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How Tuesday's Storms Unleashed Violent Winds in Maryland and Virginia

By Jeff Halverson and Jason Samenow, *July 13, 2022*

Hundreds of trees were toppled and hundreds of thousands of people lost power Tuesday afternoon and evening as three storm complexes roared across the Washington region. The storms were fueled by hot and humid air that surged into the region, and were powered and sustained by strong high-altitude winds along an approaching cold front.

Two complexes in particular were responsible for the lion's share of the damage. They were both arcing, bow-shaped lines that swept from west to east. The first plowed from Washington County to Cecil County in northern Maryland late in the afternoon. The second blitzed Northern Virginia, the District and central Maryland during the evening. Both brought down scores of trees and wires — some on homes and cars.

A third, somewhat less intense complex tracked through north-central Virginia and Southern Maryland late in the evening, leaving behind scattered reports of damaging winds and at least one instance of flash flooding.

Altogether, the National Weather Service received about 150 reports of damage from the three complexes. Pockets of hail also formed within the storms, some as wide as half-dollars. PowerOutage.US reported more than 70,000 outages still remained Wednesday afternoon, nearly 24 hours after the storm — the majority in northern Maryland.

All three of the complexes generated downward blasts of violent winds that slammed into the ground and fanned outward. The National Weather Service received about 40 reports of winds between 39 and 70 mph. Here are some the peak gusts recorded:

- Centreville: 70 mph
- Leesburg: 62 mph
- Washington Dulles International Airport: 60 mph
- Quantico: 59 mph
- Reagan National Airport: 52 mph

Within a one-county radius of Washington, concentrated areas of damage were reported near Chantilly, Olney, College Park and Bowie. Olney appeared to be hardest hit, where trees damaged as many as 20 homes, and about a half-dozen families were displaced.

Damage was also extensive in College Park, where one man was seriously injured when a tree fell on a home. The Weather Service concluded that peak winds in the area reached 80 to 90 mph and that winds blew in a straight line, ruling out a tornado.

“Straight line winds from thunderstorms can produce tornado-like damage,” the Weather Service wrote in a storm survey. “Yesterday evening’s estimated winds in College Park are equivalent to that of a low-end EF1 tornado.”

Inside the bow echo

The storm that caused the severe wind damage in Olney and College Park is known as a long-track bow echo. A bow echo, unlike a supercell that is organized around a rotating updraft, is energized by a powerful downdraft current. The surge of intense downdraft wind causes the front of the storm line to arc outward, racing ahead of the adjoining regions. Bow echoes frequently travel at high speeds of at least 40 to 50 mph.

The radar image below shows that the bow originated over West Virginia, south of Romney, between 3 and 4 p.m., as was being monitored by the Weather Service’s Storm Prediction Center. The Weather Service office in Sterling, Va., issued a continuous string of severe thunderstorm warnings ahead of this storm all the way to the Chesapeake Bay.

The next figure shows the storm at 5:30 p.m., as it approached Interstate 95. The arc shape is unmistakable. The northern end of the bow echo had evolved into a comma-head-like structure and may have contained a large vortex, as typically happens in these type of storms.

The strong downdraft outflow along the storm’s leading edge generated a menacing-appearing shelf cloud — where moist air is lifted a few hundred feet, then condenses into a low cloud.

That northern comma head generated a powerful downburst that affected the subdivision just south of Olney town center at 6 p.m. A zoom-in of the cell is shown in the next figure. The echo mass of heavy rain on the northern end of the bow is shown in the left panel. The right panel is Doppler velocity and reveals air currents hidden in the rain.

The white circle encloses the area impacted by the downburst, but the most extreme winds were contained in the subregion of pink colors, just southwest of Olney. This is strong flow away from the radar, toward the northeast. The green adjacent region represents strong flow toward the southwest.

Taken together, these two patches signify strongly diverging airflow. The premise here is that an intense downdraft core struck the surface at an impact point shown by the white “X.” White arrows show the bidirectional outflow from the point of impact. Winds in the pink region must have generated winds of at least 60 mph, probably stronger, given the size of trees that were felled.

Many people hear a sudden roaring sound as the wind rapidly accelerates to high speeds during a downburst. After the storm, the degree of tree damage can seem incredible. Based on the level of damage and the roar, many assume a tornado has occurred. But similar to the situation in College Park, the radar indicates a diverging, straight-line wind pattern, rather than the rotary signature that would be associated with a tornado.

Shelf cloud photos

As the bow echo approached, the ominous shelf cloud was a sight to behold. We received dozens of photos of the cloud from readers and share a sample below: