The Six Tornadoes of May 24, 2017

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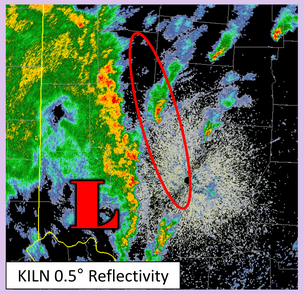
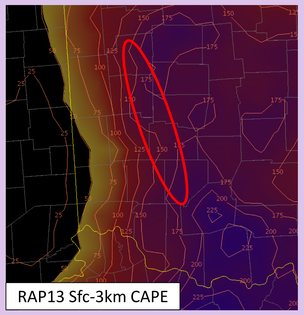
Threading the Mesoscale Needle

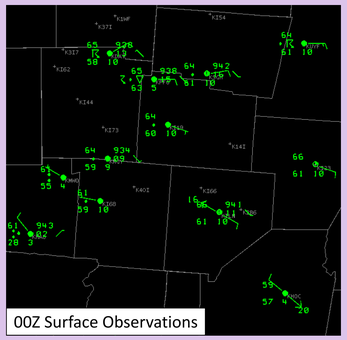
Ahead of an area of surface low pressure in southwest Ohio, temperatures warmed into the mid 60s, with dewpoints reaching the lower 60s. With steep lapse rates below 750mb, favorable instability was able to develop (SBCAPE >1000 J/kg), with a sizable portion (>200 J/kg) in the lowest 3km of the atmosphere.

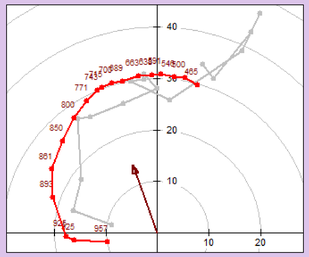
Surface winds were backed ahead of the low, with a localized area of ENE flow on the east side of the Dayton metropolitan area. With the mid-level low centered further to the southwest, producing southerly winds at 700mb, there was a significant amount of clockwise turning with height. This resulted in a very favorable wind profile for tornadoes. Modifying the 00Z KILN sounding to match surface observations near the strongest tornadoes yielded close to 200 m^2/s^2 of 0-3km SRH. The combination of these parameters occurred over only a very narrow swath ahead of the surface low. One supercell traversed this environment for several hours, producing five of the six tornadoes that occurred during the event.



KILN 0.5° Reflectivity


RAP13 Sfc-3km CAPE


00Z Surface Observations



0-6km hodograph and wind profile, modified for tornadic environment. *(from 00Z 25 May 2017 KILN sounding)*

The Six Tornadoes

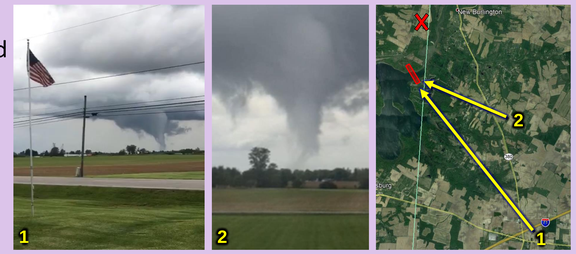
#1	Harveysburg	EF0	7:47 PM *	7:48 PM *
#2	Beavercreek Twp	EF0	8:26 PM	8:34 PM
#3	Octa	EF0	8:27 PM	8:36 PM
#4	Fairborn/Medway	EF0	9:06 PM *	9:16 PM
#5	Park Layne	EF1	9:16 PM	9:32 PM
#6	Casstown	EF1	10:03 PM *	10:10 PM

** Time changed during 2018 reanalysis.*

The Reanalysis

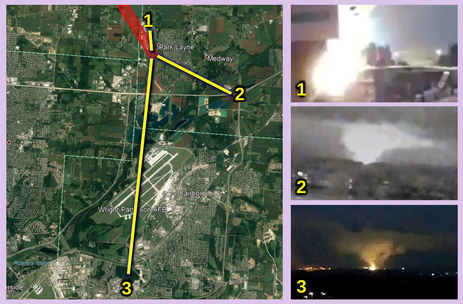
In the days following the 24 May 2017 event, the NWS in Wilmington, Ohio confirmed six tornadoes, with four rated EF0 and two rated EF1 on the Enhanced Fujita Scale. In early 2018, a comprehensive reanalysis of the event was completed, adjusting the details of the confirmed tornadoes using videos, pictures, and personal accounts from over two dozen eyewitnesses. This reanalysis brought about changes to the times and locations of three of the six tornadoes, with additional information helping to detail the tracks of all six.

Videos from Andrea Baird Pletcher (1) and Angie Hillman (2) confirmed the **Harveysburg EF0** occurred one mile south and eight minutes sooner than originally estimated. No damage was found, as the tornado impacted an inaccessible area near the north end of a lake.



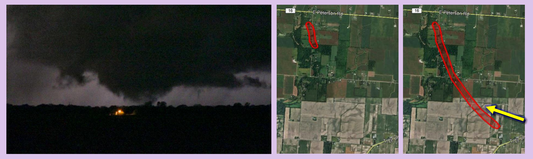
A video by Jaclyn Wisecup (1) caught the **Octa EF0** touchdown, at the exact moment that audio from the Tornado Warning began to play on the radio. An image from WCMH-TV (2) helped to verify where the tornado crossed Interstate 71 -- a useful piece of information, as no damage was ever observed.

A dramatic picture from Jessica Dunn (1) captured the **Fairborn/Medway EF0** just after it touched down. The tornado crossed the northern end of Runway 5R/23L at Wright-Patterson Air Force Base, and was illuminated by the lights at the base. A short time later, spotter Brady Smith caught a view of both the Fairborn/Medway tornado and a separate wall cloud to its north. In a matter of minutes, this wall cloud would go on to produce the Park Layne EF1, evidence of the cyclic nature of the tornadic supercell.



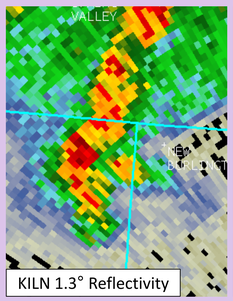
When the **Park Layne EF1** first began causing damage, it sparked a massive power flash, illuminating the entire tornado. This flash was captured on video by three separate cameras: from a spotter (1), the Ohio Department of Transportation (2), and WHIO-TV (3). Using the locations of the cameras and the directions they were facing, the tornado's exact touchdown location was triangulated, confirming the results of the ground survey.

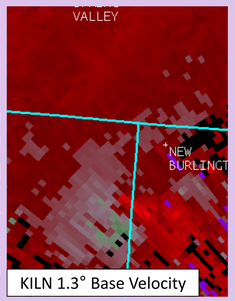
This lightning-lit video excerpt from David Baxter helped to adjust the initial touchdown location of the **Casstown EF1**, adding two miles and 6 minutes to the tornado's confirmed track.

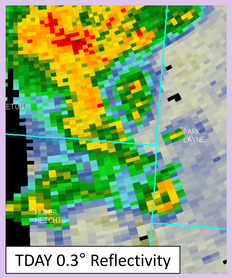


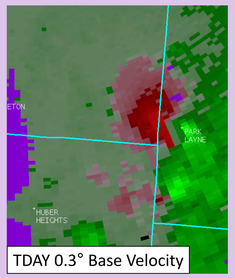
Radar Appearance

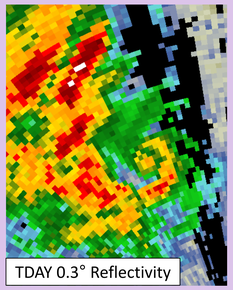
Initially, radar signatures associated with the tornadic cells were extremely weak. Through the first three tornadoes of the event, reflectivity cores were small, and rotational velocities remained at or below 10 knots (*Harveysburg EF0, top*). At first, this led to warning decision challenges, as standard thresholds had to be lowered once reliable spotter reports had began to arrive. As the main supercell became better organized, it cycled numerous times, producing multiple hook echoes and rotational couplets – including two such features at the same time (*Fairborn EF0 and Park Layne EF1, middle*). As the storm matured, it took on classic supercell characteristics, with stronger gate-to-gate velocities and well-defined hook echo and weak echo region reflectivity signatures (*Casstown EF1, bottom*).

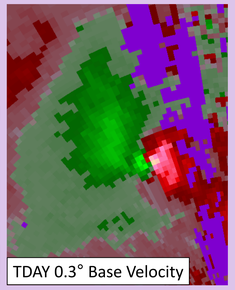

KILN 1.3° Reflectivity


KILN 1.3° Base Velocity


TDAY 0.3° Reflectivity

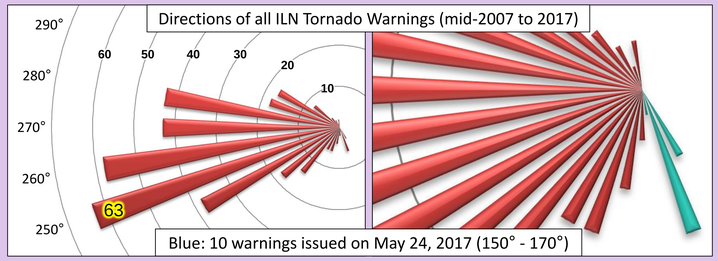

TDAY 0.3° Base Velocity


TDAY 0.3° Reflectivity


TDAY 0.3° Base Velocity

An Odd Direction?

In 2007, the National Weather Service began including storm motion vectors within all Tornado and Severe Thunderstorm Warnings. The 24 May 2017 event was the first time that tornado warnings were issued by NWS Wilmington, Ohio with storm motions from a southeasterly direction. The six tornadoes during the event all verified with storm motions from the southeast, including several at approximately 150°.



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