

ANVIL FORECAST TOOL IN THE ADVANCED WEATHER INTERACTIVE PROCESSING SYSTEM (AWIPS)

OVERVIEW

- Meteorologists from the 45th Weather Squadron and Spaceflight Meteorology Grou (SMG) have identified anvil forecasting as one of their most challenging tasks wher predicting the probability of violations of Lightning Launch Commit Criteria and Spa Shuttle Flight Rules.
- In a previous task, the Applied Meteorology Unit (AMU) created a graphical overlay for the Meteorological Interactive Data Display System (MIDDS). The tool indicates threat of thunderstorm anvil clouds up to three hours in to the future, using observe model forecast winds as input.
- In Phase I of this task, the AMU transitioned the tool from MIDDS, so that SMG cou it in AWIPS.
- In Phase II, the AMU added additional capabilities to make it faster and more flexib

DESCRIPTION OF THE GRAPHICAL OVERLAY

- The tool first calculates the upper-tropospheric layer-average wind velocity, usually between 300 mb and 150 mb. A graphic is then created with the following features:
- Two standoff circles centered at the location of interest, usually with 10 and 20 NM radii,
- A 30-degree sector width, and
- One-, two- and three-hour arcs in the upwind location.
- The graphic is often overlaid onto a weather satellite or radar image.



Graphic in MIDDS for Shuttle Landing Facility (SLF) at 1200 UTC, 7 March 200

PHASE I: MIGRATE TOOL FROM MIDDS TO AWIPS

- The MIDDS tool used code written in the McIDAS BASIC Language Interpreter (Mc programming language. The MIDDS interface was written in the Tcl/Tk language. AMU rewrote all of the code into Tcl/Tk.
- The AWIPS tool read the observed or model wind from NetCDF files using the ncdu command-line utility.
- The graphic's lat/lon points were stored as a Shapefile, a Graphical Information System (GIS) file standard. The tool used version 1.2.10 of the Shapefile C library (http://shapelib.maptools.org) to create the Shapefile.
- After testing was completed, the software, installation instructions, and User Guide delivered to SMG.

- Show Label At Circle: 🔶 Yes 📣 N

Label Distance From Center: 🔶 50 💠 100 💠 200 🛛 Label Direction From Center: 🔶 NE 🕤

Refresh Map: 🔶 ON 📣 OFF 🛛 Profiler Type: 🔶

Show Label On Frame

Dismiss

	Circle Label Position: $igstarrow$ Top \bigtriangledown Middle \diamondsuit Bottom Frame Label Position: $igstarrow$ Top \diamondsuit Mi
AWIPS Anvil Forecast Tool graphical user interface (GUI) from Phase I.	Date-Time Site Station 20060609_1200 Station NFFN 91680 20060609_0000 SLF NWWN 91592 20060608_1200 CX39 KXMR 74794 20060608_0000 CX39A SOCA 81405 20060607_1200 CX39B GOOY 61641
The text box describes the input data used to calculate the layer-average wind velocity. In this example, the XMR rawinsonde observation from 1000 UTC on 9 June 2006 is used.	<pre>statum: 74734 **** BEGIN NEW RAOB CALCULATION **** Data Type = RAOB File Date-Time = 20060609_0000 Time of observation = 10:00 GMT Station Name: KXMR 74794 Station Lat: 28.48 Station Lon: -80.57 Site = SLF Mandatory Levels: pressure(mb): 300 wd: 310 ws: 35.0 Knots pressure(mb): 250 wd: 290 ws: 32.9 Knots pressure(mb): 200 wd: 280 ws: 44.9 Knots pressure(mb): 150 wd: 255 ws: 50.0 Knots</pre>
	Total Levels: 4 U Average: 37.5 Knots V Average: -7.1 Knots Average Wind Speed: 38.2 Knots Wind Direction: 280.8 **** END OF CALCULATION*** Make RAOB: MAP 1 Make MAP 1
	Label Position: $ ightarrow$ 1 $ ightarrow$ 2 $ ightarrow$ 3
	Site
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MIDDS Anvil Forecast Tool GUI.	Real-Time Models 50MHz
	Enter Day 2005286 TIME: Latest Lat

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up	PHASE II: MAKE THE AWIPS TOOL FASTER AND MORE CONFIGURABLE	<pre># default.prot # Global vari; # Global vari;</pre>
ace	 The AMU made two improvements to make the AWIPS Anvil Forecast Tool faster and more flexible: 	minSigW 9000 maxSigW 14000
y tool s the ed or	 Created "User Profiles" so that users can define model data files, atmospheric pressure levels, and other parameters used in the tool. 	bottomMan 300 numLaunchSite: CX39 28.6269 CX39A 28.6083 CX39B 28.6269 CX40 28.562 - CX41 28.5835
uld use	 Modified the tool's source code to use a National Weather Service (NWS) application called AGRID, to make reading gridded model data easier and faster. 	CX37 28.531 -8 CX17 28.4458 - CX17A 28.4472 CX17B 28.4458 numLandingSite SLF 28.617 -8 EDW 34.92 -11
ole.	After testing was completed, the software, installation instructions, and User Guide were delivered to SMG.	MRN 37.17 -5.6 ZZA 41.67 -1.0 FMI 43.52 4.9 numLocations 1 MLB 28.1 -80.0
/	I. User Profiles	# Model varia RUCpath /data, NAMpath /data,
	A User Profile is a text file that defines several parameters previously hard-coded into the tool's source code. User Profiles make the tool more configurable and easier to maintain and update, since the parameters are easier to change. All of the User Profiles are stored in the installation directory, with a filename extension of ".profile". When the tool is started, the user is prompted to select a User Profile. A new User Profile can be created through the GUI or by creating a new file with a text editor. User Profiles can only be modified with a text editor. The tool must be restarted to change the current User Profile. The tool's installation files include a default User Profile named "default.profile". Refer to the extended abstract for a description of the User Profile parameters.	Models1Key 13 Models2Key 13 Models3Key 13 interFlag 0 # RAOB variab RAOBpath /data RAOB1Key 1319 RAOB2Key 1320 RAOB3Key 1321 # 50MHz profil RSA 0 MADIS 1 RSApath /data, MADISpath /data, MADISpath /data Profiler1Key 1 Profiler2Key 1 Profiler3Key 1 RSAname statio MADISname prov
	II. AGRID Software	
	 Ine tool was updated to use the AGRID application to make reading package of routines to read or write AWIPS NetCDF files, and is wr software and user instructions are available from the Local Applicat The AMU installed AGRID on a Linux machine running AWIPS clien scripts to read gridded model data with AGRID: getModelLevels.pl – Reads the pressure levels that contain wind getModelData.pl – Read u- and v-wind components at a particula getModelRealUV.pl – Converts the grid-relative u- and v-wind components 	g gridded n itten in the ions Databa it and serve data, ar lat/lon, fo mponents t
007.		
cBASI) The	Forecast Systems Laboratory D-2D (rotzoll) File View Options Tools Volume Obs NCEP/Hydro Local Upper Air Satellite Kmlb Khdx Keyx Radar SCAN Maps Help Valid time seq — SE US — Clear K<	th: Style: Default -
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)ismiss	Tool's output displayed in the SMG AWIPS. The graphics are over the SLF. The green overlay was created with rawinsond orange overlay with profiler data, and pink overlay with RUC	centered e data, the model data
SLF 2 aphic	Image: Anvil Threat Corridor version 2.4 Image: Anvil Threat Corridor version 2.4 User Profiles Circle Label Options Frame Label Options Data Type: RAOB Models 50MHz Refresh Map: ON OFF Profiler Type: RSA MADIS Data Type: RAOB Models 50MHz Refresh Map: ON OFF Profiler Type: RSA MADIS Date-Time Center of Plot Station Station Date-Time Circle Label Options 20060609_1200 O O Station Station O	Anvil Threat Corridor bel Options Frame abel At Circle: Sh Map abel Position: Top Midd Bott Station:

AWIPS Anvil Forecast Tool GUI at startup.

Dismiss

RAOB: 🔶 MAP 1 💠 MAP 2 💠 MAP 3

The Circle Label Options menu in the GUI.

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orecast hour, and pressure level, and to north-relative u- and v-wind components.

	Differences between Phase I and Phase II of the tool.					
Feature	Phase I (uses ncdump utility to read gridded model data)	Phase II (uses AGRID to read gridded model data)Less complex.The getModelData.pl script can directly read the u- and v-wind components for the lat/lon point.				
Source code complexity	More complex. The entire NetCDF file must be parsed to get the u- and v-wind components for the lat/lon point.					
Speed	Slower. The entire NetCDF file must be read into memory and then parsed. The amount of time to read the model data is dependent on the size of the file.	<u>Faster.</u> Only the required model data is read from the file. The amount of time to read the model data is independent of the file size; it is related to the number of pressure levels used to calculate the layer-average wind velocity.				
Number of center of plot locations in graphic that are allowed	Limited. The center locations are limited to the lat/lon points in which the grid points have already been manually calculated and hard- coded into the tool.	Unlimited. The tool can automatically calculate the corresponding grid point for any lat/lon point in the model domain.				
Accuracy of grid point location	Probably less accurate. The grid point corresponding to a lat/lon point is manually calculated by printing out the model domain, then counting the number of grid points in the x- and y-direction.	Probably more accurate. AGRID automatically calculates the grid point corresponding to a lat/lon point. It uses an algorithm that takes the model domain size, projection, and lat/lon as input. The output is the corresponding grid point.				
Able to use the nearest grid point to the lat/lon point	Yes. The grid point closest to the lat/lon point is manually calculated.	Yes. AGRID can calculate the grid point closest to a lat/lon point.				
Able to interpolate model data from the surrounding four grid points	No. The tool can only read model data from the closest grid point to a lat/lon point.	Yes. AGRID can calculate the four grid points surrounding a lat/lon point, then interpolate the data from the four grid points.				
Able to change the model files that are used her model domain size and projection affects the grid point.		Yes. AGRID can calculate the grid point for a lat/lon point, based on the model domain size and projection.				
Able to change pressure levelsNo. The pressure levels are hard-coded into the source code, since the tool cannot dynamically read which pressure levels are available for u- and v-wind components.		Yes. AGRID can dynamically read which pressure levels are available for u- and v- wind components.				

AWIPS ANVIL FORECAST TOOL, PHASE II



Anvil Forecast Tool graphic, based on the 0-hr forecast of the 2100 UTC run of the RUC model on 9 June 2006 data. The user manually entered a center location of 26.0 North 84.0 West.



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User Profiles	Circle Label Options	Frame Label Options	
Data Type: ◆ RAOB Date-Time 20060609_1200 20060609_0000 20060608_1200 20060608_0000 20060607_1200	Models SOMHz Refre	Show Label On Frame: Frame Label Position: Label Distance From Center: Label Direction From Center:	Type: ↓ RSA ◆ MADIS ∧ NE ∧ SE ∧ SW ◆ NW
Make	RAOB: 🔶 MAP 1 🔶 MAP	P 2 🕹 MAP 3	Dismiss

Barrett, J.H., 2008: Anvil Forecast Tool in the Advanced Weather Interactive Processing System, Phase II Final Report. NASA Contractor Report CR-2008-214748, Kennedy Space Center, FL, 26 pp. [http://science.ksc.nasa.gov/amu/final.html]

The Frame Label Options menu in the GUI.





Anvil Forecast Tool graphics based on rawinsonde observations at JAX (red), TBW (green) and XMR (blue) on 8 June 2006.

REFERENCE