GEOSTAC Student Lesson

**Lesson Title:** Blown Away: US Tornado Patterns and Occurrences

**Lesson Developer:** Jane Benjamin and Lynn Songer

*This lesson was adapted from an ARCLESSON by Tom Baker and Drew Keller*

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Before you begin using this module, you will need to know about using the ArcGIS Server Web-based GIS viewer. You can do this by watching the server 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. Go to the "Modules" tab and click the Tutorial link. You will need a high speed Internet connection and a current version of Adobe Flash Player.

**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.

**Computer steps** are indicated by a ▶ symbol. Questions you need to answer are numbered. Record your answers for this activity on a separate sheet of paper.

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**Background**: Since records of tornado activity were first kept in 1916, scholars and researchers have studied the 'Hows and Whys' of tornado development. Within the past few decades it has been found that tornados typically require three upper atmospheric conditions for formation:

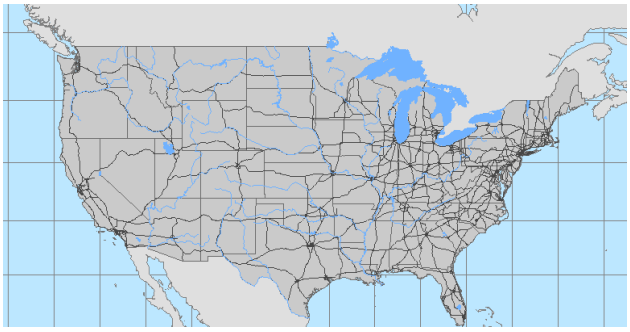
1. A northerly flow of warm, moist air (mT) from the Gulf of Mexico,
2. A cool, dry air mass (cP) descending from Canada regions, and
3. A jet stream wind exceeding speeds of 150 mph.

The region in the continental U.S. where cold, dry winds from Canada meet 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).


- ▶ Connect to the **MAPS-GIS webpage** at: http://gis.lanecc.edu
- ▶ Click on the **Modules** link**.**
- ▶ Click on the link to **Blown Away.**
- ▶ Choose **Link to the web-based map.**

The page will take a minute or two to load. The base map will load first then the other data layers. If it stalls at 55%, just click the **refresh** button on your browser.

- ▶ **Zoom** into the continential US.
- ▶ Turn on the three "Jet" data layers (Summer, Equinox, and Winter). These layers represent the **average** location of the Jet Stream at different times during the year.



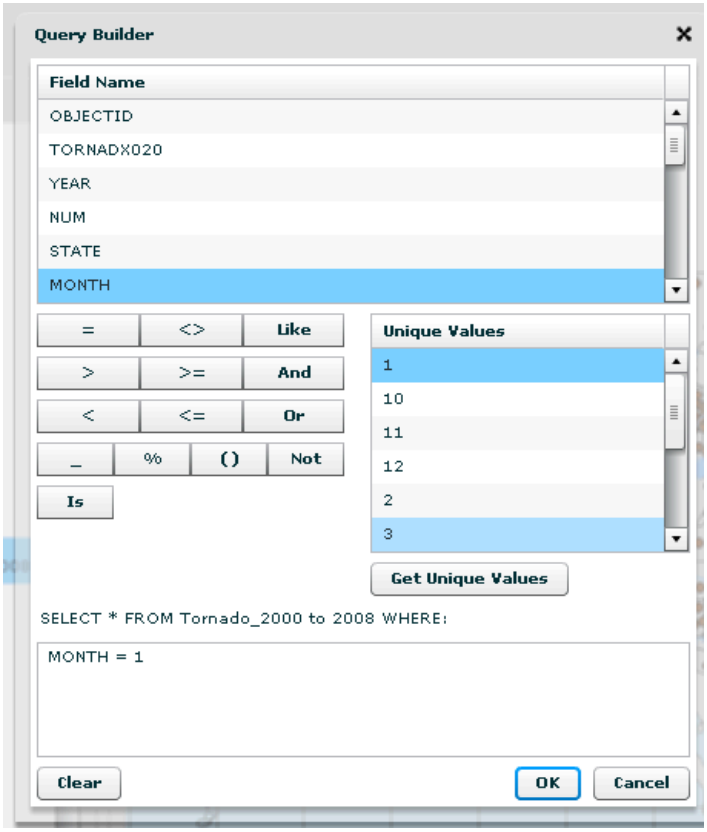
To begin to analyze the data you will work through a systematic data search to understand the location of tornadoes in January, April, July and October, and their relationship to the Jet Stream.

You will compare three different data years: 1950, 2000, 2008, and another year of your choice. The data collection for 2000, 2008 has been done for you.

- Turn on "Tornado 1950s."
- Right click the layer and choose **Query Layer**.

In the **Query Builder** set the following:

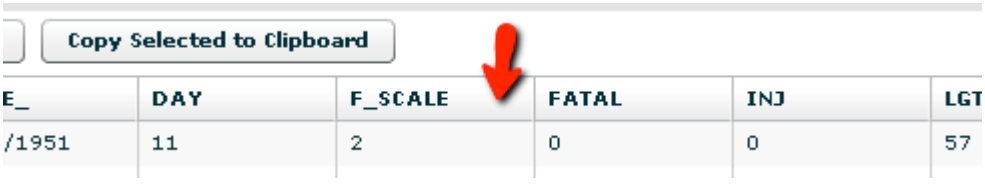
1. In **Field Name**, select "Month" (double click to enter it).
2. Type "="
3. Type "1" (This is for January)
4. Choose **OK**




The Query Results data table will open to show the selected features.

1) At the top of the Query Result is the number of tornadoes in January selected from the total 1950 data. Record this number.

- Click the "F_scale" to sort from high to low.

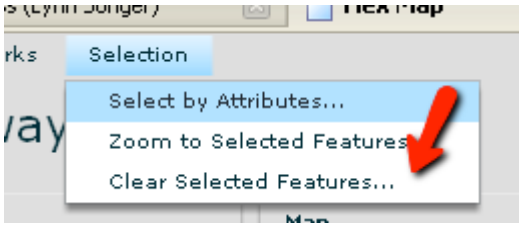



2) Record the number of F5 and F4 tornadoes.

- Close the Query Results window and describe the spatial pattern for the January Tornadoes. Look at the three jet stream lines.

3) Where are the tornadoes with respect to these lines? How are they dispersed across the US? Are they clustered, spread out evenly?

- When you are finished, **Clear Selected Features**.
- Set up a second **query** with April - month 4.



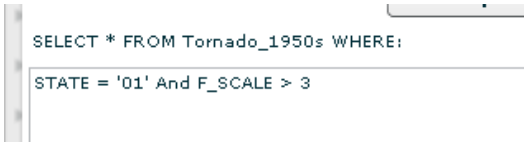


- Repeat this for July and October in the 1950 data layer.
- Choose another year and record the data for all four months.

4) When you have finished, summarize your data. In general, where are the majority of the tornadoes for each of the four months? Does one decade layer have a different pattern than the others? Are their exceptions to the patterns you are describing? What do you know about the Jet stream and tornado occurrence?

5) Choose one of the states in the contiguous US (not Hawaii, Alaska, or Puerto Rico).

Develop a series of complex queries (at least 4) to summarize the tornados for one of the decade data layers and for one state – See the example below. Look at the jet stream, the number of tornadoes, Intensity (F scale) damage, and death. Record your queries and the results, then write a paragraph describing your data search results.




***Example:*** *To search for Alabama (State 01) in 1950s.*

State = '01' and F_scale > 3

The results were 7 tornadoes in Alabama with an F scale 4 or 5.

State Number Code a– You must type the single quote ('01') to select states.

| | | | |
|---|---|---|---|
| 01 Alabama | 17 Illinois | 30 Montana | 44 Rhode Island |
| 02 Alaska | 18 Indiana | 31 Nebraska | 45 South Carolina |
| 04 Arizona | 19 Iowa | 32 Nevada | 46 South Dakota |
| 05 Arkansas | 20 Kansas | 33 New Hampshire | 47 Tennessee |
| 06 California | 21 Kentucky | 34 New Jersey | 48 Texas |
| 08 Colorado | 22 Louisiana | 35 New Mexico | 49 Utah |
| 09 Connecticut | 23 Maine | 36 New York | 50 Vermont |
| 10 Delaware | 24 Maryland | 37 North Carolina | 51 Virginia |
| 11 Washington DC | 25 Massachusetts | 38 North Dakota | 53 Washington |
| 12 Florida | 26 Michigan | 39 Ohio | 54 West Virginia |
| 13 Georgia | 27 Minnesota | 40 Oklahoma | 55 Wisconsin |
| 15 Hawaii | 28 Mississippi | 41 Oregon | 56 Wyoming |
| 16 Idaho | 29 Missouri | 42 Pennsylvania | 72 Puerto Rico |

End of Lesson.