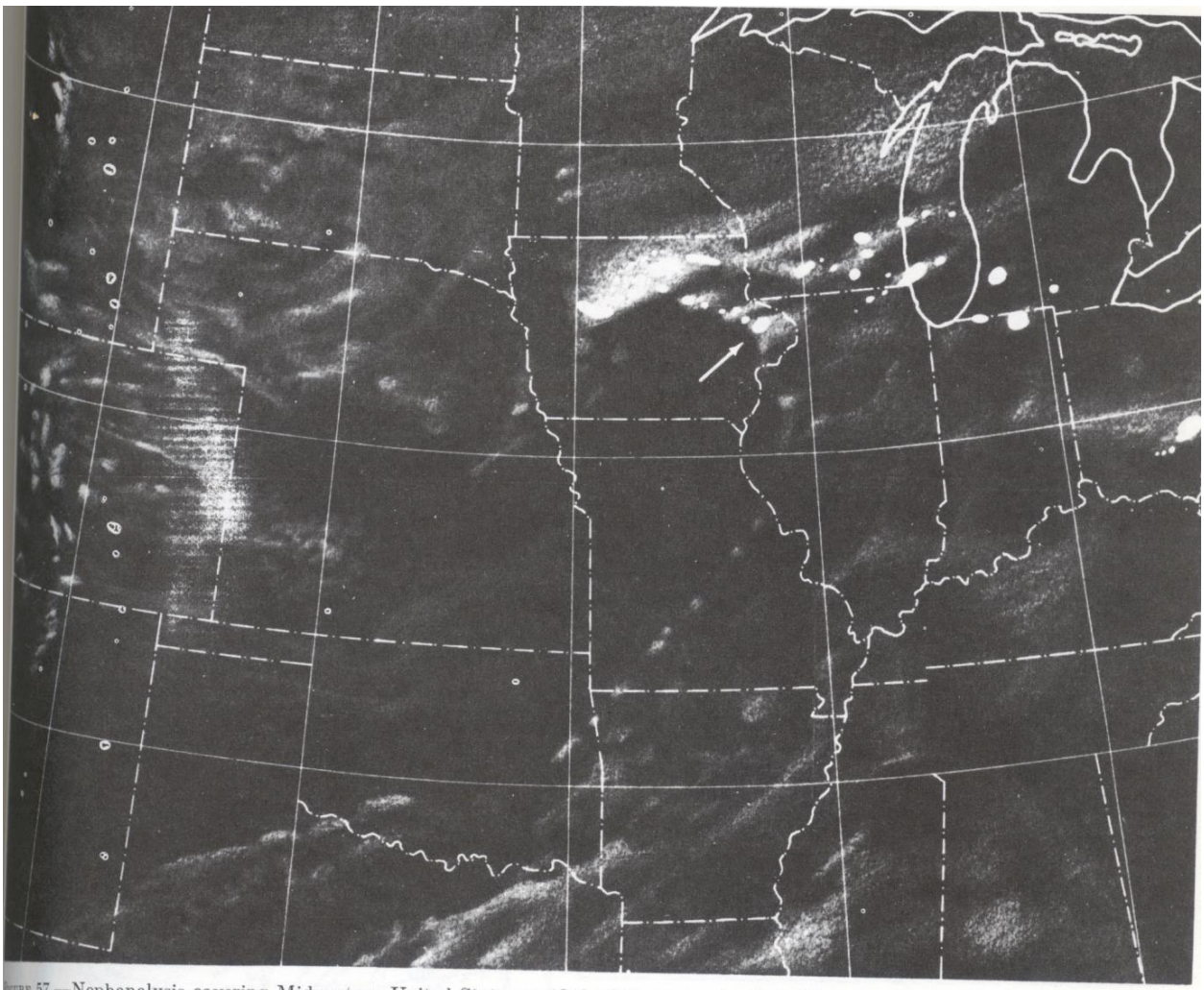
Upper Air Analysis of D Value,Theta, , Isotachs, Speed Shade (60, 80, 100), Station Plot at 500mb for Sunday, 11 April, 1965 1200 PMZ



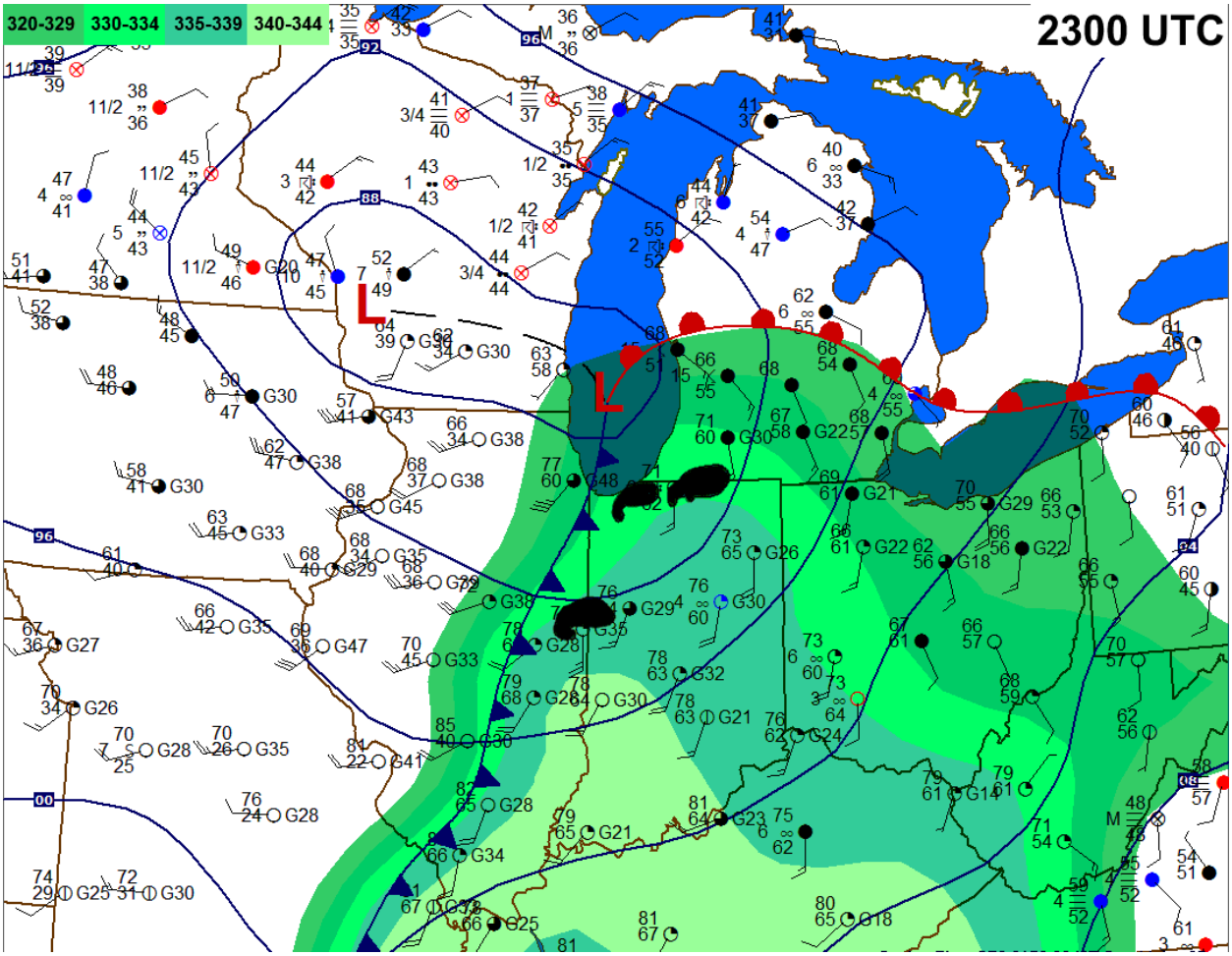
Upper Air Analysis of D Value,Theta, , Isotachs, Speed Shade (60, 80, 100), Station Plot at 500mb for Monday, 12 April, 1965 0000 AMZ



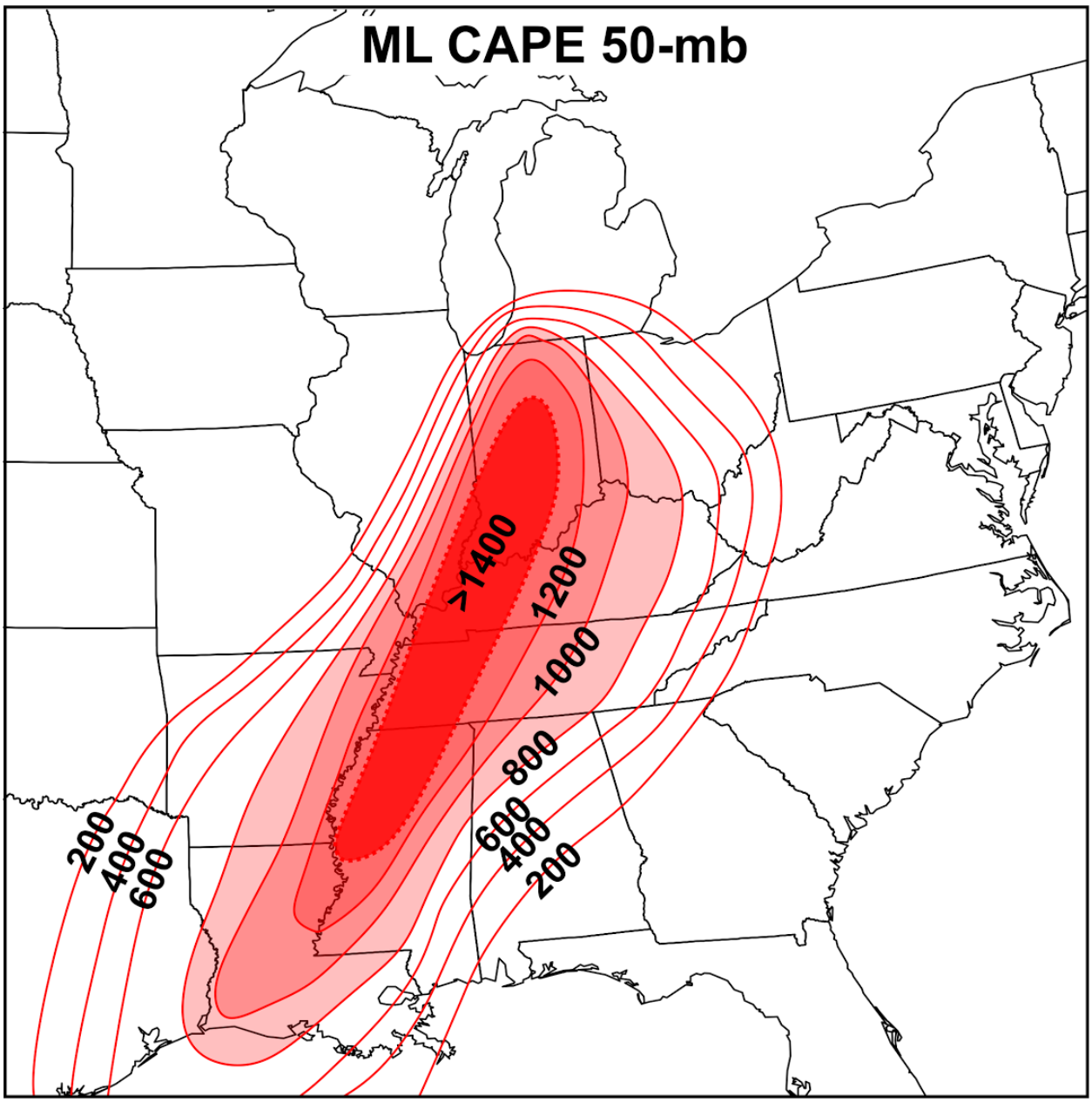
Upper Air Analysis of D Value,Theta, RH Shade, Station Plot at 850mb for Sunday, 11 April, 1965 1200 PMZ



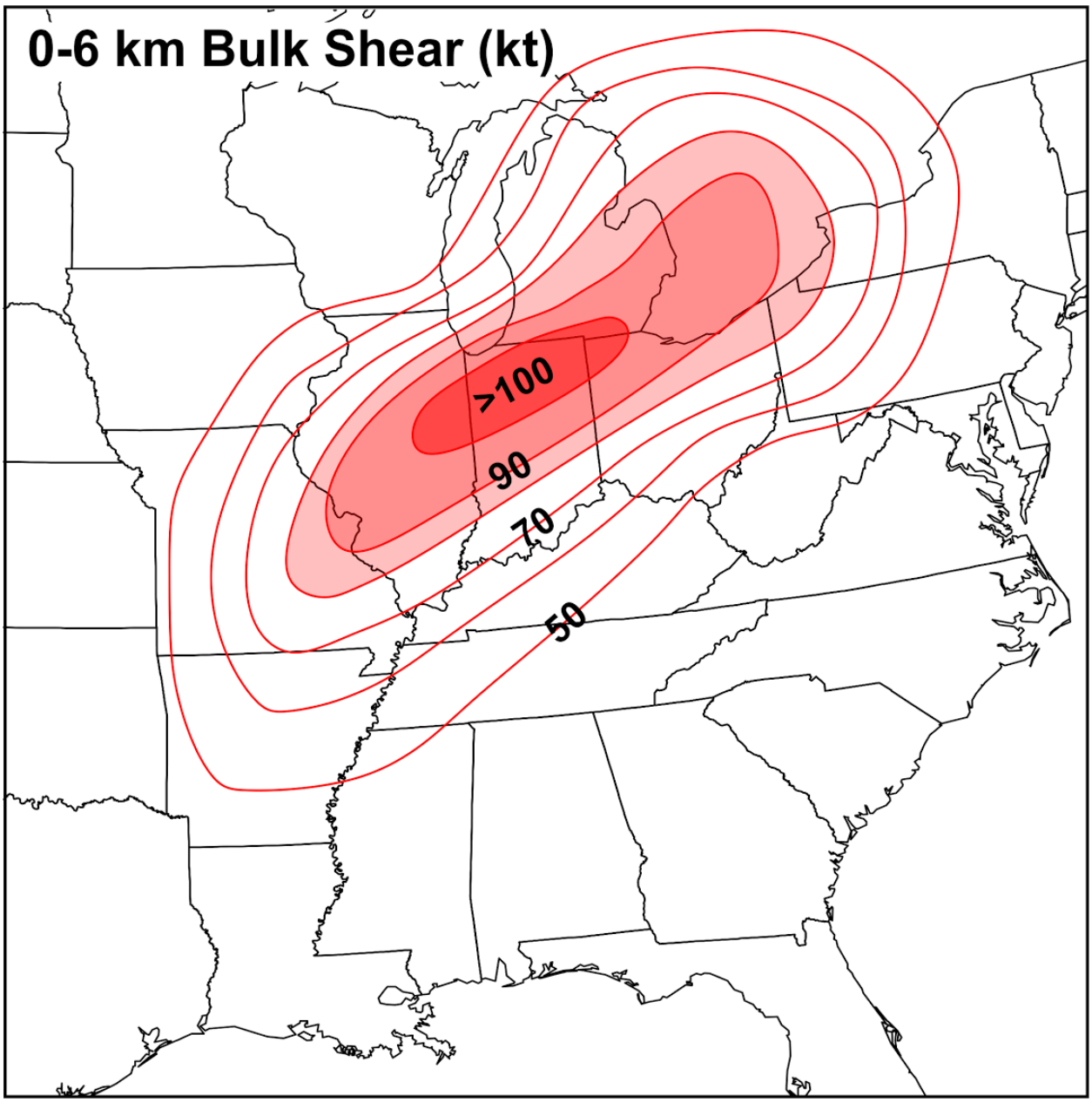
IGURE 57.—Nephanalysis covering Midwestern United States at 1240–1248 CST on April 11. The echo that produced the first tornado, about 20 min earlier in Iowa, is indicated by an arrow. White spots are radar echoes obtained at the time the satellite pictures were taken.



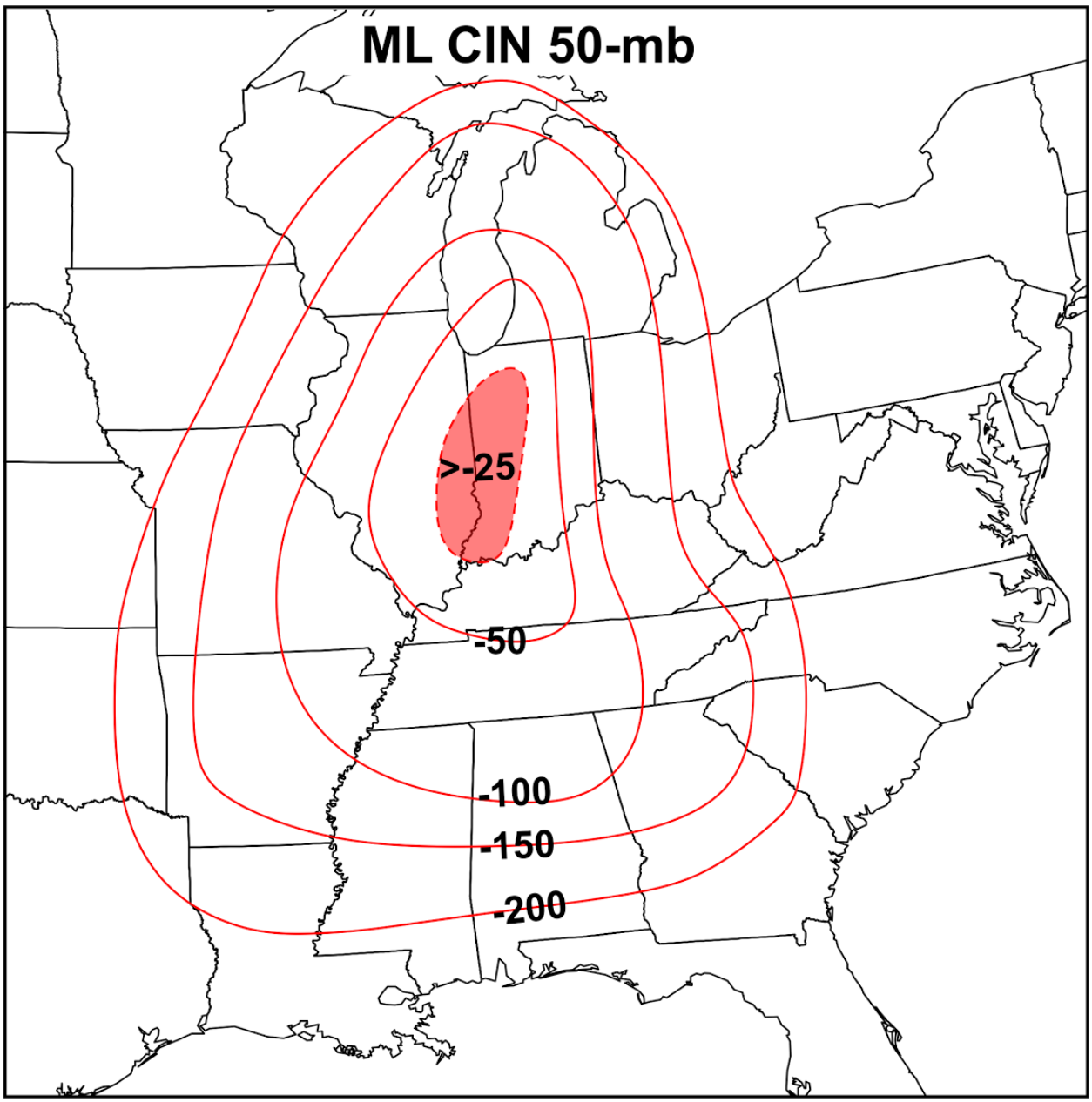
Surface map at 23z April 11, 1965 with radar imagery overlaid showing “hook echo” returns indicative of tornado activity.



23z April 11, 1965 50 mb Mixed Layer CAPE



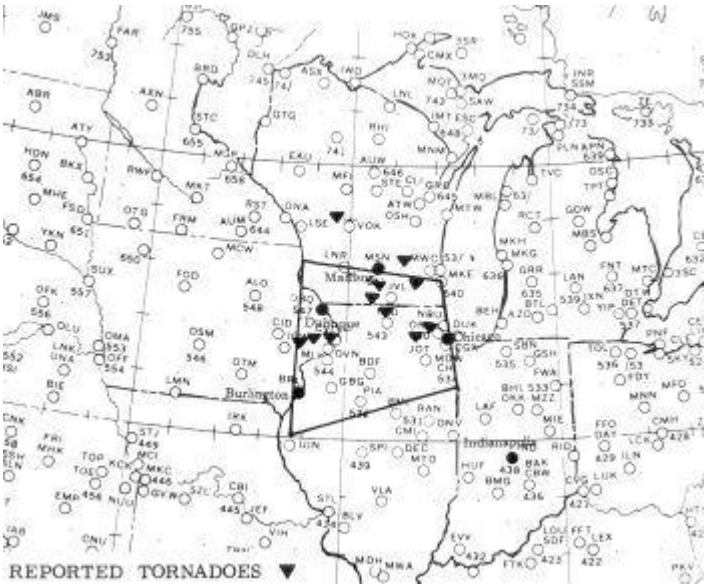
23z April 11, 1965 0-6 km Shear



23z April 11, 1965 50 mb Mixed Layer CIN

The low pressure system, rapidly deepening in response to the exceptional upper-level winds, drifted eastward toward central Iowa. Hand-analysis charts revealed a warm front extending from the low eastward across central Illinois and central Indiana, eventually reaching as far as South Carolina. Trailing behind the low, a cold front was draped south across the Ozarks and southwestward to Texas. By 10:45 am CST, forecasters at the Severe Local Storm Warning Center (SELS) in Kansas City, Missouri, a forerunner of today's Storm Prediction Center, began to suspect that conditions were setting up for rough weather. The intense jet streak, along with very strong, veering winds throughout the atmosphere, provided abundant rotational energy for any storms that managed to fire. Shortly before noon, a Severe Weather Forecast was issued mentioning the possibility of isolated tornadoes from northeast Missouri to central Illinois and north-central Indiana.

By the time the Severe Weather Forecast was issued, thunderclouds were already growing in the skies over the Iowa towns of Cedar Rapids and Waterloo. Strong, gusting winds were followed shortly by a spattering of rain and small hail. At 12:45 pm, a funnel descended from the clouds and began snapping and debarking trees outside of Tipton, Iowa. The tornado ripped through more than two dozen farms, flattening many structures along its path and carrying large pieces of debris from one farm house more than a mile. The tornado would later be rated F4, traveling 40 miles across Cedar, Clinton, and Jackson counties before dissipating near Springbrook and killing one man as he ran for his storm cellar. Unaware of the destruction in Iowa, concern nevertheless began to rise at the Severe Local Storms Center. A second Severe Weather Forecast was issued at 1pm CST, mentioning the possibility of "one or two" tornadoes:



Severe Weather Forecast Number 68, issued at 1 pm CST by the Severe Local Storms Center. The area of concern is outlined by a polygon.

SEVERE WEATHER FORECAST NUMBER 68

ISSUED 100 PM CST APRIL 11, 1965

EXTREME SOUTHERN WISCONSIN
EXTREME EASTERN IOWA
PORTIONS OF NORTHERN ILLINOIS

A FEW SEVERE THUNDERSTORMS WITH LARGE HAIL DAMAGING WINDS AND ONE OR TWO TORNADOES ARE EXPECTED FROM 1 PM UNTIL 6 PM CST THIS SUNDAY AFTERNOON AND EVENING IN AN AREA BOUNDED BY THE POINTS 40 MILES SOUTH OF BURLINGTON IOWA TO 50 MILES WST OF LONE ROCK WISCONSIN TO MILWAUKEE WISCONSIN TO 40 MILES SOUTH EAST OF CHICAGO ILLINOIS BACK TO THE POINT 40 MILES SOUTH OF BURLINGTON IOWA.

WOOD … 1906Z

The next killer tornado touched down in Jefferson County, Wisconsin, just west of Jefferson. The F3 tornado caused damage to a number of farms before crossing U.S. Route 16 near Piperville, Wisconsin where it ripped two cars from the roadway and tossed them several hundred feet, mangling the vehicles and killing three occupants. A further 28 people were injured along the tornado's half-mile wide, 24-mile path, including 12 in one home. South of Watertown, several additional farms were struck and a number of buildings were demolished. The tornado may have been at or near F4 intensity at this point, as evidenced by the fact that some destroyed buildings were reportedly reduced to "piles of rubble."

Radar operators at the US Weather Bureau office in Chicago — one of just two offices in the affected area with access to the somewhat more modern WSR-57 radars — monitored their screens with nervous anticipation as several small, white blotches began to grow in size and number. Explosive thunderstorm development had begun across Iowa, Wisconsin and northwestern Illinois. Unknown to the operators at the time, multiple tornadoes were already in progress and causing damage through largely rural areas of Iowa and Wisconsin. Forty were injured when a tornado destroyed more than 100 buildings at Monroe, Wisconsin. Trailers and barns were shredded by another tornado east of Evansville. At 3:27 pm, another violent tornado dropped from the sky in McHenry County, Illinois.

Aerial photograph of a devastated subdivision in Crystal Lake, Illinois. Three people were killed (A) when a truck was thrown into their basement, and one woman (B) was killed while removing laundry from her clothesline.

The tornado's path began on the southwest side of the town of Crystal Lake, near a public golf course. The sky turned a sickly olive-green color as the vortex began to wrap up and extend earthward. Deputy Sheriff Glen Roberts noted the unsettling appearance in the skies to his west. "Everything seemed so strange and eerie, like the clouds were a spinning wheel coming at me," he would later recall. "I had seen newsreel footage of a killer tornado in Udall, Kansas when I was 16 and the way the clouds were moving made me feel really fearful that this storm was going to be similar." He scrambled for his radio as the violent tempest began tearing across the south side of town, ravaging dozens of homes in a number of subdivisions and devastating the Lake Plaza Shopping Center, lofting large chunks of debris high into the air. In Colby Holmes subdivision, three people were killed when a truck was thrown into the basement in which they were taking shelter under a heavy table. Just yards away, another woman was killed as she was unwittingly removing laundry from her clothesline. Her home was one of 45 that were completely swept away in high-end F4 fashion. By the time the tornado lifted 11 miles later, 155 homes were damaged and six people lay dead.

Three occupants were killed while sheltering in this basement. This truck was thrown on top of the table under which the homeowners had taken shelter.

The outbreak, however, had scarcely begun. High in the atmosphere above the Wisconsin/Illinois border, the jet stream had split into a northern and southern branch. In the area surrounding the split, the already powerful atmospheric dynamics had become even more dangerous, providing additional lift to areas already undergoing explosive thunderstorm development. Supercells dotted the screens of the Weather Bureau's spotty network of aging WSR-1 and WSR-3 radars, many sporting the textbook hook echoes indicative of intense tornadic rotation. In northwestern Indiana, the mid-day sky had turned an odd, vaguely ochre hue. While concerning to some who had heard news of the incoming bad weather, most continued about their day without a second thought. Unknown to observers at the time, the strange color had been produced by fine particles of topsoil, scoured from the Earth by the tornadoes to the west and carried aloft by the swift winds of the jet stream.

Finally beginning to realize the extent of the developing tornado threat, the Chicago weather office issued a "Tornado Forecast" at 4:35pm CST for an area 60 miles either side of a line from Detroit, Michigan to Lafayette, Indiana. Along with the tornado forecast came the warning that strong storms had begun developing over northwestern Indiana. Despite the limited technology and scarcity of available information at the time, this tornado forecast would prove to be exceedingly proactive — nearly every significant tornado during the remainder of the outbreak would occur within the bounds of this forecast area.

Officials and Weather Bureau personnel in the South Bend area sprang into action to prepare for the arrival of the storms. Additional personnel were called into the Weather Bureau office to assist in tracking the storms and issuing warnings. Emergency managers began preparations for the damage that was sure to follow. Indiana State Police, who had recently taken a cue from their brethren in the Great Plains and held three-hour "Severe Weather Surveillance" training programs, scrambled into position to track the incoming storms. They would not have to wait long. Just ten minutes after the tornado forecast was issued, at 5:32 pm EST, another call from the Chicago office indicated that a rapidly intensifying thunderstorm had been spotted in northwestern Indiana. Less than 15 minutes later, the first of a violent wave of tornadoes touched down in Starke County, southwest of Hamlet, Indiana.

The La Paz tornado just outside of town, facing west. This photograph was taken approximately two minutes before Robert Chandler's famous "white" tornado photograph.

The famous “white” tornado captured by Robert Chandler on US-31 just north of La Paz.

After crossing US Route 30 on a northeast heading, the slender funnel traversed nearby Koontz Lake as a violently rotating waterspout. Upon reaching the shore of the lake, the savage winds ripped through a cluster of cottages. At least a hundred cottages were damaged or destroyed and one man was thrown more than 600 feet to his death by the winds. As the tornado crossed US-31, Indiana State Trooper Robert Chandler took one of the most famous photographs from the outbreak. Taken from just a few hundred yards away, the tornado appears a brilliant white due to the reflection of the bright sun against the dark, stormy background. Continuing northeast at speeds in excess of 60mph, the funnel appeared wide and gray as it barreled into the northern edge of the community of La Paz. Six homes were leveled and a church was destroyed before the tornado moved on toward the town of Lakeville. A local high school still under construction — the jewel of the community because of its beautiful new gymnasium and basketball court was flattened to the ground. The F4 tornado would ultimately kill ten along its path.

Just northeast of the La Paz tornado, a half-mile wide wedge began tearing through the town of Wakarusa in Elkhart County, Indiana. Soon after, the tornado would become a part of history as it was captured in perhaps the most famous tornado photograph in history. After snapping and uprooting trees in the countryside, the large tornado approached US Highway 33 northwest of Goshen. Paul Huffman, a reporter for the local *Elkhart Truth* newspaper, was on his way home from church with his wife Elizabeth when they noticed what appeared to be smoke billowing into the air. Pulling off the side of the highway to take a closer look, they noticed that the “smoke” was, instead, a massive tornado. Grabbing his camera, Mr. Huffman snapped a series of six photographs as the tornado approached his location.

The second in Paul Huffman’s series of six shots, this photo shows the massive tornado approaching the Midway Trailer Court near Goshen, Indiana.

The third photograph in the series, showing the massive tornado bearing down on the trailer court and the highway.

One of the most iconic tornado photographs ever taken, the fourth of Huffman's shots shows a multi-vortex structure which appears as two separate tornadoes rotating about a center. Debris can be seen around the left vortex as it obliterates several trailers. Headlights from several vehicles can be seen at the far end of the road near the tree.

The fifth photo in Paul Huffman's series clearly shows the multi-vortex structure of the massive wedge tornado. Large chunks of debris can be seen lofted around both sides of the tornado.

The violently rotating multi-vortex tornado slammed into Midway Trailer Court just after 5:15 pm EST. Two massive vortices swirled around a common center, obliterating trailers and throwing debris into the air. As Mr. Huffman braced himself against the strong inflow winds, a car — still airborne after being thrown by the tornado — crashed to the ground nearby. It would later be determined that the automobile was airborne for at least a full three-quarters of a mile. Although the tornado was officially rated at F4, this incredible feat of strength indicates that the tornado may in fact have attained F5 intensity. Eighty of the 100 trailers at Midway were destroyed and ten people were killed. An airplane wing from Goshen Airport, where planes were tossed and ripped apart, was eventually found more than 35 miles away in Centerville, Michigan. The tornado killed another three in Middlebury, where several homes were completely leveled and swept away. The tornado ultimately killed 14 along its 22-mile path.

At approximately 5:40 pm CST, just as the F4 that chewed through the Midway Trailer Court dissipated, a second violent multi-vortex tornado formed just southeast of the first. Beginning as

a short-lived, wispy waterspout over a small lake south of Goshen, the tornado intensified quickly as it crossed State Road 13 and destroyed a number of farms. The tornado thundered toward the Rainbow Lake area, completely demolishing a dozen homes and sweeping them away. Seventeen were killed in the area, where damage was so intense that an F5 rating may have been warranted. Onlookers described the tornado as initially having the appearance of serpents writhing around a central point, eventually evolving and expanding into a massive, malevolent wedge with "octopus-like appendages" reaching out horizontally. The tornado continued on for another 20 miles, killing two while they sheltered in their home in Ontario. By the time the tornado ground to the end of its path around 6:00 pm CST, the outbreak had reached a ferocious peak.

At Alto, Indiana near Kokomo, a mile wide F4 tornado struck the Methodist Church at about 735 pm. All the patrons took cover in the church's basement with roughly 37 seconds to spare before the tornado hit; everyone there survived with no injuries but the building and the cars in the adjacent parking lot sustained heavy damage. Here is the original audio of the approaching tornado https://www.youtube.com/watch?v=puvHPusaJTk

In the northeast corner of Indiana, one of the most devastating events of the outbreak began to unfold. A slender gray funnel began causing damage about two miles west-southwest of Lake Pleasant. As it approached the lake, the tornado widened and rapidly intensified. Damage along the eastern shore of the lake was extreme, with several structures reduced to rubble piles. Trees in the area were almost completely debarked and denuded, with many snapped and twisted close to ground level. The tornado crossed the Michigan border and roared across the landscape toward Coldwater Lake, leaving a damage path more than a mile wide. On the lake shore, several homes were "exploded" and reduced to their foundations. A mile south of Manitou Beach, six members of one family were killed when the tornado obliterated their home. The local Baptist Church, where 50 people were attending evening services, was struck and destroyed. More than half of those inside were trapped under the rubble for several hours, and at least one man died from his injuries.

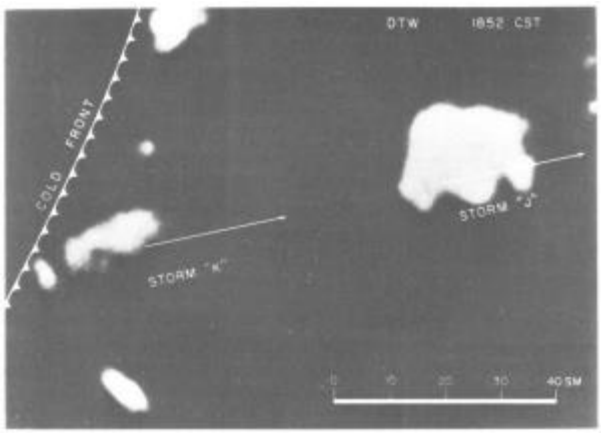
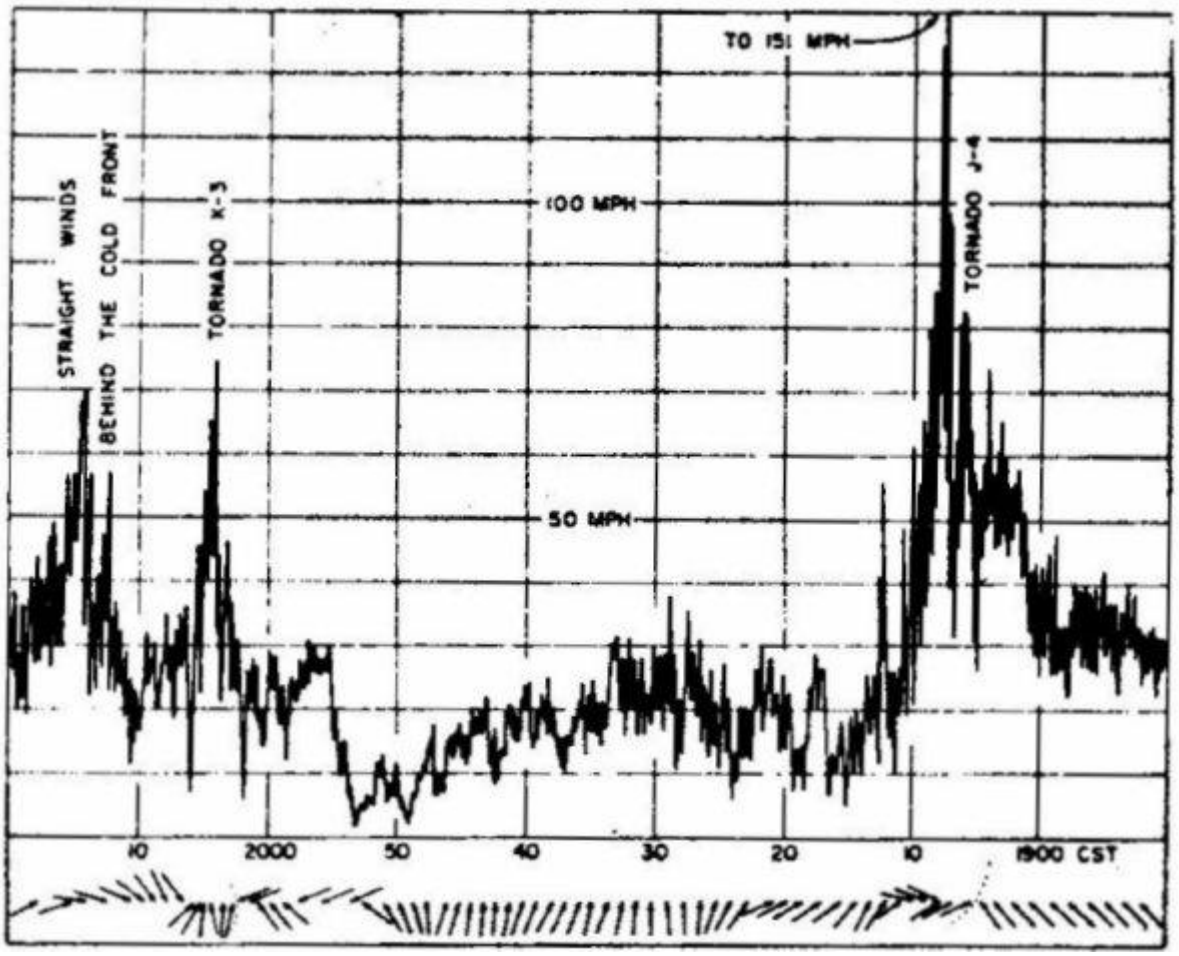


Image from Detroit's WSR-57 radar showing the supercells which produced tornadoes along virtually the same path in southern Michigan.

Approximately 35 minutes after the first tornado had touched down, a second tornado crashed to the earth and began to follow nearly the exact same path. The paths of the two tornadoes were so similar that, in most instances, it was impossible to tell the two apart. The combined damage path width of the two tornadoes ranged from one to more than three miles, and the second tornado leveled many of the structures left damaged by the first. At least 19 were killed in Branch County, Michigan. A further 11 were killed in Hillsdale County. The two tornadoes ultimately left 44 dead along paths totaling 90 and 75 miles, respectively. At least 600 homes and a number of other structures were destroyed along the damage path. Both tornadoes were rated F4, though the first was likely the stronger of the two.

As the first tornado passed north of Tecumseh, Michigan, it encountered an anemometer located on a tower at Meyers Airport. Despite being several miles from the core of the tornado, the anemometer recorded an extraordinary wind gust of 151 miles per hour. As the second tornado approached about an hour later, a wind gust of 75 miles per hour was recorded on the outer fringe of the circulation. According to Dr. Tetsuya Theodore Fujita, who used this valuable data to estimate the wind velocity, direction and structure inside and around the tornado, the core flow of the tornado itself likely had winds ranging from 180 to 240 miles per hour at the time the measurement was taken.



Wind trace from the anemometer near Tecumseh, Michigan. Peaks of 151 and 75 miles per hour can be seen with the passage of each tornado. This graph is read from right to left.

In Indiana, the outbreak continued with undiminished ferocity. About eight miles south of South Bend, yet another violent tornado began tearing up soil and vegetation. Traveling just north of the track left by the multi-vortex funnel that demolished the Midway Trailer Court, the tornado roared into the town of Dunlap. The subdivisions of Sunnyside and Kingston Heights were left in ruins, with many homes reduced to their foundations. After killing 28 at Dunlap, the tornado took a further six lives as it leveled a truck stop and a well-built home at the intersection of Highways 15 and 20. This tornado would prove to be the deadliest of the outbreak, taking 36 lives in all.

The tornado was originally rated F5, but was later downgraded to F4. However, contemporary reports of "leveled" homes and several mangled vehicles suggest the initial rating was probably appropriate. Amid the flurry of activity, the beleaguered South Bend, Indiana office of the Weather Bureau became overwhelmed by the massive influx of tornado reports. Exasperated meteorologist Larry Burns issued an ominous, unprecedented blanket warning covering the office's entire jurisdiction:

"Reports of tornadoes and funnel clouds have become so numerous that it is impossible to keep track of them. Warnings should therefore exist throughout the central northern portion of Indiana. The problems have been intensified by telephones being out in many areas and it is impossible to notify many people."

More than 90% of downtown Russiaville was destroyed, with several buildings leveled.

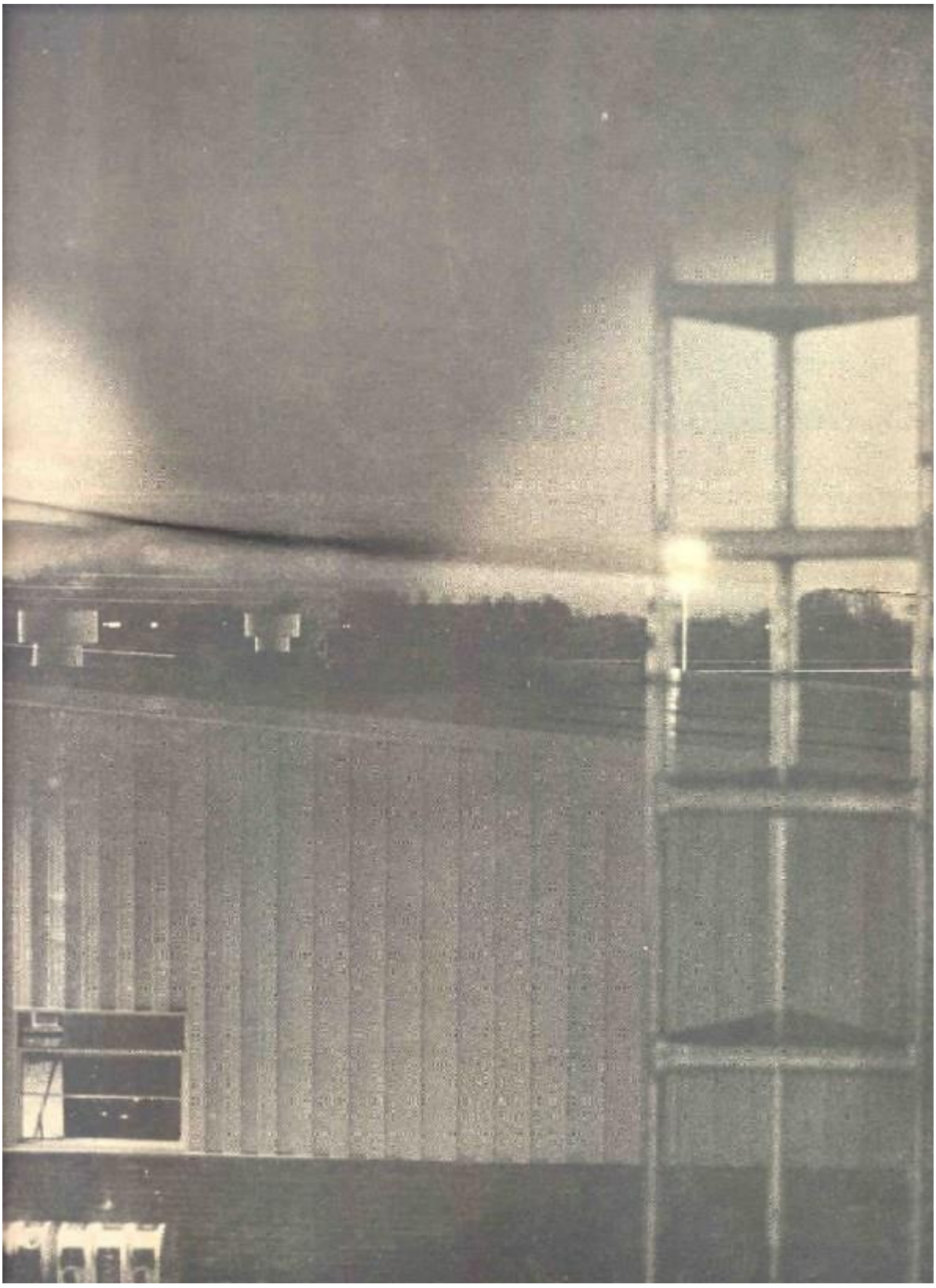
By 6:25 pm, between seven and nine violent tornadoes were simultaneously scouring the earth across Indiana and Michigan. A mile-wide tornado that began in Crawfordsville, Indiana obliterated more than 50 homes in and around Lebanon, killing six members of one family and another five nearby. Another four were killed when the tornado ripped two vehicles off the road and threw each of them more than 100 yards. Ten more were killed in Sheridan. One of the more damaging tornadoes of the outbreak began just west of the small community of Russiaville. As

the tornado churned through the center of town, more than 90% of the buildings were damaged or destroyed. So complete was the destruction that one National Guardsman would later describe the scene at Russiaville as “like a city that has been bombed and burned.” The funnel widened to nearly one mile as it engulfed the town of Alto. At least 100 homes were leveled as the tornado rampaged through Alto and into the south side of Kokomo. The well-built brick buildings of Maple Crest Apartments were damaged to varying degrees, with at least one leveled to its basement.

The Russiaville tornado reached its peak intensity near the community of Greentown. The tornado tore at the soil and left cycloidal scour marks across the fields to the west of town. These marks would come to serve an important role in the research of Dr. Fujita, who would later explain the source of their origin as narrow, particularly intense suction vortices within the main circulation of the tornado. The tornado maintained its intensity while tearing through Greenville, where 80 buildings were razed and ten people were killed. The tornado struck with such violence that it scoured the grass from the backyards of many homes and completely debarked and denuded many trees in the area. A number of fatalities occurred in cars which were lifted and tossed several hundred yards by the furious winds. Click on this link for a documentary about the Palm Sunday Tornadoes by the Indiana State Police.
https://www.youtube.com/watch?v=4FNV4kWrhAk&t=1054s

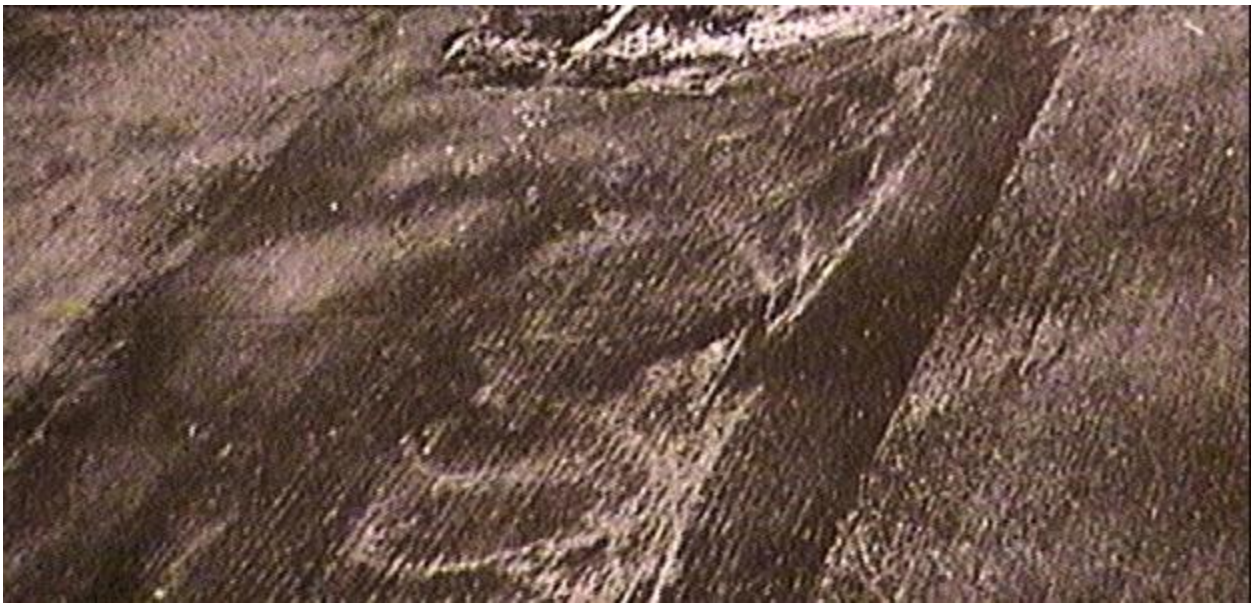
Extensive damage in Alto, Indiana.

A home along Wigger Street in Marion, Indiana completely demolished by the Russiaville tornado.



A photograph of the Russiaville tornado as it approached Kokomo, Indiana.

Probable F5 damage in Greentown, Indiana. Several homes have been leveled and extensive wind rowing is evident in several places.



Swirl marks left in the fields of Marshall County near South Bend, Indiana after one of the Palm Sunday 1965 tornadoes. Photo by Dr. T. T. Fujita.

For a brief time, the skies were nearly quiet. Several weak tornadoes spun up and sputtered out just as quickly. Beginning at approximately 7:20 pm a violent F4 tornado tore a 55-mile path of destruction through eastern Indiana and western Ohio. Just south of Willshire, Ohio, nearly a dozen homes were demolished and six were swept from their foundations. A mother and son were killed as they sought shelter from the storm. Another brief period of relative quiet followed, but it would not last long. Shortly after 8:30pm, a pair of F4 tornadoes touched down just minutes apart in Ohio. The first began doing damage just northwest of Lima. The half-mile funnel did moderate damage until it approached just north of Cairo, where a number of structures were said to have suffered "explosive" damage. At least one vehicle was thrown several dozen yards.

The second tornado began a path of destruction in northwest Toledo. For 33 year old Paul Smith, a foreman for the Norfolk & Western railroad, the approaching twister was preceded by spasmodic rain and pounding hail. Before leaving his home in the recently-built neighborhood of Fuller's Creek Addition, he hesitated a moment and turned back to reassure his fearful wife and children. Moments later, a nearby window shattered and sprayed shards of glass through the room. Wind and rain lashed the siding and roof. The tornado thundered through Fuller's Creek with tremendous force, tearing many homes from their foundations and scattering the debris hundreds of yards away. Paul was thrown in the air, as if being "swept away in a vacuum." When he came to his senses, he found himself face-down in what remained of his neighbor's garage with multiple cuts and bruises. His wife was found dead several blocks from the site of their home.

Dozens of homes in Toledo, Ohio were completely obliterated.

This photograph allegedly shows the Toledo tornado illuminated by an unexplained electrical phenomenon. Photo by Jim Weyer.

The damage path continued with nearly undiminished violence for 18 miles before moving on to Lake Erie, but the most intense damage was found in Fuller's Creek. A large DuPont paint factory was demolished, as were at least two other industrial buildings. More than 50 homes, some well-built, were swept cleanly from their foundations with possible F5 intensity. A bus was ripped from Interstate 75 and lofted through the air before being crushed upon landing, killing five occupants. The Toledo tornado took a total of 18 lives, 16 in Ohio and five at Fuller's Creek Additions. Nearly 250 more were injured. A photograph taken during the storm allegedly shows the tornado as two broadly spaced, glowing cylinders. While some have speculated that the photo shows the tornado glowing as a result of some static electrical phenomenon, the picture remains open to interpretation.

Just over an hour later, the last violent tornado of the outbreak began to fill the skies over Pittsfield, Ohio filled with bits of timber, furniture and vegetation. Virtually the entire town was destroyed, and six homes were damaged so badly that they reportedly "vanished into thin air." Those who emerged from the wreckage remarked that nothing in the town was left standing, with the exception of a Civil War memorial statue. Seven of the town's 50 residents were killed, as were two motorists who were caught in the storm while passing through town. Twenty miles later, the town of Strongsville also bore the full fury of the tornado's winds. Fifty homes were irreparably damaged and as many as 20 were leveled completely. Witnesses again testified that several homes "literally vanished." A total of 18 were killed between the two communities. This tornado was rated F5 and later downgraded to F4, though the initial rating was likely correct.

Although there have been larger outbreaks in terms of raw numbers, the Palm Sunday Outbreak of 1965 still stands as one of the most intense in history. In the span of just 11 hours, 47 tornadoes killed 271 people and injured more than 1,500. Twenty-one of those tornadoes took at least one life, and 38 were rated F2 or higher. Nineteen F4 tornadoes raked five states in the span of nine hours. Of those, as many as five produced damage that may have warranted an F5 rating. When normalized to adjust for inflation and other changes, the Palm Sunday Outbreak still ranks as the most destructive single day on record.

The outbreak also stands out for another, equally tragic reason. The extremely high death toll is owed in part to the twin failures of personnel and equipment. At the U.S. Weather Bureau office in Lansing, Michigan, a burnt circuit left the teletype machine out of commission. At the height

of the event, warnings and bulletins from Fort Wayne and South Bend fell on deaf ears as the Lansing office was unable to receive them. In Muskegon, the WSR-3 radar was rendered useless by a failing vacuum tube. With no radar coverage, both Muskegon and Grand Rapids were left to rely on spotty communication that, in many cases, did not come until far too late. In Grand Rapids, further problems came in the form of human error. The staff was caught completely off-guard by the developing outbreak and was unable to issue timely warnings.

Further issues arose because officials in Michigan lacked a single agreed-upon radio frequency on which to communicate. Communication between fire, police, emergency management and other officials within a county became extremely difficult, and contact with personnel out of county or out of state was virtually nonexistent. Additionally, when Weather Bureau offices did manage to identify and comprehend the threat, they failed to pass the information along to offices downstream. The days and weeks that followed brought finger-pointing from all parties, but eventually led to a number of changes to facilitate faster, easier communication during future events.

Meteorologist and pilot Conrad Johnson worked at WMT in Cedar Rapids, Iowa from the late 50s until his retirement in the early 80s. His genius and greatness was vastly under-recognized. He's one of the nation's first to understand the importance of weather radar and led by personally installing an old military radar at WMT (the first of its kind west of the Mississippi River). Conrad partnered with the Weather Bureau in 1966 to develop the tornado watch/warning system which saves so many lives today. He also was instrumental in organizing the spotter network SKYWARN across the country as a result of the Palm Sunday Outbreak. His forthright professionalism always shone through when Iowa's weather was unpredictable. https://www.youtube.com/watch?v=au11EamZ8uo

A violent F4 tornado ripped a path of destruction one-half mile wide and 20 miles long across Cedar county, Iowa first touching down 3 miles east of Tipton at 1245 pm. The tornado then lifted in the northeast corner of Cedar county before reaching Toronto. The tornado in the Lowden-Clarence area brought destruction to homes, farms, trees, livestock, and took the life of a Clarence farmer. The photo below shows one of the farms after it was struck by the tornado. Photo courtesy of Steve Gottschalk, CO-OP observer in Lowden.

References:

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