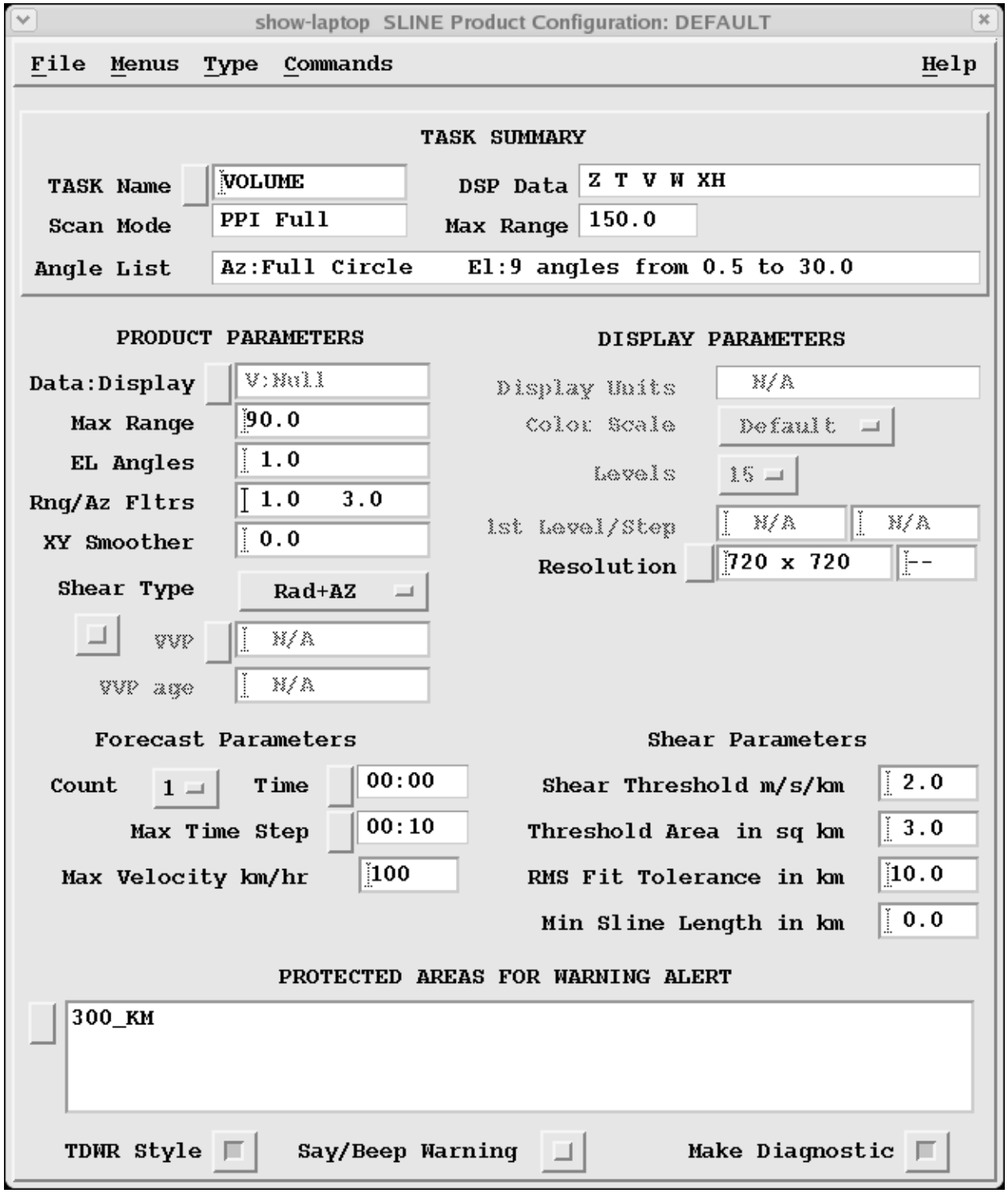
3.6 SLINE: Shear Line (Optional)

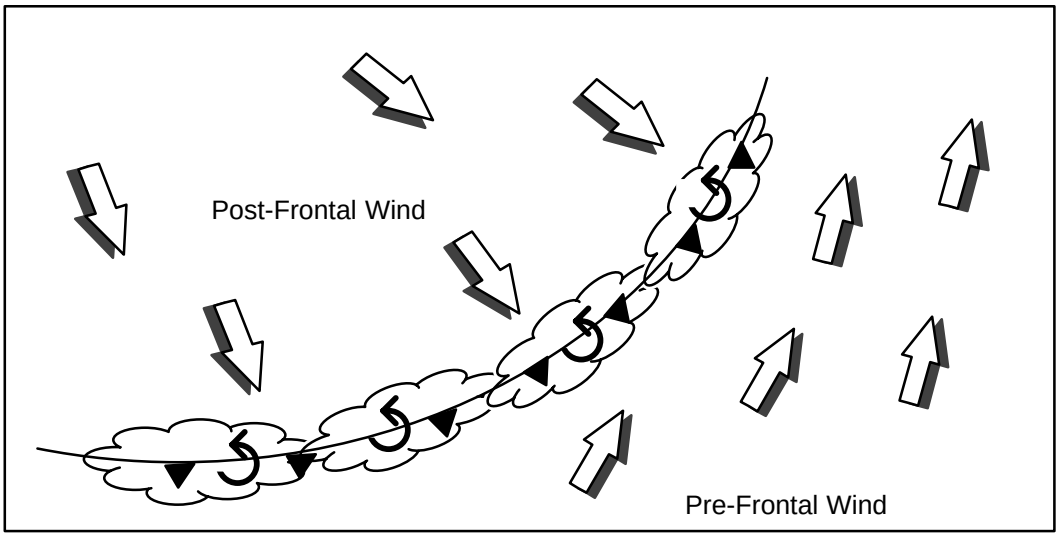


This section describes the fields of the Product Configuration menu that are unique to SHEAR products. For general information, see these other sections of this chapter:

- Task Summary area, Section 2.1.1.
- Product Parameters, see Section 2.1.3.
- Display Parameters area, Section 2.1.4.

A shear line, or frontal boundary, marks the transition between two air masses. Because the wind can be very different on either side of the air mass, sudden wind shifts occur when a frontal boundary passes. Figure 3–10 shows an example of a typical shear line. The most severe wind shifts are associated with mesoscale gust fronts, which occur at the leading edge of a thunderstorm outflow, and with larger scale cold fronts, which may be associated with severe weather.

Figure 3–10: Typical Shear Line Features



The Shear Line product can detect these sudden wind shifts and provide advance warning of their approach, with best estimates of both the time of arrival and the expected speed and direction of the new wind.

To open the SLINE Product Configuration menu:

Choose **Type–>SLINE** from the menu bar. You can use **File–>Open** to load an existing product configuration into the menu. Note that many of the configuration parameters for Shear Line products are the same as for Shear products.

Data : Display

V Shear

EL Angles

Enter the elevation angles of data you want to process. Wind shears associated with gust fronts and microbursts are usually low-level phenomena, so angles of 1 degree or less are typically used to detect these. Either one or two angles may be selected. When two angles are selected, both must be above the threshold to be included in the shear line.

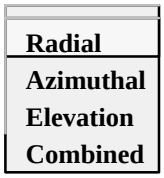
Rng/Az Filter

The first number defines the range length scale for the SHEAR product, in km. This distance determines the size of the skip that the SHEAR product can tolerate when there is missing data. It also specifies the length of the the radial smoother, which is applied before the XY smoother.

The second number is the azimuth length scale in degrees. The skipping and azimuth range length are analogous to the range filter. See the description of the SHEAR product, Section 3.5.

Shear Type

Choose one of types of shear to be computed:



Radial Shear — The bin-to-bin difference in the radial velocity.
Azimuth Shear — The azimuth-to-azimuth difference in the radial velocity.
Elevation Shear — The vertical difference in the radial velocity.
Combined Shear — The RMS value of the radial, azimuth, and/or elevation shear. This is sometimes referred to as the total shear.

Refer to the description of the SHEAR product in Section 3.5.

VVP

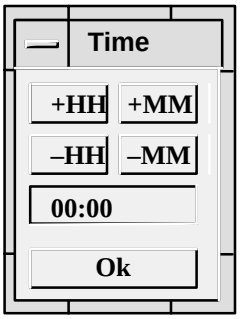
Select the name of a VVP product. The wind speed and direction from the nearest VVP wind product of this name is used to remove the effect of the mean wind on the azimuth shear calculation. This product should be scheduled to run. Use of the azimuth or total shear is not recommended without this correction.

VVP Age

The maximum number of minutes between the data for the VVP product and the data for the SLINE product. This prevents old VVP winds from being misapplied. If no VVP product is found, no mean wind correction is applied when computing the azimuth shear.

Count and Time

Enter the number of forecast points and the time interval between each forecast point.



You set the time using the plus and minus button to increase and decrease the hours or minutes. 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 directly in the Time window and press Ok to insert it into the field.

Max Time Step

When making a forecast of shear line motion, the previous shear line product is used. The Max Time Step field specifies how far back in time the previous SLINE product can be. If none exists in this time frame, no forecast is made.

Max Velocity

Enter the maximum expected velocity. If the computed velocity exceeds this value, the shear line is considered to be a new feature, and no forecast is made.

Shear Threshold

Enter the minimum speed difference per km that must be present to indicate a shear line. Winds that do not meet this speed are ignored.

Threshold Area

Enter the minimum size of the wind shear area in square km that must be present to indicate a shear line. Wind shear areas that are below this threshold are ignored.

RMS Fit Tolerance

Enter the standard deviation allowed when fitting the shear line. The line is thrown away if the points do not fit within this tolerance, indicating a random scattering of points and not a shear line.

Minimum Sline Length

Enter the minimum length distance in km that will be used to estimate a shear line. Shear lines that are below this length will be ignored.

Protected Areas for Warning Alert

Specify one or more protected areas. A warning is generated if a shear line is within a protected area or is forecast to move into one. Click on the Protected Areas button to see a list of areas. Simply toggle a choice on or off. When you exit from the list, the names of the selected areas are displayed in the field.

Protected areas are configured with the **setup** utility. They are constrained to be rectangles with arbitrary size and orientation angle. Up to 32 areas can be configured. (If you make a change to **setup,** you must restart IRIS for the change to take effect. See the *IRIS Utilities Manual* for information on **setup**.)

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.

Make Diagnostic Results

In addition to the SLINE product, you can create a thresholded version of the input SHEAR product, useful for testing purposes. It will have the same product name as the SLINE. Unless you encounter a problem with the product, you can turn this feature off.

3.6.1 Shear Line Radar Signatures

Detection of shear lines is based on the Doppler velocity rather than the reflectivity. However, accurate measurement of the Doppler velocity requires sufficient returned power. The radar reflectivity associated with shear lines can be from precipitation or clear air echoes. Because clear air echoes tend to be weak, the most efficient detection requires that the radar scan slowly for sufficient averaging.

The climatology of shear lines for a particular location dictates the scan strategy. If shear lines tend to be associated with weak returns, a slow scan rate is necessary for reliable detection. The trade-off between reliable detection of weak echo features and the need for rapid updates to detect phenomena such as microbursts is a decision that you must make, based on your site and application.

Shear lines are characterized by both vorticity and convergence (negative divergence). The vorticity associated with cold fronts in the northern hemisphere is typically positive. The vorticity associated with thunderstorm gust fronts is usually, but not always, positive. Shear lines are not characterized by positive divergence, as are microbursts.

Both azimuthal shear (partial vorticity) and radial shear (partial divergence) typically show a signature for a shear line.

3.6.2 The Shear Line Algorithm

The Shear Line algorithm uses the uniform wind assumption.

1. The radial, azimuthal, or combined shear are computed using the SHEAR algorithm. The previous VVP wind is used to remove the apparent azimuth shear caused by the mean wind. The shears are computed using polar data and the output is then X-Y data to a selectable grid spacing.
2. The shear magnitude is thresholded with regard to strength and area within a specified area. Shear regions less than the threshold or smaller than the area limit are not considered.
3. The shear magnitude values of two elevations are ANDed. This step is optional if a second elevation is specified.
4. A curve is fitted to the shear field to detect a linear region. Points that fall outside the curve are eliminated, and the curve is refit. Only one shear line can be considered in a product.
5. The speed of motion normal to the gust front is obtained by comparing the data from the current shear line location with the data from the previous location.
6. The VVP wind is computed in both areas defined by the shear line using the uniform wind assumption.
7. The computed motion is projected to determine if and when the shear line will cross each protected area.
8. The results are output.