Radar-Related Tools in D2D

Introduction

AWIPS provides a number of tools to help interpret radar data and products. Some of the tools locate features and calculate distance, speeds, and times of arrival. Other tools help facilitate querying radar data with the Volume Browser.

These steps are designed for a WES simulation using the August 24, 2006 test case. If you follow the following steps using these test data at the specified times, your D2D display should closely match the examples in this presentation.

In the following pages, steps to perform on the WES are listed in a bulleted format, and any interactions with this presentation are in red.

Click on the graphics contained in this presentation for a larger view. The graphics provide step-by-step examples to follow.

2155 UTC: Cursor Home

Cursor Home is a user-definable reference point from which D2D can calculate and display azimuth and range values. You can also use Cursor Home to locate unfamiliar locations.

- Open the **DLOC13_Tools** procedure and load the **KABR Reflectivity** bundle.
- Use cursor sampling to obtain reflectivity and location information for the supercell in Sully and Hyde counties. To do this, press and hold the left mouse button while moving the mouse over the supercell. Note that the azimuth and range of the sample location is given relative to the radar location.
- Use the **Tools** menu and choose the **Home** option.
- If the home location is not editable, make it editable by middle-clicking on the **Home Location** legend label, or by right-clicking on the legend label and selecting **Editable** from the pop-up menu.
- Move the home location to a new position. There are two ways to do this:
  1. Move the mouse pointer to the desired location and right-click.
  2. Drag the Home location symbol (using the left-mouse button) to a new location.

- Do the cursor sampling operation again. Note that information about azimuth and range relative to the home location is presented alongside the previous information.

Besides graphically placing the home location with the mouse, D2D provides another option, the **Put Home Cursor** GUI, to position the location more precisely.

- Use the **Tools** menu and choose **Put Home Cursor**.
- For this example, click on the **City/State** radio button.
- In the City entry, type **`MILLER.`**
- Click the **Go** button.
- In the D2D display, the cursor home should be located near the town of Miller in Hand county.

The Put Home Cursor provides a handy way to find an unfamiliar METAR or City location (as long as D2D knows about the location).

2200 UTC: Points and Baselines

Points and Baselines are used by the D2D Volume Browser to query the current database. There are ten sets of points (labeled A through J) and ten sets of baselines (labeled A-A', B-B', ..., J-J').

Sometimes, depending on the current map scale, all ten sets of points or baselines may not appear. For example, if points were used to mark some locations on a national scale map, and subsequently a WFO scale map is loaded, the points that were used outside the WFO domain will not appear on the D2D display.

To demonstrate radar-related uses of points and baselines, this exercise utilizes the volume browser to construct both a time-height diagram of reflectivity and a reflectivity cross section. Note that the cross sections produced in this manner are completely distinct from the RCS products from a Radar Product Generator.

Points

- Use the middle-mouse button to zoom into the thunderstorm over the Sully/Hyde county border.
- Use the **Tools** menu to load **Points**. Alternatively, you can click on the Points icon on the toolbar.

- If the points are not editable, middle-click on the **Interactive Points** label in the product legend, or right-click on the label and use the contextual menu.
- Move a point (Point A) to the hail core at the Sully/Hyde county border. Use the left mouse button to drag a point to a desired location.
- Swap the original KABR 0.5 reflectivity image with a new pane by right-clicking on the desired pane. Set the new pane to WFO scale.
- Use the **Volume** menu to load the Volume Browser.
- In the Volume Browser, change the type of plot to **Time height**.
- Change the height coordinate to **0-45 kft AGL**.
  - NOTE: Since this exercise was developed, a bug was found in AWIPS OB9.0 which prevents radar time-height plots and cross sections from plotting when they have a height coordinate expressed in AGL. You may achieve similar-looking results by choosing a different height coordinate (e.g., **Log 1050-100.**)
- Under *Sources*, choose **Radar** from the **Volume** menu.
- Under *Fields*, choose **Reflectivity** from the **Other** menu.
- Under *Planes*, click the **Points** menu and choose the **Tsect** option that corresponds to the point used earlier (Tsect A).
- A product should appear in the *Product Selection List* (24.2200 Radar pointA Reflectivity). If not already highlighted, click on this product to highlight it, then click on the **Load** button.
- When the cross section appears in D2D (as a line contour plot), right-click on the context menu and choose **Load as Image**.

Baselines

Similar to using an interactive point to create a time-height plot, the baseline tool can be used with the volume browser to create cross section plots.

- Swap the 0.5 reflectivity image back into the main pane.
- If you wish, unload the points by right-clicking on the **Interactive Points** label in the legend and using the contextual menu.
- Use the **Tools** menu to load **Baselines**. Alternatively, you can click on the Baselines icon on the toolbar.
- Position a line (C-C') over the supercell. Using the left mouse button, drag the line and the two anchor points to the desired location.
- Swap the reflectivity image with an empty pane.
- In the Volume Browser, change the plot type to **Cross section**.
- Keep the height coordinate at **0-45 kft AGL**.
  - NOTE: Since this exercise was developed, a bug was found in AWIPS OB9.0 which prevents radar time-height plots and cross sections from plotting when they have a height coordinate expressed in AGL. You may achieve similar-looking results by choosing a different height coordinate (e.g., **Log 1050-100.**)

- Click the **Volume** menu under *Sources* and choose **Radar.**
- Use the **Other** menu under *Fields* and choose **Reflectivity**.
- Use the **Specified** menu under *Planes* and choose the baseline used above (LineC)
- If the product is not highlighted in the product selection list, click it to highlight it.
- Click the **Load** button.
- In D2D, right-click on the **Radar lineC kabr Reflectivity** label and load it as an image.

Remember that cross sections created by the volume browser are distinct from the RCS and VCS products from the radar product generator.

One major advantage of cross sections generated by the volume browser is that they can be easily paired with environmental data. For example, overlaying representative temperatures aids in estimating precipitation type in winter situations. As you will find in Topic 7, the presence of a suspended core of high reflectivity values accompanied by temperatures below -20°C indicates a significant likelihood of large hail.

- In the same Volume Browser window previously used, click the **Volume** menu under *Sources* and choose **LAPS.**
- Use the **Basic** menu under *Fields* and choose **Temperature**.
- If the temperature product is not highlighted in the product selection list, click it to highlight it.
- Click the **Load** button.
- In D2D, right-click on the **LAPS lineC Temperature** label and adjust the contouring density (choose 0.5).

Note the 65 dBZ reflectivity core suspended above the -32°C level directly above weak reflectivity values at the surface.

2224 UTC: Distance Bearing

The Distance Bearing tool in D2D calculates the distance and heading between two particular points. This tool can provide an easy way to obtain the distance from a storm to a particular landmark, or the distance between any two features.

- Use the **DLOC13_Tools** procedure and load the **KABR Reflectivity** bundle.
- Zoom out (left-click) as far as the WFO scale permits.
- Use the **Tools** menu to load the **Distance Bearing** tool.
- Make the tool editable by middle-clicking on the **Distance Bearing** label in the product legend or right-clicking on the label and using the contextual menu.

- Similar to the Baselines tool, use the left mouse to position one of the movable lines.
- For this example, move the end of the line with the open circle to the hook echo of the supercell in Hyde county.
- Move the other end of the line to Pierre, the state capital.

2229 UTC: Distance Speed and FFZ

Distance Speed Tool

The Distance Speed tool is similar to the storm-motion vector in WarnGen. The tools are used to track a feature through a series of volume scans, but give different outputs. The Distance Speed tool determines a motion vector for a feature.

- Use the **DLOC13_Tools** procedure and load the **KABR Reflectivity** bundle.
- Use the middle-mouse button to zoom the map on the supercell in Hyde and Hand counties.
- Use the **Tools** menu to load the **Distance Speed** tool.
- If the tool is not editable, middle-click on the **Distance Speed** legend label, or right-click on the legend label and use the contextual menu to make it editable.
- Press and hold the left mouse button on the **Drag me to feature** symbol and drag the symbol to the hail core.
- Press the left arrow key to step backwards through the loop several frames.
- Adjust the position of the Drag me symbol.
- Advance the loop forwards (right arrow key) to check the accuracy of the motion vector. Adjust the position of the Drag me symbol as necessary.
- The Distance Speed tool reports the motion as a speed and direction.

Feature Following Zoom (FFZ) Tool

The Feature Following Zoom (FFZ) feature uses the speed from the Distance Speed tool to produce a storm-relative loop.

Note: Only one speed can be defined per AWIPS workstation. WarnGen also uses this same speed. Thus, changing the speed using the Distance Speed tool or by updating the speed in a warning will cause the FFZ tool to use a different speed, and may produce disorientation in any panes that have the FFZ tool loaded. Also, be aware that the feature following zoom tool requires D2D to be zoomed at least one zoom level.

- Use the **Tools** menu to load the **Feature Following Zoom** tool.
- Use the right arrow key or the loop button from the toolbar to advance through the loop.
- The background map shifts with each frame, keeping each frame centered on the storm.

2234 UTC: Time of Arrival

The Time of Arrival tool is similar to the Distance Speed tool, but it an additional user-specified location to extrapolate when the feature should reach that location.

- Use the **DLOC13_Tools** procedure and load the **KABR Reflectivity** bundle.
- Use the **Tools** menu to load the **Time of Arrival** tool.
- Left-click on the radar image to zoom out several levels.
- Use the left-mouse, drag the **Drag me to feature** symbol to the hook-echo of the supercell (near the Hyde/Hand county border).
- Use a similar procedure as with the Distance Speed tool to obtain a motion vector for the hook-echo/updraft.
    1. Back up the loop several frames.
    2. Adjust the location of the Drag me symbol until obtaining a suitable motion vector.
    3. Move the loop forwards to check the accuracy of the motion vector.
- Advance the radar loop to the end of the loop.
- Drag the **Drag me to Point of Arrival** symbol to Miller, SD. The tool calculates when the updraft should reach Miller, assuming constant, linear motion.
- When this storm passes though Hand county, a portion of the storm will be out of the ABR county warning area. Move the Point of Arrival symbol (now labeled with the previous arrival time) to the intersection of the motion vector with the Hand/Beadle county line.

2239 UTC: Radar Display Controls

The Radar Display Controls is a control panel that customizes how some of the derived radar products look in D2D. Perhaps the most common use of the Radar Display Controls is to specify a storm motion for the SRM product. This exercise demonstrates using the Radar Display Controls with the SRM, Storm Track (STI) and Hail Index (HI) products.

- Clear the D2D main pane and make sure the map scale is set to **WFO**.
- Under the **kabr** menu, load the 0.5 Z/SRM 8-bit product. Use the keypad "." key to toggle to the SRM product.
- Open the **Tools** menu and choose the **Radar Display Controls** option.
- In the Radar Display Controls, click the button to specify a **Custom Storm Motion**. The D2D display refreshes with the previously-specified storm motion.
- Use the **Dir** and **Spd** slider bars to specify custom direction and speed values.
- Clear the D2D main pane and use the **kabr** menu to load the **Storm Track** product (in the **Graphics** sub-menu).
- In the Radar Display Controls, change the type of track to **no tracks.** This setting causes the display to show only the storm IDs of the Storm Track algorithm.
- Change the type of track to **forecast.**
- Clear the D2D main pane and use the **kabr** menu to load the **Hail Index** product (in the **Graphics** sub-menu).
- In the Radar Display Controls, change the **High** threshold of POSH to **70**%.
- Change the **Low** threshold of POSH to **50**%. As a result, large unfilled triangles in the D2D display represent probability of severe hail between 50% and 70% and large filled triangles represent probability of severe hail greater than 70%.

2244 UTC: VR Shear

The VR Shear tool is designed to calculate the velocity difference across velocity couplets. The tool reports cyclonic shear as positive, and anticyclonic shear as negative.

- Clear the D2D main pane and make sure the map scale is set to **WFO**.
- Under the **kabr** menu, load the 0.5 Z/SRM 8-bit product. Use the keypad "." key to toggle to the SRM product.
- Open the **Tools** menu and choose the **VR-Shear** option.
- Drag the end points of the tool to the couplet in Hand County. The tool reports the velocity difference, the distance across the couplet, and the shear.

- Drag one end point of the tool to a location where there is no data or range folded data. The tool reports **NO DATA** instead of a shear value.
- For additional practice using this tool, load the All-Tilts Z/SRM 8 product and use the tool to sample the storm in McPherson County (west of the radar). Sample the strength of the circulation observed by the upper tilts of the volume scan.

2259 UTC: Estimated Actual Velocity

- The Estimated Actual Velocity (EAV) tool calculates 2-D wind speed values from a radial velocity product given a user-supplied wind direction. This calculation is very sensitive to the difference between the user-supplied wind direction and the radar beam azimuth.
- Load the 0.5 Z/V 8-bit product from the **kabr** menu. Use the keypad "." key to toggle to the V product.
- Click the **Tools** menu and choose **Estimated Actual Velocity**.
- Use the left mouse to drag the two end points of the line to a velocity feature of interest. This line defines your estimated 2-D wind direction. If the EAV tool does not appear on the screen, right-click near your velocity feature and the tool should snap to that location. The tool reports the EAV values at the two endpoints of the tool.
- Roam around the velocity image while holding the left mouse button. The EAV values appear with the cursor sampling information.
-

The EAV tool uses a tilde (~) symbol to report values based upon the difference between your specified direction and the radar beam azimuth:

Symbol	Direction/Azimuth Diff.
~	0 to 50°
~~	50 to 75°
***	75 to 90°

NOTE: This tool only works (correctly) with Base Velocity. Do not use it with SRM.

The optimum angles your direction should cross the radar azimuth should be between about 20° and 45°. Angles less than 20° (nearly parallel to radar azimuths) essentially reproduce the radial velocity value, and angles greater than 45° may produce large errors.

To obtain credit for this exercise, write the keyword for this exercise in your Topic 1 student guide. You will need this keyword for the Topic 1 post-test in the LMS. The keyword for this exercise is: distance.