2. Configuring IRIS Products

Thsi chapter describes the configuration of the IRIS meteorological products using the Product Configuration Menu. IRIS lets you create products for a wide variety of applications. These products provide information that can be used directly for weather nowcasting and forecasting.

The Live Action feature of the Quick Look Window allows you to configure many IRIS products interactviely and instantly see the results. See Section 5.5 for a description of Live IRIS. In this chapter, all products that support the Live IRIS feature are indicated by the “Live” icon (heart).

IRIS products can display radar data in many ways. For example, the CAPPI product shows the distribution of a radar parameter, such as reflectivity or spectrum width, at a constant altitude. The echo tops product shows a color contour map of the height of a selected reflectivity surface. The rainfall products, RAIN1 and RAINN, show the accumulation of precipitation over selectable time periods. There is even a product — the WARN product — that looks at other IRIS products to determine if there is significant weather, such as reflectivity or wind shear greater than a threshold amount.

Every product is associated with a TASK. TASKS collect information from signal processors and store the data on disk in ingest files. TASKS are configured with the TASK Configuration menu, described in the *IRIS Radar Manual*.

To enter the Product Configuration menus:

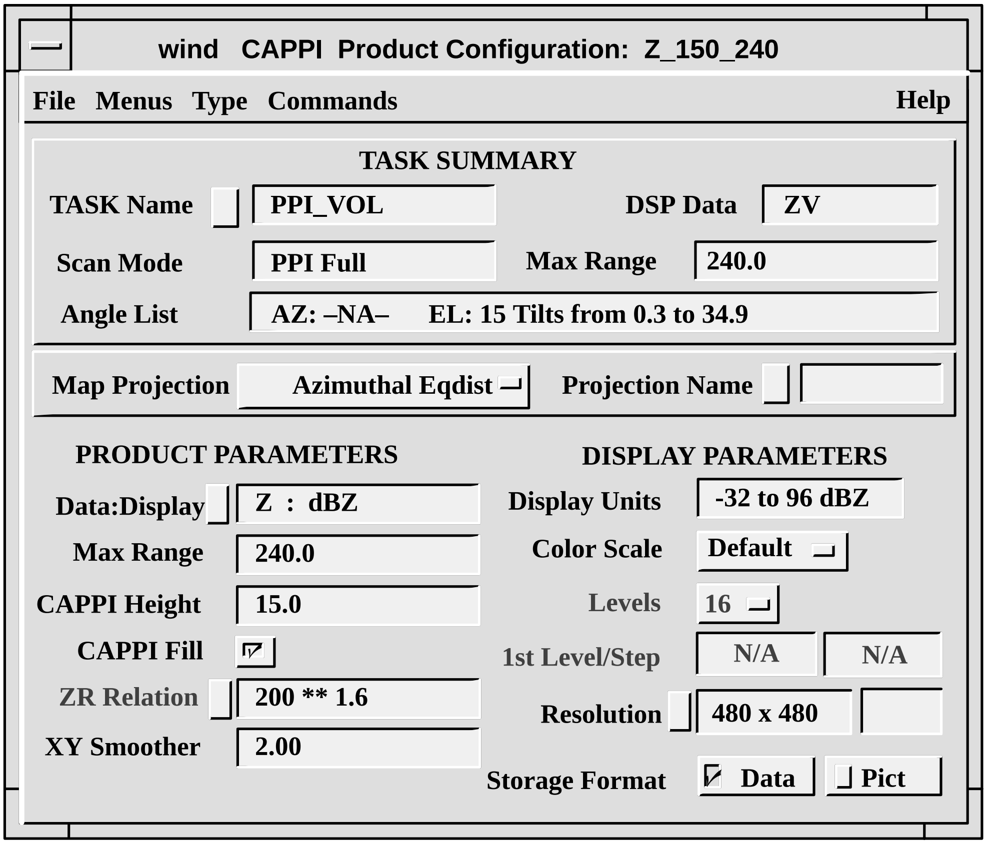
Choose **Menus–>Product Configuration** from the IRIS menu bar or from any of the IRIS menus.

In the following chapters:

FCAST: Forecast	**Section 2.5**
HMAX: Height of Maximum Reflectivity	**Section 2.6**
MAX: Maximum Reflectivity	**Section 2.7**
NDOP: Multiple Doppler	**Section 3.4**
PPI: Plan Position Indicator	**Section 2.8**
RAIN1: Hourly Rain Accumulation	**Section 2.9**
RAINN: N-Hour Rain Accumulation	**Section 2.10**
RAW: Raw Data	**Section 2.11**
RHI: Range Height Indicator	**Section 2.12**
RTI: Range Time Indicator	**Section 2.13**
SHEAR: Wind Shear	**Section 3.5**
SLINE: Shear Line	**Section 3.6**
SRI: Surface Rainfall Intensity	**Section 2.14**
STAT: IRIS System Status	**Section 2.15**
TOPS: Echo Tops	**Section 2.16**
TRACK: Track/Forecast	**Section 2.17**
VIL: Vertically Integrated Liquid	**Section 2.18**
VVP: Velocity Volume Processing	**Section 2.19**
WARN: Warning/Centroid	**Section 2.20**
WIND: Wind Speed and Direction	**Section 2.21**
XSECT: Cross Section	**Section 2.22**

Appendix B contains a complete set of product configuration examples to help you get your operation started.

2.1 Product Configuration Menu

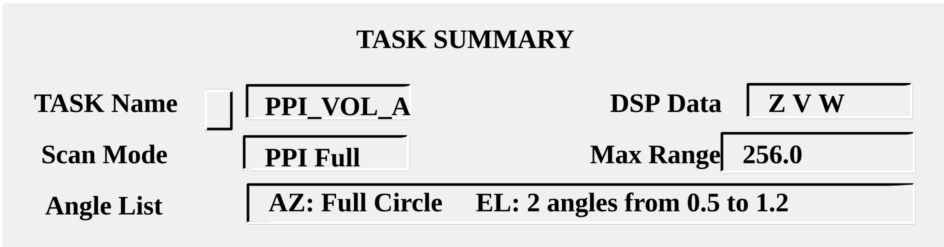


Most Product Configuration menus have the same general format:

Task Summary	Contains information about the TASK associated with the product.
Map Projection	Contains information about types of displays combining data from multiple sources that are not centered on the radar.
Product Parameters	Determines what data and display format to use.
Display Parameters	Further defines how data is displayed by the product, such as the color scale and legend format.

This section describes the information that is common to most Product Configuration menus; each product type is described in detail in its own section in this chapter.

2.1.1 Task Summary



TASK Summary information, taken from the associated TASK, shows the key TASK configuration parameters to help you make consistent products.

Every product is associated with a TASK, which provides the ingest data for the product. To associate a TASK with a product, click on the TASK Name button to pop up a list of TASKS to choose from.

If you are configuring a product to run from ingest data, enter a TASK name, including wildcard characters. The question mark (?) matches a single character; the asterisk (*) matches any string of characters.

If you wish to make volume scan product from hybrid TASKS, you can specify the special case suffixes of “_ABC”, “_AB”, “_BC”, or “_AC” to select which portions of the hybrid to include. These strings are specially interpreted, so do not use any of these suffixes for real tasks. Note that “PPI_X” has the same meaning as “PPI_ABC”, and will require all three tasks to complete.

If you are retrieving RAW data from tape or receiving a RAW product over the network, there is no TASK configuration file on your disk. In this case, you can type the TASK name directly into the field, exactly as it appears in the Ingest Summary menu or the Tape menu.

Important Hint: RHI scans should have the text “RHI” in the TASK name to distinguish them from PPI scans.

There are two important considerations when associating a TASK with a product — matched resolution sampling, and constructing volume scans for a product. Matched Resolution Sampling

For best results, the range bin spacing and number of bins in the TASK should match what is needed for the product. This is called a “matched resolution sample.” The match does not need to be exact because IRIS uses interpolation algorithms. However, for optimized product appearance and system performance the match should be close.

For example, if you are making a low resolution product (240 x 240) to a range of 120 km, and you want a single pixel to represent 1 km of data, then the TASK should be configured with at least 120 range bins spaced 1000 m apart. Note that 170 bins can be displayed to the corners of the product. For a medium resolution product with 1 km bin spacing, the best match is for TASKS with 240 to 340 bins spaced 1 km apart. Note that IRIS can make products for any range bin spacing that can be specified in the TASK Configuration menu, e.g., 500 m or 250 m spacings can be used as well.

For best performance, match the range bin spacing, number of bins and maximum range in the TASK configuration, to the desired pixel resolution, pixel scale and maximum product range in the product configuration.

Constructing Volume Scans

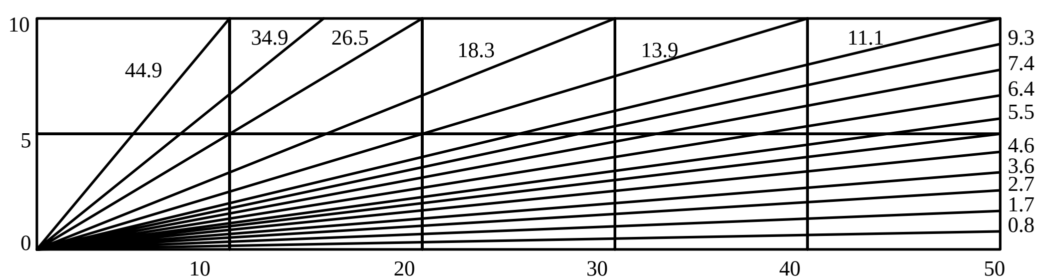
Some products require volume scan TASKS — either PPI Full or PPI Sector scans taken at multiple elevation angles. Volume scan products include:

- BEAM
- CAPPI
- MAX
- TOPS
- VIL
- XSECT
- VVP
- WIND

For these products, multiple elevation angles are required in the associated TASK. In general, there is a tradeoff between the number of elevation angles, the quality of the product and the TASK scan time. More elevation angles produce higher quality products at the expense of taking more time to complete the volume scan.

A typical volume scan is shown in Figure 2–1. In this example, the height resolution is 1 km at 60 km range, for heights less than 10 km. A one degree beam is 1 km wide at 60 km, so this scheme matches the antenna resolution. If close range work is important, one must add higher elevation angles to cover the upper regions.

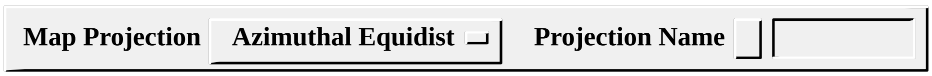
Figure 2–1: Example of 15-tilt Volume Scan



When constructing a volume scan TASK configuration, it is a good idea to do a drawing such as the one in the example, with a 1:1 vertical:horizontal scale so that you get a true picture of the sampling geometry.

Note that the example is corrected for earth curvature, as are all of the IRIS products. Also, because of beam widening effects, the accuracy of all products degrades with range. For example, the beam width at 120 km range is 2 km across for an antenna with a 1° beam. This is a fundamental limitation of radar sampling.

2.1.2 Map Projections



IRIS allows users to specify the type of map projection that is used for display. This is useful for combining the data from other sources or for generating displays that are not centered on the radar. Composites for example, must use a projection so that the data from several radars can be mapped to a single display. Page numbers refer to the projection equations from *Map Projections–A Working Manual, U.S. Geological Survey Professinal Paper 1395*. We assume a spherical earth with radius 6371 km.

The choices are:

- **Azimuthal Equidistant (AED)**—choose this for a standard radar display map where azimuth lines are straight and angles are not distorted. This projection has the property that the distance in the map horizontal direction is the same as the distance in the map vertical direction. This means that lines of constant azimuth (radar rays) are straight and circles can be used to represent lines of constant range. Because of this, the AED projection is particularly convenient for radar applications. For radar applications, the radar is usually placed in the center of the map and the radar location serves as the map reference point. Note that lines of latitude and longitude are not straight in this projection. (page 191)
- **Mercator** —choose this for true Mercator projection mapping where latitude and longitude lines are straight and intersect at right angles. Additionally, a line of constant bearing from a point is straight so it is useful for navigation. Mercator has the advantage that it is very standard so that it is easier to combine data from different sources onto a Mercator projection. It has the disadvantage that at high latitudes, the horizontal and vertical scales are very different (large distortion). (page 38)
- **Polar Stereographic**—Useful near the North Pole. This is essentially the AED projection with the reference point at the North Pole. (page 154)
- **Universal Transverse Mercator (UTM)** —This is a projection just like Mercator with the axis reversed at a selectable longitude. The horizontal dimension is compressed by a factor of 0.9996. By convention the reference longitudes should be multiples of 6 degrees. Is is used by the military, and is good for regions with long North–South extent. (page 48)
- **Perspective**— This is often used for satellite images. We assume that the satellite is at geosynchonous height. (169)

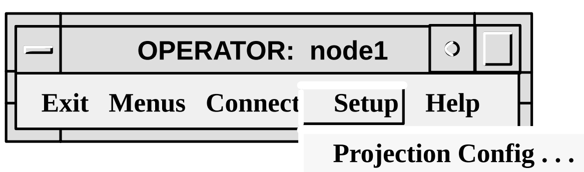
- **Equidistant Cylinder —** This is used for the digital terrain maps in IRIS (e.g., inserted in the **overlay** utility). (page 90)
- **Gnomonic —** All great–circle arcs are straight lines. (page 164)
- **Gauss Conformal —** Same as Universal Transverse Mercator except omitting the 0.9996 scale factor. (page 48)

Any projection can be selected in the Product Configuration Menu. Additionally the user can:

- Select the Projection Name of a preconfigured projection. The Projection Name button in the Product Configuration Menu gives a list of available projection files on the system. In this case the radar Max Range and Output Pixel Resolution are desensitized since they are defined by the projection file that is selected. Projection files are typically used when the radar is not centered in the display.
- Select <NONE> for the Projection Name in which case the radar is defaulted to be at the center of the screen. Additionally in the case of an AED projection, the radar is defined to be the map reference point. In this case, the Max Range and Resolution fields are configurable in the Product Configuration Menu.

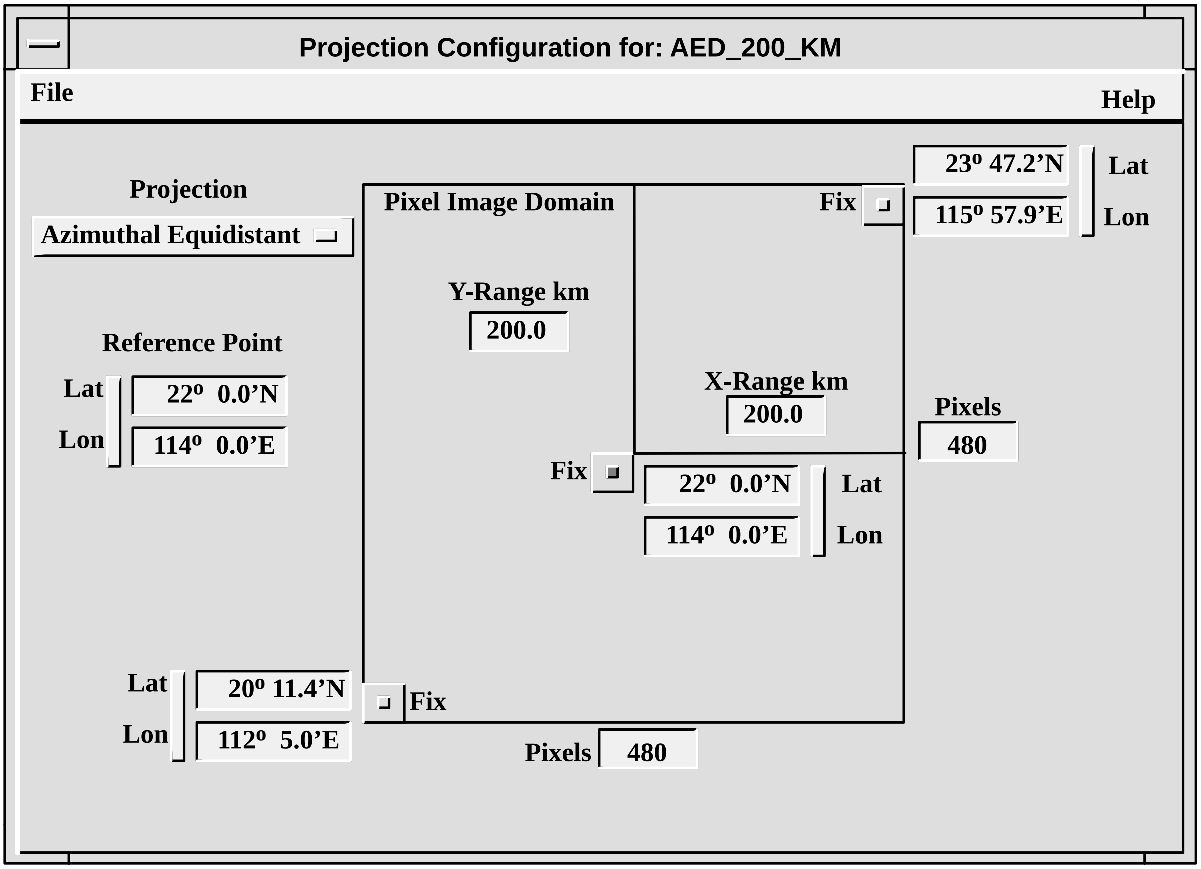
Most of the time you will not need to create or use special projection files. To configure a standard radar display centered on the radar, simply use the features that are contained in the Product Configuration Menu—Azimuthal Equidistant for the projection type and <NONE> for the Projection Name. In the event that you want the radar off-center, then you will need to configure a projection file as described below.

Starting and Using the Projection Configuration Menu



The Projection Configuration Menu is located under Setup in the IRIS Main Menu bar. Select Setup/Projection Configuration ...

The menu appears as shown below.



Define the Projection Type

First select the Projection.

It is important to define the projection type as the first step. The list of available projection files under the File command will be given only for the selected projection type.

File

This functions identical to other IRIS menus. The **File–>Open** command will give a list of existing Mercator or AED files depending on which type of projection is selected. The Save as command allows you to name the projections that you create. The name of the open projection file is displayed in the menu title bar (AED_200_KM in the example).

Reference Point

For AED projections: The reference point is the location from which all azimuths display as straight lines. Usually set to the radar location.

For Mercator projections: Only a longitude is selected. The map cannot cross the line 180 degrees away from this longitude, so set it near your location.

For Polar Stereographic: Only a longitude is selected. The is the longitude line which you wish to have vertical in the map. Effectively this rotates the map.

For UTM: Only a longitude is selected. This is the center meridian of the UTM strip. By convention these are spaced every 6 degrees, starting at 3 degrees. Use a value near your longitude.

Fixing a Corner or Center Location

To configure a projection, you will need to know the latitude and longitude of either the NE or SW corner or the center of the display. You should push the Fix button at the location that you know and then input the lat/lon coordinates. With the Fix button pushed-in, you will be able to change other parameters of the projection geometry without loosing you coordinate information.

Specifying the Projection Coverage Area

Once you have fixed one of the corners or the center, you can now specify the region of the projection in either one of two ways:

- Specify the latitude and longitude of one of the two unfixed points.
- Specify the distance north (Y-Range) and the distance east (X-Range) from the center.

The projection menu acts as a spread sheet. Whenever you change a parameter the other parameters will adjust to reflect the change.

---

i

The spread sheet algorithm will converge on a correct solution even for very strange projections. One example where it may not converge is for an AED projection where the Reference Point is several thousand kilometers from the center of the projection region.

If you encounter a problem with the spreadsheet, check the reference point, then click the Default button to load some valid numbers.

Specifying the Pixels

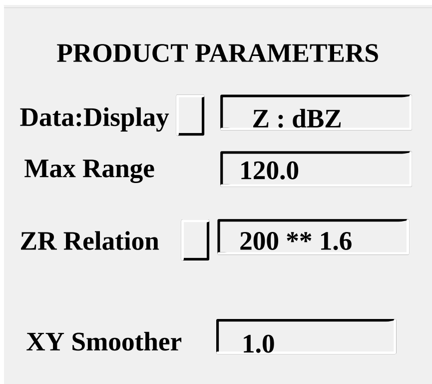
The number of pixels that are used to represent data in the projection is specified for the X- and Y-directions of the output display. If you have specified the other aspects of the projection, then simply input the correct number of X-pixels (horizontal direction). The number of Y-pixels will then adjust automatically.

If you adjust the number of Y-pixels, then other parameters of the spread sheet will change, such as the lat/lon of the unfixed points and the Y-Range.

Fine Tuning the Spread Sheet

Since all of the projection geometry parameters are linked through the spread sheet algorithm, when you change one parameter, other parameters will adjust automatically. This means that you may have to do some compromising. For example, if you want a 480 x 480 pixel Mercator display, both the X- and Y-ranges cannot in general be made equal (e.g., 100 km). In this case, the compromise might be to have an X-range of 100 km and a Y-range of 99.5 km to get a perfect 480 x 480 display. The spread sheet makes it easy to experiment with different compromises.

2.1.3 Product Parameters



Product parameters let you choose what data to take from the TASK and how to display that data.

Data : Display

The Data portion of this field specifies the data parameter from which to derive the product, such as Z, V, W, ZT, ZDR. This information comes from the TASK associated with the product. Some data parameters can be displayed in more than one way. The following display parameters are available:

Data Type	Usage
dBZ	Clutter Corrected Reflectivity
dBZt	Uncorrected Reflectivity
Rain	Rainfall Rate
Liq	Rainfall Depth
Vel	Radial Velocity
Width	Doppler Spectrum Width
ZDR	Differential Reflectivity
Tops	Echo Top Height
VIL	Vertically Integrated Liquid

Data Type	Usage
Wind	Wind Speed and Direction
Shear	Wind Shear

To select a data:display parameter, click on the Data:Display button and pop up a menu of valid choices. The list of choices varies, depending on the product type.

Product Maximum Range

i

If you select a custom Map Projection Name (other than <NONE> you cannot configure this field in the product output menu. This is because the maximum range is determined by the projection configuration. See Section 2.1.2 for a discussion of projection configurations.

This is the maximum range configured for the product, which must be less than or equal to the data range. The maximum range is the range in the E-W / N-S direction centered on the radar. This means that the range to the corners of the resulting display will be greater.

ZR Relation

Unfortunately, weather radars do not measure the rainfall rate (R) directly. Instead the measure a quantity called the equivalent radar reflectivity factor (Z). In general, the larger the reflectivity factor, the larger the rainfall rate. The ZR relationship is a standard technique for estimating the rainfall rate based on the measurement of the radar reflectivity factor. The have the general coefficient exponent form of:

$$Z = 200 R^{1.6}$$ **(the classic Marshall Palmer relationship)**

There are three options associated with this field:

- **Fixed**- In this case, the user can type–in the coefficient and exponent. The default value configured in **setup** is first inserted.
- **Setup**- The coefficient and exponent values set in **setup–>Product–>Product Generation** will be grabbed when the product is run. If the setup values were changed, the new values will be used.
- **Disdrometer**- The coefficient and exponent values are derived from a special GAGE product with the assigned name “DISDROMETER”. The GAGE product contains (optionally) the coefficient and exponent derived from a disdrometer which is measuring the size distributions of particles. Note that this is only available with the IRIS/Hydromet option. When the product is run, IRIS looks for the closest DISDROMETER product, first searching in time (within +– 1 hour) and then opening the file and searching in space by comparing lat/lon (within 200 km is valid). If a valid coefficient and exponent are found, then they are used in the product generation, otherwise the **setup** defaults are used.

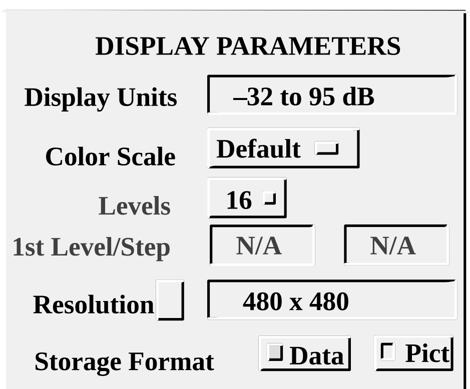
XY Smoother

The X-Y Smoother field performs image processing to average the color contours and interpolate over small gaps or missing pixels in the final Cartesian image. You can specify the length of the smoother in km. This final step can significantly improve the appearance of products for presentation. Also, smoothing can result in better data compression.

A word of caution on smoothing—it requires substantial CPU resources to perform smoothing. The internal limit on the smoother length is 60 pixels, much longer than you probably want to use. If you are going to produce many smoothed products in a regular operation, please observe the following suggestions:

- Use low resolution products together with smoothing. It is faster to make a low resolution product and smooth it than to make a medium resolution product and smooth it. In many cases, the results are nearly identical, so there is no benefit in smoothing high or medium resolution products.
- Use the minimum smoothing length to get the desired effect. That is, don't over-smooth. Larger smoothing lengths require more computation. Don't use a length that is larger than you need.

2.1.4 Display Parameters



The display parameters determine how the product appears.

Display Units

The Display Units field shows the range of values and the units for the product's output values. The values that you can assign to the display units are summarized below. For example, the Echo Tops algorithm outputs values in km to the nearest 100 m spanning the range of 0 to the maximum data height defined with the Setup utility or 25.5 km, whichever is less.

Display Parameter	Maximum Display Range and Display Units
dBZ	–32 to 96 dB mm^6/m^3
dBZt	–32 to 96 dB mm^2/m^3

Display Parameter	Maximum Display Range and Display Units
Rain	0 to 255 mm/hr
Liq	0 to 1000 mm
Vel	$-V_u$ to V_u m/s
Width	0 to V_u m/s
ZDR	–8 to +8 dB
Tops	0 to 25.5 km or height configured in Setup
VIL	0 to 65.0 mm
Wind	Configured in Setup
Shear	+– 25 m/s/km

Color Scale, Levels, 1st Level/Step

The color scale relates numerical data values to colors. The Scale field lets you choose whether to use a uniform scale with a start value and a constant step, or a custom color scale that has been preconfigured for your system:

- Custom color scales are defined with the **color_setup** utility (see the *IRIS Utilities Manual*). Each color scale has a name that has been defined in the Color Setup Utility. Names can reflect scales that are appropriate for different seasons such as “Summer” or “Winter.” If in doubt, select “Default” which is usually configured to be a reasonable scale. The number of scale steps will be filled-in automatically since this is also part of the custom color scale.
- When you choose a Uniform color scale, you pick the number of level steps (from 2 to 16). The following fields should also be set:

  The 1st Level field sets the numerical value used to label the right side of the first level in the color scale for the product. The Step field sets the spacing between the color levels. The numbers in the color legend in the product are spaced by this value.

The units you use for the 1st Level/Step depends on the display parameter, as shown in the following table:

Display Parameter	1st Level/ Step Format
dBZ	+ – XX Whole dBZ
dBZt	+ – XX Whole dBZ
Rain	+XXX.X mm/hr
Liq	+XXX.X MM
Vel	+– X.X m/s

Width	+ XX.X m/s
ZDR	+– X.X dB
Tops	+ XX.X km
VIL	+ XX.X mm
Wind	NA
Shear	+– XX.X m/s/km

In all cases, you simply enter the desired value.

Special case for the mean velocity. Selecting a level step of 0 causes the velocity to be displayed for the entire unambiguous interval between $-V_u$ to $+V_u$. Selecting an odd number of levels produces a legend with a band centered on zero velocity. Selecting an even number of velocity levels does not produce a legend with a band centered on zero velocity, but rather a color break exactly at zero velocity.

Figure 2–2 shows two examples of the display configuration parameters, one for ZT and one for velocity, and the resulting color legends that would appear with the product.

In the case of ZT, the example shows that the bottom of the scale “thresholds” such that data less than –20 dBZ are not displayed, while the top end “saturates” since the top color will include all values greater than 50 dBZ. When you select Uniform scales, the behavior (saturation vs thresholding) of the end of the scales cannot be changed. This behavior is inherited from the custom color scale named ’Default’, which is configured in Color Setup.

In the velocity example, by entering 0 for level step, the display will automatically span the full Nyquist interval. Note that both ends are set to saturate for velocity.

The format of the color legends, with regard to how the numerical legend labels relate to the color band boundaries, is configured in the Color Setup utility for each parameter. This utility offers considerable flexibility for defining how the color legends are constructed for each data parameter. Refer to the *IRIS Utilities Manual* for details.

Figure 2–2: Color Legend Format Example

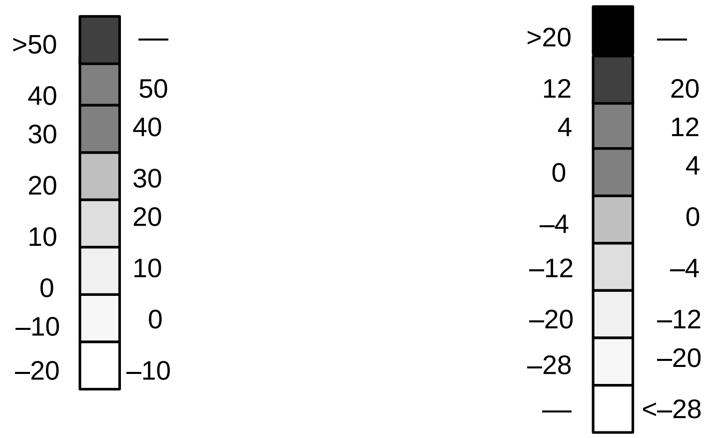
Z or ZT Example

Display Units	–32 to 96 dBZ
Number of Levels	8
First Level	–10
Level Step	10

V Example

For unambiguous velocity +–32 m/s

Number of Levels	9
First Level	NA
Level Step	0



Product Picture Resolution

If you select a custom Map Projection Name (other than <NONE> you cannot configure this field in the product output menu. This is because the resolution is determined by the projection configuration. See Section 2.1.2 for a discussion of projection configurations.

IRIS can produce product pictures in virtually any resolution, from 16 X 16 to 3100 X 3100 pixels. IRIS products are produced specifically for the display resolution that is requested, optimizing the match between the display pixels and the actual radar data. This means that high resolution products are not merely low resolution products with replicated pixels. Likewise, low resolution products are not produced by degrading a higher resolution product. When you request a high resolution product, you get the best possible image that can be generated from the original data. If a low resolution product is requested, the product is computed efficiently by calculating the product only at the requested resolution. In addition to efficient generation, low resolution products can be transmitted over a communications link and displayed more rapidly because they contain fewer pixels.

The Resolution field in the Product Configuration menus shows the X-Y number of pixels. These can be changed by entering different numbers of pixels, or by popping up a menu of the default low, medium or high picture resolutions. The defaults are shown in Table 3–1 for both PPI (square image region with legends to the right) and RHI formats (rectangular image region with legends beneath). The defaults are optimized to the resolution of the standard IRIS display devices.

Table 3–1: Default Picture Resolutions

Default Resolution	PPI (Square) Format*		RHI (Rectangular) Format**	
	X-Pixels	Y-pixels	X-Pixels	Y-Pixels
Low	240	240	288	136
Medium	480	480	600	290
High	720	720	840	530
XHigh	940	940	1060	750

*Square image region with an optional legend to the right.
**Rectangular image region with an optional legend beneath.

Regardless of the product type, IRIS figures out the best way to display your product in either PPI or RHI format. If your image does not exactly match the pixel size of a target display device, IRIS adjusts it to make a best fit. For example, if you output a low resolution image to a high or medium resolution printer, IRIS doubles the pixels so that the display fills the image area. Likewise, IRIS shrinks an image if it has more pixels than can be displayed on an output display device.

If you want the impact of the large screen, but you do not want to burden IRIS with creating high resolution products, specify 360 X 360 display resolution. IRIS will double these numbers to fit exactly into the large display window. Likewise, 240 X 240 images will be tripled to fit exactly into a large display, or doubled to fit into a medium display.

For more information on data formats, refer to the *IRIS Programmer’s Manual*.