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Comparing Richardson Number to CAPE for soundings at locations impacted by the June 29, 2012, Derecho Before & After

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Abstract

The June 29, 2012, derecho was a large storm complex that impacted a portion of the United States including parts of the Midwest and Mid-Atlantic regions. A key component to the duration and intensity of a storm system of this magnitude is Convective Available Potential Energy (CAPE). Knowing exactly how much CAPE is in the atmosphere before a derecho comes through can be indicative of how the system will evolve in the hours to come. As much as CAPE is important for being a signal of how unstable the atmosphere is, the Richardson Number within the boundary layer can also be used to see how unstable the atmosphere may be. Studying the comparison of both the recorded CAPE values, as well as calculating the Richardson Number using other given atmospheric variables from before and after the passage of the derecho was conducted in order to see if there was any similarity during the June 29, 2012, derecho.

The desired outcome of this study was to see that the negative Richardson Number, indicative of unstable conditions, was calculated compared to the CAPE values that were recorded from soundings at six different locations all impacted by the derecho. Using the nearest sounding from before and after were used at all six locations. The soundings provided the necessary information needed to calculate the Richardson Number within the boundary layer and provided the CAPE values. The purpose of this study was to look at a specific weather event that impacted a large area across the United States and try to come up with an answer as to whether the CAPE and Richardson Number within the boundary layer had any comparisons.

The June 29, 2012, derecho was a historic storm and by utilizing how vast this system was, data was used to compare two values expressive of how unstable the air was before and after the derecho's passage.

There are many factors that go into the development of hazardous weather such as severe thunderstorms or even general thunderstorms. to take a notable event like the June 29, 2012, derecho and see if there was a correlation between the Richardson Number value and the Convective Potential Available Energy (CAPE) at a given sounding location before and after the derecho came through. In the boundary layer which is from the surface to roughly 2000 meters but fluctuates, the Richardson Number can be calculated at any desired height difference. This can be done if two temperature values are available, and two wind speeds are available for both heights. The Derecho of June 2012 was specifically chosen because it impacted a larger section

of the United States with highly populated areas within the large risk area. As for many summertime wind events, especially a derecho, unstable to very unstable air has a large impact on the duration and strength of a storm system of that magnitude. CAPE can be used to measure how much energy or fuel is in the atmosphere for storm development, continuation, and strength. Looking specifically at the boundary layer, the Richardson Number is an index used to help determine the current stability of the atmosphere at a given time and location. Provided the CAPE value in the soundings around the time of this event, a calculated Richardson Number value in the boundary layer is made and then compared to the CAPE value to see if there is a relation or not.