ORIGIN AND EVOLUTION OF THE TERM "DERECHO" AS A SEVERE WEATHER EVENT

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The severe weather term *derecho* represents widespread straight-line damaging winds associated with lines of thunderstorms. Some people have asked me how the term *derecho* entered the meteorological community. And recently, Ray Wolf, the Science and Operations Officer at the National Weather Service Forecast Office in Quad Cities, IA/IL, asked me to write a story about the origin and evolution of the term as a meteorological event. So, I have written the following story.

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The origin of *derecho* as a meteorological term appears to be associated with a conflict concerning the nature of damaging winds associated with convective storms. John P. Finley, an officer in the United States Army Signal Corps, became interested in severe convective storms in the late 1870s, and he began devoting all of his spare private time to the study of tornadoes in the United States (Galway 1984, 1985a, 1985b). According to Galway (1984), by the early 1880s, the Signal Corps was supporting Finley's tornado work and he began the "Tornado Studies" project. A part of this project was establishing a network of "tornado reporters" in the central United States. During the mid and late 1880s, Finley used the tornado reports that he received from the tornado reporters in several publications. It would be Finley's publication about tornadoes in Iowa (Finley 1888) that would spark the conflict leading to the origin of the term *derecho* as a severe weather event.

In the mid 1870s, Dr. Gustavus Hinrichs, a physics professor at the University of Iowa, was hired by the state of Iowa to record and study weather phenomena occurring within the state (Wells 1980). Dr. Hinrichs set up a network of hundreds of volunteer observers across the state and analyzed weather data and severe storm reports at his Iowa Weather Station in Iowa City during the late 1870s and 1880s. When Hinrichs read Finley's paper about tornadoes in Iowa (Finley 1888), he was quite upset. From his own work he realized that the nature of damaging winds associated with severe convective storms varied considerably. It appeared that Finley's listing of Iowa tornadoes included many events that were not tornadoes. Hinrichs realized that many of these events were non-tornadic convectively induced winds associated with a violently progressive mass of cold air (Galway 1984). He decided to use the term *derecho* (Spanish for "direct or straight ahead") to define these non-tornadic events since this term could be considered as an analog to the term *tornado* which is also of Spanish origin (Ludlum 1970). He formally published a paper in the American

Meteorological Journal in 1888 where he defined the *derecho* terminology (Hinrichs 1888).

Several things occurred in the late 1880s and early 1890s that diminished the forward progress concerning severe local storms research. In 1889, Hinrichs lost his meteorological post for the state of Iowa and went to St. Louis, Missouri to teach chemistry at a local college (Wells 1980). In 1887, the U.S. Army Signal Corp obtained a new chief officer whose decisions brought an end to formal research on severe local storms in the Corps weather service unit (Galway 1992). In the early 1890s, Finley was assigned to an infantry division in the Signal Corps and his active personal involvement in tornado research also ended (Galway 1984). In 1891, the responsibility for a national weather organization was transferred from the U. S. Army Signal Corps to the Department of Agriculture. The secretary of this department decided to carry on the Signal Corps policies which would tend to discourage research on severe local storms in the United States during the next 50 years (Galway 1992). One of those policies was that the term *tornado* could not be used in any of the U. S. government weather forecasts. Despite this, the term *tornado* would continue to be used by both scientists and the media in describing such events during this "dark ages" period. However, the term *derecho* would die in the United States and not be used beyond Hinrich's proposal published in 1888.

According to Schaefer (1986) and Galway (1992), a few scientific studies concerning severe convective storms were done in the 1920s and 1930s both in the United States and in Europe. However, the major advancement or "renaissance" in tornado and severe local storm research began in the United States in the 1940s. This advancement was a result of both military and aviation needs and the associated government agencies' realization that such research was needed. This research by both government agencies and universities continued through the remainder of the 20th century, and was encouraged further by the initiation of tornado forecasts by the military's U. S. Air Weather Service in the late 1940s (Miller and Crisp 1999) and by the civilian U. S. Weather Bureau in the early 1950s (Corfidi 1999).

Although research about convective storms and tornadoes advanced rapidly in the 1940s and 1950s, research and knowledge about non-tornadic severe winds associated with thunderstorms advanced more slowly. In the mid 1970s, a commercial aircraft that crashed while landing caught Dr. Fujita's attention and he began studying the non-tornadic outflow winds associated with thunderstorms (e.g. Fujita and Byers 1977). By the early 1980's Fujita and Wakimoto (1981) defined the varying scales of severe outflow winds associated with thunderstorms. Severe convective wind events ranged from "microbursts" and "downbursts" on the small scale (from less than a ½ mile to over 6 miles in greatest width) to "families of downburst clusters" on the larger scale (equal or greater than 250 miles in maximum width).

Given the fact that terminology for varying scales of damaging convective winds was defined in the early 1980s, the question arises as to how the term *derecho* was revived and came into use again. The reason for the revival involves several happenings. In 1976, I was a forecaster with just a few years of experience at the National Severe Storms Forecast Center (NSSFC) in Kansas City, Missouri. During July of that year, I issued an "outlook" forecast that did not work out very well. This forecast failure involved a region of the northeastern United States which was situated under northwesterly flow aloft at the time. So, I asked several of the more experienced forecasters at NSSFC about their knowledge concerning severe thunderstorms associated with northwest flow aloft. The answers I received were not consistent. So, with the encouragement of NSSFC research meteorologist Charles Doswell, I decided to begin a study of severe storm cases associated with northwest flow aloft. After several years of gathering and analyzing data, I wrote two papers defining the synoptic climatology of severe weather occurring under northwesterly flow aloft in the contiguous United States (Johns 1982, 1984).

In the process of gathering data for these northwesterly flow cases, I noted that quite a number of the cases appeared to consist of relatively long paths of progressive straight-line wind damage. After publishing the two "northwest flow" severe weather papers, I decided to begin a new applied research study with co-worker William (Bill) Hirt concerning long path convective windstorms during the summer season. As we were gathering the data for this study in the mid 1980s, I wondered what one should call these events. They seemed to fit most closely with Fujita and Wakimoto's (1981) criteria for a "family of downburst clusters".

Joe Galway, one of the first severe storms lead forecasters at NSSFC, had retired in 1984 (Lewis 1996). After retirement, he began working on historical papers about U. S. Army Signal Corp meteorologist John Finley, who completed research on tornadoes and forecast them experimentally a century earlier in the 1880s. Since Galway was retired, he didn't come in to the NSSFC very often, but happened to come by one day in the mid 1980s when I was off forecast shift and working on the long path convective windstorm project.

As Galway passed by the desk where I was working on his project, he asked me what I was working on. When I explained that Bill Hirt and I were examining long path non-tornadic damaging wind events, Galway mentioned that from his studies about John Finley's tornado research and experimental forecasts he had become aware of a person by the name of Gustavus Hinrichs who had had a feud with Finley concerning what constituted a tornado event. Hinrichs had argued that these larger scale straight-line wind events should be called *derechos* as an analog to the term *tornado*.

I was surprised that Bill and I were not aware of the term *derecho* from our literature review. However, in reviewing what had been written about severe local storms, most information was limited to the period after 1940 when the

"renaissance" of severe weather research began in the United States. Further, the American Meteorological Journal which contained Hinrich's research papers was no longer being published after 1895 and historical volumes of this journal were not available in most present day libraries. However, Bill and I were pleased to hear about Hinrich's terminology proposal and decided use the term *derecho* to describe the events we were studying. Our paper concerning derechos was published in 1987, almost 100 years after Hinrichs first published his article proposing the use of the term for non-tornadic convective wind events.

Since the 1987 publication, the term *derecho* has become more commonly used in describing long lived convective straight-line wind events that have occurred and many research studies have been directed towards derecho events. Derecho events have been documented in North America (e.g. Duke and Rogash 1992; Alfonso and Naranjo 1996; Wolf 2000) and, more recently, derechos have been documented in Europe (e.g. Gatzen 2004; Punkka et al. 2006). As time progresses, it is likely that these events will be found to have occurred in many other areas of the world. Besides documentation of derecho occurrence, research studies have also examined the climatology and hazards of derechos in the United States (e.g. Bentley and Sparks 2003; Coniglio and Stensrud 2004; Ashley and Mote 2005) and determined the weather patterns (e.g. Johns and Hirt 1987; Coniglio et al. 2004) and meteorological conditions (e.g. Evans and Doswell 2001; Doswell and Evans 2003) associated with derecho events.

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