USGS
science for a changing world

Rocky Mountain Mapping Center

Spatial Analysis of North American Hurricanes Using a Geographic Information System (GIS)

Author: **Joseph J. Kerski, Geographer, USGS**, **jjkerski@usgs.gov**, 303-202-4315

Software Required:

Geographic Information Systems software, such as ArcView (ESRI, Inc), Maptitude (Caliper Corp.), MapInfo (MapInfo Corp.), or GeoMedia (Intergraph Corp.). This lesson uses ArcView 3.x by ESRI, Inc.

Summary:

Students examine North Atlantic hurricanes from 1851 to 2001 over space and time using GIS tools and methods, analyzing hurricane direction, patterns, specific damaging hurricanes, the characteristics of hurricanes near world and specific cities, hurricanes in specific states in the USA and Mexico, and characteristics of hurricanes that passed near the students' hometown.

Skills:

1. Understanding the patterns and processes of hurricanes across North America for the past century.
2. Understanding the problems of hurricanes from a geographic perspective.
3. Symbolizing data to aid in understanding it.
4. Data and file management.
5. Selection, sorting, querying data in maps and in tables.
6. Changing and understanding map projections.
7. Creating summary tables to help understand the problem.
8. Creating and analyzing graphs.
9. Creating new information.
10. Analyzing point, line, and polygon data across space.

Data:

ESRI Inc., created all countries, cities, and the world30 map and data layers.

The US National Oceanic and Atmospheric Administration, Tropical Prediction Center/National Hurricane Center created the hurricane layer.

Data Management

Create a folder on your computer to hold the data with an appropriate name, such as tornados.

Click **here to download the data** that you will need for this lab exercise, and download into the folder you created.

This file is named hurricanelesson.zip and totals approximately 2.5 MB.

Next, unzip the file using the Winzip program.

You now should have the following files:

World 30
World Cities
Countries
Mexico Cities
Mexico States
USA Cities
USA States
Hurricane Tracks
Large Hurricanes

Displaying and Symbolizing Your Data

Open ArcView GIS and start and new project with a new view.
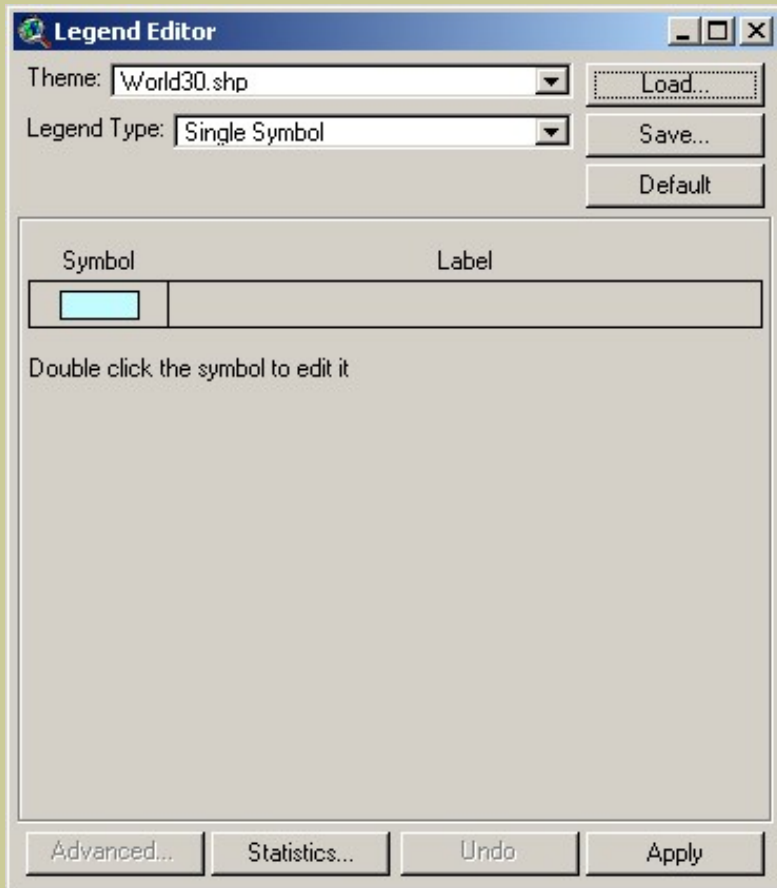
Add the following map themes using the Add Theme button:

World 30
Countries
Hurricane Tracks

Click on the buttons to the left of each theme to make them visible.

1) Does the world 30 layer represent the oceans? Why or why not?

Single click on the themes and slide them up and down in the table of contents so that world30 is at the bottom, the countries theme is in the middle, and the hurricane tracks theme is at the top.

Double-click on the world30 layer to access the Legend Editor. Select "Load" and load the world30.avl legend file, as follows:

Legend Editor

Theme: World30.shp [Load...]

Legend Type: Single Symbol [Save...]

[Default]

Symbol	Label

Double click the symbol to edit it

[Advanced...] [Statistics...] [Undo] [Apply]

Double-click on the countries layer to access the Legend Editor. Select "Load" and load the countries.avl legend file.   Go to the Theme pull-down menu and select "Hide/Show Legend" to hide this legend.

Double-click on the Hurricane Tracks layer to access the Legend Editor. Select "Load" and load the hurricanetracks.avl legend file.

2) What color are the tracks of the hurricanes?

Using File--> Save Project, save your project with the name "hurricanes" to the folder where your data is located or to the location provided by your instructor.

Hurricane Analysis

3) In what ocean are these hurricane tracks concentrated in?

Using the zoom in [⊕] , zoom out [⊖], pan [✋] , and zoom to the full extent of all map themes [⬇] buttons to answer the following questions.

4) Write 3 observations about the distribution and pattern of hurricanes in the North Atlantic.

5) Is there anything about the distribution and pattern of hurricanes that surprises you? If so, what?

6) Write 3 observations about the direction that the hurricanes move.

7) Is there anything about the direction of hurricane movement that surprises you?

Notice the coordinates to the upper right of the view as you move the mouse around the map.

8) What do these coordinates represent?

You work for the Red Cross, an organization that brings aid in natural and human-caused disasters. You need to find out what countries these hurricanes cross so that you can direct the future efforts of the Red Cross. Make the countries theme "active" by single-clicking on it.

Access the menu: Theme and then pull down: "Select By Theme." Select the countries that hurricanes crossed, as follows:
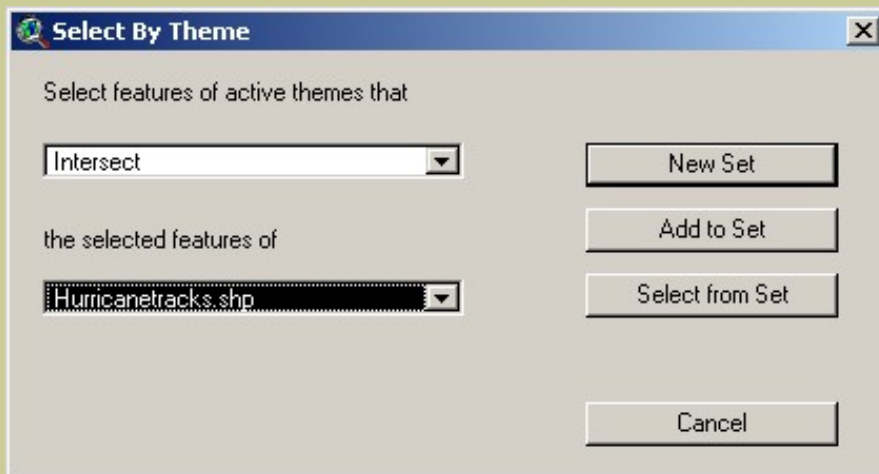
When finished, click on "New Set."

Access the countries table 🗔.

9) Look to the upper left of the table to determine how many countries hurricanes crossed. Indicate the number below.

10) Examine your map. According to the distribution of countries selected, how many continents do the North Atlantic hurricanes affect?

11) Name these continents.

Next, you will further investigate the hurricanes data in the table that stores all of the characteristics, or attributes, of the hurricanes. First, make the hurricane tracks theme active by single-clicking on it. This will make the theme "stand out" or "pop up."

Access the table of hurricanes by clicking on the open theme table button

Scroll a bit through the table.

12) What field is this table sorted by?

13) What time period does this table span?

From _____ to _____

14) Look to the upper left of the table. How many rows are in this table?

15) During what season do you suppose most hurricanes strike?

Next, you will use your GIS to determine what months are the most common for hurricanes.

Highlight the **Month** field and use the Field--> Summarize menu to create a new table. Save it in the folder where your other data resides. Take the defaults and select "OK" on the window that pops up.

The new table shows the frequency of hurricanes for each month.

16) Was any month free of hurricanes?

17) What month was by far the most common for hurricanes?

Go to your project window by using the "Window" pull down menu. Create a bar graph (chart) of your new table. Add the field "count" and label series using "month". It should look similar to the following. Print the graph.
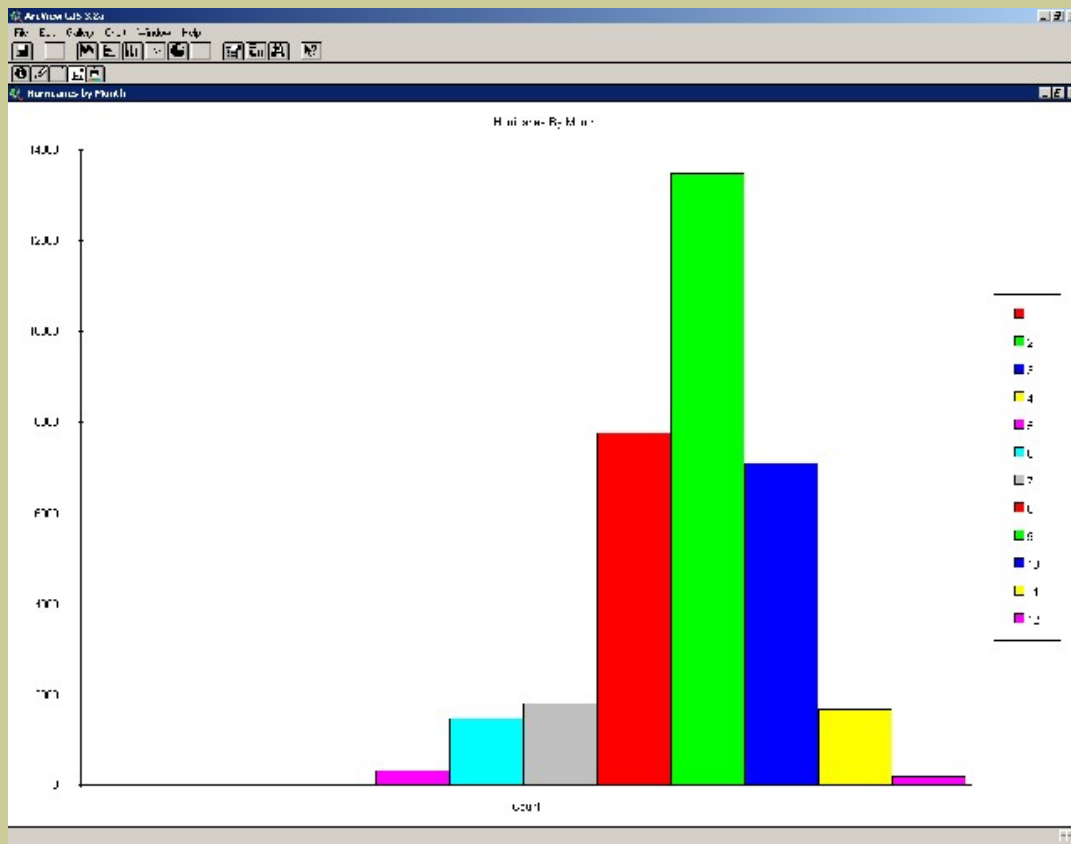
Close the graph and your monthly summary table.

Access your table for all the hurricanes.

Examine the "**cat**" field. This field represents the intensity of hurricanes, as follows:

Tropical Cyclone Severity

Categories	Winds	Typical Effects
E - Extratropical		Extratropical is a term used in advisories and tropical summaries to indicate that a cyclone has lost its "tropical" characteristics
SD - Subtropical Depression	Less than 39 mph	A subtropical depression is a subtropical cyclone with maximum sustained surface (10 meter) winds of less than 34 knots/39 mph
TD - Tropical Depression	Less than 39 mph	A tropical depression is a tropical cyclone with maximum sustained surface (10 meter) winds of less than 34 knots/ 39 mph.
SS - Subtropical Storm	39 mph or greater	A subtropical storm is a subtropical cyclone with maximum sustained surface (10 meter) winds of 34 knots/39 mph or greater.
W - Tropical Wave		A tropical wave is a trough or cyclonic curvature maximum in the trade-wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere.
L - Tropical Low		The storm was classified as a tropical low at the time of the advisory.

D - Tropical Disturbance		A tropical disturbance is a discrete tropical weather system of apparently organized convection--generally 100 to 300 nmi in diameter---originating in the tropics or subtropics, having a nonfrontal migratory character, and maintaining its identity for 24 hours or more. It may or may not be associated with a detectable perturbation of the wind field.
H1	Strongest gust less than 125 km/h	Category 1 Hurricane. Negligible house damage. Damage to some crops, trees and mobile homes. Draft may drag moorings.
H2	Strongest gust 125 - 170 km/h	Category 2 Hurricane. Minor house damage. Significant damage to signs, trees and mobile homes. Heavy damage to some crops. Risk of power failure. Small craft may break moorings.
H3 (eg. Winifred)	Strongest gust 170 - 225 km/h	Category 3 Hurricane. Some roof and structural damage. Some mobile homes destroyed. Power failure likely.
H 4 (eg. Tracy)	Strongest gust 225 - 280 km/h	Category 4 Hurricane. Significant roofing loss and structural damage. Many mobile homes destroyed and blown away. Dangerous airborne debris. Widespread power failure.
H5 (eg. Orson)	Strongest gust More than 280 km/h	Category 5 Hurricane. Extremely dangerous with widespread destruction.

Look at the relationship between wind speed (wind_mph) and the category. Highlight the Cat field and use the Field--> Summarize to create a new table. Store it in an appropriate folder. Take the defaults and select "OK" on the window that pops up.

You now have a table of hurricane categories and their frequencies.

18) What are the categories of hurricanes in this list?

19) What are the category names of the two most destructive types of hurricanes in this list?

20) What is the most *common* category of hurricane in this list?

Close your new table and go back to the map.

Save your project.

You have probably noticed that because so many hurricanes exist, it is difficult to understand the pattern they make. Make the hurricanetracks theme invisible by clicking on the check mark next to the theme name and

examine only the largest hurricanes. You will be able to examine the largest hurricanes, those that achieved Category 3, 4, or 5, as follows. These are stored in a theme named largehurricanes.shp. Add this theme using the same method that you added the other themes, earlier , and make it visible.

Double-click on this theme to access the legend editor. Click on Load, and load the legend "largehurricanes. avl". After loading, but before clicking on "Apply," examine the numbers under the field "count."

21) Which category of hurricanes is the least numerous?

22) Why?

Analyzing the Last Hurricane

In this section, you will analyze the latest hurricane recorded in the table.

Make the large hurricanes invisible and make the hurricanetracks theme visible again.   Access the table of all the hurricanes.

Go to the bottom of the table and examine the data for Hurricane Olga.

23) Does each row in the table represent one hurricane or one segment of the track of each hurricane? Circle your answer:

A. Each row represents one hurricane.

B. Each row represents one segment of the track of each hurricane.

24) Therefore, is the number of hurricanes more, less, or the same as the answer you wrote above for the number of rows in the table?

25) How many days did Hurricane Olga last?

Examine the "**cat**" field for Hurricane Olga.

26) Describe the categories classified for this hurricane and how they changed over the lifetime of Hurricane Olga.

27) Why do the categories change over the lifetime of this or any hurricane?

28) What was the highest wind speed for Hurricane Olga and on what day did it occur?

29) During what category of Hurricane Olga were the winds highest?

30) During what category of Hurricane Olga was the pressure lowest?

31) What is the relationship between wind speed and pressure? Why?

Close the table and return to your map.

Save your project using File--> Save Project.

Next, you will examine the pattern that Hurricane Olga followed. To do this, you will need to set the definition of your hurricanes map theme to Hurricane Olga. It will then be easy to see Olga on the world map.

Go to Theme--> Properties and click on the Hammer / Question Mark symbol under "Definition." Double click on the field Name, and then single click on the equals sign. Type in "OLGA" to finish the expression (in upper case letters). The expression should look like the following:
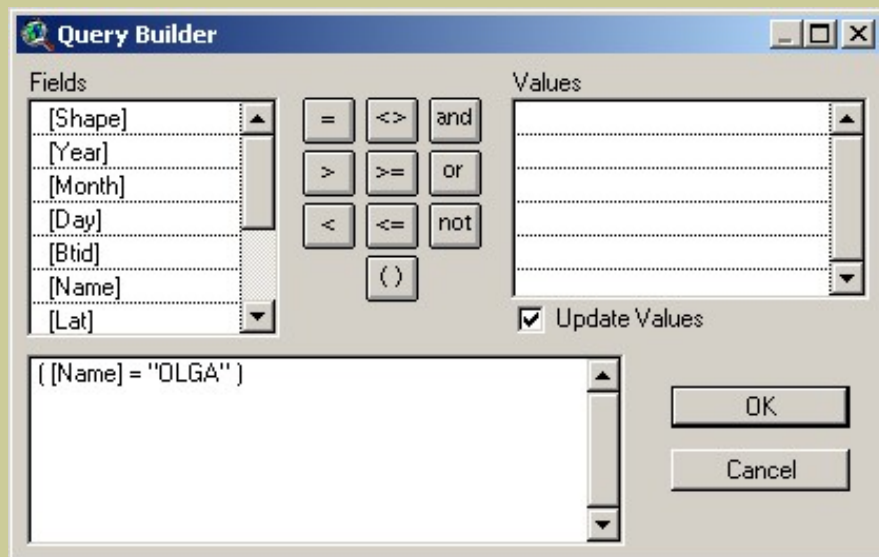
Select "OK" and return to your map. You should see the path of Hurricane Olga, as follows:

Label [icon] some countries near Hurricane Olga. To do this, single click on the countries theme, select the label tool, and click on the countries you wish to label. Clear labels by selecting them with the pointer tool [icon] and pressing "delete" on the keyboard.

32) Describe the path and direction that Olga followed, naming the closest countries that Olga approached.

Next, map the pattern of wind speed and pressure as you identified in your analysis of the attributes for Hurricane Olga. Do this by changing the legend by double-clicking on the hurricane tracks theme.

Change the legend to Graduated Symbol and the Classification Field to Wind Speed (wind_mph). Make the size range from 1 to 12.

33) Describe the pattern of wind speed as Hurricane Olga moved.

Change the legend by double-clicking on the hurricane tracks theme.

Change the legend to Graduated Symbol and the Classification Field **from** wind speed **to** pressure. Make the size range from 1 to 12.

34) Describe the pattern of pressure as Hurricane Olga moved.

Hurricane Hugo Analysis

Next, you will analyze Hurricane Hugo.   Hurricane Hugo, which caused approximately $10 billion in damage, had been the costliest hurricane to strike the United States before Andrew three years later. Hugo was, in some ways, two hurricanes in one. First, it passed through the U.S. Virgin Islands and Puerto Rico, leaving $3 billion in damage in its wake. After leaving the islands, Hugo remained over the waters of the Atlantic for over 3 days, gaining in strength and size until it made its assault on the South Carolina coast near Charleston. Even after making landfall, Hugo remained a threat and caused damage over 200 miles inland, and its effects were felt into North Carolina. (National Academy Press report, http://www.nap.edu/execsumm/0309044758.html)

Pull down the Theme --> Properties menu, and erase the Hurricane Olga expression.

35) What expression should you use to select Hurricane Hugo?

Select Hurricane Hugo by entering your expression above and select OK.

Zoom to the extent of Hurricane Hugo.

36) At what approximate latitude and longitude did Hurricane Hugo begin?

37) What is the closest country to Hugo's point of origin? (Remember the label tool)

38) At what approximate latitude and longitude did Hurricane Hugo end?

39) In what country did Hugo end?

40) What other country or countries did Hurricane Hugo cross?

Examine the table for Hurricane Hugo and use it in conjunction with your map to answer the following:

41) How many days did Hurricane Hugo last?

42) When was Hugo causing damage to Puerto Rico and the Virgin Islands?

43) How many days later was Hugo causing damage to South Carolina?

Create a map for printing by going to View--> Layout. Add a title to your map and your name by clicking on the "T" text symbol button ⊤. Print your layout.

You work for the Federal Emergency Management Agency (FEMA), an agency of the US Government that assists in helping mitigate the effects of natural and human-caused disasters. You need to find out what states Hurricane Hugo crossed. First, add the usastates theme. ⊞ Second, make this theme "active" by single-clicking on it.

Access the menu: Theme and then, "Select By Theme." Select the states that Hugo crossed, as follows:
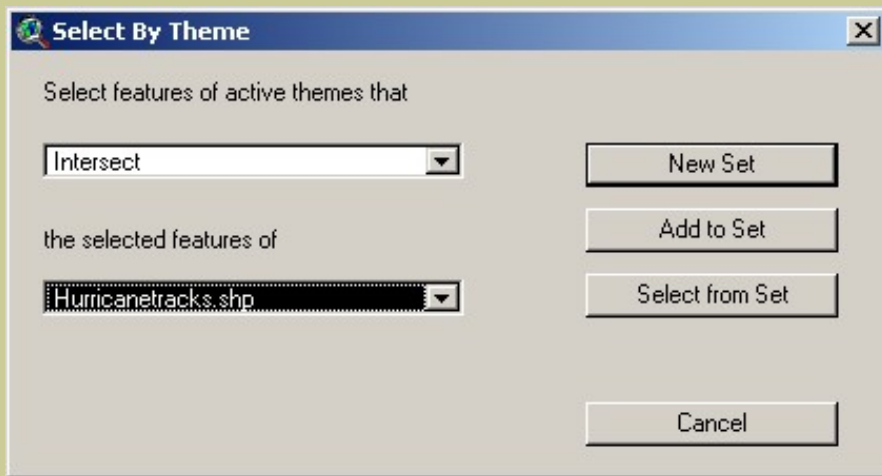
When finished, click on "New Set."

Access the states table. Look to the upper left of the table to determine how many states Hugo crossed.

44) Indicate the number of states that Hugo crossed, below.

Bring all the selected states to the top of the table by "promoting" them. ⊞

FEMA needs to assess how many people would potentially be affected by Hurricane Hugo. Click on Pop1999 to highlight the field. Go to Field-->Statistics. Examine the result.

45) What was the sum of the population of these states in 1999?

46) Label the states ⊞. Zoom in to Pennsylvania.   What part of the state of Pennsylvania did Hugo cross?

Go to Theme--> Properties on the Hurricane Tracks. Remove the definition query and click "OK." Now you should be able to see all the hurricanes again.

47) What is the primary direction that hurricanes travel across Pennsylvania?

From _____ to _____

Save your project.

Create a layout (View-->Layout) and print your Pennsylvania layout.

Pan 🖐 down to Texas.

48) What is the primary direction that hurricanes travel across Texas?

From _____ to _____

Analyzing The Worst Hurricane

The worst natural disaster ever to strike the United States in terms of loss of life was a hurricane. This is the hurricane identified in the table as having a btid of 352. As you have done above, apply a definition query under Theme--> Properties 🔨 on the hurricane tracks theme, this time make the expression ([btid] = 352]).

49) What countries did this hurricane cross?

50) What is unusual about the length of this hurricane track compared to some of the others you have examined?

51) What is unusual about the western and northern extent of this hurricane track compared to some of the others you have examined?

52) Examine your table. How long did this hurricane last?

Read the accounts of this hurricane after it left Texas on:

http://www.islandnet.com/~see/weather/events/1900hurr.htm

53) How many people were killed **after** the storm left Texas, according to this account?

54) Based on your GIS-based analysis on the storm's track, answer how this could have happened.

Zoom in [🔍] to where the hurricane hit land, or "made landfall." Add the theme usacities and label the city closest to where the hurricane made landfall (see below for example).
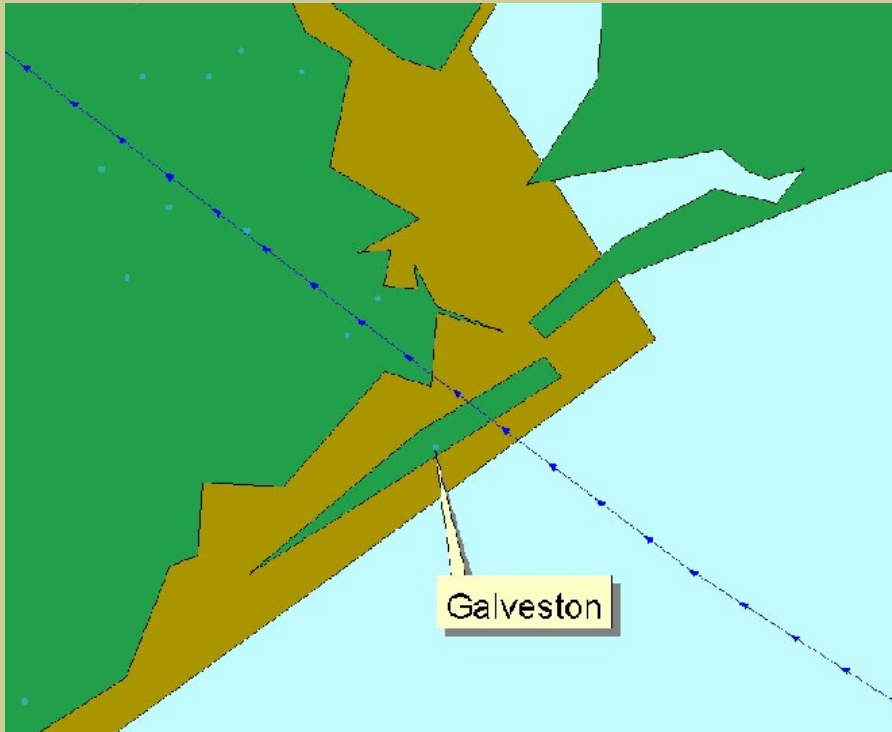
55) What city was closest to the hurricane's landfall?

Use the identify button [ⓘ] to identify the hurricane track that was closest to this city.

56) What year, month, and day did the hurricane make landfall?

During the evening before (Friday) the landfall, many of the 37,000 residents of this community were settling down to dinner, few if any of them concerned about the steady 15 mph northerly wind rattling their windows. Within 48 hours, at least 8,000 of the townspeople would be dead, victims of the single worst natural disaster in U.S. history.   (http://www.disasterrelief.org/Disasters/980813Galveston/)

For more information, read the excellent book: *Isaac's Storm: A Man, A Time and The Deadliest Hurricane in History* by Eric Larson, The Crown Publishing Group, 1999, ISBN 0-609-60233-0.

How Many Hurricanes Have Passed Near My Hometown?

The hurricane you just analyzed was not the only hurricane to pass near this city. With a GIS, you can determine how many hurricanes passed near this or any other city. Begin with finding out how many hurricanes passed within 50 miles of Galveston.

First, select the city of Galveston from the usacities theme by clicking on the Hammer/Question mark query tool.

57) What expression should you use to select the city of Galveston?

Select Galveston using your expression above and examine your map. Galveston should be yellow.

Second, create a 50 mile buffer around Galveston by accessing the Theme--> Create Buffers menu. Create a buffer around features of the theme usacities, using only the selected city of Galveston. Save the results in a theme with a name of your choice, such as galv50buff.   This is the area within 50 miles of Galveston.

58) What shape is your Galveston buffer?

59) Why?

Third, clear your definition query from the hurricane tracks theme so you are looking at all of the hurricanes (under Theme--> Properties).

Fourth, make your hurricane tracks theme your active theme and use Theme--> Select by Theme to intersect your buffer and the number of hurricanes.   Examine the table of your hurricane theme when done.

60) How many hurricane tracks passed within 50 miles of Galveston?

61) When was the earliest of these hurricanes?

62) When was the latest of these hurricanes?

Clear the selection from the hurricane tracks theme. Repeat the above four steps to find out how many hurricanes passed within 50 miles of YOUR home town.

63) What town did you investigate, what were your results, and why?

Again, select all themes (hold down SHIFT and single click each one) and clear any selections for all themes. ⊞ Save your project.

Which States in the USA are the Most Vulnerable to Hurricanes?

Zoom to where you can see the United States and all hurricane tracks.

64) Based on your observations, which state is probably the most vulnerable to hurricanes?

FEMA wants you to make an assessment of exactly how many hurricane tracks crossed each state so that you can quantitatively assess the risk in each state. To do this, you will have to create new information, but you will also use some of the functions you used before.

First, go to File--> Extensions and select the Geoprocessing extension. You must check the box to the left of the name for it to become active.

Second, access to the GeoProcessing Extension by selecting: View--> GeoProcessing Wizard. This is the new menu choice that you added by accessing the Geoprocessing extension.

Go to: Assign Data by Location.

Next: Assign data **to** hurricanetracks.shp **from** usastates.shp. Be patient. The GIS has to assign a state name to all hurricane tracks in the USA. If this is too much for your computer, then assign data **to** largehurricanes.shp **from** usastates.shp.

When complete, examine the hurricane tracks table. ⊞

65) What is the name of the first of the new field(s) that has been added?

Click on the state_name field to highlight it, and access the menu Field-->Summarize. Take the defaults and save to a table in your folder. Give it an appropriate name.

Sort the table on "count". ⊞

66) How many states or state equivalents were crossed by hurricanes between 1851 and 2001?

67) Did hurricanes cross over half of the states in the USA?

68) Which state experienced the most hurricanes? Does this correspond with your the visual observation you made earlier? Why or why not?

69) Name two reasons why this state is most vulnerable to hurricanes.

70) Access the Window pull down menu to access the Project window -- the one with views, tables, charts, layouts, and scripts on the left hand side. It should be named "hurricanes.apr" or whatever name you chose for your project. On the left side of the project menu, select charts and click on "New".   Make a chart (graph) based on the SUMMARY table that you just created. Give it an appropriate name in the "name" column. Use "count" as the field and "add" it to the chart. Print the chart.

Go to the hurricane tracks table.   Access the Table menu and select "Remove All Joins"

Select all themes (hold down SHIFT and single click each one) and clear any selections for all themes. Save your project.

Which countries south of the United States are the Most Vulnerable to Hurricanes?

The UN Disaster Relief Organization has contracted with you to make an assessment of how many hurricanes crossed each country, with a focus on Central America so that you can assess the risk in each country. To do this, you will have to create new information, but then you will use some of the functions you used before.

Zoom to where you can see the Caribbean Sea, Mexico, Central America, and northern South America, and the hurricane tracks that crossed these regions.

71) Based on your observations, which country in this region is probably the most vulnerable to hurricanes?

72) What hurricane moved furthest to the west in this area? In what ocean did it end?

To determine which countries are the most vulnerable to hurricanes, first, go to File--> Extensions and make sure that the Geoprocessing extension is on. If you turned it on for the analysis that you did above, it should still be on. You must check the box to the left of the name for it to become active.

Second, access to the GeoProcessing Extension by selecting: View--> GeoProcessing Wizard. This is the new menu choice that you added by accessing the Geoprocessing extension.

Go to: Assign Data by Location.

Next: Assign data **to** hurricanetracks.shp **from** countries.shp. Be patient. The GIS has to assign a state name to all hurricane tracks in the world. If this is too much for your computer, then assign data **to** largehurricanes.shp **from** countries.shp.

When complete, examine the hurricane tracks table.

73) What is the first of the new field(s) to have been added?

Click on the name field (there should be two name fields--you want the one on the right side of the table). After highlighting the name field, access the menu Field-->Summarize. Take the defaults and save to a table in your folder. Give it an appropriate name.

Sort the table on "count".

74) How many countries were crossed by hurricanes between 1851 and 2001?

75) Which country experienced the most hurricanes? Why?

76) Which country south of the United States experienced the most hurricanes? Why?

77) Is this the same country as the one you indicated was the country most vulnerable in your earlier visual assessment?

78) What does the first row in the table represent--the one with no country name given?

79) Change the legend for Hurricanes to map hurricanes as a unique value map using the field "Cat." Based on this map, what were the most severe hurricanes to cross the region south of the United States?

Go to the hurricane tracks table. 🖼 Access the Table menu and select "Remove All Joins"

Select all themes (hold down SHIFT and single click each one) and clear any selections for all themes. 🖼
Save your project.

Which States in Mexico are the Most Vulnerable to Hurricanes?

The UN Disaster Relief Organization has contracted with you to make an assessment of how many hurricanes crossed each state in Mexico. To do this, you will have to create new information just as you did for countries in the world.

Zoom to where you can see Mexico and the hurricane tracks that crossed Mexico.

Use the Add Theme 🖼 tool to add Mexico states. Use the Add Theme 🖼 tool to add Mexico cities. Label some states.

80) Examine the Mexico states table 🖼. How many states are in Mexico?

81) Based on your observation of the map, which state in Mexico is probably the most vulnerable to hurricanes? Why?

82) Based on your observations, which cities in Mexico are probably the most vulnerable to hurricanes? Why?

To determine which states are the most vulnerable to hurricanes, first, go to File--> Extensions and make sure that the Geoprocessing extension is on. If you turned it on for the analysis that you did above, it should still be on. You must check the box to the left of the name for it to become active.

Second, access to the GeoProcessing Extension by selecting: View--> GeoProcessing Wizard. This is the new menu choice that you added by accessing the Geoprocessing extension.

Go to: Assign Data by Location.

Next: Assign data **to** hurricanetracks.shp **from** mexicostates.shp. Be patient. The GIS has to assign a state name to all hurricane tracks in Mexico. If this is too much for your computer, then assign data **to** largehurricanes.shp **from** mexicostates.shp.

When complete, examine the hurricane tracks table. 🖼

83) What is the first of the new field(s) to have been added?

Click on the name field (there should be two name fields--you want the one on the right side of the table).

After highlighting the name field, access the menu Field-->Summarize. Take the defaults and save to a table in your folder. Give it an appropriate name.

Sort the table on "count".

84) How many states in Mexico were crossed by hurricanes between 1851 and 2001?

85) Which state in Mexico experienced the most hurricanes? Why?

86) Is this the same state in Mexico as the one you indicated was the country most vulnerable in your earlier visual assessment?

87) Change the legend for Hurricanes to map hurricanes as a unique value map using the field "Cat." Based on this map, what were the most severe hurricanes to cross Mexico?

Go to the hurricane tracks table.   Access the Table menu and select "Remove All Joins"

Analyzing Hurricane Mitch

The worst hurricane to strike Central America was Hurricane Mitch. Hurricane Mitch struck Central America with such viciousness that it was nearly a week before the magnitude of the disaster began to reach the outside world. Hurricane Mitch will be remembered as the most deadly hurricane to strike the Western Hemisphere in the last two centuries. Not since the Great Hurricane of 1780, which killed approximately 22,000 people in the eastern Caribbean, was there a more deadly hurricane.

Hurricane Mitch is responsible for over 9,000 deaths predominantly from rain-induced flooding in portions of Central America. This makes Hurricane Mitch one of the deadliest Atlantic tropical cyclones in history, ranking only below the 1780 "Great Hurricane" in the Lesser Antilles, and comparable to the Galveston hurricane you analyzed earlier, and Hurricane Fifi of 1974,

As you have done above, apply a definition query under Theme--> Properties on the hurricane tracks theme, this time make the expression ([Name] = "MITCH"]).

88) What countries do you think Hurricane Mitch affected most?

Read the USGS Hurricane Mitch overview on: http://mitchnts1.cr.usgs.gov/overview.html

89) How did your GIS assessment of which countries were most affected match the statements in the USGS overview that you just read?

90) Describe the hurricane track of Mitch, indicating how the hurricane moved over the course of its lifetime.

91) Examine your table. ▦   How long did this hurricane last?

92) What were the dates of Hurricane Mitch?

Go to the hurricane tracks table. ▦   Access the Table menu and select "Remove All Joins"

Select all themes (hold down SHIFT and single click each one) and clear any selections for all themes. ▣
Save your project.

Which World Cities are the Most Vulnerable to Hurricanes?

Next, the UN Disaster Relief Organization wants you to make an assessment of how many hurricanes passed close to world cities. The distance criteria is 50 miles.
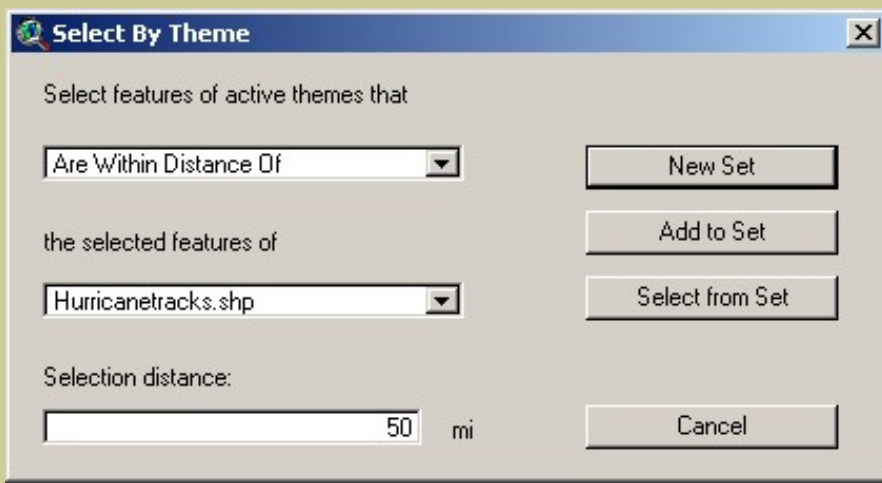
Use the Add Theme ⊞ tool to add world cities. Make it active by single-clicking on it.

Access its table. ▦

93) How many cities are in the data set?

94) How many of these cities do you estimate are within 50 miles of a hurricane track?

Use the Theme--> Select By Theme menu to select cities that are within 50 miles of a hurricane track, as follows:

Select By Theme ✕

Select features of active themes that

| Are Within Distance Of ▼ |

| New Set |

the selected features of

| Hurricanetracks.shp ▼ |

| Add to Set |

| Select from Set |

Selection distance:

| 50 | mi

| Cancel |

95) Examine the map when done. What is the pattern of the selected (yellow) cities?

96) Examine the table for cities. 🗔 How many cities are selected?

97) How does this compare to your earlier estimate?

Determine the population that resides in these cities. In the table, select (click on) the field population. Then access the menu Field-->Statistics and examine your new data summary.

98) How many people live in these cities?

99) Name three things you might do to make these cities safer from hurricanes.

Save your project, close your project, and exit ArcView GIS.

100) Summarize in a few sentences what you have learned about hurricanes in this lesson.

101) Summarize in a few sentences what you have learned about GIS in this lesson.

Back to USGS Rocky Mountain Mapping Center Education

U.S. Department of the Interior
U.S. Geological Survey
Rocky Mountain Mapping Center
Maintainer:webmaster@rockyweb.cr.usgs.gov
URL:http://rockyweb.cr.usgs.gov /public/outreach/gislessons/hurricanelesson_3.html
Last modified: 7 September 2004