Spatial Editor Training Guide

Controlling the Spatial Editor
The Spatial Editor displays one or more grids in plan-view format. This editor allows you to modify individual grid points using a number of tools, built-in to the GFE and tools that you write yourself. Before you start any exercises using the Spatial Editor, it is very useful to know how to control the Spatial Editor display.

The Spatial Editor is controlled from the Spatial Editor legends, Grid Manager, Time Scale or the Button Bar, depending on what part of the display you wish to change. First we cover animation, then discuss how to make weather elements visible and editable with Spatial editor legends or the Grid Manager. Finally we talk about Edit Areas before moving on to the edit tool exercises.

Spatial Editor Legends
The figure below is a snapshot of the Spatial Editor legends located in the lowest portion of the display. Not only do legends control the Spatial Editor, but they also convey information about the data current displayed in the Spatial Editor.

Much like the AWIPS display, the Spatial editor legends tell you which weather elements are loaded, which are displayed (and not displayed), which weather element is displayed as an image and which is currently editable. We discuss each state below.

Not Displayed - Weather elements that are not currently visible in the Spatial Editor are displayed in gray. If no grid occurs at the Spatial editor time, the legend date and time are replaced by "<No Grid>".

Displayed as a Graphic - Weather elements that are currently displayed as a graphic (contours) are indicated by a legend whose color matches that of the graphic.

Displayed as an Image - If a weather element is displayed as an image in the spatial editor, its corresponding legend is white in color. Only one weather element may be displayed as an image at a time. When you display a particular weather element as an image, any element previously displayed as an image will be displayed as a graphic.

Editable - Any time a weather element is editable, the characters "(edit)" appear immediately to the left of the legend.
In addition to its color, the legend text tells you much about the grid(s) currently displayed in the Spatial Editor. Below we list an example and explain each part.

(edit) T Fcst (BOU) 1H Fri 12Z 02-Jun-00

(edit) - This weather element is the editable weather element. When edit operations are executed, the element is modified.
T - The weather element identifier. In this example, it refers to Temperature.
SFC Fcst - The name of the database. In this case it is the forecast database. Other choice may include: NAM, MRF, AVN, NGM, and LAPS. For D2D grids, the name may include the level as well (e.g., 500mb).
BOU - WFO over which this grid is valid.
(F) - units of this weather element. In this case degrees F.
1H - Number of hours this grid is valid. In this example the grid is valid for one hour.
Fri - The day of the week.
18Z 02-Jun-00 - Start time of the grid (hour (GMT), day of the month, month and year.

For persistent grids, i.e., grids that have no associated valid time, the word "Persistent" is shown in the spatial editor legend. Although Topography is a persistent grid, it will not contain the "Persistent" label.

**Legend Pop-up Menu**

Much like the D2D display system, the GFE Spatial Editor Legends provide many option for controlling the display. To display the pop-up menu, move the cursor over any legend and press MB3. The options available on the legend pop-up menu include appearance items, control items, and grid operations. Examples of the appearance items are changing the color table, graphic color, line width and style, setting the contour values, density, and magnification. Examples of the control items are unloading the weather element, displaying the weather element as an image or graphic, and setting the display attributes in image and graphic mode. The grid operations are nearly identical to those options available via the MB3 popup over the Grid Manager and include items such as deleting the grid, fragmenting it, assigning values, and copy/paste operations.

More information is available on the legend pop-ups in the Button 3 Popups Reference Guide.

**Toggling the Legends**

By default, the legends display information about the grids that are currently loaded. But the legends can be toggled off to remove clutter from the display. To learn how to toggle the legends, perform the next exercise.

Before you begin, select a time in the Grid Manager so that a grid is visible in the Spatial Editor and make sure one of the map backgrounds is displayed.

1. Move the cursor into the Spatial Editor (away from the legends) and press and hold MB3.
2. A pop-up menu will appear displaying a list of choices. From this list select **Legends->Hide**.

The grid data legends will disappear from the display. To display them again select **Legends->Show All Weather Elements** from the MB3 pop-up over the Spatial Editor display.

The map background graphics may be toggled on and off as well. By default, map background graphic legends are not displayed. You can display them by pressing MB3 over the Spatial Editor display and selecting **Legends->Show Map**. Note that either the Weather Element legends or the Map Background legends may be displayed at any given time, but not both.

There are several other options available when toggling the legends. You can choose to just display the Fcst weather elements, or just the active weather element.

**Map Background Options**

Once you toggle the map legends so that they are displayed you may change the map color or unload the map via a MB3 pop-up menu. To access these options, move the cursor over one of the map legends and press and hold MB3. Options available include changing the graphic color, line width, style, and unloading the map background. More information is available on the legend pop-ups in the **Button 3 Popups Reference Guide**.
Changing the Spatial Editor Display using the Legends
Modifying the look of the Spatial editor display works very much like the AWIPS. The table below describes functions implemented by the legends (in the normal Grid display mode).

<table>
<thead>
<tr>
<th>Action</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB1 click</td>
<td>Toggle visibility</td>
</tr>
<tr>
<td>MB2 click</td>
<td>Toggle Edit state</td>
</tr>
</tbody>
</table>

Toggle Grid Visibility
Clicking MB1 on the legend will toggle a weather element's visibility. If it was visible before the click, it will be made invisible. If the weather element was invisible it will be made visible. Note that the Spatial Editor Time must be set such that a grid's valid period must intersect it.

- **Purpose:** To make a grid visible or invisible
  1. Make sure that there is a weather element loaded and that the Spatial Editor time is set so that it overlaps a grid.
  2. Click MB1 on the weather element's legend.

Toggle Grid Edit State
If you wish to edit a grid, you must first make the grid editable. To make the grid editable, simply click MB2 over the legend. Anytime a weather element is editable, the letters "(edit)" appear immediately to the left of the legend. Note that your grid may be displayed as an image if the "Image on Edit" mode is enabled.

- **Purpose:** To make a grid editable
  1. As in the previous exercise, make sure that there is a weather element loaded and that the Spatial Editor time is set so that it overlaps a grid.
  2. Make the weather element visible by clicking MB1, if it is not already visible.
  3. Click MB2 on the weather element editable.

You should see the letters "(edit)" appear to the left of the legend. This indicates that the weather element is now ready to edit. Note that if the displayed grid is not editable, because is locked by another user or that it is a read-only model grid, the "(edit)" string will not appear, since the GFE will not allow you edit grids in those states.

Changing the Spatial Editor Display using the Grid Manager
In the Grid Manager section we discussed that fact that the Grid Manager tool allows you to set the time displayed in the Spatial Editor and make grid editable. So we briefly switch back to the Grid Manager to explain how it is used to control the Spatial Editor.

Making a Grid Visible and Editable with the Grid Manager

- **Purpose:** Identify a grid to edit
  1. Locate a grid and click MB1 over the grid block in the Grid Manager.

Note that the grid is now visible in the Spatial Editor and is now in edit mode. Any Spatial Editor operation executed will be applied to this grid. Cases where this operation will not work include immutable weather elements such as those derived from model data and grid that are locked by another user of the forecast database.
Zooming (enlarging) the Spatial Display
The Spatial Editor display can be zoomed or enlarged at any time using the MB3 pop-up menu. When this menu is displayed, you are given a choice of zoom factors that represent the width of the display in kilometers. Selecting one of these choices will cause the display to zoom to that size centered wherever you pressed MB3.

- **Purpose:** To make the larger or smaller in order to see more or less detail.

  1. From the Spatial editor display, press and hold down MB3. A pop-up menu will appear containing the "Zoom" menu item
  2. Move the cursor to this "Zoom" menu item until another cascading menu of numbers appears.
  3. Move the mouse cursor over one of the choices in the middle of the number list and release MB3.

You should see the display zoom in and enlarge the size of the data and map backgrounds. Repeat the last exercise and select the highest value in the list to zoom out to full view.

A shortcut for Zooming
Another, faster way to zoom the Spatial Editor display is to press the SHIFT key on the keyboard and click MB2 to zoom in and MB1 to zoom out. Zooming in always uses the clicked point as the new center of the display.

Panning the Spatial Display
Panning the display works similarly. While holding down the SHIFT key, MB1 or MB2 drags will pan the display in the same direction, just like the D2D display. Note that if you move the cursor outside the Spatial Editor display area, the pan operation stops. To continue panning, you will need to reposition the cursor, press SHIFT, and drag MB1 or MB2 again.

Topography
The GFE includes topography as a special weather element. Topography can be displayed with any other weather element, except that it cannot be edited. To load topography into the GFE, perform the exercise below.

- **Purpose:** To load and display topography data

  1. From the main menu, select Maps ->Topography.

You should now see an image that represents the topography over your county warning area. The image is generated from a terrain database and mapped to your office's projection and domain. While you cannot edit topography data, it can be used to identify edit areas based on elevation. We will discuss more about defining edit areas based on gridded values in the next section.

Edit Tools

Edit Areas
Nearly all of the spatial editor tools use edit areas to determine which grid points to modify. You will need to know how to define edit areas before using the spatial editor tools.

An Edit Area defines a set of grid points. These points may comprise a county, forecast zone, or any random area that you define. They may be saved and recalled later for reuse. In fact, there are two ways to save edit areas: as an ordinary named set or as a QuickSet.

After you define a edit area you may save it as a named set. The simplest example of this type of edit area is a county. In general, named edit areas are saved once, recalled many times, and not changed very often.
Another way to save an edit area is as a QuickSet. QuickSets should be considered as a temporary method of saving edit areas as they are easily overwritten. QuickSets are similar to the store button on a calculator. They hold the state of an edit area temporarily while you perform some operation that requires a different edit area.

**Edit Area Interface**

The figure above is a snapshot of the edit area buttons on the Button Bar. The operations include toggling, clearing, doing queries, setting the edit area mode, and accessing/storing edit areas. Refer to the GFE Toolbar documentation for more details.

**Defining an Edit Area**

There are several ways to define an edit area. You can recall a previously saved set, define a new edit area by hand, or execute a query that defines the set based on data values of any grid or grids that you specify.

The simplest method of defining an edit area is to define one by hand. The Select Points tool was designed to allow you to define edit areas interactively. When this tool is selected, dragging with MB1 selects an area while dragging with MB2 deselects an area. The following exercise will get you familiar with defining references sets by hand.

**Load an Edit Area from the Main Menu**

Probably the easiest way to load an edit area is from the Main Menu. All of the edit areas that correspond to your counties, zones of various kinds, WFOs, and states are generated automatically by the IFPServer. You can find them under the Main Menu item Edit Areas.

- **Purpose:** To load a predefined edit area

1. Make sure that the current edit area mode is set to Replace (=).
2. From the main Menu Bar select **Edit Areas->Counties->[county name of your choice]**

You should see the county you chose highlight in a white stippled pattern. This indicates that this area has been choosen to edit. Any edit operation that you perform will be applied to this area.

**Define an Edit Area by hand**

- **Purpose:** To define a new edit area

1. Make sure that the current edit area mode is set to Replace (=).
2. Select the Select Points tool.
3. Move the cursor into the Spatial Editor.
4. Press MB1 and drag the cursor to outline an area with the mouse. You should see a white outline that defines the edge of your area.
5. Release MB1. You should see the area filled with a white shaded pattern.

You now have defined an edit area by hand. At this point, you could use one of the edit tools to modify the data over this new area that you defined. We discuss how to use tools in the Edit Tools section.

Repeat the above exercise, but this time select the union (|) mode button beforehand. Note that in union (|) mode, each time you define a new area the old area(s) remains and is combined with the new area. Now select the intersection
(&) button and repeat the exercise again. Note that this time the result is the intersection of the newly defined edit area and the current edit area. Only the areas that overlap remain.

**Erase an Edit Area**

Now and then you may want to remove a portion of an edit area that you've already defined. The next exercise show you how to erase an edit area.

- **Purpose:** Remove a portion of the edit area
  1. Move the cursor near any edit area and press MB2.
  2. With MB2 pressed, drag another outline to define a new area that partially intersects with your first area.
  3. Release the mouse and observe that the intersected area is removed from the edit area.

**Toggle an Edit Area**

- **Purpose:** Invert the currently defined edit area

Occasionally, it is useful to invert (toggle) the currently displayed edit area. When you toggle the current edit area, all the grid points that were selected are deselected and all the points that were previously not selected become selected.

Create an edit area by hand as you did in the exercise named, Define Edit Area by Hand, using the Select Points Tool

1. Using MB1 click on the Toggle Button.

Note that all the grid points that were selected have been deselected and vise versa.

**Clear an Edit Area**

- **Purpose:** Clear the current edit area

Frequently you will want to clear the current edit area and create a new one. The clear button was made for this purpose.

1. Make sure there is an edit area displayed in the Spatial Editor.

2. Using MB1 click on the button .

The edit area has been cleared and no grid points are selected.

A couple of handy utilities can be found on the MB3 pop-up menu over the spatial editor, one that selects a contiguous edit area based on the grid point value under the cursor, and another that deselects a contiguous edit area. We discuss these in the next two sections.

**Select Homogenous Edit Area based on Value**

**Purpose:** To select an edit area based on value.

This function allows you to select an edit area based on the value of the selected point and the value of the points surrounding it. To understand how this works, complete the next exercise.

1. Clear the edit area as you did in the previous exercise.
2. MB1 click on one of the grids in the Grid Manager to display it in the Spatial Editor and make it editable.
3. Move the mouse cursor to middle of the Spatial Editor display and MB3 press and select **Select Homogeneous Area**.

You should see a new edit area that identifies those grid points whose values are within the fuzz value of the point you selected. For example, if the fuzz value is 3, and you selected a grid point with the value 10, all the points with value between 7 and 13 and that are also touching become selected.

1. Move the mouse cursor to the middle of the Spatial Editor display and press MB3 and select **Set Fuzz Value...**
   This will display the Fuzz Value Dialog.
2. Change the Fuzz Value so that it is two to three times larger than its current value.
3. Select OK in the Fuzz Value dialog.
4. Repeat steps 2-4 above, and note that the edit area is larger, since the fuzz value is now larger.

The fuzz value is meaningless for the Weather data type. When you select Select Homogeneous Area when the Weather weather element is editable, any points that are the same weather value and touching are selected.

**Remove a Contiguous Edit Area**

**Purpose:** To remove a contiguous edit area

1. Using the edit area that you defined in the previous exercise, move the mouse cursor to any grid point in this area.
2. Press MB3 and select Deselect Contiguous Area from the pop-up menu. The area identified by your mouse cursor is deselected.

Once you define an edit area, it is often useful to save it so you do not need to define it again. This exercise show you how to save an edit area in a temporary location as a QuickSet.

**Saving Edit Areas as QuickSets**

**Purpose:** To temporarily save an edit area

1. Define an edit area as you did in any previous exercise.
2. Find the quick set store button in the group of edit area buttons on the right side of the toolbar click with MB1.
3. Move the mouse cursor over one of the numbered buttons and with MB1 click any one of them.

Now your edit area is saved under that particular slot and can be recalled at any time. The next exercise shows you how to recall a saved QuickSet.

**Loading a QuickSet**

**Purpose:** To restore a previously saved QuickSet

1. Clear the edit area, if there is one currently displayed in the Spatial Editor.
2. Find the same button under which you saved the QuickSet in the previous exercise.
3. Click MB1 on this button.

Note that the edit area that you saved as a QuickSet is now displayed.
To review, clicking the button \(q\) and then a button labeled with a number \(1\) saves the currently displayed edit area under that slot. Simply clicking the number displays that edit area. QuickSets are intended for temporary storage of edit areas. QuickSets slots should be considered volatile, since there are a limited number of them and that they are not considered to be "owned" by any user. To save edit areas more permanently, store them as a "named" edit area.

**Edit Area Groups**

Since the list of Edit Areas can be very long (well over 100), the GFE provides you with a way to organize them. Any Edit Area that you define can be saved under any combination of edit area groups.

The GFE provides two ways to assign a particular Edit Area under one or more Edit Area Groups. One way is to assign the group(s) when you initially save the Edit Area. The other method is to first save the Edit Area without assigning any group and then use the Save Edit Area Groups Dialog to assign Edit Areas to Edit Area Groups.

To assign a group to your Edit Area as you are saving it, follow the instructions in the section for Saving Named Edit Areas, but this time select or type in the Edit Area Group(s) before you click "Save." That operation will not only save your Edit Area, but also assign it to the group or groups that you selected before you clicked "Save". Note that if you do not assign a group to a new edit area, it will automatically be assigned to the "invisible" group "Misc". The only Edit Areas that are contained in the group "Misc" are those that have not been assigned to any other group. Once you assign an Edit Area to a group, it will no longer appear under the "Misc" group name in the Edit Area Query Dialog.

Now let's assume that you've saved some Edit Areas but not yet assigned them to any groups. To simply assign Edit Areas to groups, use the Save/Delete Edit Area Groups dialog found within the Edit Area Query dialog under the "File" menu item. Here's an exercise that steps through this process.

- **Purpose:** To save assign an Edit Area to a group name

  1. From the "Save/Delete" menu item in the Edit Area Query dialog, select "Save Edit Area Group... ".
  2. When the dialog appears, select one of the Edit Area Groups, located in the list on the left.
  3. Select one or more Edit Areas that you want included in that Edit Area Group.
  4. Finally, select "Save".

Now when you use the Edit Area Query Dialog, those Edit Areas will appear under the group to which it was assigned. If you want to make a new group name, just type the new name in the box labelled "Identifier" and a new group name will be created.

To remove an Edit Area from a group, bring up the Delete Edit Area Group Dialog again. Note that when you select any Edit Area Group, the Edit Areas in that group automatically highlight. To remove one or more of the Edit Areas from the selected group, simply toggle them off and select "Save".

**Loading Named Edit Areas**

- **Purpose:** To display a named edit area

Once you have saved an edit area as a named set, you will want to load it as the current edit area. The next exercise explains how to do this.

Select the Clear button \(C\) to clear the Spatial Editor of any current edit areas.

1. Select the button \(?\) from the toolbar.
2. Once the Query dialog appears, select a named edit area from the column titled "Edit Areas".
3. Select "Submit".

The edit area you selected in the dialog should now be displayed in the Spatial Editor. If an edit area is defined when you load a named edit area, it will be replaced, unioned, or intersected with the named area, depending on the edit area mode.

**Saving Named Edit Areas**

**Purpose:** To save the current edit area as named set

There are some edit areas that you will want to save permanently as named sets rather than temporarily as QuickSets. This exercise will show you how to save a named edit area.

1. Define an edit area as you did on any of the previous exercises.
2. From the Query Dialog main menu select **Save/Delete -> Save Edit Area**.
3. In the box labeled "Identifier", type in a unique name. (Don't bother with the Group Name(s) column just yet.)
4. Select "Save Active Area" and your edit area will be saved in the database.

Note that the GFE will automatically generate Edit Areas based on map data for your local area. For example, in the Edit Area Query Dialog, you should see each one of your counties and zones listed. There is no need for you to define these areas since they already are defined for you.

**Deleting Named Edit Areas**

**Purpose:** To delete a named edit area from the inventory

Occasionally you will want to remove a named set from the edit area inventory. This exercise will show you how to delete a named edit area.

1. Select the button located on the toolbar.
2. From the Edit Area Query Dialog, select "Save/Delete" from its menu bar.
3. Select one of the names listed with an MB1 click.
4. Select "Delete Selected Area" with MB1.

The edit area will be removed from the inventory.

**Edit Area Queries**

In a previous exercise, you learned how to define edit areas by hand. In the next set of examples, we will demonstrate how to define an edit area based on data values. Defining the edit area for one weather element based on data values of another weather element makes it easier to keep the weather element values consistent. For example, you may want to select all of the areas where it is raining and then assign 100% cloud cover to those points. The following exercises will show you how to define edit areas via queries.

**Simple Query**

**Purpose:** Define a new edit area via simple query

1. Set up the Spatial Editor display so that a temperature grid is displayed.
2. Carefully examine the range of values on this grid.
3. Select the Query button from the toolbar.
4. When the Edit Area Query dialog appears, select "T" from the column labeled Weather Elements.
5. Next, from the operators columns, select > (greater than).
6. Now, select a temperature value (e.g., 70) using the number keys. Make sure that you have selected a value such that there are grid values that are greater than the value you typed in.
7. Finally, select the "Submit" button, which can be found at the bottom of the dialog.

When you submit your query, the GFE calculates all of the points that satisfy the expression. You should see one or more edit areas defined on the Spatial Editor. If you don't see any edit areas, repeat the last 4 steps above, but this time choose a temperature value that will result in a valid edit area.

If you had wanted to, you could have simply typed in the query as: \( T > 70 \)

**A more complex query**
In this exercise we will execute a query expression that defines a range of temperature values.

**Purpose:** Define a new edit area via more complex query

1. Clear the current edit area by selecting \( C \) from the toolbar.
2. With temperature still loaded, select the query button, if the query dialog is not already visible.
3. Type the following into the query box: \( (T > 70) \) \& \( (T < 90) \)
4. Select the "Submit" button.

This time all of the grid points whose value is between 70 and 90 should be selected. This type of query demonstrates how to select a range of values using queries. When using the '&' or '|' operators, you must enclose the surrounding entries with parenthesis.

**Multiple Parameter Queries**
Queries are not limited to single parameters. The following example shows how you can execute an expression that includes multiple queries.

**Purpose:** To use multiple parameters in a query
Load the dewpoint (Td) parameter into the GFE if is not already loaded.

1. Display the dewpoint grid on the Spatial editor such that both temperature and dewpoint are displayed at the same time.
2. Examine an area on the screen and generally note the temperature and dewpoint over this area.
3. Select the Query dialog button to display the query dialog.
4. Use the selectors or type in a query that resembles the following: \( (T > 80) \) \& \( (Td > 50) \)
5. Select the "Submit" button.

For this query to work properly, there must be some area in the display where the temperature is greater than 80 and the dewpoint is greater than 50. If this is not the case, then repeat the exercise again but use appropriate values for your data set. Once the values fit the data, you should see an area defined that identifies those grid points that satisfy the expression that you defined.

By this time, you should start to understand why defining edit areas via queries is so powerful. This method allows you to define and edit data based on data values, thereby linking the weather elements together in a consistent way. For example, a previously defined QPF field can be used to help you define the Probability of Precipitation (PoP) field. Not only are forecast weather elements more consistent, but the need to tediously define edit areas by hand is greatly reduced. Using queries in this way encourages you to think meteorologically.

**Complex Queries**
Queries are simply expressed in numerical python. Thus the techniques you use to write smart tools and smart
initialization scripts may also be performed in the query engine, just as long as the result is a "mask" representing whether
a grid cell is marked "on" or "off". Thus, numerical functions may be used as well as numerical expressions.

For example, the following query calculates the dew point depression and then selects points where the
depression is less than 4 degrees:

\[(T - Td) < 4\]

Here is an example of a numerical query to determine which the T from the Fcst and T from the NAM12 are not
within 4 degrees of each other; note the use of the numerical absolute() function:

\[\text{absolute}(T - T_{\text{SFC\_BOU\_GRID\_NAM\_20030314\_1200}}) > 4\]

The above query also introduces the concept of performing queries on non-Fcst database grids. There are
several more convenient formats than that shown above, please refer to the Edit Area and Query Dialog for
more details.

Queries on WEATHER and DISCRETE data are also complex. The Edit Area and Query Dialog provides
several shortcuts so you don't need to remember the specific syntax. The options permit exact matches or
"contains" matches. For example, you can search for any instance (i.e., any coverage, any intensity) of RW
(rain showers) using this query:

\[\text{mask}(Wx, \":RW:\")\]

Intimate knowledge of the format of the WEATHER "ugly" string makes this job easier, even though the dialog
provides automatic fillin if desired.

The weather query above will match any grid cell that contains any form of RW. If you wanted to make an
exact match of only the RW, then the query would be similar to:

\[\text{mask}(Wx, \"^Sct:RW:-:\<NoVis>:\Z", 1)\]

If you want to select the inverse of an edit area, for example, the opposite of the above statement, then you use the
\text{logical\_not()} function. The following selects everything but Sct RW-:

\[\text{logical\_not}(\text{mask}(Wx, \"^Sct:RW:-:\<NoVis>:\Z", 1))\]

Wind queries use the "FROM" direction. Wind is presented as a tuple, so if you want to do a query based on wind speed,
use Wind[0]. If you want to do a query based on wind direction, use Wind[1]. For example, the following wind query
looks for speeds greater than 25 and directions between NW (325) and NE (45):

\[(\text{Wind}[0] > 25) \land (\text{Wind}[1] > 325) \land (\text{Wind}[1] < 45)\]

\textbf{Saving Edit Area Queries}

Edit Area Queries can be saved just like ordinary "polygon" queries. Once you have submitted the query, select the save
button to save that query. Note that it will be saved as a query so that when you submit it again, the result may be
different, depending on the particular data values on your display.
Important note about Edit Area Queries! Many of the product generation applications accept one or more edit areas as input to allow you to trim the product to a domain of your choice. Unfortunately, these product generation applications cannot accept edit area queries as input to generate a product. Edit Areas passed into these routines must be "polygon" areas that are defined by boundaries not queries. Specifying a query to these applications will likely result in a "blank" product. This restriction will be lifted in the future.

Spatial Edit Tools
Spatial Edit tools (with the exception of the Contour tool and Pencil tool) require that you first define the set of grid points to which you want the edit operation to apply and then apply the operation. Tools consist of the Select Points, Contour, Pencil, Move/Copy, and Sample. These tools are selected using the GFE Toolbar and then particular mouse actions do different editing operations. Refer to the GFE Toolbar Reference Guide for more details on the mouse button assignments. Also, you can set up keyboard shortcuts for these tools. (See gfeConfig Keyboard Shortcuts).

Select Points Tool

Purpose: To define an Edit Area

The Select Points tools allows you to define and modify edit areas. Perform the following exercises to learn three different ways Select Points tool can edit your Edit Areas.

1. Select the Select Points tool from the Button Bar (see figure above).
2. Press MB1 and drag a closed outline anywhere on the Spatial editor display.
3. Note that a white shaded area appears that indicates the extent of your edit area.
4. Now adjust the edit area by drawing another closed outline with MB2 that includes part of the area you just defined.
5. Note that the area that was inside this second outline is removed or deleted. The MB2 drag operation trims an existing edit area.
6. Next, press MB3 and select Deselect Contiguous Area. Note that the area that you defined earlier is deleted.

Contour Tool

Purpose: Modify grid values by drawing and adjusting contours

The contour tool lets you define or adjust a gridded field by drawing and adjusting contours. There are four different operations supported by the contour tool: draw a new contour, adjust an existing contour, delete a contour, and add a new contour. Because converting from contours to the actual grids can take several seconds, the contour tool allows you to perform as many of these operations as you like before the grid is actually generated. And there are two algorithms from which to choose that convert your contours into a gridded field. We will define the operations that the Contour Tool offers, and then demonstrate each one in the exercises that follow.

- **Draw New Contour**

This operation allows you to draw a new contour with a value that you choose from the Pickup Value dialog or from the Color Bar located at the top of the Spatial Editor display. To perform this operation, you first select the value of the contour and then draw the contour on the Spatial Editor display.

- **Adjust Existing Contour**
This operation lets you modify the position of a contour that already exists. After you adjust any contour, the grid is immediately recalculated.

- Add Contour

The Add Contour operation inserts a new contour at whatever location you click. Its value is same value as the gridpoint you clicked upon. After adding a new contour in this way, you may adjust it using the Adjust contour operation.

- Delete Contour

The Delete Contour operation removes a contour from the display. Contours that are removed are not used when calculating a new grid from contours.

**Using the Contour Tool**

Unlike the other edit tools, the Contour Tool lets you make many changes to the display before the gridded values are actually modified. You can draw, add and delete as many contours as you like before you command the grid to be recalculated. If you use the adjust operation, however, the grid will be recalculated automatically. Once the grid is recalculated, you can make further modifications and recalculate again. Once you are done manipulating the contours, the Button-3 popup menu gives you the options to Calculate New Grid. Selecting this options will generate a new grid based on the contours that you just edited.

The Contour Tool works only on weather elements that are of type scalar. For example, you cannot use the Contour Tool to edit the elements wind or weather. The following exercise will help get you familiar with the Contour Tool.

**Purpose:** Draw a new contour

1. To begin, move the mouse cursor over to the Grid Manager and decide which scalar element you would like to edit.
2. Press and hold MB3 over a gap (not over a grid) and select Create From Scratch. If you were successful, a small yellow rectangle should appear and its corresponding legend in the Spatial Editor should show that the grid is ready to edit.
3. Next, select the Contour Tool icon from the Button Bar. The icon looks like:
4. Now, you are ready to draw some contours. Pick a value from the color bar, located at the top of the Spatial Editor, by clicking MB1 or MB2 on whatever value you like.
5. Move the mouse cursor over the Spatial Editor. Press MB1 and drag to define the position of this new contour. You should see a thin white line trace your path.
6. When you are finished drawing this contour, release MB1.
7. Once you release, you should see small contour labels appear adjacent to the contours. This label indicates the value of the contour that you just drew.
8. Repeat steps 5 and 6, but select a new contour value from the color bar. Continue defining new contours until (in your best judgement) the contours adequately define the grid. Try to draw the contours so that the edges touch the sides of the data area, or close the contour on itself. Drawing contours this way yields the best results when the grid is recalculated.
9. Now generate the grid based on your contours by pressing MB3 anywhere in the Spatial Editor (except over the legends) and select from the pop-up menu Calculate New Grid.
10. After a few seconds a new grid should appear that correlates with the contours that you drew earlier.

**Purpose:** Adjust an existing contour

The next exercise shows you how to adjust the position of contours that already exist. With the adjust operation, the grid is recalculated automatically after you adjust each contour. So, when adjusting contours there is no need to select the command Calculate New Grid.
1. Using the grid that you just created, move the mouse cursor over one of the existing contours.
2. Press and hold MB2 and drag a new position for this contour. For the best results, make sure that you release MB2 over the same contour on which you started.
3. The grid will be recalculated and displayed using the new position of the contour that you just modified.

**Purpose: Delete a Contour**

Occasionally, you may want to remove a contour. The delete contour operation was made for this purpose.

1. Using the same grid as in the exercise above, move the mouse cursor over any contour.
2. Click MB2 over this contour. You should see the contour disappear.

Removing a contour from the display means that the removed contour will not be used in the calculations when converting the contours to a grid. Typically you would remove a few contours before drawing new ones of a different value and location to replace them. Note that the remove contour function removes the closest contour from the click point. If you are not careful to click close to the contour that you want to remove, you may remove the wrong one.

**Purpose: Add a new Contour**

Sometimes you may want to adjust gridded values between contours without modifying the existing contours. The Contour Tool allows you to add a new contour to the display so that you can manipulate the gridded values that lie between the typical contour intervals.

1. As with the previous Contour Tool exercises, make sure that you have an editable scalar grid displayed in the Spatial Editor.
2. Move the mouse cursor to a location that is between two contours.
3. MB1 click at a location that is between the two contours. You should see a new contour appear with a value that has the same value as the grid point upon which you clicked.
4. Now use MB2 drag to adjust the position of this new contour. When the grid is recalculated, note that the data changes are primarily limited to the data that lie in-between the two original contours.

When you add a new contour with MB1 click, that contour value will continue to be displayed after the grid is recalculated, until you switch to a new grid or new weather element. In other words, new contours added this way will persist until you edit a different grid.

**Contour Tool Notes**

- After you have modified a contour, but before you recalculate the grid, the contours and the gridded data are inconsistent. If you attempt to edit a new grid or change to a different edit tool while in this inconsistent state, a dialog will appear asking if you would like to recalculate the gridded data based on your modified contours before moving on. If you click "yes", the grid will be recalculated before switching to the new grid or new edit tool. If you select "no", all of your contour edits since the previous recalculate operation will be lost and the GFE will switch to the new grid or new edit tool.
- The Contour Tool allows you to cross contours. When drawing new contours (MB1 drag) over existing contours, the "old" contours are partially removed so as not to convey conflicting and ambiguous information to the contour-to-grid algorithm. To reflect this visually, the deleted portions of the old contours are removed from the display. Try this out. Pick a new value from the color bar and draw a new contour near some existing contours. Note that portions of the old contours are removed indicating that those portions will not be used when calculating the new grid.
- There are two different algorithms that convert the contours to a gridded field. You can select your favorite from the main menu under the menu item GFE->Editing Preferences->Contour Server Selection. Each algorithm has its strengths and weaknesses with respect to performance and accurately generating a grid from contours. We strongly recommend that you use generate grids using each algorithm and determine for yourself which works
best. Keep in mind that a set of contours represents a gridded field only approximately. There are many potential gridded field solutions for a given set of contours. Each algorithm implements a slightly different solution and therefore will produce different results.

- Because contours only approximate the gridded field, the better you define the field, the better the result. The more contours you define for a particular field, the more likely that you will be happy with the resulting grid. Sometimes the algorithms will produce gridded fields that appear to be noisy. The Smooth edit action will generally remove this noise in the data. You will get the best results when you:
  - Draw contours to the edge of the grid or that close in on themselves. Contours that stop before the edge tend to generate "spikes" near the end point.
  - Draw many contours rather than fewer as the contour-to-grid algorithm has more information with which to generate the grid.

- When the Contour Tool is selected, the pop-up menu includes several operations that will affect the set of contours.
  - **Calculate New Grid** - Selecting this option will calculate a new grid based on the contours that you just edited. In general, only the area under the modified contours will be modified. Grid values in areas that you did not modify will not be changed. So, if you are satisfied with the contours in a particular area and you don't change them, they will not be modified.
  - **Undo Last Contour Edit** - This will reverse the last contour edit that you made. If you added a new contour, it will be removed. If you deleted a contour, it will be added back. If you adjusted a contour, the old contour will be restored. If you deleted all of the contours with the Delete All Contours operation, all of the contours will be restored to their previous state.
  - **Delete All Contours** - Selecting this item will remove all of the editable contours from the display. This effectively allows you to throw away all existing contours and edit the grid from scratch. Simply clicking button 1 in any location will add back a contour whose value corresponds to the grid value under the cursor. So you may choose to delete all of the contours and then add a few back in areas that you want to preserve the existing gridded data.
  - **Contour Adjust Influence** - Selecting this option will cause a cascade menu to appear that lists a set of distances in kilometers. Selecting one of these distances will affect the distance over which the Contour Adjust operation modifies the grid points. The largest value affects about six times the distance from the new contour position than the smallest value. The Contour Adjust operation and influence works exactly like the Pencil Tool. In fact, if you change the Contour Adjust Influence for a particular parameter in the Contour Tool, that same influence will be applied if you use the Pencil Tool later.

- Note that you can add or remove contours by changing the contour density from the Spatial Editor product labels.

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**Pencil Tool**

The Pencil Tool can be thought of as a contour adjustment tool, but it does not actually adjust contours. The Pencil Tool assigns a specific value to a set of grid points and then recalculates the grid points nearby. The result is that the gridded data reflect the new position of the contour. You don't need to display a particular grid as contours for the Pencil Tool to work. It is envisioned that the Pencil Tool will be integrated with the Contour Tool at some point in the GFE evolutionary process since the Pencil Tool and the Contour Adjust operation are essentially identical.

**Purpose:** Modify grid values by adjusting the position of contours

The pencil tool allows you to "redraw" the position of a contour. An algorithm recalculates the grid to reflect this new contour position.

1. Load a scalar grid (e.g., Temperature) into the Spatial editor and make it editable.
2. Make sure that no Edit Areas are currently active.
3. Select the Pencil tool with MB1 (see figure above).
4. If you like, you can make contours visible by pressing MB3 over the grid label in the Spatial Editor and select Display Attributes. Turn on the Contour Image Visual type check button.
5. Move the cursor over a contour, press and hold MB1 and draw a new position for the contour.
As you drag the cursor with MB1 pressed, a white line appears that defines the new position for this contour. When you release MB1, the grid values are modified such that the new contour will be drawn very near the line you identified.

1. Redraw several more contours using the Pencil tool and get familiar with how it works. Note that you are allowed to cross contours.

**Pencil Tool Width**

The button-3 popup menu contains the option to change the Pencil Tool Width. Making this value smaller modifies a smaller area on either side of the newly modified contour. Making this value larger modifies a larger area on either side of the newly drawn contour. To become familiar with this feature, change the Pencil Tool Width to its smallest value and modify a contour. Then change it to its largest value and modify another contour. Note the relative difference in the two operations. The individual influence sizes can be configured via your GFE configuration file. Note that the Pencil Tool Width is Weather Element dependent. Changing the Pencil Tool Width for one Weather Element will not affect the Pencil Tool Width for any other Weather Element. The Pencil Tool Width is defined on a per Weather Element basis.

**Pencil Tool with Active Edit Areas**

To better control changes to your grids, the Pencil Tool operations are restricted to any active Edit Areas that you have defined. If there are no Edit Areas active, then the Pencil Tool behaves as if the entire grid is the active Edit Area. For example, if you first select an edit area and then repeat the exercise above, you will see that any changes that were made are confined to the Edit Area that you selected. The data values are identical to what they would be if no Edit Areas were active, but again changes are restricted to those grid points that lie inside the active Edit Area. **Note that if your Pencil Tool operation does not go near the active Edit Area, no changes to your grids will occur.** To turn off this feature, simply clear the Edit Area. If you have an Edit Area that you would like to save, but still use the Pencil Tool as if no Edit Area were active, you can save the Edit Area with a QuickSet button or simply clear the area and recall it again with an MB3 pop-up command **Undo Area Edit**.

**Using the Pencil tool with Wind**

Note that the Pencil Tool will also work on grids of type vector, such as wind. The algorithm is virtually identical except that the speed and direction are considered as separate components and are recalculated independently. Try the Pencil Tool with a wind grid to get an idea of how it works on data of type vector.

**The Streamline Tool**

The Pencil Tool works like a streamline editor for a given set of conditions. To use the Pencil Tool as a streamline tool, make a Wind (or any other vector-type weather element) active. Then from the main menu select **GFE->Editing Preferences->Vector Edit Mode->Direction Only** or from the MB3 pop-up menu over the Spatial Editor select **Vector Edit Mode->Direction Only**. When the GFE is in this mode the Pencil Tool behave line a streamline editor. To use it, select the tool, press and hold MB1 and drag a line in the direction you want the wind to blow. For example, if you drag a line from northwest to southeast, all of the wind values within the Pencil Tool width will now indicate a northwest wind. Give it a try. Note that with a large enough Pencil Width you can draw a circle in a counter-clockwise direction with the tool and create a large cyclonic circulation in the wind field. **Remember that this tool works only on weather elements of vector type and when the Vector Edit Mode is set to Direction Only.**

**Using the Pencil tool with Weather and Discrete**

In the case of weather, the Pencil Tool will expand the extent of the weather/discrete (or No Weather/Discrete) that you select. When using the Pencil Tool on Weather, you must begin and end the Pencil Tool operation
on the same contiguous area of weather/discrete or an error will result and no grid data will be changed. Try
the following exercise to learn how to edit weather with the Pencil Tool.

**Purpose:** Edit the extent of various areas of weather using the Pencil Tool

1. Load the "Wx" weather element into the GFE (if not already), select a grid and make it editable.
2. Select the Pencil Tool.
3. Find a contiguous area of weather such as "Sct RW-".
4. Move the cursor inside this area and press and hold MB1.
5. Drag the cursor (while holding MB1) to define a new boundary for this weather area.
6. Make sure that your MB1 drag operation ends in the same contiguous weather area in which you started.
7. Release MB1

Note that you have now defined a new boundary for the weather area in which you started. Note that this is not a "paint" operation. The Pencil Tool defines a new **boundary** for the weather area. It does not assign values along the draw path like the algorithm that operates on scalar or vector data. You can also use the Pencil Tool to make any area of weather smaller. Simply start in an area that is defined as "No Weather" and define the new boundary. If the line you draw crosses into any other weather area, the boundary of that area will change. Be sure to end your drag in the same "No Weather" area as you started. Give it a try. Note the change in the weather grid.

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**Move/Copy Tool**

**Purpose:** Adjust the spatial position of grid values

Occasionally the values of the grid points are reasonable, but you may not agree with the location of certain features. Once you have identified the feature as an edit area with the Select Points tool, you can adjust its location with the Move/Copy tool.

1. Load a grid into the Spatial Editor and make that grid editable.
2. Find a feature that you would like to copy.
3. Pick the Select Points tool and define an edit area over your feature.
4. Pick the Move/Copy Tool by clicking MB1 on the Move/Copy tool icon.
5. Move the cursor over the selected area, press and hold MB1, drag the feature to some other location, and release the mouse button.

Note that the feature you selected has been copied to a new location. The original feature (at least the part that did not overlap the copied area) was left untouched. Now try the "Move" operation by following the steps below.

1. Press MB3 anywhere in the Spatial Editor display and select Undo Grid Edit.
2. Move the cursor over the area that you selected in Step 2.
3. Press and hold MB2, drag the feature to some other location, and release the mouse button.

This time the original selected area did not remain unchanged. When you released MB2, an interpolation algorithm filled in the original area with new values.

Use MB1 when you want to copy an area of data and move it to a new location. Use MB2 if you want to move some feature and fill in the original area with background values.
There are many more tools available from the Edit Actions menu. These edit tools always operate over the currently selected edit area. To use them, click on the Button Bar button labelled "E". The Edit Action dialog menu will display a list of tools that operate on the currently editable weather element. Selecting one of these tools will perform that operation over the edit area that you have selected. The four standard tools that work for virtually all weather elements are listed in the table below.

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assign_Value</td>
<td>Assigns the current pickup value</td>
</tr>
<tr>
<td>AdjustValue_Up</td>
<td>Adds the delta amount to the current value</td>
</tr>
<tr>
<td>Adjust Value_Down</td>
<td>Subtracts the delta amount to the current value</td>
</tr>
<tr>
<td>Smooth</td>
<td>Smooths out strong gradients</td>
</tr>
</tbody>
</table>

The Edit Actions dialog also lists the set of Smart Tools that will edit the currently editable weather element. Smart Tools will also appear on the MB3 pop-up menu over the Spatial Editor. In addition, keyboard shortcuts can be set up for Smart Tools and Procedures (see gfeConfig Keyboard Shortcuts). For more information about Edit Actions and Smart Tools, go to the Smart Tool Training Guide.

**Sample Tool**

**Purpose:** Provide a textual representation of grid values

The Sample tool displays a text representation of grid values for all currently editable grids. These representations, called "Samples", are useful when you are editing data and want to know the value of a weather element at a particular location, such as a city. The Sample Tool can also be used to control "Markers", which are mainly used for Intersite Coordination data. Markers are similar to Samples, except that data values are not shown.

1. Make sure that you have at least one grid displayed in the Spatial Editor.
2. Select the Sample tool located near the middle of the button bar.
3. Move the cursor into the display. Press and hold MB1 and drag the cursor around. You should see a text representation of the value under the cursor.
5. Make a second weather element visible in the Spatial Editor by clicking MB1 on its label.
6. Press and drag MB1 again in the spatial display. You should see both grid values under the cursor displayed.
8. Click MB1 several times in the display. You have just added Fixed Sample. These will remain on the Spatial Editor display until you clear them. Add more Samples by clicking MB1 in several other locations.
9. Position your cursor directly under one of the "+" symbols located below one of your samples. It may be difficult to find them if the data background is light in color.
10. To remove individual Samples, click MB2 directly on the "+" symbol. Your sample is removed.
11. To remove all of the samples from the display, select from the main menu bar Maps->Samples->Clear. All of the samples are removed.

Note that there is an option to also display the latitude and longitude of the sample point. To display the latitude/longitude select from the main menu bar Maps->Samples->Show Lat/Lon. Turning this mode on will cause the samples to display
the latitude and longitude always at the bottom of the sample in the color white. Turning this mode off will remove the 
lat/lon display.

Samples may also be defined by latitude/longitude through the Define Samples via Lat/Lon Dialog. This is
accessed from the main menu bar, Maps->Samples->Define Samples via Lat/Lon...

Samples and Marker options are available from the Maps->Samples and Maps-> ISC Markers menu. The
user can choose to enable optional features of the sample points, which include the update time, WFO site
identifier, and "P" official database symbol for those data points. Markers and Samples differ in the fact that
markers do not show data values and are intended for display of intersite coordination data status. Samples
display data points. The Sample Tool provides a MB3 popup menu to add and remove markers. Markers are
not cleared from the Samples->Clear menu. Refer to the Intersite Coordination User's Guide for more
information.

Example of regular samples and ISC Markers

You can save a set of samples after you have defined them. Once you have the set of samples just the way you like, select
from the main menu bar, Maps-Samples->Save/Delete... This will display the Save/Delete Sample Dialog which allows
you to assign a name to your sample set.

Samples are represented with additional information if the GFE is in "Show ISC Mode". When "Show ISC
Mode" is enabled, the sample points may contain update times, site identifiers, and the official database
symbols for those areas outside of your CWA. Refer to the Intersite Coordination User's Guide for more details.

Behavior of the GFE when in ISC Mode
When the button is pressed, the GFE is put into the ISC (intersite coordination) mode. The data viewed in the spatial editor will be the composite of your forecast data and the adjacent received site's data. Certain edit tools, such as Pencil, also work different in ISC mode. The data values are picked up may be either from your forecast grid or from the intersite coordination grid depending upon the location on the grid.

Try placing the GFE into ISC mode and observe how the display changes. You may have observed that the entire grid is no longer pictured. If so, this means that data is not available from all of your surrounding sites. Note also that your forecast grid is clipped to your CWA. Use the Sample Tool and note that when you sample outside your area that the samples will now shown an update time and site identifier from the ISC sites (if those features are enabled).

Try using the Pencil Tool and Move/Copy tool to change some data. Note that it uses the values from the composite grid for its operation, but you may not see the entire data change. Since only a portion of your forecast grid is shown (just those parts within your CWA), changes you make to portions of your grid outside your CWA will not be seen while in ISC mode. Toggle off ISC mode to see your entire forecast grid.

Markers (similar to samples) may appear, which represent one location per adjacent grid. The markers may be set up to display the last grid update time, the WFO identifier, and whether the ISC data was published or is the working grid.

While most of the weather elements simply are masked so that you see your Fcst database within your CWA, and the ISC data outside your CWA, some ISC elements are calculated on-the-fly. For example, the QFP weather element for ISC is a virtual, as shown with the VISC label in the spatial editor legend. There is a QPF ISC element, and a virtual QPF ISC element. The virtual element is the summation of all of the "precipitation rates" and is valid the same time period as the Forecast grid.