

Downbursts !

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Photo by Catrine Lehrer-Brey, Madison , WI 2004/06/23 @ 19:53

Downbursts are often spectacular, sometimes dangerous and frequently misunderstood. A downburst is a strong downdraft associated with the outflow of a mature thunderstorm. It is often accompanied by precipitation and sometimes dust which makes the air movement visible. It is often precipitation that initiates the downward movement of air as the weight of water droplets and ice crystals along with the chilled air itself is so great that it can no longer be supported by the thunderstorm's updraft. The precipitation streams downward through the cumulonimbus cloud, dragging the surrounding dense cold air with it. In many cases this downdraft will smother the updraft and kill the storm. If its location is offset from the updraft, however, it may contribute to the storm's longevity by helping to organize air flow within the storm. When a downburst "splashes" against the ground it can move outward as strong straight line winds and can even force the upward movement of moist surface air which can initiate additional thunderstorm cells.

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Downbursts occur in different positions within the thunderstorm structure and come in a variety of sizes. They can be “wet” involving significant precipitation or “dry” with little or no rain reaching the ground. Frequently there is a somewhat linear outflow stretching almost continuously along the front of a thunderstorm or series of storms. This is termed a gust front. The gust front is often associated with the menacing but usually harmless roll cloud, an elongated, tube shaped cloud that appears to rotate horizontally along a line just behind the gust front. If the descending air sweeps the warm and humid air at the surface upward it can create or arcus or shelf cloud which can be associated with the damaging straight line winds of a severe thunderstorm. Usually less spectacular is wind associated with the rear flank downdraft. Recent research suggests, however, that if this air is moist and unstable and gets wrapped into the circulation of a mesocyclone it can contribute to tornado formation. This wrap-around often includes precipitation which can obscure the view of an approaching tornado.

In terms of size, small downbursts, less than 2.5 miles in diameter, associated with the outflow of a single thunderstorm cell are termed microbursts. Larger downbursts, greater than 2.5 miles are macrobursts. An organized linear macroburst which stretches dozens of miles long associated with a squall line or mesoscale convective complex of thunderstorms and has wind speeds in excess of 58 miles per hour is called a derecho.

Downbursts can be dangerous. They are a particular hazard to aviation. A plane flying in the vicinity of a thunderstorm may suddenly be caught in upward moving air. Seconds later after the pilot pushes the nose down to compensate, the aircraft hits the downdraft, plunging it rapidly toward the ground with little time to recover. Most large airports now have instrumentation that can detect microbursts along aircraft approaches. Most pilots avoid thunderstorms because of the unpredictability of these violent vertical air movements. When a downburst hits the ground the air is forced sideways creating straight line winds that can literally mow down trees and do severe damage to property.

My family (including daughter Catrine, who captured the accompanying photo of downburst precipitation from a microburst in a Madison storm last summer) and I and a group of UW Fox Valley GeoAdventure Club students were canoe camping on the Wisconsin River in late Spring 1998 when a derecho with winds clocked at over 100 miles per hour descended on our island campsite. This storm did significant amounts of damage in southern Wisconsin along a swath over 100 miles long! For more information about this famous event go to:

<http://www.spc.noaa.gov/misc/AbtDerechos/casepages/may30-311998page.htm>.

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Nobody in our party got hurt. Fortunately we had a NOAA weather radio which warned us of the impending blast! We were able to move our tents well away from the trees and lash them to the scrubby willows deeply rooted in the sand. When the wind came it flattened all the tents and drove the rain down so hard that water literally blasted through the fabric. One of our canoes was blown almost a half mile. Even the largest trees surrounding the site were flattened!

Some of the information for this article came from:

- ◆ *NOAA Advanced Spotters Field Guide, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, NOAA PA 92055*
- ◆ *Online Weather Studies, Joseph M. Moran, American Meteorological Society, Boston, 2002.*
- ◆ *Jeff Last, Warning Coordination Meteorologist, NWSFO Green Bay. Personal communication*

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