

## 2.20 WARN: Warning/Centroid Product

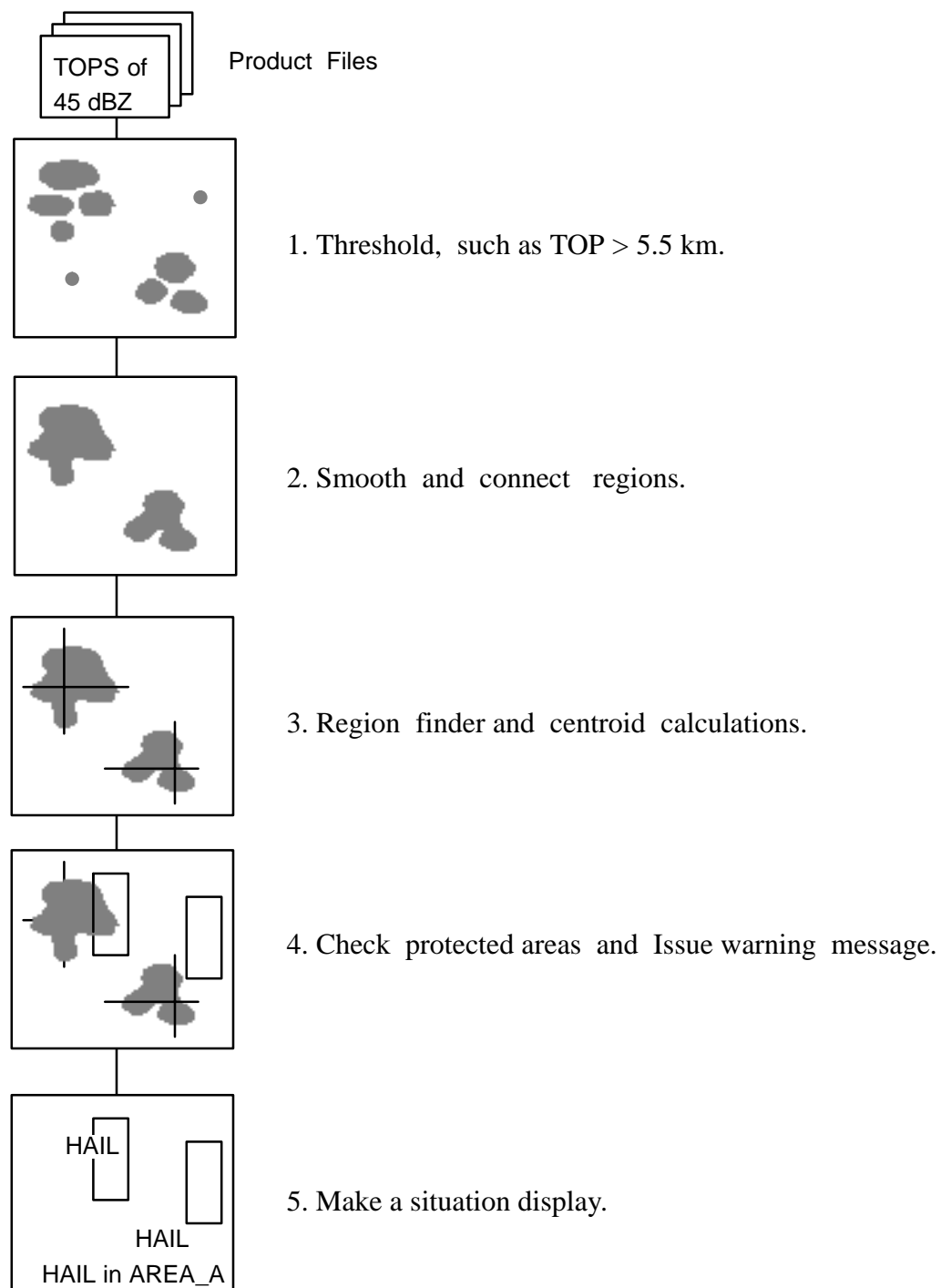
The WARN product looks at other IRIS products to detect significant weather. For example, the occurrence of 45 dBZ at 1.5 km above the freezing level is a good indicator of hail in many mid-latitude locations. Suppose the freezing level is at 4 km, and you run an echo TOPS product for the 45 dBZ contour. If the TOPS product shows 45 dBZ tops at heights greater than 5.5 km, there is a high probability of hail.

Before issuing a HAIL alert, you might also check for a region of hail signature at least 10 km<sup>2</sup> so you don't issue an alarm based on a single pixel. This is called a "threshold region." To further reduce the possibility of a false alarm, you might also look at the VIL for the same region between 1 and 10 km to see if it is greater than 5 mm (or some other value determined from the local climatology of hail). Clearly you could construct some powerful tests, but it would be nearly impossible to monitor all of the various displays and parameters in real time.

The WARN product automates this procedure so you don't have to spend time searching every product for significant weather. In other words, the WARN product rather than the operator does the tedious task of searching the products for significant weather, then alerts the operator when an event is detected. Figure 2-10 shows how the WARN product works.

1. Threshold the input product (45 dBZ TOPS in the example) so that only points greater than the threshold are considered (for example,  $>>5.5$  km). The result is a 2-D array of "ones and zeroes."
2. Smooth and connect the regions that are almost touching, and eliminate any isolated bins.
3. Contiguous regions are identified by a Region Finder procedure. The centroid location and area of each region is computed. Regions below the threshold size are discarded.
4. Determine whether any part of any region is in a protected area. If so, a warning message and audio beep are broadcast to all IRIS terminals.
5. The output of the WARN product is a situation display, also called an overlay display because it can be overlaid on any X-Y product display as selected in the Product Output menu. For example, a HAIL warning display can be overlaid on a display of PPI reflectivity to show the relationship between the warning and the current weather.

**Figure 2–10: HAIL Warning/Centroid**



The text of the message can be constructed by the user. For example:

**2 HAIL Warnings at 11:30:00 in: AREA\_A AREA\_B**

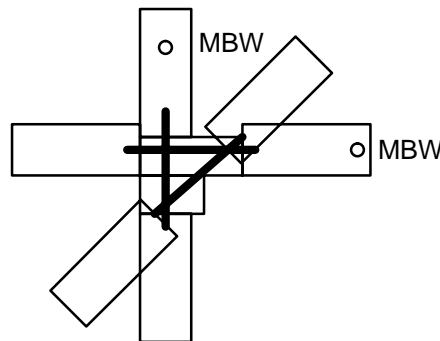
In this case, “HAIL” is the user-selected warning text and “AREA\_A” is the user-selected name of the protected area. The names and locations of protected areas are defined in the IRIS **setup** utility. As with all IRIS messages, these messages are added to the Message Summary menu.

The contents of the Situation Displays are as follows:

- Outlines of active protected areas.
- Warning text at each centroid location which exceeds threshold size (such as, HAIL or MBW).
- A warning message.

An example is shown in Figure 2–11 for the case of a microburst warning (MBW) based on the optional radial shear product. Note that a warning display can also be transmitted with a selectable geopolitical overlay (as with any other product).

**Figure 2–11: Example of Warning Situation Display**



2 MBW Warnings in 2 regions at 11:30:30  
RWY\_35D: 1 RWY\_09D: 1

The outlines of the protected areas are shown for the areas included in the WARN product. Note that in the example, the runway outlines are from a separate overlay map which is merged with the product when it is displayed.

The warning text (MBW in the example) is displayed at the centroid location of the weather phenomenon that has been detected. If a weather phenomenon has been detected in a protected area, the warning message is displayed in large characters across the bottom of the screen. The time associated with each warning is also displayed. If more than one hit is detected in a protected area, then the number of hits is displayed. A legend on the right of the display summarizes the characteristics of the product. This includes the product ID, date, data time and a summary of the product configuration parameters.

Up to three criteria can be used. The thresholding and smoothing is performed separately for each, then the results are ANDed together so that centroid definition is performed on the combined field. For example, the additional criterion of the 1 to 10 km VIL >> 5mm could be added to reduce a HAIL warning false alarm rate.

Because of this general approach, the automatic warning feature can provide alerts for a wide variety of weather phenomena, such as the approach of a severe storm, turbulence, lightning hazard or flood potential. Some additional examples of warning criteria are summarized below:

- **Wind Shear Detection**

[Shear > 10 m/s/km at 0.5° EL] .AND. [ ... at 0.7° EL] over an area of 3 km<sup>2</sup>

- **Storm Turbulence Detection**

[Spectrum Width > 6 m/s] .AND. [Reflectivity > 20 dBZ] over an area of 10 km<sup>2</sup>

- **Hail Detection**

[45 dBZ TOPS > 1.5 km above freezing level] over an area of 10 km<sup>2</sup>

- **Precipitation Surveillance Detection**

[1.5 to 14 km VIL > 1mm] over an area of 10 km<sup>2</sup>

- **Severe Storm Detection or Lightning Hazard**

[1.5 to 15 km VIL > 10 mm] .AND. [10 dBZ TOPS > 8 km] over an area of 10 km<sup>2</sup>

- **Flash Flood Warning**

[Hourly Rainfall or N-Hour Rainfall > 5 mm] over an area of 25 km<sup>2</sup>

Each criterion, surrounded by square brackets above, is one TASK. The results of multiple TASKS are ANDed together.

## 2.20.1 WARN Product Configuration Menu

wind WARN Product Configuration: SEVERE

File Menus Type Commands Help

Warning Symbol

Area in Sq Km

	Type	Product Name	Time	Threshold
1	CAPPI	Z_030_120	00:00:00	40.0
2				
3				

Apply Clear

Protected Areas for Warning Alert

TDWR Style ☒ Say Warning ☒

The WARN product configuration menu looks different from the other product configuration menus. It lets you specify the message, the area of the threshold region, up to three products to use as criterion for the warning, and up to 16 protected areas.

### To open the WARN Product Configuration menu:

Choose **Type**→**WARN** from the menu bar.

### Warning Symbol

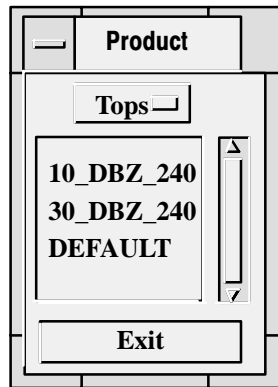
Use the Warning Symbol field to specify the text is used in the warning messages and the text displayed at the centroid position on the situation display. For example, the text may be, “HAIL” or “MBW”, “S++”, or “TRW+”. Note that if there is a defined icon with the same name, then the icon symbol can be displayed.

### Area in Sq Km

Enter the minimum size of a thresholded region in the Area in Sq Km field. Areas that do not meet or exceed this size are discarded. Enter the desired value in sq km. For example, for a 3 km by 3 km size area, enter “9”.

## Product Type and Product Name

The automatic warning algorithm operates by looking at other products. The center portion of the menu lets you select up to three products to be examined.



The product type and product name are specified by menu selection. Pick the type first — the list of product names then corresponds to the selected type. Note that this list is based on products currently on your system. If the product you want does not show, you should run your system until it is there. Alternatively, you can pick a different product of the desired type, then override the product name.

There are some important restrictions on the characteristics of the products that you select.

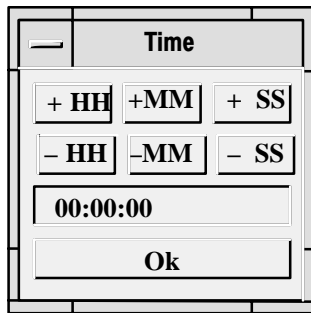
- The products must have the same maximum product range per the respective Product Configuration menus.
- The products must have the same resolution per the respective Product Configuration menus.
- The products must be of a supported data type. Current data types supported are: dBt, dBZ, dBZc, Height, Kdp, LDRH, LDRV, R, Rain, RhoH, RhoV, RhoHV, Shear, SQI, Time, VIL, Width and ZDR.

Errors are reported at run time in the Radar Status menu. Note that as long as these requirements are observed, the associated TASKS can be very different.

## Time

The Time field lets you use products taken from different TASKS or different runs of the same TASK. This field applies only when there is more than one criterion. For example, suppose the second criterion has a time of 00:10:00. When the first product becomes available, the scheduling algorithm searches back in time as far as 10 minutes to find a version of the second product.

If you are using products based on different TASKS, you must set the Time field to some nonzero number or the product never runs. Some knowledge of your TASK schedule is required. In general, if all of your product criteria are based on the same TASK, you should set all of the times to 00:00:00 so that only data from the same run are used.



You set the time by clicking on the Time button. This pops up the Time window. Using the plus and minus buttons, you can increase and decrease the hours, minutes or seconds. When you are satisfied, press Ok to exit from the window. The time you specify is inserted into the field.

You may also type a time value into the window and press Ok to insert it into the field.

## Threshold

The Threshold field selects the value of the product parameter used as the threshold. The WARN product considers only those values that meet or exceed the threshold. The units of measure depend on the selected product. For example, a Tops threshold is specified in km, while a VIL threshold is specified in mm. You may want to refer to the appropriate Product Configuration menu if you are uncertain about the units of measure.

It is important to realize that the WARN product operates on the color bands in the product image and that the threshold is set accordingly. For example, suppose you want to set up a reflectivity warning based on a CAPPI product. First, display an example of the product, then pick your threshold to match the number displayed with the color band that will serve as your threshold. If 45 dBZ is the number displayed with the red color, and you set your threshold to 45 dBZ, then all of the regions displayed as red (or “greater”) will be included in the warning algorithm. This is convenient for verifying the algorithm. If you display the reflectivity product along with the situation display (warning overlay), the centroid labels will be positioned precisely in the red-colored regions.

For the VVP product, the threshold refers to the divergence in units of m/s per km ( $10^{-3} \text{ s}^{-1}$ ). When the Warning product is run for the VVP, a warning is generated if the divergence exceeds this value at any height in the VVP. Strong low-level divergence over the radar could be an indicator of a microburst. Proper setting for microburst alert applications requires that the user have knowledge of the local characteristics of the phenomena.

## Protected Areas

Click on the Protected Areas button to see a list of areas. Simply toggle a choice on or off.

The protected areas are configured in the **setup** utility. They are constrained to be rectangles with arbitrary size and orientation angle. There is a limit of 16 areas. (If you make a change to **setup**, you must restart IRIS for the change to take effect.)



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**Important Hint: It is a good idea to make a large area (for example, 500 by 500 km) named ALL. When ALL is selected, the entire radar area out to 250 km range is a protected area.**

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## TDWR Style

IRIS supports two formats of warning messages. In TDWR format, only the strongest centroid in the highest priority area is reported along with its strength. For example: “MBA 3MF 30K–”, in spoken language: “Microburst Alert, Three Mile Final, 30 Knot loss”. The older IRIS format reports all centroids in all protected areas, for example: “3 MBA warnings at 11:30 in: 3MF, 2MF”. These messages are displayed at the bottom of the display screen, signalled as a pop-up when they are generated, and optionally spoken.

## Say Warning

Pushing this button tells the product generator to verbally signal the warning message in addition to displaying it as a pop-up message. You must also select “Enable Speech” from the Setup pull-down menu in IRIS.

## 2.20.2 Using the WARN Product

The WARN product is designed to save the operator from the tedious TASK of screening data for significant weather. To function effectively, a WARN product must be based on the local climatology and experience. SIGMET, Inc. can work with customers to assist them in developing such a climatology or in advising customers on the capabilities and limitations of the WARN product.



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**SIGMET makes no warranty, either express or implied, that the WARN product will detect all hazardous weather situations. In no event can SIGMET, Inc. be held liable for damages of any kind for failure of the WARN product to issue a warning, or for false alarms that may be issued by the WARN product.**

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