



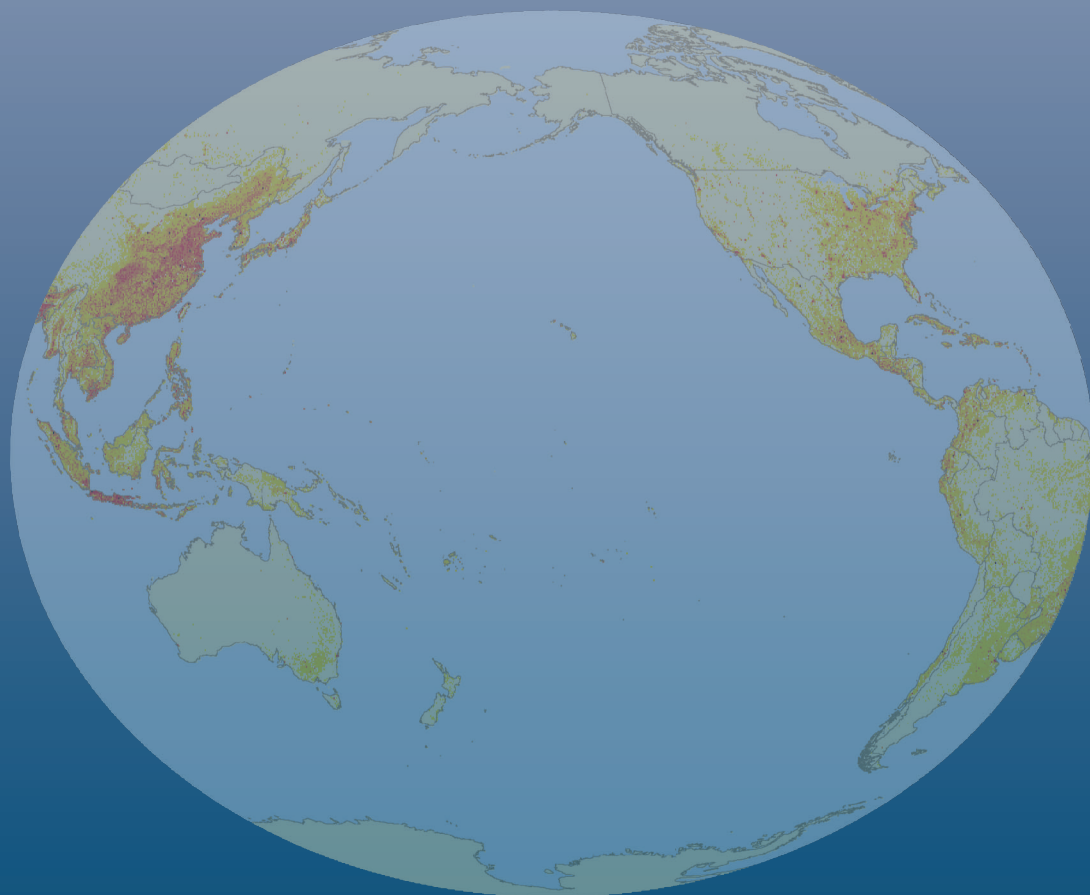
HAZPAC

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

HAZPAC User Guide: ArcView 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



Digital Data Series DDS-76
Version 1.0

2002

U.S. Department of the Interior
U.S. Geological Survey



HAZPAC User Guide: ArcView Version

This **HAZPAC Tutorial** will familiarize you with the data layers and functions contained in the ArcView version of HAZPAC. It also contains examples and suggestions 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).

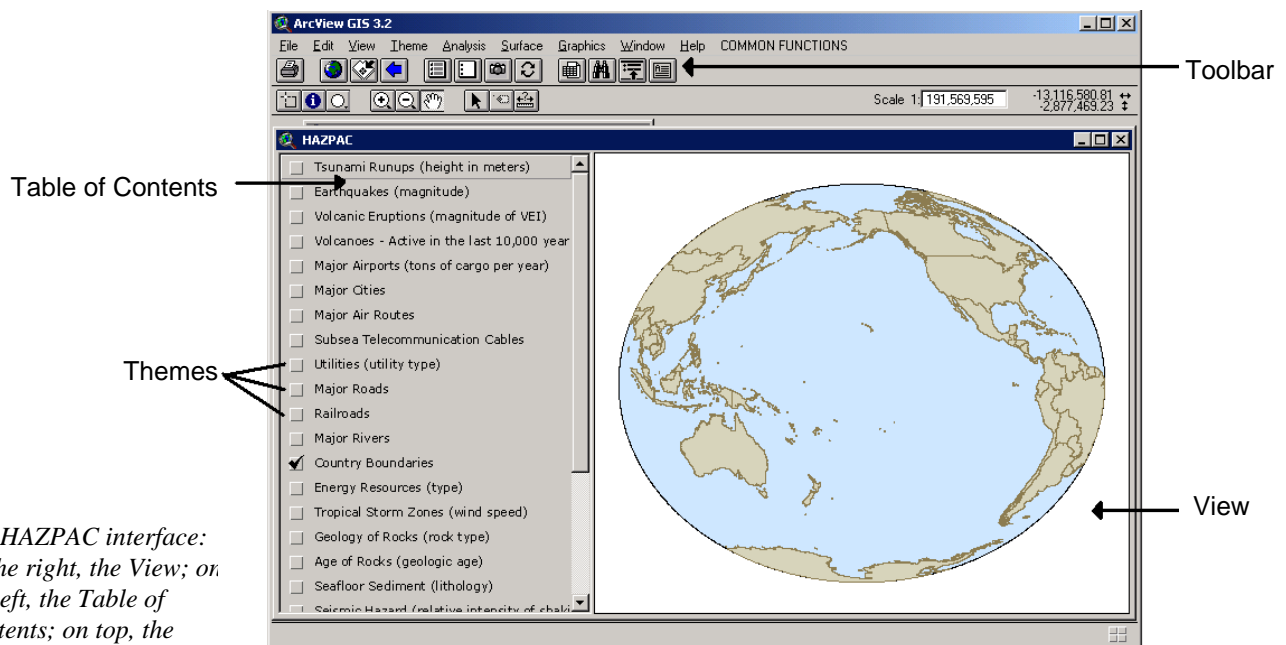
The ArcView version of HAZPAC requires that you have ArcView 3.x software (Windows version) installed on your Windows PC. For information on how to obtain ArcView 3.x software, please contact ESRI directly at <http://www.esri.com/software/arcview/index.html>.

Two ArcView HAZPAC versions are included on this CD-ROM, both of which are located in the 'HAZPAC_ARCVIEW' folder. One version ('HAZPAC_ARCVIEW.APR') is suitable for use with ArcView Spatial Analyst, which will enable you to query the data in the Grid Themes or use their data for analysis. In the other version ('HAZPAC_NOSPATIALANALYST.APR'), the Grid Themes have been replaced by images. For information on how to obtain the ArcView Spatial Analyst extension, please contact ESRI directly at <http://www.esri.com/software/arcview/extensions/spatext.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, Tools, and Common Menu Functions**, in the **HAZPAC User Reference Guide** below. For more general information on using ArcView software, please consult the user manual that accompanies your ArcView software.

HAZPAC Tutorial (ArcView version)

Concept One: Opening HAZPAC and Recognizing Components of the Interface



To open the Spatial Analyst version, double-click on the file 'HAZPAC_ARCVIEW.APR.' To open the non-Spatial Analyst version, double-click on the file 'HAZPAC_NOSPATIALANALYST.APR.' Both files are located in the 'HAZPAC_ARCVIEW' folder.

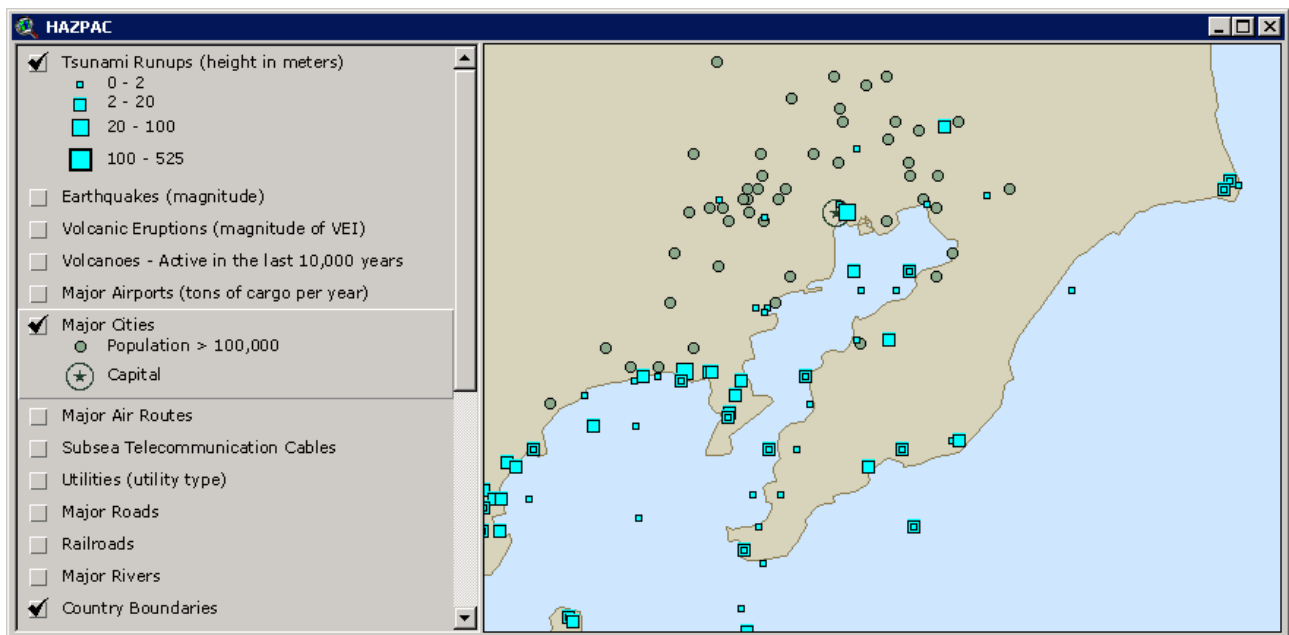
When HAZPAC is first opened, the **View** displays a map showing the Pacific Ocean, the Pacific Islands and the surrounding Pacific Rim countries. The **Table of Contents** lists the names of the **Themes** that are contained in HAZPAC. Themes are layers of information that can be displayed on the map and whose data or visual display can be used for analysis.

The **HAZPAC Toolbar** contains a series of customized **Buttons** and **Tools** that allow you to perform certain functions, such as zooming in and out, selecting features, and displaying tabular data. **Buttons** require only one click to perform their operation. **Tools** need to be activated and then used directly on the map. 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 'Countries,' 'Country Boundaries,' and 'Water' are automatically displayed in the View. You may add or subtract Themes from the View by turning Themes on and off in the Table of Contents. 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 Table of Contents. To display a particular Theme "on top" of all other Themes, drag that Theme name to the top of the Table of Contents. Try moving Themes around in the Table of Contents to see how this changes the display in the View.





The HAZPAC View and Table of Contents. In the View, the Themes 'Major Cities' and 'Tsunami Runups' are displayed (in addition to 'Countries,' 'Country Boundaries,' and 'Water'), and their legends are shown in the Table of Contents. 'Major Cities' is the active Theme.




You may interact with an "active" Theme, meaning that you can query information about that Theme, or perform a mathematical or logical operation using its data. Click on a Theme name to activate it, or "shift-click" to activate more than one. An active Theme will appear "raised" in the Table of Contents.

The 'Show/Hide Legend' button  will display a Legend of the symbols that have been chosen to show information in the various Themes. To display the Legend for a particular Theme, first "activate" the Theme and then click the 'Show/Hide Legend' button. The symbols and their values will display below each Theme name in the Table of Contents (to hide the Legend, simply click the 'Show/Hide Legend' button again). 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.

Concept Three: Changing the View Extent

The HAZPAC Toolbar contains a customized 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'  and 'Zoom Out'  tools. To use these tools, click on the tool and then click on a point on the map, and the display will redraw, centered on that point. 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, Tools, and Common Menu Functions** 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 or a city near to you? For help in identifying your city, please see **Concept Five: Identifying Features and Grid Values**.

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, cities and volcanoes), lines (for example, roads, and power lines), or polygons (for example, countries and storm zones).

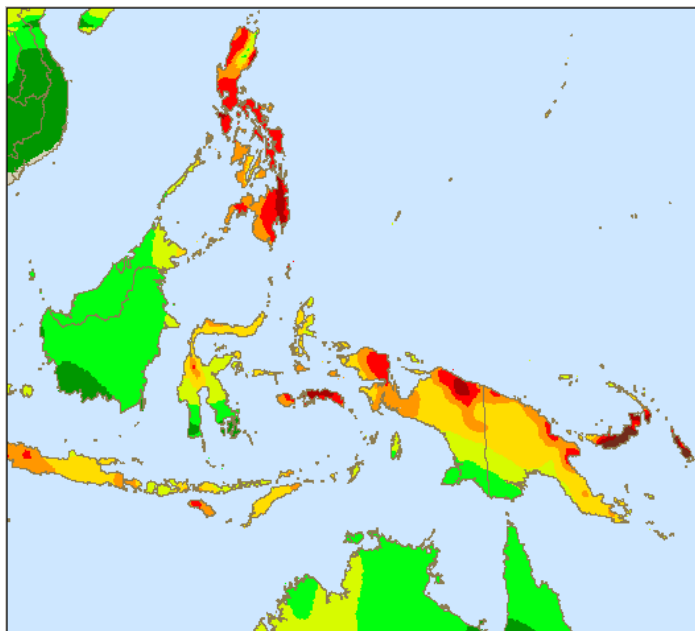
Four Feature Themes are displayed in this map of Central America: 'Major Cities' (displayed as points), 'Country Boundaries' (displayed as lines), and 'Countries' and 'Water' (displayed as polygons). Capital cities are shown as circled stars. In addition, names of countries and capital cities have been added as labels.



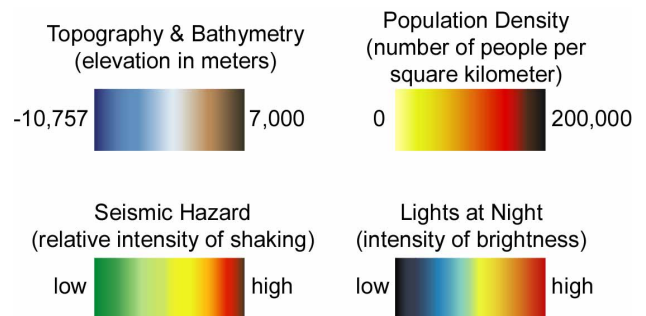
Each Feature is represented by a symbol (for points and lines) or a colored or patterned area (for polygons). In addition, every Feature has associated with it a location and one or more types of information. For example, some of the types of information included for Features in the 'Major Cities' Theme are the name of the city, its population, and its latitude and longitude. For information on ways to view the information associated with a Feature, please see **Concept Five: Identifying Features and Grid Values**.

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.

If you are using the non-Spatial Analyst version of ArcView HAZPAC, Grids can be displayed only as lower resolution images, which means that you will not be able to interact with the cells in the Grids or display their Legends in the Table of Contents. However, the Legends for all the images can be viewed in the file 'COLORMAP.JPG' (located in the folder 'HAZPAC_ARCVIEW\DATA\IMAGE').



Above, the 'Seismic Hazard' Grid shows the level of intensity of shaking that parts of the Southeast Asia and Oceania regions may feel during an earthquake. Areas in red will shake more intensely than areas in green.




Above, the Legend for the 'Seismic Hazard' Grid image is shown along with all the other Legends 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 Grids or Grid images.

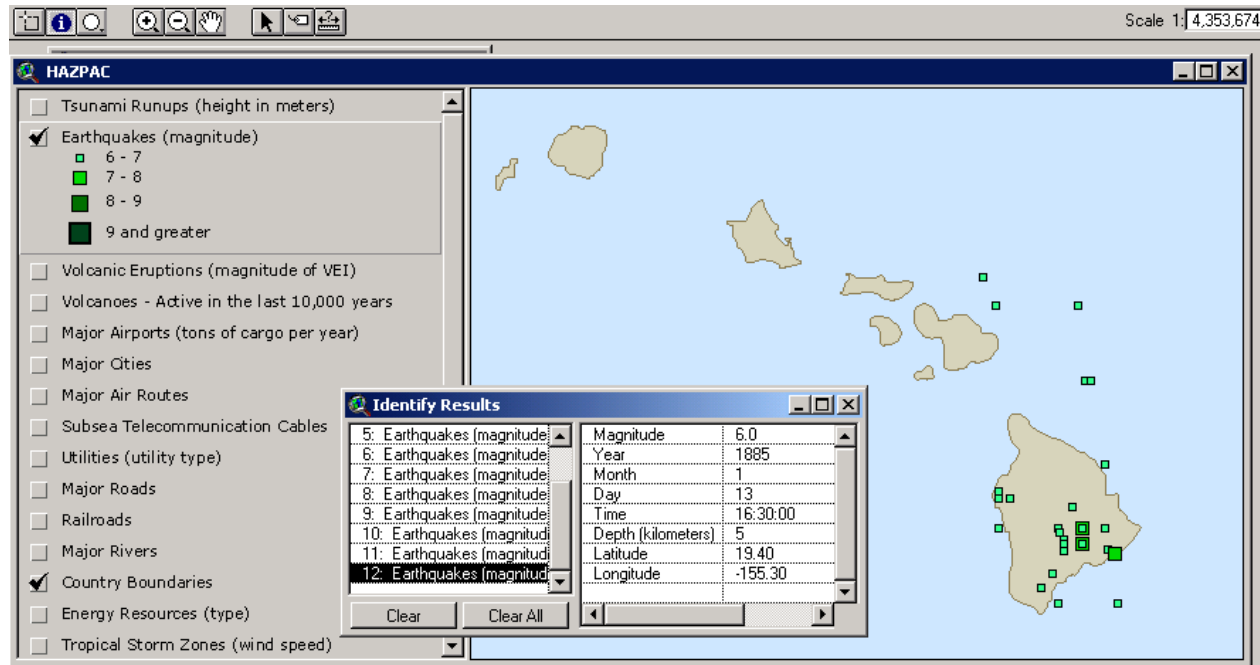
Concept Five: Identifying Features and Grid Values

HAZPAC allows you to display information about each Theme. With the 'Major Cities,' '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?

With the 'Earthquakes' Theme still displayed and activated, 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-hand side of the window, the Attributes are shown in two columns, the Attribute Field name (for example, 'Magnitude' and 'Year') and the Value (for example, '7.9' and '1868'). Find the earthquake that has occurred nearest to your city, and then use the 'Identify' tool to display the Attributes for that earthquake. What was the magnitude of that earthquake?

In some Themes (for example, 'Earthquakes'), several Features will overlap one another on the map. If you click on one of the overlapping Features with the 'Identify' tool, all the other overlapping Features also will be listed in the Feature column, which is on the left-hand side of the 'Identify Results' window. To view the Attributes for each Feature, click on each Feature in the list individually.




Above, the 'Identify Results' window shows the Attribute Fields and Values for one of several overlapping earthquakes.

If you are using the Spatial Analyst version of ArcView HAZPAC, you can also identify cell values in a Grid. To do so, first display and then activate a Grid Theme of interest, such as 'Land Use and Vegetation,' then click on the 'Identify' tool and then on a grid cell near your city. The 'Identify Results' window will display the value of that grid cell (in this case, the value will be the type of land use or vegetation cover of a 1-square-kilometer cell near your city).

Unfortunately, because the non-Spatial Analyst version of ArcView HAZPAC can only display Grid Themes as lower resolution images, you will not be able to gain any more information from a Grid Theme other than from the visual display of the image.



Concept Six: Opening Tables

To display all the Attributes contained in a Theme, use the 'Open Theme Table' button . First activate a Theme of interest, such as 'Earthquakes,' and then click the 'Open Theme Table' button. An 'Attributes of [Theme Name]' table window will open (in this case, the 'Attributes of Earthquakes' table window will open). The table window will display all the Attribute Fields (in the column headings) and Values (listed in the columns below each heading) for that Theme.


Magnitude	Year	Month	Day	Time	Depth (kilometers)	Latitude	Longitude
6.0	1933	6	18	3:53:58	0	-15.00	-172.00
8.6	1942	8	24	22:50:27	60	-15.00	-76.00
8.0	1942	8	24	22:50:00	0	-15.00	-76.00
6.5	1932	12	9	8:34:55	75	-15.00	-75.00
7.0	1960	1	15	9:30:24	150	-15.00	-75.00
7.0	1943	2	16	7:28:35	190	-15.00	-72.00
6.8	1928	9	21	13:27:05	250	-15.00	-70.50
7.0	1959	7	19	15:06:12	200	-15.00	-70.50

At left, the 'Attributes of Earthquakes' table window shows all the Attribute Fields and Values for the 'Earthquakes' Theme.

When a table window is active, a customized **HAZPAC Table Toolbar** will be displayed above the View window. The HAZPAC Table Toolbar contains several table-specific Buttons and Tools, and it also shows the number of features in a Theme. How many earthquakes are included in HAZPAC?

You may gain additional information by using the 'Sort Ascending'  and 'Sort Descending'  buttons to sort and re-sort the values in the tables. For example, to see information about the oldest earthquake in the 'Earthquakes' Theme, click on the 'Year' Attribute Field heading, then click on the 'Sort Ascending' button. The oldest earthquake will now appear at the top of the list. What was its magnitude? Now try clicking on the 'Depth' heading, then on the 'Sort Descending' button, to see information on the deepest recorded earthquakes. How deep were they? What were their magnitudes?

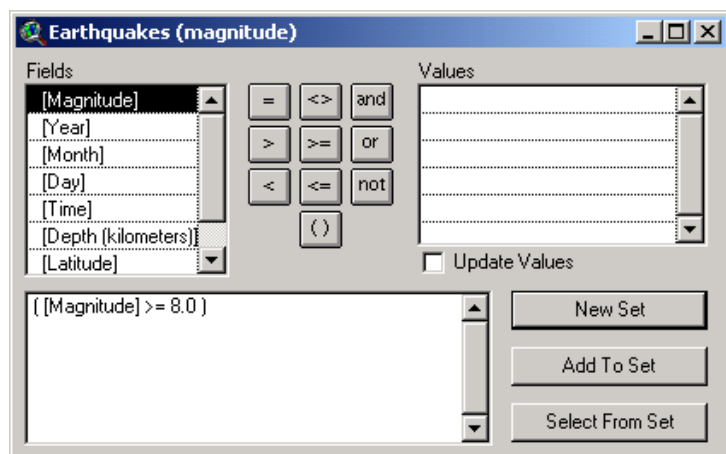
The following sections contain more exercises that will help familiarize you with the HAZPAC Table Toolbar functions. For more information on using these buttons and tools, please consult **Table Buttons and Tools** in the **HAZPAC User Reference Guide** below.

To return to the map View, click on the 'Back to View' button .

Concept Seven: Querying Data

Another way HAZPAC lets you view and select features in a Theme is with the 'Select by Characteristics...' function in the 'COMMON FUNCTIONS' menu. For example, the 'Earthquakes' Theme contains all the recorded earthquakes of magnitude 6.0 or larger that have occurred since the year 780 B.C. If you are interested in viewing only the earthquakes that have, for instance, a magnitude of 8.0 or larger, you can choose to select and display just these earthquakes.


To do so, first display and then activate the 'Earthquakes' Theme. From the 'COMMON FUNCTIONS' menu, choose the 'Select by Characteristics...' function, and a query window will open that will enable you to establish your own criteria for what is selected and displayed on the map. You will build your query as a simple mathematical or logical expression. For each query, you will enter an **Attribute Field** (for example, '[Magnitude]'), an **Operator** (for example, '>='), and a **Value** (for example, '8.0').

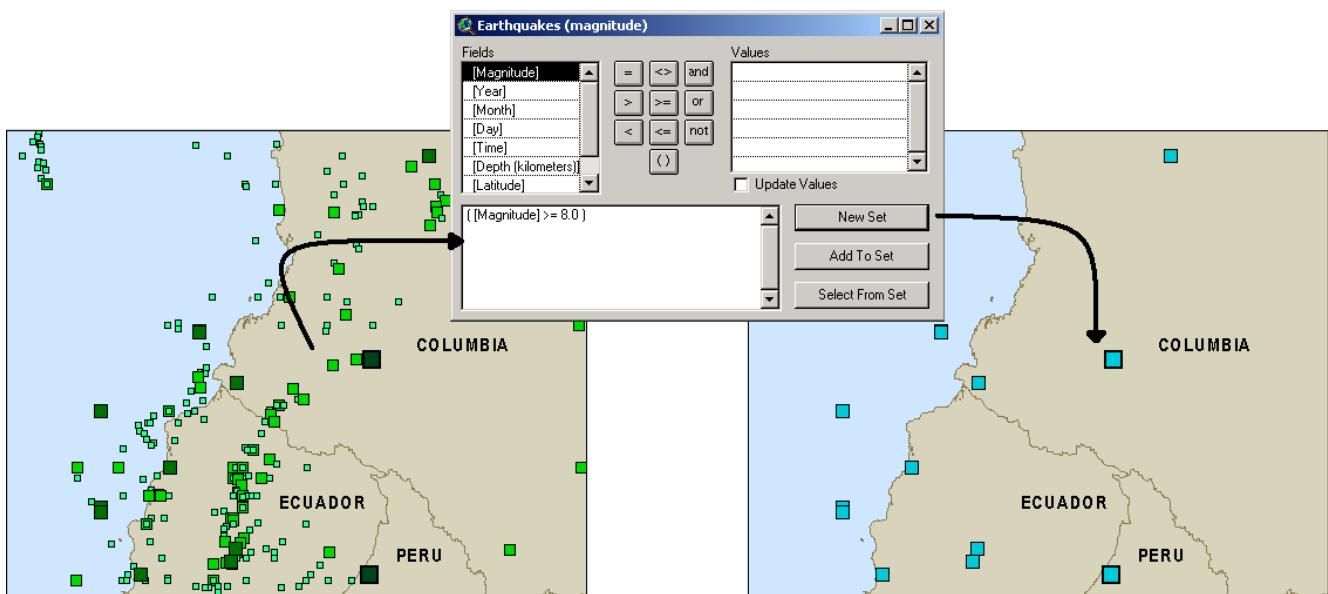


To build your query, use the buttons provided in the query window. First, double-click the '[Magnitude]' Attribute Field, then click once on the '>=' Operator button. You should now see '[Magnitude]' and '>=' in the dialog box. To complete the expression, simply type in '8.0' as the value. Your expression should now read '([Magnitude] >= 8.0)' in the dialog box.



When you are satisfied that the expression is properly written, click the 'New Set' button. ArcView will now select all recorded earthquakes that have magnitudes greater than or equal to 8.0 and highlight them in blue on the map.

The Attributes for the selected set also will be "selected" in the 'Attributes of Earthquakes' table window. Click on the 'Open Theme Table' button to view the Attributes. Notice also that the HAZPAC Table Toolbar now shows the number of earthquakes in the selected set. How many recorded earthquakes of magnitude greater than or equal to 8.0 are in the 'Earthquakes' Theme?

To display only the selected earthquakes on the map, click on the 'Show Selected Features' button .



On the left, all historic earthquakes are displayed for parts of Ecuador, Columbia, Peru, and the adjacent Pacific Ocean area. In the middle, the query window is set up to select only earthquakes that have magnitudes greater than or equal to 8.0. On the right, the selected set of earthquakes are highlighted in blue, and the non-selected earthquakes have disappeared from the View after clicking on the 'Show Selected Features' button.

Click on the 'Select None' button  and then the 'Show All Features' button  to deselect the selected set of earthquakes and to display all earthquakes again.

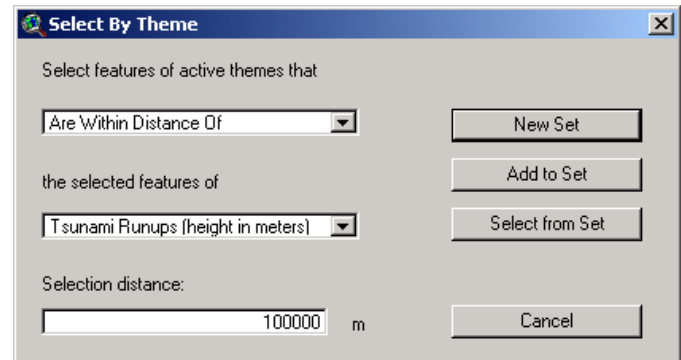
Experiment with the 'Select by Characteristics...' function in the 'COMMON FUNCTIONS' menu and Buttons and Tools in the HAZPAC Table Toolbar to answer the following questions:

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?

Concept Eight: Relating Datasets

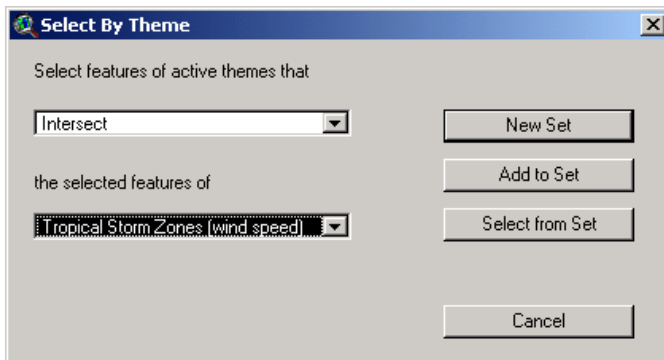
Another way HAZPAC lets you query and select features in a Theme is with the 'Select by Location...' function in 'COMMON FUNCTIONS' menu. This function will select features on the basis of their spatial relation to another feature or features. One such spatial relation is *distance*. For example, you can select and display the cities that are located within 100 kilometers (100,000 meters) of where tsunami runups have occurred.

To do so, display and activate the 'Major Cities' Theme. From the 'COMMON FUNCTIONS' menu, choose the 'Select by Location...' function, and a 'Select by Theme' window will open. To build your query, choose 'Are Within Distance Of' from the 'Select features of active themes that' pull-down menu. Now choose the 'Tsunami Runups' Theme from the 'the selected features of' pull-down menu. To complete the expression, type in '100000' (meters) as the value in the 'Selection distance:' box.



When your query is properly written, click the 'New Set' button. ArcView will now select all cities that are located within 100 kilometers of recorded tsunami runups and highlight them in blue on the map. To display only the selected cities on the map, click on the 'Show Selected Features' button. How many selected cities are there?

Another spatial relation that can be used to query and select features is *intersection*. For example, you can determine which cities are located within Tropical Storm Zone 5, the areas of highest wind speeds.





First, activate (but do not display) the 'Tropical Storm Zones' Theme. Using the 'Select by Characteristics...' function, select areas that have wind speeds of '>= 250 km/hr'. Now, display and activate the 'Major Cities' Theme. Using the 'Select by Location...' function, build your query by choosing 'Intersect' from the 'Select features of active themes that' pull-down menu, then the 'Tropical Storm Zones' Theme from the 'the selected features of' pull-down menu.

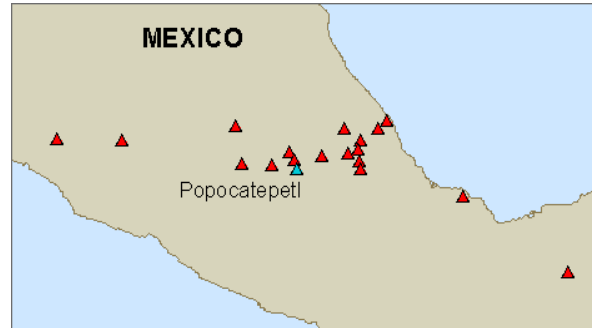
When your query is properly written, click the 'New Set' button. ArcView will now select all major cities that are located within Tropical Storm Zone 5 and highlight them in blue on the map. To display only the selected cities on the map, click on the 'Show Selected Features' button. How many selected cities are there?

Concept 9: Assessing Risks to Populated Areas and Calculating Population Values

One way to analyze the extent of risk to a population is to determine how many people live in close proximity to a potential hazard. For example, you could study the population density of the area that lies within 100 kilometers of the active volcano Popocatepetl, located in south-central Mexico.

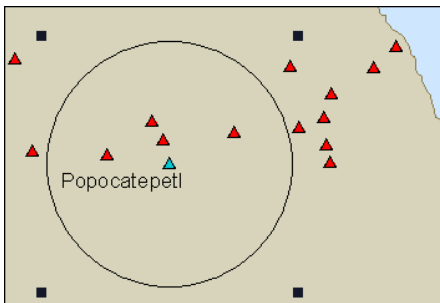
Note that you will need the ArcView Spatial Analyst extension to actually calculate the population values from the 'Population Density' Grid. However, users of the non-Spatial Analyst version of HAZPAC can still use the lower resolution Grid images to visualize the results.


To begin your study, use the 'Find'  and the 'Zoom to Selected'  buttons to zoom in to the study area. First, activate the 'Countries' Theme (it should already be displayed). Now, click on the 'Find' button, which will open a 'Find Text in Attributes' window, and then type 'Mexico' in the dialog box. ArcView will now select the country of Mexico and highlight it in blue on the map. Click on the 'Zoom to Selected' button to zoom in to Mexico. Now, click on the 'Select None' button to deselect Mexico.



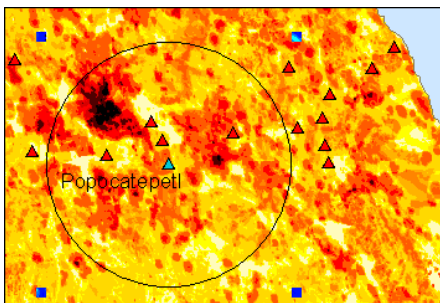
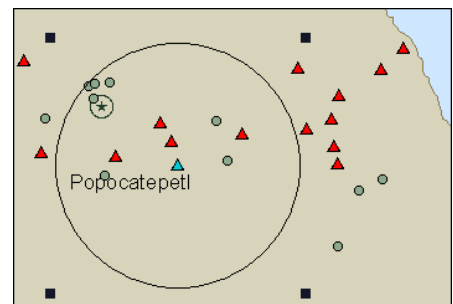
Next, display and activate the 'Volcanoes - Active' Theme, then use the 'Find' button to locate and select (highlight) the volcano 'Popocatepetl.' Use the 'Identify' tool to verify that you have located the correct volcano. Use the 'Zoom In' tool to zoom in closer to the study area, and then click on the 'Zoom to Selected' button to center the display on Popocatepetl.

If desired, you may use the 'Label Feature' tool  to label Popocatepetl on the map. To do so, first click on the 'Label Feature' tool, then click on Popocatepetl. (If you also wish to label Mexico, first activate the 'Countries' Theme, then, with the 'Label Feature' tool still active, click on Mexico.)




Use the 'Draw Circle' tool  to define your study area. First, zoom in even closer to Popocatepetl. Now, click on the 'Draw Circle' tool, then draw a circle around the volcano by clicking and dragging (while holding down the mouse) a radius line from Popocatepetl outward (in any direction). As you drag, the length of the radius is actively displayed (in meters) in the lower left-hand corner of the View. Let go of the mouse when you reach a radius length of about 100 kilometers (100,000 meters).

Within this 100-kilometer radius lies Mexico City (Ciudad De Mexico), the capital of Mexico and one of the world's most densely populated cities. Verify that Mexico City (Ciudad De Mexico) lies within your study area by displaying the 'Major Cities' Theme. Can you identify Mexico City (Ciudad De Mexico)? Use the 'Identify' tool to verify that you have correctly located Mexico City (Ciudad De Mexico). In what general direction is it from Popocatepetl?



Now turn off the 'Major Cities' Theme, and then display the 'Population Density' Theme. You should see a large, dark-colored area near Mexico City (Ciudad De Mexico), as well as several other (smaller) dark-colored areas within the 100-kilometer radius of Popocatepetl. On the basis of this visual display, how high would you assess the general hazard to the population, or perhaps even the potential for loss of life, caused by a major eruption of Popocatepetl?

If you are using the ArcView Spatial Analyst version of HAZPAC, use the 'Identify' tool to determine the population of a few of the dark-colored cells near Mexico City (Ciudad De Mexico). Now do the same for a few of the light-colored cells nearby. How does the population of these light-colored cells compare with those near Mexico City (Ciudad De Mexico)? Use the 'Find' tool to locate two other major cities in your study area, Cuernavaca and Puebla de Zaragoza, and then use the 'Identify' tool to make the same type of comparison for cells near these cities. Now use the 'Identify' tool to compare the actual Attribute Values for the population of Mexico City (Ciudad De Mexico) proper with that of its suburbs. Make the same comparison for Cuernavaca and Puebla de Zaragoza. Are the Attribute Values for cities in the 'Major Cities' Theme similar to the values that you determined from cells in the 'Population Density' Theme? If the values are not similar, why do you think this might be?

Now calculate the actual population within your study area. First, use the 'Select Graphics' tool  (on the HAZPAC Toolbar) to make sure that the buffer circle that defines your study area is still selected. Click on the 'Select Graphics' tool and then click on the buffer circle. If the buffer circle is selected, four square "handles" will be displayed outside the circle at its "corners." If they are not displayed, click once more on the buffer circle.

Now, from the 'COMMON FUNCTIONS' menu, choose the 'Calculate Population' function. ArcView will now calculate the population within your study area, and then display the value (in scientific notation) in a 'Population from Population Density Grid' window. How many people live within 100 kilometers of Popocatepetl? On the basis of this information, what would you estimate might be the number of potential casualties (both injuries and fatalities) caused by a major eruption of Popocatepetl?

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.

General HAZPAC Questions

1. How many people live within 100 kilometers of Mexico City?
2. How many recorded tsunami runups have occurred in the Pacific Rim region since 1980?
3. In what year did the most recent earthquake of magnitude 8.0 or greater occur? In what country was it located? What was its magnitude? Can you estimate about how often earthquakes of magnitude 8.0 or greater occur in the Pacific Rim region?
4. How many recorded earthquakes of magnitude 7.0 or greater have occurred in your country? What was the magnitude of the most powerful earthquake ever recorded in your country?
5. How many active volcanoes are located in your country? How many recorded volcanic eruptions have occurred in your country?

Natural Hazards and Your City

1. How many people live within 100 kilometers of your city?
2. How many recorded earthquakes of magnitude 6.0 or greater have occurred within 100 kilometers of your city? When did the most recent one occur? What was its magnitude?
3. When did the most recent volcanic eruption occur near your city?
4. What natural hazards do you think may have the most potential impact on your city?
5. How do you think your city compares with other Pacific Rim cities in terms of its susceptibility to natural hazards?
6. 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? How do you think land use and vegetation may relate to population density?
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? In terms of passenger load?
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 roads, 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 ArcView version of HAZPAC, as well as detailed information on data sources and formats, please consult the file 'METADATA_AV.TXT,' which is located on this CD-ROM in the folder 'HAZPAC_ARCVIEW\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) represent 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.

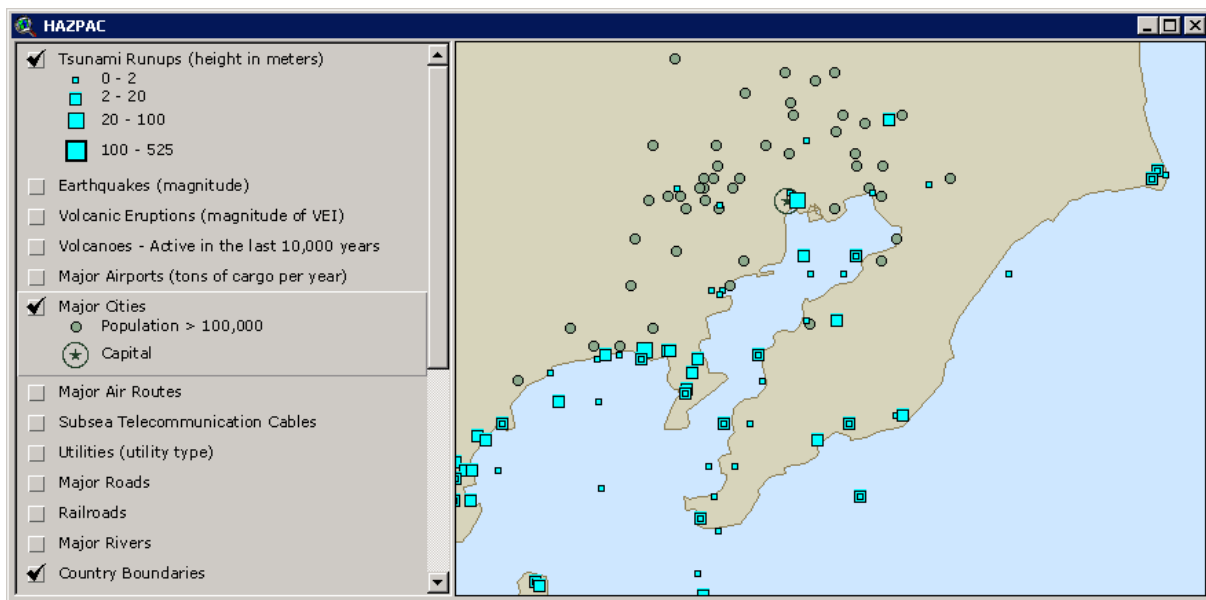
HAZPAC User Reference Guide (ArcView Version)

HAZPAC User Reference Guide (ArcView 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 features or groups of features for further study.



Above, the HAZPAC interface: on the right, the View window (containing the map), and on the left, the Table of Contents (listing the data layers).

Table of Contents:

The Table of Contents 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 (or Themes) upon which certain operations can be performed. To "activate" a Theme, click on the Theme name in the Table of Contents. An Active Theme will appear "raised" in the Table of Contents. If desired, more than one Theme can be activated at the same time by holding down the "shift" key while clicking on several Theme names in the Table of Contents. In the above figure, 'Major Cities' is the Active Theme.

Legend:

A Legend shows the symbology that has been chosen to display the data values in a Theme. The Legend for a particular Theme will be shown beneath the Theme name in the Table of Contents.

HAZPAC Toolbar:

The HAZPAC Toolbar contains a series of customized Buttons and Tools that perform various functions, such as zooming in and out and selecting and viewing HAZPAC data. Buttons, which are on the top row of the HAZPAC Toolbar, require only one click to perform their operation. Tools, which are on the bottom row of the HAZPAC Toolbar, need to be activated and then used directly on the map. For detailed information on each of the Buttons and Tools, please consult **Buttons, Tools, and Common Menu Functions** below.

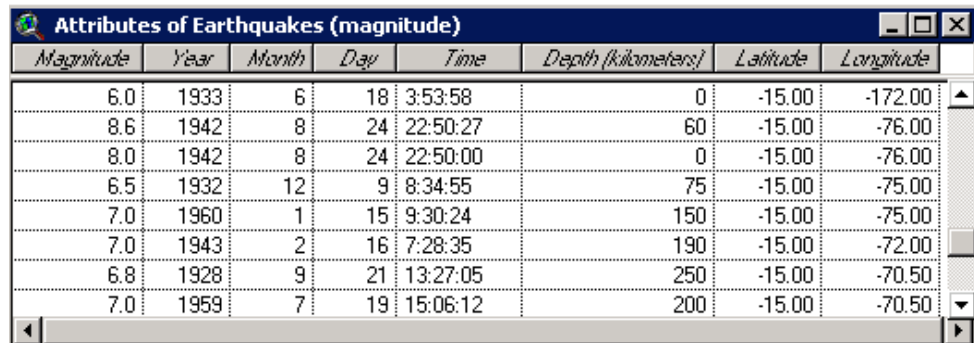
'COMMON FUNCTIONS' Menu:

The 'COMMON FUNCTIONS' Menu is a customized pull-down menu containing several functions that allow users to perform analysis on the data in HAZPAC. For detailed information on each of these functions, please consult **Buttons, Tools, and Common Menu Functions** below.

Attribute Table Window:

An Attribute Table Window shows the Attribute Fields and Values associated with the data in a Theme. To display the Attribute Table Window for an active Theme or Themes, click on the 'Open Theme Table' button in the HAZPAC Toolbar.

At right, the Attribute Table Window for the 'Earthquakes' Theme, showing all the Attribute Fields and Values associated with the Theme.



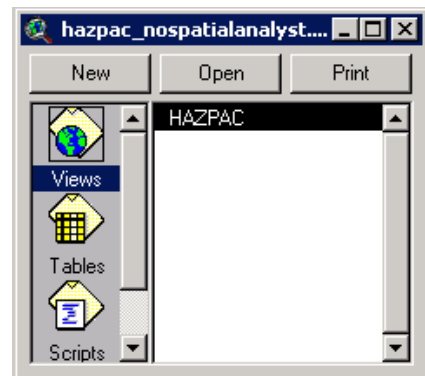
Magnitude	Year	Month	Day	Time	Depth (kilometers)	Latitude	Longitude
6.0	1933	6	18	3:53:58	0	-15.00	-172.00
8.6	1942	8	24	22:50:27	60	-15.00	-76.00
8.0	1942	8	24	22:50:00	0	-15.00	-76.00
6.5	1932	12	9	8:34:55	75	-15.00	-75.00
7.0	1960	1	15	9:30:24	150	-15.00	-75.00
7.0	1943	2	16	7:28:35	190	-15.00	-72.00
6.8	1928	9	21	13:27:05	250	-15.00	-70.50
7.0	1959	7	19	15:06:12	200	-15.00	-70.50

HAZPAC Table Toolbar:

The HAZPAC Table Toolbar, which is displayed whenever an Attribute Table Window is open and active, contains a series of customized Buttons and Tools that perform various functions on Attribute Fields and Values. Buttons require only one click to perform their operation. Tools need to be activated and then used on the records in the Attribute Table. For information on each of the Table Buttons and Tools, please consult **Buttons, Tools, and Common Menu Functions** below.

Project Window:

The Project Window allows the user to manage customized views, tables, charts, scripts, and layouts. When the Project Window is active, project-specific icons appear in the left-hand column. The Project Window is accessible by closing the View window. To open the HAZPAC View window again, click on the 'Views' icon on the left, then either select 'HAZPAC' from the list on the right and then click the 'Open' button, or simply double-click on 'HAZPAC' in the list. (Note that it is not necessary to work with the Project Window to use the data in HAZPAC; however, experienced ArcView users who want more functionality from HAZPAC or want to further customize HAZPAC may choose to use the Project Window.)



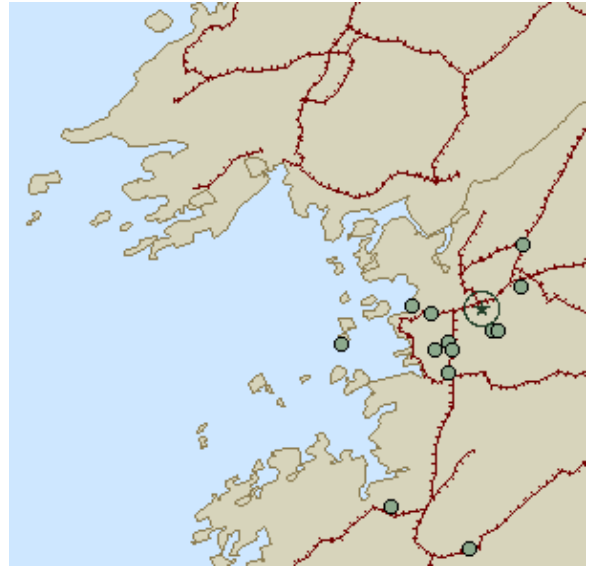
Above, the HAZPAC Project Window.

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.

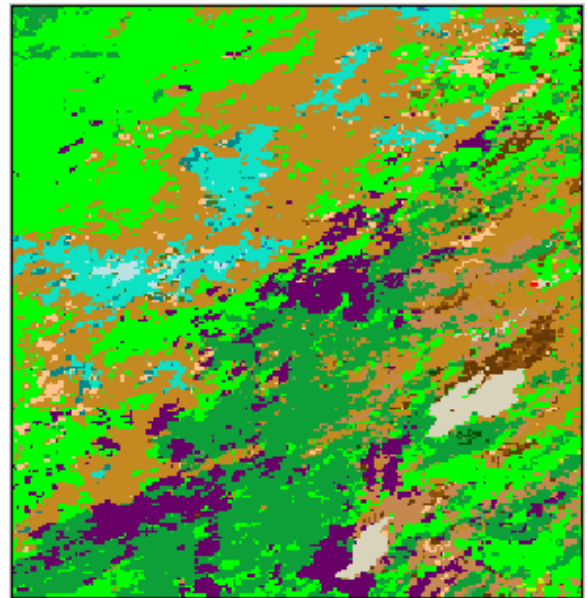


Above, a few of the discrete features in HAZPAC: the greenish-gray dots are cities (capital cities are shown as circled stars), and the reddish-brown, hachured lines are railroads.

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) arranged in a grid pattern and organized into rows and columns. Each pixel has a value that applies to the entire area contained within it. An example of continuous grid data, the 'Land Use and Vegetation' Theme, that has been included in HAZPAC is illustrated at right.

In the non-Spatial Analyst version of ArcView HAZPAC, continuous grid data are displayed as lower resolution images only, which means that you will not be able to access any more information from the continuous grid data other than the visual display of the image.



Above, an example of some of the continuous grid data in HAZPAC: the pixels (or cells) represent different types of land use and vegetation cover; the purple cells are herbaceous wetland areas; the green cells are various types of woodland or forested areas; the brown cells are various types of cropland or grassland; and the turquoise cells are areas of tundra.

Buttons, Tools, and Common Menu Functions

Below are general descriptions of the Buttons, Tools, and Common Menu Functions in the HAZPAC ArcView interface. Experienced ArcView users will notice several differences from the standard (default) ArcView interface. For instance, the HAZPAC Toolbar (displayed above the Table of Contents and the View) and the HAZPAC Table Toolbar (displayed only when an Attribute Table Window is open and active) have been customized so that the Buttons and Tools allow easy access to useful HAZPAC features. In addition, a new 'COMMON FUNCTIONS' menu has been added, which contains several functions that allow users to perform analysis on the data in HAZPAC. All functions normally performed by the original Buttons and Tools in the standard (default) ArcView interface can still be accessed through the standard menus. If desired, the original Buttons and Tools in the standard (default) ArcView interface can be re-established by importing the HAZPAC datasets into a new (empty) ArcView project.

Buttons and Tools in the HAZPAC Toolbar:

The HAZPAC Toolbar contains various Buttons and Tools that have been assembled to allow easy display and use of HAZPAC features. Buttons, which are on the top row of the HAZPAC Toolbar, require only one click to perform their operation. Tools, which are on the bottom row of the HAZPAC Toolbar, need to be activated and then used directly on the map. Buttons and Tools on the HAZPAC Toolbar are grouped into the following four categories:

Navigation Buttons and Tools allow the user to change the visual display of the View;

Selection Buttons and Tools allow the user to select Features and their Attributes;

Connection Buttons and Tools allow the user to query Features and their Attributes;

Miscellaneous Buttons and Tools allow the user to perform various miscellaneous functions.

Navigation Buttons and Tools:



Zoom to Full Extent Button displays the entire HAZPAC Pacific region map.



Zoom to Selected Button zooms to the extent of the selected Features.



Zoom to Previous Extent Button zooms to the most recent previously 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.

Selection Buttons and Tools:



Select All Button selects all Features (and Attributes) in the Active Theme(s). Display and "activate" the Theme(s) of interest, then click on the 'Select All' button. To view the selected Attributes, click on the 'Open Theme Table' button (see below). The selected set of Features will be highlighted in blue (both in the View and in the Attribute Tables).



Select None Button clears the selection of Features (and Attributes) from the Active Theme(s).



Show Selected Features Button displays only the selected set of Features from the Active Theme(s) in the View (and selected Attributes in the Attribute Tables). Once the Features (or Attributes) of interest have been selected (by whatever means) from the Active Theme(s), click on the 'Show Selected Features' button. All other Features (and Attributes) in the Active Theme(s) will no longer be displayed; however, any already-displayed Features from other (non-Active) Themes will remain displayed in the View. The selected set of Features will be highlighted in blue (both in the View and in the Attribute Tables).



Show All Features Button redisplay all Features (and Attributes) in the Active Theme(s) after they have been removed from the View and the Attribute Table(s) by using the 'Show Selected Features' button (see above). The selected set of Features will be still be highlighted in blue (both in the View and in the Attribute Tables), but all other Features in the Active Theme(s) will be displayed in the normal symbol colors that have been specified in the Legend.



Select Features Tool allows the user to select one or more Features (and their Attributes) in the Active Theme(s). Display and "activate" the Theme(s) of interest, then click on the 'Select Features' button. Now hold down the mouse button and drag a box around the Features of interest in the View. Release the mouse button, and all Features within that rectangle (and their Attributes) will be selected. To deselect a particular Feature from an already-selected set, hold down the "shift" key and then click on that Feature in the View. Similarly, to select one or more Features individually (or to add Features to an already-selected set), hold down the "shift" key and then click on a Feature or Features in the View. To display the selected Attributes, click on the 'Open Theme Table' button (see below). The selected Features will be highlighted in blue (both in the View and in the Attribute Tables).



Select Graphic Tool allows the user to select a graphic in order to move it, resize it, or modify it. A graphic is a circle, rectangle, polygon, or text label that has been added to the View but is not part of a Theme. To select a particular graphic, click on the 'Select Graphic' tool, and then click on the graphic. If the graphic is selected, square "handles" will be displayed at its "corners" (for text labels, circles, and polygons) or around its edges (for rectangles). If the handles are not displayed, click once more on the graphic. To move a selected graphic, hold down the mouse button and drag it to its new position. To resize a selected graphic, click on one of its handles and then drag it in or out. To add fill to a graphic, double-click on it, and a 'Palette' window will open that will allow the user to choose a fill color or pattern. To modify a selected text label, either open the 'Text and Label Defaults' window under the 'Graphics' pull-down menu (to change font style or size) or double-click on the label, which will open a 'Text Properties' window (to change text alignment, spacing, angle, or even the text string itself).

Connection Buttons and Tools:



Open Theme Table Button opens the Attribute Table(s) for the Active Theme(s).



Find Button finds Features or Attributes in the Active Theme(s) by searching for a particular (non-numeric) text string. To search for a Feature or Attribute, display and "activate" the Theme(s) of interest, then click on the 'Find' button, and a 'Find Text in Attributes' window will open. Type in a text string, and then click 'OK.' ArcView will find in the Attribute Table(s) the first Feature that contains that text string, then select it, highlight it in blue, and center the display on it. To display only the "found" Feature in the View, click on the 'Show Selected Features' button (see above). To continue searching, click on the 'Find' button again, then either click 'OK' to search for the next Feature that contains the same text string, or enter a new text string to find. Note that if the 'Show Selected Features' button was used to display only the "found" Feature in the View, then a new search cannot be performed until the 'Show All Features' button (see above) is used to redisplay all the Features in the Active Theme(s). To display the Attributes for the selected Feature, click on the 'Open Theme Table' button (see above), and then click on the 'Promote' button in the HAZPAC Table Toolbar (see below). The selected Feature (highlighted in blue) will be moved to the top of the Attribute Table (note that the 'Find' button in the HAZPAC Table Toolbar works a little differently -- see below).



Identify Tool allows the user to display the Attributes for a Feature or Features in the Active Theme(s). Display and "activate" the Theme(s) of interest, then click on the 'Identify' tool, and then click on the Feature(s) of interest. An 'Identify Results' window will open that will list all the Attribute Fields and Values for the Features(s). In many cases, multiple Features will be located at the same place on the map. In these cases, the 'Identify Results' window will list the Attributes for all the Features, each of which you will be able to examine individually.



Label Feature Tool allows the user to add labels to Features in the Active Theme(s). Display and "activate" the Theme(s) of interest, then click on the 'Label Features' tool, and then click on the Feature(s) to be labeled. Labels can be modified by selecting the label and then either opening the 'Text and Label Defaults' window under the 'Graphics' pull-down menu (to change font style or size) or, by double-clicking on the label, opening a 'Text Properties' window (to change text alignment, spacing, angle, or even the text string itself). Labels can also be moved by selecting them and then dragging them to a new position.

Miscellaneous Buttons and Tools:




Print View Button prints the View on a local or networked output device.





Show/Hide Legend Button opens or closes the Legend(s) of the Active Theme(s) in the Table of Contents. To open the Legend(s) of the Active Theme(s), click on the 'Show/Hide Legend' button. To close the Legend(s), click on the 'Show/Hide Legend' button again.





Explain Theme Button opens a window that contains a brief description of the data in the Active Theme(s). For more detailed information on the data that are included in the ArcView version of HAZPAC, as well as on data sources and formats, please consult the file 'METADATA_AV.TXT' in the folder 'HAZPAC_ARCVIEW\DATA.'

 **Draw Graphic Tool Menu** allows the user to choose a particular 'Draw Graphic' tool in order to add a graphic (a circle, rectangle, or polygon) to the View. Click and hold the 'Draw Circle' tool icon (which is the default 'Draw Graphic' tool icon on the HAZPAC Toolbar), and the following 'Draw Graphic' tool choices will become visible and, thus, available. Note that the chosen 'Draw Graphic' tool will remain active on the HAZPAC Toolbar until another one is chosen.

 **Draw Circle Tool** allows the user to add a circle graphic to the View by clicking and dragging a radius line from the center of the circle outward.

 **Draw Rectangle Tool** allows the user to add a rectangle graphic to the View by clicking and dragging a box from one corner across to its opposite corner.

 **Draw Polygon Tool** allows the user to add a polygon graphic to the View by clicking repeatedly to add vertices that define the shape of the polygon. Double-click to close the polygon.


 **Measure Tool** allows the user to measure the distance between points. Click on two or more points on the View, then double-click to end the line. The distance between the points is displayed in the lower left-hand corner of the 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.


Buttons and Tools in the HAZPAC Table Toolbar:


The HAZPAC Table Toolbar, which is automatically displayed whenever an Attribute Table Window is "active," contains Buttons and Tools that allow the user to perform various functions on the HAZPAC data in the Attribute Tables. To open an Attribute Table Window, first activate the Theme of interest, then click on the 'Open Theme Table' button (see above). Although several Attribute Table Windows can be open at the same time, only one may be "active" at a particular time. To make an Attribute Table Window "active," click on its title bar. Buttons require only one click to perform their operation. Tools need to be activated and then used directly on the table.


Table Buttons and Tools:

 **Print Table Button** prints the active Attribute Table on a local or networked output device.


 **Promote Button** moves the Attributes for the selected set of Features to the top of the active Attribute Table.


 **Sort Ascending Button** sorts all Attributes in the active Attribute Table in the ascending order (smallest to largest) of Values of a chosen Attribute Field. Click on the column heading of a particular Attribute Field of interest, then click on the 'Sort Ascending' button.


 **Sort Descending Button** sorts all Attributes in the active Attribute Table in the descending order (largest to smallest) of Values of a chosen Attribute Field. Click on the column heading of a particular Attribute Field of interest, then click on the 'Sort Descending' button.


 **Select All Button** selects and highlights (in blue) all Attributes in the active Attribute Table (and Features in the View).


 **Select None Button** clears the selection of Attributes from the active Attribute Table (and Features from the View).


 **Show Selected Records Button** displays only the selected set of Attributes in the active Attribute Table (and selected Features in the View). Once the Attributes of interest have been selected (by whatever means) from the active Attribute Table, click on the 'Show Selected Records' button. All other Attributes in the active Attribute Table (and Features from that Theme in the View) will no longer be displayed; however, any already-displayed Attributes or Features from other Themes will remain displayed. The selected set of Attributes will be highlighted in blue (both in the Attribute Table and in the View).

 **Show All Records Button** redisplay all Attributes in the active Attribute Table (and Features in the View) after they have been removed from display in the Attribute Table and the View by using the 'Show Selected Records' button (see above). The selected set of Attributes (and Features) will still be highlighted in blue (in both the Attribute Table and the View), but now all other Attributes will be listed in the Attribute Table, and all other (non-selected) Features in the View will be displayed in their normal symbol colors as specified in the Legend.

 **Query Button** opens a window that allows the user to build a question, or query, that will define precisely which Attributes or Features from the active Attribute Table to select and display. To search for an Attribute or Feature in an active Attribute Table, click on the 'Query' button, and a 'Attributes of [theme name]' window will open. To build a query, first double-click on an Attribute Field name, then click on an operator (for example, '>' or '='), and then type a value or name in the dialog box to complete the expression. Click on the 'New Set' button, and ArcView will select and highlight (in blue) all Attributes in the Attribute Table (and Features in the View) that fit those characteristics.

 **Find Button** finds Attributes or Features in the active Attribute Table (or in the View) by searching for a particular (non-numeric) text string. To search for a Feature or Attribute, click on the 'Find' button, and a 'Find Text in Attributes' window will open. Type in a text string, and then click 'OK.' ArcView will find in the active Attribute Table the first Feature that contains that text string, then select it, highlight it in blue, and move it near the top of the Attribute Table (the Feature will also be highlighted in blue in the View). To display only the "found" Feature in the Attribute Table and the View, click on the 'Show Selected Records' button (see above). To continue searching, click on the 'Find' button again, then either click 'OK' to search for the next Feature that contains the same text string, or enter a new text string to find. Note that if the 'Show Selected Records' button was used to display only the "found" Feature in the Attribute Table and the View, then a new search cannot be performed until the 'Show All Records' button (see above) is used to redisplay all the Features in the active Attribute Table.

 **Back to View Button** brings the View window to the front and redisplay the HAZPAC Toolbar; however, any open Attribute Tables will remain open beneath the View window.

 **Select Tool** allows the user to select Attributes in the active Attribute Table. If desired, more than one Attribute can be selected at the same time by holding down the "shift" key while clicking on several Attributes.

Functions in the HAZPAC 'COMMON FUNCTIONS' Menu:

The HAZPAC 'COMMON FUNCTIONS' menu, which is accessible above the HAZPAC Toolbar, contains several functions that allow users to perform analysis on the data in HAZPAC.

'COMMON FUNCTIONS' Menu Functions:

'Select by Characteristics...' function allows the user to select of the Active Themes(s) on the basis of their Attributes.

'Select by Location...' function allows the user to select Features of the Active Themes(s) on the basis of their spatial relation (for example, *distance*, *intersection*, or *containment*) to another Feature or Features.

'Calculate Population' function allows the user to calculate the population within a defined area from the data in the activated 'Population Density' Grid Theme. Note that this function requires the ArcView Spatial Analyst extension.