Registering new custom watershed models or other polygonal themes

Add new watershed model
The "*Add New Watershed Model...*" option on the AWRD Modules menu allows users to register new custom watershed models or other polygonal themes so they can be used with the tool-sets of the AWRD Watersheds Module. Although users can in fact register any type of polygon theme, certain watershed functions will only work on "true" watershed models containing unique ID values that identify watersheds immediately downstream.

Using the dialogs described below, users can also modify some of the settings associated with any of the current watershed models such as which field contains the name or megabasin characterization, and which fields contain the unique ID and/or Downstream ID values. Currently these ID values must be numeric.

Simple version
Selecting the "*Add New Watershed Model...*" menu option will open the *Simple* version of the "Select New Watershed or Polygon Theme:" dialog. This tool version will be sufficient to register watershed delineations and general polygon themes, but is not sufficient to register properly encoded watershed models. The Simple version shows a list of all the polygon themes in the current view, as well as a list of all the currently registered polygon themes (Figure 1.36).

FIGURE 1.36
Registering new custom watershed model (simple version)
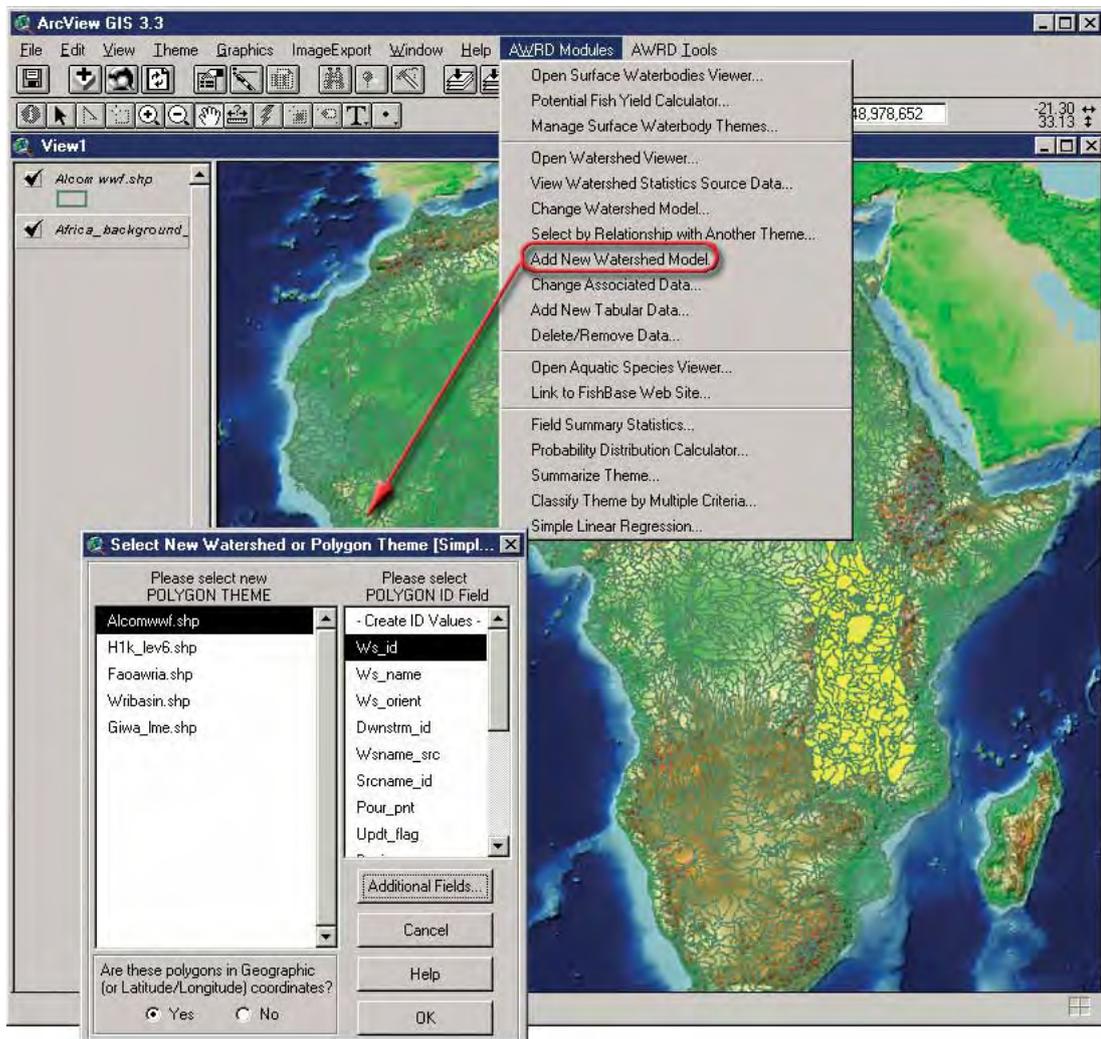
The "POLYGON ID Field" list on the right contains all the fields in the watershed model feature attribute table. As different polygon themes are selected from the "POLYGON THEME" list on the left, the list on the right will refill with the fields from each new polygon theme. Select a polygon theme from the list on the left, and then pick a field that contains unique ID values for each of the watersheds from the list on the right. These are values that uniquely identify each watershed in the theme, and are necessary for calculating and reporting statistics. If there is no such ID field, click the "– Create ID Values –" option at the top of the list and the tool will add a new field to the theme. This field will be filled with record numbers, such that the first watershed will have a value of zero and the numbers will increase until the last watershed. In this example the "H1k_lev6" watershed model was selected with "Level6" ID (Figure 1.37).

In general the AWRD will work most efficiently if the watershed and grid data are in geographic coordinates (i.e. in latitude/longitude values). However, the interface will also work with watershed models in other projections, although users may not be able to visually review the grid data layers unless the source grids are in the same projection. In cases where a WS model is in projected units, then the projection of the watershed model must be specified.

Because this "simple" version of the tool does not allow users to specify Downstream ID values, the best use for this version of this tool is to register polygonal themes such as watershed delineations, administrative areas, ecological zones, etc. and not true watershed models. If a user needs to register a true watershed model, then the "Additional Fields…" button must be used to switch over to the *Advanced* version of the tool.

Advanced version

The advanced version of the dialog includes choices for Watershed (or Polygon) Name, Downstream ID, Megabasin ID and Area. All of these choices include an option for "-No Such Field–", if there is no such field available.

POLYGON NAME Field: This field should contain names for each watershed, based on the field the user wishes to use as a basis for selections and reporting. As depicted in the Watershed Viewer illustration (Figure 1.37), the attributes in the polygon name field will be the ones that show up on the main Watershed Statistics Module dialog in the "Selected Polygon Names" list box (i.e. in this example H1k_lev6 watershed model is used).

In the event that there are no names for the watersheds (i.e. there is no "POLYGON NAME" field), then the extension will use the values from the unique ID field specified by the user. This is in fact the case for the USGS-H1k watershed model of Africa that was modified for the AWRD, where the Pfafstetter code is also used as a name.

DOWNSTREAM ID Field: this field is necessary for the watershed model tools to work. It should contain the ID value for the watershed immediately downstream from each watershed, and the ID values should correspond with those in the ID field. For example, if Watershed #1 drains into Watershed #2, then the ID value for Watershed #1 should be "1" and the Downstream ID value should be "2". The ID value for Watershed #2 should be "2", and the downstream ID value should be the ID value of whatever watershed lies immediately downstream from Watershed #2. If this field is not specified, or if it is specified incorrectly, then the watershed modelling tools will not function properly.

MEGABASIN ID Field: this field should contain the ID value for the megabasin.

POLYGON AREA Field: if the user does not specify an area field, the extension will calculate areas when it needs to and report the values based on units in square

kilometres. If an area field is specified, however, then the extension will report area values from that field. In this case the measurement units will be those originally defined for the calculation (for example, hectares or square metres), and will not be assumed to be in square kilometres (Figure 1.37).

FIGURE 1.37
Calculation of area in the originally defined measurement units
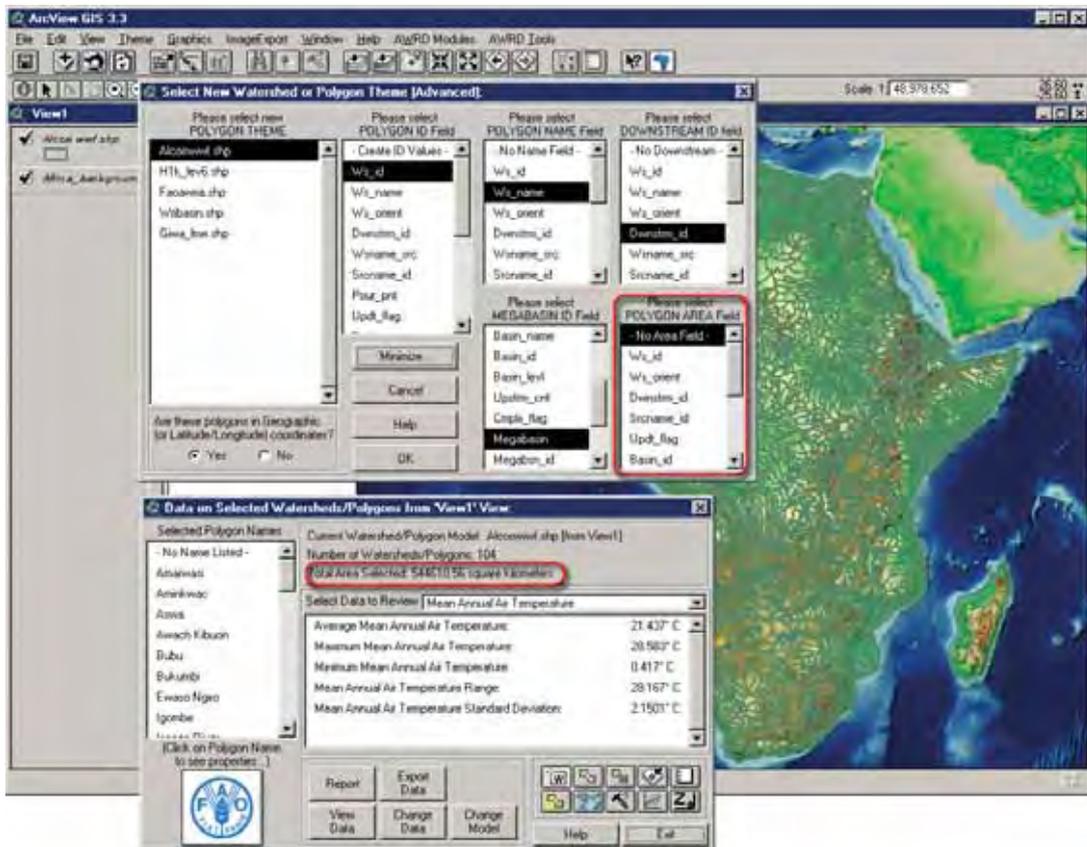
Users can calculate or update the area values for any polygon theme using the "*Calculate/Update GeoStats in Polygon Theme Tables…*" menu option in the AWRD Tools menu. This tool will calculate/update the area for each polygon in square kilometres, hectares, square miles and/or acres, and/or the perimeter in metres, based on the Lambert Equal Area Azimuthal projection centred at 20° longitude and 5° latitude.

Add new tabular data
This option, accessed by selecting the "*Add New Tabular Data...*" menu option in the AWRD Modules menu, allows a user to generate new data from grid themes. For example, if a user wishes to add a new custom watershed model and then wants to review statistics on elevation, precipitation, air temperatures, etc. for watersheds in the new model, then this option must be used to generate the data tables for those grids.

This option generates the elevation, precipitation, etc. grid statistics for each watershed and then registers that data so the watershed tools will recognize that the data is associated with the WS model.

Note Because this tool works with grid data, it is only available if Spatial Analyst is installed.

Clicking this option opens the "Generate Data from Grid Themes:" dialog depicted in Figure 1.38.

FIGURE 1.38
Generating new data from grid themes
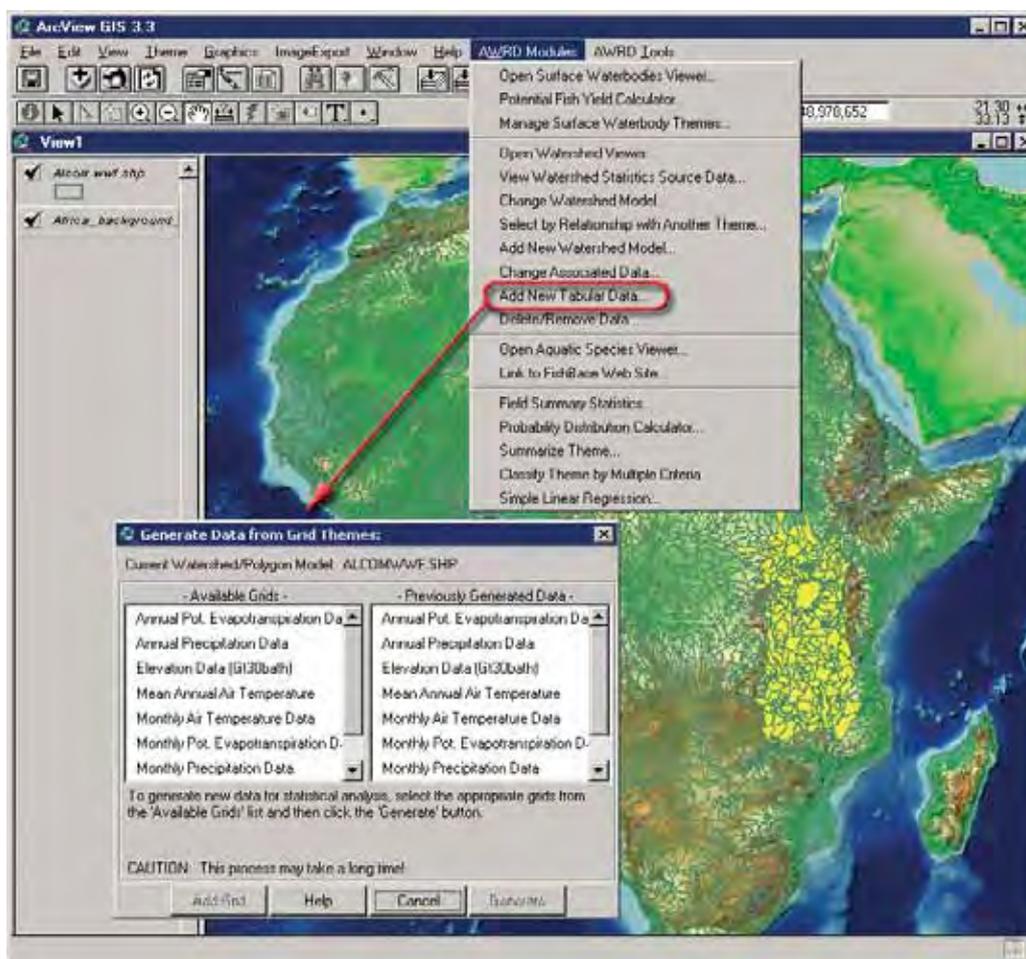
In this dialog the list on the left contains all the grid themes that are currently registered in the extension. The list on the right contains all the data tables that have already been generated from the grids for this particular watershed model. Simply click on the grid data from the list on the left and then click the "Generate" button. Users may also regenerate a table that already exists (but which has perhaps become corrupted, or perhaps the polygon boundaries have changed) by clicking the grid name for that table and then clicking the "Generate" button. In this case, the tool will warn the user that the table already exists and then ask for confirmation before regenerating it. If the user clicks "Yes" then the data will be regenerated and the existing data tables will be replaced.

Registering new grid themes
Users will also need to use the above dialog to register new grid themes. If the user has any grid themes in the current view, then the "Add Grid" button will be enabled and data for these grids can be registered. Once that grid has been registered, the user can now generate watershed tables for it.

> **Note** This tool is intended to be used with grids that represent a continuous range of data, such as elevation values or population densities. It is not intended to be used with classification grids where grid cell values represent some categorical classification such as forest cover types or political regions. The Watershed Statistics Viewer generates statistics such as mean, minimum, maximum, range and standard deviation, and none of these are valid statistics for categorical data. What,

for example, would the "standard deviation" represent for a watershed that was overlaying the boundary of the Republic of Namibia and the Republic of Botswane on a grid of political regions? The combined set of "the Republic of Namibia" values and "the Republic of Botswana" values cannot be evaluated as a continuous range of numerical values. The Watershed Statistics Viewer will do its best to derive statistics from these data, but the statistics will be meaningless.

To register a new grid theme, the user must first identify or create the grid theme. For example, suppose a user was interested in reviewing average total precipitation for the summer months of May through August (north of the equator, at least!). Values for these grids would need to be generated as follows:

1. Add the relevant grids to the view. Use the "*View Watershed Statistics Source Data…*" option on the AWRD Modules menu or the "View Data" button on the Watershed Module to see a list of grid themes (a user could also simply use the standard ArcView "Add Theme" tool ![icon] if the location of the relevant grids is known (e.g. "c:\wrd\data\aras_dbc\precip"). From the list, choose the grids representing precipitation for the months of May, June, July and August. Click "OK" and these grids will be added to the current view (Figure 1.39).

FIGURE 1.39
Selecting and adding the grids of interest to the view from the AWRD Modules menu option or by clicking the View Data button on the Watersheds Module
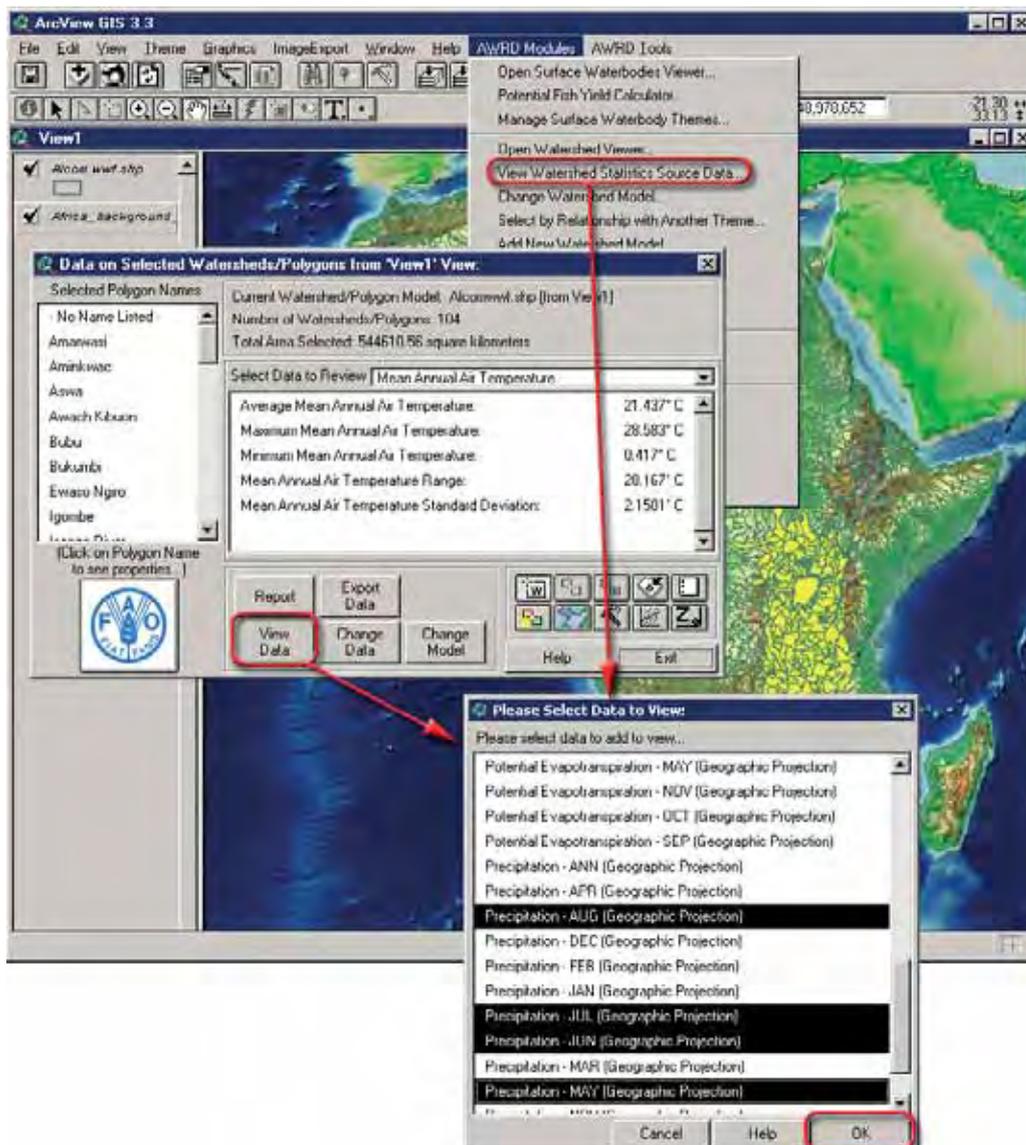
2. Combine the four grids into a single grid. Use Spatial Analyst functions to calculate the total precipitation for these four months by adding these four grids together (Figure 1.40).

FIGURE 1.40
**Combining the four grids into a single grid**
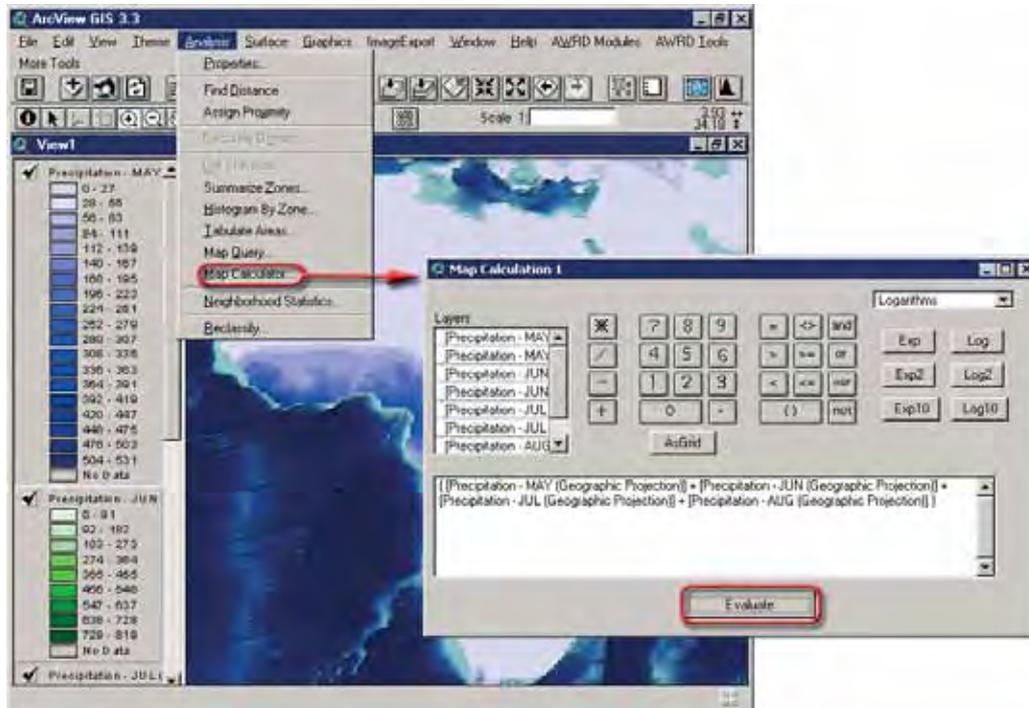
3. Rename the new grid to something like "Summer Precipitation" (or "Winter Precipitation" in cases south of the Equator) through the "Theme" menu option "*Properties…*" (Figure 1.41).

FIGURE 1.41
Viewing the new grid "Summer Precipitation"
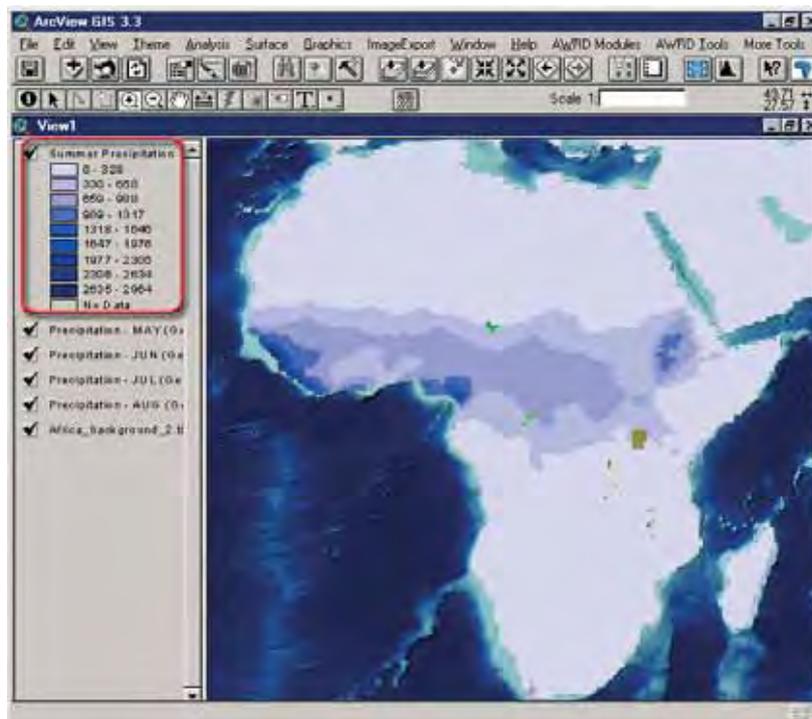
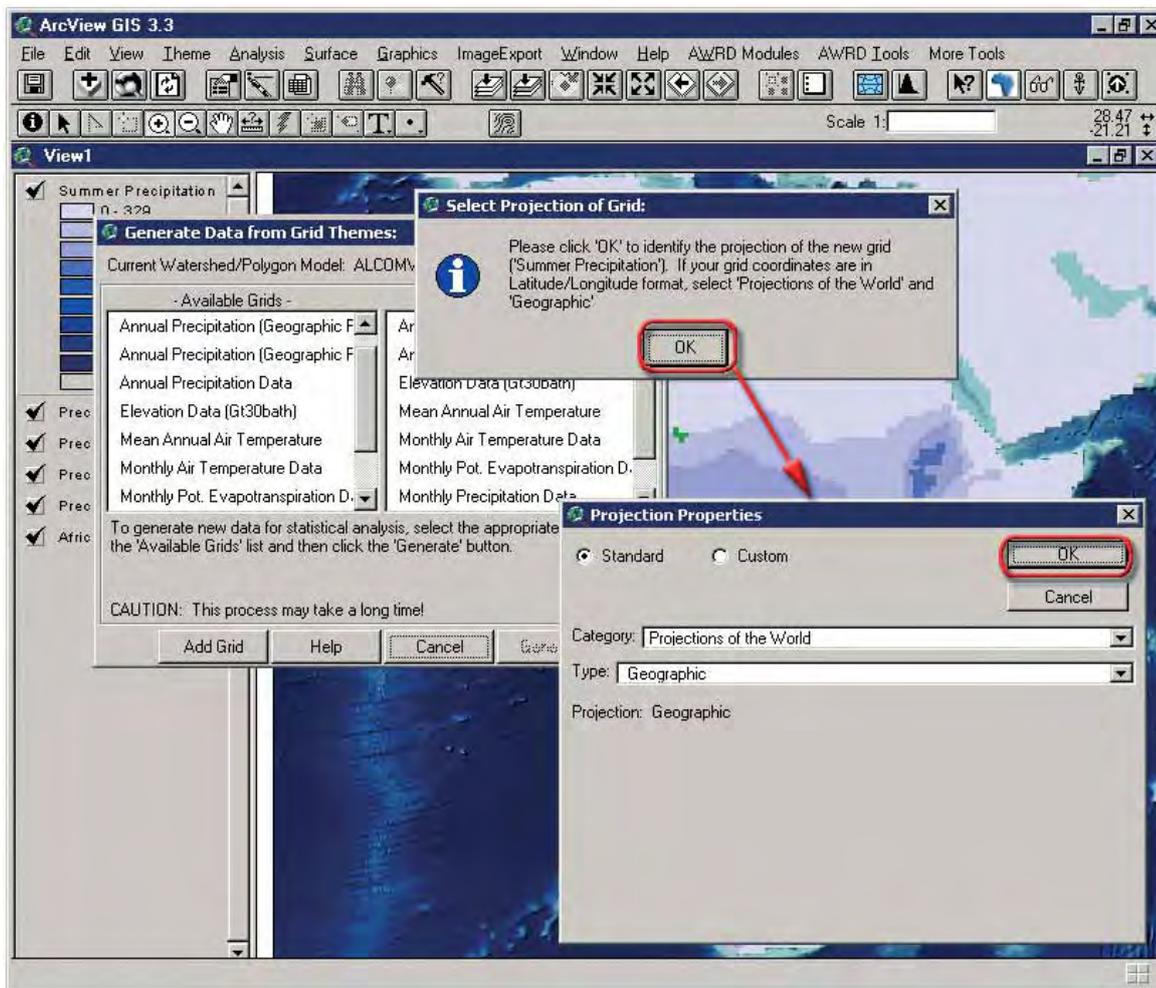4. Register the new Summer Precipitation grid with AWRD. Click the "*Add New Tabular Data…*" menu option to open the "Generate Data from Grid Themes:" dialog, then click the "Add Grid" button to open the "Please Select Grid Theme:" dialog (Figure 1.42).

FIGURE 1.42
**Adding the new grid (Summer Precipitation) into the AWRD**
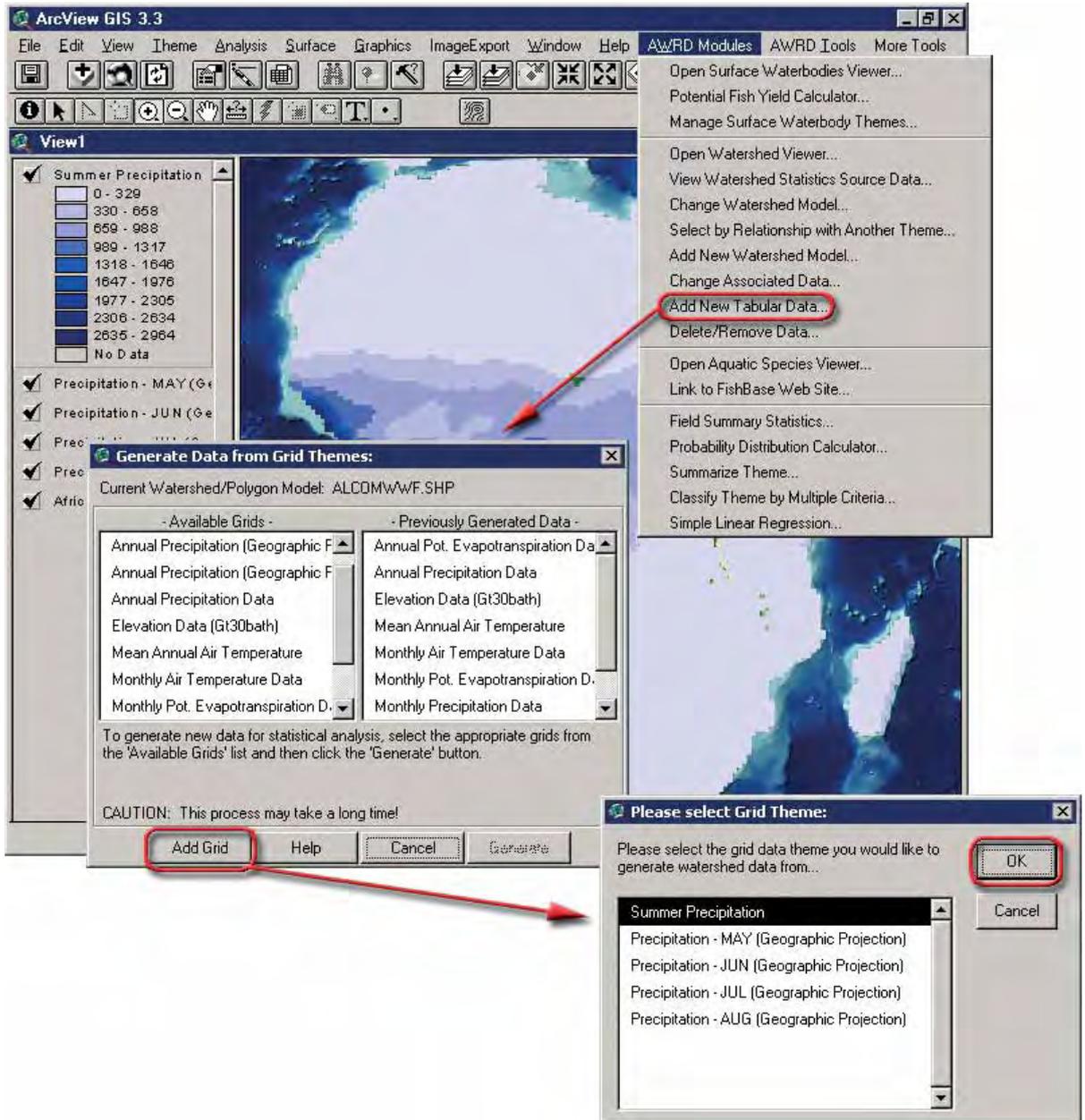
5. Pick the "Summer Precipitation" grid from the list and click "OK".
6. Specify the projection of the Summer Precipitation grid. In this case, because the monthly precipitation grids were in the Geographic projection, the Summer Precipitation grid is also in the Geographic projection (Figure 1.43).

Section 1.4

FIGURE 1.43
Specifying the projection of the new grid

7. After clicking "OK" on the "Projection Properties" dialog, the user is returned to the "Generate Data from Grid Themes:" dialog. Notice that the Summer Precipitation grid has been added to the list of available grids (Figure 1.44).

FIGURE 1.44
Registering the new grid
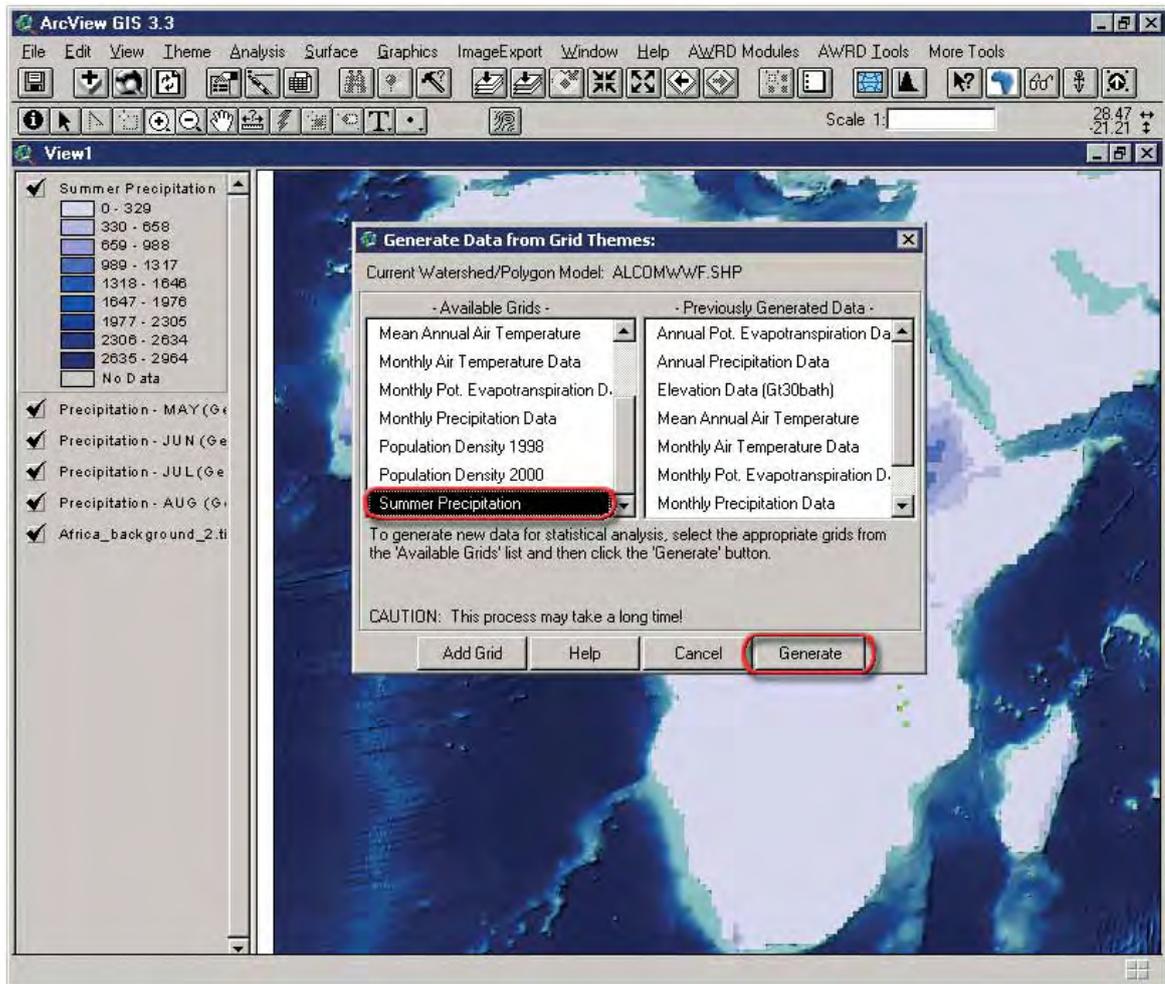
8. Select "Summer Precipitation" from the list and click "Generate". Because the current default watershed model is "Alcomwwwf.shp", this tool will generate a table of summer precipitation statistics for the Alcomwwwf watershed model (Figure 1.45).

FIGURE 1.45
Visualization of the new registered grid
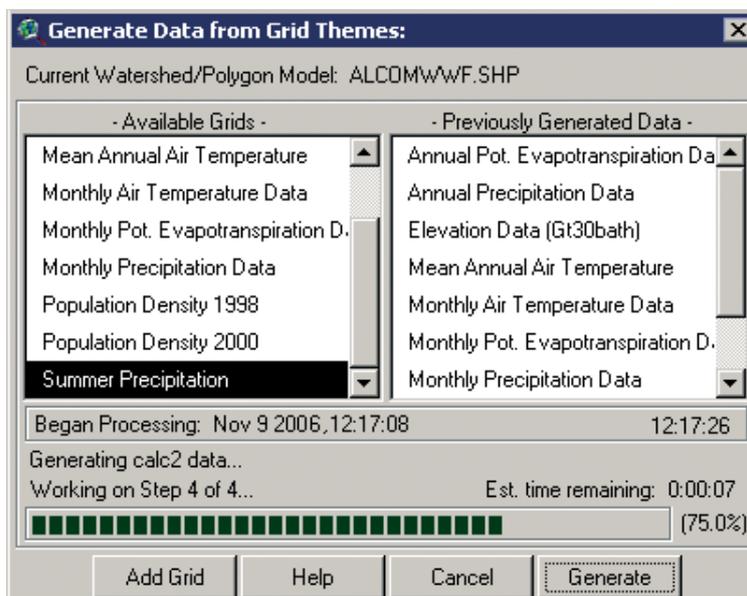
Now that the Summer Precipitation grid has been registered and a table of data generated for it, this tool automatically adds the Summer Precipitation data to the default list of selected data, and summary data will automatically be calculated for the selected set of watersheds in the main Watershed Statistics Module dialog (Figure 1.46).

FIGURE 1.46
Calculation of summary data for the new grid
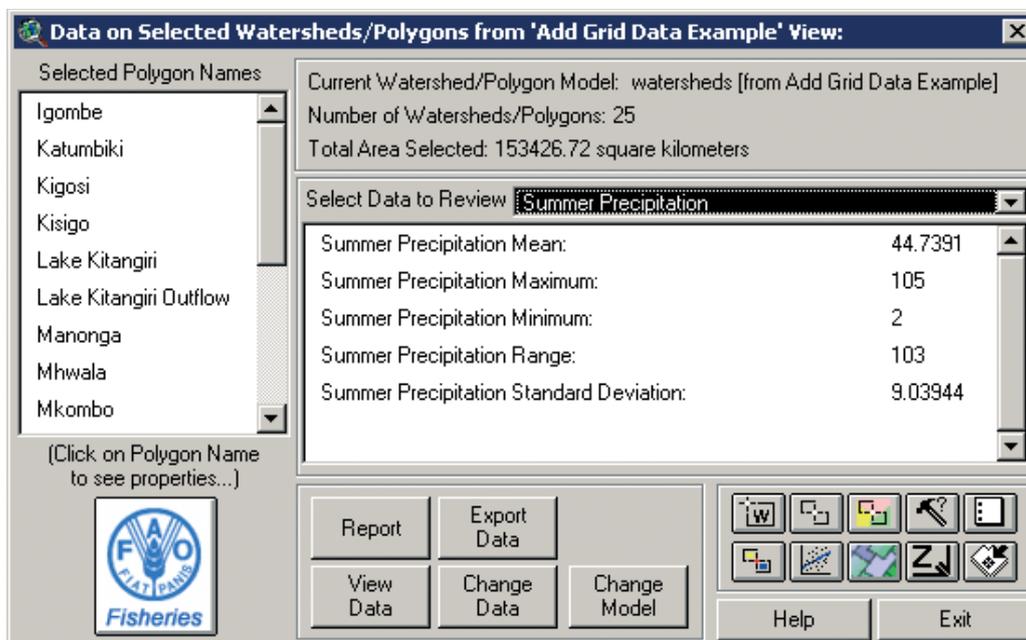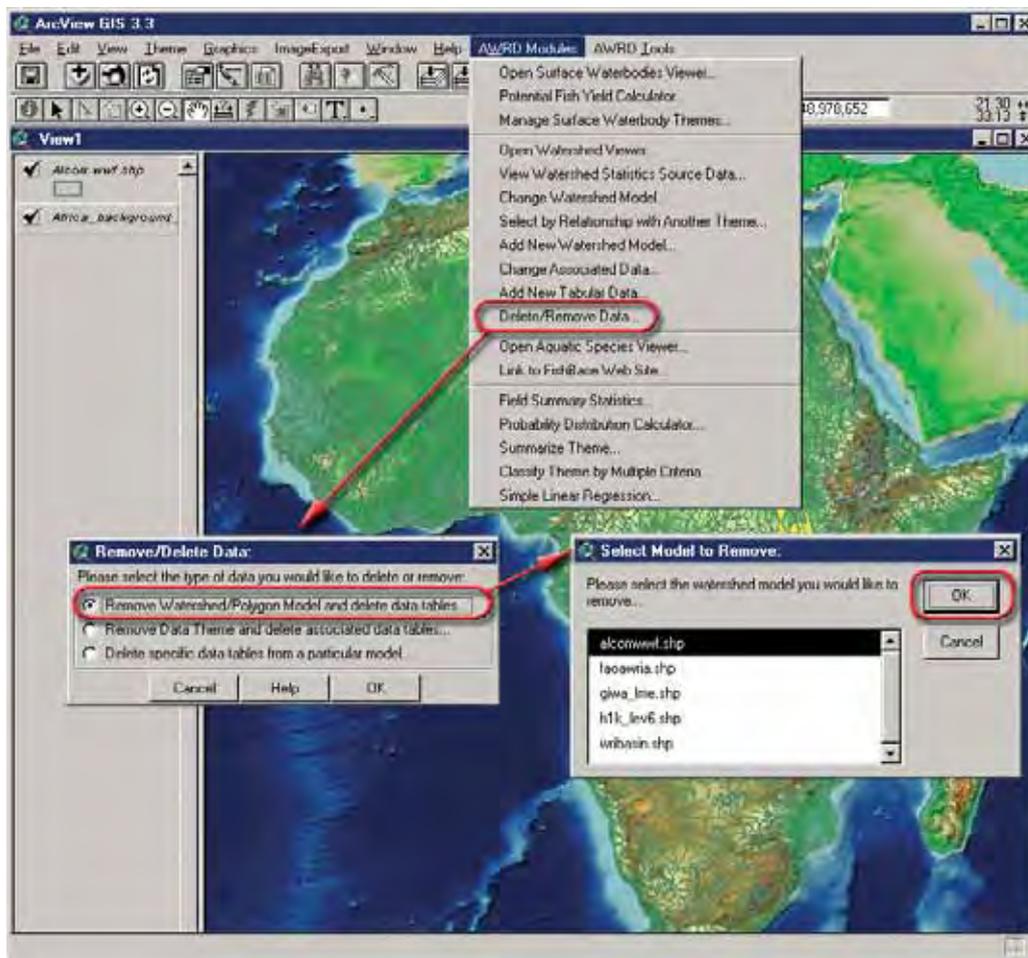

Delete/Remove Data

The "*Delete/Remove Data...*" menu option on the AWRD Modules menu allows users to delete and/or unregister watershed models, grid themes and specific data tables. Clicking on this option opens the "Remove/Delete Data:" dialog where the following three options can be found:

Remove Watershed/Polygon Model and delete data table: this option will completely remove a particular watershed model and delete all the associated data tables. This option will not delete the actual watershed model, but it will unregister it so that the AWRD interface will no longer recognize the theme as a watershed model. Clicking this option opens a dialog that will prompt the user to identify a WS model from the list of registered models (Figure 1.47).

1. Select a watershed model and click "OK" and the tool will then prompt the user to confirm the removal. Click "OK" again and the tool will unregister that watershed model and delete all its associated data tables.

Note Using this function will NOT delete the actual watershed feature dataset from the hard disk.

FIGURE 1.47
Selecting the watershed model to remove

Remove Data Theme and delete associated data tables: this option allows users to completely remove a particular grid data theme and delete all the associated data tables. In this case, several watershed models may have data tables that were derived from that grid. All such data tables will be deleted, but the grid itself will only be unregistered. Although the grid will not be deleted, this extension will no longer recognize it as a data theme. Clicking this option opens a dialog prompting the user to pick the grid theme from a list (Figure 1.48).

African Water Resource Database – Technical manual and workbook

FIGURE 1.48
Selecting the grid theme to remove
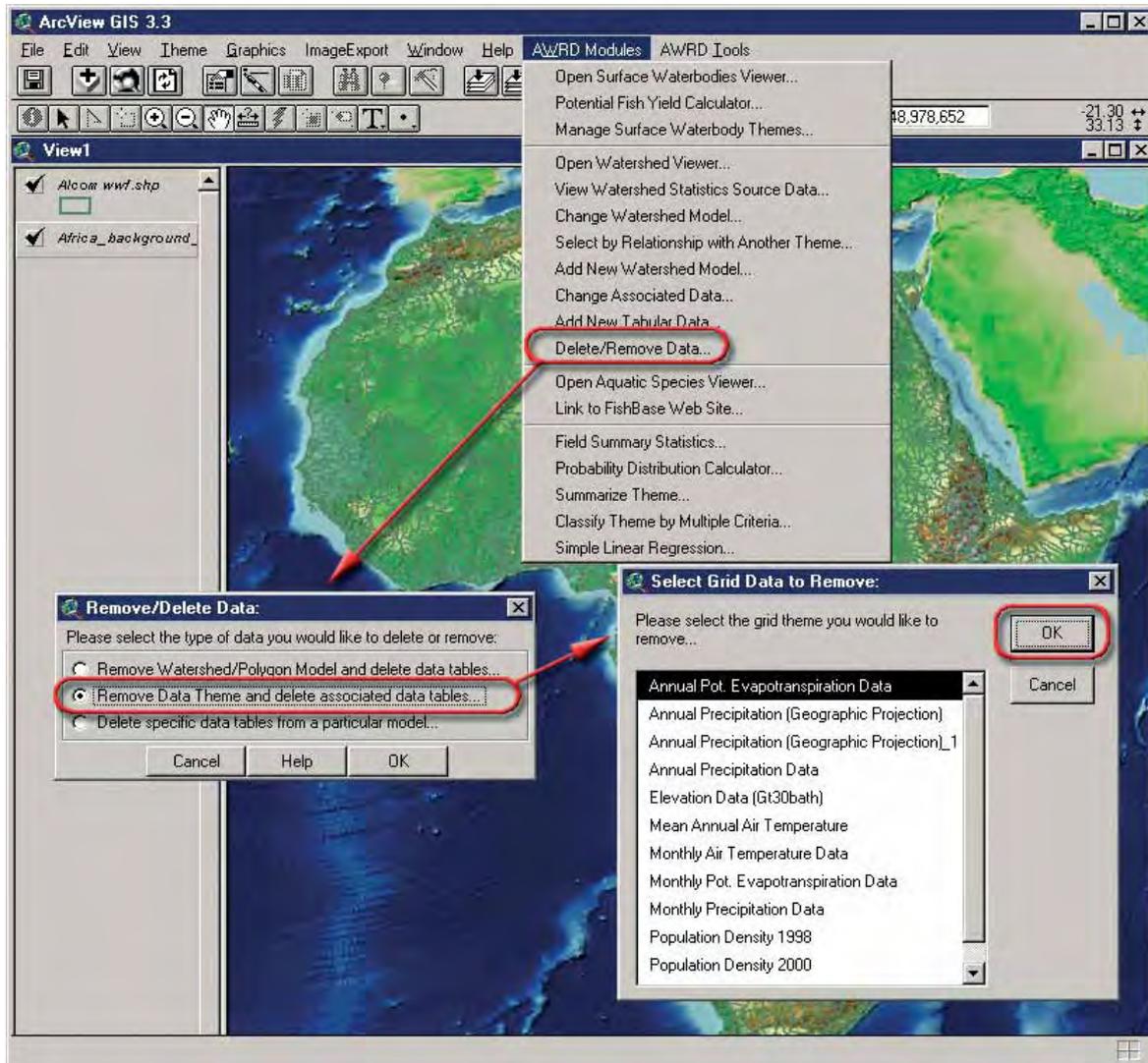
1. Select a grid theme (e.g. Annual Potential Evpotranspiration Data) and click "OK" and the tool will then prompt for confirmation of the deletion. Click "OK" and the tool will unregister that grid theme and delete all data tables derived from it.

Delete specific data tables from a particular model: this option provides users with greater control over deleting specific data tables. Clicking this option opens the "Delete Data Tables" dialog (Figure 1.49).

FIGURE 1.49
Deleting specific data tables
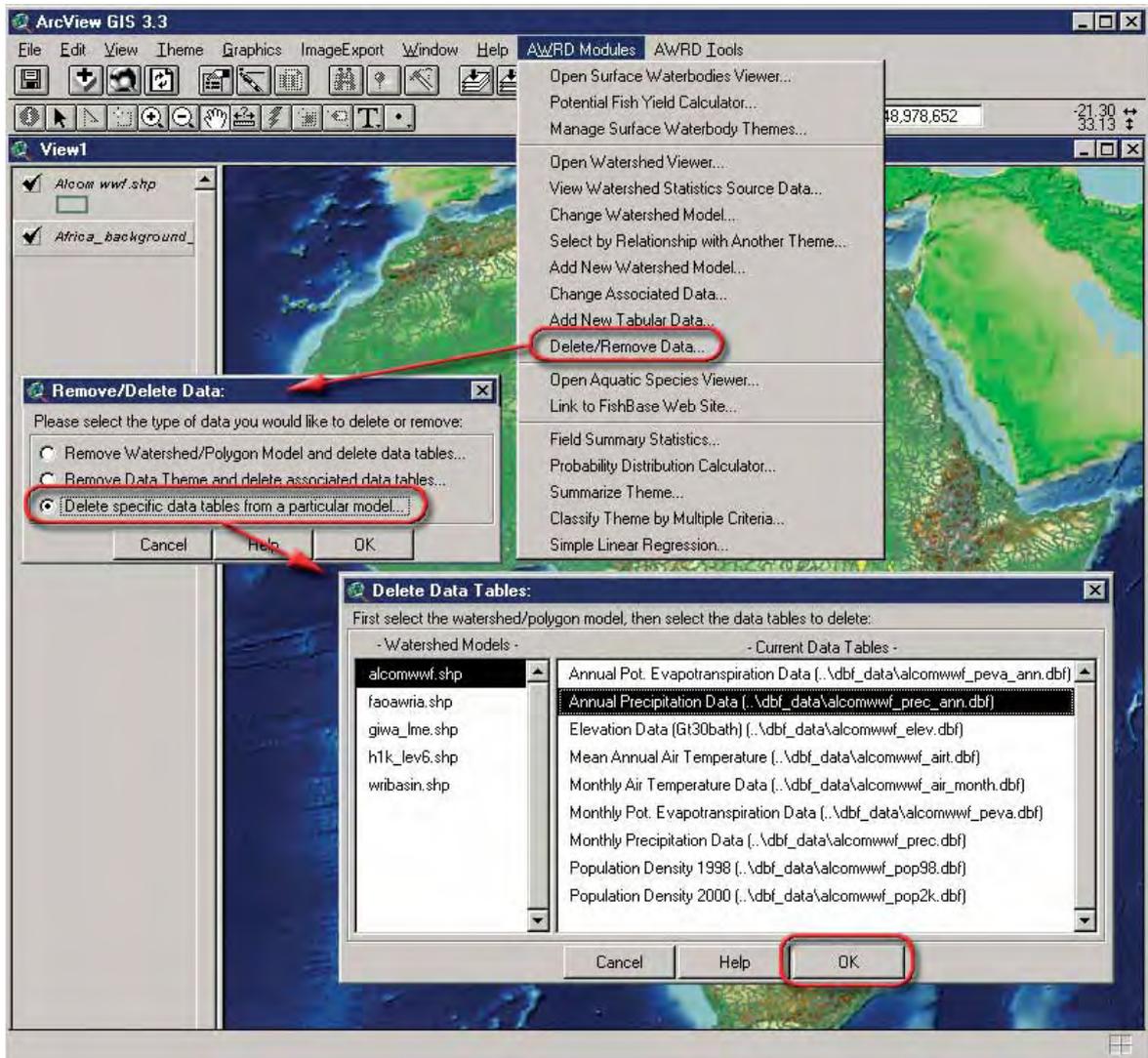
1. The list on the left contains all the currently registered watershed models. Click on one of these and a list of all the current data tables for that particular model appears in the list on the right. Pick any or all of the themes selected for deletion (e.g. Annual precipitation) and click "OK". The tool will again prompt for confirmation before the associated data tables are deleted. Click "OK" and the data files will be deleted.