

Hazard Services User's Guide
OB18.1.1
November 2018 - R1.4 Sprint 12

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1.0 Introduction to the Hazard Services User's Guide

1.1 Scope

This document serves as a guide to the Hazard Services Application implemented in AWIPS II. The purpose of the Hazard Services Application is to replace and unify the hazard generation capabilities of WarnGen, GHG, and RiverPro applications. Hazard Services is used by forecasters to create, update, cancel, and expire hazards. Focal Points will customize Hazard Services for local sites.

The initial phase of Hazard Services development focuses on hydrologic hazards, which touches portions of all three legacy applications. Work on winter hazards is in progress in FY17, with remaining GHG and WarnGen hazards to follow in FY18 or later.

1.2 Intended Audience and Assumed User Skills

This Guide is intended for use by hydrometeorological forecasters on operational shifts to create and communicate hazard information and by WFO Focal Points who configure and customize the system for the local site. Extensive information for Focal Points is contained in the [Hazard Services Focal Point User's Guide](#). External partners such as emergency managers, private weather organizations, broadcasters, and the public will also be interested in the products being generated and the changing paradigm of Hazard Services. We assume that forecasters and Focal Points using this Guide have a basic understanding of, and experience with, using a mouse to navigate a graphical user interface and are familiar with the AWIPS II CAVE interface.

1.3 Product versus Information Centric Paradigm

In addition to providing a seamless forecast process for generating short-fused, long-fused, and hydrologic hazards, Hazard Services allows the forecaster to focus more on the meteorology of the hazard situation, letting the system take on more of the responsibility for the generation and dissemination of products. The shift to a more 'information-centric' paradigm is not 100%, but rather moves us a step further on the spectrum between focus on products versus focus on information. For a more complete understanding, please see the [Hazard Life Cycle section](#).

1.4 How To Use This Guide

To gain an overall comprehensive understanding of Hazard Services, you may follow this Guide sequentially. The [Quick Start](#) section, which appears first, provides the overview and context for the remainder of the material. This will be especially useful for forecasters who wish to jump into the Hazard Life Cycle process.

For Focal Points who wish to understand the Customization of Hazard Services, Hazard Types, Meta Information, Recommenders, and Product Generation, please see the [Hazard Services Focal Point User's Guide](#) after becoming familiar with the [Quick Start](#) section.

For external partners who wish to see the Partner XML format or an example CAP message, please see the [Hazard Services Focal Point User's Guide](#) Appendices. In addition, the [Hazard](#)

[Services Quick Reference Guide](#) provides short descriptions of some of the Hazard Services features.

User Role	Recommended Material
<p>Forecaster on Shift who is watching the meteorological situation and issuing hazard information</p>	<ul style="list-style-type: none"> ● Introduction ● Quick Reference Guide ● Quick Start / Job Sheets ● Creating Hazards ● Hazard Life Cycle ● Reference as needed: <ul style="list-style-type: none"> ○ Console ○ Settings ○ Alerts
<p>Focal Point who configures and customizes the system for the region, site, or even individual.</p>	<ul style="list-style-type: none"> ● Introduction ● Quick Reference Guide ● Quick Start / Job Sheets ● Creating Hazards ● Hazard Life Cycle ● Hazard Services Focal Point Guide ● Reference as needed: <ul style="list-style-type: none"> ○ Console ○ Settings ○ Alerts
<p>Partners who are the consumers of hazard information e.g. emergency managers, broadcasters, the public and private sectors.</p>	<ul style="list-style-type: none"> ● Introduction ● Hazard Life Cycle

2.0 Quick Start -- Jumping In

To jump into the button clicks and the Hazard Services process for creating hazards and following them through their life cycle, you may choose from the following Job Sheets. Please follow the steps exactly the first time through in order to get a good idea of the flow of hazard generation and give feedback.

The Simple Hazard Story contains a step-by-step ‘recipe’ to create a simple hazard sequence. This story is a quick way to expose the reader to how to create a hazard and follow the hazard through its life cycle. A quick version of the Simple Hazard Story can be found [here](#).

The [Mixed Hazard Story](#) contains a step-by-step ‘recipe’ to create multiple hazards associated with a flooding event. It includes explanations of what you see in the Hazard Services interface. A [quick version of the Mixed Hazard Story](#) is also available. In a nutshell, this user story can be

summed up as this:

As a Forecaster, I need to Issue a flash flood warning, point flood warning, and later, an areal flood warning. I need a mixture of long-fused and short-fused hazards without having to jump between different GUIs or applications. I need all information generated from a single interface rather than three separate programs.

These stories were developed at the Hazard Services Virtual Workshop held in September 2012 during brainstorming sessions to translate requirements into use cases for the Human Machine Interface (HMI) and illustrate Hazard Services functionality.

There is a [Job Sheet / Functional Test Collection](#) that contains more stories for you to explore. After following the Simple and Mixed Hazard Stories, please reference this collection for a more in-depth exploration of the system.

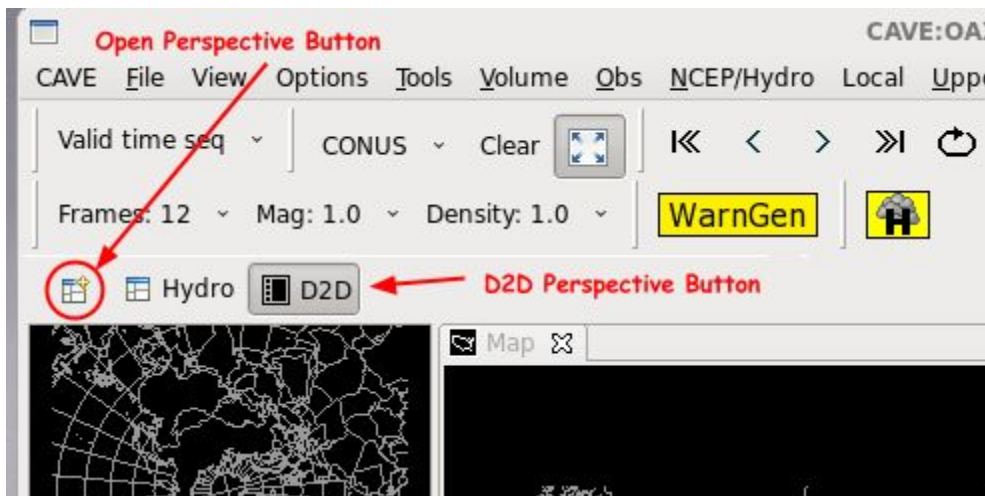
2.1 Getting Started

You should be familiar with CAVE and how to navigate the different CAVE perspectives. The next sections describes each of the CAVE perspectives.

2.2 CAVE Perspectives

CAVE Perspectives are built upon Eclipse Perspectives which provide a visual container for a set of views and editors. In CAVE, perspectives are used to compartmentalize specific areas of functionality. While in AWIPS I GFE, Hydroview, and MPE were run separately from D2D, the use of perspectives in AWIPS II allows these disparate applications to be better integrated together in CAVE.

Several perspectives are available in CAVE: D2D, GFE, Hydro, Localization, MPE, and NCP (National Centers). These are accessed either by selecting the Open Perspective button beneath the CAVE toolbar or the button corresponding to the desired perspective. The CAVE title bar indicates which perspective is currently being viewed.

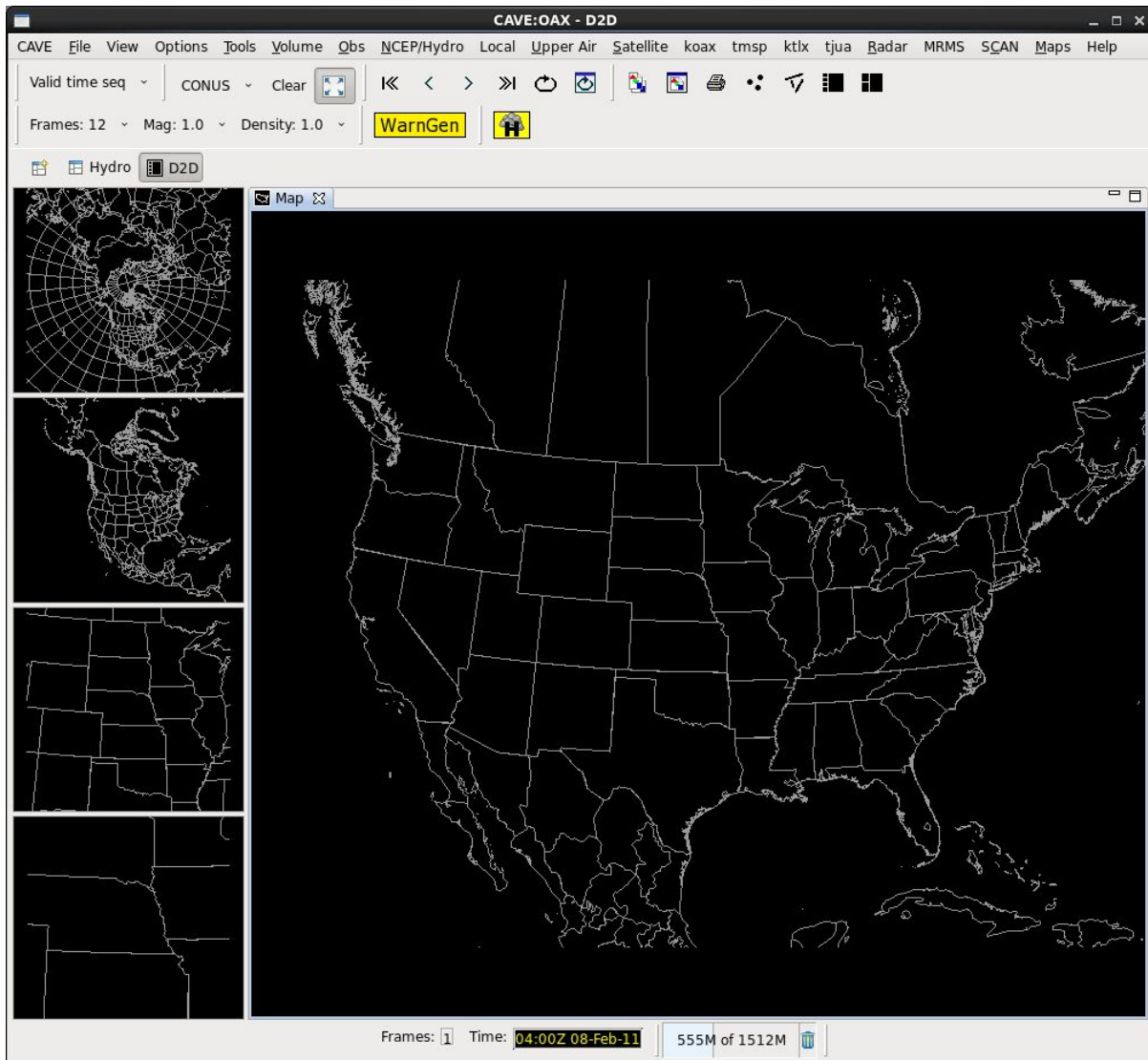


An important feature of Hazard Services is that it can be run from most perspectives. Also, it is not necessary to restart Hazard Services when switching

between most perspectives. This allows you to create and issue hazards using data from a variety of different sources, including forecast models, radar, surface observations, river gauges, and GFE grids. However, Hazard Services cannot be run from perspectives that do not have a map view. The Localization Perspective is an example of this. If Hazard Services is running and you switch to the Localization Perspective, then Hazard Services will be shut down.

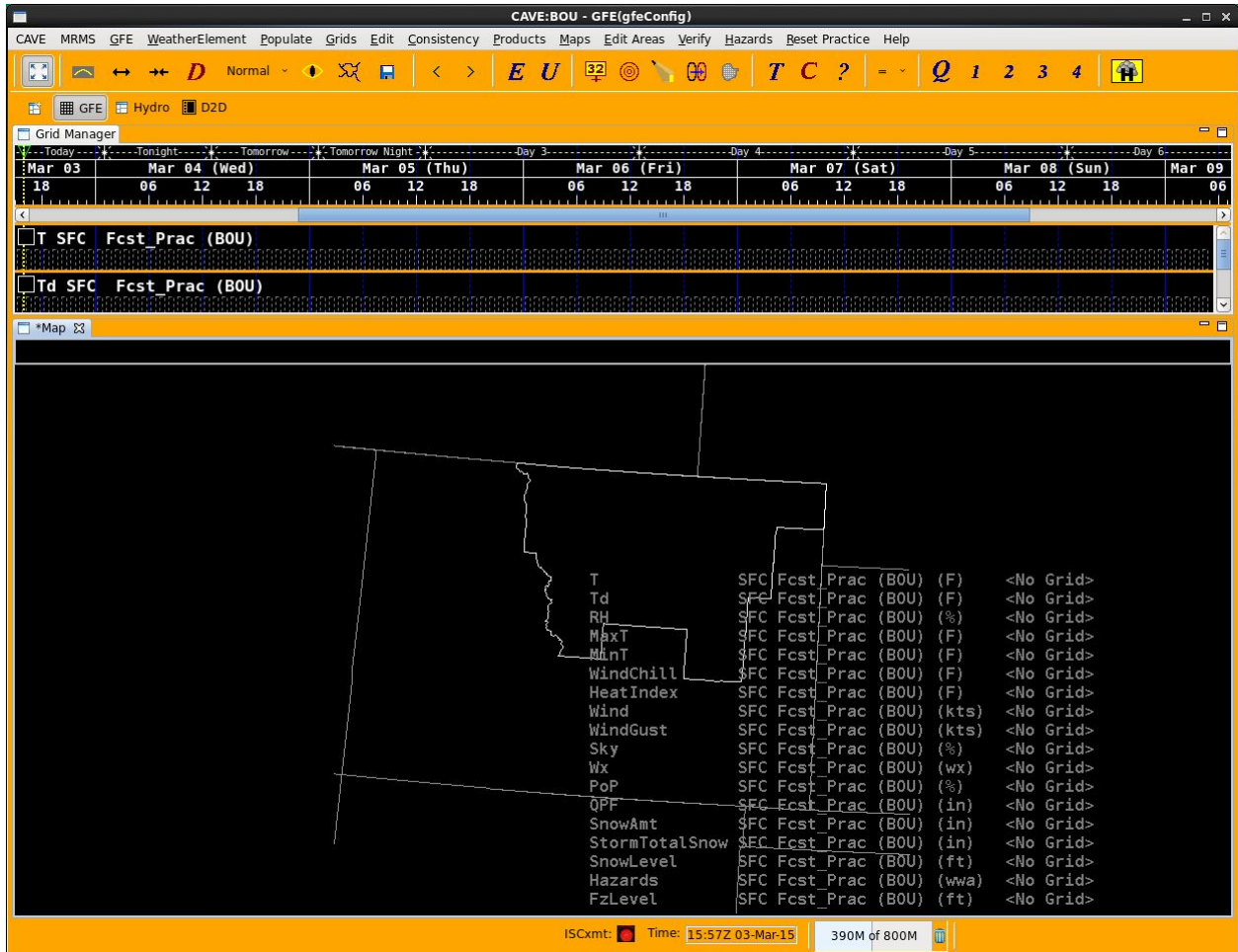
2.2.1 D2D

You use the D2D perspective to, among other activities, interrogate radar/satellite data, examine forecast model data, and plot observations. In general, you use D2D as a first step in the forecast process to develop a picture of the current and future state of the atmosphere.



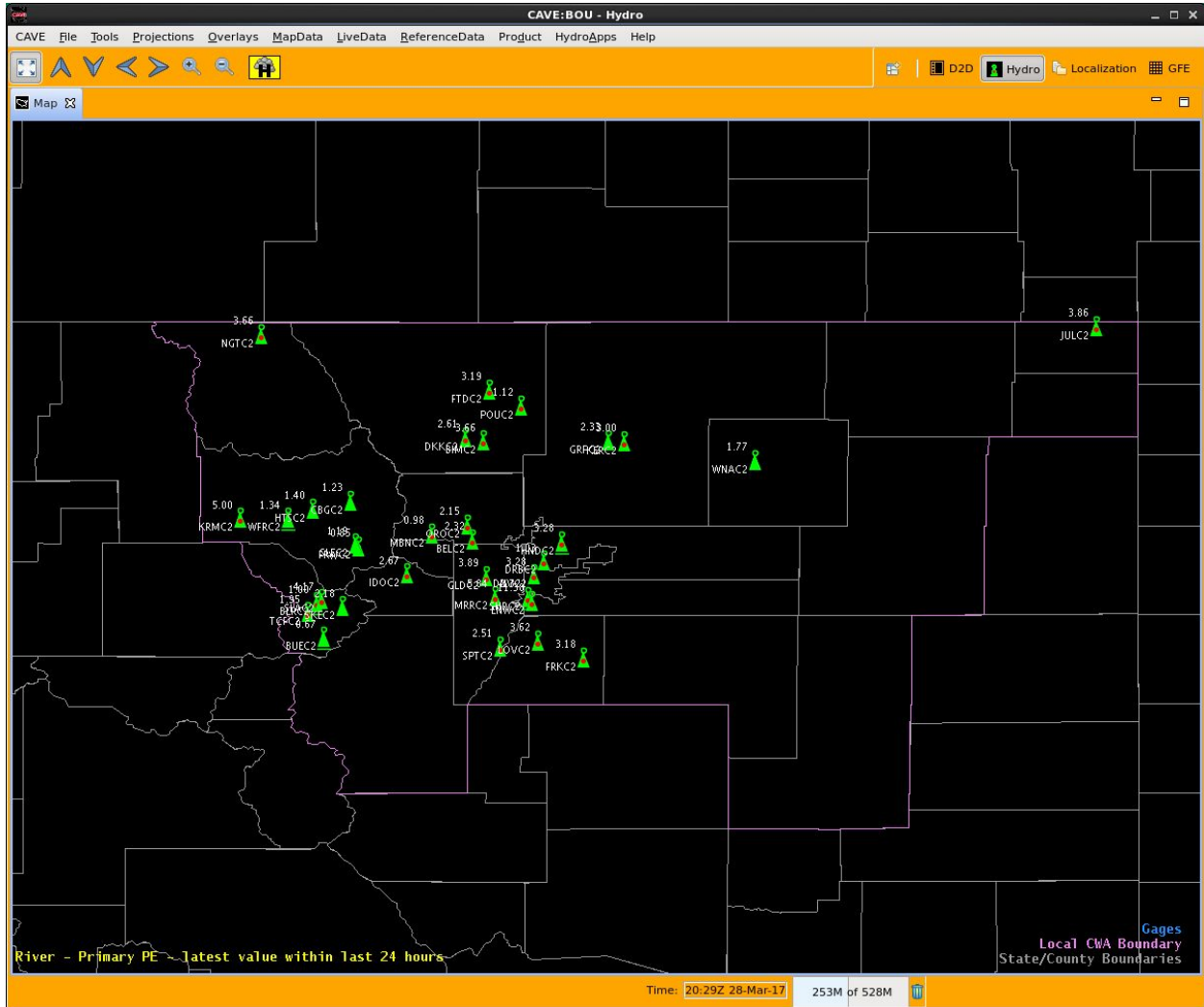
2.2.2 GFE

The GFE perspective is used to produce forecast and hazard grids. Many of the public forecast products are created from these grids. These grids are also stored in the National Digital Forecast Database (NDFD). Note in the figure below that this instance of CAVE is in Practice Mode.



2.2.3 Hydro

In addition to its use with Hazard Services (the focus of this Guide), the Hydro perspective provides tools to view hydrometeorological observations and meta information associated with river forecast points such as significant stages and crest history. It also provides tools to view flash flood guidance and Multisensor Precipitation Estimator (MPE) grids. Generally, these data are read-only (although TimeSeries can be used to edit observations and forecasts). However, the HydroBase application, through which one can update the hydro database, can be started from the Hydro perspective.



2.2.4 Localization

Of primary interest to Focal Points, the localization perspective provides a convenient interface to the AWIPS II Localization File System. Many of the base versions of the AWIPS II localization files can be viewed in this perspective. It also makes it easy to create local versions of these files. This allows CAVE and many of its applications (including Hazard Services) to be tailored to site needs and preferences.

The screenshot displays the CAVE - Localization application interface. On the left is a File Browser showing a tree view of folders including Archive, AvnFPS, CAVE, D2D, EDEX, GFE, GFE Server, Hazard Services, Alerts, Event Utilities, General Utilities, GeoSpatial Config, Hazard Categories, Hazard Meta Data, Hazard Types, Product Formats, Product Generator Table, Product Generators, Python Bridge, Python Events, Recommender Utilities, Recommenders, Settings, Startup Config, Utilities, Validation, and Hydro Apps. The Startup Config folder is expanded, showing StartUpConfig.py with sub-items for BASE and SITE (OAX).


The main window shows a Text Compare view of two files: settingsDefaultInfo (OAX.HazardServices.settings.config) and StartUpConfig. The comparison is between StartUpConfig.py - BASE and StartUpConfig.py - SITE. The code is as follows:

```
StartUpConfig.py - BASE
1 StartUpConfig = {
2     #####
3     #####
4     # MUST OVERRIDE!!
5     # Site Configuration - The following MU
6
7     # Map Center -- The Spatial Display will
8     "mapCenter": {
9         "lat": 41.06,
10        "lon": -95.91,
11        "zoom": 7
12    },
13    #####
14    # Settings
15    # defaultSettings: The settings that are
16    # commonSettings: List of commonly used
17    "defaultSettings": [],
18
19    "commonSettings" : [],
20
21    #####
22    # General Display
23    # eventIdDisplayType is one of: "ALWAYS
24    "eventIdDisplayType" : "FULL_ON_DIFF",
25
26    #####
27    # Default Display Maps - List of map nam
28    # started.
29    # Map names can be found in the loca
30    # CAVE->Bundles->Maps. Use the file
31    # Counties_site.xml -> Counties site
32    # Note that only Maps that use the follo
33    # toolbar option:
34    # mapdata.cwa
35    # mapdata.ffmp_basins
36    # mapdata.firewxzones
37    # mapdata.zone
38    # mapdata.basins
39    # mapdata.county
40    # mapdata.isc
41    #
42    "display_maps" : [ "Counties_site" ],
43
44    # Flag indicating whether or not the ext
45    "extensionAreaVisible" : False,
46
47    #####
48    # Hazard Information Dialog
49    #
```

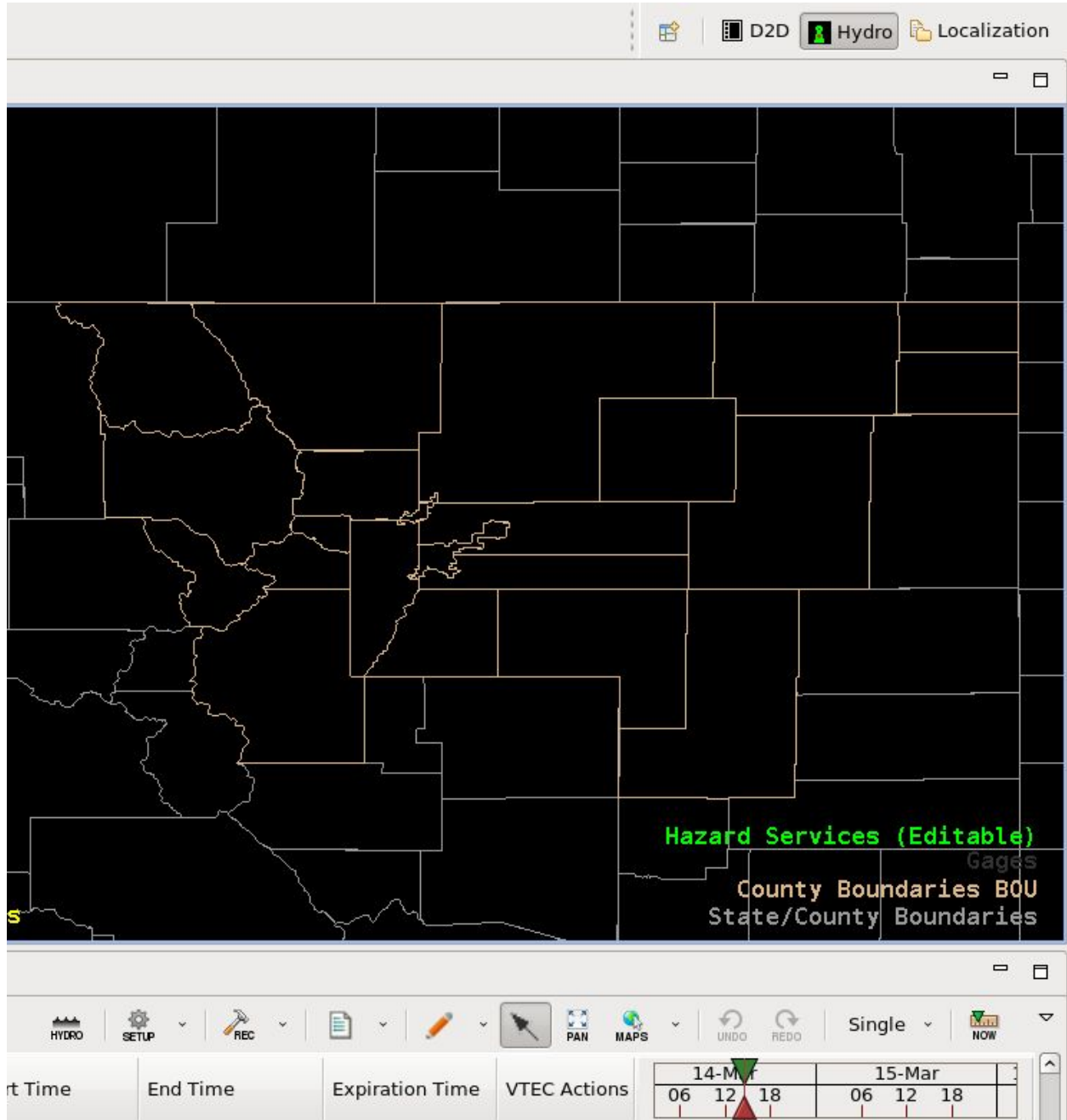
```
StartUpConfig.py - SITE
1 StartUpConfig = {
2     #####
3     #####
4     # MUST OVERRIDE!!
5     # Site Configuration - The following
6
7     # Map Center -- The Spatial Display w
8     "mapCenter": {
9         "lat": 41.06,
10        "lon": -95.91,
11        "zoom": 7
12    },
13    #####
14    # Settings
15    # defaultSettings: The settings that
16    # commonSettings: List of commonly us
17    "defaultSettings": ["Hydrology All"],
18
19    "commonSettings" : [],
20
21    #####
22    # General Display
23    # eventIdDisplayType is one of: "ALW
24    "eventIdDisplayType" : "FULL_ON_DIFF"
25
26    #####
27    # Default Display Maps - List of map
28    # started.
29    # Map names can be found in the
30    # CAVE->Bundles->Maps. Use the
31    # Counties_site.xml -> Counties_
32    # Note that only Maps that use the f
33    # toolbar option:
34    # mapdata.cwa
35    # mapdata.ffmp_basins
36    # mapdata.firewxzones
37    # mapdata.zone
38    # mapdata.basins
39    # mapdata.county
40    # mapdata.isc
41    #
42    "display_maps" : [ "Counties_site" ],
43
44    # Flag indicating whether or not the
45    "extensionAreaVisible" : False,
46
47    #####
48    # Hazard Information Dialog
49    #
```

2.3 Launching Hazard Services

Hazard Services may be launched from the various perspectives by clicking Mouse Button 1

(MB1) on the  button near the top of the CAVE display. A dialog shows startup in progress.

When Hazard Services is first started, the Console and the Spatial Display are visible.



3.0 Spatial Display and Console

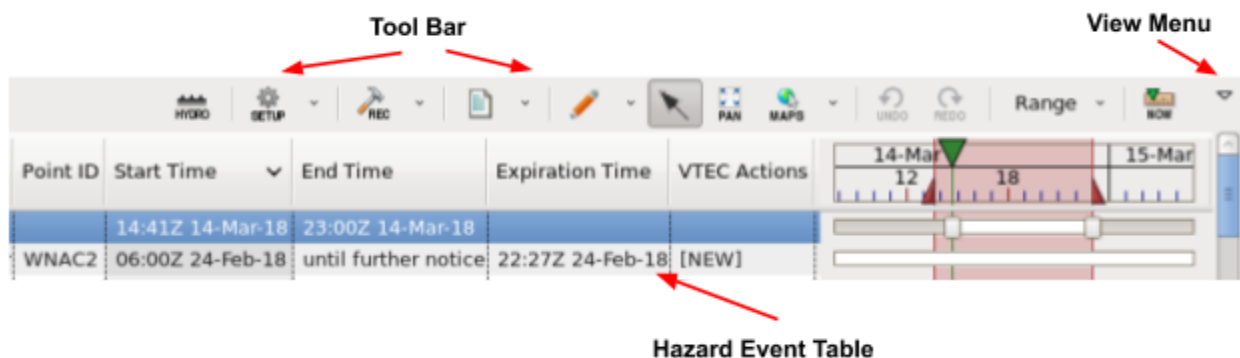
The Spatial Display is the Hazard Services drawing layer which is loaded into the CAVE Map Editor when Hazard Services is started. It is the Hazard Services map, displaying hazard areas relative to geopolitical boundaries and handling hazard drawing and editing. Its presence is indicated by the 'Hazard Services (Editable)' line in the CAVE Map Legend, and it supports operations common to other AWIPS II drawing layers.

Note that other functions you may use (e.g., Points, FFMP) within AWIPS can assume the Editable state, taking it away from Hazard Services. You may need to make Hazard Services Editable by clicking with Mouse Button 2 on its legend. Swapping panes in the D2D perspective can sometimes result in non-obvious situations - the Hazard Services Console may be displayed without the Hazard Services layer being loaded in your main display.

The Console is the main control panel for Hazard Services. It is always displayed if Hazard Services is running. Closing it closes Hazard Services as well.

The Console is a CAVE View. (For reference, another View is the GFE's Grid Manager.) This means that by default it docks within the main CAVE window. It can be redocked elsewhere in CAVE (e.g. above the map editor), or may be dragged away and floated as a separate window altogether. (To undock/redock, press on the Console's title - that is, the tab - and drag it around. The pointer will change shape to indicate detaching/attaching actions.)

The Console includes a toolbar and a drop-down ("view") menu to the right of or just under its title tab. Below these is the body of the Console, which is occupied by a table of hazard events.



The latter displays temporal and other information about the included events.

3.1 Tool Bar

The leftmost icon on the tool bar is a Hydro "button" that indicates that Hydro hazards are being

worked. Although it can be clicked, there is no action assigned to the icon. However, an important property is that it will change color (yellow) if any active hazards are hidden from view by a filter. (In the future, as other non-hydrologic hazards are added to Hazard Services, similar icons will be added to the display as appropriate.)

3.1.1 Setup (Settings)

'Settings' allow you to filter the hazard information being displayed to focus on the meteorological situation of concern. For example, you may want to focus only on hydrological hazards in a particular time scale and over a particular area. For a complete description, see the [Settings Overview](#) section.

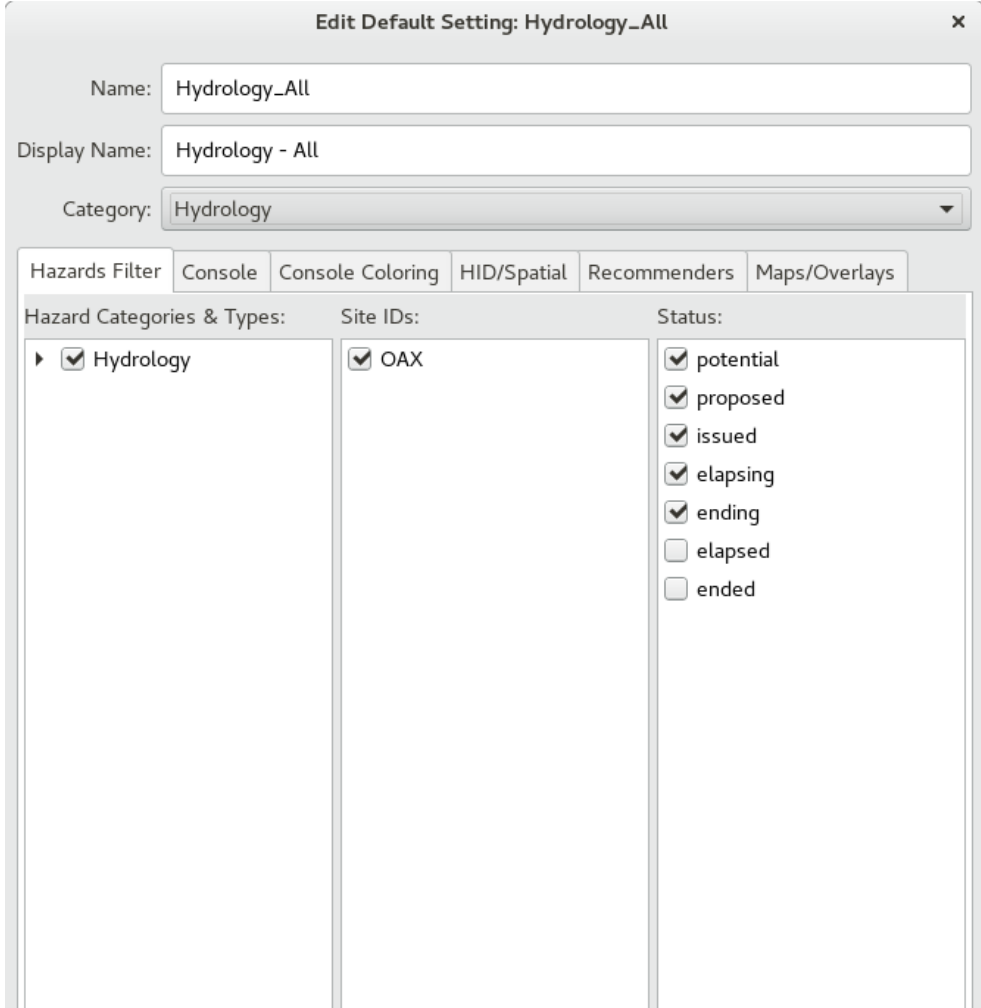
The Settings drop-down menu allows you to select an existing Setting or a recently-used Setting, create a new Setting, edit the current Setting, or delete the current (User) Setting. New Settings are created at the User level, and they are added to this drop-down list to allow their selection. (A Setting can be shared with other users by making a Site copy in Localization.) The Console's title tab shows the name of the currently loaded Setting. Settings can be viewed and edited also in the Localization perspective.

Note: When you mouse over this icon, the gear and v appear to be distinct. You can click on either or press on the v to show the drop-down menu. Other tools on the console toolbar behave similarly.

3.1.2 Filters

The Settings drop-down menu includes a Manage Settings > Edit/Filter... option that allows quick modification of the filters being used by the current Setting. Events may be filtered by Hazard Type, Site ID, and/or Status. As the filters are altered, the Hazard Event Table contents change to include only those hazards that pass the filters.


For example, suppose you run the River Flood recommender and it

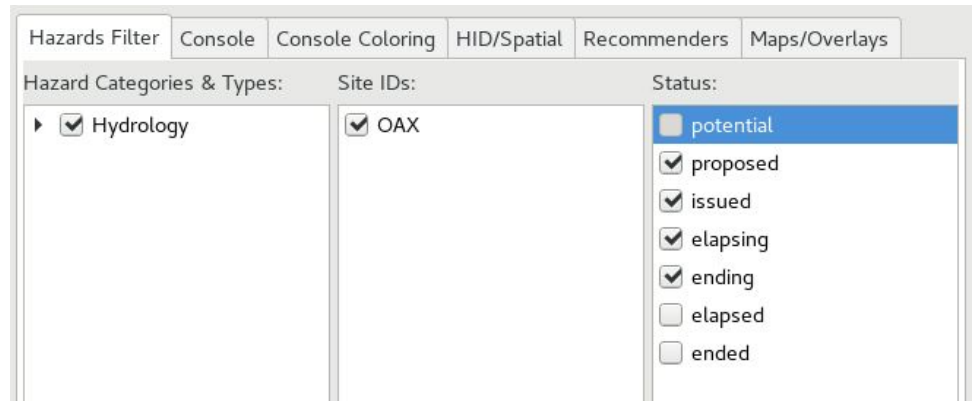


Hazard Categories & Types:	Site IDs:	Status:
<input checked="" type="checkbox"/> Hydrology	<input checked="" type="checkbox"/> OAX	<input checked="" type="checkbox"/> potential
		<input checked="" type="checkbox"/> proposed
		<input checked="" type="checkbox"/> issued
		<input checked="" type="checkbox"/> elapsing
		<input checked="" type="checkbox"/> ending
		<input type="checkbox"/> elapsed
		<input type="checkbox"/> ended

produces a host of potential events. You select a couple of interest, move them to pending state, then propose one. To reduce the clutter in the Console, you can hide potentials using the Filters menu, changing this: to this:

All of the potential events are still present but are hidden in both the Console and the Spatial Display.

In this situation, the Hydro icon turns yellow () to indicate that at least one active hazard is hidden from view by a filter.



If you want to filter out hazards by type, click the triangle next to Hydrology to open the list.

3.1.3 Recommenders (Tools)



The Tools button reveals a drop-down menu listing all the recommenders and other tools available in the current Setting. Recommenders may be run from this menu. When you select a Setting, this menu is populated with appropriate content. See [Section 4.1](#) for information about the standard set of tools and recommenders.

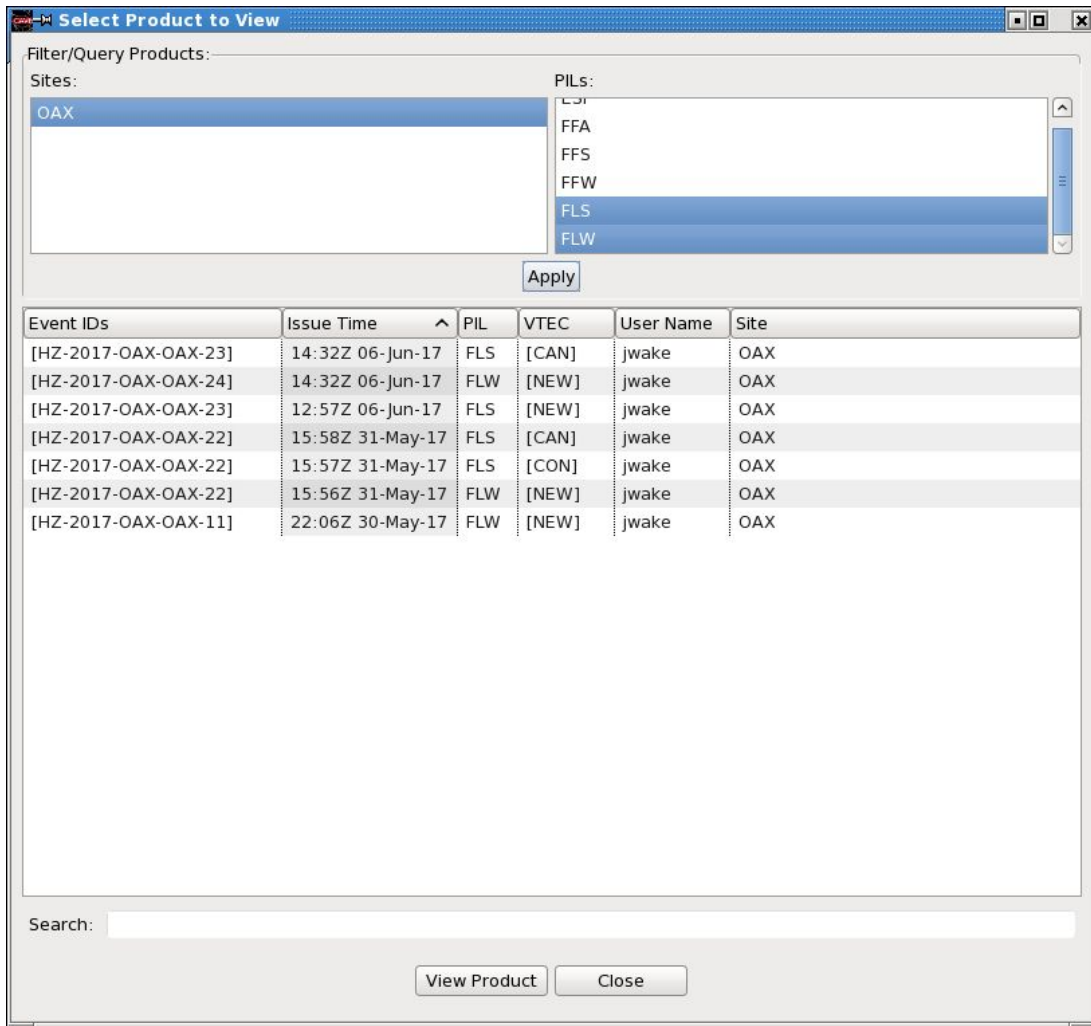
3.1.4 Products



The menu here provides three choices, to wit:

- **Generate RVS.** With an FL.x hazard selected in the Console, select this item to bring up a dialog to write an RVS text product.
- **Correct Product.** Selecting the Correct Product option provides a list of products that may be corrected. (Products may be corrected only during the first 10 minutes after issuance.) The dialog includes seven columns: Product Category, Issue Time, Event IDs, Hazard Type, VTEC, Expiration Time, and User Name. You can click in a column header to order by, or type in the Search box at the bottom. Upon selecting an item from the list, the Hazard Information Dialog launches and **Product Correction Mode** displays below the Console. You can also select Corrections > Correct This Event from the pop-up menu off of the hazard row in the Console. This menu is disabled 10 minutes after issuance. Once the hazard is opened in Correction Mode, update metadata and re-issue.
- **View Product.** This option allows you to review issued products, selecting from a list in a *Select Product to View* dialog. Use the dialog to select the product type (using click,

Ctrl-click, Shift-click), then click and select View Product or double-click to see the legacy text.



A similar dialog will be produced by selecting the *View Products for Selected Events* item from the Console pop-up. In this case, the Filter/Query section is not needed, so you'll see just the lower portion of the illustrated dialog.



3.1.5 Spatial Display Modes

When Hazard Services is in Editable state, three buttons set the mode of the Spatial Display, governing how it interprets mouse clicks.

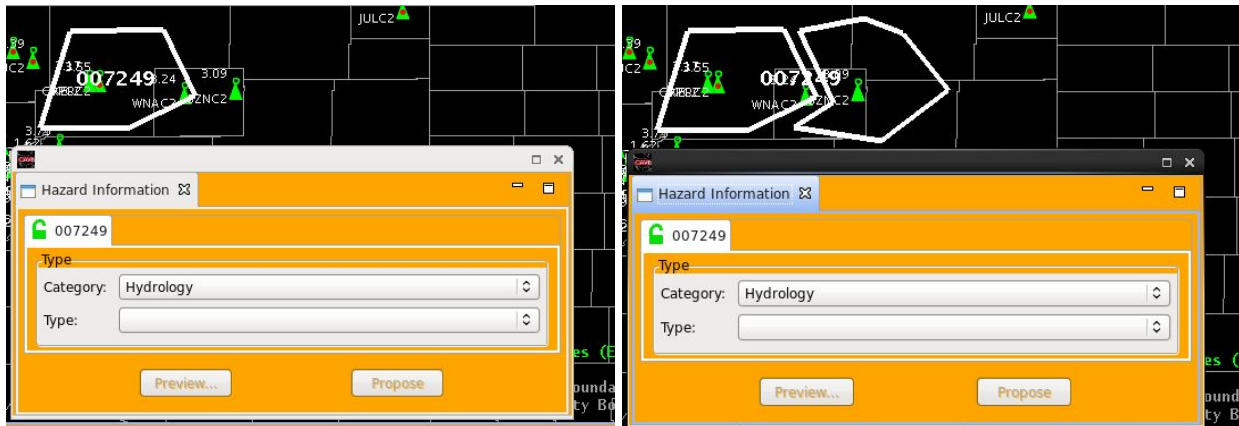
3.1.5.1 Drawing Tools







This menu has six choices:

- 
Draw Polygon When set, mouse clicks on the Spatial Display draw polygons, one click per node (MB1 click to place a node, MB3 click to complete the polygon).
- 
AddTo Polygon If a polygon is active (hazard selected), this choice allows you

to augment the area or create a new separate area that will be logically joined with the current polygon. Example of the latter:



Note how the single hazard (#007249) now comprises two polygons. (When you select Preview, these will be joined into a single polygon for issuance.)

- Draw Freehand Polygon**  When set, mouse clicks on the Spatial Display draw freehand polygons (MB1 press, drag, and release to draw the polygon's outline). Note that issued text products will conform to current rules limiting polygon vertices to 20 or snapping areas to counties or zones. The freehand, many-vertex, shapes will be modified at some point during the hazard-issuance workflow.
- AddTo Freehand Polygon**  Similar to AddTo Polygon, but drawing is freehand. Note that you can augment both multi-segmented and freehand polygons with either of the AddTo tools.
- Remove Polygon Vertices**  In the case where you have a polygon with many vertices, it is very difficult to modify a boundary. This tool will remove a section of vertices to make the problem more tractable. With the tool selected, drag with MB1 to enclose a segment of the polygon. When you release, those vertices will be removed.
- Remove Polygon Area**  This tool provides a way to remove sections of a geometry. Press MB1 and drag out an area that intersects your geometry. Upon release, the intersection area will be removed with the new boundary along the curve you drew.

If more than one hazard is selected in the Console, only Draw Polygon and Draw Freehand Polygon are available. The others are invalid and dimmed.

Note that, in all cases, drawing and editing options are subject to policy-driven limitations. Examples: at issue time, a freehand polygon may be made to conform to zone boundaries or reduced to a 20-vertex polygon; area cannot be added to issued warnings.

3.1.5.2 Select Event

This radio button sets the mode to event selection. When set, mouse clicks on the Spatial Display select hazard events, and drags cause panning. This is the default mode choice of this set of radio buttons.

3.1.5.3 Pan

This radio button sets the mode to pan mode. When clicked, you can pan the map without inadvertently moving or selecting polygons.

3.1.6 Maps for Select by Area

The Maps for Select by Area button reveals a drop-down menu allowing the selection of maps that may be used for selecting by area within the Spatial Display. If the button is disabled, no maps that allow select-by-area are currently loaded. If the button is enabled, but a map menu item within the drop-down menu is disabled, that map is loaded but is currently invisible.

See Section [4.2.1 Select By Area](#) for details of this area-selection method.

3.1.7 Undo


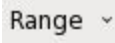


Undo the last user drawing action or actions performed on the Spatial Display. The Undo/Redo buttons are dimmed unless there are suitable actions available.

3.1.8 Redo

Reinstate un-done drawing actions.

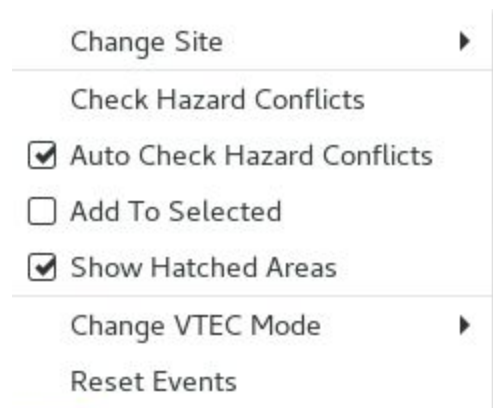
3.1.9 Temporal Controls

There are two buttons used to control the Timeline view at the right side of the Hazard Table. You can also zoom and pan the Timeline using the mouse. See Section [3.3.1 Column Headers](#) - Timeline Header for more detail.

- **Selected Time Mode**  /  /  - This options menu allows you to select the time mode, a single time, a range of times, or a time range encompassing all items selected in the Console.
- **Show Current Time**  - This button moves the Timeline so that the current time is visible toward its left end.

3.2 View Menu

The View menu is a drop-down menu holding menu items for functions that in general are less frequently used than those available via the toolbar.



3.2.1 Change Site

This allows you to Change Site during Service Backup.

3.2.2 Check Hazard Conflicts

Selecting this runs conflict checking on the selected hazards. For example, it's not permissible to have both Flash Flood and Areal Flood Watches covering the same zone. (FF.A and FA.A are both zone-based hazards.) The check will detect that situation, pop up a dialog listing the conflicting hazards and areas, and put an X in place of the lock status in the Hazard Information Dialog tabs.

3.2.3 Auto Check Hazard Conflicts

When Auto Check Hazard Conflicts is enabled (it is by default), hazard conflicts are identified to alert you that the hazards about to be issued are in conflict as defined by directives.

3.2.4 Add To Selected

When off (default), the most recently-drawn hazard will be selected. With this option checked, newly-drawn hazards will add to the selected set in the Console.

3.2.5 Show Hatched Areas

When Show Hatched Areas is enabled, hazard hatching is displayed on the Spatial Display for the hazard polygons, based on hazard type.

3.2.6 Change VTEC Mode

Selecting Change VTEC Mode provides a list of VTEC formats, including:

- Normal: O-VTEC - Operational Product - In the formatted hazard, you will see an 'O' preceding the VTEC code (for example, 'O.NEW') in the VTEC line.
- Test: T-VTEC - Test Product - In the formatted hazard, you will see a 'T' preceding the VTEC code (for example, 'T.NEW') in the VTEC line.
- Normal: X-VTEC - Experimental VTEC in an Operational Product - In the formatted hazard, there will be an 'X' preceding the VTEC code (e.g., 'X.NEW') in the VTEC line.
- Normal: E-VTEC - Experimental Product - In the formatted hazard, you'll see an 'E' preceding the VTEC code (for example, 'E.NEW') in the VTEC line.

When running in Operational mode, the menu choices are O and T. In Practice mode, the menu includes T, X, and E.

3.2.7 Reset Events

This clears the hazard events list, providing a clean slate for practice/test. This entry is not present when in Operational mode.

3.3 Hazard Event Table

The Hazard Event Table displays information about hazard events that are visible in the current Setting (that is, those that pass through the Setting's filter). Each row in the table represents a single hazard event.

3.3.1 Column Headers

- **Non-Timeline Headers**

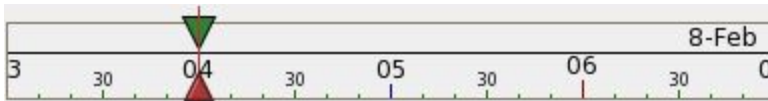
Event ID	Hazard Type ^	Status	Time Remaining	Start Time	End Time
----------	---------------	--------	----------------	------------	----------

You can drag a column header to the left or right in order to reorder the columns. No column may be dragged to the right of the Timeline column, however.

MB1-clicking a column header causes the hazard events in the table to be sorted by the contents of that column's cells. Clicking the same header again reverses the order of the sort.



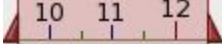
MB3-clicking a column header reveals a pop-up menu listing all available table columns, with check marks next to those columns that are currently showing in the table. Individual menu items may be checked or unchecked to show or hide their associated columns. At the bottom of this list are Sort by and Secondary Sort by pull-outs, which allow you to sort ascending or descending (alphanumerically) on any column contents. For example, you might wish to sort by Stream and then by River Mile - even if the column is not visible.

- **Timeline Header**



The rightmost column header constitutes a Timeline. This column's cells provide sliders that represent the start and end times of their associated hazard events.

The timeline may be navigated via mouse actions. If you roll the mouse wheel forward or backward while hovering the cursor over the timeline, the timeline zooms in or out, respectively. You may also drag any point in the timeline not within a red triangle to the left or right, causing the timeline to pan appropriately. The current time can be brought into view by clicking the "Now" button just above the timeline.

The current time is shown as a green inverted triangle and line . The red triangular slider and line  or split triangle  indicate, and allow the changing of, the selected time.

If the selected time mode is 'Single,' only those hazard events whose start and end times encompass the current selected time are visible on the Spatial Display. If the selected

time mode is set to 'Range' or 'Show All Time,' two red half-sliders with a shaded area between them are also made available on the Timeline. These define the earlier and later extremes of a time range, and like the red slider, may be moved to alter the range. When in this mode, hazard events whose time ranges overlap with this selected time range are visible on the Spatial Display.

3.3.2 Table Rows

Each row in the table represents a hazard event. The columns showing in the table are those that have been configured to be visible (see section [3.3.1 Column Headers](#) - Non-Timeline Headers). The Timeline column is always visible.

The leftmost column in each row contains a checkbox. When checked, the event is visible in the Spatial Display.

Clicking a row (in any cell except the Timeline column's cell, and not in the aforementioned checkbox) selects that row's hazard event, deselecting all others. If not already visible, the Hazard Information Dialog opens with a tab for this event. Holding down the Shift key while clicking a row in this fashion selects all rows between the previously-selected row and this one. With the Ctrl key, a click on any row toggles its selection.



The sliders in the Timeline column of each row display the start and end times as points along the Timeline.

Double-clicking a timestamp found in the Start Time or End Time column causes the timeline to pan so as to center on the Start Time.

3.3.3 Hazard History

Once an event is issued, an expansion tree arrow appears at the left end of its row in the Console. When you click on the arrow, a history of the event is revealed - initially just the original issuance. (You can open all hazard events' history via the Show Hazard History checkbox in the pop-up menu over the Console rows.)

Illustrated here is an example of a Flood Watch that was canceled an hour after issuance.

Event ID	Lock Status	Hazard Type	Status	Stream ▲	Point ID	Start Time	End Time	Expiration Time	VTEC Actions
▼ <input checked="" type="checkbox"/> 3	U	FA.A	ENDED			15:44Z 04-Oct-17	00:00Z 05-Oct-17	16:45Z 04-Oct-17	[CAN]
<input checked="" type="checkbox"/> 3		FA.A	ENDED			15:44Z 04-Oct-17	00:00Z 05-Oct-17	16:45Z 04-Oct-17	[CAN]
<input checked="" type="checkbox"/> 3		FA.A	ISSUED			15:44Z 04-Oct-17	00:00Z 05-Oct-17	23:45Z 04-Oct-17	[NEW]

4.0 Hazard Creation Methods

Creating a hazard consists in broad terms of three steps, to wit:

1. Define the area affected by the hazard

2. Assign a hazard type
3. Set the hazard duration and other attributes

The steps may be followed manually, or a recommender (see Section 4.1, following) can suggest some or all of these components by examining data residing in the AWIPS database.

The creation, definition, and modification of hazards is a core functionality of Hazard Services and is a key component of the Hazard Life Cycle. The Hazard Life Cycle starts with the creation of a hazard. A set of atomic information or details is associated with each hazard. The number and type of these details will vary per hazard, but some examples common to many hazards are a start time, an end time, and a hazard type. Also, one or more geometries are associated with a hazard, and these geometries denote where hazardous conditions may be experienced. For example, a polygon describes a hazard area while a point describes a specific hazard location.

When defining a hazard, there are several techniques that you can use to specify the area(s) associated with it. These include:

- Running a hazard recommender
- Selecting a set of geopolitical boundaries (for example, selecting a group of counties for an areal flood watch)
- Drawing the area by hand

Combined, these techniques provide the ability to tailor and refine hazard areas to the locations where hazardous conditions are expected to occur. The hazard area constitutes one piece of the atomic information associated with the hazard. Other hazard 'metadata' can be assigned via the Hazard Information Dialog.

4.1 Recommender Execution

You can use recommenders to augment both situational awareness and hazard operations. Recommenders are code modules developed as part of the baseline or added by Focal Points which produce hazard recommendations based on a variety of input data, including but not limited to hydrometeorological observations, model forecasts, other hazards, Hazard Services session state, and run-time user input. Session state refers to information such as the Hazard Services current selected time and index of the frame of time-matched data loaded in CAVE. Input can be obtained through a dialog defined by the recommender and/or your interaction with the Hazard Services Spatial Display. Based on these input data, the recommender may produce pending or potential hazards which are displayed in the Hazard Services Spatial Display and Console. In short, recommenders can quickly analyze a vast variety of data and notify you of places in your area of forecast responsibility where criteria for hazardous conditions may be met.

Recommenders are analogous to GFE Smart Tools in that they can define their own dialogs to obtain forecaster input and produce analyses to support forecast operations. A difference is that Smart Tools generally produce forecast grids, while recommenders product hazard recommendations.

You can run a recommender by selecting the tools button



on the Hazard Services

Dam/Levee Break Flood Recommender
Burn Scar Flood Recommender
River Flood Recommender
Flash Flood Recommender

In Hazard Services, the distinction between short-fused, long-fused, and hydro hazards is diminished somewhat since the same basic process is used to create all hazards. Specific recommenders are associated with individual Settings. So, an office may define a Severe Weather or 'Short-fused' Hazard Services Setting containing recommenders including a storm track tool. This tool could be used to recommend short-fused hazards such as those associated with severe thunderstorms and tornadoes. Hazard Services will provide the flexibility for offices and forecasters to group hazards and recommenders together in any way they desire. Instead of having a set of recommenders for the classic 'long-fused' hazards, an office could have recommenders grouped together based on type. For example, an office could have a set of recommenders for winter weather, a set of recommenders for wind-related events, and a set of recommenders for extreme temperature-related events.

Each of the three legacy warning applications can issue hydrologic hazards. For example, river point flood warnings can be issued from RiverPro, areal flood and flash flood watches can be issued from GHG, and flash flood warnings can be issued from WarnGen. In Hazard Services, hydro recommenders can be used to produce all of these same hazards with the advantage that you're working in one application and following one process to create them. A river point flood warning can be created in much the same way as a flash flood warning which in turn is created in much the same way as an areal flood warning. This reduces the number of application interfaces and workflows you need to be familiar with for hazard operations.

Recommender Output

Recommenders produce a hazard event or a list of hazard events. Each hazard event contains a core set of details including a site identifier, an eventID, a hazard state, an issue time, a start time, an end time, a phenomenon, a significance, a subtype, a hazard mode, and one or more hazard geometries. Each hazard event may also have an additional set of recommender-defined hazard attributes. This provides the flexibility for a recommender to return information to further quantify the hazards it is recommending. An example of this would be the flood crest time and crest stage or flow for a point river flood warning.

The following sections give examples of each of the baseline Recommenders.

4.1.1 River Flood Recommender

The River Flood Recommender retrieves information from the Hydro Database and creates Hazard Events for Watches, Warnings, and Advisories based on flood stage, action stage, rise, fall, and crest times. When you select River Flood Recommender from the tools list, a dialog

(see below) appears to gather necessary input.

The **Flood Recommender** dialog box is shown with the following settings:

- Type:** ALL
- Misc. Options:**
 - Include points below advisory
 - Watch/Warning Cutoff Time (hours): 24
 - Flood Watch Stage/Flow Buffer (%): 0
 - Clear Ingest Filter Cache
- Recommender Run Type:** Create/update/end hazards for chosen river points
- Forecast Point Choices:**
 - Blue River:
 - Boulder Creek: MBNC2, OROC2, BELC2
 - Cache La Poudre River:
 - Cherry Creek:
 - Clear Creek:
 - Colorado River:

Buttons: All, None, Run, Cancel

The Hazard Information Dialog also opens (next page, at left), and you can start defining metadata for the hazard. A 'potential' event becomes 'pending' when any change is made.

Choose the hazard types for which Hazard Events should be created. In the Misc. Options section, you can choose to include points below advisory (they will be assigned an HY.S hazard), adjust the Cutoff Time for creating a Watch vs. a Warning, and/or "force" a Watch even if stage is some percentage below flood. To improve performance, the system caches things like impacts, flood stages, and ingest filter type source ranks. If you change something like that and want to use it immediately, check the Clear Ingest Filter Cache box and the Recommender will reload it. The bottom section is where you can select points or groups of points by stream name.

After the Recommender runs, the generated hazard events appear in a dialog (below) and in the Console and Spatial Display with a status of 'potential.'

The **Flood Recommender Results (on a2devel)** dialog box displays the following results:

- Warning Hazards:**
 - Potential:
 - ASLN1-Ashland-Platte River
 - BLAN1-Blair-Missouri River
 - DCTN1-Decatur-Missouri River
 - LOUN1-Louisville-Platte River
 - OMHN1-Omaha-Missouri River
- Watch Hazards:**
 - Potential:
 - BRON1-Brownville-Missouri River
 - NEBN1-Nebraska City-Missouri River

Buttons: Close

The screenshot displays the CAVE software interface. The top menu bar includes options like File, Tools, Projections, Overlays, MapData, LiveData, ReferenceData, Product, HydroApps, Annotation, and Help. The main map area shows a geographical region with various hazard points labeled with codes like SCWC2, NCHC2, LVC2, etc. A detailed panel on the left shows the 'Hazard Information' for '2746 FLY FTDC2', including its category (Hydrology), type (FLY (RIVER FLOOD ADVISORY)), and time range (Start: 16-Jan-2018 17:42, End: N/A). Below this, the 'Point Details' tab is active, showing 'FTDC2 - Cache La Poudre River' with an immediate cause of 'ER (Excessive Rainfall)' and a flood record status of 'NO (Record Flood Not Expected)'. It also lists 'Rise Above Time' as missing, 'Crest Time' as 15-Jan-2018 17:45, and 'Fall Below Time' as missing. A 'Graphical Time Editor...' button is visible. At the bottom, a table lists various hazard events with columns for Event ID, Lock Status, Hazard Type, Status, Stream, Point ID, Start Time, End Time, Expiration Time, and VTEC Actions. The table shows events 2739 through 2751, with event 2746 highlighted in blue. The status of event 2746 is 'PENDING' for 'Cache La Poudre River'.

Event ID	Lock Status	Hazard Type	Status	Stream	Point ID	Start Time	End Time	Expiration Time	VTEC Actions
2739	Edit	FL.W	ENDING	Straight Creek	SLAC2	17:32Z 10-Jan-18	until further notice	05:45Z 11-Jan-18	[NEW]
2741	U	HYS	POTENTIAL	South Platte River	KERC2	17:42Z 16-Jan-18	until further notice		
2742	U	HYS	POTENTIAL	Fraser River	FRWC2	17:42Z 16-Jan-18	until further notice		
2743	U	HYS	POTENTIAL	Blue River	BLRC2	17:42Z 16-Jan-18	until further notice		
2744	U	HYS	POTENTIAL	Colorado River	CBGC2	17:42Z 16-Jan-18	until further notice		
2745	U	HYS	POTENTIAL	South Platte River	DNVC2	17:42Z 16-Jan-18	until further notice		
2746	U	FLY	PENDING	Cache La Poudre River	FTDC2	17:42Z 16-Jan-18	until further notice		
2747	U	HYS	POTENTIAL	Colorado River	KRMC2	17:42Z 16-Jan-18	until further notice		
2748	U	HYS	POTENTIAL	Clear Creek	IDOC2	17:42Z 16-Jan-18	until further notice		
2749	U	HYS	POTENTIAL	Blue River	BUEC2	17:42Z 16-Jan-18	until further notice		
2750	U	HYS	POTENTIAL	Tenmile Creek	TCFC2	17:42Z 16-Jan-18	until further notice		
2751	U	HYS	POTENTIAL	Saint Vrain Creek	LNSC2	17:42Z 16-Jan-18	until further notice		

The Point Details tab visible in the HID includes Rise, Crest, and Fall times. These are viewed and edited graphically as illustrated below. The vertical lines represent **Rise**, **Crest**, **Begin** (hazard start time), **Fall**, and **End** (hazard end time). These can be edited by dragging left-right or by clicking on one of the times in the boxes below, then using the resulting calendar/clock widget to specify the time. (Note: If you open the R/C/F editor at some later time without refreshing data/rerunning the recommender, the original data/recommender time will be indicated by a vertical dashed white line, while the B line will have moved to the current time.)

You can drag or specify R-C-F times out of order, but when you click Apply or OK, a dialog will alert you to your error. Similarly, B can be changed, but will snap to “now” when you apply it. Reset will restore the default information.

The crest value can also be adjusted in this dialog, and will be reflected in the graph and Hazard metadata.

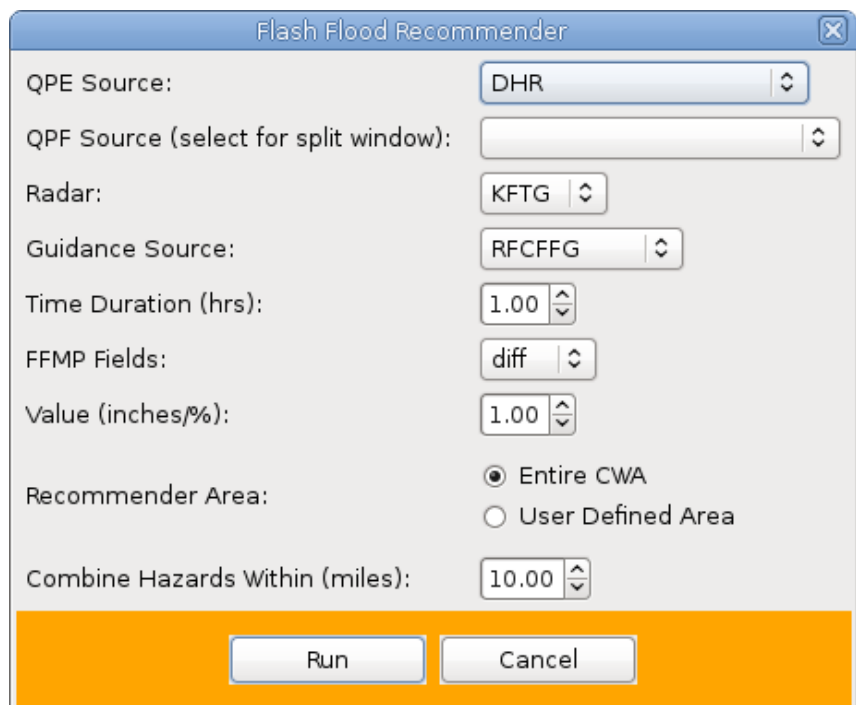


Note that HY.S (Forecast Information) is never issued as a stand-alone product, but rather is included as a segment within a point hazard (FL.A, FL.W). Further, HY.S segments will be included with any point hazards that are worked as a group. Further, since HY.S has no start/end times, they take on Elapsed status immediately upon issuance.

4.1.2 Flash Flood Recommender

The Flash Flood Recommender compares expected precipitation estimates to RFC-issued flash flood guidance, alerting you to areas where precipitation is expected to be heavy and fast enough to cause flash flooding.

When run, the Recommender produces a dialog as shown here to allow you to



select the QPE, QPF, and guidance sources and an accumulation interval for the forecast precipitation. [General note: Typing numbers into a “spinner” (one with up and down arrows to adjust values) can be tricky. You should take care that the numbers entered are what you want.]

The Recommender also provides an option to use FFMP data - difference or ratio of the FFMP values to the FFG, or just use the QPE.

If you select **User Defined Area**, you will draw a freehand polygon on the spatial display to define the area which will be examined for potential hazards.

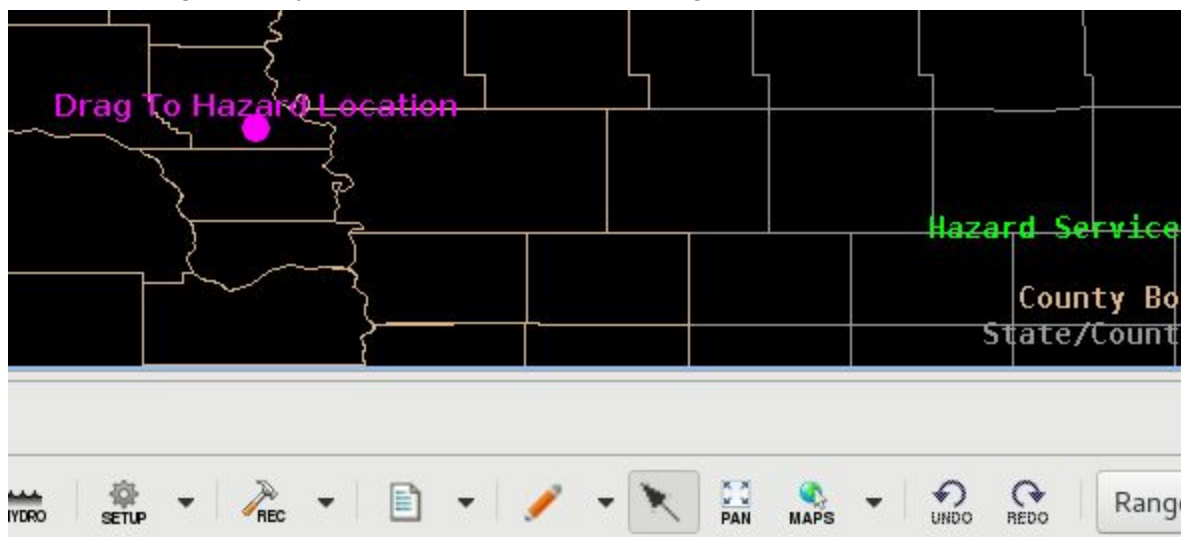
If other flash flood warnings are in effect, they will be shown at the bottom of the dialog with an option to exclude any that may overlap in area and thus need to be combined.

Upon completion, the Recommender will create zero or more potential hazards. If none is indicated, you’ll see a dialog to that effect.

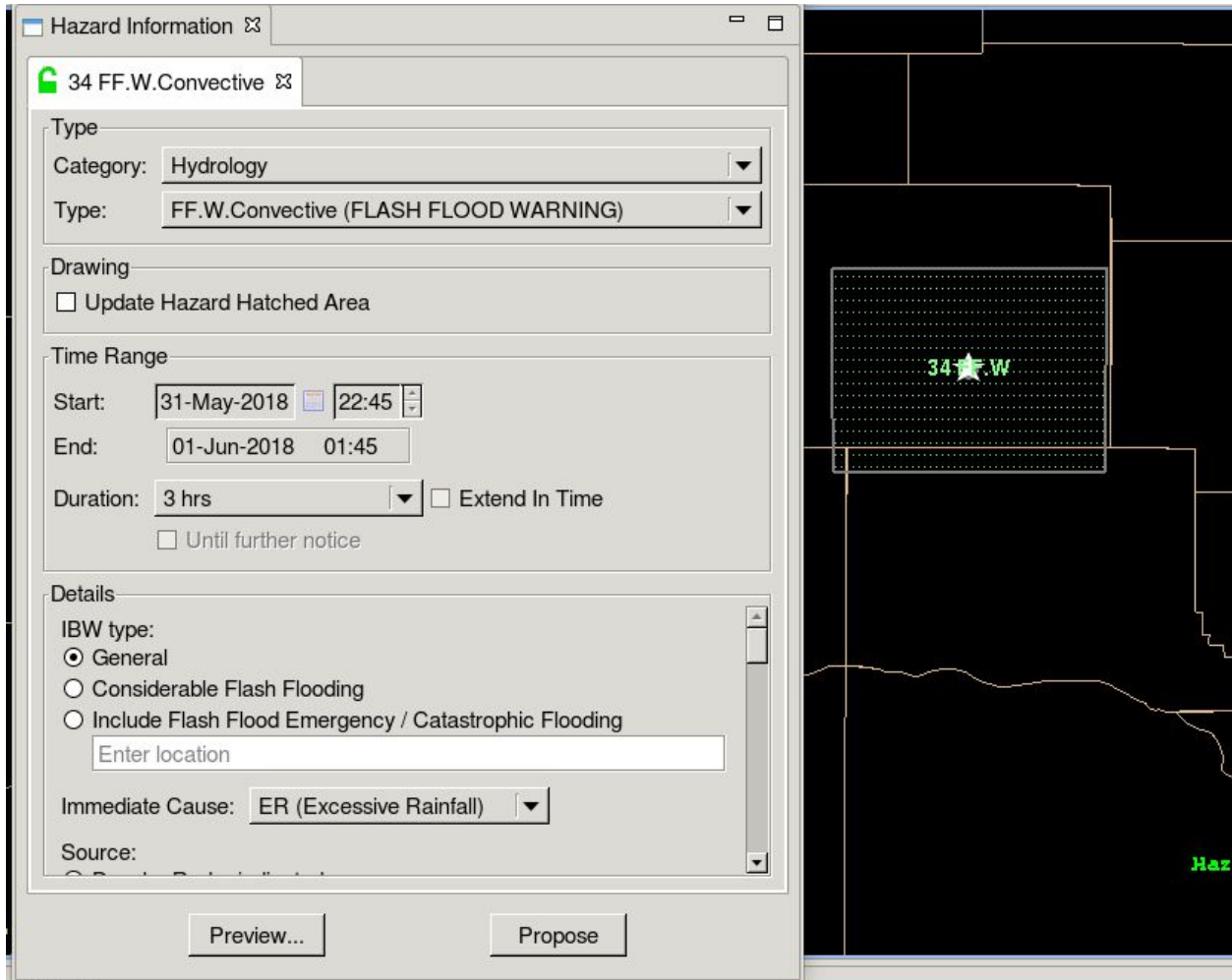
4.1.3 Storm Track Recommender

Note: This tool is not included in the baseline Hazard Services Initial Operating Capability (Hydrology focus). Since convective storms are still handled by WarnGen at this time, a more efficient workflow is to use WarnGen also for the convective storm track floods. The tool is described here to illustrate the capabilities of Hazard Services. It is available to be added to the menu through localization, if desired at a site.

You may choose to run the Storm Track Recommender to quickly issue a convective Flash Flood Warning. When you select Storm Track, a ‘Drag To Hazard Location’ icon appears.



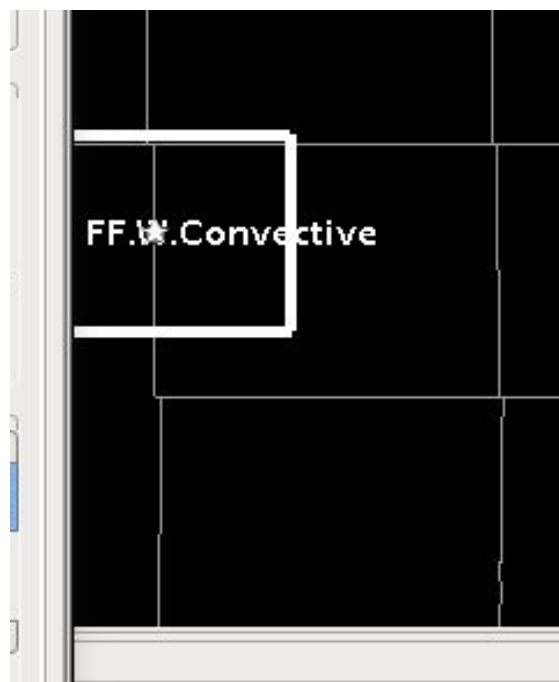
Drag the icon to the storm location and a polygon for an FF.W.Convective hazard event appears.

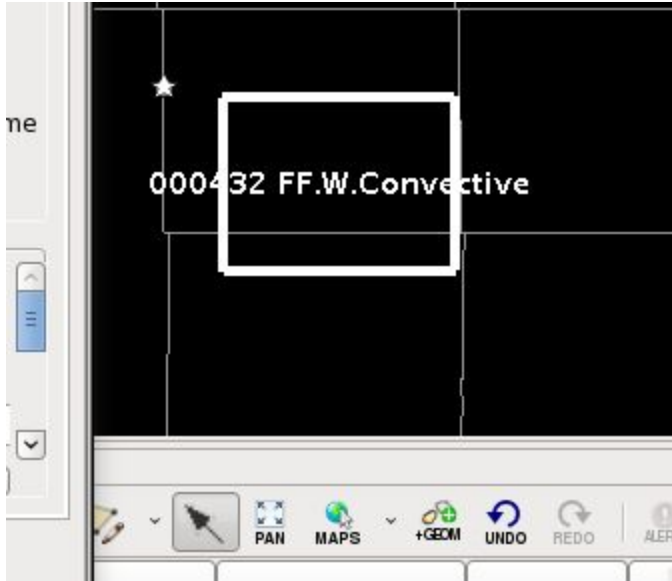


You can enter metadata in the Hazard Information Dialog and adjust the polygon by moving the 'star' (which represents the location of the storm), changing the shape of the polygon, and/or moving the polygon.

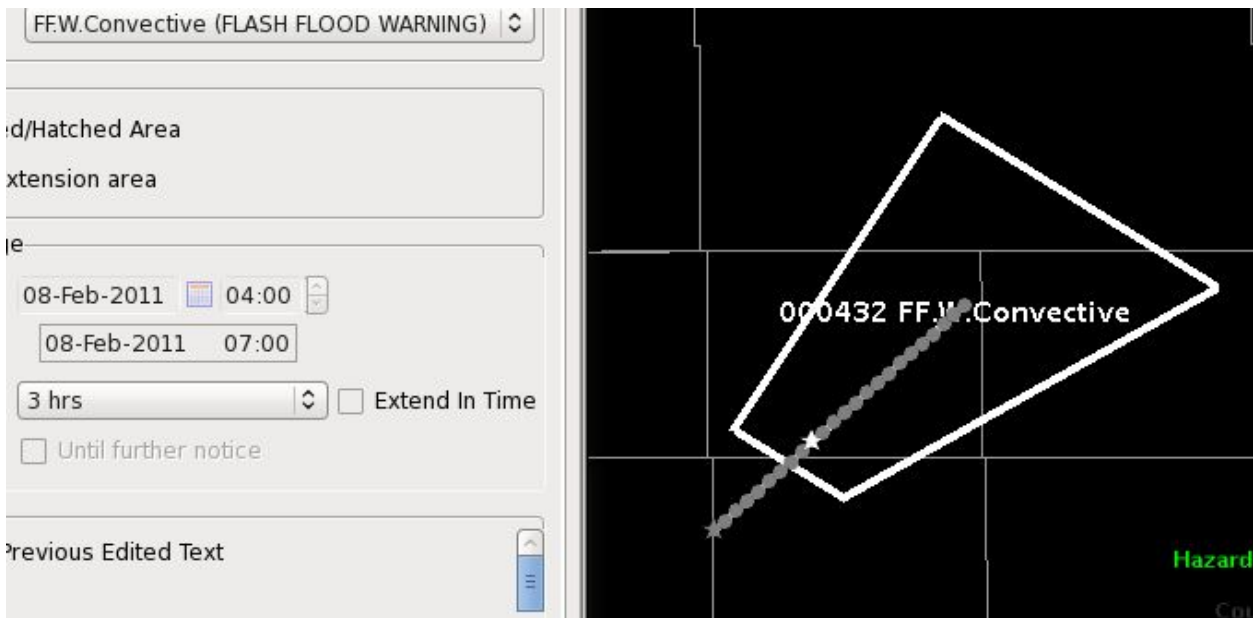
The 'star' represents a storm track with stationary motion. So if you move the star, the polygon will move with the storm.

However, if you move the polygon, the star will not move with it.





To illustrate that the star actually represents a storm track with stationary motion, step back a few frames. The star changes to a dot. When you drag it, a track appears and the polygon conforms to the track.



4.1.4 Dam/Levee Break Flood Recommender

The Dam/Levee Break Flood Recommender provides a quick path to issue a Flash Flood Watch or a non-convective Flash Flood Warning.



When you select Dam/Levee Break Flood Recommender from the tools list, it opens a dialog to gather your input specifying which dam or levee has failed and the level of urgency.

From this dialog, type in the box to filter or select the structure from the pull-down. Select the level of urgency and click Run. This produces a hazard recommendation for a non-convective Flash Flood Warning (or Watch, if selected). The hazard polygon represents the flood inundation area which was obtained from the appropriate Emergency Action Plan (EAP). (These shapes are stored in the maps database via a procedure run by your Focal Point.) Note that not only does the recommender produce the hazard polygon, but it also can provide initial definitions for the details displayed in the Hazard Information Dialog. You may change and refine all of this hazard information, including the polygon.

The screenshot shows a software interface for configuring a flood recommender. The dialog box is titled "69 FF.W.NonConvective" and contains several sections:

- Type:** Category: Hydrology; Type: FF.W.NonConvective (FLASH FLOOD WARNING)
- Drawing:** Update Hazard Hatched Area
- Time Range:** Start: 05-Jun-2018 13:33; End: 05-Jun-2018 16:30; Duration: 3 hrs; Extend In Time; Until further notice
- Details:** IBW type: General, Considerable Flash Flooding, Include Flash Flood Emergency / Catastrophic Flooding; Enter location: [text input]; Flood Severity: U (Unknown); Hydrologic Cause: Dam - site specific - failure has occurred

At the bottom of the dialog are "Preview..." and "Propose" buttons. To the right, a map displays a green dotted hazard polygon labeled "69 FF.W". Below the map is a toolbar with "HYDRO", "SETUP", and "REC" icons. At the very bottom, a table shows the following data:

Point ID	Start Time
9	U
FF.W.NonConvective	PENDING
	13:33Z 05-Jun-18

This example illustrates the value of recommenders. The Focal Point has configured this tool so that in the event of a dam or levee failure, all you need to do is run the tool, select the correct

dam or levee, perhaps modify some of the hazard information, and issue the legacy hazard product - in this case a non-convective FFW. Most of the information, including the flood inundation area, is produced by the recommender. This allows you to issue a hazard quickly and refine it later as more information is available.

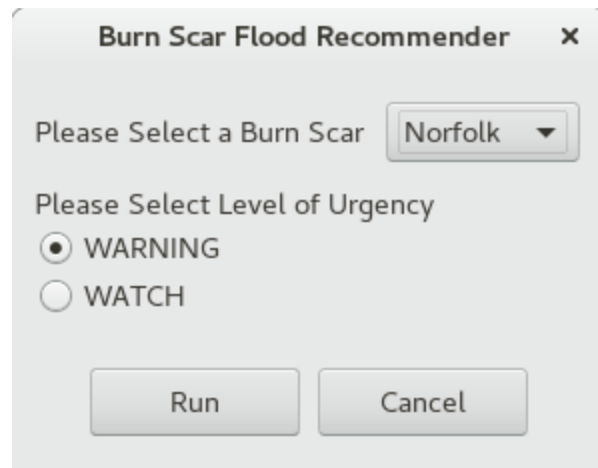
Note: Suppose you are working with an issued dam break watch and another forecaster runs the Dam Break Recommender for the same dam to issue a warning. The recommender will provide a notice of the conflict, as shown here.

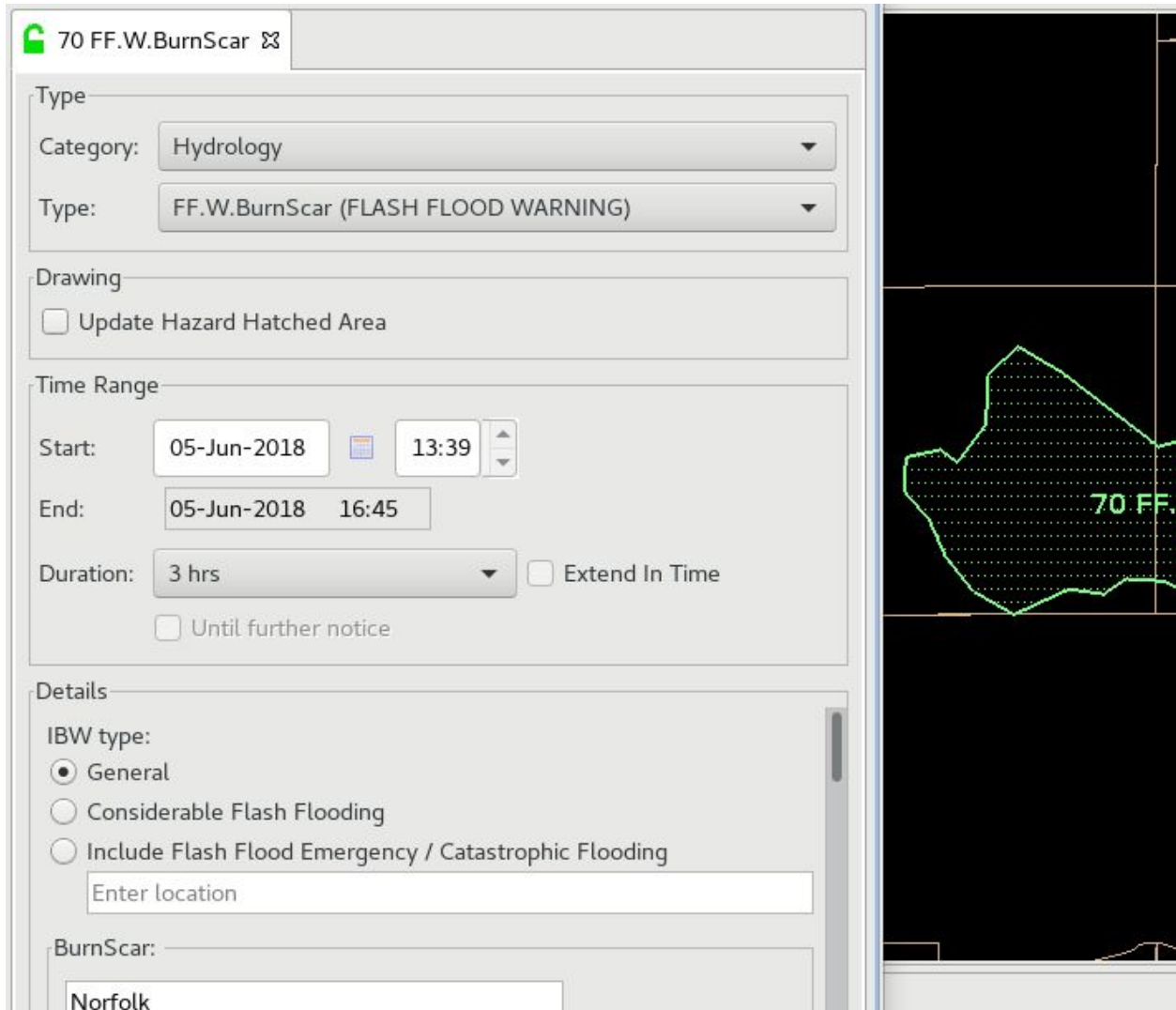


4.1.5 Burn Scar Recommender

The Burn Scar Flood Recommender is similar the Dam/Levee Break Flood Recommender. A dialog appears for you to choose a pre-defined Burn Scar area:

When run, an FF.W.BurnScar hazard event is created and the Hazard Information Dialog appears for entry of the metadata.





Note: If you have no burn areas in your maps database, a dialog so stating will pop up.

Similar to the Dam Break Recommender, a dialog will alert you if there is already a hazard pending or issued for this burn scar.

4.1.6 Creating a Hazard from a River Gauge

To create a hazard event from a river gauge, follow these steps:

1. Display gauges (click MapData->Refresh Data if gauges are not showing in Hydro Perspective)
2. Double click a gauge in the Spatial Display. A red box will appear around the gauge.
3. Now press MB3 on that gauge to bring up the pop-up menu and choose "Create Hazard." Wait a moment for the Flood Recommender to start. Click Run.
4. A Hazard Point Geometry (polygon) will appear encompassing and in the vicinity of the gauge, and an entry will appear in selected state in the Hazard Services Console. Close

the Flood Recommender Results dialog and proceed with previewing and issuing the product.

4.2 Selection Tools

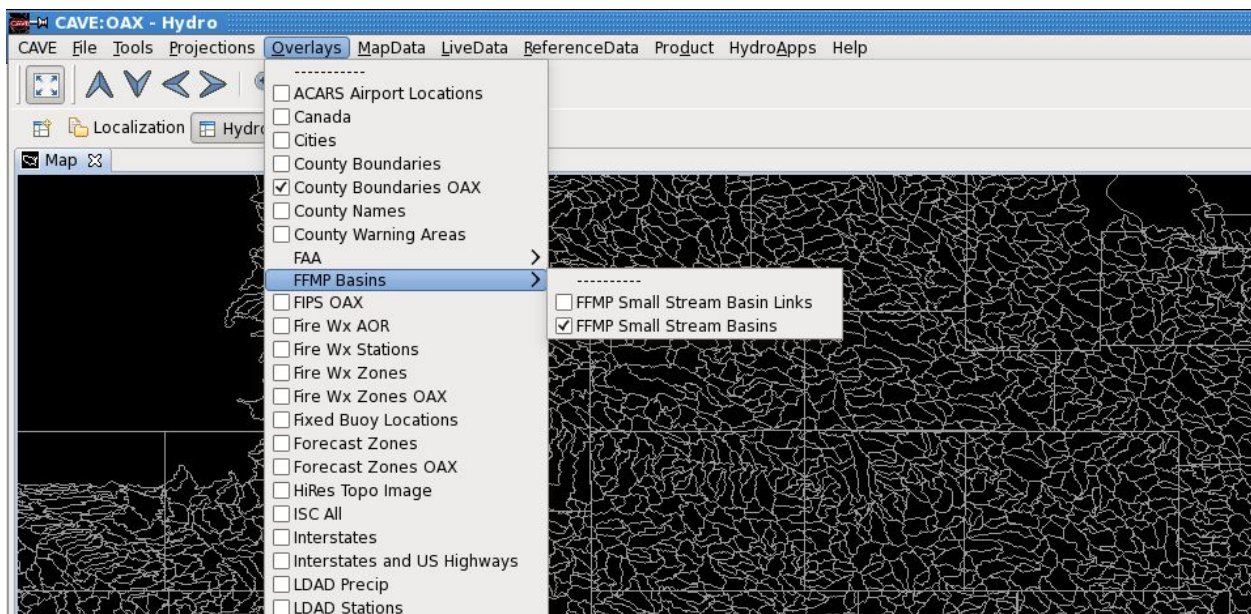
There are several different ways to draw a hazard area. Hazard Services provides a full suite of drawing tools. These were designed to be similar to the familiar drawing and editing tools offered in WarnGen and GHG.


4.2.1 Select By Area

You can define hazard areas much as hazards are created in GHG, that is, by filling in areas such as counties or zones. In addition to counties and zones, you may also choose FFMP small basin boundaries, or fire weather zones. (Any map, including CWA boundaries, ISC boundaries, RFC basins, even Canada, can be used. Be careful with very complex maps - for example, NE Canada. You may wait a long time for the Hazard Information Dialog to open.)

Select By Area Example

To use the Select by Area tool to create a hazard area based on a selected set of geopolitical boundaries, first load the CAVE overlay or overlays to use. For example, to create a Flash Flood hazard by filling in the affected FFMP small basins, the FFMP Small Basins map needs first to be loaded from the set of available CAVE overlays:

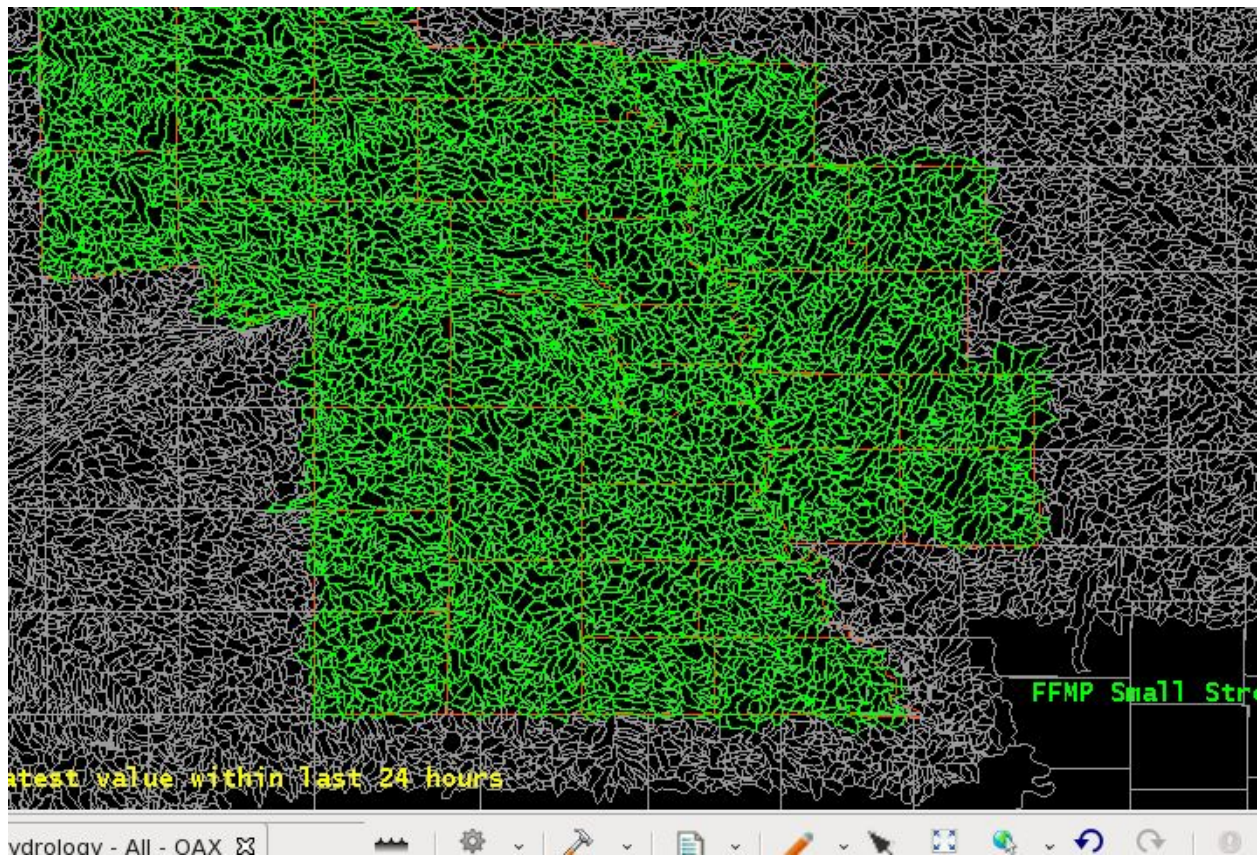


Then the Select by Area button  will display a list of the overlays loaded in the CAVE display which can be used for Select by Area.

Selecting FFMP Small Stream Basins from this menu highlights all of the FFMP small basins which can be



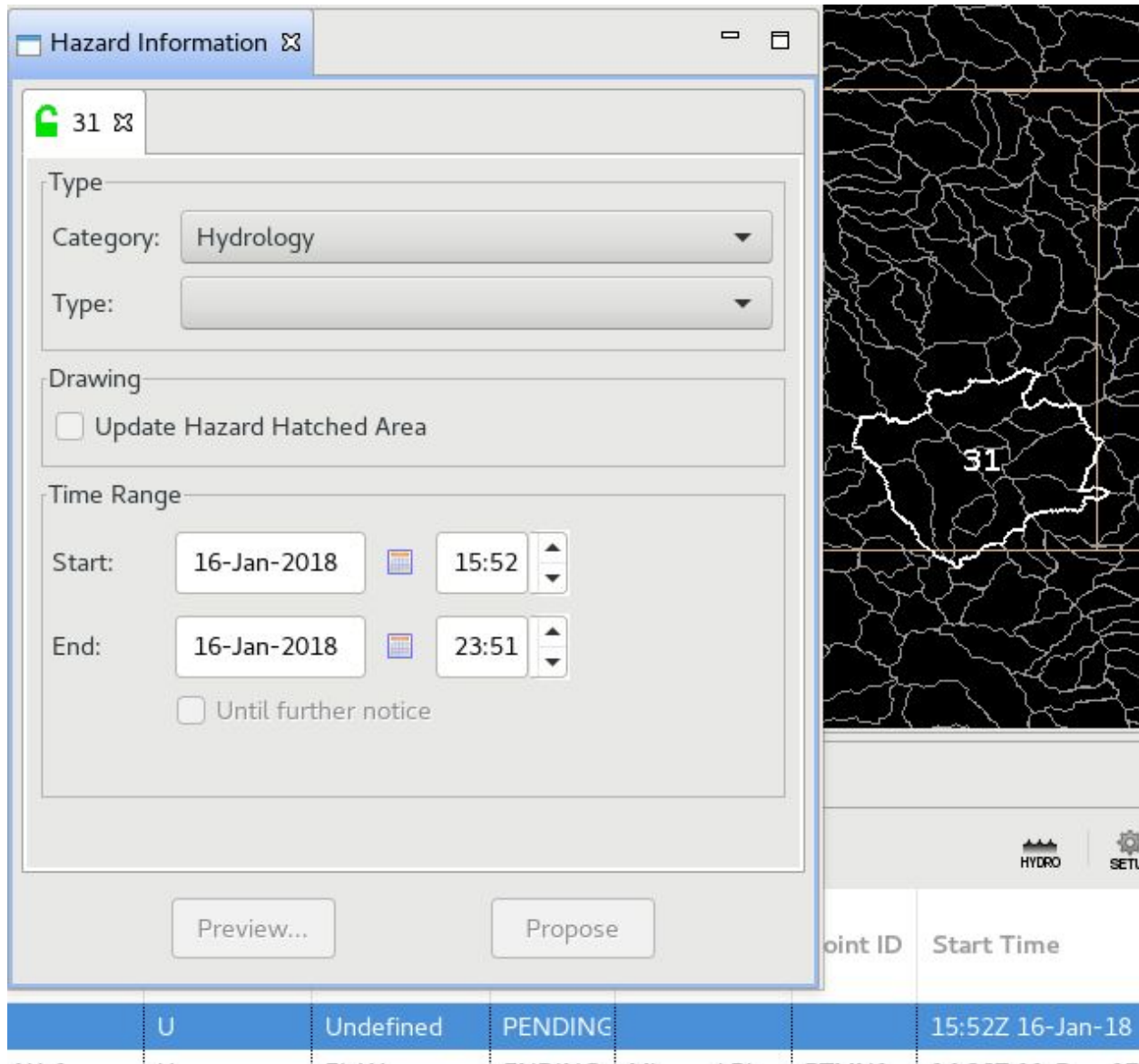
used to define hazard areas. These are colored based on the CWA boundary:



Much like the GHG drawing tools, you can select FFMP Small Basins to include in the hazard area:

- Pressing MB1 and dragging the mouse will add the basins that the mouse cursor passes over to the hazard area
- Clicking on a basin will either add or remove the basin from the hazard area


A single MB3 click will complete the Select by Area drawing action and create a hazard geometry based on the selected basins:



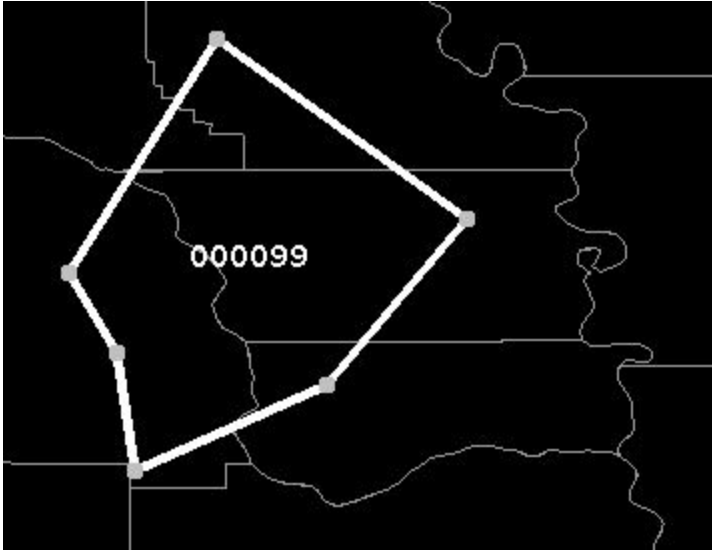
One may modify this area by selecting from the pop-up menu Modify area... > Add/Remove Shapes. After clicking on/off shapes, an MB3 click will update the hazard geometry.

4.2.2 Freehand Drawing

Hazard Services offers drawing tools to draw free form polygons, that is polygons which are not constrained by geopolitical boundaries. These tools provide the ability to create hazard geometries tailored to the areas where hazardous conditions are expected to occur.

The Drawing Tools menu  on the Hazard Console includes a Draw Polygon choice to create a hazard area by specifying the locations of the hazard vertices:

- Each MB1 click will create a vertex



- Click MB3 to complete (close) the hazard polygon

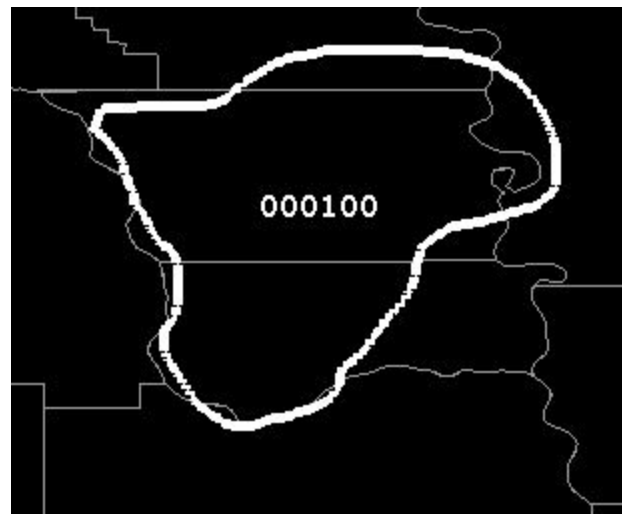
A polygon must have at least three vertices or it will be discarded. When the polygon is completed the Hazard Information Dialog appears, allowing you to specify the polygon's hazard information. Mousing over the polygon will show the locations of vertices.

The Draw Freehand Polygon option allows a smooth polygon to be drawn:

- Drag with MB1 to draw a polygon with a free-form boundary.
- Release MB1 to close the polygon.

4.3 Manipulating Hazards

Hazard Services provides several ways to manipulate hazards and their defining information. This includes changing the shape and extent of their associated geometries. The tools for editing hazard polygons are very similar to those provided by WarnGen.



4.3.1 Adjusting a Hazard Polygon

Mousing over a selected hazard polygon causes the vertices to be displayed as grey dots.

4.3.1.1 Moving a Polygon Vertex

When the mouse pointer is placed close to one of these vertices, the pointer turns into a hand. Pressing MB1 and dragging the mouse will move the vertex closest to the pointer.

4.3.1.2 Deleting a Polygon Vertex

When the mouse pointer is placed close to one of the polygon vertices, the pointer turns into a hand. Middle clicking on the vertex causes it to be deleted. Alternatively, the vertex may be deleted by selecting 'Delete Vertex' from the MB3 context menu.

4.3.1.3 Adding a Polygon Vertex

When the mouse pointer is placed close to the boundary of the polygon at a location away from a vertex, the pointer turns into a cross. A vertex can be added by clicking mouse button

2 on the outline of the hazard polygon. In addition, a new vertex may also be added by pressing MB3 on the polygon boundary and selecting 'Add Vertex' from the context menu.

4.3.1.4 Moving a Hazard Geometry

A Hazard Geometry may be moved by pressing MB1 in the hazard polygon and dragging to a new location.

4.3.2 Hazard Information Dialog

The Hazard Information Dialog (HID) provides the ability to view and manipulate the details of hazard events. It is divided into a tabbed area, with each tab containing three informational sections, and a command area, the latter allowing the events showing in the dialog to be previewed or proposed.

The tabbed area shows one tab for each hazard event that is currently selected, with selection occurring by clicking on hazard(s) in the Spatial Display or the Console (Section [3.3.2 Table Rows](#)). Thus, if two items are selected within the Spatial Display and the Console, two tabs will be present, one for each of the selected events. The tabs are labeled with the event identifier and, if the hazard event has been

The screenshot shows the Hazard Information Dialog (HID) with two tabs: "72 FF.A" and "73 FF.W.NonConvective...". The "73 FF.W.NonConvective..." tab is active. The dialog is divided into several sections:

- Type:** Category: Hydrology; Type: FF.W.NonConvective (FLASH FL...)
- Drawing:** Update Hazard Hatched Area
- Time Range:** Start: 05-Jun-2018 13:46; End: 05-Jun-2018 16:45; Duration: 3 hrs; Extend In Time; Until further notice
- Details:** IBW type: General, Considerable Flash Flooding, Include Flash Flood Emergency / Catastrophic Flooding; Enter location: [text input]; Flood Severity: U (Unknown); Hydrologic Cause: Dam failure - generic

At the bottom of the dialog are two buttons: "Preview..." and "Propose".

assigned a type, the type as well. (As illustrated, if the tabs won't fit in the window, a >>n tag will so indicate. The hidden tabs' titles are revealed by clicking on the >>n - or you can widen the dialog to see them.

Events can be added to or removed from the selected set (and thus to the HID) by ctrl-clicking them in the Console or in the Spatial Display. Each tab in the HID includes a close X (visible in the active tab as shown above, but appearing in other tabs as the pointer passes over them), which provides an alternate method of deselecting an event. A dialog confirms the removal from the selected set.

Note: The illustration here includes a 'Use coastal extension area' checkbox. This optional selector may be enabled in Localization > Hazard Services > Startup Config > StartUpConfig.py.

4.3.2.1 Hazard Type

The Hazard Type section displays the hazard category and type. Which category is chosen dictates the types available, since each category is a collection of one or more hazard types. Changing the category causes the type to be reset to nothing; you must then choose a type.

When both a category and type are selected, the metadata section detailed below is filled in with whatever fields are appropriate for that type's metadata. Additionally, the hazard type shown in the 'Hazard Type' column within the Console table is altered to match the new type.

4.3.2.2 Time Range

The Time Range section holds the start time and duration of the event. These are reflected in the time ranges shown in the Console table for that event. The example hazard uses a duration choice list; many hazards use two time widgets to set the start and end times. Some hazards automatically start at the current time, some have user-choice ending time but are limited to a maximum duration. These and other time constraints are set in Localization > Hazard Services > Hazard Types > HazardTypes.py.

4.3.2.3 Details (Metadata)

The Details section displays fields holding any type-specific metadata for the hazard event being viewed. This section will be empty if there is no metadata for the chosen hazard type.

The fields provided within the Details section may have the values they display manipulated so as to change the metadata associated with the event. If there are too many fields to display within the body of the dialog, a vertical scrollbar is provided.

The metadata for the event is configurable as described in the Hazard Services Focal Point User's Guide.

Note to Focal Points: You can see full details of a hazard event using the *View Details for Selected Events...* option in the Console pop-up menu.

4.4 Hazard Status

The status or 'state' of a hazard changes as the hazard situation progresses. Most changes are automatic, some can be set. The status of a hazard can be:

- 'potential' -- Suggested hazards sometimes created by Recommenders using data such as that from the IHFS database. When selected, the Hazard Information Dialog appears, and you can start defining metadata for the hazard. Any change results in the 'potential' event becoming 'pending.'
- 'pending' -- A hazard for which you are in the process of editing and defining metadata. The hazard is 'pending' proposal or issuance. A Recommender can produce a pending hazard - for example, as a result of a "Drag Me To Storm" action. In this case, the hazard is automatically selected and the Hazard Information Dialog appears for immediate action similar to the streamlined process of WarnGen for short-fused warnings.
- 'proposed' -- Hazards that you wish to share with other sites or partners. This would be for collaboration purposes prior to issuing a hazard. These hazards are stored in the database, but are not disseminated.
- 'issued' -- Hazards that have been issued and associated products disseminated
- 'elapsing' -- If you do not actively 'end' a hazard, the status remains as 'issued' until time marches to the expiration time, then the status will change to 'elapsing.' In this state, the hazard can be expired or will elapse. See below.
- 'elapsed' -- This state is set when an 'elapsing' hazard passes the 'afterMinutes' window.
- 'ending' -- Hazards that are in the process of being ended.
- 'ended' -- Hazards for which a product has been issued as either an expiration (EXP) or cancellation (CAN).

The expirationTime, and in some cases, expirationSubTime, are set per hazard type in HazardTypes.py. These time windows are defined therein:

```
# expirationTime:      A tuple (beforeMinutes, afterMinutes).
#
#                      This is set according to VTEC policy, so cannot be changed.
#                      See below rules to understand how this and the expirationSubTime
#                      decide the corresponding vtec action.
#                      Rules:
#                      Within Sub-Window -- always EXP
#                      Within Expiration Window, but outside Sub-Window
#                          User Ends Hazard via "End This" (status is "ENDING") -> CAN
#                          Only available outside the Sub-Window
#                          User Updates Hazard via "Update This"
#                          Only available outside the Sub-Window AND inside the
#                          Expiration Window -- results in a CON
#                          If User simply issues -> EXP
# expirationSubTime:  A tuple (beforeMinutes, afterMinutes).
#
#                      This is set according to VTEC policy, so cannot be changed.
#                      If a hazard event is issued within the (beforeMinutes, afterMinutes)
#                      window around the hazard end time, then a VTEC EXP will be
#                      automatically generated.
```

Example from Localization > Hazard Services > HazardTypes.py:

```
'FF.W.Convective' : {'headline': 'FLASH FLOOD WARNING',  
                    'expirationTime': (-10, 10),  
                    'expirationSubTime': (-5, 10),
```

Archiving and purging from the Hazard Database

A 'hazardDatabasePurgeTime' can be specified in StartUpConfig.py (not implemented yet). After this time, Hazard Events will be purged from the Hazard Database. Archiving of the Hazard Database can be done via standard PostgreSQL processes.

4.4.1 Propose

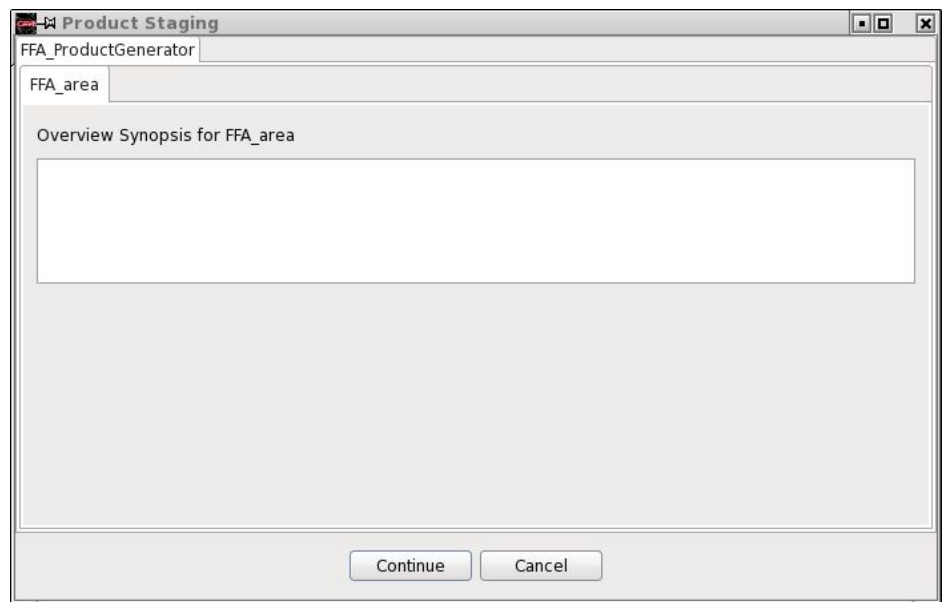
To propose the selected hazards, press MB3 over the Spatial Display and choose 'Manage hazards > Propose This'. Or you may click mouse MB3 over the hazard in the Console and select 'Propose This.' The status will change in the Console and the border on the hazards will appear dotted. (Note: When you propose a hazard, it clips to your CWA. If the polygon is completely outside of your CWA, you'll be so notified.)

4.4.2 Preview

Once the Hazard Information is complete, the resulting product(s) may be previewed. If multiple hazards are selected and appear in the Hazard Information dialog tab, products will be generated for all of them. Select 'Preview...':

4.4.2.1 Product Staging Dialog

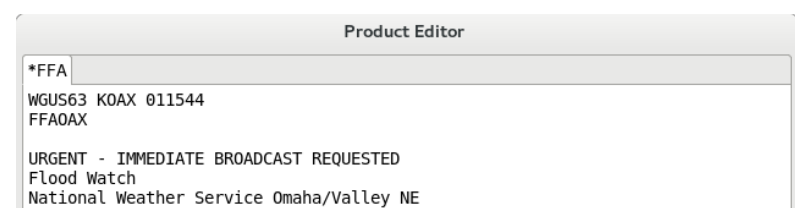
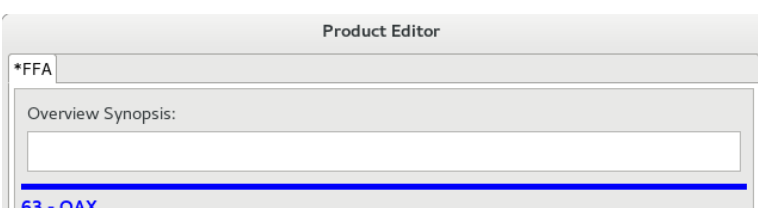
Some products can include multiple hazard types or multiple hazards of the same type. If there are related hazards in the session which are not selected in the Hazard Information dialog, a Product Staging dialog will appear to ask you if the other related hazards are to be included in the previewed products.



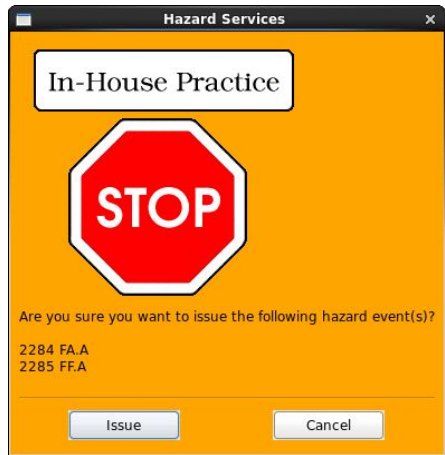
The Product Staging dialog can also include run-time input fields that may be needed by Product Generators. For example, a Product Generator may specify an 'overview' text field to be entered.

4.4.2.2 Product Editor

The resulting products appear in the Product Editor dialog. You can modify various text fields in the Hazard Data Editor tab. These modifications update in the Legacy tab.



If you want to issue the hazard, you can do so from here. Please note that since some products are issued “now,” the issue and expire times may differ from the preview.



4.4.3 Issue

You may issue the hazard(s) from the Product Editor: select Issue All. A confirmation dialog similar to that at left will appear.

Once issued, the status will change in the Console and the border will appear solid in the Spatial Display.

4.4.4 Ending and Ended

You can end a hazard. To do so, select the hazard, then press MB3 over the Spatial Display and choose 'Manage hazards > End This'. The Hazard Information Dialog appears providing the opportunity to enter an Ending Synopsis. The status of the hazard changes to 'ending,' and the Lock Status is E (being edited; note: on other Consoles, reads L:<user name>). Select the Preview button to see the resulting product in the Product Editor. You may then issue from the the Product Editor. Depending on the time of issuance relative to the expiration time 'beforeMinutes' and 'afterMinutes' for the Hazard Type, the resulting product will have either a CAN or EXP VTEC code. The status will then change to 'ended' in the Console. Alternatively, you can MB3 on the entry in the Console and select 'End This.'

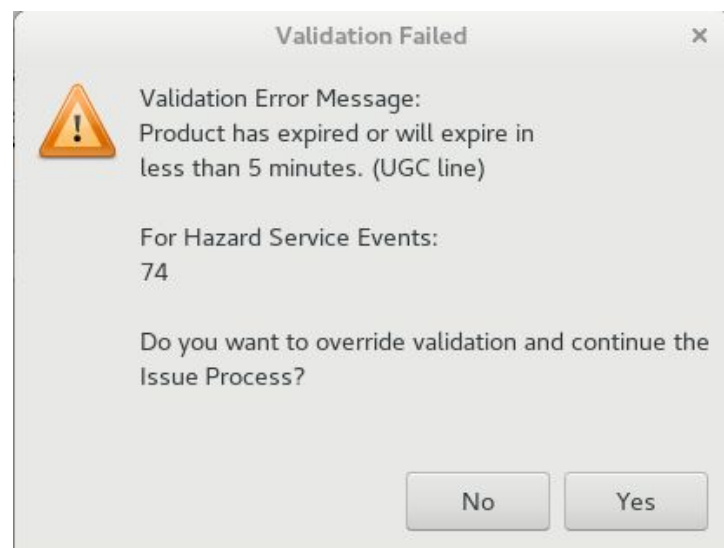
If you change your mind about ending the hazard, you can select 'Revert This' in the Console, or 'Revert 1 Selected Events' over another row in the Console or from the Spatial Display pop-up (Manage hazards > Revert 1 Selected Events). The status will return to Issued and Lock Status to U (unlocked).

There is also an “End *n* Selected Issued” option. If you choose this, you’ll get a dialog asking if you wish to proceed.

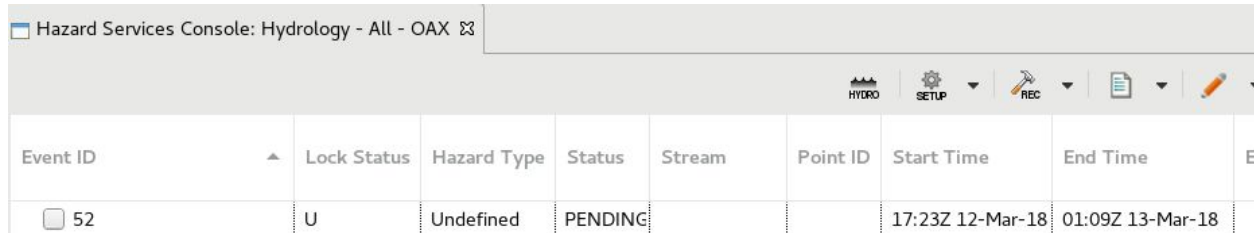
If you begin the process of canceling a hazard but then don’t get to issuing the cancellation until less than five minutes before the hazard’s expiration time, you’ll be informed with a dialog as shown here.

5.0 Settings Overview

'Settings' allow you to filter the hazard information being displayed so that you can focus on the meteorological situation of concern. For example, you may want to focus only on hydrological hazards in the next three days for your CWA.




A Setting is a set of parameters governing the viewing of hazard events within the Console and Spatial Display. Several Settings are predefined as part of the localization process, but they may also be created, modified, and deleted while Hazard Services is running. The Console's title tab shows the name of the currently loaded Setting.

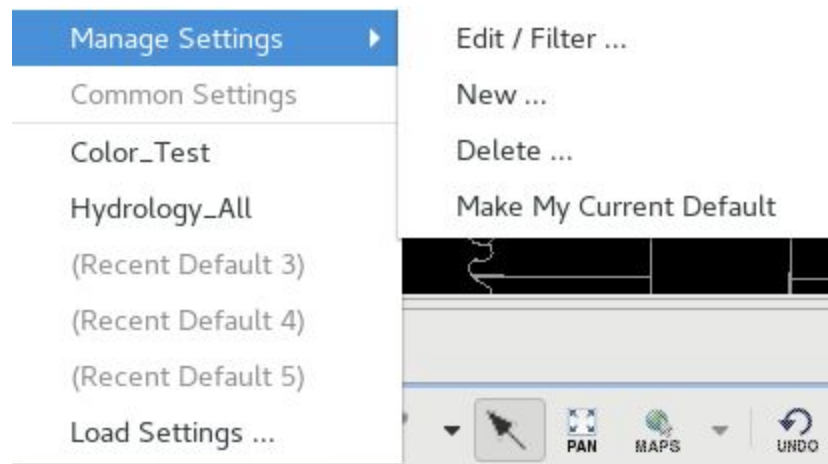


Event ID	Lock Status	Hazard Type	Status	Stream	Point ID	Start Time	End Time
<input type="checkbox"/> 52	U	Undefined	PENDING			17:23Z 12-Mar-18	01:09Z 13-Mar-18

Foremost among the parameters that make up a Setting are the filters used to determine which hazard events are visible when that Setting is in use. Filtering is possible by hazard type, by site identifier, and by event status. Console-specific parameters within a Setting include which columns are to be displayed in the Console table, and in which order; the timeline's starting visible time range's width (i.e. how many minutes/hours/days are visible at once along the timeline); and the list of tools that may be run via the Console toolbar's drop-down Tools menu. A newer item is Time Window, which filters visible events to a range of hours. Time Window has a default range of [-999, 999] relative to the CAVE clock time. The Time Window default values result in the display of hazards for all times with no limits. Switching to a Setting will also center the Spatial Display's map around a point and zoom to a certain level, if such is defined in the Setting.

5.1 Settings Menu

The Settings drop-down menu can be accessed from the Setup icon  on the Console toolbar and looks similar to this:



'Edit/Filter...' and 'New...' launch essentially similar Settings Dialogs (see next section). 'Delete...' allows you to delete USER-level settings - modified from BASE set or locally created. 'Make My Current Default' sets the current Setting as the one that will be used when you start Hazard Services in the future. This is remembered in a USER StartUpConfig.py.

A default Setting and any desired Common Settings are defined in your SITE StartUpConfig.py via Localization > Hazard Services > Startup Config. (Restart Hazard Services to see the changes.) Note also that you can include a desired Setting in a saved display configuration

(CAVE > Load/Save Displays > Save Editor Display... and Load Displays...).

The Load Settings... menu lists both user-created and BASE (preset) Settings. Selecting any of these (or from Common Settings or Recents) makes the specified Setting the current one, altering the hazard events visible (due to different Settings providing different filters), the visible columns and their order within the Console, etc. As Settings are opened, recently-used items will appear in the Recent Default section.

5.2 Settings Dialog

The Settings Dialog may be opened via the Setup > Manage Settings > 'Edit/Filter...' menu item. This dialog reflects the configuration of the currently loaded Setting, and is illustrated here. (The 'New...' dialog is the same except for a Create button instead of Save/Save As...)

Clicking 'Save' for a BASE file creates a USER version. 'Save As...' allows you to make a new USER version under a name of your choice. (Name must be alphanumeric, with underscores if desired.) For Save As..., you should type in a new Display Name first, which otherwise will result in a warning dialog noting that the Display Name will match the original (confusing!). You can also do a second Edit/Save to set it.

5.2.1 Hazards Filter Tab

The Hazards Filter tab provides a way to customize the hazard event filters that are in effect. Hazards may be filtered by categories and types, by site identifier, and by status. (More detail in [Section 3.1.2 Filters.](#))

Edit Default Setting: Hydrology_All

Name:

Display Name:

Category:

Hazards Filter | Console | Console Coloring | HID/Spatial | Recommenders | Maps/Overlays

Hazard Categories & Types: Hydrology

Site IDs: OAX

Status:

- potential
- proposed
- issued
- elapsing
- ending
- elapsed
- ended

5.2.2 Console Tab

The Console tab (below) allows you to click and move columns between the 'Available' and 'Visible' lists. Moving a column from 'Available' to 'Visible' inserts that column into the Console table. Moving a column the other direction removes it from said table. Columns may also be reordered within the 'Visible' list by selecting and using the up/down arrows on the right to move them above or below other columns.

The screenshot shows a dialog box titled "Edit Default Setting: Hydrology_All" with a close button (X) in the top right corner. The dialog is divided into several sections:

- Name:** Hydrology_All
- Display Name:** Hydrology - All
- Category:** Hydrology (dropdown menu)
- Navigation Tabs:** Hazards Filter, Console (selected), Console Coloring, HID/Spatial, Recommenders, Maps/Overlays
- Console Columns:**
 - Available Columns:** Phen, PILs, User Name, Issue Time, Location Name, Creation Time
 - Visible Columns:** Event ID, Lock Status, Hazard Type, Status, Stream, Point ID
 - Arrows between lists allow moving columns back and forth.
 - Up/down arrows on the right of the Visible list allow reordering.
 - Column Definitions** button is located below the lists.
- Console Sorting:**
 - Primary Sort:** Event ID (dropdown), Ascending (dropdown)
 - Secondary Sort:** Issue Time (dropdown), Ascending (dropdown)
- Console Times:**
 - Default Time Display Duration:** 48 (spin box)
 - Time Window:** Before Hours: -999, After Hours: 999 (spin boxes)
- Misc Options:**
 - Add new hazards to selected set
 - Display EventID Type:** FULL_ON_DIFF (dropdown)

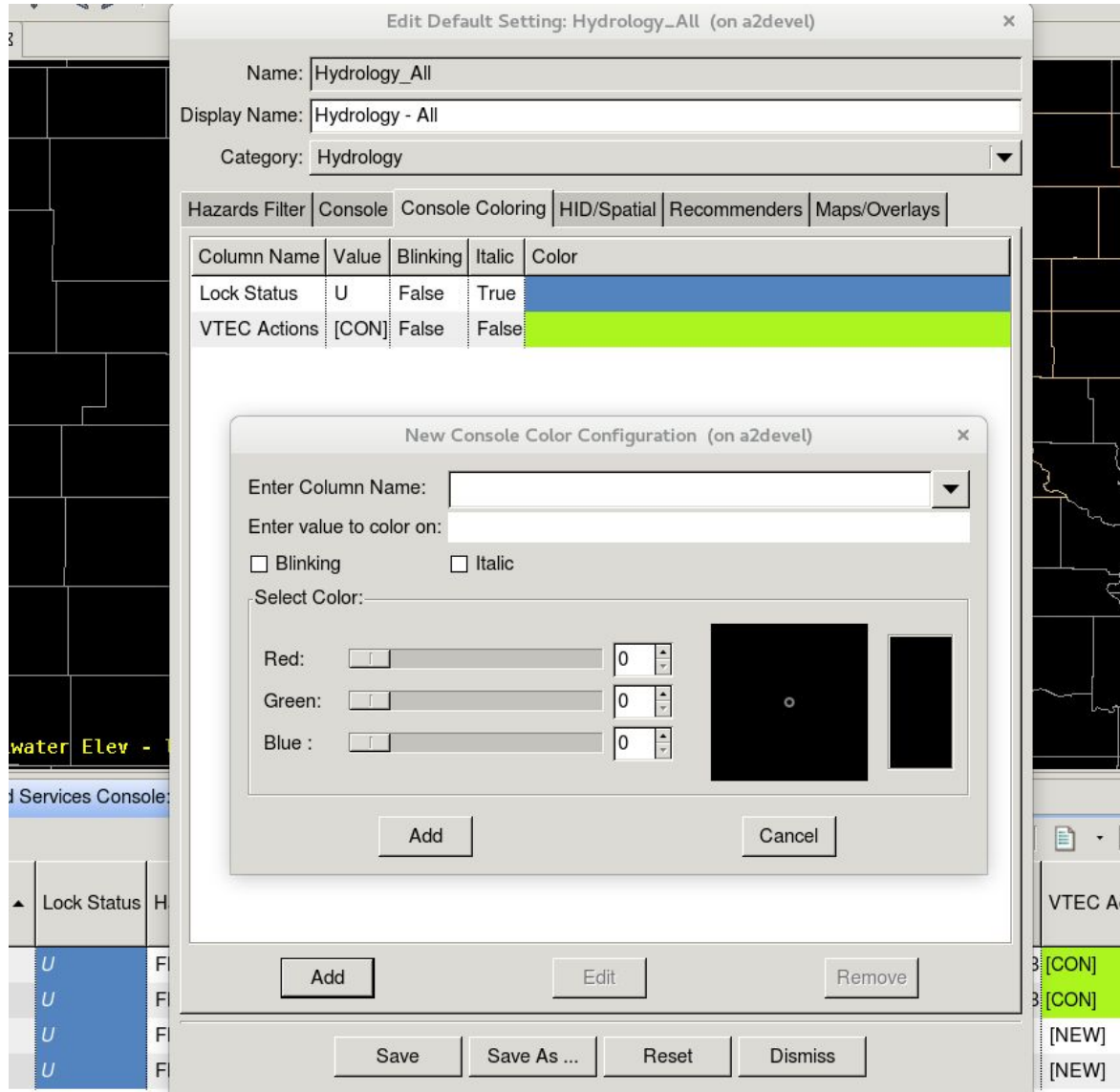
At the bottom of the dialog are four buttons: Save, Save As ..., Reset, and Dismiss.

Again, the Console tab's functionality is duplicated within the Console itself, since columns may be shown or hidden via context-sensitive pop-up menus ([Section 3.1.2 Filters](#)), and may be reordered by dragging them directly ([Section 3.3.1 Column Headers](#) - Non-Timeline Headers).

5.2.3 Console Coloring Tab

This tab provides a way to set color and other attributes for the Console columns. In the illustration here, a blue color with italic font has been applied to a Lock Status of U, and a green color to hazards with [CON] VTEC Actions. The user has opened the Add dialog to continue customizations.

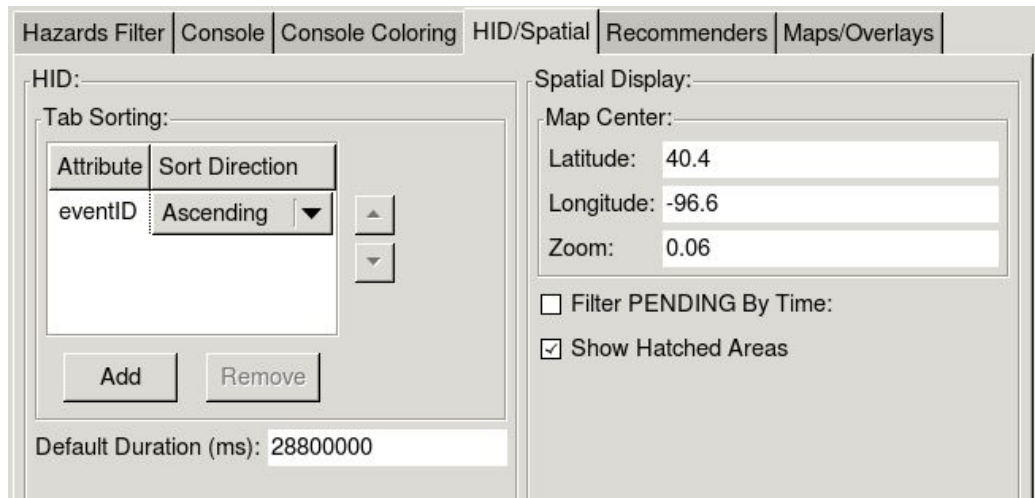
As with the Console tab, these actions take immediate effect, and may be saved in a Setting if desired.



5.2.4 HID/Spatial Tab

In the HID section on the left, you can set the sorting for tabs in the Hazard Information Dialog. The default is as shown; you can reorder or remove the defaults and add your own, as desired.

On the right side, Spatial Display, you can set the default map location and zoom associated with this Setting.



By default, Pending hazards are shown in the spatial display, since you're probably actively working on them. When toggled on, Filter PENDING By Time will suppress display of such hazards if their time range does not intersect the Selected Time.

Visibility of area hatching is toggled in the [View Menu](#), but you can set the default to Off by unchecking it here and Saving the Setting. A global "no hatching" option is not available at present.

5.2.5 Recommenders Tab

The Recommenders tab allows you to select which recommenders will appear in the Tools drop-down menu



5.2.6 Maps/Overlays Tab

A list of basemaps is presented. You can select one or more to be loaded into the display when the Setting is recalled.

6.0 Alerts

You can be alerted at configured times before the expiration of a hazard event. The expiration time is defined to be the earliest expiration time of the products generated by the event. Currently, two manifestations are supported. One is a countdown timer of time remaining before expiration located in the Console Hazard Event Table. As soon as the event is issued, a black text version of the countdown timer will appear. Then, when the configured expiration times are reached, the color and other text characteristics change accordingly. The units of the timer vary. If the time remaining is more than one day, the timer is expressed in day intervals such as 1-2 days, 2-3 days, etc. If the time remaining is between one day and one hour then the units are hours and minutes. If the time remaining is between one hour and one minute then the unit is minutes. If the time remaining is less than a minute then the unit is seconds. As with any other column in the table, the Time to Expiration column can be visible or not and the table sorted upon it. By default, the column is invisible if there are no active alerts.

The breakpoint times and associated colors are specified in Localization > Hazard Services > Alerts > HazardAlertsConfig.py. As you can see there, units can be either time (hours or minutes) or percent of hazard time span completed. You can customize this with an override.

The other manifestation is a message appearing in an AlertViz pop-up, which will happen at the appropriate configured time to expiration.

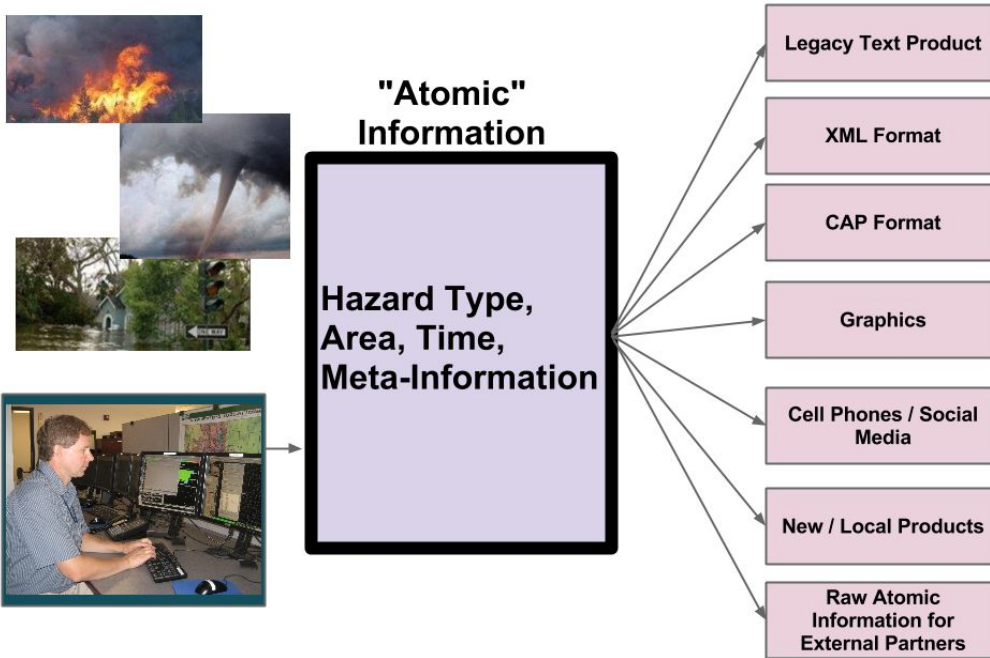
7.0 Hazard Life Cycle

The Hazard Life Cycle is the process that you follow to describe and communicate hazard events from beginning to end. The process followed in Hazard Services differs from that for legacy applications. First, the process has been unified and standardized across applications to be similar for all hazard situations. In addition, the process has moved a degree from being product centric to being more 'information centric.' As the National Weather Service adds more decision support to its operations, products will become diverse and increasingly tailored to customer needs. Meeting these needs calls for a new paradigm of storing the basic hazard information from which many products, including legacy, can be derived.

7.1 Transition from Product Centric toward Information Centric

The following picture and table serve to show the key differences between product-centric and information-centric approaches. Note that current Hazard Services is not 100% Information Centric. For example, in Hazard Services you'll edit products being disseminated for quality control.

From Product-Centric to Information-Centric



100% Product Centric	100% Information Centric
<p>One way to disseminate information: Legacy text product</p>	<p>Many ways to disseminate information: Legacy text product, XML format, CAP format, graphics, cell phones / social media, local products, raw information</p>
<p>Focus on the Product Life Cycle Forecaster actions are directly related to the product</p>	<p>Focus on Hazard Life Cycle Forecaster actions are directly related to the meteorology of the hazard situation</p>
<p>How has the hazard situation changed from the last time a product was generated? The forecaster guides the system as to the product life cycle e.g. New, Follow-up, Continue, Expire, Cancel</p>	<p>What is the hazard situation NOW? The forecaster focuses on expressing the current hazard situation and how it has evolved. The system compares to the previous situation and automatically tracks the product life cycle.</p>
<p>Workflow is directly related to product policy</p>	<p>Workflow is independent of product policy</p>

<p>Products are the information stored.</p> <p>VTEC records are the central data structure or object.</p>	<p>Hazard type, area, time, metadata are stored.</p> <p>Hazard Events are the central data structure or object.</p>
<p>One way communication from forecasters to partners / public</p>	<p>Two way communication between forecasters and partners / public</p>

Note that for Hazard Services, VTEC records must be stored in order to produce legacy products, so we might say that it is not 100% information-centric.

The table below compares the forecast process in the legacy applications and Hazard Services. While similar, there are variations and we can roughly say that they are on different points of the product- to information-centric spectrum. However, please note that the forecaster using Hazard Services is still aware of and working with the legacy products.

RiverPro	WarnGen	GHG	Hazard Services
<p>Create:</p> <ul style="list-style-type: none"> - Examine hydrograph in TimeSeries/validate observed hydro data and forecast - Run RiverPro and choose recommended products - Create products - Make any needed edits and Send 	<p>Create:</p> <ul style="list-style-type: none"> - Track weather feature and then initialize threat area using that location and motion - Choose duration, justification, threat intensity, and CTAs products - Choose Create Text to send scratch product to text editor - Make any needed edits and Send 	<p>Create:</p> <ul style="list-style-type: none"> - MakeHazard procedure to select area, hazard type, time, and create Hazard Grid - Formatter Launcher to run, enter metadata, edit, and issue product 	<p>Create:</p> <ul style="list-style-type: none"> - Specify Hazard area, time, type, and metadata - Optionally select Propose - Select Preview... - Make any needed edits and Issue
<p>Continuing:</p> <ul style="list-style-type: none"> - Examine hydrograph in TimeSeries/validate observed hydro data and forecast 	<p>Continuing:</p> <ul style="list-style-type: none"> - Choose the event to continue from the follow up action list (geographical selection available) 	<p>Continuing:</p> <ul style="list-style-type: none"> - MakeHazard procedure to select area, hazard type, time, and create Hazard Grid 	<p>Continuing:</p> <ul style="list-style-type: none"> - Specify changed Hazard area, time, type, and metadata

<ul style="list-style-type: none"> - Run RiverPro and select recommended follow-up products - Create products - Make any needed edits and Send 	<ul style="list-style-type: none"> - Make any desired adjustments to justification, threat intensity, and CTAs - Choose Create Text to send scratch product to text editor - Make any needed edits and Send 	<ul style="list-style-type: none"> - Formatter Launcher to run, enter metadata, edit, and issue product 	<ul style="list-style-type: none"> - Optionally select Propose - Select Preview... - Make any needed edits and Issue
<p>Cancel:</p> <ul style="list-style-type: none"> - Examine hydrograph in TimeSeries/validate observed hydro data and forecast - If RiverPro doesn't recommend a cancellation, force CAN in VTEC settings - Create products - Make any needed edits and Send 	<p>Cancel:</p> <ul style="list-style-type: none"> - Choose the event to cancel from the follow up action list (geographical selection available) - Choose Create Text to send scratch product to text editor - Make any needed edits and Send 	<p>Cancel:</p> <ul style="list-style-type: none"> - Remove Hazard Grid - Formatter Launcher to run, enter metadata, edit and issue product 	<p>Ending:</p> <ul style="list-style-type: none"> - MB3 'End <i>n</i> Selected Issued' - Product appears; can select or write Ending Synopsis - Issue
<ul style="list-style-type: none"> - Metadata entered through templates and by directly editing the product itself - RiverPro attempts to automatically set VTEC, but this can be overridden by the user 	<ul style="list-style-type: none"> - Metadata entered through templates and by directly editing the product itself - VTEC automatically determined 	<ul style="list-style-type: none"> - Metadata entered through product dialogs or in product itself - VTEC automatically set and locked 	<ul style="list-style-type: none"> - Metadata specified independently of products as part of Hazard information - VTEC automatically computed and locked

7.2 Examples of Creating, Continuing, and Ending Hazards in an information centric paradigm and understanding the translation into products.

7.2.1 The [Simple Hazard Story](#) and [Mixed Hazard Story](#) both follow the Hazard Services process and illustrate how you work through the hazard life cycle by adjusting the Hazard information and letting the system generate the legacy products and compute the resulting VTEC automatically.

7.2.2 Hazard Events and VTEC Records

Hazard Events are the central data structure or object in Hazard Services. This includes the hazard type, start time, end time, polygon, and meta information such as calls to action and basis.

VTEC records store the information for legacy products which have been issued from Hazard Events. They are stored per UGC area per hazard type and are used for comparison in calculating VTEC segments for NEW, CON, EXA, EXT, etc. Note that in contrast, a Hazard Event can represent multiple UGC areas and there is not a 1-1 correspondence between them.

7.2.3 Changing Hazard Time and Area

In the Hazard Types Table, hazards are denoted as to whether they can be extended in time or area. If extension is allowed, then when you change the time or area of an issued hazard, the same hazard is retained. When products are generated, the VTEC utilities automatically compute the appropriate EXA, EXT, or EXB codes. Note that changing the hazard area does not necessarily result in an EXA. For example, the polygon might change, but if the corresponding UGC codes remain the same, a CON VTEC code will result instead of an EXA.

If extension in time or area is not allowed, then a new hazard event automatically appears in the Hazard Services display.

As an exercise, try changing the area of an FF.A hazard that has been issued. Since extension in area is allowed, the same Hazard Event and eventID will be retained. Next, try changing the area of an FA.W which has been issued. Since extension in area is not allowed, a new FA.W hazard event will appear. Its area can then be adjusted independently from the original before issuing.


8.0 Service Backup

8.1 File / Database Syncing

- Syncing allows the system to request files from another site to keep in sync with backup sites' files. If automated, then it would be done once a day. Otherwise, sites will want to do this manually on a regular basis. Items that need to be synced are all overridable Hazard Services localization files e.g. Recommenders, Product Generation, Utilities, Metadata, Hazard Types, Hazard Categories, Settings, etc.
- Syncing also requires a "hot" backup of the IHFS database. This is done manually:

- Manually copy static database information (*Can this be done automatically?*)
- Set up ingest for dynamic database information so that there is a “hot” backup

8.2 Running Hazard Services as a Backup Site

- From the View Menu () at the right end of the Console, select Change Site > <backup site ID>

8.3 Interoperability and Service Backup

In order for Interoperability to work properly, the following must be done:

- When Hazard Services is set to a backup site, the user must go into backup mode for legacy applications for which corresponding Hazard Services hazards will be generated. For example, if a Hazard Services Flash Flood Warning will be generated, then WarnGen will also have to be in backup mode.
- By the same token, when any legacy application is put into backup mode, Hazard Services needs to be set to backup mode. (In A-II each perspective must set its own backup mode.)

Note: Active Table Sharing will be invoked when applications go into Service Backup

Requirement for future development: Automate going into backup mode for all applications so that they will be automatically synchronized.

Appendices

Appendix 1: [User Stories - Functional Tests](#)

Appendix 2: [Glossary](#)

Appendix 3: Acronyms and Abbreviations

AWIPS I	Advanced Weather Interactive Processing System, Version 1
AWIPS II	Advanced Weather Interactive Processing System, Version 2
CAP	Common Alerting Protocol
CAVE	Common AWIPS Visualization Environment
D2D	Display Two Dimensions
EAP	Emergency Action Plan
EXA	Extend in Area
EXB	Extend in Area and Time (Extend Both)
EXT	Extend in Time
FFW	Flash Flood Warning
GFE	Graphical Forecast Editor
GUI	Graphical User Interface
HID	Hazard Information Dialog

HMI	Human Machine Interface
H-VTEC	Hydro Valid Time Event Code
MPE	Multi-sensor Precipitation Estimator
VTEC	Valid Time Event Code
XML	Extensible Markup Language