



# **Users Guide for the Anvil Threat Corridor Forecast Tool V1.7.0 for AWIPS**

William H. Bauman III Applied Meteorology Unit Kennedy Space Center, Florida



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#### 1. Background

The Applied Meteorology Unit (AMU) originally developed the Anvil Threat Sector Tool for the Meteorological Interactive Data Display System (MIDDS) and delivered the capability in three phases beginning with a feasibility study in 2000 and delivering the operational final product in December 2003. This tool is currently used operationally by the 45th Weather Squadron (45 WS) Launch Weather Officers (LWO) and Spaceflight Meteorology Group (SMG) forecasters. Phase I of the task established the technical feasibility of developing an objective, observations-based tool for short-range anvil forecasting. The AMU was subsequently tasked to develop short-term anvil forecasting tools to improve predictions of the threat of triggered lightning to space launch and landing vehicles. Under the Phase II effort, the AMU developed a nowcasting anvil threat sector tool, which provided the user with a threat sector based on the most current radiosonde upper wind data from a co-located or upstream station. The Phase II Anvil Threat Sector Tool computes the average wind speed and direction in the layer between 300 and 150 mb from the latest radiosonde for a user-designated station. The following threat sector properties are consistent with the propagation and lifetime characteristics of thunderstorm anvil clouds observed over Florida and its coastal waters (Short et al. 2002):

- 20 n mi standoff circle,
- 30 degree sector width,
- Orientation given by 300 to 150 mb average wind direction,
- 1-, 2-, and 3- hour arcs in upwind direction, and
- Arc distances given by 300 to 150 mb average wind speed.

Figure 1 is an example of the MIDDS Anvil Threat Sector tool overlaid on a visible satellite image at 2132 UTC 13 May 2001. Space Launch Complex 39A was selected as the center point and the Anvil Threat Sector was determined from upper-level wind data at 1500 UTC in the preconvective environment. Narrow thunderstorm anvil clouds extend from central Florida to the space launch and landing facilities at the Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS) and beyond. The anvil clouds were generated around 1930 UTC (1430 EDT) by thunderstorm activity over central Florida and transported 90 n mi east-northeastward within 2 hours, as diagnosed by the anvil forecast tool.

Phase III, delivered in February 2003, built upon the results of Phase II by enhancing the Anvil Threat Sector Tool with the capability to use national model forecast winds for depiction of potential anvil lengths and orientations over the KSC/CCAFS area with lead times from 3 through 168 hours (7 days). In September 2003, AMU customers requested the capability to use data from the KSC 50 MHz Doppler Radar Wind Profiler (DRWP) in the Anvil Threat Sector Tool and this capability was delivered by the AMU in December 2003.

In March 2005, the AMU was tasked to migrate the MIDDS Anvil Threat Sector Tool capabilities onto the Advanced Weather Interactive Processing System (AWIPS) as the Anvil Threat Corridor Forecast Tool.



Figure 1. Example of the Phase II anvil forecast graphic overlaid on a visible satellite image of the Florida peninsula displayed in MIDDS. The Anvil Threat Sector was computed from radiosonde data observed at XMR at 1500 UTC (1100 EDT) 13 May 2001. Thunderstorms that formed within the graphical threat sector produced anvil clouds that moved over the KSC/CCAFS area.

#### 2. Operating the Anvil Threat Corridor Forecast Tool in AWIPS

The instructions in this section provide the user with a step-by-step guide to activate the Anvil Threat Corridor Forecast Tool (hereafter called "Anvil Tool") and display the resulting graphics in the AWIPS primary display window. This User's Guide assumes the user has been trained in the use of AWIPS.

#### 2.1. Starting the Anvil Tool Graphical User Interface (GUI)

To access the Anvil Tool GUI, click the **Tools** dropdown menu from the AWIPS Main Menu and select **Anvil Tool...** (Figure 2).



Figure 2. Illustration showing selection of the Tools dropdown menu from the AWIPS Main Menu and location of the Anvil Tool GUI menu item.

The default selection for the map refresh is "**ON**". When the user creates an Anvil Tool map with **Refresh Map** "**ON**", the plot is automatically displayed in the AWIPS frame. If another Anvil Tool map is already displayed and the user does not change the existing map number shown at the bottom of the GUI, the new Anvil Tool map will overwrite the old one. If the user turns the **Refresh Map** "**OFF**", the calculation for the Anvil Tool map will be made following the instructions in this guide but the Anvil Tool map will not displayed. The user can still display the previously calculated Anvil Tool map through the **Maps** dropdown menu\* as shown in Figure 4.

\*NOTE: SMG has placed the Anvil Tool maps under the Tools dropdown menu just below the Anvil Tool.

Anvil Threat Corridor ve	ersion 1.7.0	
Data Type: 🔶 RAOB \prec	Models 💊 50MHz Refresh M	lap: 🔶 ON 😞 OFF 🛛 Profiler Type: 🔶 RSA 🥪 MADIS
Show Label At Circle:	: 🔶 Yes 💊 No	Show Label On Frame: 🔶 Yes 🕹 No
Label Distance From Cer	nter: 🔶 50 🕹 100 🥪 200 🛛 La	bel Direction From Center: 🔶 NE 😞 SE 😞 SW 😞 NW
Circle Label Position: 🔶	Top 🕹 Middle 🧅 Bottom	Frame Label Position: 🔶 Top 💸 Middle 💸 Bottom
Date-Time	Site	Station
20070307_1200 20070307_0000 20070306_1200 20070306_0000 20070305_1200	Station:	
Make	RAOB: 🔶 MAP 1 💠 MAP 2	♦ MAP 3 Dismiss

Figure 3. Anvil Tool GUI as it is first displayed after the user has selected Anvil Tool... from the Tools dropdown menu.

The 50 MHz profiler data are delivered to the 45 WS and AMU AWIPS via the Range Standardization and Automation (RSA) program while SMG receives the data via the Meteorological Assimilation Data Ingest System (MADIS). Users at the 45 WS should select the **Profiler Type "RSA**" while SMG should select the **Profiler Type "MADIS**".





The labels can be placed near the center circle of the plot and/or at a specified distance and direction from the center of the circle (Site). Figure 5 shows the GUI after the user has decided to display the label only at the circle and not on the frame. When the user selects "No" next to Show Label On Frame, the other options associated with displaying the label on the frame are automatically grayed-out. If the user creates plots with the label at the circle, they have the option of placing the label at the top, middle or bottom relative to the circle. This is done so the labels do not overwrite each other for up to three plots of the Anvil Tool as shown in Figure 6.

Anvil Threat Corridor v	ersion 1.7.0	
Data Type: 🔶 RAOB 🧹	> Models 🕹 50MHz Refres	h Map: 🔶 ON 👳 OFF 🛛 Profiler Type: 🔶 RSA 👳 MADIS
Show Label At Circle	: 🔶 Yes 🕹 No	Show Label On Frame: 💸 Yes 🔶 No
Label Distance From Ce	nter: 🔶 50 💠 100 🕹 200	Label Direction From Center: $\blacklozenge$ NE $\checkmark$ SE $\checkmark$ SW $\diamondsuit$ NW
Circle Label Position: ♦	Top 💠 Middle 🧇 Bottom	Frame Label Position: 🔶 Top 💊 Middle 🕹 Bottom
Date-Time 20070313_1200 20070313_0000 20070312_1200 20070312_0000 20070311_1200	Site	Station
	Station:	
Make	RAOB: 🔶 MAP 1 👳 MAP	2 💠 MAP 3 Dismiss

Figure 5. Anvil Tool GUI after the user has selected not to display the label on the frame.



Figure 6. Three Anvil Tool corridors with the data labels plotted at the center circle. The labels are plotted at the top, middle and bottom based on the GUI selection so they do not overwrite each other. The colors of each label correspond to the color of the Anvil Tool plot.

The user can also choose to plot the labels elsewhere in the frame of the image but away from the center circle. Figure 7 shows the GUI after the user has decided to display the label elsewhere on the frame and not at the center circle. When the user selects "No" next to Show Label At Circle, the other options for the circle label position are automatically grayed-out. The user now has the option to display the label at distances of 50, 100 or 200 miles from the center of the circle (Site) and to the northeast, southeast, southwest or northwest of the center of the circle (Site) (these options are also available when Show Label at Circle is "Yes" and Show Label on Frame is "Yes".). Figure 8 shows the same plot as in Figure 6 but with the three labels plotted 50 miles to the northeast of the circle. The user also has the option to plot the labels at the top, middle or bottom. This is useful if the labels are all plotted at the same distance and direction from the center of the circle so they do not overwrite each other.

Anvil Threat Corridor version 1.7.0	_ 0 >
Data Type: 🔶 RAOB 😞 Models 😞 50MHz 🛛 Refres	h Map: 🔶 ON 👽 OFF 🛛 Profiler Type: 🔶 RSA 👽 MADIS
Show Label At Circle: 👽 Yes 🔶 No	Show Label On Frame: 🔶 Yes 💸 No
Label Distance From Center: $\blacklozenge$ 50 $\checkmark$ 100 $\checkmark$ 200	Label Direction From Center: $\blacklozenge$ NE $\bigcirc$ SE $\diamondsuit$ SW $\diamondsuit$ NW
Circle Label Position: 🔶 Top 🥪 Middle 🐳 Bottom	Frame Label Position: 🔶 Top 🕹 Middle 🕹 Bottom
Date-Time         Site           20070313_1200         A           20070313_0000         A           20070312_1200         A           20070312_0000         A           20070311_1200         A           Station:         Station:	Station
Make RAOB:  MAP1  MAP	2 🗢 MAP 3 Dismiss

Figure 7. Anvil Tool GUI after the user has selected not to display the label at the circle.



Figure 8. As in Figure 6 but the data labels are now plotted in the frame and away from the center circle. The labels are plotted at the top, middle and bottom based on the GUI selection so they do not overwrite each other. The colors of each label correspond to the color of the Anvil Tool plot.

## 2.2. Displaying RAOB data with the Anvil Tool GUI

Once the Anvil Tool GUI is displayed, the user selects the **Data Type** which can be **RAOB**, **Models** or **50 MHz** representing worldwide radiosonde data, numerical weather prediction data or 50 MHz DRWP data from the KSC profiler. In Figure 9, the default, **RAOB**, has been selected and the user has selected a **Date-Time**. Once the **Date-Time** has been selected, the GUI displays a list of sites (**Site**) and a list of stations (**Station**). It is not required that the user select a **Site**, but the user must select a **Station**. If the user does not select a **Site**, the Anvil Tool graphic will be centered at the location of the data source (**Station**). The user can select a **Station** by using the vertical scroll bar associated with the **Station** column or type the station identifier in the space provided under the **Station** column.

Anvil Threat Corrido	or version 1.7.0	
Data Type: 🔶 RAOB	B 💠 Models 💠 50MHz	Refresh Map: 🔶 ON 👽 OFF 🛛 Profiler Type: 🔶 RSA 👽 MADIS
Show Label At Circ	rcle: 🔶 Yes 🕹 No	Show Label On Frame: 🔶 Yes 🞺 No
Label Distance From	Center: 🔶 50 🕹 100 🕹	200 Label Direction From Center: $\blacklozenge$ NE $\bigcirc$ SE $\bigcirc$ SW $\bigcirc$ NW
Circle Label Position:	🔶 Top 🕹 Middle 🕹 Bo	ttom Frame Label Position: 🔶 Top 🗸 Middle 🗸 Bottom
Date-Time	Site	Station
20070307_1200 20070307_0000 20070306_1200 20070306_0000 20070305_1200	Station SLF CX39 CX39A V CX39B	△         KTBW 72210         △           ↓         KMAF 72265         △           ₽ТКК 91334         ₽АУА 70361         ✓           ✓         KJAX 72206         ✓
		Station:
Make	RAOB: 🔶 MAP 1 🧹	MAP 2 V MAP 3 Dismiss

Figure 9. Anvil Tool GUI after a user has selected RAOB as the Data Type and a Date-Time of 20070307\_1200 (3 March 2007, 1200 UTC) which is now highlighted in red.

If the user selects a **Site**, as in Figure 10, the Anvil Tool graphic will be centered on that location and the **Station** will be automatically highlighted in the **Station** column if data from the **Date-Time** selected is available in AWIPS. In Figure 10, the **Site** chosen was **SLF** and the GUI automatically highlighted **KXMR 74794** as the **Station** but the user must still click on the **Station** they want to use. The GUI is designed to not automatically select the **Station** but instead it picks and highlights the **Station** closest to the **Site** chosen. The user still has the option to chose a different **Station** if they desire.

When the user clicks on the **Station** (in this example **KXMR 74794**), the anvil threat sector calculation is done and the data from that **Station** is displayed in the GUI as shown in Figure 11 (for this example, expanded to the full extent of the vertical scroll bar).

Anvil Threat Corridor	r version 1.7.0	
Data Type: 🔶 RAOB	♦ Models ♦ 50MHz Re	efresh Map: 🔶 ON 🕹 OFF 🛛 Profiler Type: 🔶 RSA 🥪 MADIS
Show Label At Circ	cle: 🔶 Yes 🕹 No	Show Label On Frame: 🔶 Yes 🕹 No
Label Distance From (	Center: 🔶 50 🗸 100 🗸 2	200 Label Direction From Center: 🔶 NE 🗸 SE 🗸 SW 🗸 NW
Circle Label Position:	🔶 Top 👴 Middle 💊 Bott	om Frame Label Position: 🔶 Top 😞 Middle 😞 Botton
Date-Time	Site	Station
20070307_1200 20070307_0000 20070306_1200 20070306_0000 20070305_1200	Station SLF CX39 CX39A CX39B	CYVQ 71043 PKWA 91366 KXMR 74794 RJAM 47991 RJCW 47401
Make	RAOB: 🔶 MAP 1 😞	MAP 2 🕹 MAP 3 Dismiss

Figure 10. Anvil Tool GUI after the user has selected SLF as the Site which is now highlighted in red.

Anvil Threat Corridor version 1.7.0	
Data Type: 🔶 RAOB 💊 Models 🕹 50MHz Refresh	Map: 🔶 ON 👳 OFF 🛛 Profiler Type: 🔶 RSA 👽 MADIS
Show Label At Circle: 🔶 Yes 🕹 No	Show Label On Frame: 🔶 Yes 🕹 No
Label Distance From Center: $\blacklozenge$ 50 $\checkmark$ 100 $\checkmark$ 200 Li	abel Direction From Center: $ullet$ NE $\bigtriangledown$ SE $\diamondsuit$ SW $\diamondsuit$ NW
Circle Label Position: ♦ Top 🗸 Middle 🗸 Bottom	Frame Label Position: 🔶 Top 🛇 Middle 🛇 Bottom
Date-Time Site	Station
20070307_1200	CYVQ 71043
20070307_0000 - SLF	PKWA 91366
20070306_1200 CX39	RIAM 47991
20070305_1200 7 CX39B	RJCW 47401
Stat	ion: 74794
*** BEGIN NEW RAOB CALCULATION ***	
File Date-Time = 20070307 1200 Time of observation = 12:00 GMT Station Name: KXMR 74794 Station Lat: 28.48 Station Lon: -80.57 Site = SLF Mandatory Levels: pressure(mb): 300 wd: 285 ws: 63.0 Knots pressure(mb): 250 wd: 265 ws: 82.0 Knots pressure(mb): 200 wd: 270 ws: 84.0 Knots pressure(mb): 150 wd: 280 ws: 84.9 Knots	
Significant Levels: height(m): 9000 wd: 280 ws: 63.0 Knots height(m): 10500 wd: 265 ws: 80.9 Knots height(m): 11400 wd: 270 ws: 84.9 Knots height(m): 13500 wd: 285 ws: 84.0 Knots	
Total Levels: 8 U Average: 77.4 Knots V Average: -6.2 Knots	
Average Wind Speed: 77.6 Knots Wind Direction: 274.6	
*** END OF CALCULATION***	
Make RAOB:  MAP 1  MAP 2	V MAP 3 Dismiss

Figure 11. Anvil Tool GUI after the user has selected KXMR 74794 as the Station.

To create the Anvil Tool graphic for display in AWIPS, the user must click the button labeled "Make" (Make" (Make"). The text area in the GUI will display the name of the Site as the mid point of the graphic as well as the latitude and longitude of the Site as shown in Figure 12. In this example the user chose the SLF for the Site which is what is now displayed at the bottom of the GUI in Figure 12. The Anvil Tool graphic is now displayed in AWIPS as shown in Figure 13. The user can now click Dismiss in the Anvil Tool GUI or leave the GUI open to plot other Anvil Tool graphics.

Anvil Threat Corridor vers	ion 1.7.0	
Data Type: 🔶 RAOB 👳	Models 🕹 50MHz Re	efresh Map: 🔶 ON 🕹 OFF 🛛 Profiler Type: 🔶 RSA 🤣 MADIS
Show Label At Circle:	🔶 Yes 🤯 No	Show Label On Frame: 🔶 Yes 🕹 No
Label Distance From Cente	er: 🔶 50 💠 100 🕹 20	200 Label Direction From Center: $\blacklozenge$ NE $\checkmark$ SE $\rightsquigarrow$ SW $\rightsquigarrow$ NW
Circle Label Position: 🔶 1	Fop 🔷 Middle 🕹 Botte	om 🛛 Frame Label Position: 🔶 Top 🕹 Middle 🕹 Bottom
Date-Time	Site	Station
20070307_1200	Station	CYVQ 71043
20070307_0000	SLF	PKWA 91366
20070306_1200	00394	RXMR 74794
20070305 1200	/ CX39B	7 RJCW 47401
-		Station: 74794
*** BEGIN NEW RAOB CALC	CULATION ***	
Time of observation = 1 Station Name: KDMR 7479 Station Lat: 28.48 Station Lon: -80.57 Site = SLF Mandatory Levels: pressure(mb): 300 wd: pressure(mb): 250 wd: pressure(mb): 150 wd: Significant Levels: height(m): 9000 wd: 28 height(m): 10500 wd: 2 height(m): 11400 wd: 2 height(m): 13500 wd: 2 Total Levels: 8 U Average: 77.4 Knots V Average: -6.2 Knots	2:00 GMT 4 285 ws: 63.0 Knots 265 ws: 82.0 Knots 270 ws: 84.0 Knots 280 ws: 84.9 Knots 80 ws: 63.0 Knots 265 ws: 80.9 Knots 270 ws: 84.9 Knots 285 ws: 84.0 Knots	
Average Wind Speed: 77. Wind Direction: 274.6	6 Knots	
*** END OF CALCULATION*	***	
Creating map overlay Circle Label Position = Mid point of plot: SLF Lat:28.617 Lon:-80.683	= Top, Frame Label Po	osition = Top
Finished creating MAP 1		
Make	RAOB: 🔶 MAP 1 🕹	MAP 2 V MAP 3 Dismiss

Figure 12. Anvil Tool GUI after the user has clicked on the Make button. The GUI now displays the midpoint of the Site where the graphic will be plotted on the AWIPS.





Users can change the color, line type, line thickness, text magnification, etc. using the standard procedures available in AWIPS to customize the look of the Anvil Tool graphic. Figure 14 shows the same view as in Figure 13 but the color of the Anvil Tool graphic was changed to red and the line thickness increased to make the tool more visible on the mostly black background of the satellite image.



Figure 14. As in Figure 8 but the color of the Anvil Tool graphic was changed to red and the line thickness increased.

## 2.3. Displaying 50 MHz data with the Anvil Tool GUI

Processing data from the 50 MHz profiler in the Anvil Tool GUI is similar to processing the RAOB data except the data is only available from one **Station** – the 50 MHz profiler at KSC. In Figure 15, **50MHz** has been selected as the **Data Type** and the available **Date-Time** of the 50 MHz data is displayed. Once the **Date-Time** has been selected, the GUI displays a list of sites under **Site** and displays times of the profiler data under **Station** that are closest to the previously selected **Date-Time** (now highlighted in red) as shown in Figure 16. The user will select a **Site** where they want the Anvil Tool graphic to be centered when displayed in AWIPS. As shown in Figure 17, the **Site** chosen was **SLF**. The user must still click on a time in the **Station** column. When the user clicks on the time (in this example **12:00 GMT**), the data from the profile at that time is displayed in the GUI as shown in Figure 18.

For SMG, before choosing 50MHz, SMG must select MADIS. Otherwise an error box displays that says **Error: no files matched glob pattern** "\*\_\*".

Anvil Threat Corridor ve	rsion 1.7.0		_
Data Type: 💊 RAOB 🗸	Models 🔶 50MHz 🛛 Refresh I	Map: 🔶 ON 😞 OFF 🛛 Profile	r Type: 🔶 RSA 🕹 MADIS
Show Label At Circle:	🕹 Yes 🔶 No	Show Label O	n Frame: 🔶 Yes 🕹 No
Label Distance From Cen	iter: 🔶 50 💠 100 🕹 200 🛛 La	abel Direction From Center: 🗸	NE 🔶 SE 🕹 SW 🕹 NW
Circle Label Position: ♦	Top 💊 Middle 💠 Bottom	Frame Label Position: 🔶	Top 🕹 Middle 🥪 Bottom
Date-Time	Site	Station	
20070222_2000 20070222_1930 20070222_1900 20070222_1830 20070222_1800			
	Station:		
Make	50MHz 🔶 MAP 1 🕹 MAP 2	◇ MAP 3	Dismiss

Figure 15. Anvil Tool GUI after the user has selected Anvil Tool... from the AWIPS Tools dropdown menu and selected 50MHz as the Data Type.

Anvil Threat Corridor	r version 1.7.0		
Data Type: 🤝 RAOB	🗸 🗸 Models 🔶 50MHz	Refresh Map: 🔶 ON 😞 OFF 🛛 Profiler Ty	rpe: 🔶 RSA 🕹 MADIS
Show Label At Circ	cle: 💊 Yes 🔶 No	Show Label On Fr	ame: 🔶 Yes 🕹 No
Label Distance From (	Center: 🔶 50 😞 100 😞	200 Label Direction From Center: V	🔶 SE 🕹 SW 🧅 NW
Circle Label Position:	🔶 Top 👽 Middle 👽 Bo	ttom Frame Label Position: 🔶 Top	🗸 Middle 🗸 Bottom
Date-Time	Site	Station	
20070222_1330 20070222_1300 20070222_1230 20070222_1200 20070222_1130	△     Station       SLF     CX39       CX39A     CX39A       ✓     CX39B	11:45 GMT 12:00 GMT	
		Station:	
Make	50MHz 🔶 MAP 1 🗸	> MAP 2 💊 MAP 3	Dismiss

Figure 16. Anvil Tool GUI after a user has selected a Date-Time of 20070222\_1200 (22 February 2007, 1200 UTC) which is now highlighted in red.



Figure 17. Anvil Tool GUI after the user has selected SLF as the Site.

Show Label At Circle: 🧹	Yes 🔶 No	Show Label On Fram	ne: 🔶 Yes 💸 No
abel Distance From Center:	🔶 50 😞 100 😞 200 🛛 Lat	oel Direction From Center: 💸 NE ┥	SE 🕹 SW 🕹 N
Circle Label Position: 🔶 Top	🕹 Middle 🥪 Bottom	Frame Label Position: 🔶 Top 🧹	> Middle 🕹 Bottor
Date-Time	Site	Station	
20070222_1330     \(\lambda\)       20070222_1300     \(\alpha\)       20070222_1230     \(\alpha\)       20070222_1200     \(\alpha\)       20070222_1130     \(\frac{1}{2}\)	Station A SLF CK39 CK39A CK39B	11:45 GMT 12:00 GMT	
	Station:	74794	T
** BEGIN NEW PROFILER CA	LCULATION ***		ſ
<pre>ime = 12:00 GMT ite = SLF ignificant Levels: eight(m): 9041 wd: 298 eight(m): 9186 wd: 297 eight(m): 9331 wd: 294 eight(m): 9331 wd: 292 eight(m): 9766 wd: 292 eight(m): 9766 wd: 292 eight(m): 10055 wd: 291 eight(m): 10055 wd: 292 eight(m): 10055 wd: 292 eight(m): 10020 wd: 285 eight(m): 10490 wd: 285 eight(m): 10490 wd: 285 eight(m): 10780 wd: 290 eight(m): 10780 wd: 292 eight(m): 11070 wd: 295 eight(m): 11070 wd: 295 eight(m): 11070 wd: 295 eight(m): 11070 wd: 295 eight(m): 11504 wd: 296 eight(m): 11504 wd: 296 eight(m): 11504 wd: 296 eight(m): 11504 wd: 296 eight(m): 12218 wd: 294 eight(m): 12374 wd: 294 eight(m): 12663 wd: 289 eight(m): 12808 wd: 286 eight(m): 13098 wd: 286 eight(m): 13098 wd: 286 eight(m): 13388 wd: 282 eight(m): 13678 wd: 279 eight(m): 13822 wd: 278 eight(m): 13967 wd: 278 votal Levels: 31 Average: 83.8 Knots Average Wind Speed: 88.9 ind Direction: 289.4 ** END OF CALCULATION***</pre>	<ul> <li>Ws: 63.6 Knots</li> <li>Ws: 63.6 Knots</li> <li>Ws: 66.1 Knots</li> <li>Ws: 64.9 Knots</li> <li>Ws: 64.9 Knots</li> <li>Ws: 64.9 Knots</li> <li>Ws: 66.0 Knots</li> <li>Ws: 69.0 Knots</li> <li>Ws: 69.0 Knots</li> <li>Ws: 71.5 Knots</li> <li>Ws: 73.7 Knots</li> <li>Ws: 80.7 Knots</li> <li>Ws: 80.7 Knots</li> <li>Ws: 80.7 Knots</li> <li>Ws: 109.6 Knots</li> <li>Ws: 112.0 Knots</li> <li>Ws: 109.4 Knots</li> <li>Ws: 102.4 Knots</li> <li>Ws: 102.4 Knots</li> <li>Ws: 99.1 Knots</li> <li>Ws: 101.9 Knots</li> <li>Ws: 101.9 Knots</li> </ul>		
** END OF CALCULATION***			

Figure 18. Anvil Tool GUI after the user selected 12:00 GMT as the time in the Station column.

To create the Anvil Tool graphic for display in AWIPS, the user must click the button labeled "Make" (Make" (Make"). The GUI displays the name of the Site as the mid point of the graphic as well as the latitude and longitude of the Site as shown in Figure 19. In this example the user chose the SLF for the Site which is what is now displayed at the bottom of the GUI in Figure 19.

Show Label At Circles	Vos 🌰 No	Show John On France & Vice Ale
shel Distance From Contorn	Fes NU 200	
abei Distance From Center:	SU ↓ 100 ↓ 200	Label Direction From Center: V NE VE SE V SW V N
arcie Label Position: + Top	V Middle V Bottom	Frame Label Position:  Top  Middle  Botton
20070222 1230	Station	TIL:45 GMT
20070222_1200	SLF	12:00 GMT
20070222_1130	CX39	
20070222 1030	CX39B	
- 1411	Statin	an: 0
** BEGIN NEW PROFILER CAN	CULATION ***	
ata Type = 50MHz profile tation Lat: 28.62755		
tation Lon: -80.69519		
ime = 12:00 GMT		
ite = Station		
ignificant Levels: eight(m): 9041 wd: 298	ws: 63.6 Knots	
eight(m): 9186 wd: 297	ws: 63.6 Knots	
eight(m) 9621 wd 292	ws: 66 1 Knots	
eight(m): 9766 wd: 295 eight(m): 9910 wd: 292	ws: 64.9 Knots	
eight(m): 10055 wd: 291	ws: 68.0 Knots	
eight(m) 10345 wd 286	ws 70.0 Knots	
eight(m): 10635 wd: 286	ws: 73.9 Knots	
eight(m): 10780 wd: 290 eight(m): 10925 wd: 292	ws: 71.5 Knots ws: 73.7 Knots	
eight(m): 11070 wd: 295 eight(m): 11214 wd: 295	ws: 80.7 Knots ws: 88.8 Knots	
eight(m): 11359 wd: 296	ws: 98.0 Knots	
eight(m): 11649 wd: 295	ws: 116.6 Knots	
eight(m): 11794 wd: 295 eight(m): 12229 wd: 296	ws: 121.7 Knots ws: 112.0 Knots	
eight(m): 12374 wd: 294	ws: 117.0 Knots	
eight(m): 12663 wd: 289	ws: 108 9 Knots	
eight(m): 12808 wd: 286 eight(m): 13098 wd: 286	ws: 111.6 Knots ws: 99.3 Knots	
eight(m): 13243 wd: 284 eight(m): 13388 wd: 282	ws: 102.4 Knots ws: 100.3 Knots	
eight(m): 13533 wd: 279	ws: 102.8 Knots	
eight(m): 13822 wd: 278	ws: 96.4 Knots	
eight(m): 13967 wd: 278	ws: 101.9 Knots	
otal Levels: 31 Average: 83 8 Knots		
Average: -29.6 Knots		
verage Wind Speed: 88.9 1 ind Direction: 289.4	Knots	
** END OF CALCULATION***		
reating map overlay	and the second second	
o Label At Circle, Frame id point of plot: Station	Label Position = Top	
at:28.62755 on:-80.69519		
inished creating Map 1		
intened creating MAP 1		
		and the second

Figure 19. Anvil Tool GUI after the user has clicked on the Make button. The GUI now displays the midpoint of the Site where the graphic will be plotted on the AWIPS display.

Users can change the color, line type, line thickness, text magnification, etc. using the standard procedures available in AWIPS to customize the look of the Anvil Tool graphic. Figure 20 shows the view after the user changed the color, line type, line thickness and magnified the text of the Anvil Tool graphic.



Figure 20. The Anvil Tool graphics plotted in AWIPS based on the 50 MHz profiler data selected from the Anvil Tool GUI. The source of the data (Station), center of the graphics (Site) and Date-Time of the data is plotted with the graphic based on the user-selected locations. After the Anvil Tool graphic was plotted, the user changed the color, line type (dashed), increased line thickness and magnified the text.

## 2.4. Displaying Model forecasts with the Anvil Tool GUI

Processing data from the model forecasts in the Anvil Tool GUI is similar to processing the RAOB and 50 MHz data with a few exceptions. The forecasts are available from three models – the Rapid Update Cycle (RUC), Eta model (NAM) and Global Forecast System (GFS) and the forecasts are available at multiple forecast hours, depending on the model. In Figure 21, Models has been selected as the Data Type and the GUI now displays a choice of the three models as Model Type, just above the Date-Time list. In this example, the RUC is selected.

Anvil Threat Corridor ver	sion 1.7.0	
Data Type: 💸 RAOB 🔶	Models 🕹 50MHz Refre	sh Map: 🔶 ON 👽 OFF 🛛 Profiler Type: 🔶 RSA 👽 MADIS
Show Label At Circle:	🕹 Yes 🔶 No	Show Label On Frame: 🔶 Yes 🕹 No
Label Distance From Cent	er: 🔶 50 🐟 100 🕹 200	Label Direction From Center: $\checkmark$ NE $\rightsquigarrow$ SE $\blacklozenge$ SW $\checkmark$ NW
Circle Label Position: +	Top 💊 Middle 💊 Bottom	Frame Label Position: 🔶 Top 🕹 Middle 🕹 Bottom
Model Type: 🔶 RUC 😞	NAM 🕹 GFS	
Date-Time	Site	Fcst Hour
20070307_2000		
20070307_1900	A Martin States	
20070307_1800		
20070307 1600		
Make	Models 🔶 MAP 1 🕹 MA	P 2 🗢 MAP 3 Dismiss

Figure 21. Anvil Tool GUI after the user has selected Anvil Tool... from the AWIPS Tools dropdown menu and selected Models as the Data Type.

Once the user selects the **Date-Time** (initial time of the model) as shown in Figure 22 (now highlighted in red), the GUI displays a list of sites (**Site**) and available forecast hours (**Fcst Hour**). The user will select a **Site** where they want the Anvil Tool graphic to be centered when displayed in AWIPS. In Figure 22, the **Site** chosen was **SLF**. For the model forecasts, unlike the **RAOB** and **50 MHz** data, the GUI does not present a **Station** column but instead displays the **Fcst Hour** column and does not automatically highlight a **Fcst Hour**. The user must click on a **Fcst Hour** as shown in Figure 23. When the user clicks on the **Fcst Hour** (in this example **0**), the anvil threat sector calculation is done and the data from that **Fcst Hour** is displayed in the GUI as shown in Figure 23. Unlike the observed data, it takes a bit longer to calculate the Anvil Tool parameters from model data. Typically, it takes 3 sec for the RUC, 15 sec for the NAM and 35 sec for the GFS.

лата туре: 🗸 кнов	Mudels V JUMHZ Re	Tresh Map: VI VI VII	Profiler Type:
Show Label At Circle	e: 💊 Yes 🔶 No	Show	Label On Frame: 🔶 Yes 🕹 No
Label Distance From Ce	nter: 🔶 50 🕹 100 🕹 20	00 Label Direction From Cen	iter: 💠 NE 🕹 SE 🔶 SW 🕹 NW
Circle Label Position: 🖣	Top 🕹 Middle 🧇 Botto	Frame Label Positi	ion: 🔶 Top 🕹 Middle 🕹 Bottom
Model Type: 🔶 RUC	> NAM 🕹 GFS		
Date-Time	Site	Fcst Hour	
20070307_1700	SLF	0	
20070307_1600	CX39	3	
20070307_1500	CX39A	6	
20070307_1400	CX39B	9	
	M Jarro	- M hr	
			É
			The second se
Make	Models 🔶 MAP 1 🕹	MAP 2 🗸 MAP 3	Dismiss

Figure 22. Anvil Tool GUI after a user has selected SLF as the Site. The GUI now displays the available forecast hours in the Fcst Hour column.

Anvil Threat Corridor ver	sion 1.7.0		_ = ×
Data Type: 💊 RAOB 🔶	Models 🕹 50MHz 🛛 R	Refresh Map: 🔶 ON 💊 OFF	Profiler Type: 🔶 RSA 🕹 MADIS
Show Label At Circle:	🗸 Yes 🔶 No	Show	Label On Frame: 🔶 Yes 🕹 No
Label Distance From Cent	er: 🔶 50 🕹 100 🕹 2	200 Label Direction From Cen	iter: 💠 NE 💠 SE 🔶 SW 💠 NW
Circle Label Position: 🔶	Top 💊 Middle 🕹 Bot	tom Frame Label Positi	ion: 🔶 Top 🕹 Middle 🥪 Bottom
Model Type: 🔶 RUC 🗸	NAM 🕹 GFS		A MERICA STATE
Date-Time	Site	Fcst Hour	
20070307_1700 20070307_1600 20070307_1500 20070307_1400 20070307_1300	SLF CX39 CX39A CX39B CX40	△ 0 3 6 9 √ 12	
Performing calculation Model = RUC Model run = 20070307_1 Site = SLF, using grid Forecast hour = 0 number of grid points number of grid points grid point used in y d grid point used in x d	<pre>sRead variables f 300 point nearest to th in x direction: 76 in y direction: 57 irection = 13 irection = 58</pre>	rom file e Site	
U Average: 76.1 Knots V Average: -0.2 Knots	ponentCalculating	v-wind component	
Average Wind Speed: 76 Wind Direction: 270.1	1 Knots		
Adjusted Wind Direction	n (changed from grid	-relative to north-relative	e): 275.1
*** END OF CALCULATION	***		-
Make	Models 🔶 MAP 1 👳	MAP 2 💠 MAP 3	Dismiss

Figure 23. Anvil Tool GUI after the user has selected 0 as the Fcst Hour.

To create the Anvil Tool graphic for display in AWIPS, the user must click the button labeled "Make" (Make" (Make"). The GUI will now display the name of the Site as the mid point of the graphic as well as the latitude and longitude of the Site as shown in Figure 24. In this example the user chose the SLF for the Site which is what is now displayed at the bottom of the GUI in Figure 24.

Anvil Threat Corridor version 1.7.0
Data Type: 🕹 RAOB 🔶 Models 🕹 50MHz Refresh Map: 🔶 ON 😓 OFF Profiler Type: 🔶 RSA 🕹 MADI
Show Label At Circle: 🗸 Yes 🔶 No Show Label On Frame: 🔶 Yes 💸 No
Label Distance From Center: $\blacklozenge$ 50 $\diamondsuit$ 100 $\diamondsuit$ 200 Label Direction From Center: $\diamondsuit$ NE $\diamondsuit$ SE $\blacklozenge$ SW $\diamondsuit$ NV
Circle Label Position: 🔶 Top 🕹 Middle 🥪 Bottom 🛛 🛛 Frame Label Position: 🔶 Top 🥪 Middle 🥪 Bottom
Model Type:      RUC      NAM      GFS
Date-Time Site Fcst Hour
20070307_1700       A       SLF       A       0         20070307_1600       CX39       J       3         20070307_1500       CX39A       6         20070307_1400       CX39B       9         20070307_1300       CX40       12
*** BEGIN NEW MODEL CALCULATION *** Performing calculationsRead variables from file
Model = RUC Model run = 20070307_1300 Site = SLF, using grid point nearest to the Site Forecast hour = 0 number of grid points in x direction: 76 number of grid points in y direction: 57 grid point used in y direction = 13 grid point used in x direction = 58
Calculating u-wind componentCalculating v-wind component
U Average: 76.1 Knots V Average: -0.2 Knots
Average Wind Speed: 76.1 Knots Wind Direction: 270.1
Adjusted Wind Direction (changed from grid-relative to north-relative): 275.1
*** END OF CALCULATION***
Creating map overlay No Label At Circle, Frame Label Position = Top Mid point of plot: SLF Lat:28.617 Lon:-80.683
Finished creating MAP 1
Make Models  MAP 1  MAP 2  MAP 3 Dismiss

Figure 24. Anvil Tool GUI after the user has clicked on the Make button. The GUI now displays the midpoint of the Site where the graphic will be plotted in the AWIPS display.

## 2.5. Displaying multiple Anvil Tool graphics in AWIPS

Multiple Anvil Tool graphics can be displayed in AWIPS. If a user wants to display one Anvil Tool graphic from each of the three data types, they will follow the procedures in the previous sections for each data type. This will display up to three Anvil Tool graphics overlaid on each other (Figure 25). Using the standard procedures available in AWIPS, the color, line type, line thickness, etc can be changed to customize the look of each Anvil Tool graphic from each separate data type.



Figure 25. An example of the Anvil Tool graphics plotted in AWIPS based on RAOB (red), 50 MHz (cyan) and RUC Model (green) after creating them in the Anvil Tool GUI.

To display multiple Anvil Tool graphics in AWIPS from the same data type, users must select different map numbers by using the **MAP** options at the bottom of the Anvil Tool GUI. First, users would create an Anvil Tool graphic for one of the three data types described in previous sections and use the default **MAP1**. They would then choose the same data type at a different observation or model forecast time, but would choose **MAP2** or **MAP3** before clicking the **Make** button. This will display up to three Anvil Tool graphics of the same data type overlaid on each other (Figure 26). If the user does not change the map number, the Anvil Tool graphic will overwrite the previous graphic in the AWIPS display that used the same map number.

Up to nine Anvil Tool graphics can be overlaid on each other in one AWIPS frame using all three data types. Although the resulting graphic could be confusing, it can be done as shown in Figure 27.



Figure 26. An example of the Anvil Tool graphics plotted in AWIPS based on three different RAOB times.



Figure 27. An example of the Anvil Tool graphics plotted in AWIPS based on three different RAOB times, three different models and three different 50 MHz profiler times for a total of nine plots overlaid on each other. All of the data labels were plotted on the frame, not near the center of the circle and at varying distances and directions so they did not overwrite each other.

#### References

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