

Tornado Patterns and Occurrence

Before you begin using this module, you will need to know about using a Web-based GIS viewer. You can do this by watching the tutorial video or working through the tutorial. The tutorial video, student activity, and Web-based GIS Tutorial Viewer can be found at <http://gis.lanecc.edu> → “Modules” tab → “Tutorial” link. The activity works best with a high speed Internet connection.

Prior Skills: You will need to know how to turn layers on and off, use the ID tool and, zoom in and out of the map, toggle from layers to the legend, and perform a search (Boolean) query.

Objectives:

Remember, computer steps are indicated by a ► symbol and questions you need to answer are numbered.

Background

Since records of tornado activity were first kept in 1916, scholars and researchers have studied the ‘How’s & Whys?’ of tornado development. Within the past few decades it has been found that tornados typically require three upper atmospheric conditions for formation.

1. A northerly flow of warm, moist air (mT) from the Gulf of Mexico
2. A cool, dry air mass (cP) descending from Canada regions
3. A jet stream wind exceeding speeds of 150mph

The region in the continental U.S. where cold, dry winds from Canada meets warm moist air from the Gulf of Mexico forms the U.S. jet stream. Scientists believe that the U.S. jet stream serves as a likely indicator of tornado position and intensity. In the activity below, try to refute or support this scientific theory using GIS (Geographic Information Systems).

- Open the GIS Viewer - <http://arcgis.lanecc.edu/website/tornado/viewer.htm>

Before you begin to analyze the data it is important to look at the spatial patterns and association of tornado location data.

- Make a table with 13 rows and three columns. Label it like the one in the image.

Month	Location	Distribution	Jet Stream
January			
February			
March			

- ▶ Make the January “Visible” and “Refresh the map.”

1. In the table you created, briefly describe the spatial pattern of tornadoes which have occurred in the month of January. Describe their general location and distribution. What is their association to the Jet Stream images? The Jet stream for winter, summer and the equinox are seen as lines. Each jet stream has a 100 mile buffer along the extent.

- ▶ Repeat the evaluation for each month. Make sure you uncheck the previous month and refresh the map after each new selection.

- ▶ Turn on January, February and March tornados. This is approximately the winter tornado season.

2. Describe the winter tornados locations, distribution and association with the winter jet stream.

- ▶ Turn on April, May and June tornados. This is approximately the spring tornado season.

3. Describe the spring tornados locations, distribution and association with the equinox jet stream.

- ▶ Turn on July, August, and September tornados. This is approximately the summer tornado season.

4. Describe the summer tornados locations, distribution and association with the summer jet stream.

- ▶ Turn on October, November, and December tornados. This is approximately the fall tornado season.

5. Describe the fall tornados locations, distribution and association with the equinox jet stream.

Quantify Data Occurrence

To determine how many winter tornados occur within 100 miles of the winter jet stream, you will perform buffer and layer-on-layer selection.

- ▶ Make Winterjet both Visible and Active.



- ▶ Make January and States visible as well.

- ▶ Refresh the map. Be sure all other layers are not visible.

- ▶ Use the select by rectangle tool and draw a square around the entire winterjet. It will be highlighted in blue to indicate it is selected.



- ▶ Click the buffer tool. Fill in the dialogue window to match the image below.



- ▶ Make sure the Display Attributes is checked.

Buffer

Highlight features from within a distance of MILES around the selected features of winterjet

Display Attributes

- ▶ The window below the map displays the tornados within 100 miles of the jet stream. Use your mouse to scroll down in the bottom of the map and click more records until you come to the end of the list. This will take 20 or more clicks.



6. How many January tornados are within 100 miles of the jet stream? What percent is it of the January tornados?

- ▶ Find out the number of January Tornados > F2 that are within 100 miles of the winter jet stream.

7. How many are there?

8. What percent of the January tornados within 100 miles of the jet stream are rated >F2?

Formula: ((January >F2 within 100 miles) / (total January tornados within 100 miles) X 100)

- ▶ Show your work

- ▶ Determine the number of May tornadoes within 100 miles of the equinox jet stream and the percent of the tornadoes F> 2.

9. Show your work.

- ▶ Determine the number of August tornadoes within 100 miles of the summer jet stream and the percent of the tornadoes F> 2.

10. Show your work.

Compare the F scale for different time periods to see if the tornadoes seem to be increasing in strength. Evaluate only the May F> 2 data layer.

Make a table show these time periods , and a column for F> 2 and F>= 4

Time period	Number of F > 2	Number of F >= 4	Percent of F>=4
>1949 AND < 1960			
>1969 AND < 1980			
> 1989 AND < 2000			
> 1999			

- ▶ Make May F > 2 Active and Visible → Refresh the map.

▶ Click the Query tool.



Field	Operator	Value	
YEAR	<	1960	Get Samples
And Or			
Not ()			
Add to Query String			
YEAR > "1949" AND YEAR < "1960"			
Execute Undo Clear			

11. How many May F > 2 tornadoes were recorded between 1949 and 1960?

▶ Set your next query to include F >= 4

(YEAR > "1949" AND YEAR < "1960") AND F_SCALE >= 4

12 How many of these are >= F 4

13. How many May F>2 tornadoes were recorded between 1969 and 1980? How many were >= F4?

14. How many May F>2 tornadoes were recorded between 1989 and 2000? How many were >= F4?

15. How many May F>2 tornadoes were recorded after 1999 and 1980? How many were >= F4?

16. Do you see an increase in the number of F>2 tornadoes over time or an increase in general intensity of tornadoes?

17. If the water in the gulf warmed what might you expect to see with respect to changes in tornado pattern and intensity?

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