The Devastating Nebraska–Iowa–Missouri Tornadoes of 1913: Harbingers of the U.S.'s Now-Forgotten Most Widespread Natural Disaster

Trudy E. Bell
1260 Andrews Avenue
Lakewood, Ohio 44107
216-221-5008; *t.e.bell@ieee.org*

[[[PORTIONS IN TRIPLE BRACKETS I MAY OMIT IN ACTUAL TALK TO KEEP WITHIN TIME CONSTRAINTS]]]

[**1- PHOTO OF OMAHA TORNADO**]

> "The first we noticed of the approach of the tornado was the deep, angry rumbling south of Ralston. Looking out of the window we saw the funnel-shaped clod in all its grim and terribly appearance as it came sweeping upon Ralston. As it approached the roar grew louder and louder like the approach of some fast speeding express train. As it came on its angry arms were filled with flying roofs and small buildings. It swept just west of us, the building being only swished by the edge of the twisting cloud. The crash of glass from the windows sent us hurrying to a dark corner. … Darkness followed at once in the wake of the cyclone though it was little after 5:30. All the electric wires were down and the sputtering blue of the electric fires added new terrors to the scene of destruction."[1]

This tornado, which roared through downtown Omaha just before 6 PM the evening of Easter Sunday, March 23,1913, demolished more than 600 homes, wrecked 1,100 others, and left downtown Omaha looking like Dresden after the bombing in World War II [**2 - MAP OF PATH THROUGH OMAHA**]. More heartrending, the generally accepted casualty count was 101 dead (94 within Omaha's city limits), another 350 injured, and more than 2,000 homeless. Today rated with a force of F4—among the most violent possible—nearly a century later it still holds the record as the single deadliest twister ever to have struck Nebraska,[2] and the twelfth deadliest of *all* known tornadoes in the United States.[3]

Part of a national natural disaster

But the Omaha tornado was actually one of an outbreak of tornadoes that struck a region at least 100 miles across near the Nebraska–Iowa–Missouri borders, killing at least another 70 people and injuring another 250—perhaps 70 percent more victims than generally credited to this aspect of the national tragedy. [**3 - NOAA MAP OF 6 TORNADO TRACKS**] Not only was the Omaha tornado the single deadliest one in Nebraska's history, but two of the three other tornadoes that roared past the city just to the north and south still rank as second and third deadliest in the state, respectively killing 22 and 18.[4] Indeed, although also rated as F4s, both the Yutan and Berlin tornadoes were twice as large as the one that struck downtown Omaha (both their funnels up to 800 yards wide instead of Omaha's "only" 400 yards[5]); [**4 - NOAA TABLE OF 7 TORNADOES**] the single life-saving reason they killed fewer people was that they spent their fury principally across sparsely populated farmland.

Of even greater significance, all the tornadoes in this outbreak—plus a devastating F4 tornado that roared through southern Terre Haute, Indiana—were part of a mammoth and unusually powerful winter storm system that caused the United States' most widespread natural disaster. It followed what is now known to be a typical

Midwestern winter storm track, the Colorado track [**5 - U.S. MAP OF HISTORICAL AND MODERN COLORADO TRACK**]. Beginning on Easter Sunday rains of tropical force but frigid temperatures deluged the Midwest—in Ohio and Indiana, dropping *three months* of rain in four days (March 23–27, 1913), bloating the Wabash River in Indiana to 30 miles wide and the Ohio Rivers to 50 miles wide.[6] The storm system also traveled north to set record flood heights on the Hudson, Mohawk, and Connecticut Rivers in New England and the Mid-Atlantic.

At its peak, flooding spread across the lowland regions of nearly a dozen states from Pittsburgh to St. Louis, completely severing all communications between New York City and Chicago for a day and a half.[7] [**6 - MAP OF WORST FLOODING OF INDIANA AND OHIO**] In April and early May, the flood crests surging down the Mississippi burst levees in Kentucky, Illinois, Tennessee, and Arkansas, and set new record heights all the way down to New Orleans. [**7 - PHOTOS OF FLOODED AREAS OF MIDWEST**] [[[The Midwest's property damage (including 38,000 homes swept away) was estimated—probably underestimated—to top a third of a billion dollars in 1913 dollars (nearly $7 billion in current dollars), most of which was not covered by the business or homeowner's insurance of the day. The devastation disrupted freight and passenger rail service and the mails for weeks, and the damage was not fully repaired until August. The storm's death toll of more than 700 exceeded that of the 1871 Chicago fire. Moreover, thousands more people were injured, and a quarter of a million were left homeless and bereft of their life's savings.]]] Although the 1913 tragedy is now nearly forgotten, it helped trigger revolutions [**8 – EFFECTS OF 1913 STORM AND FLOOD**] in emergency radio, disaster relief, national policy on flood control (influencing the engineering of the Tennessee Valley Authority), as well as inspiring the mechanism of federated philanthropy (which eventually led to the foundation of the United Way).[8]

Just one of my research goals—and it *must* be emphasized that my research is still very much a work in progress, begun in 2003—has been to identify the exact geographical extent, the nature, and the power of storm system. Another goal is to ascertain exact statistics for casualties, whose numbers at this point are best described as unreliable. This paper on the Nebraska-Iowa-Missouri tornadoes is part of my investigation toward both goals, basically using historical eyewitness accounts as points of meteorological data.

Pattern of the Nebraska-Iowa-Missouri tornado outbreak

In 1913, as shown by the innumerable "instant books" published that year, it was well recognized that the Omaha tornado was part of the same storm system that caused record flooding 800 miles east [**9 - INSTANT BOOKS FROM 1913**]. ~~There has subsequently been at least one recent book on just the Omaha tornado itself [TRAVIS SING'S ARCADIA BOOK].~~

According to the classic two-volume reference by Thomas P. Grazulis called *Significant Tornadoes* published in 1990, which catalogues most tornadoes that occurred in the United States for more than a century, the Omaha tornado was but one of possibly seven tornadoes that assaulted at least 14 counties in Nebraska and Iowa between 5 and 7 PM Easter night. For the force of the tornadoes, Grazulis and NOAA used the Fujita scale of force, devised around 1971 by the late T. Theodore Fujita of the University of Chicago

for inferring the wind speeds and force of tornadoes from the types of damage done, because that information is rarely directly measured [**10 - TABLE SHOWING LEVEL OF DAMAGE CORRESPONDING TO INFERRED WIND SPEEDS AND F-NUMBERS**].[9] "Gale" tornadoes of F0 and "moderate" tornadoes of F1 tornadoes are officially classed as "weak," but that's only by comparison, as an F1 can have winds as high as 112 mph, capable of pushing mobile homes off their foundations. Still, to be included in Grazulis's classic reference, a tornado had to be at least F2 or "significant." Both F2 and F3 tornadoes are classed as "strong," and F4 and F5 tornadoes are classed as "violent." One last important point: each of these Fujita force classifications covers a *range* of wind speeds and deliberately says nothing about the width of the funnels (there is no correlation between strength and width), so two F4 tornados might differ significantly in the amount of damage they cause.

It is also now known that the most violent tornadoes are produced by storm systems known as supercell mesocyclones [**11 – 3-D DIAGRAM OF SUPERCELL AND TORNADO**]—parent thunderstorms about 6 miles (10 kilometers) across whose winds have exceptionally strong central updraft winds with a twisting motion.[10] [**12 - TORM-CHASER PHOTO OF MESOCYCLONE**] Although accounting for only 1 or 2 percent of thunderstorms, supercell thunderstorms give rise to more than 70 percent of tornado fatalities [**13 - HISTOGRAM OF TORNADO CASUALTY STATISTICS**]. Sometimes a single supercell can spawn two or more tornadoes [**14 – PHOTO OF MULTIPLE VORTICES**]. A widespread storm system may have a number of associated supercells traveling together and in difference stages of development, producing its own tornado(es), often in succession, over hundreds of square miles and over the course of a day—a circumstance called a *tornado outbreak*. Updrafts dramatically reduce pressure at the earth's surface, sometimes dropping the barometric pressure by as more than 10 percent.[11] Although most tornadoes last less than 10 minutes, some have been documented to persist for more than an hour and travel 100 miles or more, and have been documented to cross ground at up to 70 miles per hour.

[**15 – RECAP OF GRAZULIS/NOAA PLOTS**] For my investigation, which is also still a work in progress, I carefully read the *Omaha World-Herald* and the Council Bluffs *Evening Nonpareil* between Good Friday, March 21 and the end of the month March 31, and plotted any reported tornado damage and times on a map. So far, this is what I've found:

First, the newspaper reports also reveal that the swath of destruction of the four known violent F4 tornadoes were likely significantly longer that Grazulis tabulated [**16 – MAP OF REDRAWN COUNTIES PLOTTING EXTENDED PATHS**]. The Yutan tornado farthest north did not terminate in Logan, Iowa, but in Woodbine 7 or 8 miles farther for a total of more than 60 miles.[12] The Omaha tornado itself continued its destruction beyond east of Logan, passing by Defiance, Panama, Manilla,[13] and just south of Arcadia with enough force to throw a farmhouse 50 feet[14]—a track as much as *45 miles* longer and more than double the 40-mile length Grazulis attributed to it.[15] The Council Bluffs tornado (which at 400 yards across was about the same size as the Omaha tornado) did not die in Harlan, but continued past Gray and southeast of Carroll and Glidden with enough force to blow at least one schoolhouse off its lot,[16] perhaps another 50 miles, also about double the 48 miles Grazulis attributed to it.[17] And the Berlin tornado also struck near Henderson[18] and dissipated east of Macedonia, apparently on a

track slightly different than that mapped by NOAA based on Grazulis. Even the F2 tornado in Pawnee County, Nebraska, may have had a track about double the 5 miles cited by Grazulis; not only was a schoolhouse and four homes unroofed in Burchard about 7 PM, but a the Omaha *Evening World-Herald* reported that a "small tornado" blew down two barns in Barneston to the southeast.[19]

Second, the newspaper reports reveal that this outbreak included at least five additional tornadoes—70 percent more—in six more counties than were tabulated by Grazulis [**17 – MAP OF REDRAWN COUNTIES PLOTTING ALL THE NEW TWISTERS**]. In Nebraska, one occurred in the south part of Fremont some distance above Yutan, lifting the 150-foot stack of the Fremont Power Co. and hurling it 30 feet,[20] possibly ranking it F2 or F3. Farther south in Falls River around 7 PM, a small twister blew down a large storage house of the Knickerbocker Ice Co. and leveled trees and poles, also consonant with an F2 or F3.[21] In Iowa, another small twister touched down in Guthrie Center, damaging outbuildings on a single farm, possibly making it an F0.[22] A fourth that struck Mount Ayr about 8 PM, however, blew down large trees, blew a church from its foundations and moved about eight inches, and blew down several chimneys including the stack on a power plant,[23] all the kind of damage characteristic of at least an F3. Similarly, a fifth that ran from south of Casey[24] to between Menlo and Stuart, Iowa, broke down trees and telegraph poles[25] and blew down houses and barns,[26] which also would make it around an F2 or F3. So both are clearly significant and should have been included in Grazulis.

Third, the placement of new tornadoes to within 40 miles of Des Moines and as far south as the Missouri border suggests that the geographical area covered by the supercell storm system was much more widespread and longer-lasting than realized—a hypothesis supported by the fact that the Mount Ayr tornado occurred as late as 8 PM. Indeed, these facts imply that another tornado that Grazulis does list in Missouri also may have been part of this same outbreak: another violent F4 twister that at 200 yards across was about half the diameter of the Omaha and Council Bluffs tornadoes. Striking about 8:30 PM, it cut a swath of destruction 45 miles long from below Savannah just north of St. Joseph to just east of Albany, killing 2 and injuring 8.

Significance of newspaper reports of the tornadoes

[[[How reliable are the contemporary newspaper accounts of the tornadoes as scientific data? Most eyewitness observers were not trained scientists, although a few were; others ranged from newspaper reporters to railway personnel to farmers. Newspaper reporters are alert observers, and many of the accounts have a just-the-facts-ma'am objectivity about phenomena that were themselves so astonishing that there was no need to embellish reality, giving credence to the accuracy of the descriptions. In a day well before widespread weather forecasts and in this area of the country known for its violent storms, both railway personnel and farmers had to be keenly aware of weather if they were to protect their rolling stock or their crops with any success. The type of damage reported—such as railway trestles blown down, houses unroofed, outbuildings destroyed, or churches moved off their foundations—are unambiguous factual occurrences not open to subjective interpretation. Moreover, the locations of damage are specified in distances from well-known locations, and plots on a map are consistent. In

short, both the content and context of the reports "feel" sufficiently reliable to trust (not to mention that they're all the first-hand data that exist!).]]]

All observations suggest that the approaching storm system was very large and powerful, and that supercell tornadic conditions extended over double or triple the area usually recognized. A barometer can start dropping many hours or even days in advance of a tornado if low pressure on a broad scale is moving into an area; pressure may drop sharply as a mesocyclone—the parent thunderstorm with its spiraling updraft winds—moves overhead or nearby.[27] Normal atmospheric pressure at sea level is 29.9 inches of mercury. The Omaha Weather Bureau station about 1¼ mile from the track of the Omaha tornado officially recorded a pressure of 28.5 inches at 7 AM Easter morning that dropped steadily to 27.9 inches just as the tornado passed about 6 PM.[28] But between 3 and 5:30 PM, the president of the Union Pacific railroad saw that a recording barometer in his office reached an unofficial low of 27.7 inches; he became alarmed and telegraphed warnings to trains in the Omaha area to proceed with extreme caution and watchfulness for potential tornadoes.[29]

The newly discovered tornadoes and the additional path lengths of the known tornadoes also mean that statistics for fatalities, injuries, and property damage need adjustment—important for assessing the true scale of the consequences of the 1913 storm system for the nation.

Directions for continued research

What avenues would I like to pursue to complete assessing the accurate scale of the supercell tornadic conditions of the Easter 1913 storm system? [**18 – SLIDE OF FUTURE RESEARCH**]

First, to plot the exact paths of the tornadoes in finer detail and to ascertain the presence of multiple vortices, I'd like to obtain plat maps of the various counties. Many newspaper reports are richly detailed, to the point of specifying what side of various townships a tornado entered and departed and even what outbuildings on whose farms were destroyed. Plat maps might also help distinguish the damage between primary and secondary vortices, and make sense of statements that, at this point, are puzzling—such as the fact that "two distinct funnels" were seen from Ashland, Nebraska (but no directions are given), and the apparent "skipping" pattern of a tornado or tornadoes in Iowa.

Second, to ascertain the boundary of the supercell tornadic conditions, I'd like to search for evidence of still other twisters in newspapers in Sioux City, Fremont, Columbus, Ames, Fort Dodge, and other small and medium-sized towns likely to have covered detailed local news (the Council Bluffs *Evening Nonpareil* was invaluable for its fine-scale local reporting). [MENTION OTHER NEWSPAPERS I WILL HAVE PHOTOCOPIED IN THE THREE DAYS PRECEDING MY TALK]

My ultimate goal [**19 – SLIDE OF CONTACT INFO**] is to take all data and observations I can gather from around the country, hand them to a meteorologist with a supercomputer and sense of history, and see whether it's possible to answer the twin questions "what really happened to create such an extraordinary storm system that devastated a quarter of the nation?" and "could it happen again?"

Thank you very much.

TRUDY E. BELL, whose M.A. is in American intellectual history and history of science (NYU, 1978), is a former editor for *Scientific American* and *IEEE Spectrum* magazines and a fulltime freelance science journalist specializing in the physical sciences and engineering. The author of 10 books and 400 articles, her latest book *Weather* for the upcoming Smithsonian Science 101 boxed set is to be published in June by HarperCollins. For her research on the 1913 weather disaster, she has traveled to libraries ranging from Boston to New Orleans to Kansas City; she is now on contract with Arcadia Publishing for a book on the 1913 flood in Dayton, Ohio.

[SIGNIFICANCE OF RFD DUST]

[COMPARE WITH MWR Temperature dropped 40 degrees,]

---

[1] "Business Section of Ralston in Ruins," *Omaha World-Herald*, March 24, 1913, p. 12, col. 4.
[2] NOAA, "The Tornadoes of Easter 1913," http://www.crh.noaa.gov/oax/archive/1913_Omaha_Tor/topten.php .
[3] NOAA, "The 25 Deadliest U.S. Tornadoes," http://www.spc.noaa.gov/faq/tornado/killers.html
[4] NOAA, "The Tornadoes of Easter 1913," http://www.crh.noaa.gov/oax/archive/1913_Omaha_Tor/topten.php .
[5] Thomas P. Grazulis, Significant Tornadoes, 1880–1989 (St. Johnsbury, VT: Environmental Films, 1990–1991), vol. 1, pp. 131–132.
[6] SOURCES
[7] Newspapers on microfilm indicate that principal flooding occurred in western Pennsylvania, western West Virginia, all of Ohio, all of Indiana, southern Illinois, eastern Iowa (mostly from rising backwater along the Mississippi as far north as Davenport) eastern Missouri, northern Kentucky, and the flood crests down the Mississippi also flooded western Tennessee, eastern Arkansas, western Mississippi, and eastern Louisiana before draining out the Atchafalaya (New Orleans was not flooded). Further east, flooding from the same storm system arose in New York state (especially around Albany), Massachusetts, Connecticut, and possibly elsewhere. Rainfall amounts of topping 11 inches fell in Ohio in four days.
[8] These numbers are documented in the footnotes to my article "Taking Engineering by Storm," *The Bent* of Tau Beta Pi (the engineering honor society) 95 (1): pp. 15-22, Winter 2004 http://www.tbp.org/pages/publications/BENTFeatures/W04Bell.pdf . See also "Forgotten Waters: Indiana's Great Easter Flood of 1913," *Traces* of the Indiana Historical Society *18* (2): 4–15, Spring 2006. The development of federated philanthropy, the Cleveland Community Chest, and its merger to form the United Way is the subject of other work-in-progress research.
[9] The original scale has since been modified and made more precise by taking into account differences in building construction, the most recent version (the Enhanced Fujita scale), going into effect just this year (February 1, 2007). Great care was taken, however, in ensuring that the EF scale dovetailed seamlessly with the older F-scale. See http://www.spc.noaa.gov/faq/tornado/ef-scale.html .
[10] Many excellent references describe supercell mesocyclones and their formation of violent tornadoes; a good primer is "Tornado Basics" by NOAA's National Severe Storms Laboratory at http://www.nssl.noaa.gov/primer/tornado/tor_basics.html . Some spectacular and informative storm-chasing photos of mesocyclones, supercells, and tornadoes appear at http://www.mesoscale.ws/pictures/structure/ .
[11] REFERENCE – NASA SITE?
[12] "I.C. Train Has Narrow Escape," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 3, and "13 Injured at Woodbine," same issue, p. 10. The former article notes "The hail came ahead of the wind, which is unusual for it generally follows it," but hail in advance of a tornado apparently happens more than 60 percent of the time—see Courtney Hanna, David Imy, and John Hart, "A Study of Severe Weather Prior to Significant Tornado Occurrences," NOAA/Storm Prediction Center Oak Ridge Institute for Science and Education Final Project, July 29, 2004, online at www.caps.ou.edu/reu/reu04/Courtney%20Hanna%20Final%20Paper.pdf .

[13] "Bad Blow at Manilla" and "New Barn Destroyed," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 10.
[14] "Additional Carroll Losses," Council Bluffs *Evening Nonpareil*, March 27, 1913, p. 3 [page erroneously gives date of March 28].
[15] "The Storm Very Severe at Defiance," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 1, 10.
[16] "Strikes Hard Near Carroll" and "Destroys Barns Near Glidden," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 10; "Additional Carroll Losses," Council Bluffs *Evening Nonpareil*, March 27, 1913, p. 3 [page erroneously gives date of March 28].
[17] "Manning Girl Carried Fifteen Rods in Storm," Council Bluffs *Evening Nonpareil*, March 28, 1913, p. 2–3.
[18] "More Reports of Buildings Destroyed," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 10.
[19] "Tornado at Barneston, Neb." Omaha *Evening World-Herald*, March 27, 1913, p. 5.
[20] "Damage of the Storm Vicinity of Fremont," Omaha *Evening World-Herald*, March 25, 1913, p. 7.
[21] "Ice House Blown Down," Omaha *Evening World-Herald*, March 26, 1913, p. 3.
[22] "Freak Effects of the Tornado," Council Bluffs *Evening Nonpareil*, March 31, 1913, p. 3.
[23] "Taylor County Is Hit," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 10; "Mount Ayr is Damaged," Council Bluffs *Evening Nonpareil*, March 26, 1913, p. 3.
[24] "Damage Near Casey," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 10.
[25] "Nine Farm Homes Are Demolished," Council Bluffs *Evening Nonpareil*, March 24, 1913, p. 2. Also "All Railroads Are Hard Hit by Storm," same issue, p. 7.
[26] "Much Damage Near Fontanelle," Council Bluffs *Evening Nonpareil*, March 28, 1913, p. 3.
[27] NOAA Storm Prediction Center, Norman, Oklahoma, FAQ at http://www.spc.noaa.gov/faq/tornado/#History.
[28] "The Omaha Tornado, March 23, 1913," *Monthly Weather Review 41* (3): 481–483, March 1913.
[29] "Barometer at 27.7," Omaha *Evening World-Herald*, March 25, 1913, p. 12; "Mohler Sensed the Storm," Council Bluffs *Evening Nonpareil*, March 25, 1913, p. 2.