System for Convection Analysis and Nowcasting (SCAN): Digital Mesocyclone Detection (DMD)

Guide for Users

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Introduction ↩

The System for Convection Analysis and Nowcasting (SCAN) is an integrated suite of multi-sensor applications which detects, analyzes, and monitors convection and generates short-term probabilistic forecast and warning guidance for severe weather automatically within AWIPS. SCAN will provide forecasters with accurate, timely, and consistent severe weather guidance and supplement forecaster event monitoring with multi-sensor, automated event monitoring. The intended benefits are:

- Longer lead times on warned events
- Fewer missed events
- Increased forecaster situational awareness
- Reduced forecaster fatigue during warning situations

The Digital Mesocyclone Detection (DMD) display will appear very similar to SCAN's Storm Cell display, but there are a few important differences and additions that you should be aware of.

Requesting the DMD Suite ↩

On the D2D, there is a menu entitled "SCAN". Under the SCAN menu will be sections for each dedicated radar. Each of these radar sections has the available SCAN, DMD and FFMP (Flash Flood Monitoring and Prediction) products.

Selecting the DMD Suite will load: the DMD icons and the DMD Table. Also, the DMD loading window will appear while the DMD elements are loading. Figure 1 shows the DMD Table.

The D2D ↩

Once the DMD Suite is loaded, on the D2D you will see identified circulations and perhaps meso tracks. The DMD Table will appear in front of the D2D. The circulation identification symbols are circles with different characteristics to differentiate between different kinds of circulations, like strong or weak mesocyclones and low-level mesocyclones.

Thin Circles:	Represent circulations with a low (user-defined) strength rank attribute.
Thick Circles:	Represent circulations with a high (user-defined) strength rank attribute.

Circles with spikes:	Represent circulations that reach down to the lowest elevation scan or when the height of the circulation base is below 1km.

The DMD Table Constituents: ↩

See Figure 1.

The Menu/Information Bar ↩

Contains the File, Configurations, Rank, and Attributes menus, as well as information regarding alarms, the currently utilized configuration file name, and the valid time of the SCAN DMD Table. The Menu/Information bar also contains the option buttons for Link to Frame (to link the table time with the D2D display time), CWA filter, Vert (to render the table vertically), and Tips (to provide helpful tips about table functions). See Figure 5 for an example of the vertical table.

The File Menu

The File Menu options are for controlling the configuration files. The current configuration file is displayed on the menu button. This file indicates which configuration file (also known as the DMD Display Parameters file or DDP file) was last used in the DMD table and that is being used by the D2D DMD Display. The File Menu options are:

Retrieve Default DMD Configuration	Retrieves and uses the default configuration file.
Retrieve DMD Configuration . . .	Retrieves and uses a specified configuration file.
Save DMD Configuration	Quick-saves the DMD configuration file.
Save DMD Configuration As . . .	Saves the DMD configuration file to a new file, defined by the user.

The Configurations Menu

The Configurations Menu choices are for setting up the D2D display, changing the alarm parameters, and controlling the Trend functions. The Configurations Menu options are:

D2D Display. . .	Produces the DMD Display Filter Control (DFC) window (see Figure 2). The DFC window allows the user to control how the D2D displays the mesocyclone identifications.
Alarm Thresholds. . .	Produces the Alarm Thresholds window which allows the user to define the absolute alarms for the DMD attributes. If a mesocyclone attribute meets or exceeds this value, an alarm is issued. (See Figure 3.)
Trend Sets➤	Produces selections that allow the user to choose which of the defined trend sets will be used as the active trend set as well as create and edit other trend sets. The active trend set is that which is accessible by the D2D and by the body of the DMD Table (see the Table Body section).
Box Colors. . .	Produces the Attribute Color Threshold (ACT) window. The ACT window allows the user to define value ranges of each applicable DMD attribute. These value ranges are intended to reflect the degree of strength of the DMD, from green (weak) to yellow (moderate) to red (strong). These colors will be used when rendering the data in the table body, in the time trends, and in the time-height trends.

The Rank Menu

Allows the user to choose the mesocyclone attribute by which the data in the table body will be sorted. The attribute that is currently being used for ranking is displayed on this button and will have its column title background changed to light purple. Refer to Appendix A to see which attributes can be used for ranking.

The Attributes Menu

Allows the user to choose which of the available mesocyclone attributes will appear in the DMD Table. Refer to Appendix A for information about all available attributes.

◙ Link to Frame

Indicates whether the valid time in the SCAN DMD Table will always match the time in the D2D

frame. If this button is activated and the user changes the frame in the D2D, the DMD Table will update to match the data shown on the D2D. If this is off, the data in the DMD Table will represent the *most recent available inventory time*.

◙ CWA Filter

A toggle that allows you to turn CWA filtering on/off. When on, the mesocyclone listing in the table will exclude any circulations that have been identified outside your CWA. This will also exclude such circulations from absolute alarm consideration.

◙ Vert

Indicates whether or not the table is vertically rendered. If this button is activated, the table orientation will change from horizontal (default) to vertical. (See Figure 5).

◙ Tips

Indicates whether or not the Tips functionality is turned on. When this button is activated and the mouse cursor is focused over "clickable" widgets in the table, a pop-up text box will appear next to the cursor containing useful information on the available features of that particular widget.

Alarm Button

If an Absolute Alarm value is met or exceeded, an alarm is issued. When an alarm is issued, a blinking alarm button will appear. The appropriate grid box in the table body will also blink and an audible alarm will sound. Button-3 clicking on the Alarm button will toggle the audible alarm. Clicking on the Alarm button will produce the Alarm Information window (see Figure 1), which presents a listing of all alarms. ("Abs" = Absolute.)

Elevation

This shows the most recent elevation scan received by SCAN's DMD Table. Because the DMD radar product is a rapid update radar product, the DMD radar product gets sent to AWIPS from the ORPG at the end of each elevation scan (instead of at the end of each volume scan, like many other volume-based products.)

Valid Time

This displays the UTC time for which the data in the DMD Table is valid.

The Attribute Title Row ↩

Shows what attributes are currently selected for viewing. These represent the attributes selected from the Attributes menu described above.

Ranking By Attribute

Clicking on applicable attribute titles will sort the table data according to that attribute and change the background color of that attribute title to light purple to signify that it is being used for ranking. Refer to Appendix A to see for which attributes the table can be ranked.

Changing the Attribute Color Thresholds

Button-3 clicking on applicable attribute titles will bring up the Attribute Color Threshold (ACT) window, as described in the Configurations Menu section above. Refer to Appendix A to see which attributes can be multi-colored.

The Table Body ↩

Displays the mesocyclone information, including such attributes as: alphanumeric identifier, location (azm/range, lat/lon, state/county), strength rank, and various circulation-based characteristics. If no circulations have been identified, the message "NO CIRCULATIONS DETECTED" will appear in place of the table. The values for the various DMD attributes are displayed in the table body and color coded (when applicable) according to the attribute color thresholds defined in the ACT window. Refer to Appendix A for a list of all circulation attributes available through SCAN's DMD Table.

Producing a Time Trend

Clicking on any applicable grid box will produce a single time trend for that particular circulation and attribute. Refer to Appendix A to see for which attributes time trends are available. See Figure 1 for an example of a single time trend.

Producing a Trend Set

Button-3 clicking on a DMD identifier in the 'ident' column will produce an 'active' trend set for that particular circulation. The 'active' trend set can be defined by selecting the Trend Set option under the Configurations menu (see the section on trend sets in SCAN DMD Table Sub-GUIs in Detail below).

Producing a Time-Height Trend

Button-3 clicking on any applicable grid box will produce a Time-Height Trend for that particular circulation and attribute. Refer to Appendix A to see for which attributes time-height trends are available. See Figure 6 for an example of a Time-Height trend.

Inspecting a Circulation

Clicking on an identifier in the 'ident' column will cause the D2D to zoom-and-recenter on that particular DMD identification. This also fills the Inspection Row with data and highlights the identifier in the 'ident' column. The Inspection Row can be seen in Figure 1.

The Inspection Row ↩

Duplicates the row in the table body for the circulation that was last inspected (see the section on circulation inspection under the Table Body topic for instructions on how to inspect a circulation). This row emphasizes the data for the identified circulation last inspected via the zoom-and-recenter method. The individual grid boxes in the Inspection Row have the same capabilities as the grid boxes in the table body, except clicking on the identifier box will zoom the D2D back out to the zoom level defined on the D2D menu bar. See Figure 1.

Producing a Time Trend

See information under the Table Body section above.

Producing a Trend Set

See information under the Table Body section above.

Producing a Tim-Height Trend

See information under the Table Body section above.

Zooming Back Out

Clicking on the identifier in the 'ident' column will cause the D2D to zoom back out.

SCAN DMD Table Sub-GUIs in Detail ↩

Display Filter Control (DFC) ↩

Launched from the Configurations menu. The DMD Display Filter Control (DFC) window allows the user to control the appearance of the mesocyclone identifiers on the D2D and define the zoom factor. See Figure 2.

The Zoom Factor:	This number represents the magnitude of the zoom used when zooming and re-centering is done *from the table* (see the section on storm inspection in the Table Body section). Clicking the desired radio button will change the zoom factor. A larger number represents greater magnification. Either the "OK" or "Apply" button must be pressed for a change in Zoom Factor to take effect. Note: this Zoom Factor does **not** affect the D2D's zooming abilities. Only the zoom-and-recenter functionality of the SCAN DMD Table when zooming and re-centering on a specific circulation can be affected by this Zoom Factor.
Tracks & Overlap:	This portion of the window contains the track and overlap toggle filters.
Tracks:	You can have the D2D render past and forecast meso tracks in the D2D by turning this on.
Overlap:	If a mesocyclone's icon graphically overlaps another, you can choose whether you want both to be displayed or just the one that is 'higher'.
Display Threshold Filter:	☻ Green: Any circulation with a strength rank that puts it in the green or below will not be rendered in the D2D, however, the circulation will remain in the DMD Table. ☻ Yellow: Any circulation with a strength rank that puts it in the yellow will be represented in the D2D by a thin yellow circle. ☻ Red: Any circulation with a strength rank that puts it in the yellow will be represented in the D2D by a thick yellow circle These thresholds are the same thresholds that are set using the ACT window - but only for the strength rank attribute.
"OK"	Accept the changes made and close the window.
"Apply"	Accept the changes made.
"Cancel"	Discard changes and close the window.

Trend Window ↩

See the Table Body section above for instructions to produce a time trend window. See Figure 1 and Figure 3 for examples. Whether the trend is one of several or the only trend in the Trend window, each time trend graph will have the same appearance. The x-axis represents time, labeled with hhmm UTC time. The y-axis represents the attribute, with pre-defined labels. The name of the attribute and its units are above the y-axis labels. (Note: If the value of the attribute for any plot point exceeds the pre-defined maximum axis value, the y-axis will be automatically re-defined and the y-axis labels will be highlighted in pink.) The plot points will be colored according to the defined attribute color threshold values for the selected attribute.

Changing To a Different Circulation:	Clicking on the numeric identifier above the graph will bring up a menu of all selectable circulations. Choosing a different circulation will cause the trend window to render the new circulation's trend information.
Changing To a Different Attribute:	Clicking on the attribute button above the graph will bring up a menu of all selectable attributes. Choosing a different attribute will cause the trend window to render the circulation's trend information for that attribute.
"Close"	Clicking will close the trend window.

Attribute Color Threshold (ACT) Window ↩

Launched from the Configurations menu or the Attribute Title Row. The user can edit the color-coded strength values for any of the DMD attributes displayed in the Attribute Title Row.

"Attribute:"	The user can switch to a different circulation attribute. The units of the attribute will also appear on this button.
"Upper:", "Mid:", "Lower:"	The strength thresholds, corresponding to the attribute values that meet or exceed these threshold values.
"OK"	The user accepts the changes just made and closes the window.
"Cancel"	The user can discard the changes just made.

Absolute Alarm Threshold Window ↵

Launched from the Configurations menu. This window allows the user to set the thresholds for determining when SCAN DMD absolute alarms are issued. (See Figure 3.)

"Attribute:"	The user can select any applicable DMD attribute.
"Absolute Value"	The user can define the value that a DMD's attribute must meet or exceed in order to trigger an alarm. The units are also displayed here.
"OK"	The user accepts the alarm conditions.
"◙Bell"	The user can toggle the audible alarm.

Alarm Information Window ↵

Launched by clicking on the Alarm button. See Figure 1 for an example. The buttons in the window are labeled with the DMD's numeric identifier and the DMD's attribute for which the alarm has been issued. (Note: Only Absolute Alarm shave been implemented for the DMD Table.)

Investigating Alarms:	Clicking on an individual alarm button in the Alarm Information window will bring up a trend window for that circulation and attribute that caused the alarm, cause the D2D display to zoom and re-center on that circulation, and display the circulation's table data in the Inspection Row. Once all alarms have been investigated, the Alarm Information window will close.
"Clear All Alarms"	Clear all active alarms without inspection.

Edit/Create Trend Set Window ↵

Launched from the Configurations menu/Trend Sets selection. See Figure 3. The user can edit an existing trend set's defined attributes, create a new trend set, or delete an unwanted trend set

by following the directions in this window. The Active Trend Set, which is the trend set created from the D2D (see below) and the table body (see the Table Body section above), can also be defined.

"Add Attribute"	Allows the user to add an attribute to an existing trend set.
"Remove Attribute"	Allows the user to remove an attribute from an existing trend set.
"Select Trend"	Allows the user to select a defined trend set he/she wishes to edit/delete.
"Remove Trend"	Allows the user to delete a defined trend set.
"OK"	The user accepts the changes just made and closes the window.
"Cancel"	The user can discard the changes just made and close the window.

Data Monitoring System (DMS) ↵

The SCAN Data Monitoring System (DMS) is a web browser-based, automated system for monitoring the status of the vital components of SCAN. It consists of a suite of HTML files, a Tcl/Tk Common Gateway Interface (CGI) script, and various supporting procedure, data, and image files. The system is housed on a web server, accessed through any browser that supports frames, and is updated using the CGI script. Please see the SCAN User's Guide for more detailed information. For the DMD display, all that was added was the DMD radar product to the list of radar products that SCAN's DMS monitors. (See Figure 4.)

Figures ↵

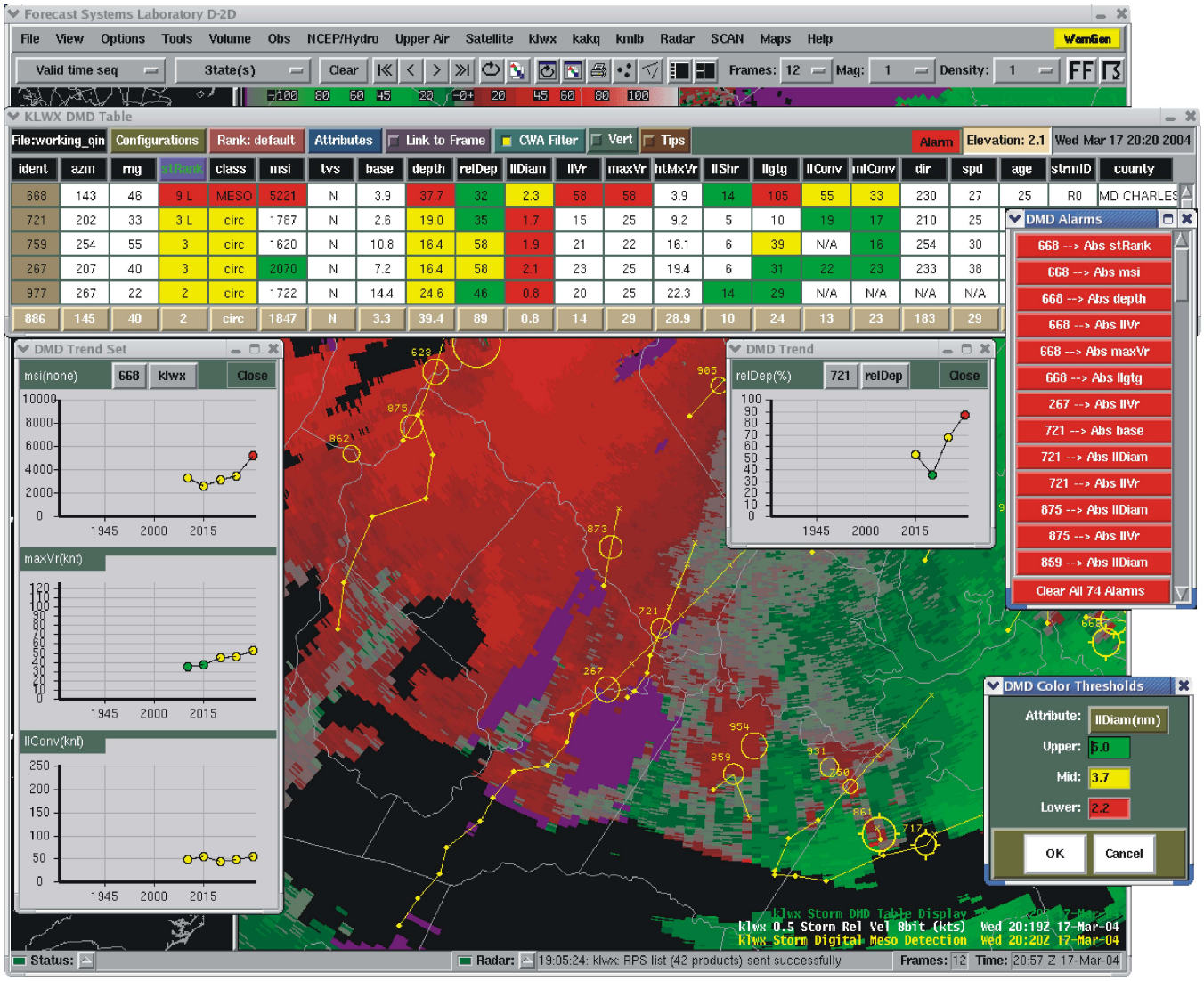

Figure 1 This figure includes the D2D, SCAN DMD Table, single trend, trend set, the Attribute Color Threshold (ACT), and Alarm Information windows.

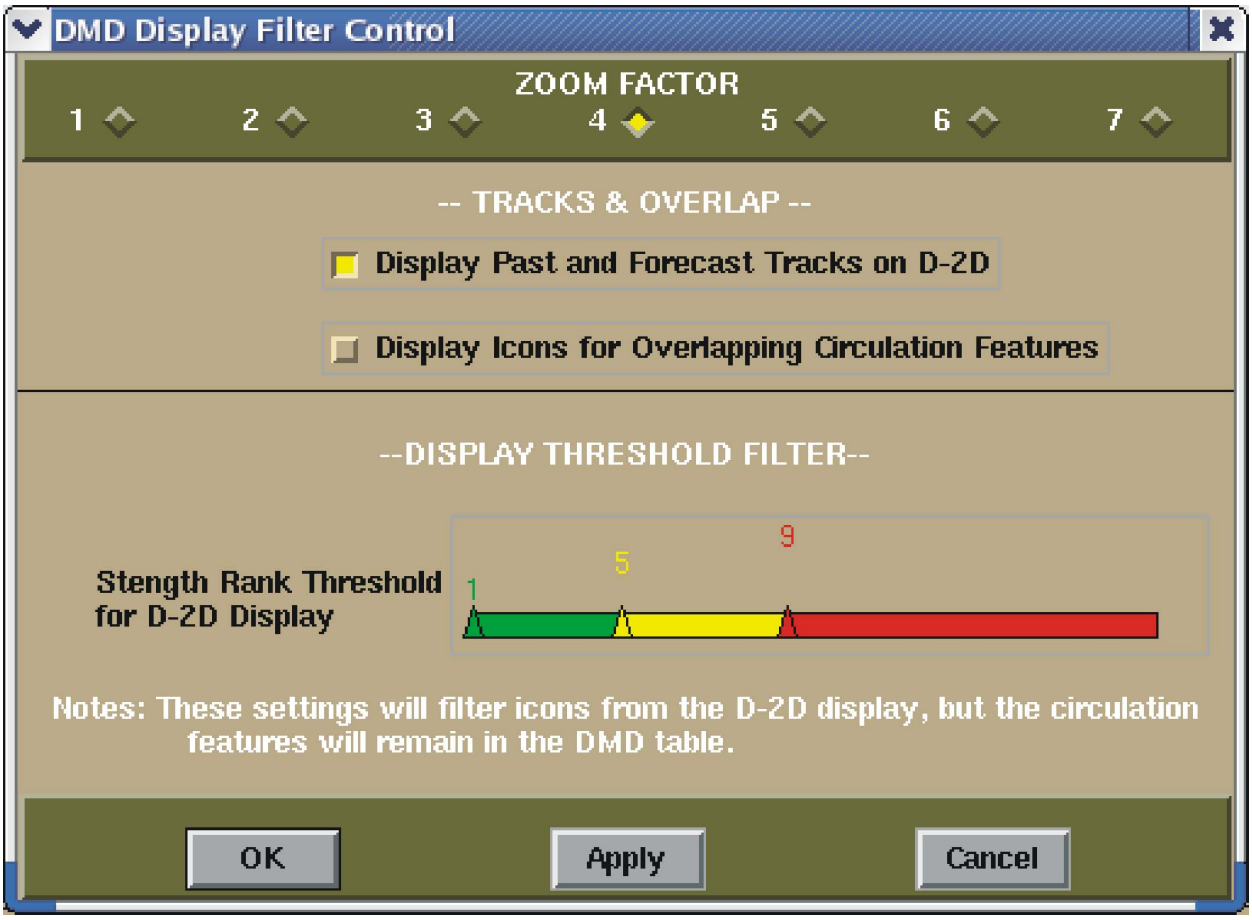

Figure 2 The DMD Display Filter Control (DFC) window.

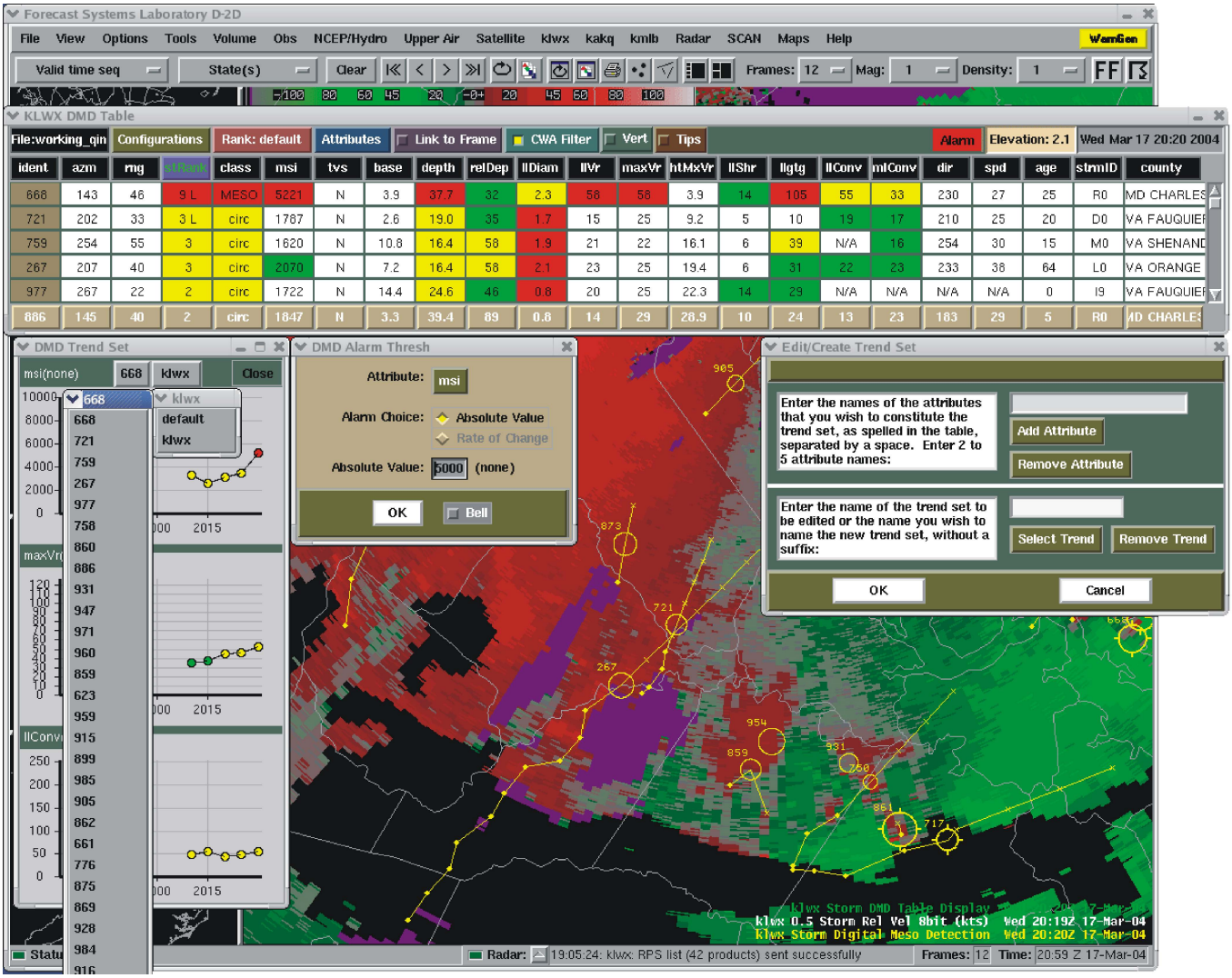

Figure 3 This figure includes the D2D, SCAN DMD Table, Alarm Threshold window, Edit/Create Trend Set window, and a trend set example.

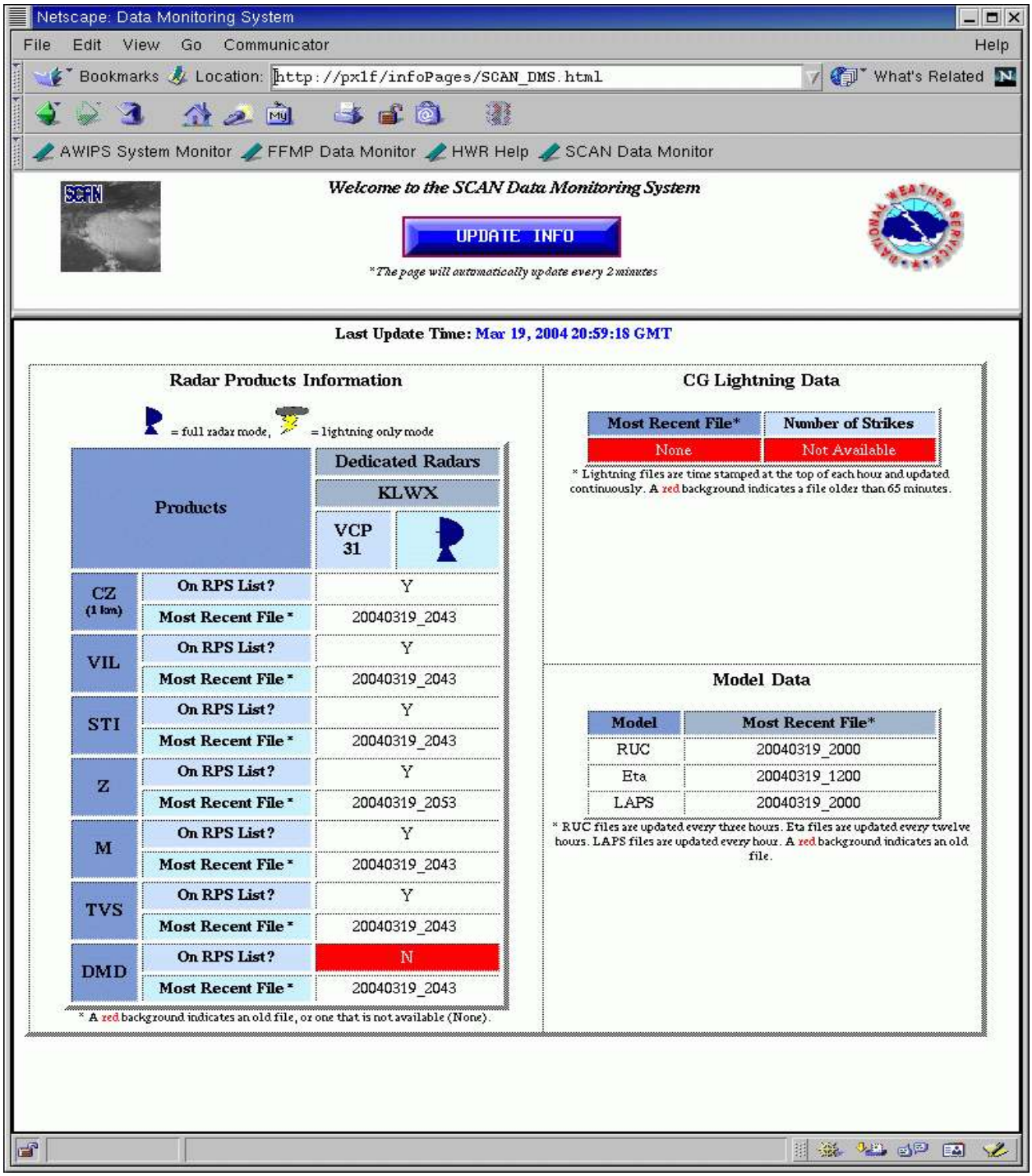

Figure 4 The SCAN Data Monitoring System display.

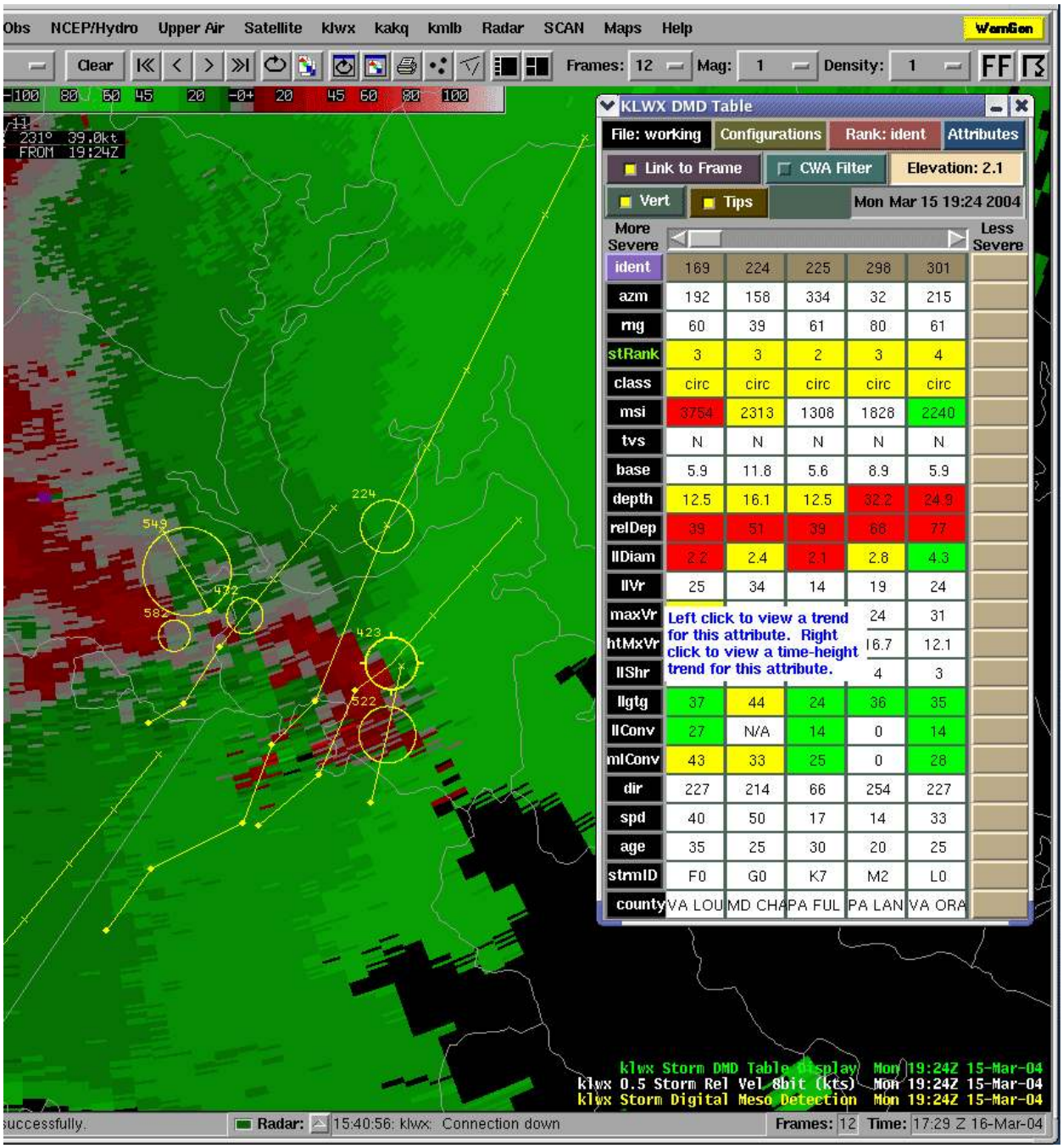

Figure 5 This is an example of the vertical format of the DMD Table, with tip visible.

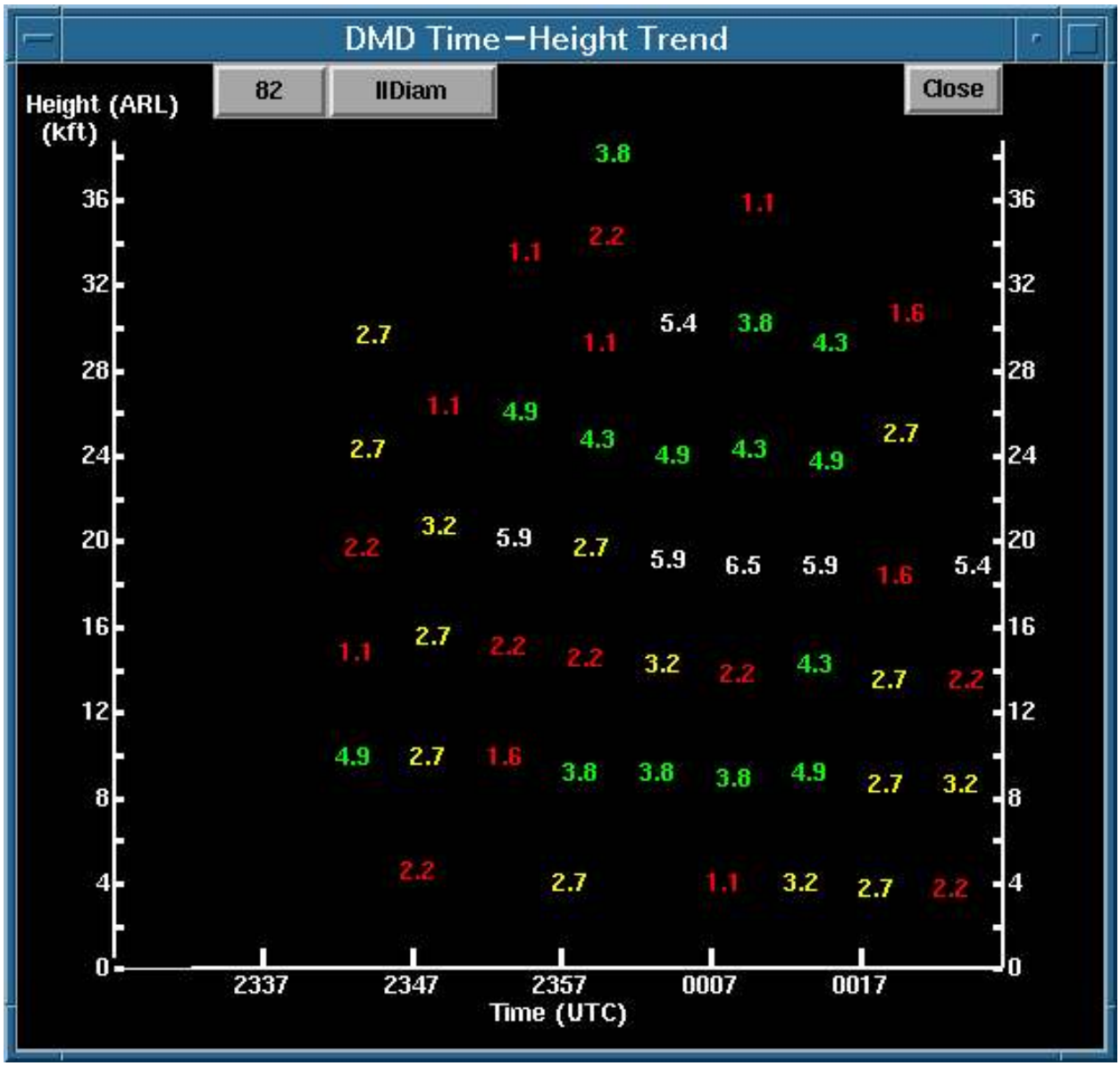

Figure 6 This is an example of a Time-Height Trend, showing the Low-level Diameter of circulation #82. The columns appear vertically tilted due to the time of arrival of each elevation. The rows do not have a constant height due to changes in the distance from the radar.

Help ↩

To report problems or ask questions concerning the operation of SCAN DMD in general, please use the SCAN list server (awips-scan@infolist.nws.noaa.gov). Please check the SCAN homepage at http://www.nws.noaa.gov/mdl/scan for more information, including the latest troubleshooting tips, version release information, and testing results.

Glossary ↩

ACT - Attribute Color Threshold

CGI - Common Gateway Interface

CWA - County Warning Area

CZ - Composite Reflectivity - 1km (a radar product)

D2D - Display 2 Dimensions

DFC - Display Filter Control

DMD- Digital Mesocyclone Detection

DMS - Data Monitoring System

GUI - Graphical User Interface

MDL - Meteorological Development Laboratory

RPS - Routine Products Set

SCAN - System for Convection Analysis and Nowcasting

VCP - Volume Coverage Pattern

Appendix A SCAN DMD Table Attributes ↩

Attribute	Definition	Units	Can be used for ranking?	Can be multi-colored?	Trend available ?	Time-Height Trend ?
ident	Circulation ID	Numeric, three digit	Ascending	No	No	No
azm	Current Azimuthal Position	Degrees	Ascending	No	Yes	No
rng	Current Radial Position	nmi	Ascending	No	Yes	No
stRank	Circulation Strength Rank	none	Descending	Yes	Yes	Yes
class	Circulation Type	char	No	Yes	No	No
msi	Mean Strength Index	none	Descending	Yes	Yes	No
tvs	Tornado Vortex Signature	none	No	Yes	No	No
elev0	Flag:Feature Detected at Lowest Tilt	none	No	No	No	No
base	Height of Base of Circulation	kft	Ascending	Yes	Yes	No
depth	Depth of Circulation	kft	Descending	Yes	Yes	No
relDep	Depth of Circulation Relative to Storm Depth	%	Descending	Yes	Yes	No
llDiam	Low-level Diameter	nmi	Ascending	Yes	Yes	Yes
llVr	Low-level Rotational Velocity	knt	Descending	Yes	Yes	Yes
maxVr	Maximum Rotational Velocity	knt	Descending	Yes	Yes	No
htMxVr	Height of Maximum Rotational Velocity	kft	Ascending	No	Yes	No

Attribute	Definition	Units	Can be used for ranking?	Can be multi-colored?	Trend available ?	Time-Height Trend ?
llShr	Low-level Shear	10^{-3}/s	Descending	Yes	Yes	Yes
llgtg	Low-level Gate-to-Gate	knt	Descending	Yes	Yes	Yes
llConv	Low-level Convergence	10^{-3}/s	Descending	Yes	Yes	No
mlConv	Mid-level Convergence	10^{-3}/s	Descending	Yes	Yes	No
dir	Direction of Movement	degrees	Ascending	No	Yes	No
spd	Speed of Movement	m/s	Descending	No	Yes	No
age	Age of Circulation	sec	No	No	No	No
strmId	Identification of Parent Storm	AlphaNumeric	Ascending	No	No	No
lat	Latitude of Circulation Centroid	degrees	No	No	No	No
lon	Longitude of Circulation Centroid	degrees	No	No	No	No
county	County Location	none	Ascending	No	No	No
cwa	County Warning Area Location	none	No	No	No	No

NOTE: “Low-level” means 0-2km AGL. “Mid-level” means 2-4km AGL. All heights are above radar level (ARL).