

# Forensic Weather Report



## **HAILTRACE**

Prepared For: **Company Name**

### Location

80 E 5<sup>th</sup> St, Ste 100

Edmond, OK 73034

### Expert Preparation

Extreme Weather Prediction LLC DBA HailTrace

80 E 5th St Suite 100

Edmond, OK 73034

Lead Forensic Meteorologist John Choquette

**Date of Report Completion**

## **ASSIGNMENT:**

This case was assigned to me by [company name]. I was asked to evaluate and provide an in-depth weather analysis and forensic weather investigation for 80 E 5<sup>th</sup> St, Ste 100, Edmond, OK 73034 on April 19, 2023, and March 27, 2020. The weather peril in question was a large hail event for both dates.

This written report and all the graphs, findings, and opinions contained in it has been prepared for the purposes of example use only. Use of this information for any other matter other than what is indicated above is prohibited.

## **METHODOLOGY:**

HailTrace uses sources of weather information that originate from the National Oceanic and Atmospheric Administration (NOAA) and/or the National Weather Service (NWS) to conduct a reliable weather analysis. These data sources are scientifically reliable resources to consider when conducting a forensic meteorological analysis and are the type of data sources widely relied upon by meteorologists.

The methodology used for this case begins by collecting all available data on a large scale over the date in question and continuing to work toward a small-scale analysis of what occurred over the specific property.

All data, observations, and conclusions in this report were derived from the following sources:

- Surface analyses from the Weather Prediction Center (WPC) Surface Analysis Archive
- Satellite imagery from Google Earth
- Historical NOAA WSR-88D KTLX Doppler Radar data from NCEI
- NOAA Severe Weather Database Inventory (SWDI)
- Warning texts, Area Forecast Discussions (AFDs), Convective Outlooks, Daily Weather Maps, and Local Storm Reports (LSRs), accessed through the Iowa Environmental Mesonet (IEM), the National Centers for Environmental Information (NCEI), the Storm Prediction Center (SPC) Archive, and the National Oceanic and Atmospheric Administration (NOAA) Storm Events Database (SED)
- GRLevel2 Analyst Edition software
- Atmospheric Sounding – Norman, OK

Times of day in this report are given in Central Daylight Time (CDT), the time zone of the property. However, please note: the National Oceanic & Atmospheric Administration (NOAA) and other entities frequently use Universal Time Coordinate (UTC) to express time. Radar image date and time stamps that are given on the Doppler radar images are also given in UTC and require a subtraction of 5 hours to convert to Central Daylight Time (CDT). Additionally, the Local Climatological Data are given in “Local Standard Time” which requires a one-hour addition

time adjustment to obtain “Central Daylight Time (CDT)”. In some figures, these timestamps may be shown in UTC, however, those timestamps have been converted to CDT in the explanatory text of this report.

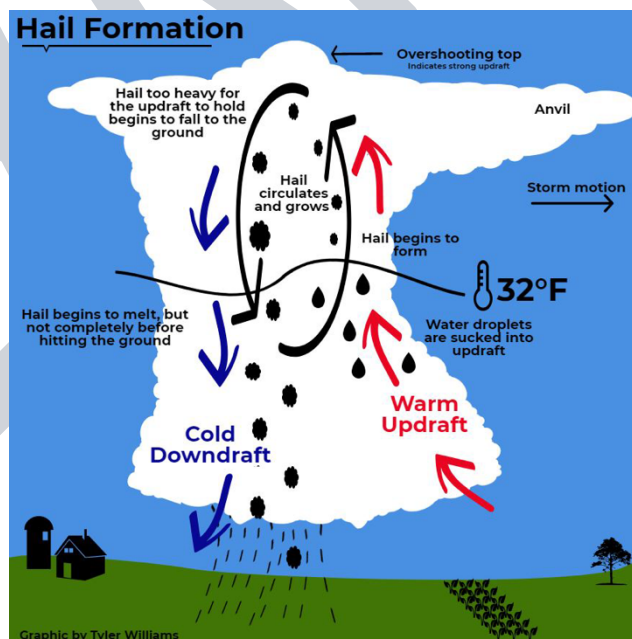
The findings in this report utilize the weather records that were available at the time of data retrieval for this case. Any additional weather records, data, or information that become available after data retrieval may be incorporated into my findings and this report in the future. The information and data relied upon in this report is the type of data that forensic meteorologists reasonably and customarily rely upon in reaching an opinion as to the weather conditions at a property on a given date.

## **HAIL FORMATION AND SIZE CLASSIFICATION OVERVIEW**

Thunderstorms often contain hail within them. According to the NOAA National Severe Storms Laboratory (NSSL), hail formation is as follows:

*Hailstones are formed when raindrops are carried upward by thunderstorm updrafts into extremely cold areas of the atmosphere and freeze. Hailstones then grow by colliding with liquid water drops that freeze onto the hailstone’s surface. If the water freezes instantaneously when colliding with the hailstone, cloudy ice will form as air bubbles will be trapped in the newly formed ice. However, if the water freezes slowly, the air bubbles can escape and the new ice will be clear. The hail falls when the thunderstorm’s updraft can no longer support the weight of the hailstone, which can occur if the stone becomes large enough or the updraft weakens.*

The following graphic from the University of Nebraska visualizes this process.



Source: University of Nebraska

Hail within a given storm are made up of a mix of different sizes and hail size is often estimated by comparing it to a known object. Measurements of hail stones using a ruler, tape measure, or calipers are best but are not always readily available thus estimating hail size with known objects with a definite size are common practice. The Storm Prediction Center (SPC) classifies hail that is 1.00" in diameter or greater as severe hail. The following chart from the SPC shows commonly utilized objects for estimating hail size and their respective measurements.

HAIL SIZE (in.)	OBJECT ANALOG REPORTED
.50	Marble, moth ball
.75	Penny
.88	Nickel
1.00	Quarter
1.25	Half dollar
1.50	Walnut, ping pong
1.75	Golf ball
2.00	Hen egg
2.50	Tennis ball
2.75	Baseball
3.00	Tea cup
4.00	Softball
4.50	Grapefruit

Source: SPC

## **INCIDENT LOCATION**

The property is in downtown Edmond, OK in northwest Oklahoma County. This is a large commercial property surrounded by other commercial and residential properties. The property address is plotted below with a yellow pushpin on Google Earth. The storms in question on April 19, 2023, and March 27, 2020, both moved over the property from the southwest to the northeast. A red arrow was plotted onto the image over the property to show the storm motion as they passed over the property.



Doppler radar data was processed by the Norman, OK radar site (KTLX). This data was downloaded from the National Centers for Environmental Information, zoomed in over the property and the property was plotted on each image by a red square.

Super-resolution Doppler radar data and other types of weather records were used together in this study. Doppler radar data are a useful tool for locating precipitation. The radar unit sends a pulse of energy into the atmosphere. If the pulse of energy intercepts any precipitation, part of the energy is scattered back to the radar. These returning signals are called “radar echoes” and are assembled to produce radar images. The location of the colored radar echoes indicates where precipitation is falling, and the various colors indicate intensity through the color code key on the left side of the radar image itself. Doppler radar data is received approximately every 2-6 minutes and can determine if precipitation was falling at the incident location and if so, approximately when it started and stopped.

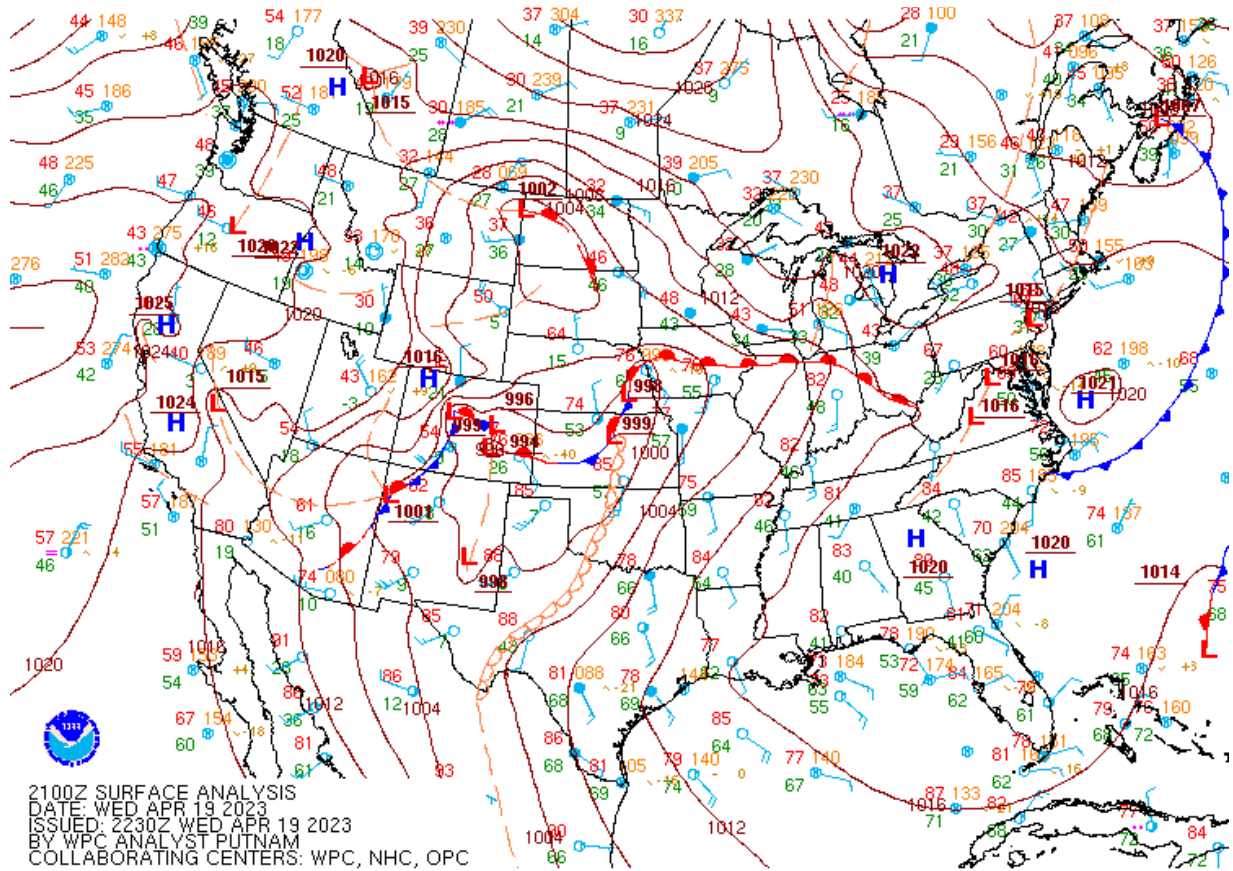
Base reflectivity is the display of the intensity of the returned radar echoes and is measured in dBZ (decibels of Z, where Z represents the energy reflected back to the radar). Base Reflectivity images are available at several different elevation angles (tilts) of the radar antenna and are used to detect precipitation, evaluate storm structure, locate atmospheric boundaries, and determine hail potential. The Base Reflectivity image is from the lowest “tilt” angle (0.5 degrees), meaning the radar’s antenna is tilted 0.5 degrees above the horizon.

I used the program Gibson Ridge Analyst Edition (GRAE), which is widely used by other consulting meteorologists and National Weather Service offices nationwide, to obtain data for Base Reflectivity, Correlation Coefficient, Differential Reflectivity, Specific Differential Phase, and Base Velocity data over the incident location. These images were zoomed in over the incident location where a red “dot” was manually plotted on the radar map to indicate the property.

### **WEATHER SITUATION FOR APRIL 19, 2023:**

On the evening of April 19, 2023, a surface low pressure was in north central Kansas. A dryline extended from the low pressure southward through west central Oklahoma. Temperatures were in the upper 70s with dew points in the upper 60s Fahrenheit ahead of the dryline, which provided ample heat and moisture for storm development. This can all be seen on the 4 PM CDT April 19, 2023, surface map below. The NCDC Storm Events Database summary for April 19, 2023 in the Edmond area is as follows:

*Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.*

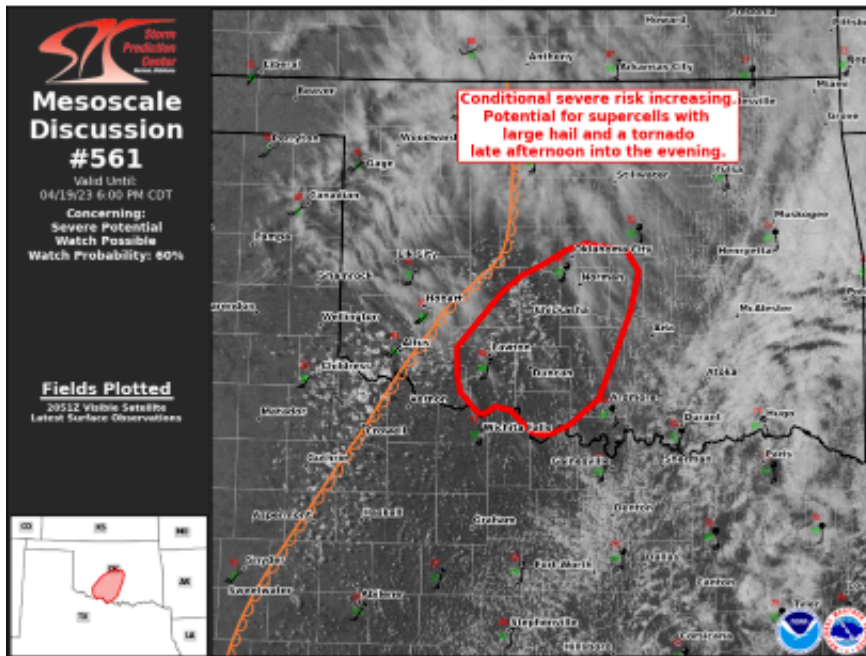


Weather Prediction Center (WPC) Surface Map Analysis – 2100 UTC April 19, 2023  
 (4 PM CDT April 19, 2023)

Due to the potential for severe weather increasing, the Storm Prediction Center issued a Mesoscale Discussion (MCD) at 3:57 PM CDT on April 19, 2023. The discussion mentioned the threat for very large hail and tornadoes developing in the region over the next few hours. Below is the information and discussion text for this MCD.

Mesoscale Discussion 561

< Previous MD    Next MD >



Mesoscale Discussion 0561  
 NWS Storm Prediction Center Norman OK  
 0357 PM CDT Wed Apr 19 2023

Areas affected...Portions of southwestern and south-central Oklahoma

Concerning...Severe potential...Watch possible

Valid 192057Z - 192300Z

Probability of Watch Issuance...60 percent

SUMMARY...Conditional severe threat increasing. Potential for supercells with large hail and a couple tornadoes late afternoon into the evening. A watch will be possible in the next few hours.

DISCUSSION...A conditional severe threat is increasing across portions of southwestern and south-central Oklahoma. A surface dryline continues to mix eastward across Oklahoma and Texas. Ahead of the dryline, mid 60s dew points have moved north of the Red River across southern Oklahoma. 19z RAOB from OUN indicates moistening and a weakening cap beneath an elevated mixed layer with steep lapse rates (around 8 C/km). Temperatures have warmed into the 80s with strong daytime heating, with MLCAPE around 2500-3000 J/kg. Further indication of the weakening cap can be seen in satellite, as cumulus fields continue to show increasing development. The 19z OUN RAOB and surface objective analysis also indicate deep layer shear around 35-40 kts. The main risk with any initial storm development would be large hail, given steep lapse rates. As the main wave approaches from the west with deepening low pressure across the Central Plains, 850 mb flow will increase through the evening, further elongating hodographs and increasing risk of a couple tornadoes. Trends will be monitored closely with a watch will be possible within few hours.

..Thornton/Grans.. 04/19/2023

...Please see [www.spc.noaa.gov](http://www.spc.noaa.gov) for graphic product...

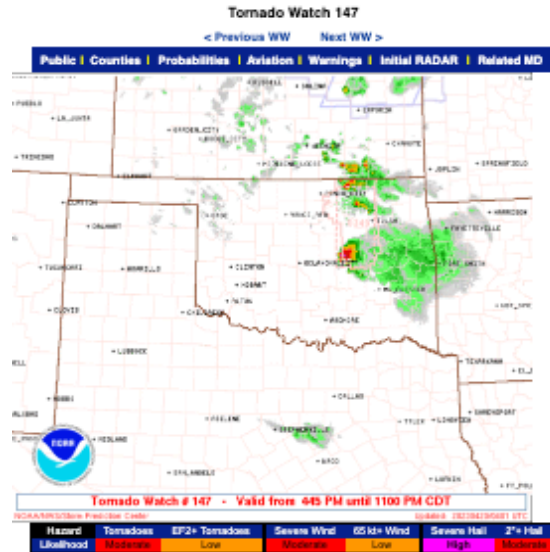
ATTN...WFO...FWD...OUN...

LAT	LON	34169733	35999757	33929774	33909784	33949796	34139818
		34159835	34089846	34129855	34299871	34439874	34669876
		35169828	35299807	35399786	35499766	35529759	35589739
		35519695	35349683	35099688	34989692	34669705	34509713
		34239726	34169733				

MCD 561



With the severe weather potential increasing across the region, the Storm Prediction Center issued a Tornado Watch, which included Oklahoma County, at 4:45 PM CDT. The watch gave a moderate chance for large hail of 2" in diameter or greater. The watch information and text is below.



Note: The expiration time in the watch graphic is amended if the watch is replaced, cancelled or extended.  
 Note: Click for Watch Status Reports.

SEL7

URGENT - IMMEDIATE BROADCAST REQUESTED  
 Tornado Watch Number 147  
 NWS Storm Prediction Center Norman OK  
 4:45 PM CDT Wed Apr 19 2023

The NWS Storm Prediction Center has issued a

- \* Tornado Watch for portions of Southern and Central Oklahoma Western North Texas
- \* Effective this Wednesday afternoon and evening from 4:45 PM until 11:00 PM CDT.
- \* Primary threats include...  
 A couple tornadoes possible  
 Scattered large hail likely with isolated very large hail events to 3 inches in diameter possible  
 Scattered damaging wind gusts to 70 mph possible

**SUMMARY...**At least isolated severe storms, including supercells, are expected to develop and increase through late afternoon/early evening. Locally very large hail will be possible with any supercell storms, and tornado potential should increase toward/just after sunset as the low-level jet increases and storms intercept somewhat richer low-level moisture near the Interstate 44/Interstate 35 corridors.

The tornado watch area is approximately along and 60 statute miles east and west of a line from 45 miles northwest of Chandler OK to 35 miles south of Wichita Falls TX. For a complete depiction of the watch see the associated watch outline update (N0US64 KNWS W0U7).

**PRECAUTIONARY/PREPAREDNESS ACTIONS...**

**REMEMBER...**A Tornado Watch means conditions are favorable for tornadoes and severe thunderstorms in and close to the watch area. Persons in these areas should be on the lookout for threatening weather conditions and listen for later statements and possible warnings.

&&

OTHER WATCH INFORMATION...CONTINUE...NW 145...NW 146...

**AVIATION...**Tornadoes and a few severe thunderstorms with hail surface and aloft to 3 inches. Extreme turbulence and surface wind gusts to 60 knots. A few cumulonimbi with maximum tops to 550. Mean storm motion vector 22025.

...Guyer

Storm Prediction Center – Tornado Watch 147

## WARNINGS ISSUED FOR PROPERTY

The property in Oklahoma County is overseen by the National Weather Forecast Office in Norman, OK (OUN). A supercell thunderstorm developed and crossed into Oklahoma County at approximately 5:24 PM CDT. The storm moved northeast, splitting into two, with the north split continuing to move northeast towards the property. At 5:45 PM CDT, the National Weather Service in Norman, Oklahoma issued a Severe Thunderstorm Warning for Oklahoma County, including the property. The initial warning mentioned hail up to golf ball size (1.75" in diameter). The warning text is below:

758  
WUUS54 KOUN 192245  
SVROUN  
OKC083-109-192330-  
/O.NEW.KOUN.SV.W.0125.230419T2245Z-230419T2330Z/

*BULLETIN - IMMEDIATE BROADCAST REQUESTED  
Severe Thunderstorm Warning  
National Weather Service Norman OK  
545 PM CDT Wed Apr 19 2023*

*The National Weather Service in Norman has issued a*

*\* Severe Thunderstorm Warning for...  
Northern Oklahoma County in central Oklahoma...  
Southeastern Logan County in central Oklahoma...*

*\* Until 630 PM CDT.*

*\* At 545 PM CDT, a severe thunderstorm was located over northwestern Oklahoma City, or near The Village, moving northeast at 40 mph.*

*HAZARD...Golf ball size hail and 60 mph wind gusts.*

*SOURCE...Radar indicated.*

*IMPACT...People and animals outdoors will be injured. Expect hail damage to roofs, siding, windows, and vehicles. Expect wind damage to roofs, siding, and trees.*

*\* Locations impacted include...  
Northern Oklahoma City, Edmond, Guthrie, Warr Acres, The Village, Nichols Hills, Jones, Langston, Arcadia, Meridian, Forest Park, Lake Aluma, and Seward.*

*PRECAUTIONARY/PREPAREDNESS ACTIONS...*

*This storm is producing large hail. SEEK SHELTER NOW inside a sturdy structure and stay away from windows!*

*A Tornado Watch remains in effect for the warned area.*

*&&*

*LAT...LON 3594 9714 3572 9714 3551 9743 3555 9766  
3595 9746  
TIME...MOT...LOC 2245Z 208DEG 34KT 3559 9753*

*THUNDERSTORM DAMAGE THREAT...CONSIDERABLE  
HAIL THREAT...RADAR INDICATED  
MAX HAIL SIZE...1.75 IN  
WIND THREAT...RADAR INDICATED  
MAX WIND GUST...60 MPH*

*\$\$*

*Mahale*

The Severe Thunderstorm Warning was updated as the storm moved over Edmond. The update was issued at 5:56 PM CDT, with the maximum hail size remaining at golf ball size (1.75" in diameter). The text for the update is below:

*378  
WWUS54 KOUN 192256  
SVSOUN*

*Severe Weather Statement  
National Weather Service Norman OK  
556 PM CDT Wed Apr 19 2023*

*OKC083-109-192330-  
/O.CON.KOUN.SV.W.0125.000000T0000Z-230419T2330Z/  
Oklahoma OK-Logan OK-  
556 PM CDT Wed Apr 19 2023*

*...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 630 PM CDT  
FOR NORTHERN OKLAHOMA AND SOUTHEASTERN LOGAN COUNTIES...*

*At 555 PM CDT, a severe thunderstorm was located over western Edmond,  
or near Downtown Edmond, moving northeast at 40 mph.*

*HAZARD...Golf ball size hail and 60 mph wind gusts.*

*SOURCE...Trained weather spotters reported golf ball size hail in  
Edmond.*

*IMPACT...People and animals outdoors will be injured. Expect hail  
damage to roofs, siding, windows, and vehicles. Expect wind  
damage to roofs, siding, and trees.*

*Locations impacted include...  
Northeastern Oklahoma City, Edmond, Guthrie, Langston, Arcadia,  
Meridian, and Seward.*

*PRECAUTIONARY/PREPAREDNESS ACTIONS...*

*A tornado watch remains in effect for the warned area. Tornadoes can  
develop quickly from severe thunderstorms.*

*This storm is producing large hail. SEEK SHELTER NOW inside a sturdy  
structure and stay away from windows.*

*&&*

*LAT...LON 3594 9714 3572 9714 3558 9734 3562 9763  
3595 9746*

*TIME...MOT...LOC 2255Z 208DEG 34KT 3568 9747*

*THUNDERSTORM DAMAGE THREAT...CONSIDERABLE  
HAIL THREAT...OBSERVED  
MAX HAIL SIZE...1.75 IN  
WIND THREAT...RADAR INDICATED  
MAX WIND GUST...60 MPH*

*\$\$*

*Mahale*

## **LOCAL STORM REPORTS**

Below is a list of storm reports that occurred in Oklahoma County, Oklahoma on April 19, 2023, from the National Climatological Data Center's Storm Events Database (SED). The storm in question was a prolific hail producer, with numerous reports of large hail of 1.00" or greater:



**Storm Events Database**

**Data Access**

- Search
- Bulk Data Download (CSV)
- Storm Data Publication

**Documentation**

- Database Details
- Version History
- Storm Data FAQ
- NOAA's NWS Documentation
- Tornado EF Scale

**External Resources**

- NOAA's SPC Reports
- NOAA's SPC WCM Page
- NOAA's NWS Damage Assessment Toolkit
- NOAA's Tsunami Database
- ESRI/FEMA Civil Air Patrol Images
- SHELDUS
- USDA Cause of Loss Data

## Storm Events Database

### Search Results for Oklahoma County, Oklahoma

Event Types: **Hail**

47 events were reported on 04/19/2023

**Summary Info:**

Number of County/Zone areas affected:	1
Number of Days with Event:	1
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1

**Column Definitions:**

'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

**Data Export:** (current results)



[CSV Download](#) / [Documentation](#)

Click on **Location** below to display details.

Available Event Types have changed over time. Please refer to the [Database Details](#) for more information.

Select: **Hail 1.00 in. and larger**

Sort By: **Date/Time (Oldest)**

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	16:31	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	16:37	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">WHEATLAND</a>	OKLAHOMA CO.	OK	04/19/2023	16:37	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">NICHOLS HILLS</a>	OKLAHOMA CO.	OK	04/19/2023	16:40	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">NICHOLS HILLS</a>	OKLAHOMA CO.	OK	04/19/2023	16:43	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	16:45	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">NICHOLS HILLS</a>	OKLAHOMA CO.	OK	04/19/2023	16:45	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:47	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:49	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:50	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:51	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	16:53	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:53	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:55	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:55	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">ARCADIA LAKE</a>	OKLAHOMA CO.	OK	04/19/2023	16:56	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">ARCADIA LAKE</a>	OKLAHOMA CO.	OK	04/19/2023	16:58	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	16:58	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">ARCADIA LAKE</a>	OKLAHOMA CO.	OK	04/19/2023	16:59	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	17:01	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:01	CST-6	Hail	2.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:03	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:09	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:13	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K

<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	17:15	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:15	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:18	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:18	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	04/19/2023	17:21	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:22	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:23	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	04/19/2023	17:24	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	04/19/2023	17:25	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(TIK)TINKER AFB</a>	OKLAHOMA CO.	OK	04/19/2023	17:52	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">CHOCTAW</a>	OKLAHOMA CO.	OK	04/19/2023	17:59	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">MIDWEST CITY</a>	OKLAHOMA CO.	OK	04/19/2023	18:12	CST-6	Hail	2.00 in.	0	0	0.00K	0.00K
<a href="#">CHOCTAW</a>	OKLAHOMA CO.	OK	04/19/2023	18:25	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	19:04	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">(OKC)WILL ROGERS APT</a>	OKLAHOMA CO.	OK	04/19/2023	19:15	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">NICOMA PARK</a>	OKLAHOMA CO.	OK	04/19/2023	20:23	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<a href="#">HARRAH</a>	OKLAHOMA CO.	OK	04/19/2023	20:29	CST-6	Hail	1.00 in.	0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

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### Storm Events Database (SED) – Oklahoma County, OK April 19, 2023

Of the reports listed above, three hail reports were located within two miles of the property. The reports are plotted on Google Earth (seen as blue pushpins), along with the property (seen as the yellow pushpin) and have the hail sizes and distances from the property listed. The closest report was for 1.75” hail approximately 0.73 miles southeast of the property.

#### Storm Events Database

##### Event Details:

Event	Hail
Magnitude	1.75 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Emergency Manager
NCEI Data Source	CSV
Begin Date	2023-04-19 16:55 CST-6
Begin Location	2NW EDMOND
Begin Lat/Lon	35.67/-97.5
End Date	2023-04-19 16:55 CST-6
End Location	2NW EDMOND
End Lat/Lon	35.67/-97.5
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	
Crop Damage	
Episode Narrative	Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.
Event Narrative	

Storm Events Database (SED) – Oklahoma County, OK 5:55 PM CDT April 19, 2023

### Storm Events Database

**Event Details:**

Event	Hail
Magnitude	2.00 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Public
NCEI Data Source	CSV
Begin Date	2023-04-19 16:55 CST-6
Begin Location	2WNW EDMOND
Begin Lat/Lon	35.66/-97.51
End Date	2023-04-19 16:55 CST-6
End Location	2WNW EDMOND
End Lat/Lon	35.66/-97.51
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	
Crop Damage	
Episode Narrative	Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.
Event Narrative	MPing report.

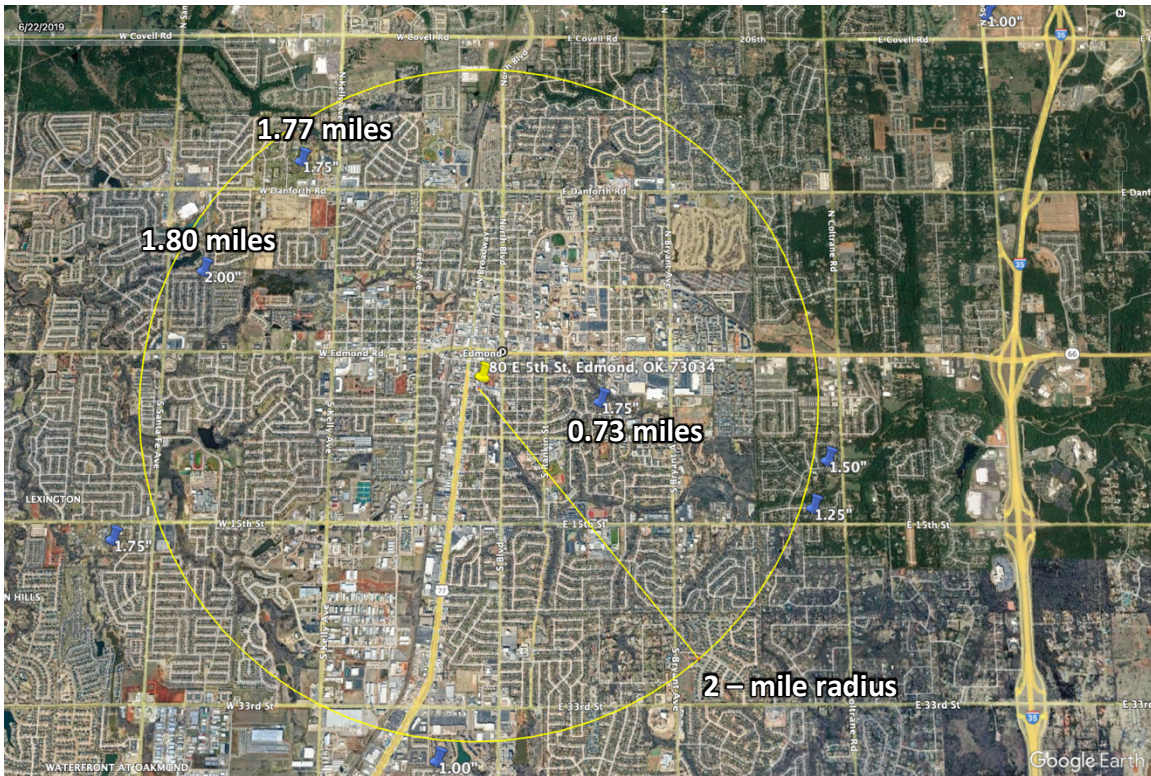
Storm Events Database (SED) – Oklahoma County, OK 5:55 PM CDT April 19, 2023

### Storm Events Database

**Event Details:**

Event	Hail
Magnitude	1.75 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Public
NCEI Data Source	CSV
Begin Date	2023-04-19 16:58 CST-6
Begin Location	1E EDMOND
Begin Lat/Lon	35.6485/-97.4677
End Date	2023-04-19 16:58 CST-6
End Location	1E EDMOND
End Lat/Lon	35.6485/-97.4677
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	
Crop Damage	
Episode Narrative	Broad troughing was present aloft across the Western US during the afternoon/evening of the 19th. An area of surface low-pressure slowly deepened and moved towards north-central Kansas, with dryline extending from central Kansas through western-north Texas by the late afternoon hours. A well-timed lead upper wave, combined with broken insolation, led to the development of a few supercell thunderstorms across central Oklahoma. Multiple instances of large to very large (>2 inches) hail, along with 18 tornadoes, occurred across central Oklahoma.
Event Narrative	

Storm Events Database (SED) – Oklahoma County, OK 5:58 PM CDT April 19, 2023



Plotted hail reports and their distances from the property.

After analysis of the storm reports and NWS Warning text on April 19, 2023, in Oklahoma County, large hail of 1.00" in diameter or greater likely impacted Edmond between approximately 5:30 and 6:00 PM CDT. To get a clearer picture on the timeline of severe weather impacts and maximum hail size at the property, Doppler radar analysis was conducted.

### **DOPPLER RADAR ANALYSIS**

After analysis of Storm Reports and NWS Warning text, it was evident that the most likely timeframe the storms impacted the property was roughly between 5:30 and 6:00 PM CDT. That timeframe will be the focus of this radar analysis. As previously mentioned, radar data from the KTLX radar facility was utilized. The radar facility KTLX is NEXRAD (Next Generation Weather Radar) which provides over 60 meteorological products and has a coverage range up to 124 nautical miles. KTLX is part of the larger radar network that covers the United States. NEXRAD (WSR-88D) is the official meteorological radar for the National Weather Service, the Department of Defense, and the Federal Aviation Administration, and is the radar network most widely used by meteorologists in the private sector. In relation to the property, KTLX is the closest NEXRAD facility located at the National Weather Service in Norman, OK and is approximately 24.64 miles to the southeast of the property. The height of the radar beam was approximately 1,411 feet over the property.





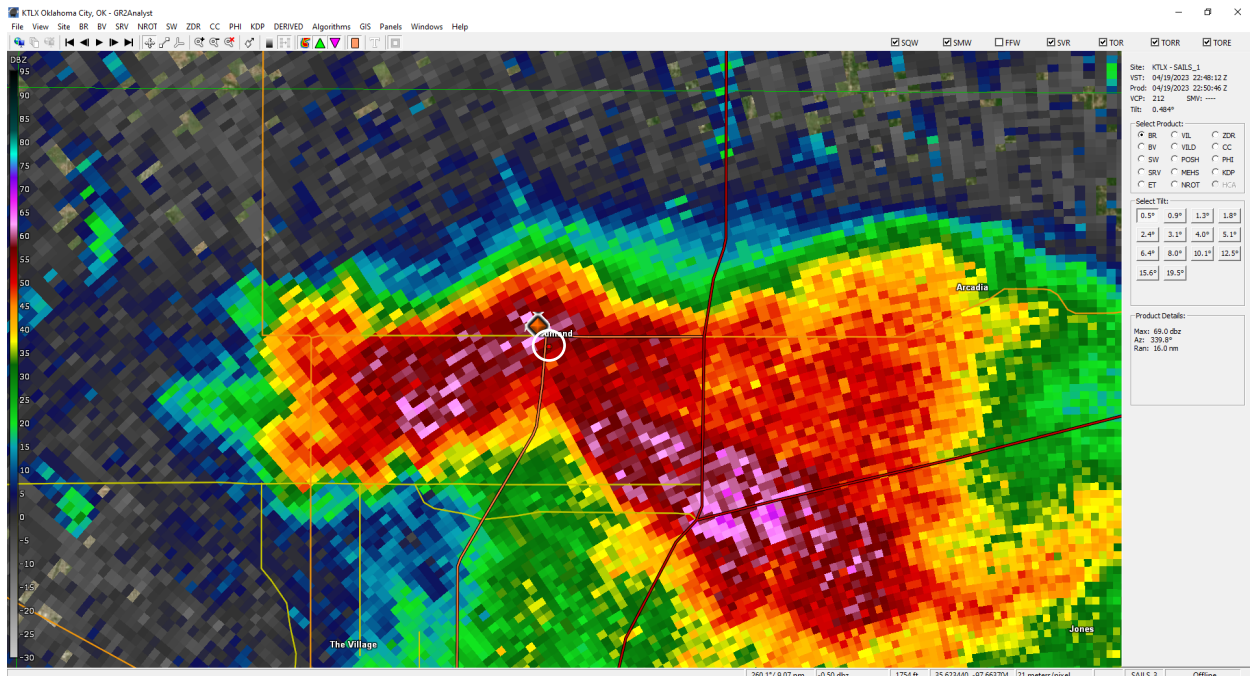
Distance of property from KTLX – 24.64 miles (21.41 nautical miles)

When it comes to radar analysis for hail occurrence, there are some basic thresholds that must be met before analyzing a storm. According to the Federal Meteorological Handbook, Part D:

**4.8.1 Recognition of Hail Potential.** *Historically, one of the first techniques used to identify storms producing hail was to identify storms that possessed high reflectivity > ~ 55 dBZ. Subsequently, storms that possessed unusually high reflectivity at unusually high altitudes within the storm were found to produce hail, often large in size.*

**4.8.2 Considerations.** *High, near-surface reflectivity values (over ~60 dBZ) often indicate that the precipitation is in the form of hail and not rain. The existence of sidelobe contamination may also indicate the presence of hail.*

I utilized Gibson Ridge Analyst Edition to process the KTLX NEXRAD data for Base Reflectivity to determine if initial thresholds were met for the presence of hail at the property. At 2250 UTC (5:50 PM CDT), the property, as identified by the red dot surrounded by a white oval plotted in the center of the image below, had reflectivity values of 57 dBZ over the property.

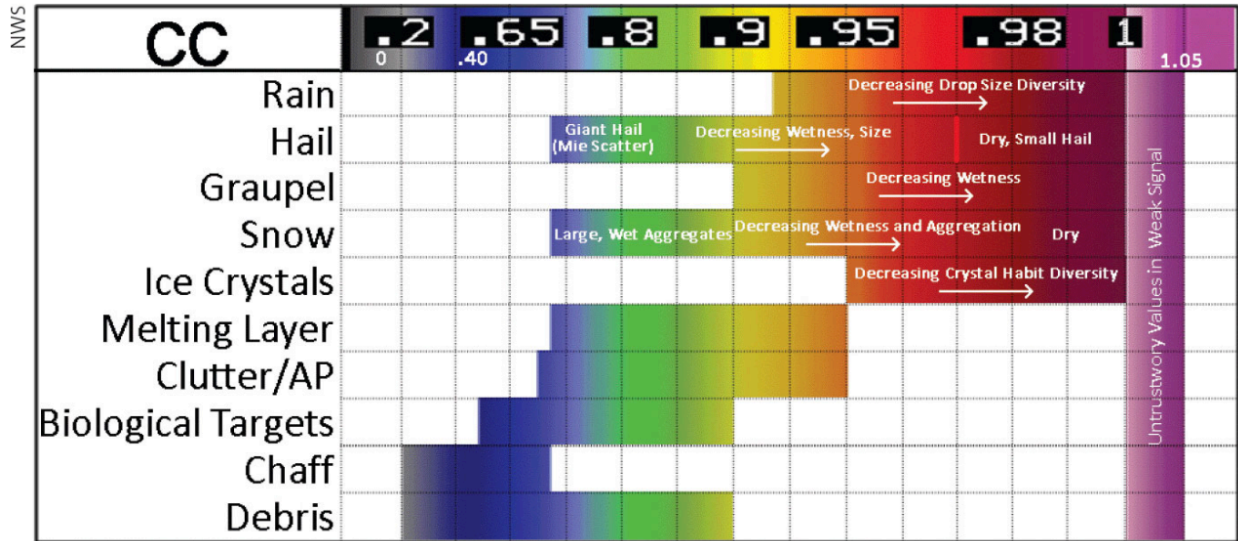


KTLX Base Reflectivity – 2250 UTC April 19, 2023  
(5:50 PM CDT April 19, 2023)

Knowing initial thresholds from the Federal Meteorological Handbook have been met, I began analysis of three dual-pol products in conjunction with Base Reflectivity. Base Reflectivity (left), Correlation Coefficient (CC) (right), Differential Reflectivity (ZDR) (bottom left), and Specific Differential Phase (KDP) (bottom right) all are shown in the following radar images in a four-panel view with the property plotted with a red dot in the center of the frame.

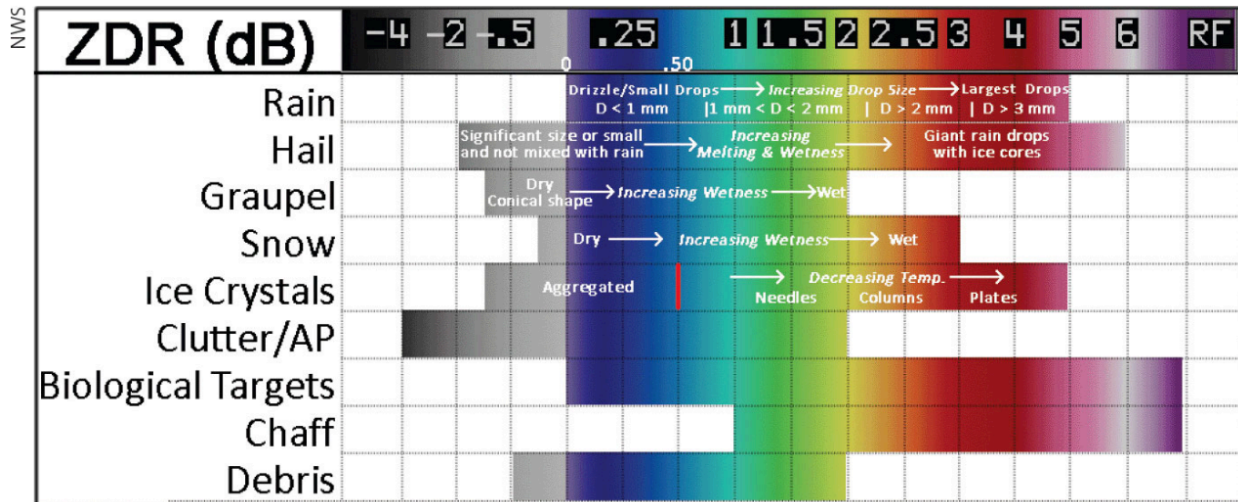
In addition to reflectivity, the dual-pol products Correlation Coefficient, Differential Reflectivity, and Specific Differential Phase are used for detecting hail.

Correlation Coefficient (CC) provides a measure of the consistency of the shapes and sizes of targets within the radar beam. Very high values show high consistency in the size and shape of radar targets, while lower values indicate greater variability in shapes and sizes. As hail mixes with rain, the radar targets become increasingly variable. The sizes of actual hail stones vary with a storm and the larger the stones, the lower the Correlation Coefficient value. The National Weather Service considers Correlation Coefficient values between 0.7 and 0.95 typical for hail with values below 0.85 indicative of “giant hail” (greater than 2” in diameter). Values greater than 0.95 but still under 1.00 are typical for small dry hail. The following ‘color keys’ were obtained from the “WSR-88D Dual Polarization Guide” that was created by the “Warning Decision Training Division” (WDTD) of the National Weather Service (NWS) and the National Oceanic and Atmospheric Administration (NOAA) to visualize the Correlation Coefficient values.



Correlation Coefficient (CC) chart of values for various objects

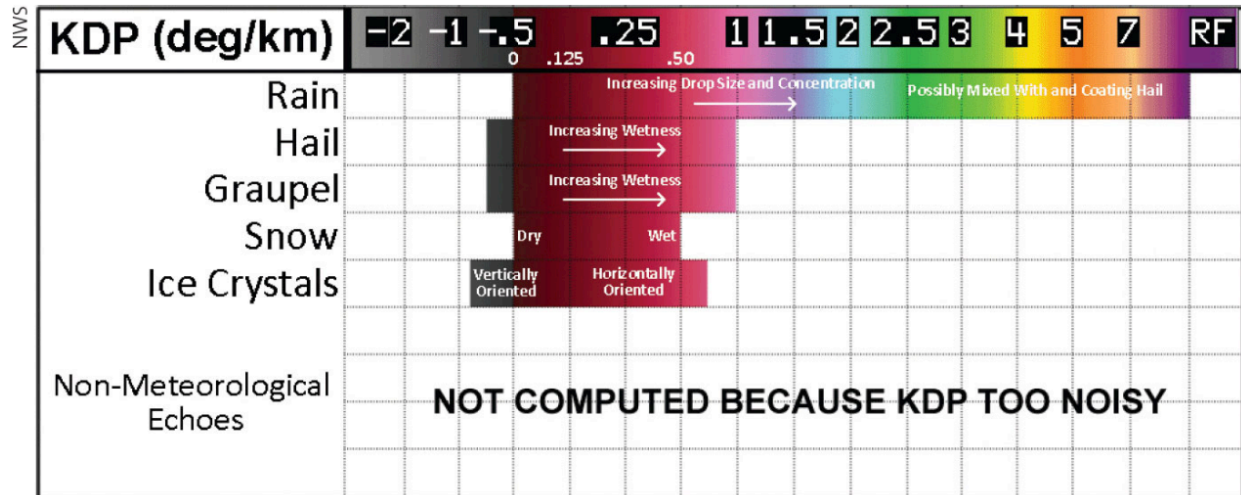
Differential Reflectivity (ZDR) is the logarithmic ratio of the horizontal and vertical reflectivity. Positive values of Differential Reflectivity indicate that the dominant precipitation type is larger in the horizontal than in the vertical. Negative values indicate the dominant precipitation type is larger in the vertical than the horizontal. Hail is irregular in shape and tumbles as it falls, thus it appears spherical on radar. Spherical shapes are nearly the same horizontally and vertically, thus large hail brings values ZDR close to 0. Large hail may also be found in areas with higher Differential Reflectivity values but in correspondence with high reflectivity. The following 'color keys' were obtained from the aforementioned dual polarization user's guide.



Differential Reflectivity (ZDR) chart of values for various objects

Specific Differential Phase (KDP) is a range derivative of the differential phase shift between horizontal and vertical pulses. It is an indicator of the liquid water content sampled within the

radar beam and is useful in identifying hail with little or no liquid water content, water-coated or melting hail, or plain rain. It is a useful tool to determine how much, if any, melting of hail is ongoing. The following ‘color keys’ were obtained from the aforementioned dual polarization user’s guide.



Specific Differential Phase (KDP) chart of values for various objects

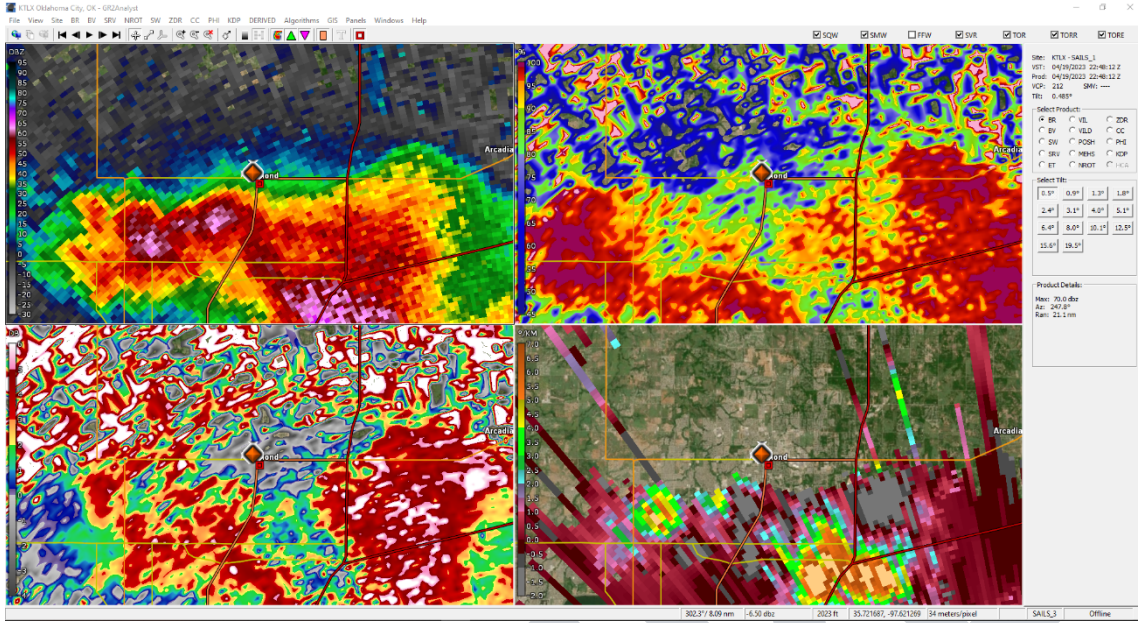
Combining these dual-pol products with Base Reflectivity paints a clearer picture of the presence of hail and an initial estimate on if the hail is in excess of 2” in diameter.

I also obtained a special sounding from the Norman, Oklahoma site at 19Z (2 PM CDT) on April 19, 2023. The information that was obtained from the balloon launch provided a very detailed snapshot of the atmosphere. It revealed a freezing level of approximately 11,659 ft above the ground and a -20-degree Celsius of approximately 20,868 ft above the ground.

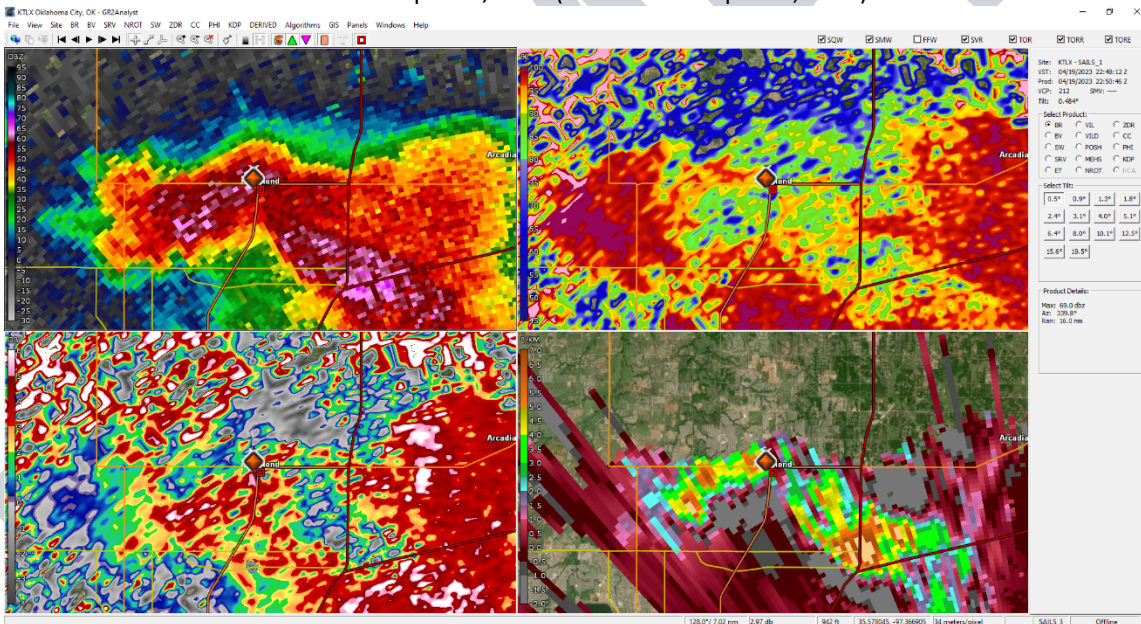
Research from “The Impact of Vertical Wind Shear on Hail Growth in Simulated Supercells” by Dennis and Kumijan (2017) summarized that, based on over 50 years of research, maximum hail production can be obtained by hailstones following paths through optimal growth environments within thunderstorms. These regions are generally located between at least -10 degrees Celsius to -20 degrees Celsius regions of the atmosphere.

It is well known among the meteorological community that “Severe Hail” is associated with 50 dBZ reflectivity values that are present in the atmosphere above the environmental freezing level. Very large severe hail is also known to occur when 50 dBZ value is located above the -20 degrees Celsius level.

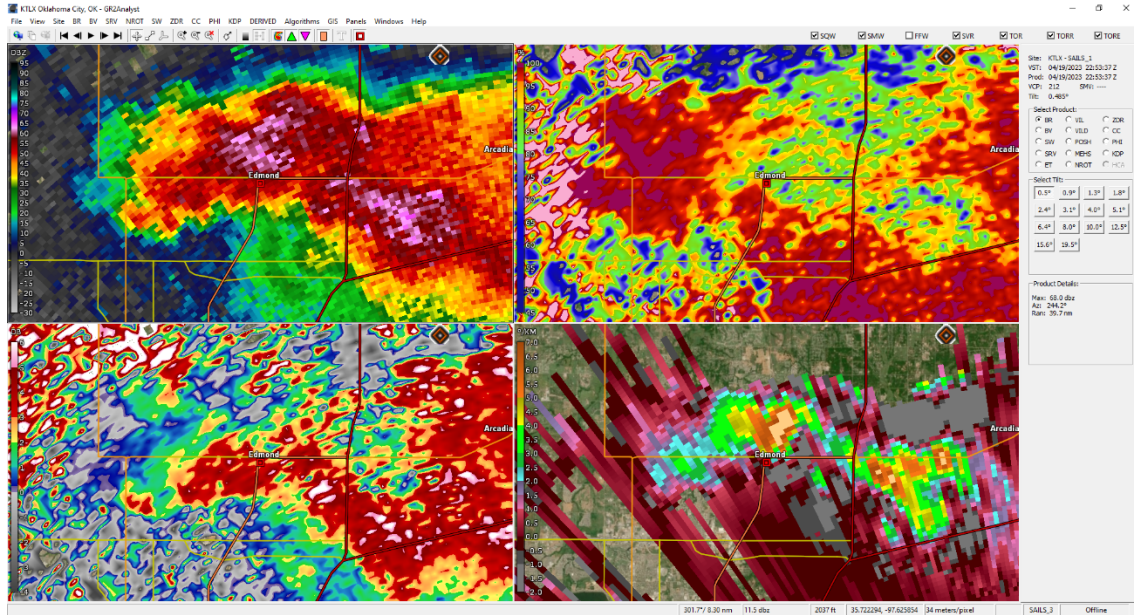
The following four panel radar images are taken from the time frame of 2248 UTC to 2256 UTC (5:48 PM CDT to 5:56 PM CDT) on April 19, 2023. They show the BR (top left), CC (top right), ZDR (bottom left), and KDP (bottom right).



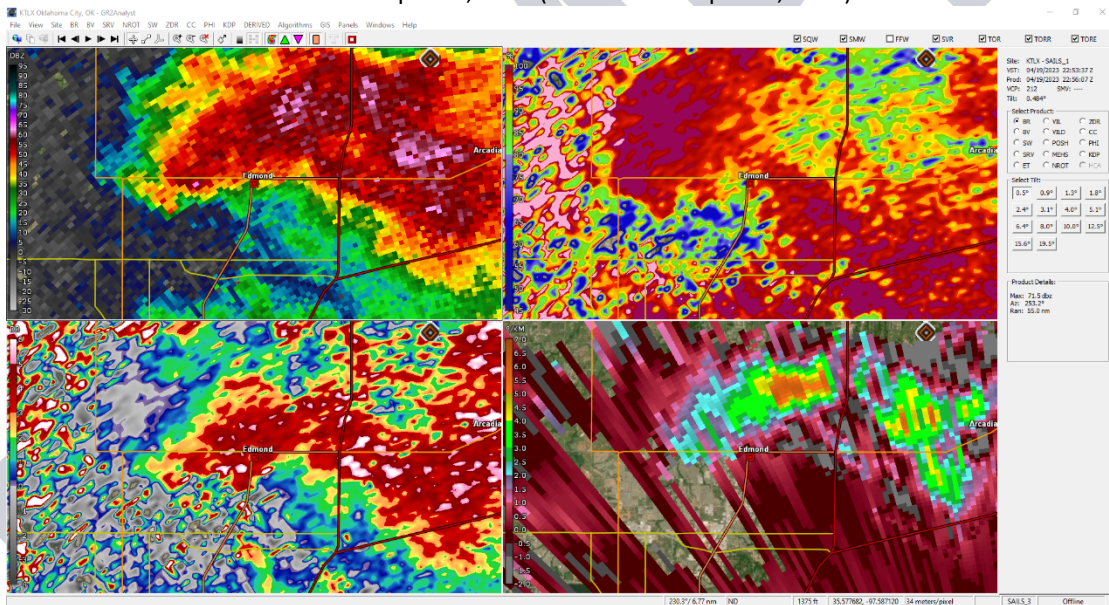
KTLX Radar Image – BR, CC, ZDR, and KDP  
 2248 UTC April 19, 2023 (5:48 PM CDT April 19, 2023)



KTLX Radar Image – BR, CC, ZDR, and KDP  
 2250 UTC April 19, 2023 (5:50 PM CDT April 19, 2023)



KTLX Radar Image – BR, CC, ZDR, and KDP  
2253 UTC April 19, 2023 (5:53 PM CDT April 19, 2023)

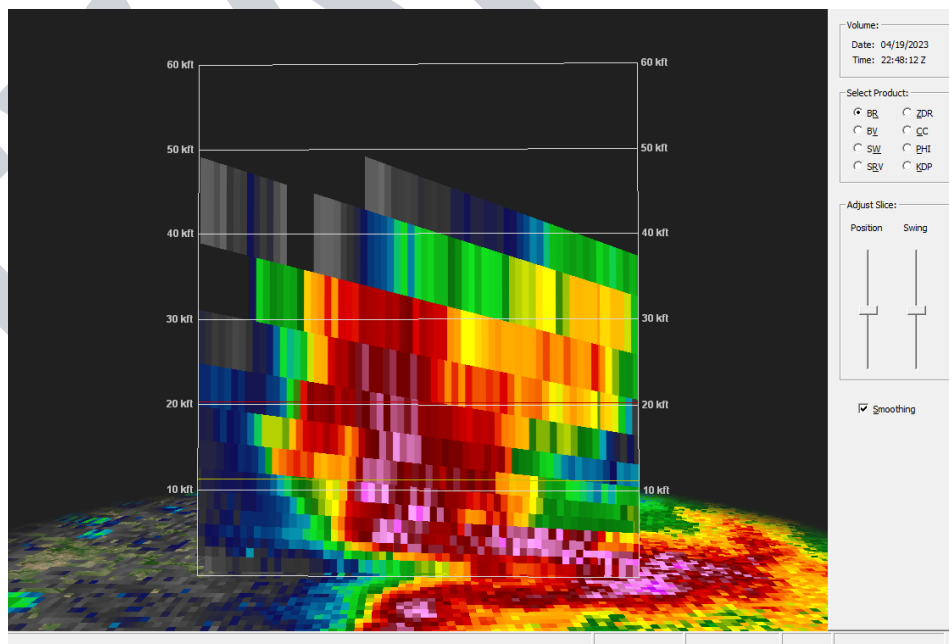


KTLX Radar Image – BR, CC, ZDR, and KDP  
2256 UTC April 19, 2023 (5:56 PM CDT April 19, 2023)

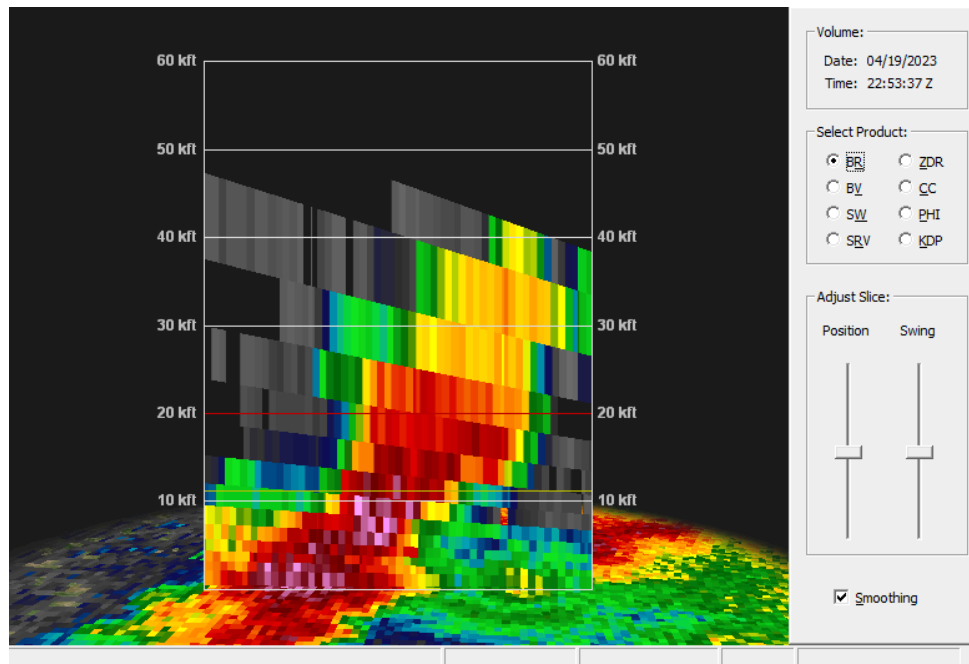
Based on the radar data from KTLX, the storm moved from the southwest to the northeast. Starting at 2248 UTC (5:48 PM CDT), base reflectivity values at the property were at 25.5 dBZ. However, base reflectivity values of 60 dBZ or greater were present to the southwest of the property. Correlation Coefficient (CC) values of at or below 0.95 and Differential Reflectivity (ZDR) values of at or around 0 dB, in correlation to the high reflectivity values of 55 dBZ or greater, were southwest of the property. Specific Differential Phase (KDP) values were between 1.10 and 2.80 degrees/km to the southwest of the property, which was indicative of some

melting of the hail along with a mixture of rain with the hail present. These values would be present within the storm for the duration of hail fall at the property. With the collocation of these values, hail of 1.00" or larger was present southwest of the property. By 2250 UTC (5:50 PM CDT), base reflectivity values of 55 to 60 dBZ were over and surrounding the property, with values of 55 dBZ over the property. CC values of at or below 0.95 were over and surrounding the property, with values as low as 0.74 in the vicinity of the property. ZDR values of at or around 0 dB were surrounding the property, with higher ZDR values over the property indicating a mixture of rain and water coated hail was likely present. KDP values indicated some hail melting. Large hail of 1.00" or greater was falling at the property. At 2253 UTC (5:53 PM CDT), base reflectivity values of 55 to 60 dBZ were over and surrounding the property, with values of 56 dBZ over the property. CC values of at or below 0.95 were over and surrounding the property, with values as low as 0.77 in the vicinity of the property. ZDR values of at or around 0 dB were northeast of the property, with some higher values over the property. KDP values indicated little melting of the hail. A mixture of rain and hail was likely present. At 2256 UTC (5:56 PM CDT), the 55 dBZ or greater reflectivity values were northeast of the property, with reflectivity values of 34 dBZ over the property. Hail 1.00" or larger had ended at the property.

Additionally, the reflectivity cross section was analyzed for the duration of the hail fall. The following cross section images show that reflectivity values of 60 dBZ or greater extended to as high as approximately 21,400 ft, well above to the -20 degrees Celsius level (20,868 ft), at 2248 UTC (5:48 PM CDT) along with greater than 60 dBZ values above the freezing level for the duration of hail impact at the property. This indicates that large to very large hail was likely present within the storm as it fell to the surface. The cross-section data is below:



KTLX Base Reflectivity Cross Section 2248 UTC April 19, 2023  
(5:48 PM CDT April 19, 2023)



KTLX Base Reflectivity Cross Section 2253 UTC April 19, 2023  
(5:53 PM CDT April 19, 2023)

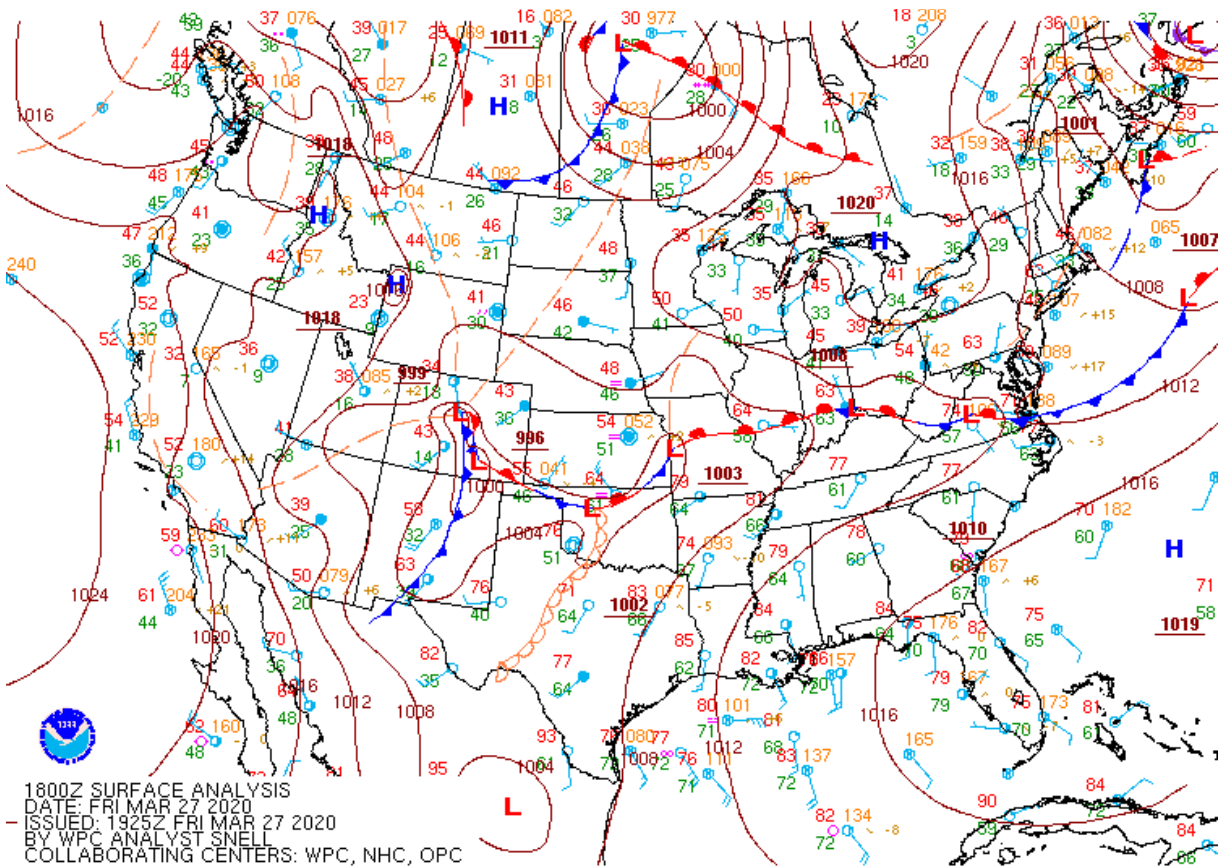
By combining the radar data analysis with local storm reports, a storm moving southwest to northeast at 40 mph impacted the property with hail up to 1.75" in diameter from approximately 5:49 PM CDT to approximately 5:54 PM CDT on April 19, 2023.

**WEATHER SITUATION FOR MARCH 27, 2020:**

On the afternoon of March 27, 2020, a stationary front was in northern Oklahoma, with a dry line extending from the front southward into west central Oklahoma. Ahead of these fronts, temperatures were in the mid 70s, while dew points were in the low 60s Fahrenheit. Light southwesterly winds were bringing in warm, moist air from the Gulf of Mexico. This can all be seen on the 1 PM CDT March 27, 2020, surface map below. The NCDC Storm Events Database summary for March 27, 2020, in the Edmond area is as follows:

*A few thunderstorms developed during the early afternoon over central Oklahoma and produced numerous large hail reports on the 27th. Later, strong to severe thunderstorms produced high winds and sub-severe hail during the late evening of the 27th.*



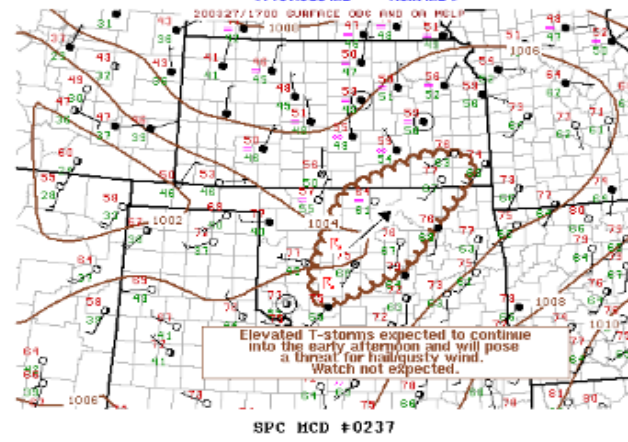


Weather Prediction Center (WPC) Surface Map Analysis – 1800 UTC March 27, 2020  
(1 PM CDT March 27, 2020)

Shortly before 1 PM CDT, isolated thunderstorms began to develop in central Oklahoma. Because of the storms rapid development, the Storm Prediction Center issued a Mesoscale Discussion (MCD) at 1:00 PM CDT. It mentioned that elevated thunderstorms would continue for the next 1-2 hours and that a watch was unlikely for this activity. The information and discussion text for this MCD is below.

## Mesoscale Discussion 237

< Previous MD    Next MD >



Mesoscale Discussion 0237  
NWS Storm Prediction Center Norman OK  
0100 PM CDT Fri Mar 27 2020

Areas affected...Portions of central and north central Oklahoma and southeast Kansas

Concerning...Severe potential...Watch unlikely

Valid 271800Z - 272000Z

Probability of Watch Issuance...5 percent

SUMMARY...Elevated thunderstorms should persist for the next 1-2 hours and may pose a threat for hail and gusty winds across central and north central OK and southeast KS.

DISCUSSION...Thunderstorms developing across west central OK within a mid level confluence zone are propagating into central and north central OK along a MUCAPE gradient. Although these storms are rooted around 700 mb, MUCAPE values on the order of 500-1000 J/kg along with 55-60 knots of effective bulk wind shear will allow the strongest storms, especially those further south into central OK where better quality instability is located, to pose a threat for hail. Mid to low level lapse rates between 6.5-7 C/km (per recent RAP forecast soundings) and a low level dry layer above the surface suggest conditions are somewhat favorable for downdrafts to reach the surface with gusty winds.

Although much of this activity is expected to struggle as individual cells propagate north into a less favorable air mass, there is a possibility that the southern storms that can linger into the late afternoon hours may strengthen and become surface based as instability increases later today. This will be conditional on whether currently elevated storms can develop a strong/deep enough low level cold pool to lift near surface parcels and utilize the better quality moisture in place across central and north central OK on the southeast side of the surface dryline. While this potential will be monitored through mid/late afternoon, no watch is currently expected.

..Moore/Thompson.. 03/27/2020

...Please see [www.spc.noaa.gov](http://www.spc.noaa.gov) for graphic product...

ATTN...WF0...SGF...TSA...ICT...OUN...

LAT...LON    35199871 35499867 35959850 36469827 36839813 36979789  
37169747 37629622 37649540 37499507 37039527 36279605  
35879632 35419677 35189737 34939786 34769841 34729857  
34879862 35199871

MCD 237

### WARNINGS ISSUED FOR PROPERTY

The property in Oklahoma County is overseen by the National Weather Forecast Office in Norman, OK (OUN). At approximately 1:00 PM CDT, a thunderstorm was about to enter Oklahoma County as it moved northeast. The National Weather Service issued the initial Severe

Thunderstorm Warning at 1:01 PM CDT, which included the property and Oklahoma County. The maximum hail size mentioned was quarter size (1.00" in diameter). The warning text is below:

315  
WUUS54 KOUN 271801  
SVROUN  
OKC017-073-109-271830-  
/O.NEW.KOUN.SV.W.0040.200327T1801Z-200327T1830Z/

*BULLETIN - IMMEDIATE BROADCAST REQUESTED  
Severe Thunderstorm Warning  
National Weather Service Norman OK  
101 PM CDT Fri Mar 27 2020*

*The National Weather Service in Norman has issued a*

*\* Severe Thunderstorm Warning for...  
Southeastern Kingfisher County in central Oklahoma...  
Northwestern Oklahoma County in central Oklahoma...  
Eastern Canadian County in central Oklahoma...*

*\* Until 130 PM CDT.*

*\* At 101 PM CDT, a severe thunderstorm was located 6 miles west of Yukon, moving northeast at 60 mph.*

*HAZARD...Quarter size hail.*

*SOURCE...Radar indicated.*

*IMPACT...Damage to vehicles is expected.*

*\* Locations impacted include...  
Northwestern Oklahoma City, western Edmond, El Reno, Yukon,  
Bethany, Warr Acres, The Village, Piedmont, Nichols Hills, Union  
City, Okarche, Concho, Woodlawn Park, Lake Aluma and Richland.*

*PRECAUTIONARY/PREPAREDNESS ACTIONS...*

*For your protection move to an interior room on the lowest floor of a building.*

*&&*

*LAT...LON 3573 9753 3557 9734 3537 9796 3573 9815  
TIME...MOT...LOC 1801Z 239DEG 52KT 3550 9785*

*HAIL...1.00IN  
WIND...<50MPH*

\$\$

SIX

An updated Severe Thunderstorm Warning was issued at 1:14 PM CDT, with an increase in hail size to ping pong ball (1.50" in diameter). The updated warning text is below:

OKC017-109-271830-  
/O.CON.KOUN.SV.W.0040.000000T0000Z-200327T1830Z/  
Oklahoma OK-Canadian OK-  
114 PM CDT Fri Mar 27 2020

...A SEVERE THUNDERSTORM WARNING REMAINS IN EFFECT UNTIL 130 PM CDT  
FOR NORTHWESTERN OKLAHOMA AND NORTHEASTERN CANADIAN COUNTIES...

At 113 PM CDT, a severe thunderstorm was located over northwestern Oklahoma City, or 4 miles north of Wiley Post Airport, moving northeast at 60 mph. Ping pong sized hail has been reported with this storm.

HAZARD...Ping pong ball size hail.

SOURCE...Radar indicated.

IMPACT...People and animals outdoors will be injured. Expect damage to roofs, siding, windows, and vehicles.

Locations impacted include...  
Northwestern Oklahoma City, southwestern Edmond, Yukon, Bethany, Warr Acres, The Village, Piedmont, Nichols Hills, Woodlawn Park, Lake Aluma and Richland.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

For your protection move to an interior room on the lowest floor of a building.

&&

LAT...LON 3573 9757 3557 9734 3545 9771 3572 9792  
TIME...MOT...LOC 1813Z 239DEG 52KT 3559 9766


HAIL...1.50IN  
WIND...<50MPH

\$\$

SIX

## LOCAL STORM REPORTS

Below is a list of storm reports that occurred in Oklahoma County, Oklahoma on March 27, 2020, from the National Climatological Data Center's Storm Events Database (SED). The storm in question was a prolific hail producer, with numerous reports of large hail of 1.00" or greater:



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NCEI > Storm Events Database (Select State) > (Select Date/County/Event)

**Storm Events Database**

**Data Access**

- [Search](#)
- [Bulk Data Download \(CSV\)](#)
- [Storm Data Publication](#)

**Documentation**

- [Database Details](#)
- [Version History](#)
- [Storm Data FAQ](#)
- [NOAA's NWS Documentation](#)
- [Tornado EF Scale](#)

**External Resources**

- [NOAA's SPC Reports](#)
- [NOAA's SPC WCM Page](#)
- [NOAA's NWS Damage Assessment Toolkit](#)
- [NOAA's Tsunami Database](#)
- [ESRI/FEMA Civil Air Patrol Images](#)
- [SHELDUS](#)
- [USDA Cause of Loss Data](#)

### Storm Events Database

#### Search Results for Oklahoma County, Oklahoma

**All Available Event Types**

Due to changes in the methods used by the NWS to spatially locate Waterspouts, please query by state (FL, TX, VA, etc) for Jan 1996 through Sep 2001. Beginning October 2001, please query by Marine Zone (N. Atlantic, S Atlantic, Gulf of Mexico, S Pacific, N. Pacific, Alaskan Waters, Hawaiian Waters, Great Lakes, etc) using the drop-down box for "State/Area".

**Oklahoma county contains the following zones:**  
[Oklahoma](#)

7 events were reported on 03/27/2020

**Summary Info:**

Number of County/Zone areas affected:	1
Number of Days with Event:	1
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	0
Number of Days with Event and Property Damage:	0
Number of Days with Event and Crop Damage:	0
Number of Event Types reported:	1


**Column Definitions:**  
'Mag': Magnitude, 'Dth': Deaths, 'Inj': Injuries, 'PrD': Property Damage, 'CrD': Crop Damage

*Click on **Location** below to display details.*  
*Available Event Types have changed over time. Please refer to the [Database Details](#) for more information.*

Select: Hail 1.00 in. and larger | All Tornadoes | All Wind Speeds | Sort By: Date/Time (Oldest)

Location	County/Zone	St.	Date	Time	T.Z.	Type	Mag	Dth	Inj	PrD	CrD
<b>Totals:</b>								0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	03/27/2020	12:12	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">EDMOND</a>	OKLAHOMA CO.	OK	03/27/2020	12:15	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">(PWA)WILEY POST APT</a>	OKLAHOMA CO.	OK	03/27/2020	12:17	CST-6	Hail	1.75 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	03/27/2020	12:18	CST-6	Hail	1.50 in.	0	0	0.00K	0.00K
<a href="#">THE VILLAGE</a>	OKLAHOMA CO.	OK	03/27/2020	12:19	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">MIDWEST CITY</a>	OKLAHOMA CO.	OK	03/27/2020	12:50	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<a href="#">MIDWEST CITY</a>	OKLAHOMA CO.	OK	03/27/2020	12:53	CST-6	Hail	1.25 in.	0	0	0.00K	0.00K
<b>Totals:</b>								0	0	0.00K	0.00K

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Storm Events Database (SED) – Oklahoma County, OK March 27, 2020

Of the reports listed above, two hail reports were located within six miles of the property. The reports are plotted on Google Earth (seen as blue pushpins), along with the property (seen as the yellow pushpin) and have the hail sizes and distances from the property listed. The closest report was for 1.50" hail approximately 2.66 miles southeast of the property.

## Storm Events Database

[Prev](#) / [Search Results](#) / [Next](#)

### Event Details:

Event	Hail
Magnitude	1.50 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Fire Department/Rescue
NCEI Data Source	CSV
Begin Date	2020-03-27 12:15 CST-6
Begin Location	3SW EDMOND
Begin Lat/Lon	35.62/-97.51
End Date	2020-03-27 12:15 CST-6
End Location	3SW EDMOND
End Lat/Lon	35.62/-97.51
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	0.00K
Crop Damage	0.00K
Episode Narrative	A few thunderstorms developed during the early afternoon over central Oklahoma and produced numerous large hail reports on the 27th. Later, strong to severe thunderstorms produced high winds and sub-severe hail during the late evening of the 27th.
Event Narrative	

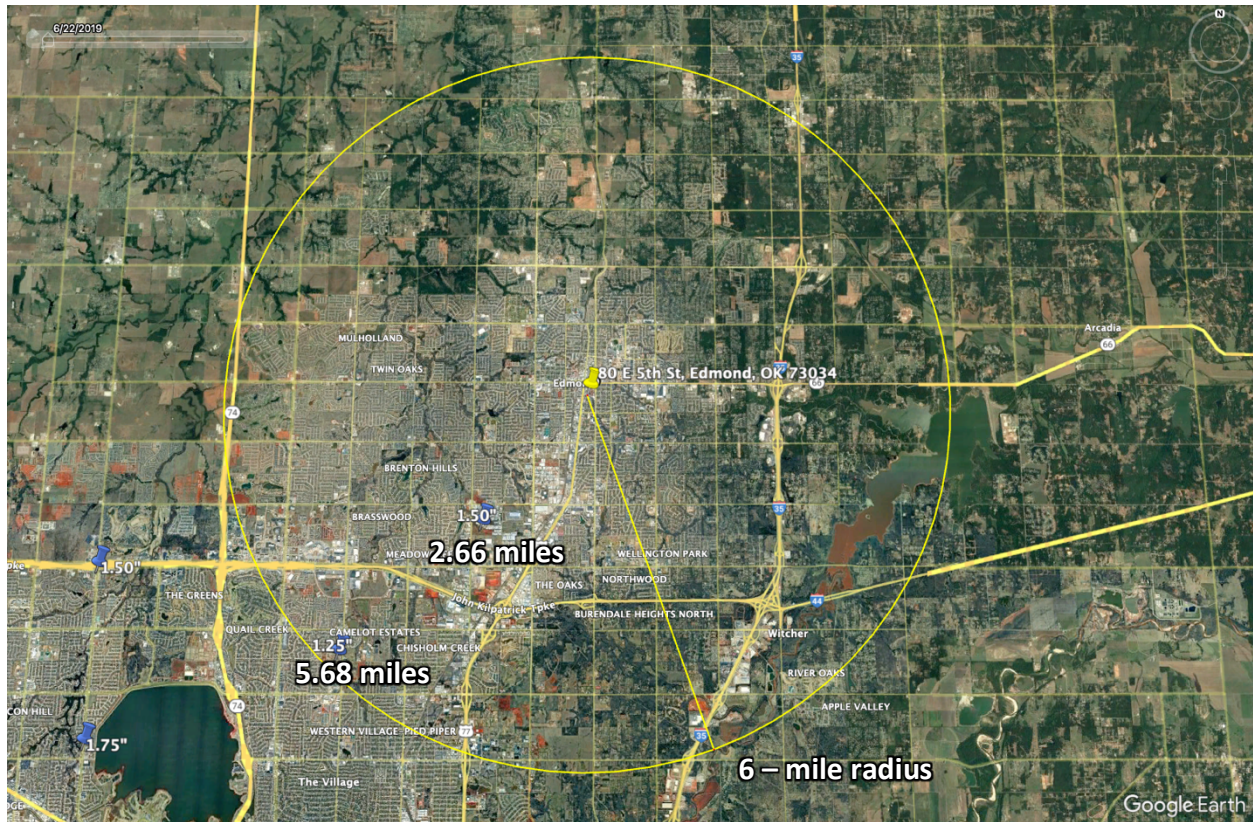
Storm Events Database (SED) – Oklahoma County, OK 1:15 PM CDT March 27, 2020

## Storm Events Database

### Event Details:

Event	Hail
Magnitude	1.25 in.
State	OKLAHOMA
County/Area	OKLAHOMA
WFO	OUN
Report Source	Public
NCEI Data Source	CSV
Begin Date	2020-03-27 12:19 CST-6
Begin Location	1N THE VILLAGE
Begin Lat/Lon	35.59/-97.55
End Date	2020-03-27 12:19 CST-6
End Location	1N THE VILLAGE
End Lat/Lon	35.59/-97.55
Deaths Direct/Indirect	0/0 (fatality details below, when available...)
Injuries Direct/Indirect	0/0
Property Damage	0.00K
Crop Damage	0.00K
Episode Narrative	A few thunderstorms developed during the early afternoon over central Oklahoma and produced numerous large hail reports on the 27th. Later, strong to severe thunderstorms produced high winds and sub-severe hail during the late evening of the 27th.
Event Narrative	

Storm Events Database (SED) – Oklahoma County, OK 1:19 PM CDT March 27, 2020

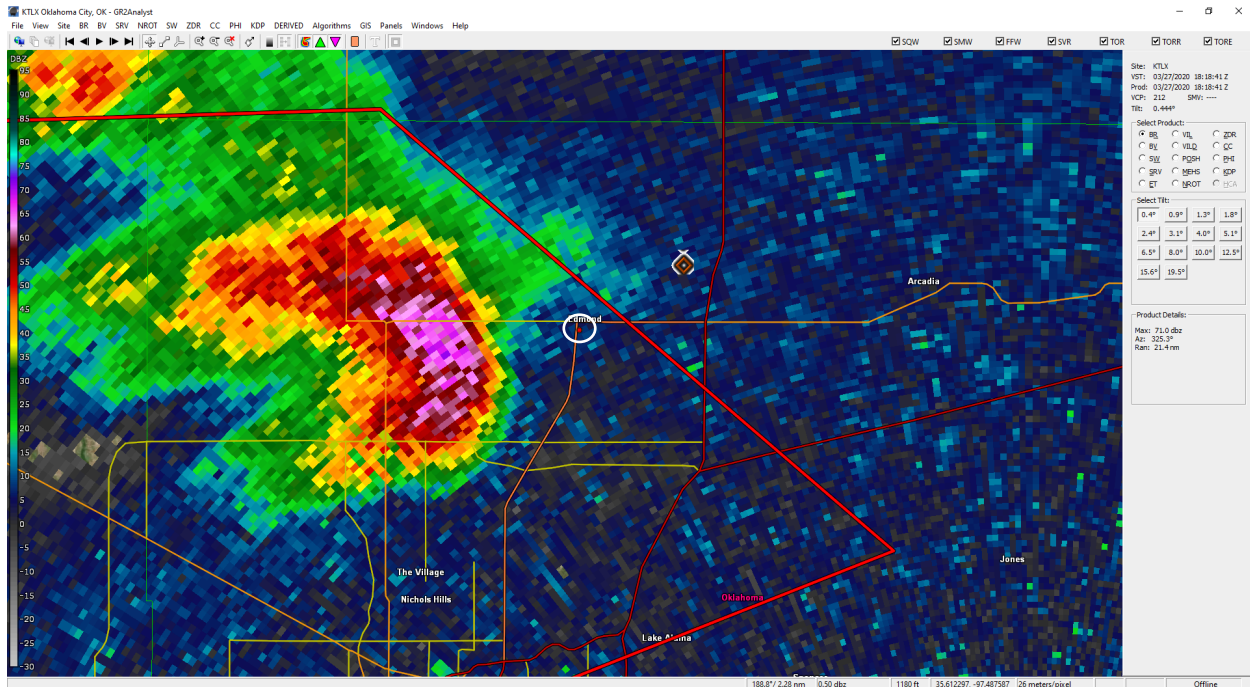


Plotted hail reports and their distances from the property.

After analysis of the storm reports and NWS Warning text on March 27, 2020, in Oklahoma County, large hail of 1.00" in diameter or greater likely impacted Edmond between approximately 1:00 and 1:30 PM CDT. To get a clearer picture on the timeline of severe weather impacts and maximum hail size at the property, Doppler radar analysis was conducted. The same information regarding how and what the radar was used for in the analysis of the April 19, 2023, storm will be utilized in this storm analysis.

I utilized Gibson Ridge Analyst Edition to process the KTLX NEXRAD data for Base Reflectivity to determine if initial thresholds were met for the presence of hail at the property. At 1818 UTC (1:18 PM CDT), the property, as identified by the red dot surrounded by a white oval plotted in the center of the image below, had reflectivity values of only 4 dBZ over the property. However, the storm was still to the southwest of the property, indicated by the high base reflectivity values as high as 71 dBZ.



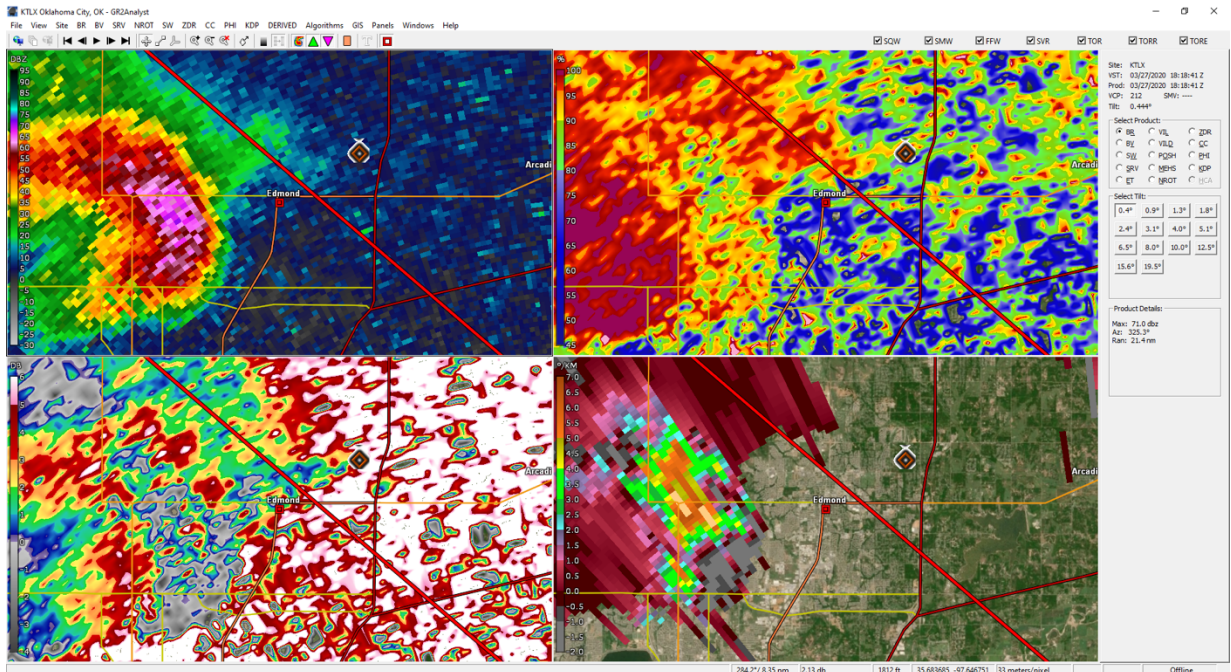


KTLX Base Reflectivity – 1818 UTC March 27, 2020  
(1:18 PM CDT March 27, 2020)

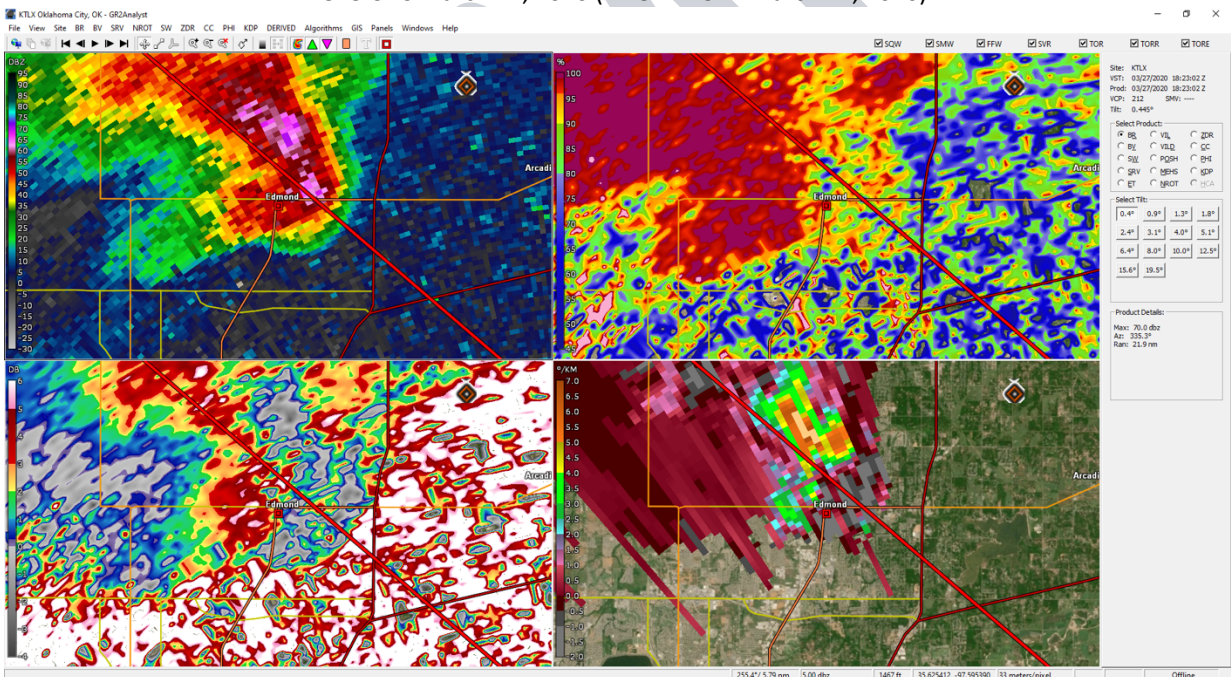
Knowing initial thresholds from the Federal Meteorological Handbook have been met, I began analysis of three dual-pol products in conjunction with Base Reflectivity. Base Reflectivity (left), Correlation Coefficient (CC) (right), Differential Reflectivity (ZDR) (bottom left), and Specific Differential Phase (KDP) (bottom right) all are shown in the following radar images in a four-panel view with the property plotted with a red dot in the center of the frame.

I also obtained sounding data from the Norman, Oklahoma site at 12Z (7 AM CDT) on March 27, 2020. The information that was obtained from the balloon launch provided a very detailed snapshot of the atmosphere. It revealed a freezing level of approximately 13,890 ft above the ground and a -20-degree Celsius of approximately 21,557 ft above the ground.

The following four panel radar images are taken from the time frame of 1818 UTC to 1823 UTC (1:18 PM CDT to 1:23 PM CDT) on March 27, 2020. They show the BR (top left), CC (top right), ZDR (bottom left), and KDP (bottom right).



KTLX Radar Image – BR, CC, ZDR, and KDP  
1818 UTC March 27, 2020 (1:18 PM CDT March 27, 2020)

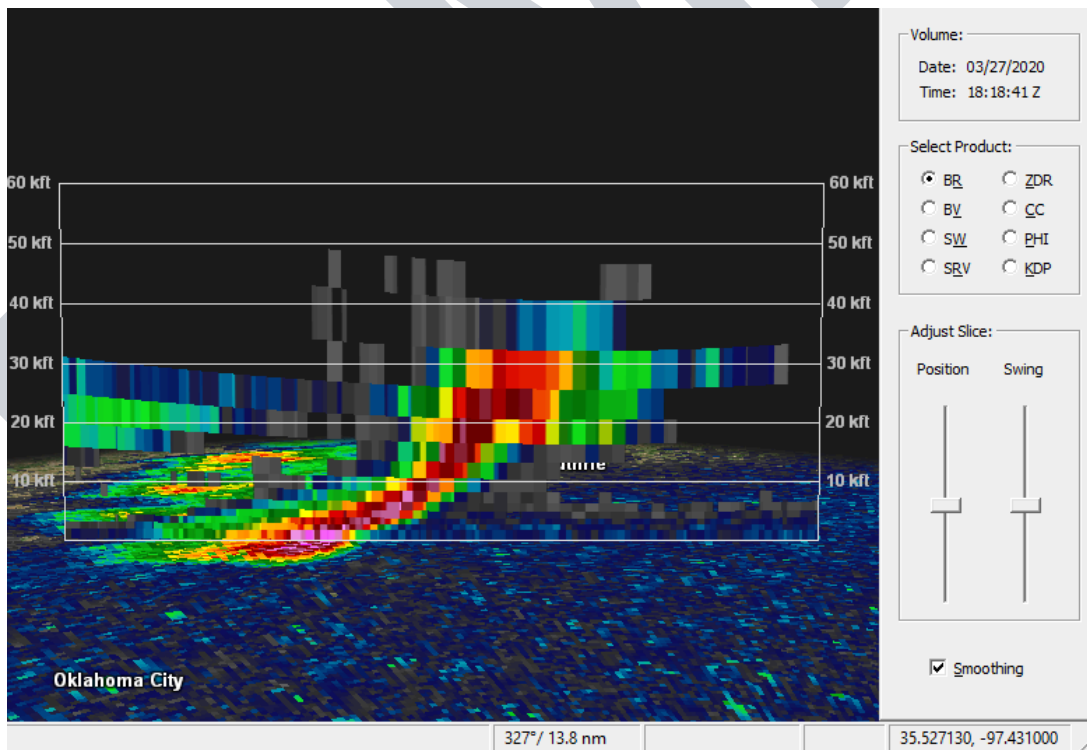


KTLX Radar Image – BR, CC, ZDR, and KDP  
1823 UTC March 27, 2020 (1:23 PM CDT March 27, 2020)

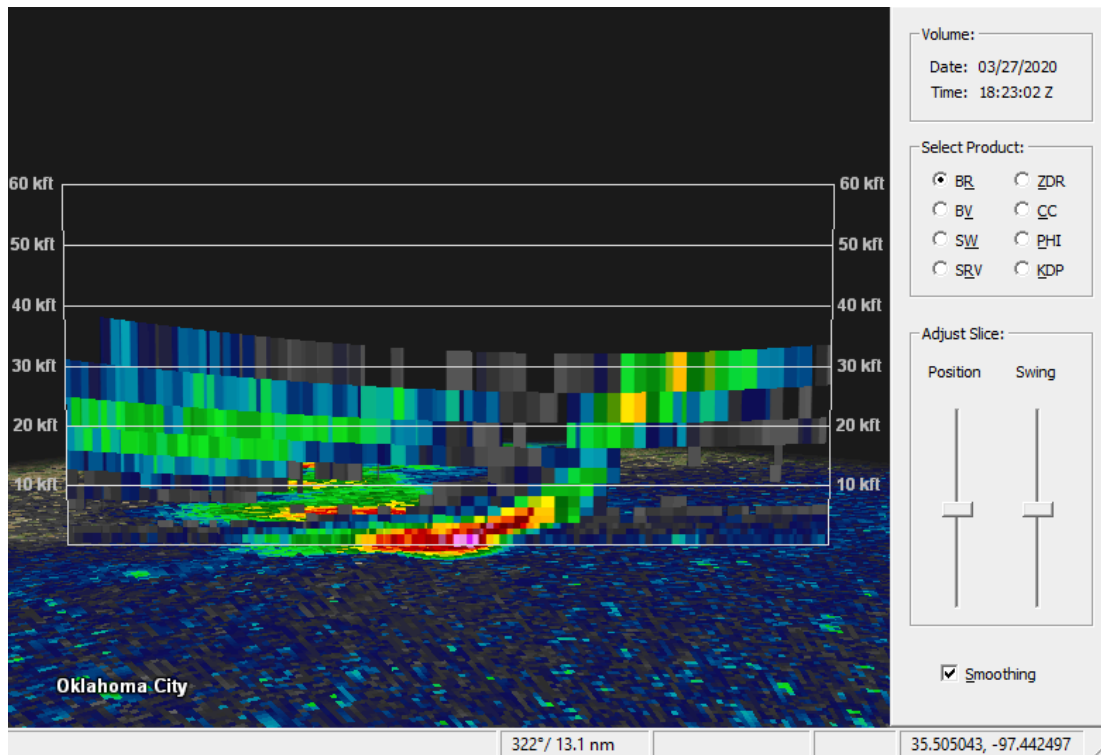
Based on the radar data from KTLX, the storm moved from the southwest to the northeast. Starting at 1818 UTC (1:18 PM CDT), precipitation was not present at the property. However, base reflectivity values of 60 dBZ or greater were present to the southwest of the property. Correlation Coefficient (CC) values of at or below 0.95 and Differential Reflectivity (ZDR) values

of at or around 0 dB, in correlation to the high reflectivity values of 55 dBZ or greater, were southwest of the property. Specific Differential Phase (KDP) values ranged from -2.00 degrees/km to 0.45 degrees/km southwest of the property. Therefore, there was likely mostly dry hail within the southern part of the storm, which impacted the property as it moved northeast. These values would be present within the hail for the duration of hail fall at the property. With the collocation of these values, hail of 1.00" or larger was likely present southwest of the property. At 1823 UTC (1:23 PM CDT), base reflectivity values of 55 dBZ or greater were already east of the property, with values of 53.5 dBZ over the property. CC values of at or below 0.95 were surrounding the property, with values as low as 0.74 in the vicinity of the property. Over the property, the CC values were 0.97. ZDR values of at or around 0 dB were east of the property. 1.00" or larger hail likely has ended at this radar snapshot. However, based on the two radar images available, it is likely that large hail of 1.00" or greater fell at the property in between these two radar snapshots.

Additionally, the reflectivity cross section was analyzed for the duration of the hail fall. The following cross section images show that reflectivity values of 50 dBZ or greater extended to as high as approximately 32,400 ft, well above to the -20 degrees Celsius level (21,557 ft), at 1818 UTC (1:18 PM CDT) along with 60 dBZ or greater values above the freezing level for the duration of hail impact at the property. This indicates that large to very large hail was likely present within the storm as it fell to the surface. The cross-section data is below:



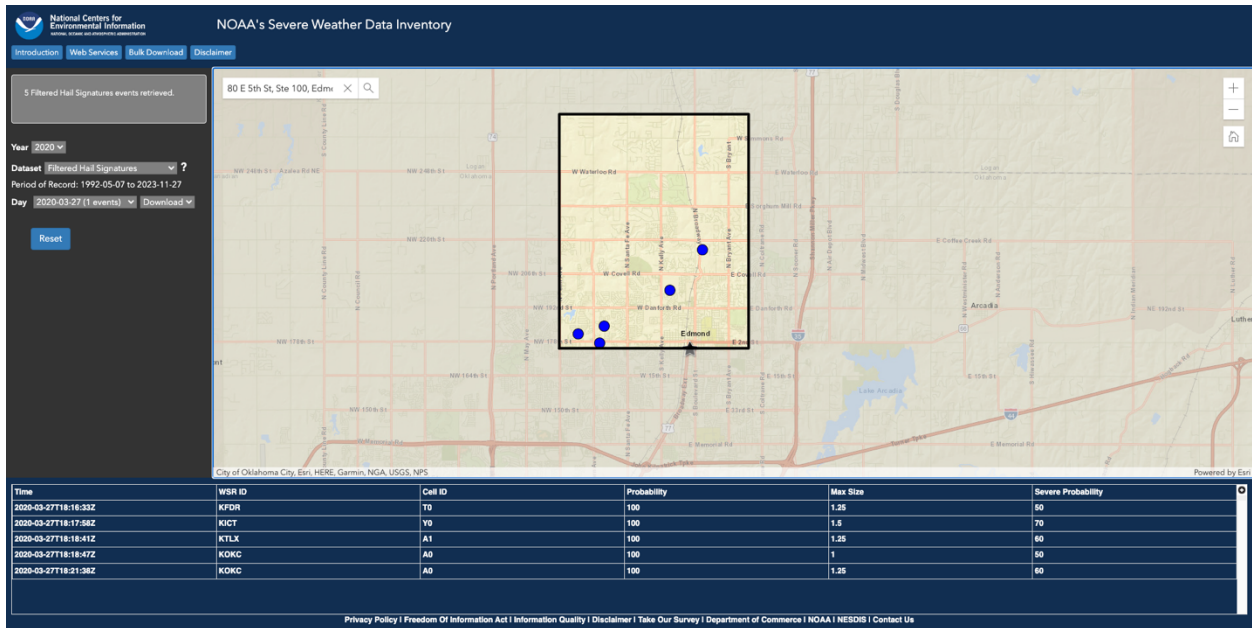
KTLX Base Reflectivity Cross Section 1818 UTC March 27, 2020  
(1:18 PM CDT March 27, 2020)



KTLX Base Reflectivity Cross Section 1823 UTC March 27, 2020  
(1:23 PM CDT March 27, 2020)

## RADAR ESTIMATED HAIL SIGNATURES

I also researched radar detected hail signatures. Below is an image of the radar detected hail signature data from the Severe Weather Detection Inventory (SWDI) for March 27, 2020. The property is marked by a black star. There were multiple radar hail signatures of 1.00" or larger detected near the property on this date, with the highest value being 1.50". The detected hail sizes aloft matched well with ground observations and radar analysis.



SWDI – March 27, 2020

By combining the radar data analysis with local storm reports, a storm moving southwest to northeast at 60 mph impacted the property with hail up to 1.50” in diameter from approximately 1:20 PM CDT to approximately 1:22 PM CDT on March 27, 2020.

## **CONCLUSIONS**

It is my professional opinion that the following weather events occurred at 80 E 5<sup>th</sup> St, Ste 100, Edmond, OK 73034 on April 19, 2023, and on March 27, 2020:

1. Severe hail varying in size up to 1.75” in diameter impacted the property from approximately 5:49 PM CDT until approximately 5:54 PM CDT on April 19, 2023.
2. Severe hail varying in size up to 1.50” in diameter impacted the property from approximately 1:20 PM CDT until approximately 1:22 PM CDT on March 27, 2020.

I certify that the above information contained in this report is true and accurate to the best of my ability and that all of my opinions, findings, estimations and interpolations expressed in this report were made with accuracy as a professional meteorologist within a reasonable degree of meteorological certainty.

John Choquette  
 Lead Forensic Meteorologist  
 HailTrace  
 DATE OF COMPLETION