

# Damage Path Tool

Justin Gibbs

Warning Decision Training Division



This is the module on the Damage Path Tool. This is Justin Gibbs with the Warning Decision Training Division.

## Lesson Objectives

Without references and according to the lesson you will be able to identify:

- The purpose of the damage path tool
- Situations in which the tool is to be used
- The two main users of the damage path polygons
- Output of the damage path tool
- The two ways to create polygons with the tool
- What your office needs to do to issue a damage path

Please take a moment to review the learning objectives. Then click on the Next button to advance to the next slide.

## Lesson Objectives

Without references and according to the lesson you will be able to identify:

- How to open the Damage Path Tool in CAVE
- The three basic steps for issuing damage path products
- How to distribute the finished product to users
- The output of metadata for the finished paths/files
- Special considerations for issuing tornado tracks
- Potential limitations of the tool

Please take a moment to review the learning objectives. Then click on the Next button to advance to the next slide.

## Overview/Purpose

An AWIPS Tool to allow forecasters to quickly highlight in near real-time geographic areas that have been impacted by a significant:

**-Tornado**

**-Damaging Wind (70+ mph)**

**-Flood (Widespread Property/Infrastructure Damage)**

**-Extreme Ice or Snow Accumulation (Widespread Property /Infrastructure Damage)**

**-Other Natural/Man Made Hazard**

The damage path tool will allow you to highlight geographic areas within CAVE pertaining to these phenomena.

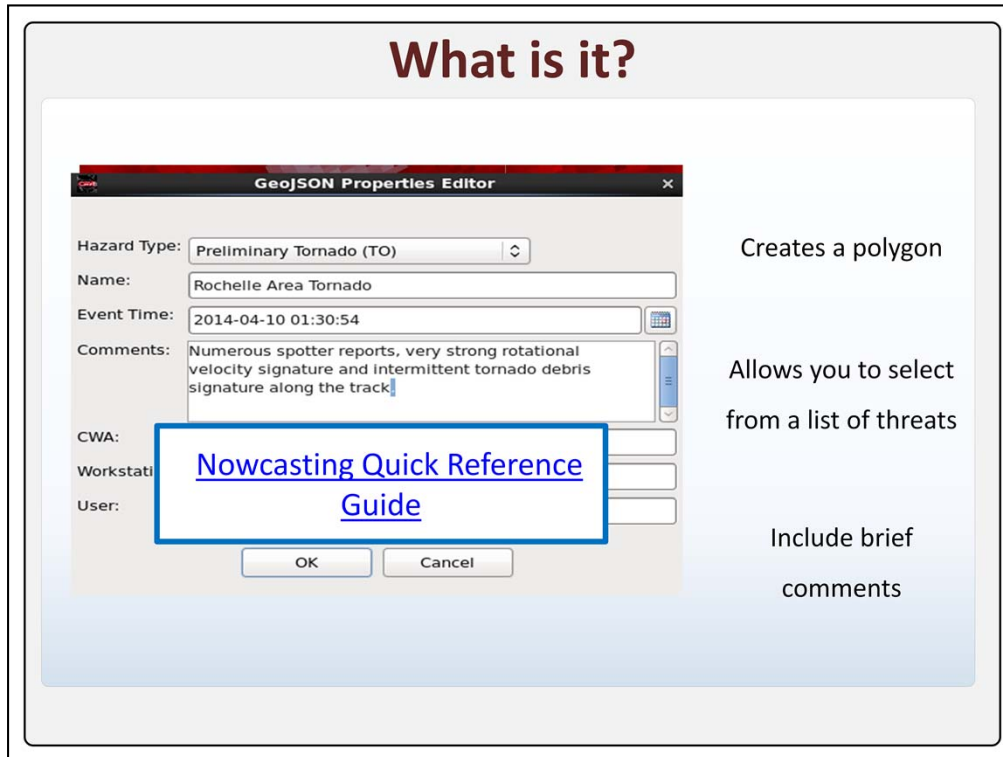
Tornadoes, of a significant nature that did damage requiring a response or that you want to highlight.

Damaging wind, widespread areas of more than 70 mph

Floods, with widespread property and infrastructure damage

Extreme ice or snow accumulation

Or another natural or man made hazard



The original intent and specific design of this tool is to highlight areas of significant tornado damage. But it also allows you to create a polygon and

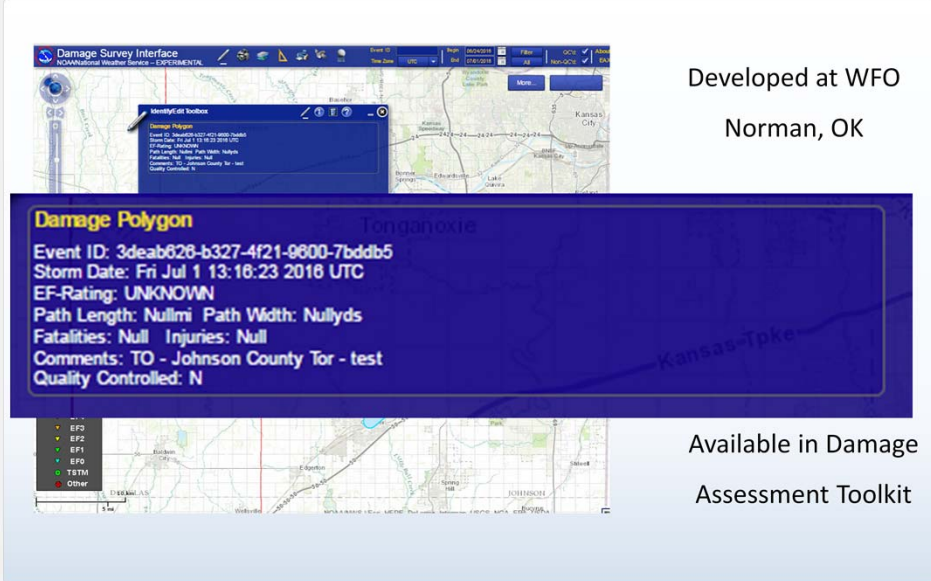
select from a list of threats and

include brief comments on the area you are highlighting.

When it comes to tornado tracks however you can use established scientific methodology to draw your tornado polygons.

See WDTDs Nowcasting tornado intensity guidance for ways to step through establishing an operational estimate of tornado intensity and applying that knowledge to creating tornado tracks.

# Rationale



The screenshot displays the 'Damage Survey Interface' software. It features a map of a region in Kansas with a blue polygon overlaid on it. A 'Damage Polygon' data entry form is open, containing the following information:

- Event ID: 3deab626-b327-4f21-9800-7bddb5
- Storm Date: Fri Jul 1 13:16:23 2018 UTC
- EF-Rating: UNKNOWN
- Path Length: Nullmi Path Width: Nullm
- Fatalities: Null Injuries: Null
- Comments: TO - Johnson County Tor - test
- Quality Controlled: N

The software interface also shows a legend with categories like EF2, EF1, EF0, TSTM, and Other. The text 'Developed at WFO Norman, OK' and 'Available in Damage Assessment Toolkit' is visible on the right side of the screenshot.

So why this product? It was originally developed by WFO Norman, OK and used following the 2013 tornadoes.

It was revealed in the service assessment for that event that it saved emergency management resources about 2-3 hours setting up emergency response and recovery efforts.

The output will be available in the damage assessment toolkit.

You can see an example of what it will look like here. Partner organizations can be given access to the DAT, controlled at the office and regional level, where they can view this information in near real time.

Here is an close up example of some of the data that you can provide about the polygon you generated as well. You'll simply enter the comments and the date and everything else will stay null.

## Output/Use

Output used by FEMA/State/Local EMs for disaster  
response/recovery



So it gives you a much more specific means of communication where a significant tornado or other event happened. and cuts down on the ambiguity that can happen about where the worst damage may or may not be, especially for non-meteorologists.

## Product Use

No directive on this product's use



FEMA requested



Help you communicate

Its important to point out there is currently no directive governing, or requiring this products use.

It was a FEMA request after they found it useful

And It can help you and your office communicate where a high impact event occurred as we are most likely to know first where a major tornado occurred. So collaborate with your office and within your region to develop the best practices and use for the product.



## Event Examples

### **Preliminary Tornado**

Tornado of significance  
Use WDTD Nowcasting tornado intensity best practices if needed

### **Significant Wind Damage**

Microburst or derecho appropriate  
When radar or observations suggest  $\geq 70$  mph wind with structural damage and is supplanted by at least some reports

### **Hail**

Destructive hail event with widespread significant damage or injuries  
Skylights destroyed, windows knocked out, infrastructure impacted

### **Flood**

For flooded areas, or areas where significant property damage occurred from flooding

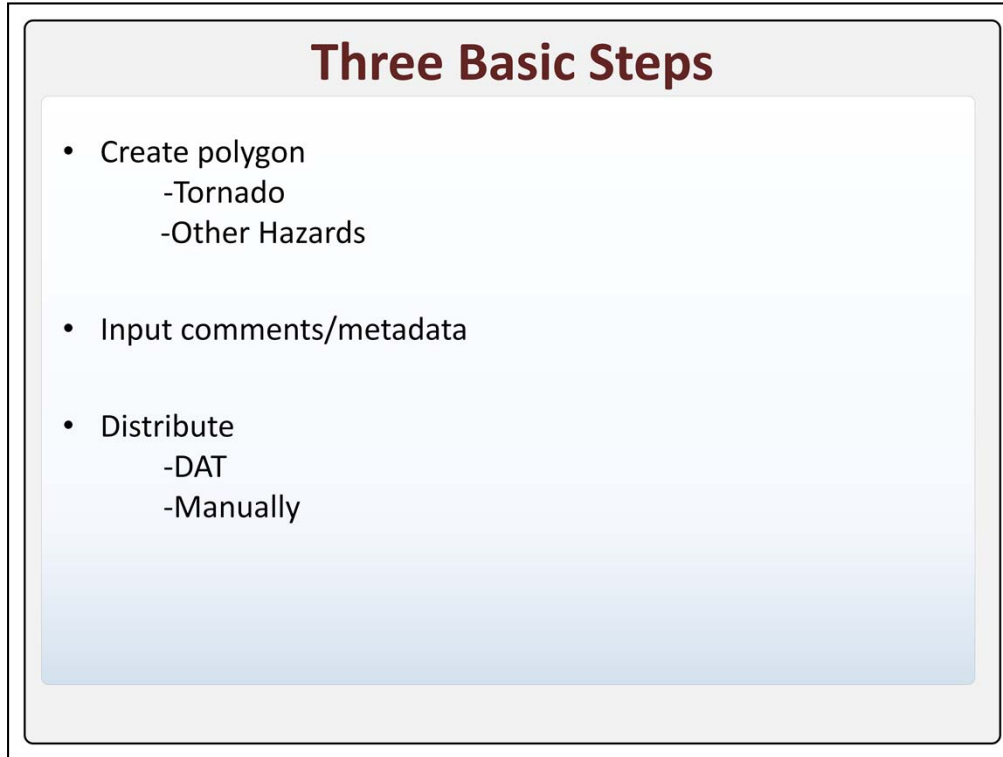
### **Extreme Ice or Snow Accumulation**

Used to highlight areas of exceptional winter weather impact, where significant property or infrastructure impact is likely to have occurred

### **Other Man Made/Natural Hazard**

West, TX chemical plant explosion type atmospheric interaction or other event

Here are more specific examples of the six different events the damage path tool is designed to highlight and communicate. These fields will be post-processed by a formatter to be entered into the DAT, where they can be used to aid in tornado damage survey and event response.



Use of the Damage Path Tool involves these three basic steps.

First, create a polygon, and there are two methods for doing that, one for a tornado path and another for all other hazards.

Input comments and metadata about the polygon

And Distribute the polygon to end users such as emergency managers, and that can be done via the DAT server or by sending the GEOFJSON file manually.

## Step by Step Instructions

<https://vlab.ncep.noaa.gov/web/oclo/dpt>

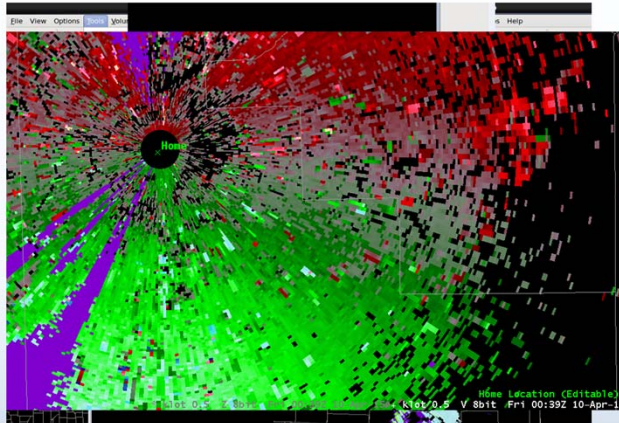
### Jobsheet #1: Creating a Tornado Damage Path From Baselines

1. Load a product to base your damage path off of (e.g. base velocity for a wind swath).
2. Load the **Home** tool from the **CAVE Tools** menu, and ensure that it is editable. (Fig. 1)
3. Ensure the Home cursor is set at the location of the radar you are using to estimate your damage path, if it is not, move it to that location. (Fig. 2)
4. Load **Baselines** from the **CAVE Tools** Menu and ensure baselines are editable.
5. **Right click** at the approximate start, and end of a tornado damage path to move the baseline (or manually drag and adjust the start and end point) (Fig. 3)
6. **Middle click** (or right click and drag vertex) along the path of the tornado as needed to align the baseline with the track of the tornado. (Fig. 4)

Before we take the tool for a test drive, we want to point out we don't expect you to memorize this process. There are job sheets available on the OCLO webpage under the forecaster references tab at the link posted on the screen there we will take you step by step through the process, we're just going to show it to you here today.

## Home Location is Important!

First make sure the “Home” cursor is set to the radar you are using to estimate your tornado track



Go to Tools-> Home

Right Click on the menu and make the location editable

Drag it to the radar location

OK so lets get started. The home cursor is an important part of how the tornado tracks are created, so we want to make sure its matched to the radar we want to use before we start creating our tornado track.

First select “home from the tools menu,

right click an set home to editable if necessary,

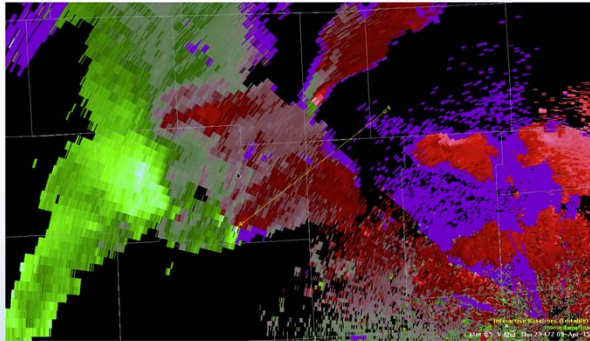
and then drag it to the radar location.

## Use the Baseline Tool

Go to Tools -> Baselines

Make the baselines editable

Drag the first point to where the tornado appears to have started and the endpoint roughly where it ended



Activate baselines from the menu by going to Tools, Baselines.

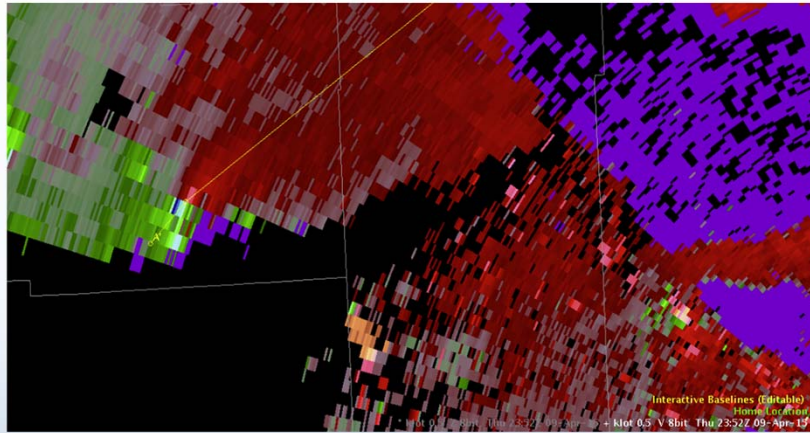
Make the baselines editable

And then drag the first point to where the tornado appears to have started, and the end point roughly where it ended. You can do this with the tool editable by right clicking on the two different locations.

## Building the Tornado Track

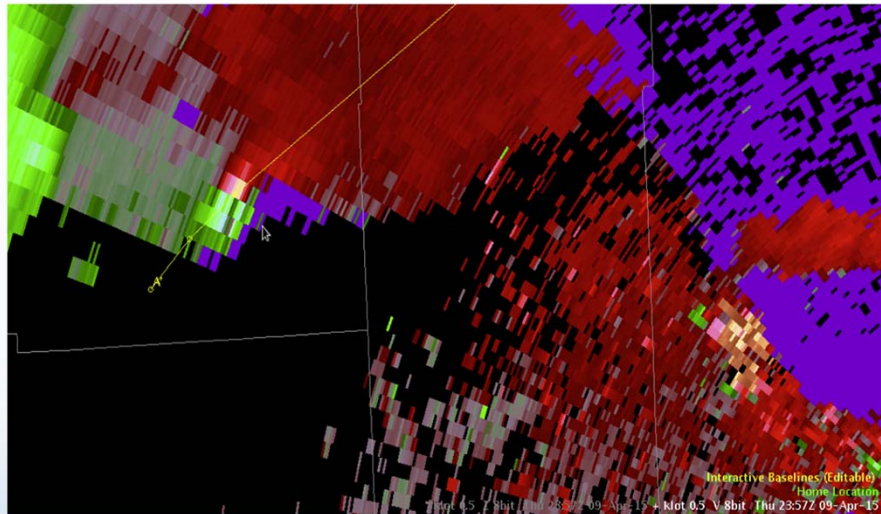
Middle click on the baseline to add vertices

Follow the path using available data



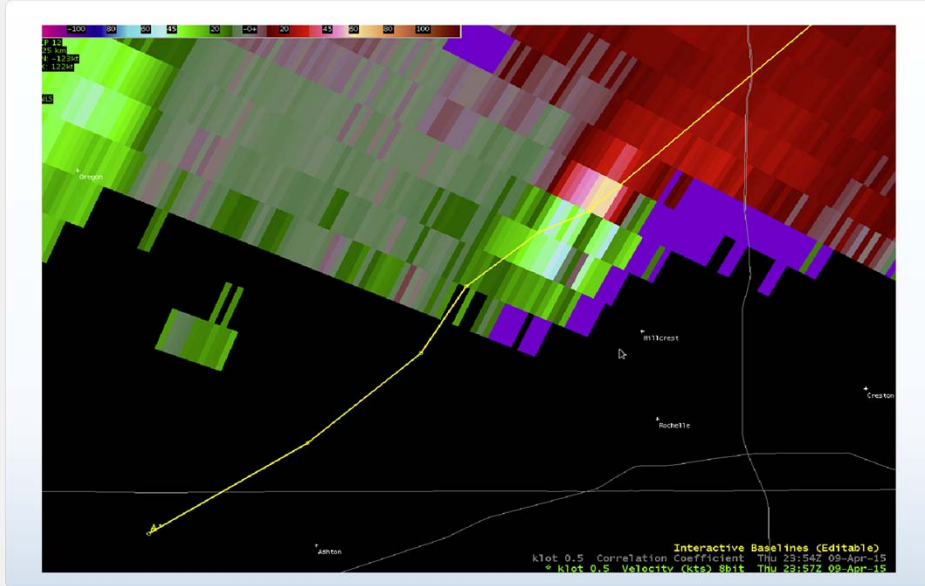
From there, go along the track from scan to scan adding vertices along the approximate center of the tornado path. Middle click on the baseline to add vertices.

## Building the Tornado Track



Continue this through the duration of the path as much as needed to keep the baseline aligned with the best track of the tornado.

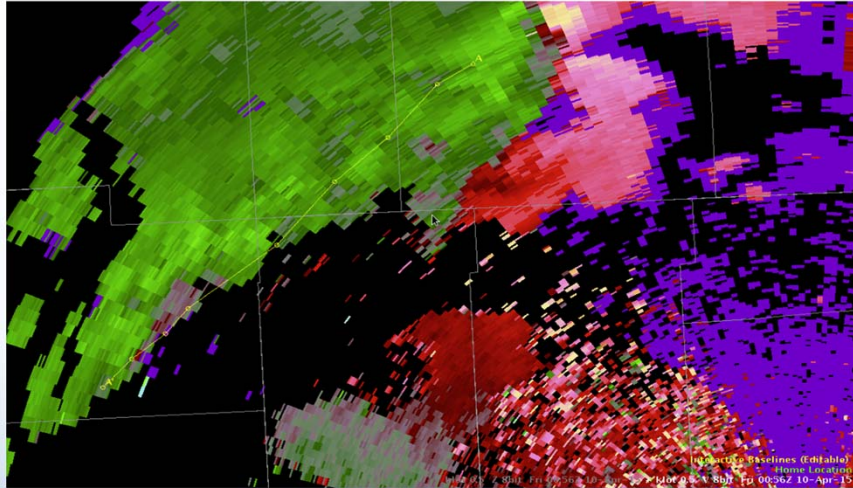
# Building the Tornado Track





## Finished Baseline Track

End the baseline where you estimate the tornado ended

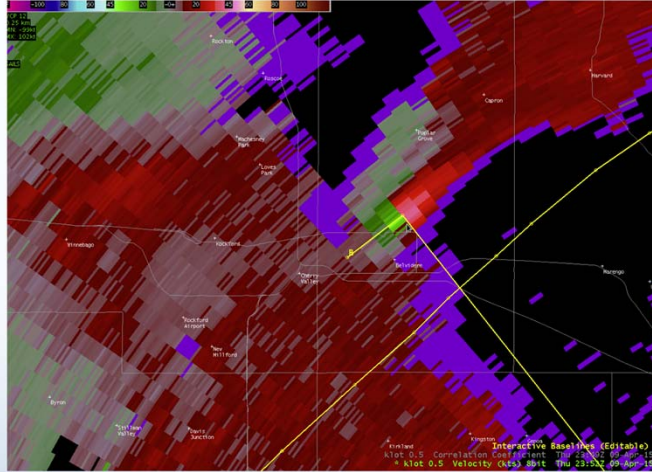


Your path should look something like this. End the baseline at the point you believe the tornado ended.

## Adding a Second Track

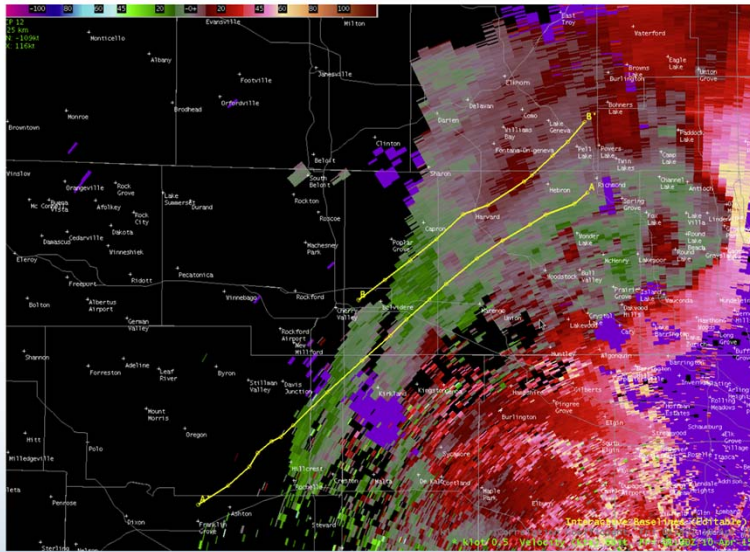
Need to add another track?

Grab another baseline!



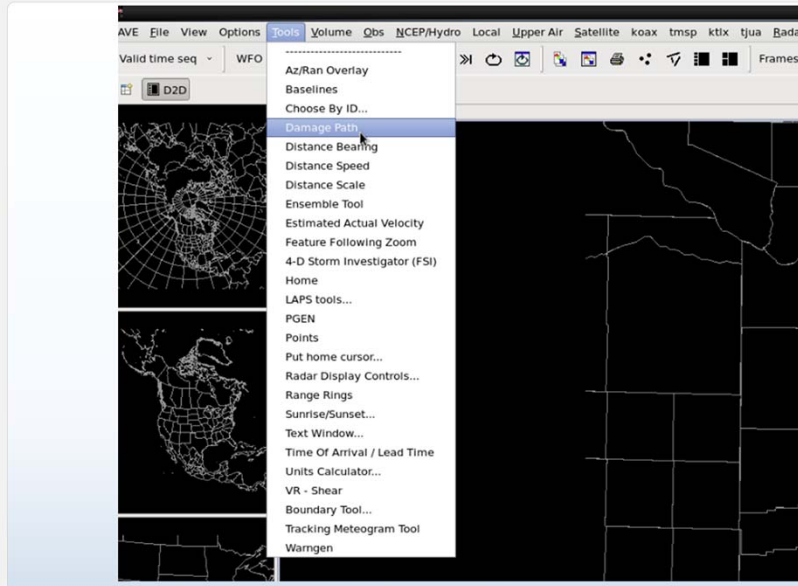
To add a second track just repeat the process, grab a baseline and trace out the path. Do that for as many paths as you want to highlight.

# Tornado Tracks



You will end up with something that looks like this.

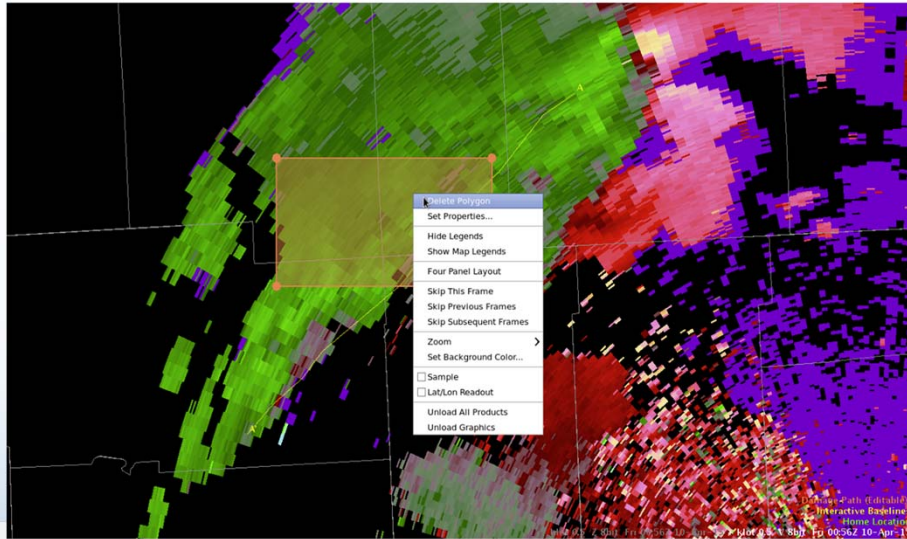
## Opening the Tool



Next, Go to the tools menu in CAVE and select “Damage Path.”

## Right Click on Polygon

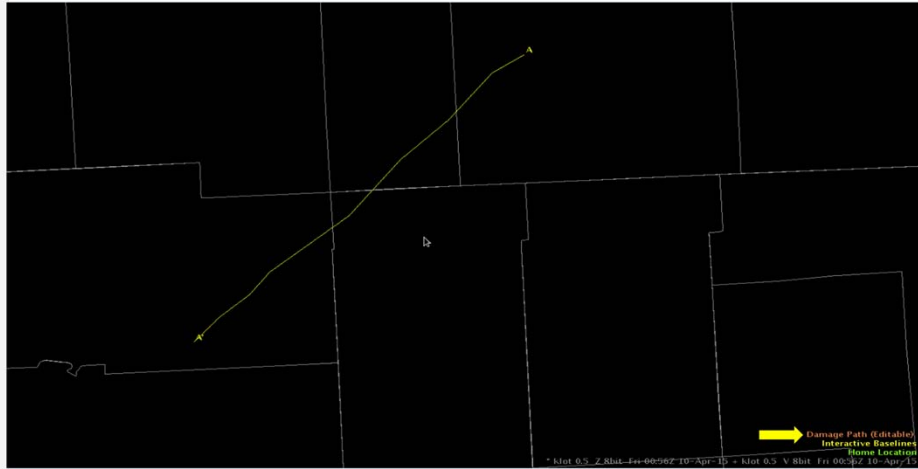
To delete a polygon or set polygon properties



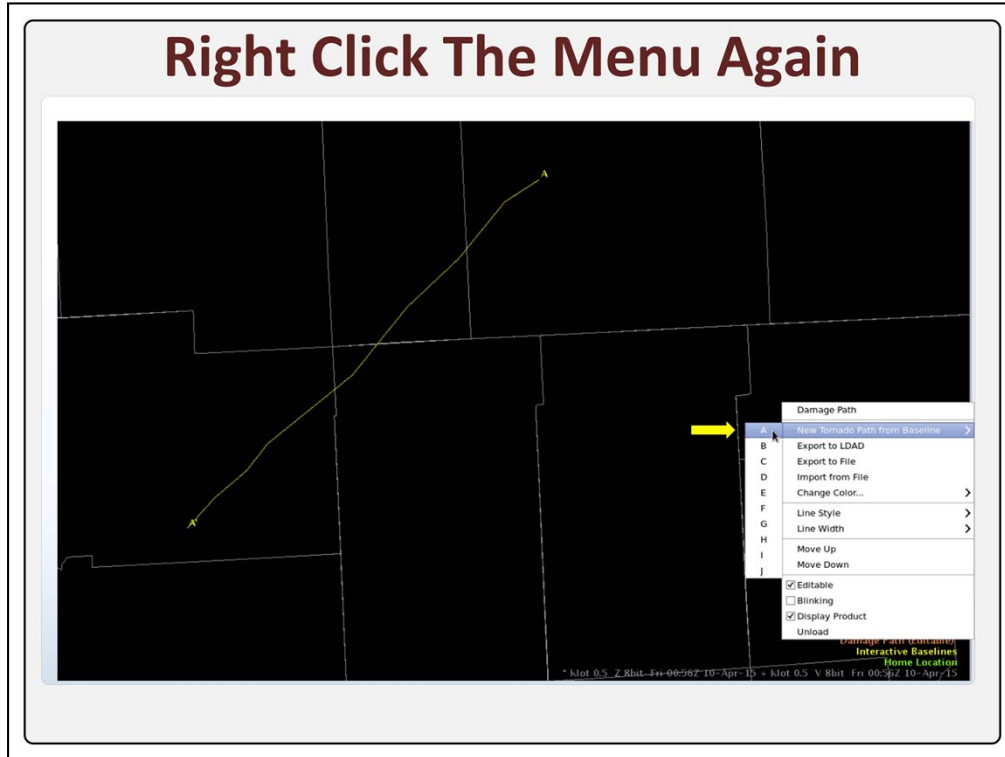
You may have a square pop up immediately. You can right click on the polygon and hit “delete polygon” when preparing a tornado track. If you are creating a track based on other hazards you can start with this polygon, but we will talk about that more in a moment.

## Make Damage Path “Editable”

Right click on the product menu



Right click on the Damage Path product menu in the lower right corner of the screen and make damage path “editable.”



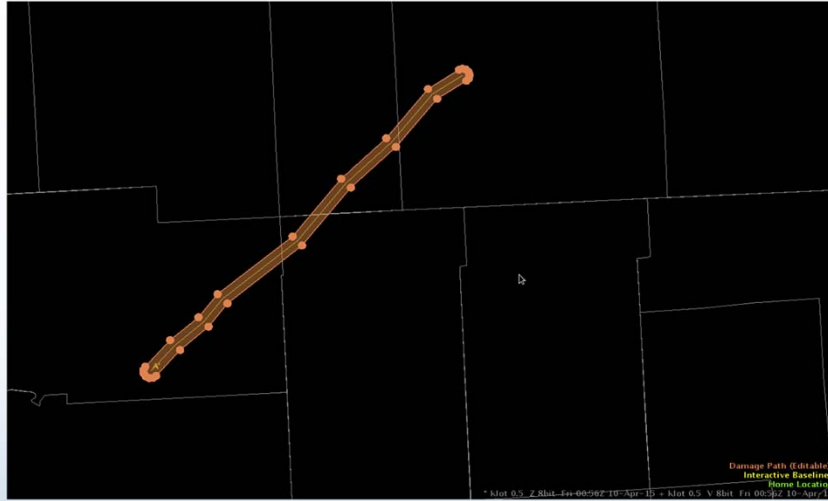
Right click on the Damage Path product menu again and select “New Tornado From Baseline”

and select the baseline with which you estimated your tornado path. In this case Baseline “A.”

This menu will not be selectable if you do not have damage path set as “editable.”

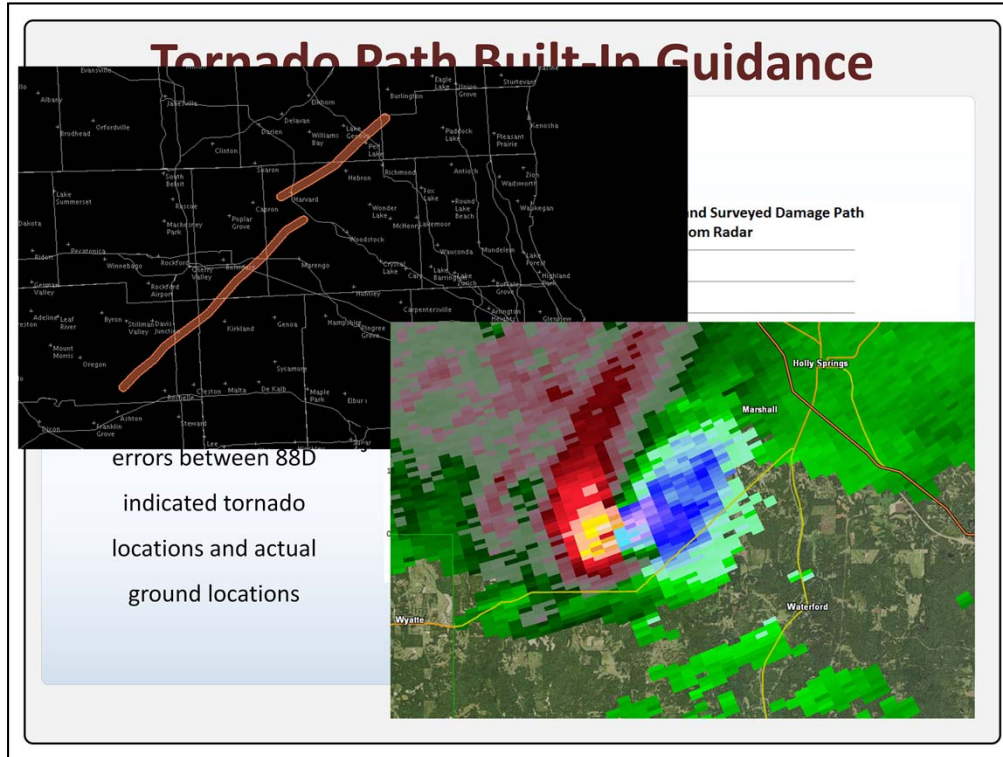
## Preliminary Tornado Path

Move, add, or delete vertices to better estimate the track



You will get a preliminary tornado path based on that baseline.





The tornado path portion of the tool uses data from a 2008 study from Spegher and Smith

The scatter plot shows the position difference in miles relative to range from the radar from where the tornado is on the ground and where the radar says it is. The red line indicates the equation that approximates this relationship in the Damage Path Tool, which changes at 40 and 80 miles.

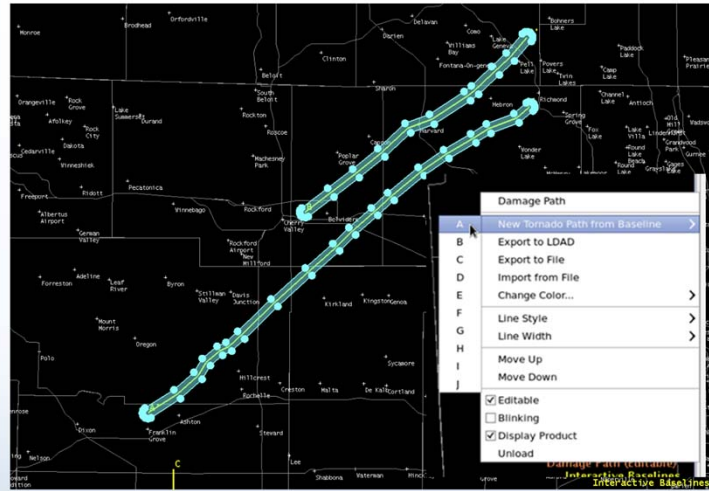
Notice that at 40 nautical miles the uncertainty in position was around half a mile and

At 80 miles it is around 1 mile

The path width on the uncertainty will be twice this.

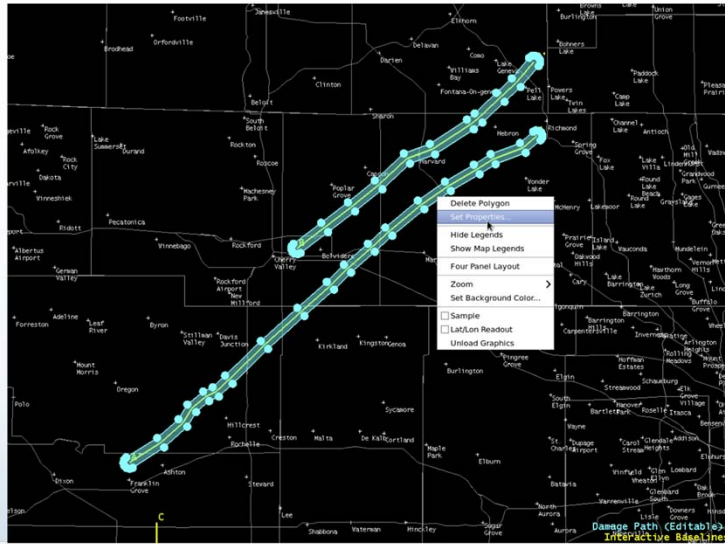
So basically, it provides some wiggle room based on limitations we know exist on pinning down exactly where a tornado is happening, on the one to three mile scale, based on radar signatures and adjusts by distance.

## Additional Damage Paths



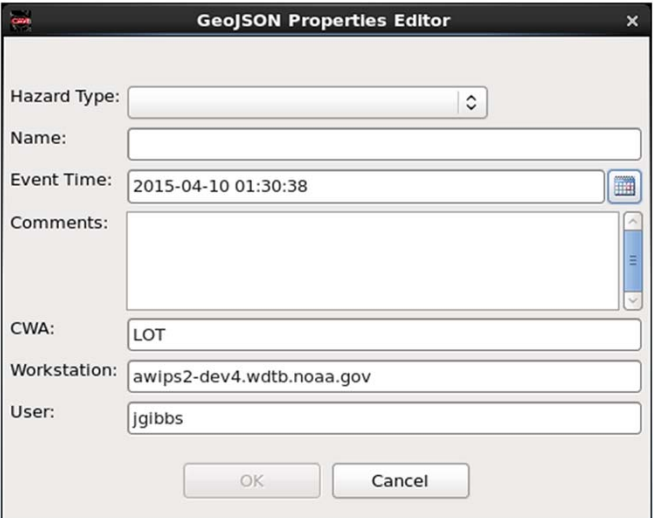
For any other paths just create it from the baseline you used to trace the couplet.

## Set Path Properties



When you have your paths, right click and hold on the track polygons and select “Set Properties.”

## Path Properties GUI



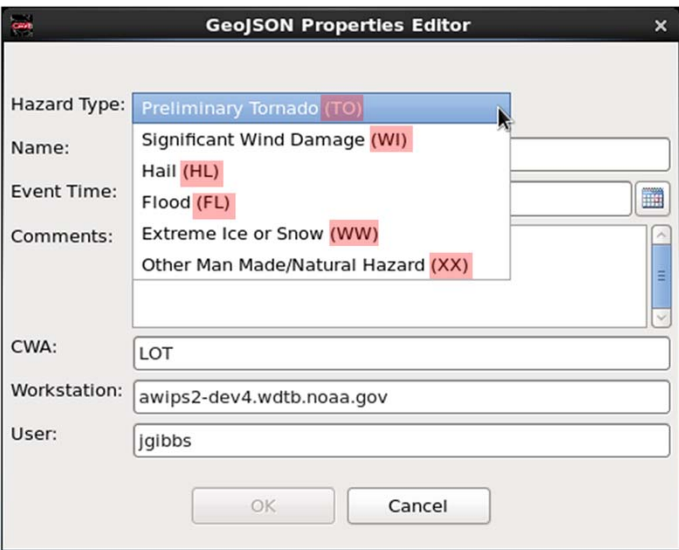
The screenshot shows a window titled "GeoJSON Properties Editor" with the following fields and values:

- Hazard Type:
- Name:
- Event Time: 2015-04-10 01:30:38
- Comments:
- CWA: LOT
- Workstation: awips2-dev4.wdtb.noaa.gov
- User: jgibbs

At the bottom of the window are two buttons: "OK" and "Cancel".

This will pull up a menu where you can enter metadata information to accompany your polygons.

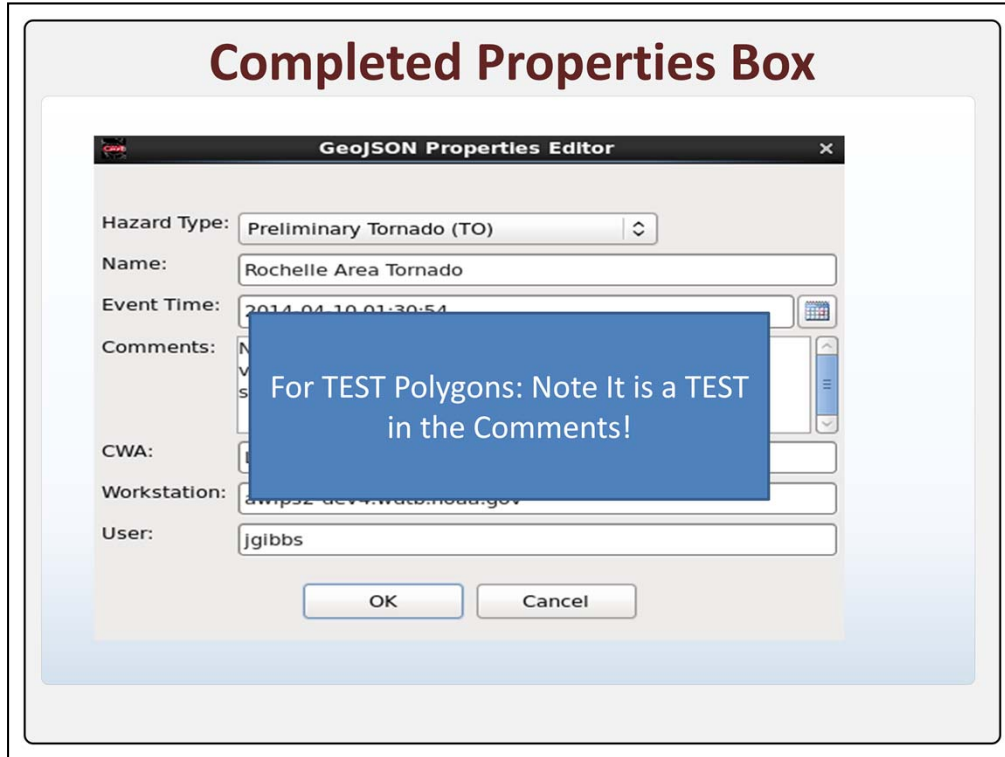
## Hazard Type Selection



The screenshot shows a dialog box titled "GeoJSON Properties Editor" with a close button (X) in the top right corner. The dialog contains several input fields and a dropdown menu. The "Hazard Type:" field is currently open, showing a list of options: "Preliminary Tornado (TO)", "Significant Wind Damage (WI)", "Hail (HL)", "Flood (FL)", "Extreme Ice or Snow (WW)", and "Other Man Made/Natural Hazard (XX)". The "Preliminary Tornado (TO)" option is highlighted. Below the dropdown, there are text input fields for "Name:", "Event Time:", "Comments:", "CWA:", "Workstation:", and "User:". The "CWA:" field contains "LOT", "Workstation:" contains "awips2-dev4.wdtb.noaa.gov", and "User:" contains "jgibbs". At the bottom of the dialog are "OK" and "Cancel" buttons.

The Hazard Type entry will give you a dropdown menu with the six different options we mentioned earlier. In this case we would select preliminary tornado.

Note the abbreviations on the GUI menu, those are metadata about the polygon that will go over to the DAT server to help highlight what type of event occurred.

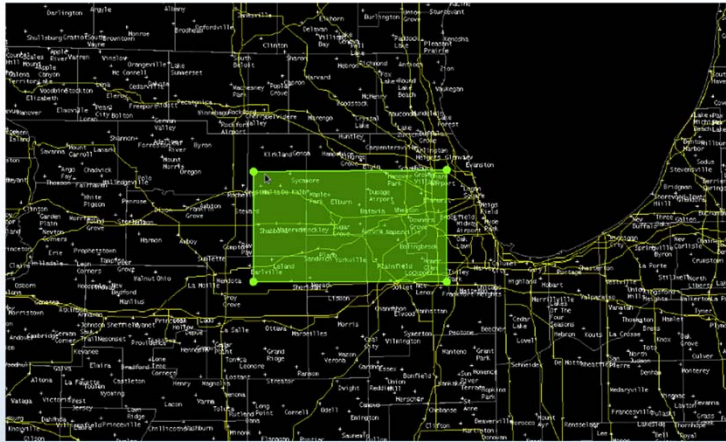


Give the event a name that will be recognizable to outside users, set the event start time, along with some very brief comments on why the track was created. There is a 500 character limit on the DAT server so keep the comments short. The other items should automatically populate.

For test polygons make sure to note in the comments this is a TEST!

## Other Events

For significant wind damage, flood, extreme ice or snow accumulation or other man made/natural hazard



Select  
“Damage  
Path” from  
the Tools  
menu

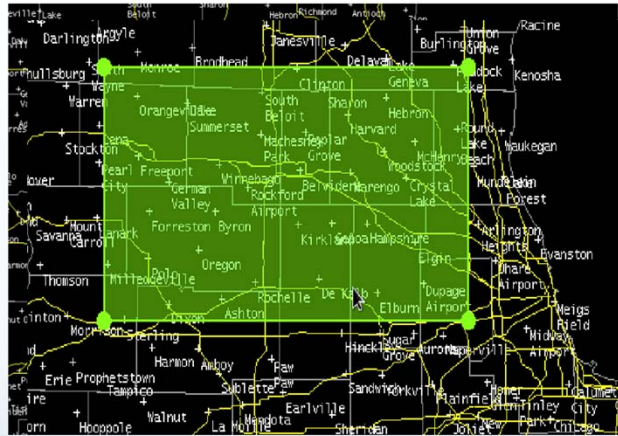
You’ll see  
a square  
box

For other phenomena the polygons will need to be manually adjusted to fit the desired area.

Select “damage path” from the tools menu

That will give you a square box.

## Other Events



You can move  
the vertices by  
dragging them

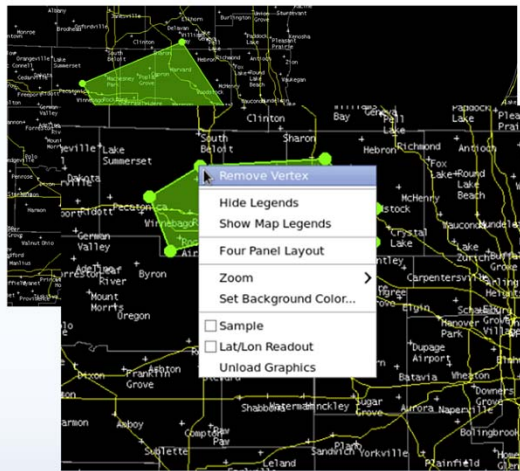
Hold and drag  
to move the entire  
polygon

You can move the vertices by dragging them.

Hold and drag over the polygon itself to move the entire polygon.



## Other Events



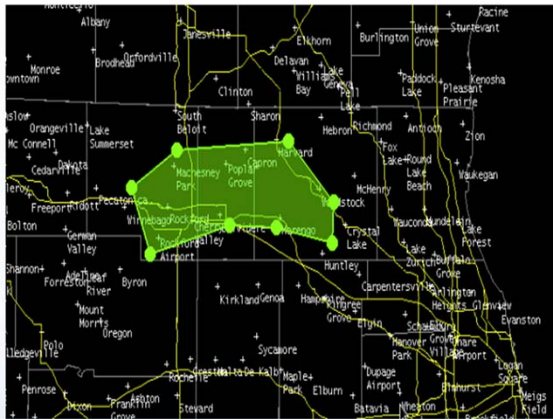
Right click and hold, or middle click to add a vertex

Right click and hold on any vertex to remove a vertex

Right click and hold, or middle click to add a vertex.

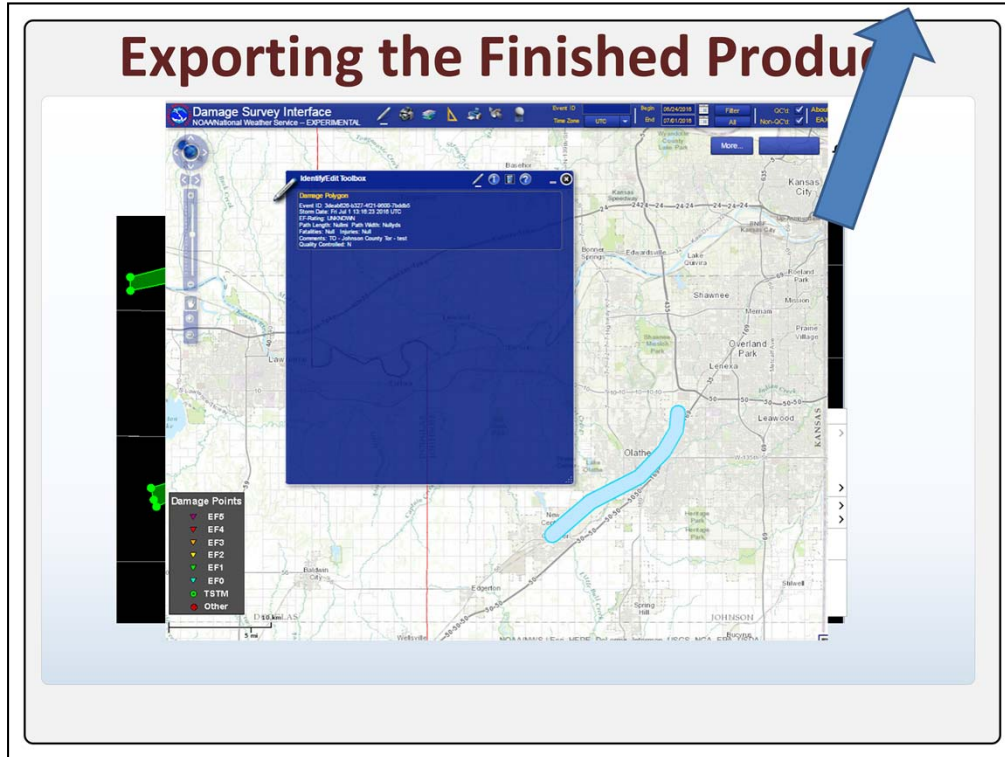
Right click and hold on any vertex to remove a vertex.

## Other Events



Manipulate the polygon until product completed

Manipulate the polygon based on the data you have until the product is the way you want it.

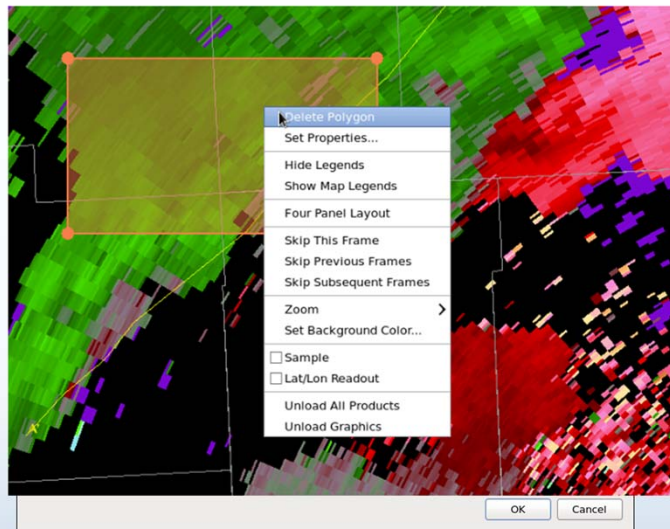


To export right click on the Damage Path menu item, and then select Export to LDAD which will send it to the

Damage Assessment Toolkit to be viewed by partners. Your AWIPS focal point will have to install a local application however before this will work,

the instructions are in the resources tab under Local App Installation Instructions

## Exporting the Finished Product



You will also have the option to export it to a local drive using the export to file option on the product menu in a GeoJSON format.

Then you can save the file, and send it via email or distribute it on your web page.

Additionally, once you hit “delete polygon” in CAVE the polygon is lost forever so this would be a good way to save a backup of your existing polygon so it doesn’t accidentally get deleted. Tracks can’t be individually filtered off so deleting the polygon after saving it and re-loading it may be one way to save workspace clutter.

## Limitations/Caveats

Inconsistent use could divert emergency response resources from areas of higher impact

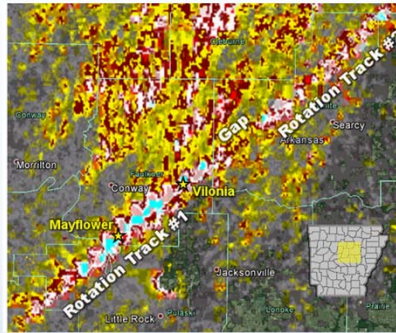


Some caveats of the tool. Inconsistent use could divert emergency response resources from areas of higher impact. For example if your office begins labeling small tornado areas as significant tornado areas. Or the office labels every tornado and doesn't highlight the most significant ones.

## Limitations/Caveats

Rotation tracks can be used

May not be as skillful as base velocity



**Figure 4.** Example of the object-based geospatial verification technique developed to evaluate the quality of the proposed damage paths of this study. Green areas correspond to hits, blue areas are misses, and red areas are false detections. An electronic supplement for analyzing the classification method of geospatial verification for each damage path is available at [hvt.nssl.noaa.gov/damagepaths/verification.php](http://hvt.nssl.noaa.gov/damagepaths/verification.php).

Rotation tracks can be used to create damage paths, as can any data source. But a recent study showed that manually identifying couplets in velocity data and drawing a path from there will generally be more skillful. I've included a link to that paper in the resources tab.

## WFO Preparation

Check out the jobsheet/training

Work with local office management  
to identify potential uses

Coordinate with partners

Integrate into SWOPs

Consider alternate distribution



So what will you and the office need to get ready?

First check out the jobsheet and training associated with the tool, you're halfway there on this one.

Work with local office management to identify how you want to use the tool, remember it's not required but it has shown positive dividends amongst our partners

Coordinate with your partners, find out what they will need and ways you can use it.

Integrate the tool into your severe weather operating plans, while it won't take an hour to draw something like this up, it will require a dedicated person at least a few minutes of concentrating, which is often in short supply in emergency operations.

And also consider alternate distribution. How will your partners want to view the data, will they need access to the DAT or should it come another way?



## Summary

– Creates GeoJSON damage path/area

- Tornado
- Wind
- Hail
- Flood
- Ice/Snow
- Other natural/man made hazard



To Summary the Damage Path Tool will create a GeoJSON file that highlights a geographic area corresponding with a damage path or area for

Significant Tornado

Damaging Wind

Destructive Hail

Flooding

Ice or Snow

Or other man made or natural hazards

## Summary

- Opened from the Tools Menu
  - Create polygon
  - Enter metadata
  - Distribute polygon
- Export to LDAD
  - Via the DAT Server
- Export to file
  - File for other external users
- Requires preparation and planning

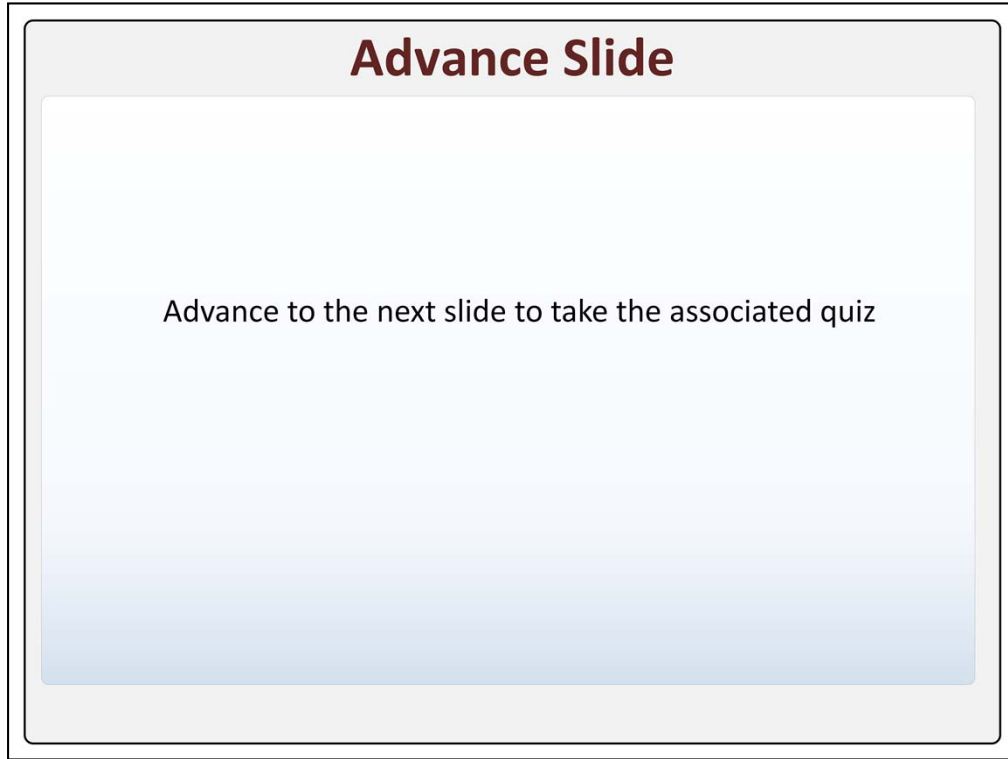


It is opened from the tools menu

The export to LDAD tool exports it directly to the DAT server.

Export to file is a way to get the file on your local machine for transfer to other external users such as local Ems

And the tool will require some prep work and planning to be used most effectively.



Advance to the next slide to take the quiz.

# Damage Path Tool

Questions?

[justin.gibbs@noaa.gov](mailto:justin.gibbs@noaa.gov)



That concludes this module, thanks for listening. If you have any questions you can contact me at the address listed on the screen.