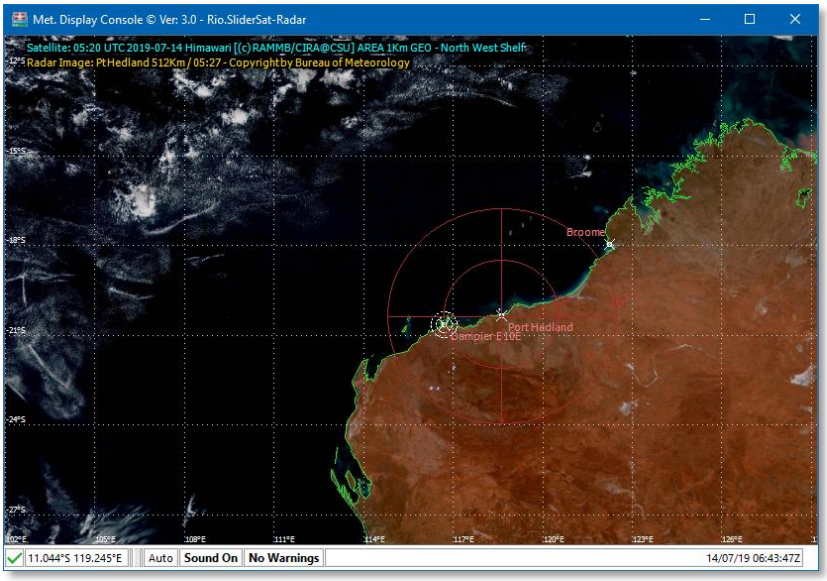
Met. Display Console©

(Previously 'Satellite Squall Tracker'©)

Ver. 3.1.5

User's Manual



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NOTE: For users who hate reading manuals, please at least look at page 11 for important tips, in yellow boxes like this one.

Introduction

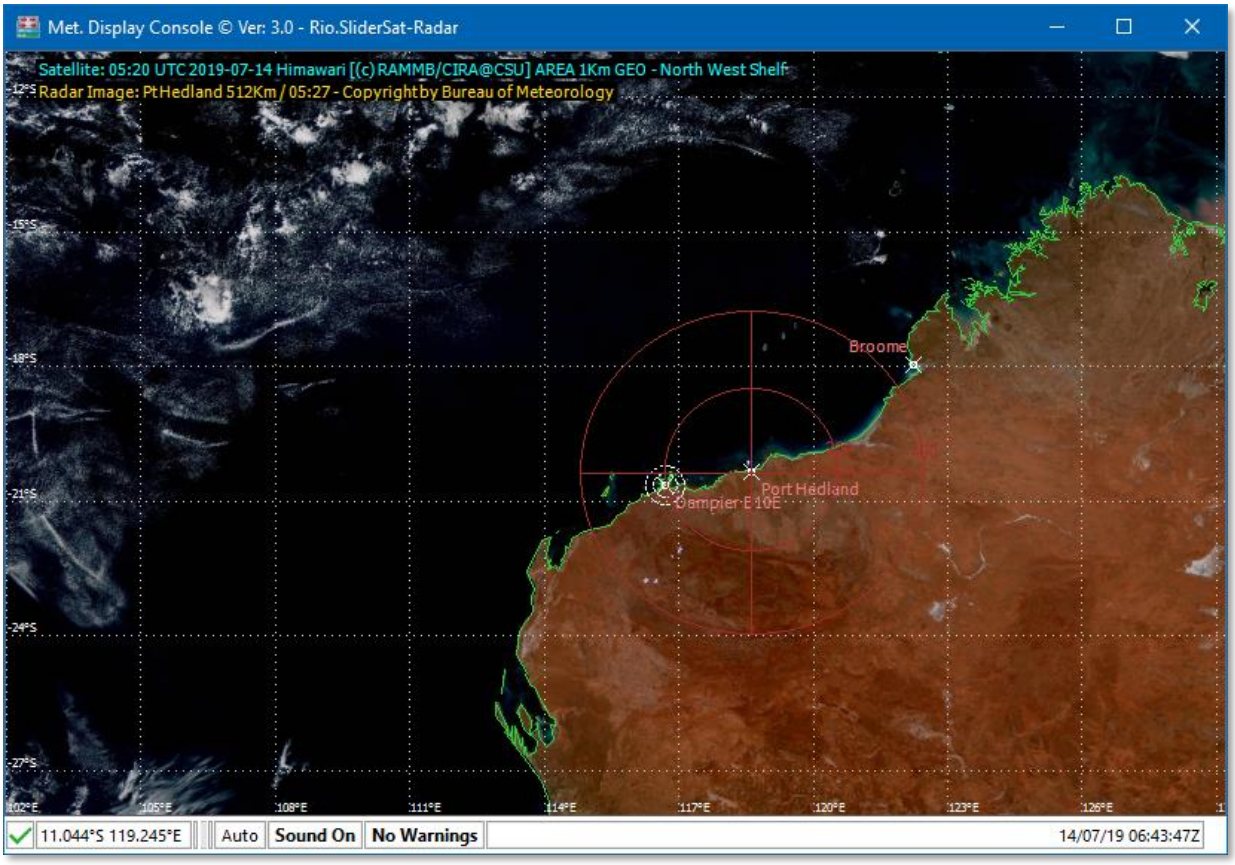
In the field of Meteorology, there is a requirement to be able to visualise various environmental parameters in a geographical mapping format, such that one parameter may be visually superimposed upon another in the same time frame, in order to see the effect of one parameter on another. This requirement is further enhanced when a time series of superimposed images is displayed over a suitable period.

This Display Console allows Meteorological data to be layered one on top of another (e.g. satellite channel imagery on radar imagery, on a map of Steering Winds) in a time series. Each layer's imagery is downloaded or computed by a Plugin DLL (Dynamic Linked Library) that is loaded only when necessary. Each DLL runs in its own process (thread) thereby making maximum usage of today's multi-threaded processors.

At startup, the Display Console waits for the user to select a pre-configured Display Setting, which specifies various sub-settings pertaining to the display, the Plugins required and the Site(s) to display on the final display.

Once the Display Setting has been selected, the Display Console will load the Plugin DLLs and instruct them to start preparing their respective images. One Plugin is designated the 'primary' Plugin, and this Plugin controls the timing of the other Plugins, e.g. Satellite channel(s) received every 10 minutes acting as the 'primary', will dictate that other images from 'secondary' Plugins will also display every 10 minutes (to the nearest time frame available).

Each Plugin reports back to the Display Console when their images are ready, but the display is not updated until the 'primary' Plugin is ready. At that time, the 'primary' images are used as a base upon which the other images are superimposed, which is finally displayed.



The Display Console also offers the following functionality:

- Saving the current image as a JPG, PNG or BMP
- Saving the current image loop as an animated GIF
- Saving the current image loop as a movie (MPEG4)
- Displaying a vertical profile graph of data specified by a user drawn line on the image (providing the Plugin can offer this data)
- Displaying Pixel or Lat/Long co-ordinates of the mouse pointer's current position over the display
- Displaying the value of the pixel directly under the mouse pointer (if the data is available from the Plugin), for any of the layers, on the Status Bar
- Ability to change the configuration of the Display Setting, and each loaded Plugin's settings
- Ability to sound a warning or alarm if a site is deemed to be in danger from some weather phenomenon computed within a Plugin

Minimum Hardware Requirements

Processor: 64-bit architecture, i5 or better (or equivalent).
Operating System: Windows 10.
Memory: 8GB of RAM (preferably 16GB)
Storage: 20GB of free space or more
Screen resolution: 1920 x 1080.

Available Plugins

The following Plugin DLLs (aka Managers) are available (at time of writing):

Ess Satellite Manager

This Plugin supplies satellite images derived from data sourced from OWS (Offshore Weather Services). The multi-channel data are downloaded and saved to a local repository. The data (reflectance and temperature values) are converted to images for each channel, together with appropriate colour bars. No re-projection is required. The images, colour bars and data values are made available to the Display Console.

BoM Satellite Manager

This Plugin supplies satellite images sourced from the Australian Bureau of Meteorology. The VIS (Red Band) and IR1 (Band 13) images are downloaded and saved to a local repository. The data (reflectance and temperature values) are computed from the image colours for each channel, together with appropriate colour bars. No re-projection is required. The images, colour bars and data values are made available to the Display Console. Note that IR2 (Band 15) images are not available. *A licence is required from BoM for commercial use*.

Slider Satellite Manager

This Plugin supplies satellite images sourced from RAMMB/CIRA@CSU. The VIS (Red Band), IR1 (Band 13), IR2 (Band 15) and GeoColor (processed) images are downloaded as tiles, which are then stitched together and re-projected into a linear LAT/LON projection using the GDALWARP utility, and saved to a local repository. Unfortunately, the data (reflectance and temperature values) cannot be computed from the image colours for each channel, as they do not coincide with the online colour bars. The colour bars are created directly from the online versions. The images and colour bars (but not data values) are made available to the Display Console. *Can only be used for research purposes*.

Ceres Satellite Manager

This Plugin supplies satellite images sourced from CERes. The VIS (vis.01), IR1 (tir.01), IR2 (tir.03) and IR3 (tir.08) data channels are downloaded (for the entire hemisphere), which are then cropped to the area of interest, and saved to a local repository. The images, data and colour bars are made available to the Display Console. *Can only be used for research purposes*.

BoM Radar Image Manager

This Plugin supplies radar images sourced from the Australian Bureau of Meteorology. The images are downloaded and saved to a local repository. Sprites are (optionally) removed from the images (actually all white pixels are removed, which also removed light rain, leaving only blue values and above). The images (but not data values) are made available to the Display Console.

Noaa Steering Wind Manager

This Plugin supplies forecast wind map images derived from data sourced from NOAA (nomads.ncep.noaa.gov). Multi-level wind data can be downloaded and saved to a local repository. The data are converted to images (from a GRIB format), and the images and data values are made available to the Display Console.

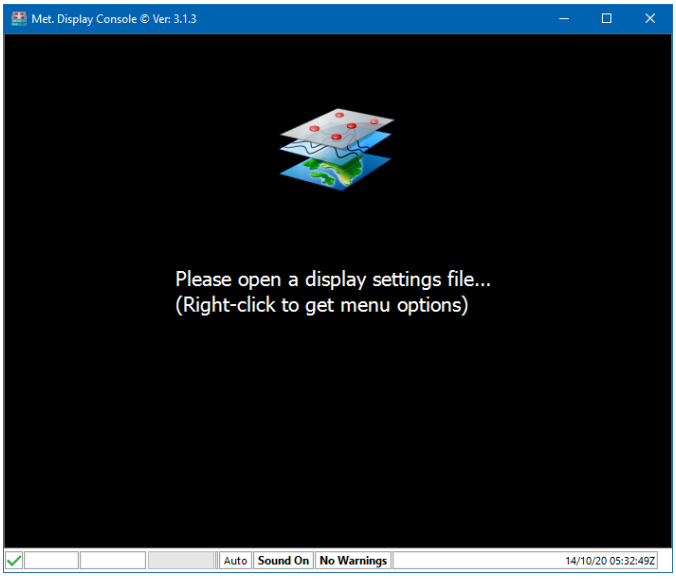
Sat Algorithm Manager

This Plugin alerts the user of an impending squall within a given radius of one or more specific locations of interest. It imports temperature data from other satellite Plugins (via the Display Console) to produce images and squall tracks. Various algorithms are incorporated within the Plugin, specifically the **Indonesian Squall** algorithm, and the **Indonesian Cloud** (both require IR1 and IR2 temperature data), the **ESS Convection** algorithm (requires IR1, IR2 and IR3 temperature data), and the naive **Temperature Only** algorithm which requires IR1 temperature data only.

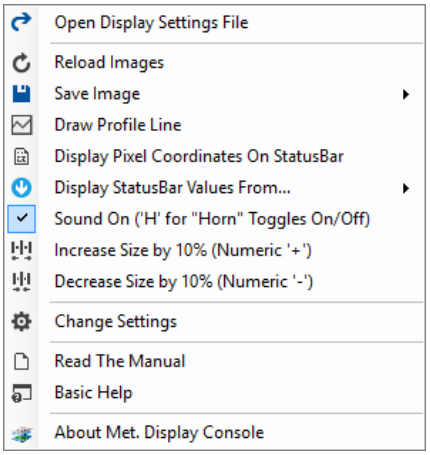
Each Plugin can reference different settings for its type, e.g. the Slider Satellite Manager can reference settings for the Perth area (SliderSatelliteImageManager-Perth.json), or the North West Shelf area (SliderSatelliteImageManager-NWS.json).

Starting Met Display Console

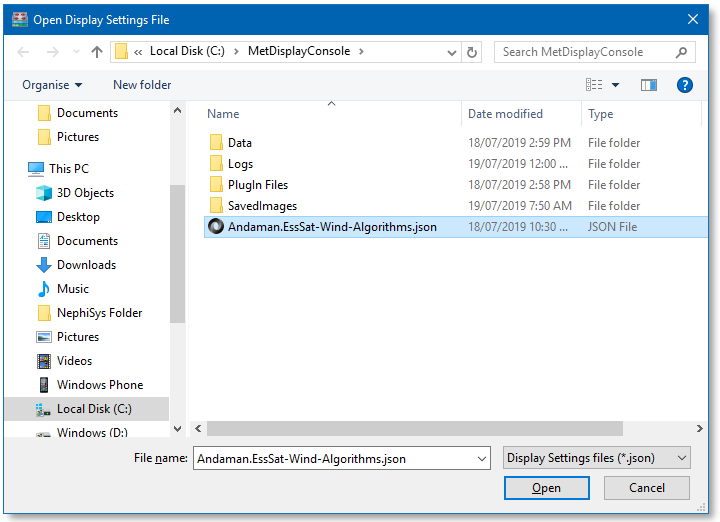
The Display Console can be started in two ways, 1) via user interaction, or 2) via a Windows short-cut in which the command line argument (-startWith: SliderSatelliteImageManager-NWS.json) is given. The first method requires that the user choose a Display Setting:



Where the user **right** clicks anywhere on the Console window:



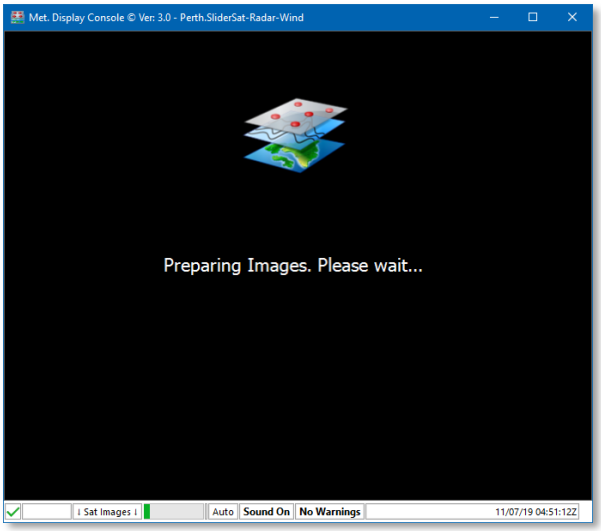
And selects “Open Display Settings File”:



The second start method is via a Windows short-cut which specifies the name of the Display Settings file to run. Windows will invoke the Display Console with the specified file name and the Console will start by automatically running the Settings file. The command line argument is “*-startWith*”, e.g.

"C:\Program Files\Meteosoft\Met Display Console\MetDisplayConsole.exe" -startWith: *ExampleManager*-NWS.json

Once the user has selected the Display Settings, the Console will load the Plugins specified in the settings and downloads will begin.



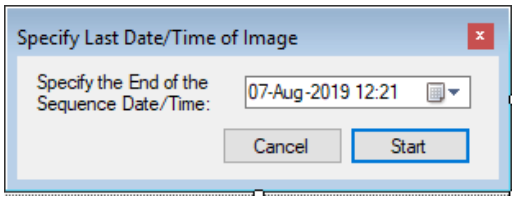
Depending on what data or images have already been downloaded, the periods before the image loop appears can differ considerably. The length of the image loop (default is 60 minutes, but can be 180 – 240 minutes) will also affect the initial load time.

No images will be displayed until the 'primary' (usually a satellite manager) Plugin has completed its download. If the 'primary' Plugin images complete before the other Plugins, then the 'primary' images will be displayed without the other images, until those images are available, in which case the image loop will update to include those images.

To start Display Console in **manual** mode (i.e. to visit some historical data), the Console must be invoked from the command line or from a Windows Shortcut, using the argument:

```
MetDisplayConsole.exe -m
```

The user may now click on 'Open a Display Settings File' in the menu. They are then required to specify the date/time of the **LAST** image in the loop of images they wish to view:

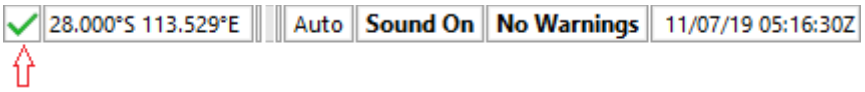


It is assumed that the files containing the data they wish to peruse are already in the appropriate data folders. They are then asked to wait while the program loads and processes the files, before displaying the images in a loop.

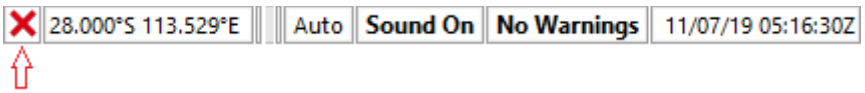
Met Display Console Status Bar and Menu

The status bar (bottom of the Console's window) shows the status of various application variables.

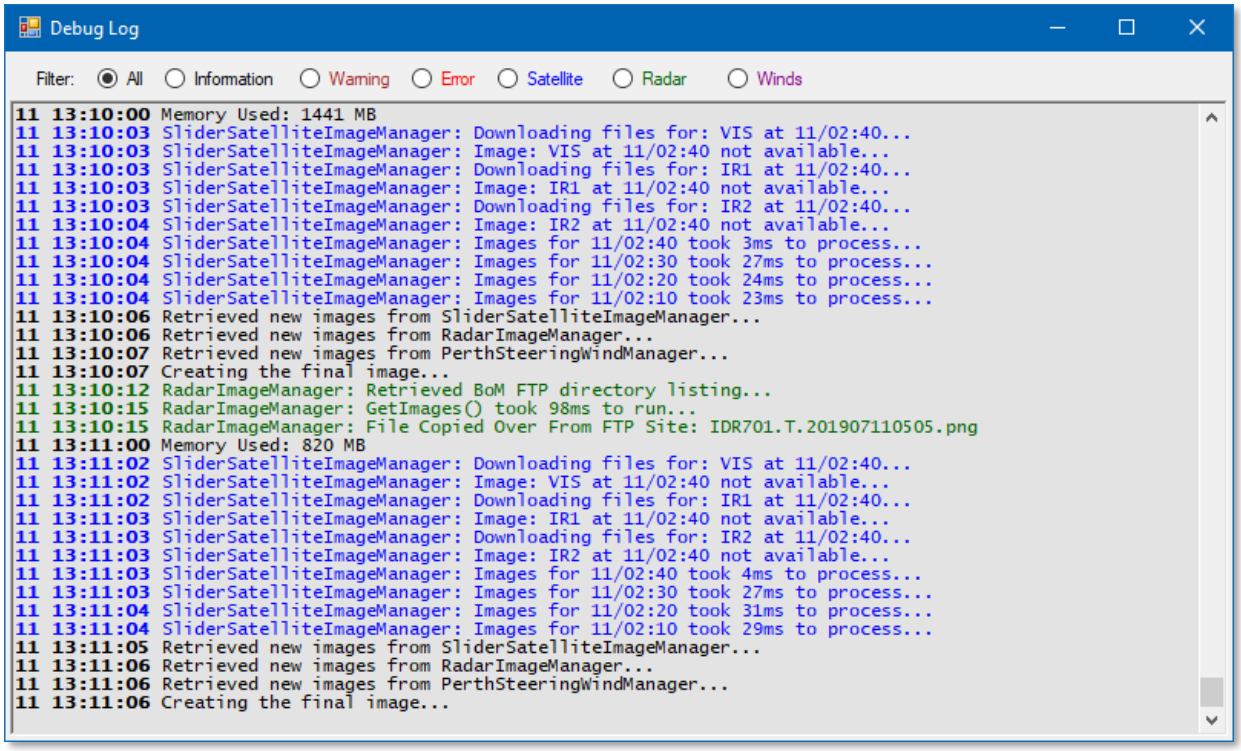
Error Indicator Panel



Should an error occur within the Display Console, a Red cross will replace the Green tick that appears on the left hand side of the status bar:

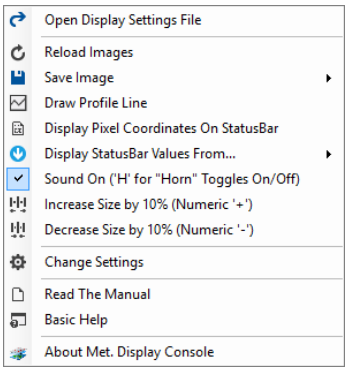


Clicking on the tick or cross will open the Debug Log window, where a real-time view of what the Console or the Plugins are doing, is displayed:



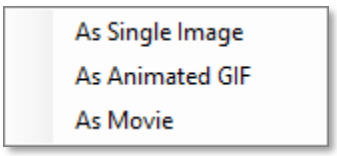
Menu Items

The other menu items perform the following:



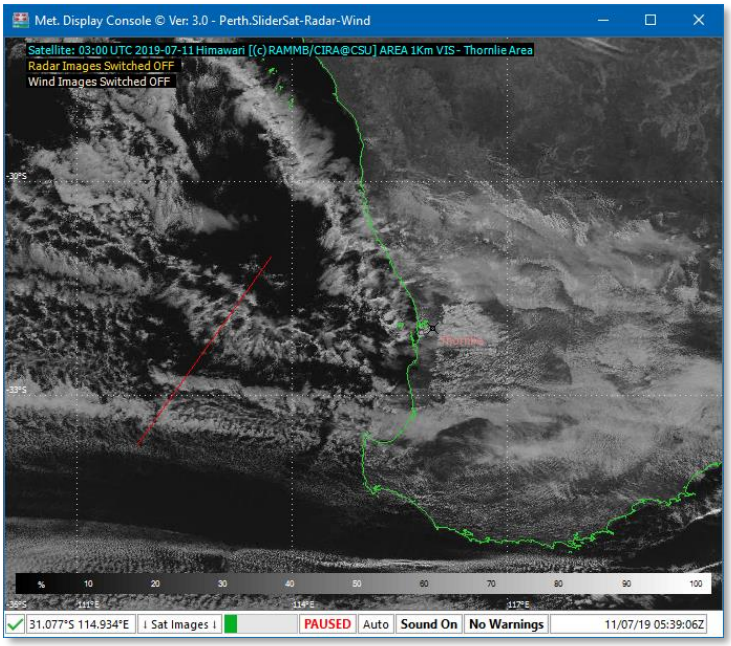
Reload Images: Forces the Display Console to reload the images from the Plugins

Save Image:

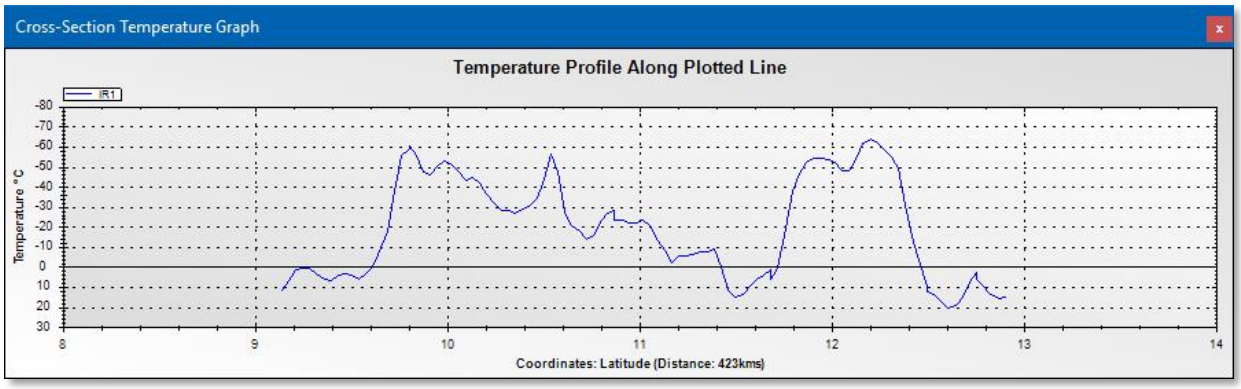


Allows the user to save the current image, or to save the image loop as an animated GIF or MPEG4 file

Draw Profile Line: Allows the user to draw a profile line on the image for when they wish to view the reflectance, temperatures or wind data along that profile line, on a graph. The user first clicks on the "Draw Profile Line" menu item, when a cross cursor appears. They then click on a start point (and RELEASE the mouse button) and move to an end point, when a red line will appear from the start position to the mouse pointer (the loop will automatically pause):



The user then clicks (and releases) the end point to finish and a graph will appear showing the reflectance values or temperatures of the cloud tops along the profile line:

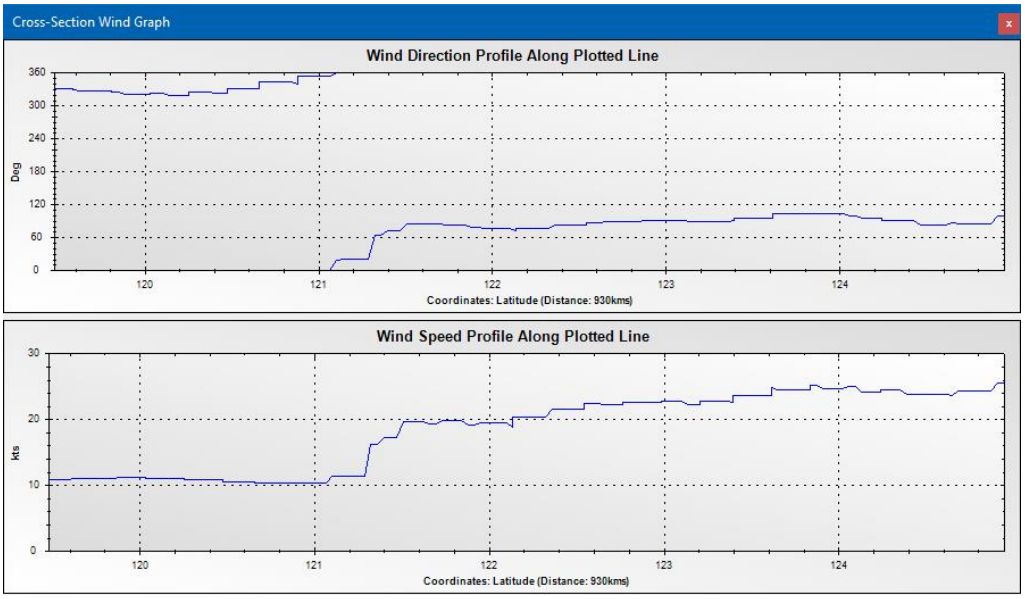


Note that in the above example, the X-Axis shows the Latitude, as the profile line is orientated more North-South than East West. If the line were more horizontal, the X-Axis would show Longitude.

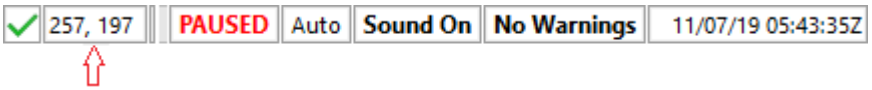
Also note that the distance between the two points is displayed in brackets after the X-Axis label.

To revert to normal mode, press the [Esc] key to hide the graph, and press [Esc] again to remove the red profile line from the image.

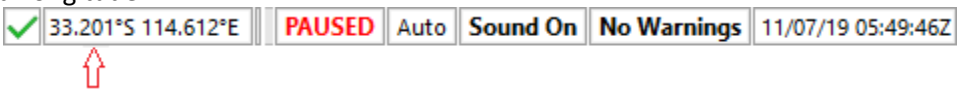
If the data being profiled happens to be wind data (see “Display StatusBar Values From” below), then the following graph is displayed:



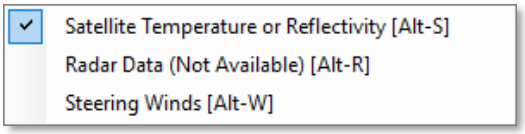
✓ **Display Pixel Coordinates On Status Bar (Ticked)**: The mouse pointer position is displayed in Pixels: X pos, Y pos:



Display Pixel Coordinates On Status Bar (Unticked): The mouse pointer position is displayed in Latitude and Longitude:



Display StatusBar Values From…:



Provided the Plugin has data for the image it displays, this menu item allows the user to choose what values to display on the status bar (and profile graphs) when the mouse is moved over pixels on the display, e.g. The VIS channel (Band 3) will display Reflectance data (0-100%), or IR channels will display temperature data. The Steering Wind Plugin will display wind values at the current mouse pointer position:

✓ **Sound On ('H' for "Horn" Toggles On/Off)**

If the sound is On, then Sound On is displayed on the status bar, otherwise it will show Sound Off. Pressing the ‘H’ key (for Horn) also toggles the sound On/Off.

Paused Panel

If the image loop is currently paused, then PAUSED is displayed on the status bar, otherwise it will display Auto in normal mode, or MANUAL in manual mode.

NOTE: The image loop can be paused and unpaused by hitting the [**P**] key or **SPACE** bar on the keyboard. The [🡐] or [🡒] keys will also pause the loop, and then move the display to the previous or next time frame in the loop.

Warnings Panel

If a warning is currently in place, then this panel will display **WARNING** in red. If an alert is in place then the panel displays **DANGER**.

Date and Time Panel

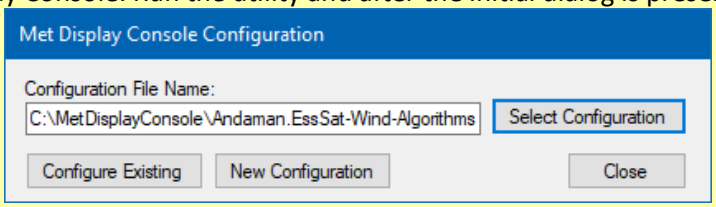
This panel displays the date and time in UTC.

NOTE: The Plugin managers specify their own short-cut keys. For example, the satellite Plugins may specify their short-cut key to be 'S', which when pressed, will cause the next available Plugin image to be displayed, i.e. from VIS, to IR1 to IR2, to OFF. Conversely, [Shift] 'S' will cycle backwards to the previous image type. Radar and Wind images typically use 'R' and 'W' respectively, and will cycle from ON to OFF. The Algorithm Plugin (using 'A') will cycle through the available algorithms. The Algorithm Plugin also allows the user to change the algorithm's minimum squall value, by pressing [Alt] plus a number representing that value.

Change Settings

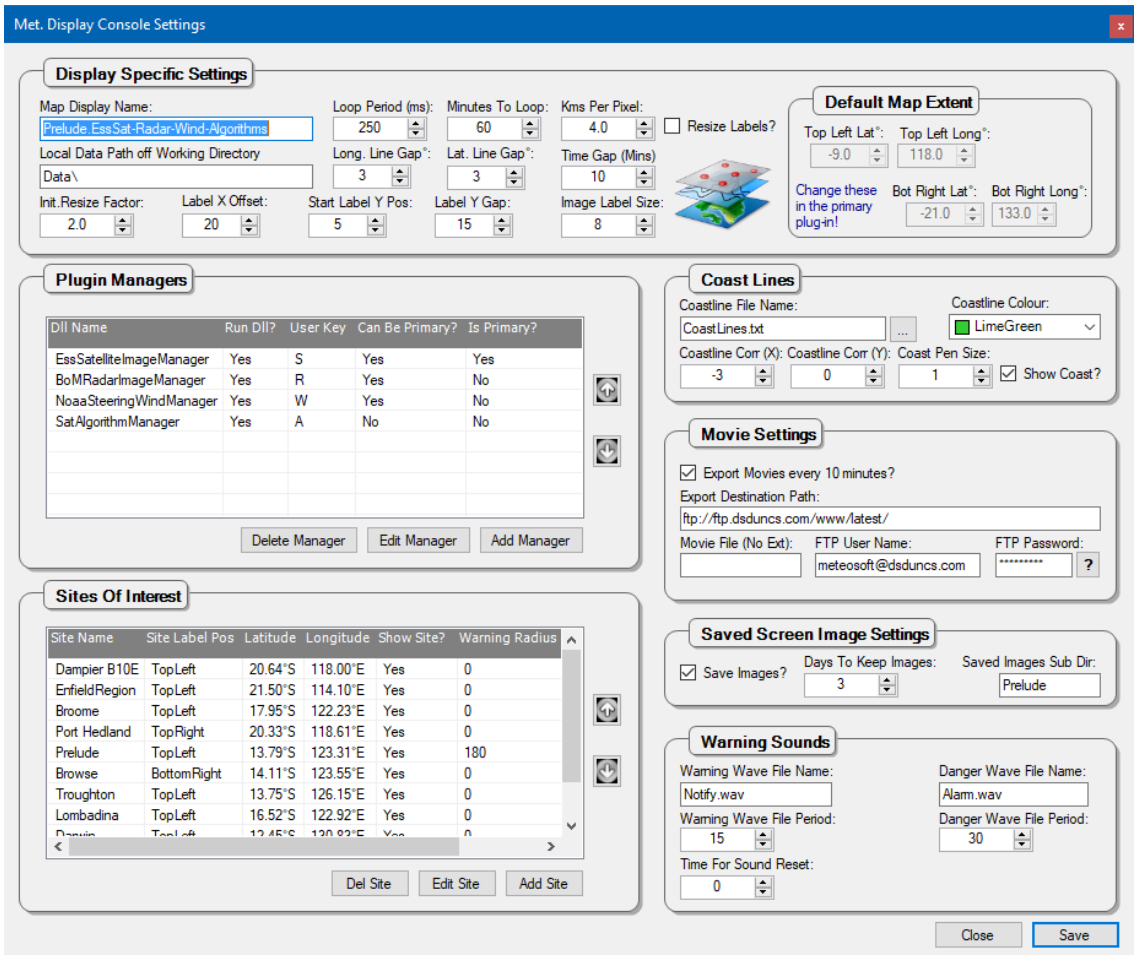
To edit the currently loaded Display Settings, click on the menu item 'Change Settings':

NOTE: A separate utility, MDC Config, is available to edit any Display Settings without having to run Met Display Console. Run the utility and after the initial dialog is presented:

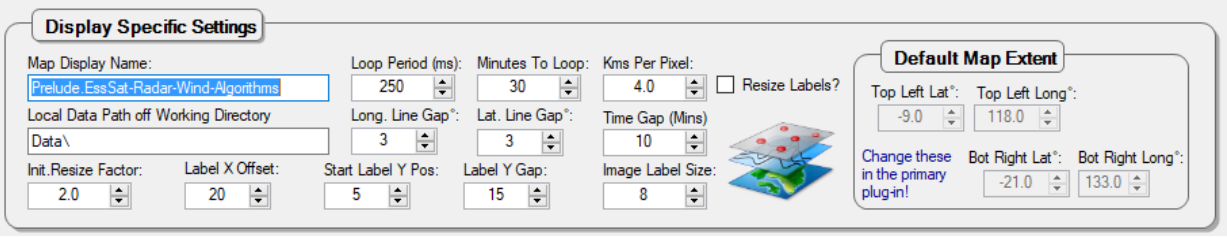


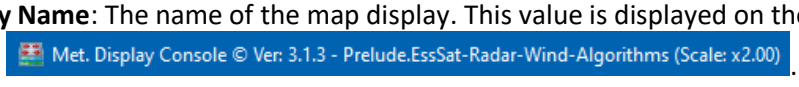
Select the Display Settings (Configuration File) to edit and click on [Configure Existing], then configure the settings as described below. The user may also create a new Display Settings by clicking [New Configuration].

NOTE: Although the Display Console does not have a zoom capability, the user may enlarge the Display Console by pressing the numeric keyboard '+' key, or reduce the size by pressing the numeric keyboard '-' key. Menu options are also available to increase or decrease the window size.



The Display Specific Settings:



Map Display Name: The name of the map display. This value is displayed on the title bar of the Display Console: 

. It is suggested that the name gives some idea of what functionality is available.

Loop Period: Number of milliseconds between frames when looping.

Minutes To Loop: The number of minutes of data to loop.

Kms Per Pixel: The default number of kilometres per pixel of base image. This is overridden by the primary plugin when it is loaded.

Long. Line Gap: The gap between drawn lines of longitude on the display.

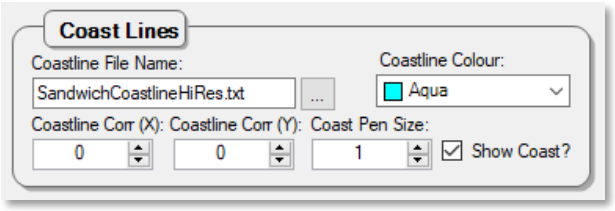
Lat. Line Gap: The gap between drawn lines of latitude on the display.

Time Gap: The default time gap between the images. This is overridden by the primary plugin when it is loaded.

Init. Resize Factor: The amount the Display Console should be enlarged (> 1.0) or reduced (< 1.0) from the base satellite image size.

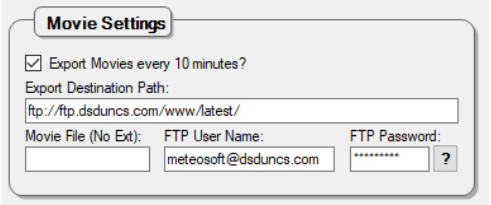
Label X Offset: The X offset of all labels on the image.
Start Label Y Pos: The starting Y offset of all labels on the image from the top of the display.
Label Y Gap: The Y offset gap between labels on the image.
Image Label Size: The default label font size for the all labels.
Resize Labels? : Should we resize labels as we resize the map? Otherwise the labels are always the original size
Top Left Lat: The Top/Left latitude of the map display.
Top Left Long: The Top/Left longitude of the map display.
Bot Right Lat: The Bottom/Right latitude of the map display
Bot Right Long: The Bottom/Right longitude of the map display

Coast Lines Settings:



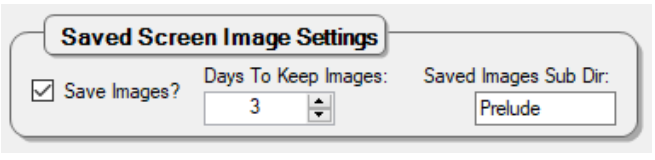
Coastline File Name: The full path and file name of the coast line table. If no path is given, the working directory is assumed.
[…]: Select a coast line file to use.
Coastline Colour: The colour to use to draw the coast line.
Show Coastline? : Should we display the coast line?
Coastline Corr (X): The horizontal coastline correction.
Coastline Corr (Y): The vertical coastline correction.
Coast Pen Size: The pen size to draw the coastline - default is 1.

Movie Settings:



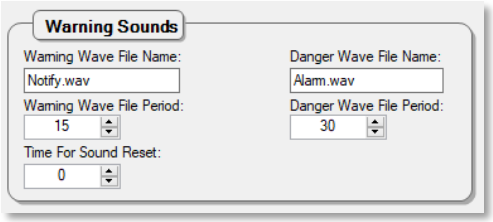
Export Movies every 10 minutes? : Export movies after each image update?
Export Destination Path: FTP Destination path for movies.
Movie File (No Ext): The default destination movie file name to use, without an extension. Leaving this blank (default) will force the Console to use the machine name on which the Console is running as the movie name.
FTP User Name: Destination movie FTP user name.
FTP Password: Destination movie FTP password.
[?]: Toggle the password between clear text and asterisk characters.

Saved Screen Image Settings:



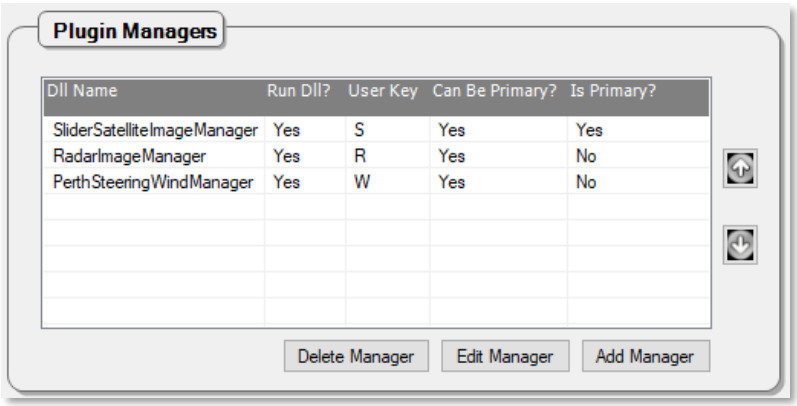
Save Images? : Should we save an image of the latest map, every 10 minutes?
Days To Keep Images: The number of days to keep the images. Old images will be deleted automatically.
Saved Images Sub Dir: The subdirectory, off the directory “SavedImages”, to save the images.

Warning Sound Settings:



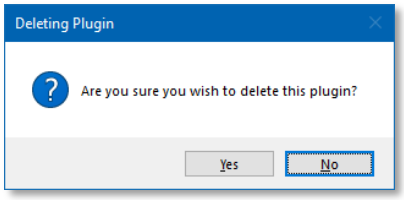
Warning Wave File Name: The 'Warning' wave file name, residing in the working directory.
Danger Wave File Name: The ‘Danger’ wave file name, residing in the working directory.
Warning Wave File Period: The interval in seconds that the warning sound should repeat.
Danger Wave File Period: The interval in seconds that the danger sound should repeat.
Time For Sound Reset: The maximum time, in minutes, that the sound may be turned off. The value 0 will disable the sound automatically switching on.

Plugin Manager Settings

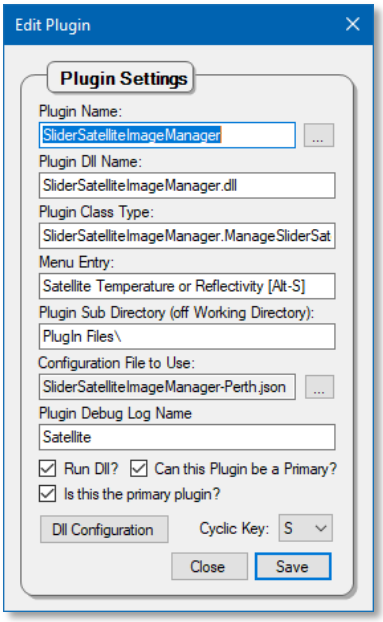


This is a list of Plugin managers currently assigned to this Display Setting. Here the user can:

Delete a Manager: Select then press [Delete Manager]

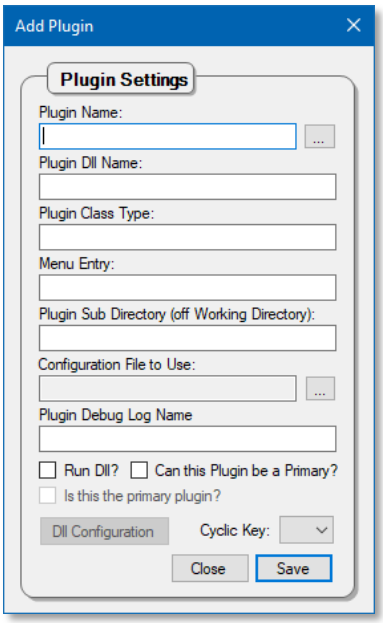


Edit a Manager: Select then hit [Edit Manager], OR just double click a Plugin in the list. If the user wishes to edit the Plugin’s own settings (handled by the Plugin itself), then the following form offers a [**Dll Configuration**] button to access this functionality.



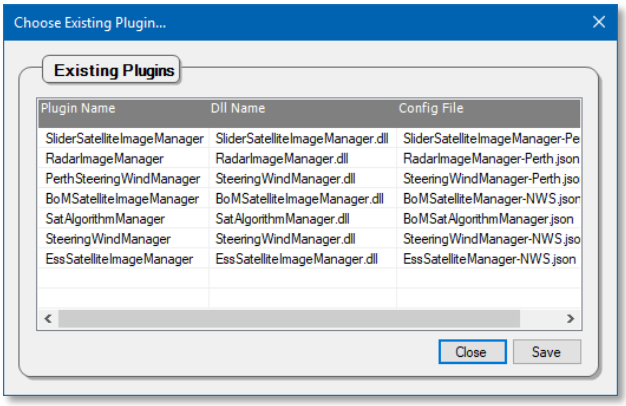
This form is discussed below.

Add a Manager: Press [Add Manager]



Plugin Name: The name of the Plugin, e.g. BoMSatelliteImageManager.

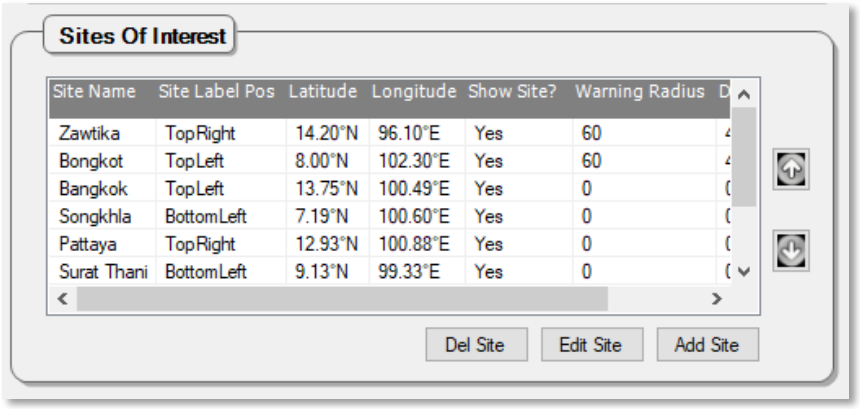
[…] : Instead of filling out all the Plugin settings, the user may wish to clone an new plugin from an existing configuration:



Select a manager to clone, and press [Save], or [Close] to cancel.

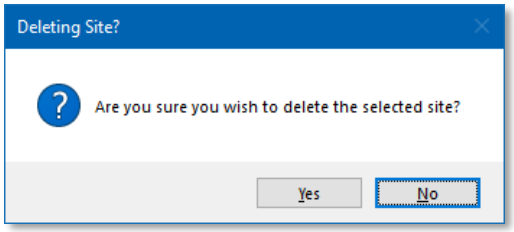
Plugin Dll Name: The name of the plugin's DLL
Plugin Class Type: The Namespace/ClassName of the main process method within the plugin's DLL
Menu Entry: The menu entry that allows the user to select what gets displayed on the status bar when the current mouse cursor hovers over a pixel that has a specific value, e.g. Satellite Temperature or Reflectivity, Wind Dir/Speed, Algorithm result etc.
Plugin Sub Directory (off Working Directory): The sub-directory (off the working directory) where the plugin Dll's and configuration files are placed
Configuration File to Use: The configuration file to use for this plugin
Plugin Debug Log Name: The name that appears on the Debug Log, that allows users to select debug messages from this plugin only, e.g. Satellite, Radar, Winds, Algorithms
Run Dll? : Should we run the Dll? Use this to disable Dll functionality. This will require a restart to the program!
Can this Plugin be a Primary? : Can this plugin act as a primary plugin? If it requires data input from another plugin, it cannot be a primary!
Is this the primary plugin? : Should we use this Dll to get the initial reference date/time and size?
Cyclic Key: The shortcut key used to cycle through the plugin's resultant images
[Dll Configuration] : Edit the plugin's configuration. Each Plugin is responsible for its own configuration, and is handled by the Plugin. Please see the relevant manual for the Plugin. This button invokes this functionality.

Setting Up Sites of Interest

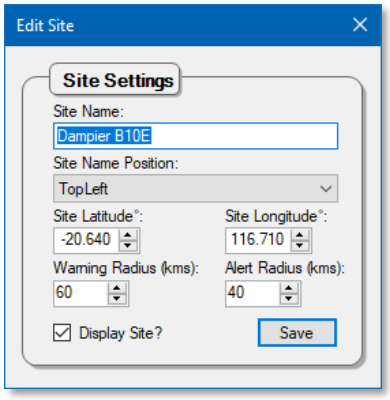


This is a list of locations for which the user wants warnings from approaching squalls. Here the user can:

Delete a Site: Select then press [Del Site]



Edit a Site: Select then hit [Edit Site], OR just double click a Site in the list.

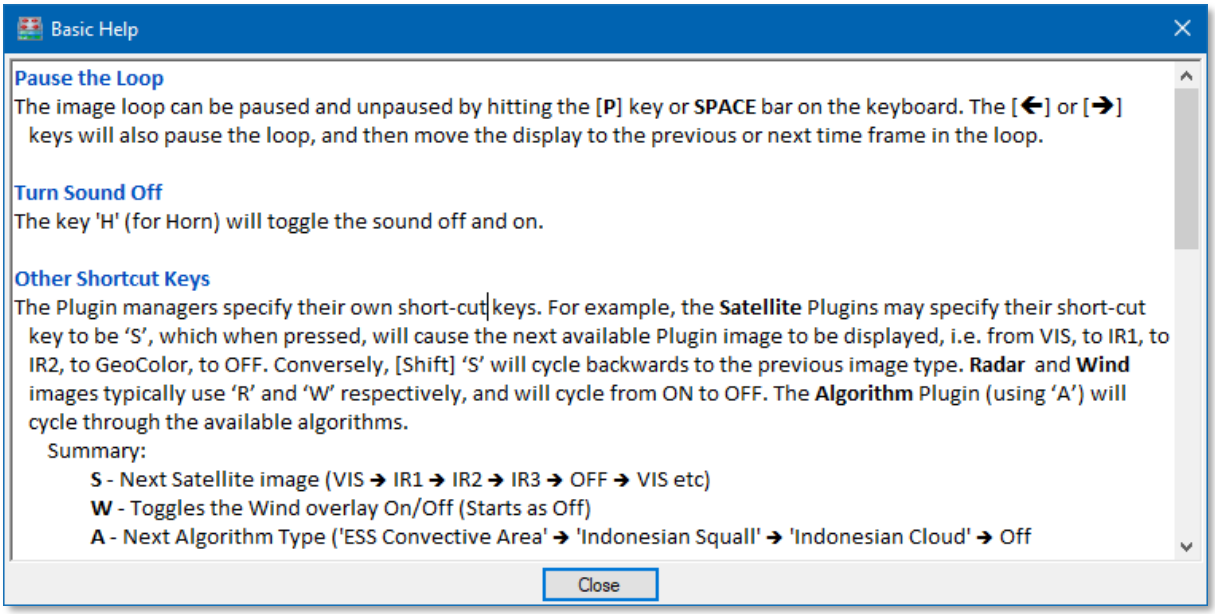


Site Name: The name of the site
Site Name Position: Enter the site name position, with respect to its position on the map. Choices are: TopLeft, TopRight, BottomLeft, BottomRight.
Site Latitude°: The site's latitude in decimal degrees.
Site Longitude°: The site's longitude in decimal degrees.
Warning Radius (kms): Radius of circle (in kms) around location in which a squall warning must be issued if a squall enters the area. If no warnings are required, set this value to 0.
Alert Radius (kms): Radius of circle (in kms) around location in which a squall alert must be issued if a squall enters the area. If no alerts are required, set this value to 0.
Display Site? : Should the site be displayed? The user should untick this checkbox when the site is to be hidden from view

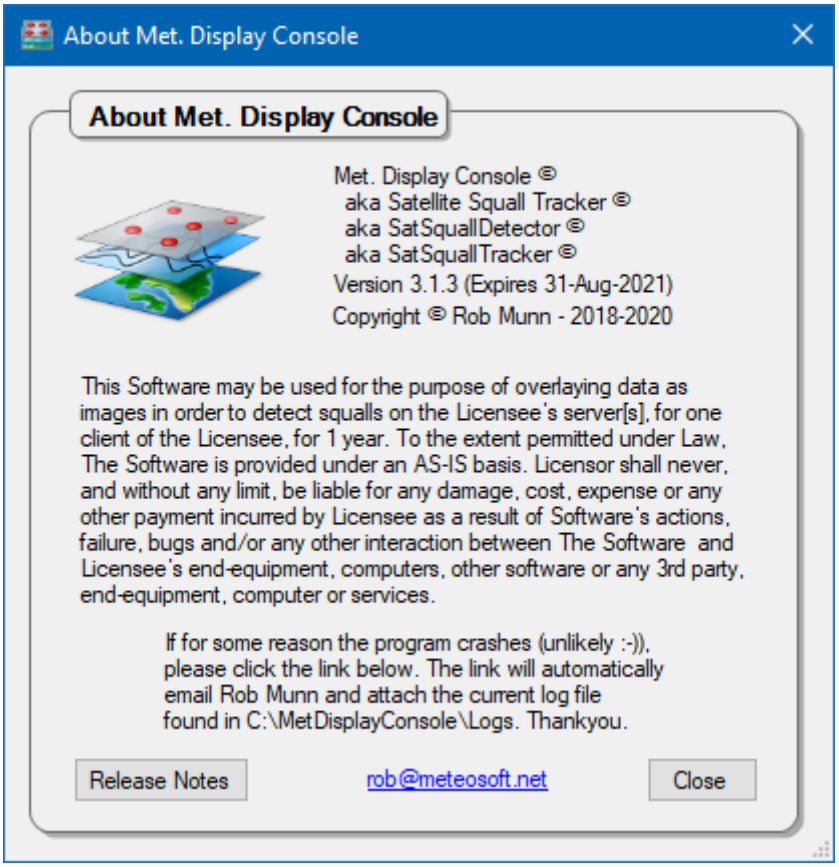
Note that sites with warning or danger radii are **active** sites (will be included by optional algorithms that produce squall warnings), whilst those without warning or danger radii in **inactive**.

Basic Help

Basic help is available to navigate the Display Console:

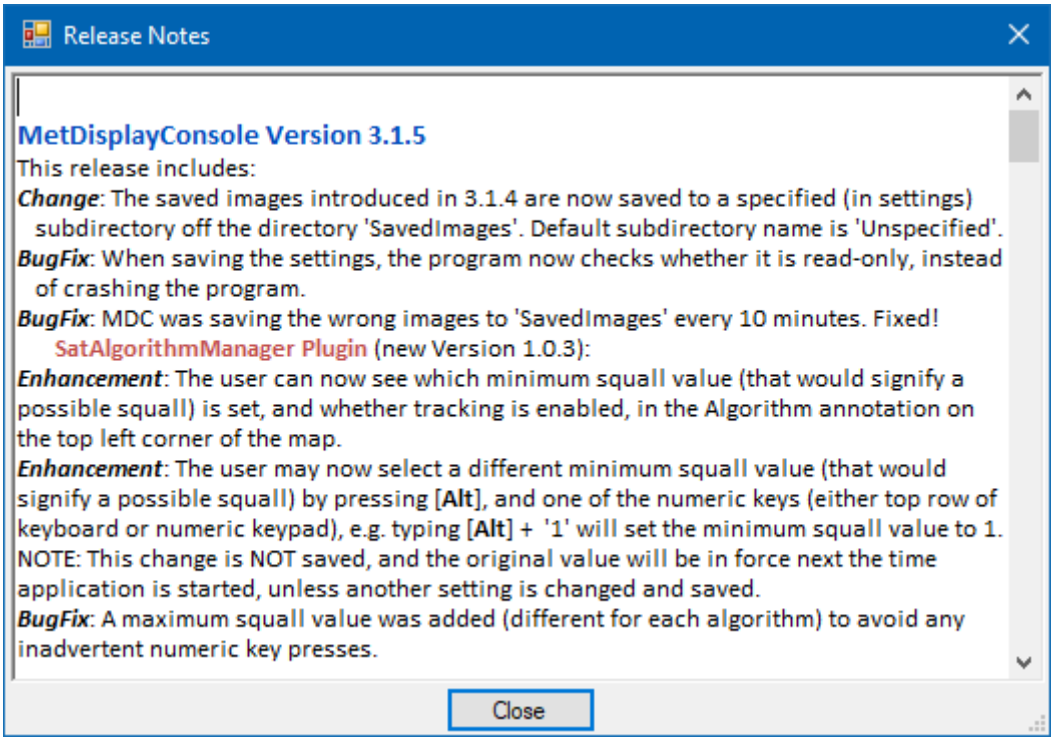


About Met Display Console



Release Notes

A list of all changes made to the Met. Display Console and associated Plug-Ins, together with the version changes.



Appendix

Creation of Coastline File

The coast line file was created using 'gmt' (General Mapping Tool) in the format (section text removed):

```
#!/usr/bin/bash
TOPLAT=-00:30
BOTTOMLAT=-23:00
LEFTLON=115
RIGHTLON=141
# RANGE='115/141/-23:30/-00:30'
RANGE=${LEFTLON}/${RIGHTLON}/${BOTTOMLAT}/${TOPLAT}
echo ${RANGE}
# ((f)ull, (h)igh, (i)ntermediate, (l)ow, and (c)rude)
RESOLUTION='l'
gmt pscoast -R${RANGE} -JM -D${RESOLUTION} -W -M > out_${RESOLUTION}.txt
```