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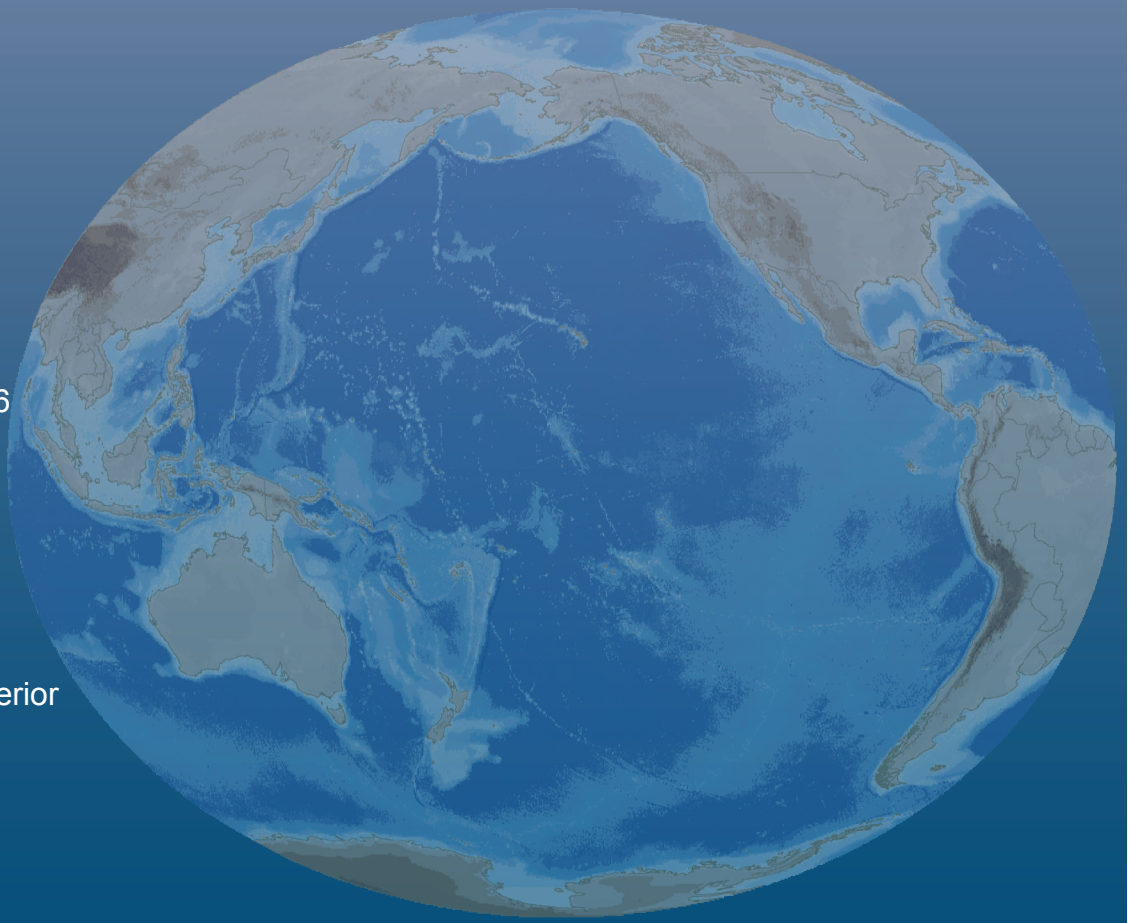
CROWDING THE RIM Understanding Risk

HAZPAC | An Interactive Map of Pacific Rim Natural Hazards, Population, and Infrastructure

HAZPAC User Guide: ArcExplorer Version

By: Brynn L. Bemis, Heather V. Goss, Eric S. Yurkovich, Taylor J. Perron, *and* David G. Howell

Prepared in cooperation with: American Red Cross, Circum-Pacific Council, *and* Stanford University



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HAZPAC User Guide: ArcExplorer Version

This **HAZPAC Tutorial** will familiarize you with the data layers and functions contained in the ArcExplorer version of HAZPAC. It also contains examples and suggestions as to how HAZPAC can be used to address issues of *Crowding the Rim* (for example, to identify potential intersections of natural hazards, population centers, and areas of economic value).

This version of HAZPAC requires that you have ArcExplorer 2.0 software (Windows version) installed on your Windows PC. ArcExplorer can be installed directly from this HAZPAC CD-ROM (follow instructions in '1_README_ARCEXPLORER.TXT'), or it can be downloaded free from ESRI at http://www.esri.com/software/arcexplorer/download2.html.

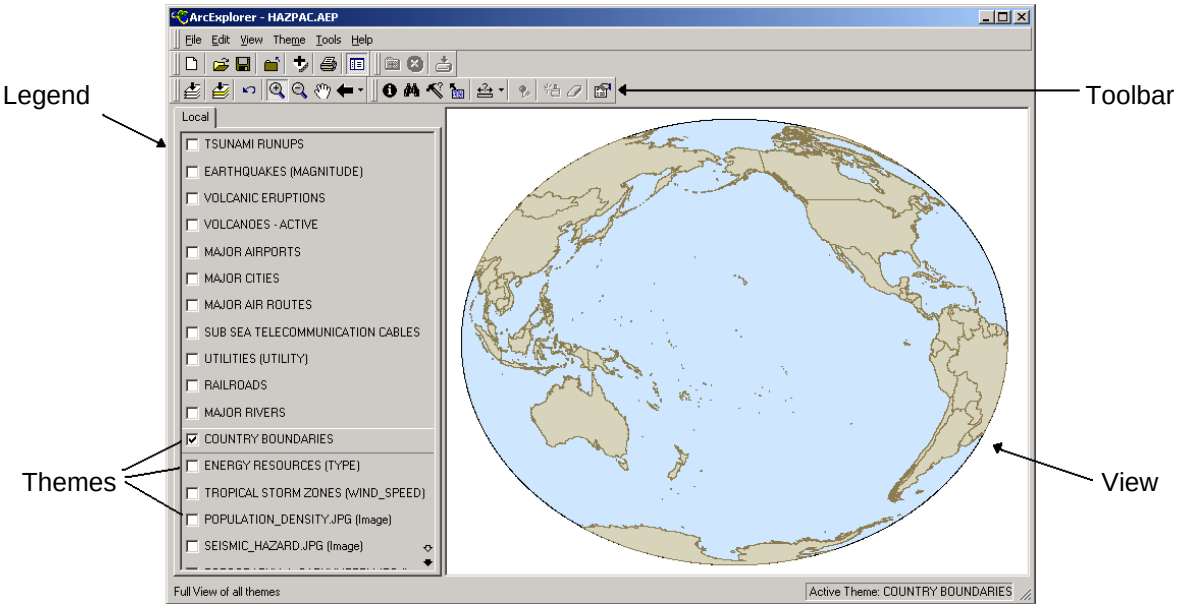
For detailed descriptions of any of the terms used in this tutorial, please consult the sections entitled **Components of the Interface**, **Data Types**, or **Buttons and Tools**, in the **HAZPAC User Reference Guide** below. For more general information on using ArcExplorer software, please refer to the ArcExplorer User Guide ('UserGuide_ArcExplorer20.pdf'), a PDF file that comes with ArcExplorer software, whether it is installed from this CD-ROM or downloaded from ESRI. If you should experience installation problems, the User Guide ('arcexplorer.pdf') also may be downloaded separately from ESRI at http://www.esri.com/software/arcexplorer/arcexplorer.pdf.

HAZPAC Tutorial (ArcExplorer version)

Concept One: Opening HAZPAC and Recognizing Components of the Interface

To open HAZPAC, double-click on the file 'HAZPAC.AEP,' located in the 'HAZPAC_ARCEX' folder.

HAZPAC will open in a window that consists of the following interface components: the ***View*** on the right, the ***Legend*** on the left, and the ***Toolbar*** on top.



When HAZPAC is first opened, the ***View*** displays a map showing the Pacific Ocean and the surrounding Pacific Rim countries. The ***Legend*** lists the names of the ***Themes*** that are contained in HAZPAC. Themes are layers of information that can be displayed interactively on the map.

The ***Toolbar*** contains a series of ***Buttons*** and ***Tools*** that allow you to perform certain functions, such as zooming in and out, selecting features, and displaying attribute information. The following sections contain exercises that will help familiarize you with these functions.

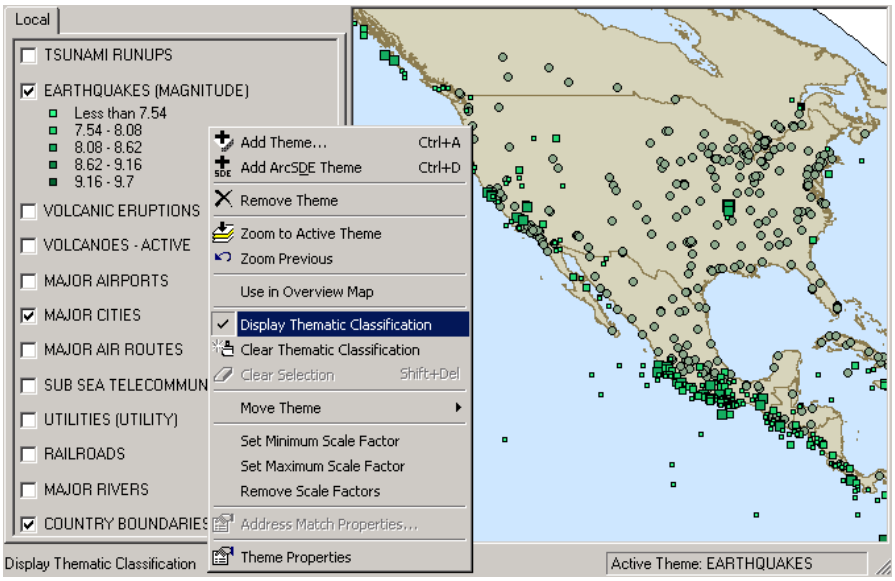
Concept Two: Displaying Data Layers and Symbols

When HAZPAC is first opened, the Themes 'Country Boundaries,' 'Countries,' and 'Water' are automatically displayed in the View. You may add or subtract Themes from the View by turning them on and off in the Legend. To turn a Theme on, check the box to the left of that Theme name. To turn it off, uncheck the box.

Themes can overlap one another in the View, so you may display more than one Theme at the same time. Try turning on and off different Themes to display several at once. You may also change the way Themes overlap by rearranging the order of Themes in the Legend. To display a particular Theme "on top" of all other Themes, drag that Theme name to the top of the Legend. Try moving Themes around in the Legend to see how this changes the display in the View.

To display an explanation of the symbols that are used to show information in the various Themes, "right-click" on a particular Theme name, then select 'Display Thematic Classification.' The symbols and, if applicable, their values will display below each Theme name in the Legend. For Themes that use different symbols to display more than one classification of data, the type of data classification is given in parentheses after the Theme name.

You may interact with an "active" Theme, meaning that you can query information about that Theme, or perhaps perform a mathematical or logical operation using its data. To activate a Theme, click on its name (not its check box). An active Theme will appear "raised" in the Legend.



The HAZPAC View and Legend. In the View, the Themes 'Major Cities' and 'Earthquakes' are displayed (in addition to 'Countries,' 'Country Boundaries,' and 'Water'). In the Legend, the explanation for the 'Earthquakes' Theme is displayed (after having checked the box next to 'Display Thematic Classification' in the sidebar menu, as shown). The classification of information that is shown in the explanation for the 'Earthquakes' Theme is the 'Magnitude' of the earthquake (shown in parentheses after the Theme name).

Concept Three: Changing the View Extent

The Toolbar contains a series of Buttons and Tools that perform various functions, such as zooming in and out and selecting and viewing data. Buttons require only one click to perform their operation. Tools need to be activated and then used directly on the map.

Try navigating around the map using the 'Zoom In' tool and the 'Zoom Out' tool. To use one of these tools, click on the tool and then click on a point on the map. With the 'Zoom In' tool, you also have the option of zooming in to a particular area by clicking and holding down the mouse and then dragging the mouse to draw a box around the desired area.

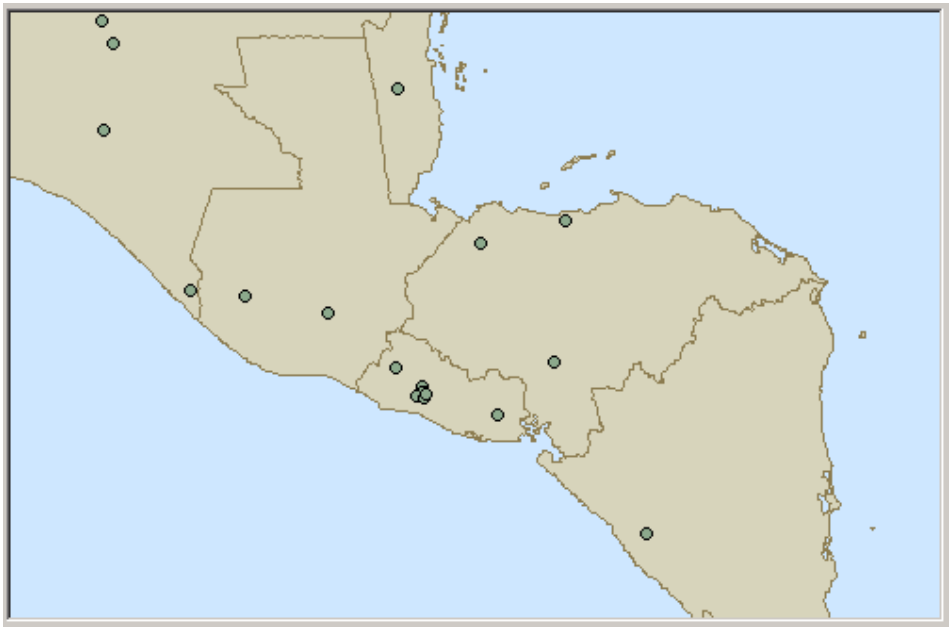
Also try the 'Zoom to Full Extent' button, 'Zoom to Previous Extent' button, and 'Pan' tool. For more information on using each of these buttons and tools, please consult **Buttons and Tools** in the **HAZPAC User Reference Guide** below.

With the 'Countries,' 'Country Boundaries,' and 'Water' Themes displayed, try zooming in to your own country. Now display the 'Major Cities' Theme. Can you find your own city? For help in identifying your city, please see **Concept Five: Identifying Features**.

Concept Four: Recognizing Different Types of Data

HAZPAC Themes display data in one of two ways, either as discrete ***Features*** or as continuous ***Grids***.

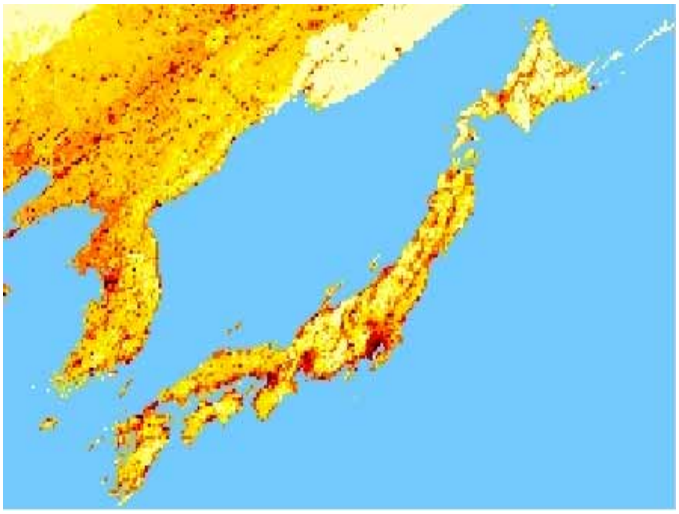
Features represent data types that are best displayed by either points (for example, earthquakes and volcanoes), lines (for example, railroads and power lines), or polygons (for example, countries and storm zones). Each Feature is represented by a symbol (for points and lines) or a colored area (for polygons). In addition, every Feature has associated with it a location and one or more types of information. For example, some of the types of information that are included for Features in the 'Major Cities' Theme are the name of the city, its population, and its latitude and longitude. For information on different ways to view the information associated with a Feature, please see **Concept Five: Identifying Features**.



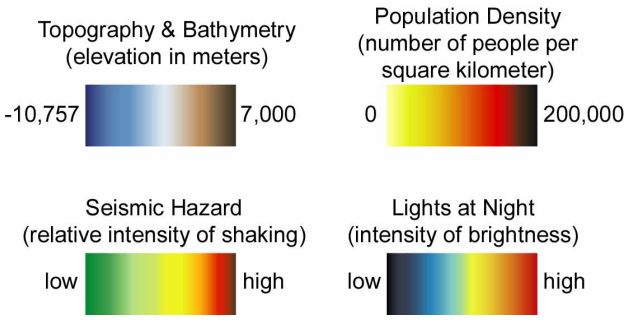
Four Feature Themes are displayed in this map of Central America: 'Major Cities' (displayed as points), 'Country Boundaries' (displayed as lines), and 'Countries' and 'Water' (displayed as polygons).

Grids display information that is best shown as a continuous surface rather than as discrete points, lines, or polygons. This type of data is composed of pixels (cells) arranged in a grid pattern and organized into rows and columns. Each cell has a unique value that applies to the entire area of the cell, and each value is shown in a different color.

In ArcExplorer, Grids are displayed as images only, which means that you will not be able to interact with the cells in the Grids or display their explanations in the Legend. However, the explanations for all the images in HAZPAC can be viewed in the file 'COLORMAP.JPG' (located on this CD-ROM in the folder 'HAZPAC_ARCEX\DATA\IMAGE').



At left, the 'Population Density' Grid image shows the population density of Japan, North and South Korea, and parts of China and Russia. Below, the explanation for the 'Population Density' Grid image is shown along with all the other explanations for the HAZPAC Grid images in the file 'COLORMAP.JPG.'

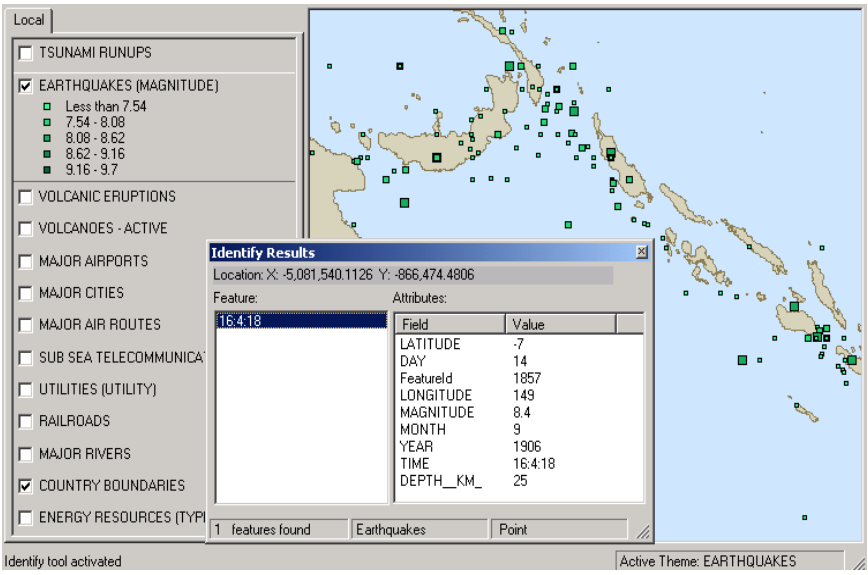


Try displaying some of the different HAZPAC Themes. Notice which Themes contain point Features, line Features, or polygon Features. Also, notice which Themes are Grid images.

Concept Five: Identifying Features

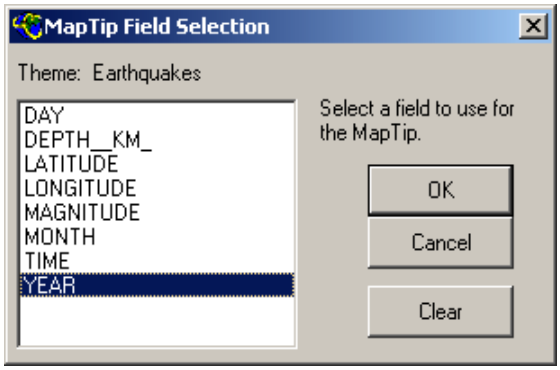
HAZPAC allows you to display information about Features in a Theme. With the 'Countries,' 'Country Boundaries,' and 'Water' Themes displayed, display and then activate the Theme 'Earthquakes.' Now zoom in to your country. Have there been many earthquakes in your country?

Use the 'Identify' tool to view data in HAZPAC Themes. Click on the 'Identify' tool, and then click on an earthquake in your country. An 'Identify Results' window will open, which contains information about that earthquake. Each piece of information about a Feature is called an ***Attribute***. On the right side of the window, the Attributes are shown in two columns, ***Field*** (for example, 'Magnitude' and 'Year') and ***Value*** (for example, '8.4' and '1906').



In some Themes (for example, 'Earthquakes'), several Features may overlap one another on the map. If you click on one of the overlapping Features with the 'Identify' tool, all the other overlapping Features will be listed in the ***Feature*** column, which is on the left side of the 'Identify Results' window. Click on each individual Feature to view the different Attributes for each Feature.

The 'Map Tips' tool provides a easy way to view information about Features in a Theme. To use the 'Map Tips' tool, first display and then activate a Theme of interest, such as 'Earthquakes,' then click on the 'Map Tips' tool. A 'Map Tip Field Selection' window will open, which lists the Attribute Fields for that Theme. Choose an Attribute Field of interest, such as 'Year,' and then click 'OK.' Now, as you move the cursor around the map, the year in which a particular earthquake occurred will pop up if you pause the cursor on that earthquake.

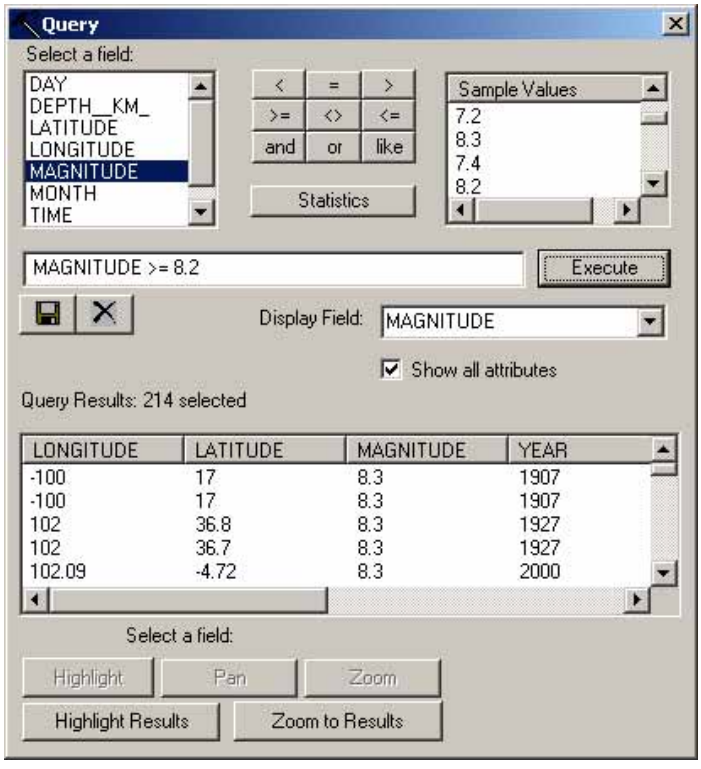


Unfortunately, because ArcExplorer can only display Grids as images, you will not be able to access any more information from a Grid Theme than the visual display of the image.

Concept Six: Querying Data

Another way HAZPAC lets you view information in a Theme is with the 'Query Builder' button. For example, the 'Earthquakes' Theme contains all the recorded earthquakes of magnitude 6.0 or larger that have occurred since the year 782 B.C. If you are interested in viewing only the earthquakes that have, for instance, a magnitude of 8.2 or larger, you can choose to select and display just these earthquakes.

To do so, first display and then activate the 'Earthquakes' Theme. Click on the 'Query Builder' button, and a 'Query' window will open, which will enable you to establish your own criteria for what is displayed on the map. You will build your query as a simple mathematical or logical expression. For each query, you will select or enter an ***Attribute Field*** (for example, 'Magnitude'), an ***Operator*** (for example, '>='), and a ***Value*** (for example, '8.2').

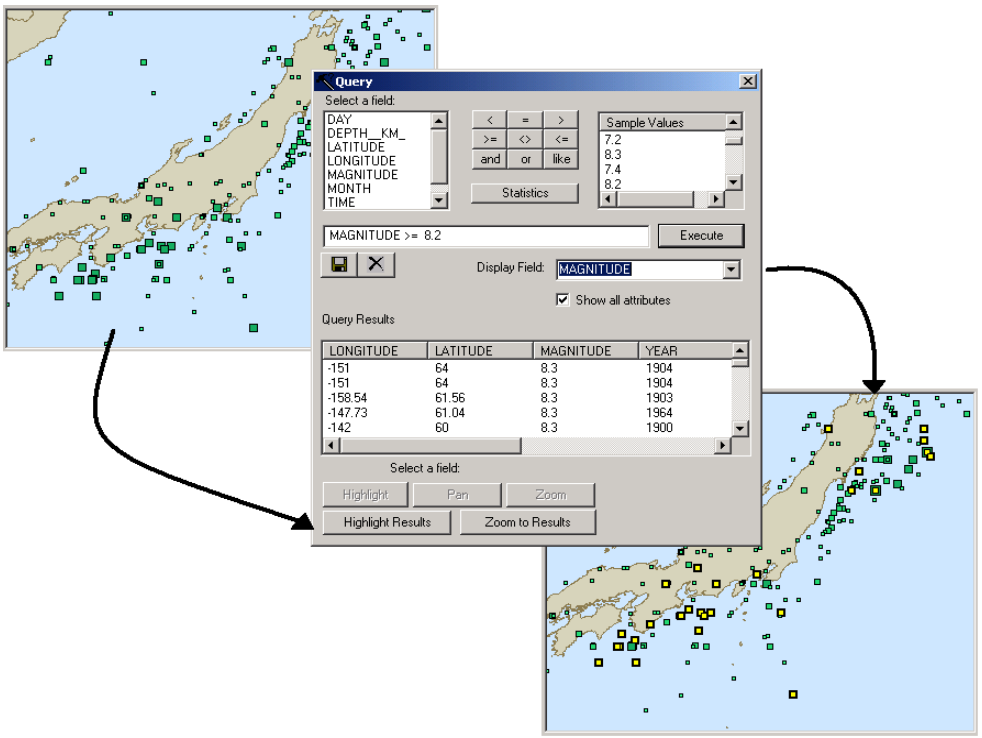


To build your query, use the buttons provided in the 'Query' window. First, click the 'Magnitude' Attribute Field, then the '>=' Operator. You should now see 'Magnitude' and '>=' in the dialog box. To complete the expression, place your cursor in the dialog box and simply type the value '8.2' (you might also try choosing this value or another from the ***Sample Values*** list). Your expression should now read 'Magnitude >= 8.2' in the dialog box.

When you are satisfied that the expression is properly written, click the 'Execute' button. ArcExplorer will now select all earthquakes that have magnitudes greater than or equal to 8.2.

To display the selected set of earthquakes on the map, click the 'Highlight Results' button in the 'Query' window. The selected set of earthquakes will now be highlighted in yellow.

To view all the Attribute information about the selected set of earthquakes, check the 'Show all attributes' box in the 'Query' window. You will now see all the Attribute Fields and Values listed in the 'Query Results' box. If desired, you may sort or re-sort these lists of values to obtain additional information. For example, to see information about the most recent earthquake in the selected set, click once on the 'Year' Attribute Field heading in the 'Query Results' box. The most recent earthquake will now appear at the top of the list. To see the oldest earthquake in the selected set, click on the 'Year' heading again. What was the magnitude of the oldest earthquake in the selected set?



In the upper left image, all Japan's historic earthquakes are displayed. In the middle image, the 'Query' window is set up to select only earthquakes that have magnitudes greater than or equal to 8.2. The lower right image shows the selected earthquakes highlighted in yellow.

If desired, you may view the Attribute information about an individual highlighted earthquake. To do so, keep the 'Query' window open, and then click on the 'Identify' tool. Now click on a particular earthquake. A new 'Identify Results' window will open that lists the Attributes for that particular earthquake.

Experiment with the 'Query Builder' button and 'Identify' tool to answer the following questions:

1. How many recorded earthquakes have occurred since the year 1996? Before the year 1800?
2. Only one earthquake has had a recorded magnitude equal to 9.0. In what year did it occur? At what depth did it occur?
3. What is the largest magnitude earthquake ever recorded? In what year did it occur? In what country did it occur?

Additional Questions and Activities to Encourage Further Exploration with HAZPAC

The following questions are examples of the types of questions that HAZPAC can help you to answer or visualize. They are intended to stimulate thinking beyond just the data contained in HAZPAC.

Natural Hazards and Your City

1. When did the most recent earthquake occur near your city?
2. When did the most recent volcanic eruption occur near your city?
3. What natural hazards do you think may have the most potential impact on your city?
4. How do you think your city compares with other Pacific Rim cities in terms of its susceptibility to natural hazards?
5. Can you think of any other natural hazards that potentially might affect your city but that have not been included in HAZPAC? What might they be?

Geographical Comparisons of Natural Hazards

1. How are the various types of natural hazards distributed geographically?
2. How do you think earthquakes and volcanoes are related to topography and bathymetry?
3. What do you think is the level of natural hazard threat to Tokyo, Japan, compared with that of San Francisco, USA? Melbourne, Australia? Lima, Peru?

Relation of Natural Hazards to Population, Infrastructure, and Economic Value

1. Do you notice any patterns in the geographical distribution of cities? What do you think may be some of the conditions that favor the development of cities?
2. What similarities or differences do you notice about the locations of Tokyo, Japan, compared with San Francisco, USA? Melbourne, Australia? Lima, Peru?
3. What are the busiest airports (in terms of cargo load) in the Pacific Rim region?
4. Can you identify any major air routes that potentially may be affected by volcanic eruptions?
5. What do you notice about the distribution of railroads, telecommunication cables, and utilities? What do you think may be some of the factors that affect their distribution?
6. How are energy resources distributed around the Pacific Rim? How do you think their distribution relates to the location of cities? Railroads? Utilities?
7. Can you think of other types of natural resources that have not been included in HAZPAC? What do you think might be their relation to the locations of cities?
8. How do you think topography relates to population centers? Infrastructure? Economic value?
9. How do you think transportation corridors relate to natural hazards?

Notes on datasets included in HAZPAC

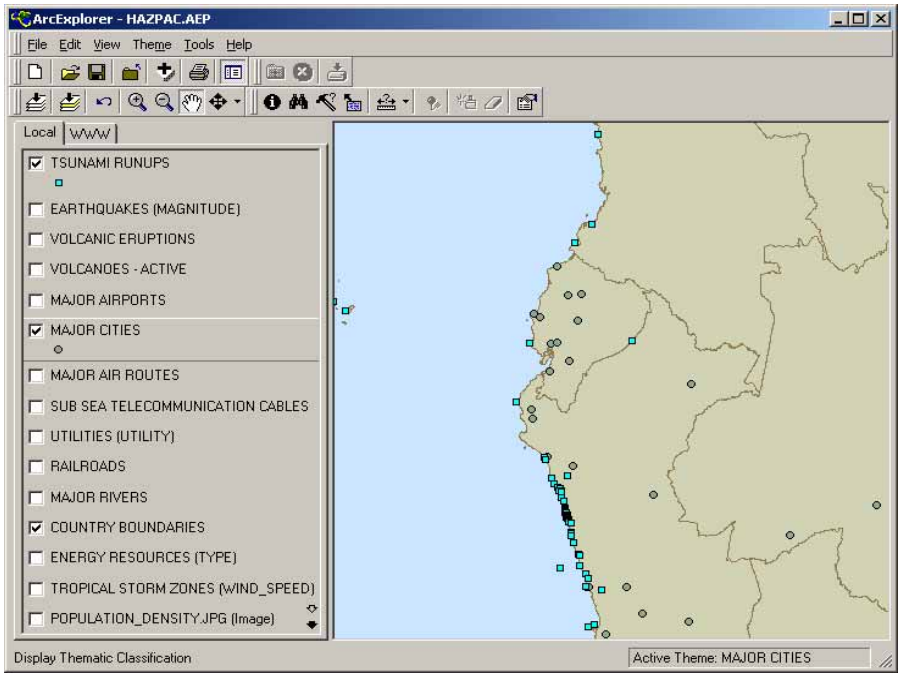
For more information on the data that are included in the ArcExplorer version of HAZPAC, as well as detailed information on data sources and formats, please consult the file 'METADATA_AX.TXT,' which is located on this CD-ROM in the folder 'HAZPAC_ARCEX\DATA.' The datasets in HAZPAC, which are all public domain, contain data for the entire Pacific Rim region, although some datasets (for example, utilities and railroads) display certain areas in more detail than others. In order to maintain a roughly analogous level of data representation throughout the entire Pacific Rim region, some detailed data that may have been available for certain areas were not included in HAZPAC if little or no data were available for other areas. Datasets pertaining to flooding, economic value, migrations, and other highly relevant issues were either not available or not accessible on a global scale. HAZPAC does, however, allow you to add additional datasets and to customize your own HAZPAC maps to reflect your particular interests.

HAZPAC User Reference Guide (ArcExplorer Version)

HAZPAC User Reference Guide (ArcExplorer version)

Components of the Interface

View:
The View contains the interactive map that is seen upon opening HAZPAC. This window allows the user to display and analyze different data layers, or to select either individual or groups of features for further study.



At right, the HAZPAC interface: the View window (containing the map) on the right, the Legend (listing the data layers) on the left, and the Toolbar on top.

Legend:
The Legend lists the names of the data layers that can be displayed interactively on the map. A data layer can be turned on or off by checking or unchecking the box next to its name.

Theme:
A Theme is a geographically referenced data layer (for example, 'Earthquakes' or 'Railroads') and its associated symbology. A Theme can be displayed on the map, and its data can be selected and queried. In the above figure, the 'Tsunami Runups' and 'Major Cities' Themes are displayed (in addition to 'Countries,' 'Country Boundaries,' and 'Water').

Active Theme:
The Active Theme is the current Theme upon which certain operations can be performed. To "activate" a Theme, click on the name of the Theme in the Legend. An Active Theme will appear "raised" in the Legend. In the above figure, 'Major Cities' is the Active Theme.

Explanation:
An Explanation shows the graphical elements, and, if applicable, their associated data values, that have been chosen to display the data in a Theme. If the Explanation for a particular Theme is displayed, it will appear beneath the Theme name in the Legend. In the above figure, the Explanations for the 'Tsunami Runups' and 'Major Cities' Themes are displayed.

Toolbar:
The Toolbar contains a series of Buttons and Tools that perform various functions, such as zooming in and out and selecting and viewing data. Buttons require only one click to perform their operation. Tools need to be activated and then used directly on the map.

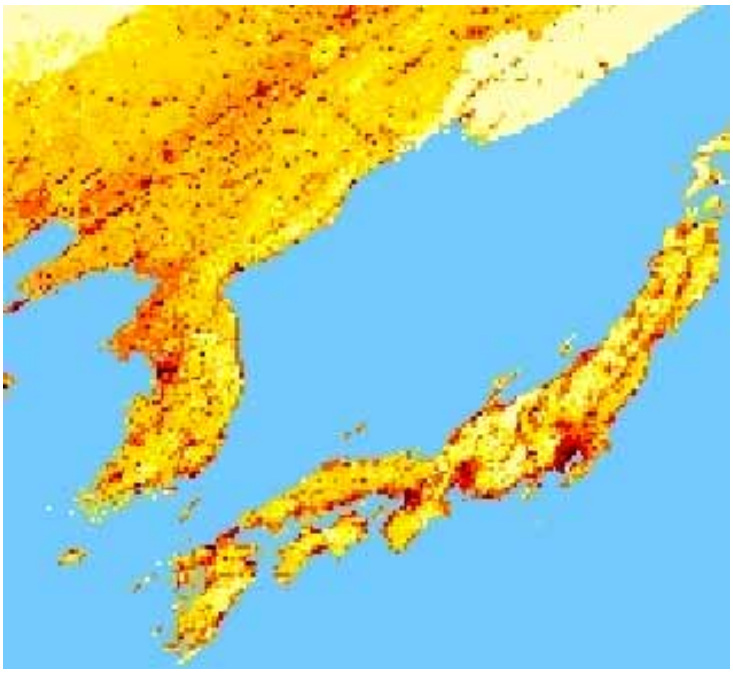
Data Types

HAZPAC Themes display data in two different forms, as ***discrete features*** or as ***continuous grids***.

Discrete features:
Discrete features are individual objects (such as cities or volcanoes) or events (such as earthquakes or volcanic eruptions) that have a specific geographic location. Discrete features are represented by points, lines, and polygons. Examples of discrete features included in HAZPAC are illustrated at right: cities, which are represented by points; railroads and country boundaries, which are represented by lines; and countries and water, which are represented by polygons.

Above, a few of the discrete features in HAZPAC: the greenish-gray dots are cities, and the reddish-brown lines are railroads.

Continuous grids:
Continuous grids best display information in the form of a surface, rather than as individual points, lines, or polygons. Continuous grids are composed of pixels (or cells), each with a unique value, that are arranged in a grid pattern and organized into rows and columns. ArcExplorer displays grids as images in which the different colors in the image indicate different data values. For example, in the population-density image shown at right, the darkest red color indicates areas of highest population density, whereas the lightest yellow color indicates the most sparsely populated areas.



Above, an example of continuous grid data (displayed as an image) in HAZPAC: the pixels (or cells) represent population density; the darkest red areas are more densely populated than the lightest yellow ones.

Buttons and Tools

Below are descriptions of some of the Buttons and Tools in the HAZPAC ArcExplorer interface. Buttons and Tools allow the user to change the map view or perform various functions on the data. For more complete descriptions of all of the Buttons and Tools available in ArcExplorer, please consult the ArcExplorer User Guide ('UserGuide_ArcExplorer20.pdf'), a PDF file that comes with ArcExplorer software.

Note: *To use a button function, the user simply clicks once on the icon. To use a tool, the user must first "activate" the tool function by clicking on the icon before clicking on the map.*

 **Add Theme(s) to View Button** opens an 'Add Theme(s)' window that allows the user to choose one or more additional Themes to add to the View.

 **Toggle Display of Legend Button** opens and closes the Legend.

 **Zoom to Full Extent Button** displays the entire HAZPAC Circum-Pacific map.

 **Zoom to Active Theme Button** zooms to the extent of the presently active Theme.

 **Zoom to Previous Extent Button** zooms to the most recently viewed extent.

 **Zoom In Tool** allows the user to view a portion of the map in more detail. Click to "activate" the 'Zoom In' tool, then click once on a location. The display will then zoom in, centering on that location. Alternately, activate the 'Zoom In' tool, then hold down the mouse button and drag a box around an area of interest. Release the mouse button, and the display will then zoom in to that area of interest.

 **Zoom Out Tool** allows the user to view more of the map in less detail. Click to "activate" the 'Zoom Out' tool, then click once on a location. The display will then zoom out, centering on that location.

 **Pan Tool** allows the user to move the map view in any direction without zooming in or out. Click to "activate" the 'Pan' tool, then hold down the mouse button and drag the map view in the desired direction. Release the mouse button, and the display will redraw the new map view.

 **Pan Direction Button Menu** allows the user to choose a 'Pan Direction' button. Click on the small triangle to the right of the 'Pan Direction Button Menu' icon, and the following 'Pan Direction' button choices will become visible and, thus, available. Note that the chosen 'Pan Direction' button will remain active on the Toolbar until another one is chosen.

 **Pan North Button** pans the map view to the north.

 **Pan South Button** pans the map view to the south.

 **Pan East Button** pans the map view to the east.

 **Pan West Button** pans the map view to the west.

Identify Tool allows the user to display all the information (or Attributes) about a particular Feature. To use this tool, first "activate" a Theme of interest, then click on the 'Identify' tool, and then click on a Feature of interest. An 'Identify Results' window will open that lists all the Attributes of the Feature. In some cases, multiple events (such as historic volcanic eruptions) have been recorded at the same location on the map. In such cases, the 'Identify Results' window will list each event, each of which you can examine individually.

Find Features Button opens a window that allows the user to find Features in a Theme by searching for a particular (non-numeric) text string. Click on the 'Find Features' button, and a 'Find Features' window will open. To search for a piece of information, first type in a text string to find, then select the type of search, and then select which Theme(s) in which to search. Click on the 'Find' button, and ArcExplorer will list all the Features that contain that text string in the 'Pick a feature' box below. To view a particular Feature in the map display, select it from the list of Features, then click on the 'Highlight' button, and then on either the 'Pan To' or 'Zoom To' button.

Query Builder Button allows the user to select and display Features by creating a question, or query, to define precisely which Features to select and display. To use this button, "activate" a Theme of interest, then click on the 'Query Builder' button. A 'Query' window will open in which to build a query expression. First, click on the field name, then click on an operator (for example, '>' or '='), and then type a value to complete the expression. Click on the 'Execute' button, and ArcExplorer will list all the Features that fit those characteristics in the 'Query Results' box below. To view all the Attributes for the selected features, check the 'Show all attributes' box. To display the selected features on the map, click on the 'Highlight Results' button.

Map Tips Tool provides a quick and easy way to view information, or Attributes, about Features in a Theme. To use this tool, first "activate" a Theme of interest, and then click the 'Map Tips' tool. A 'Map Tip Field Selection' window will open, which lists the Attribute fields for that Theme. Choose one type of information, or Attribute, and then click 'OK.' Now, as the cursor moves around the map, the Attribute Value for the specified Attribute Field will pop up if the cursor pauses above a Feature.

Measure Distance Tool Menu allows the user to choose a 'Measure Distance' tool. Click on the small triangle to the right of the 'Measure Distance Tool Menu' icon, and the following 'Measure Distance' tool choices will become visible and, thus, available. Note that the chosen 'Measure Distance' tool will remain active on the Toolbar until another one is chosen. To measure the distance between two points, select a 'Measure Distance' tool, then click and, holding down the mouse button, drag a line between two points on the map. The distance between the two points will be displayed in the upper left-hand corner of the map view. Note that the measured distances are approximate and will contain a certain amount of error owing to the projection of the data and the resolution of the map view.

Measure Distance in Feet Tool measures the distance in feet between points on the map.

Measure Distance in Miles Tool measures the distance in miles between points on the map.

Measure Distance in Meters Tool measures the distance in meters between points on the map.

Measure Distance in Kilometers Tool measures the distance in kilometers between points on the map.