Metview Introduction

for OpenIFS seminar

mv⁴

Meteorological Visualisation Section

Operations Department

ECMWF

31/05/2013

ECMWF

This tutorial was tested with Metview version 4.3.10

but should work for all 4.3.x versions.

The Metview Desktop

First start Metview; the command to use is **metview**. You will see something like this:
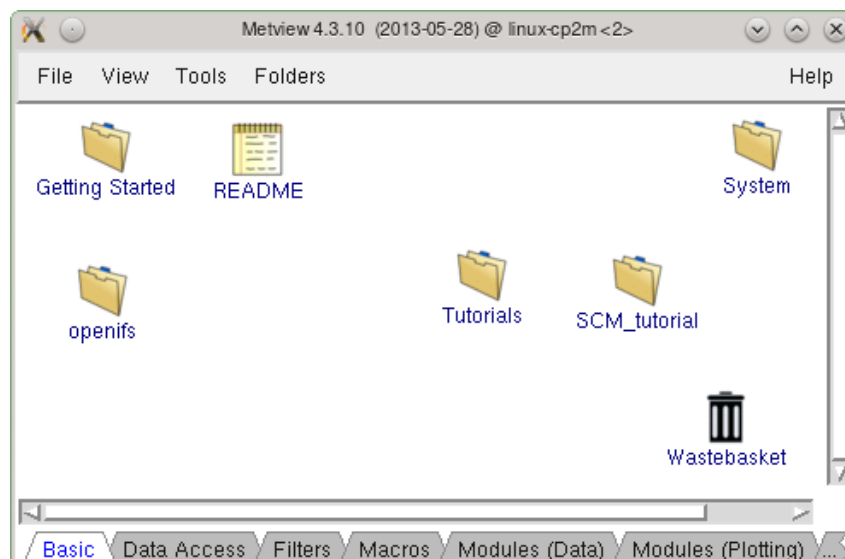
This sort of window is called a **Metview desktop**. The yellow folder icons represent directories in the file system, in the Metview world these are just referred to as **folders**.

Open folder 'openifs' (double-click or right-click **edit** on the icon). Here you will find the folders that you will use for this tutorial:

- **openifs_intro**: this is the working directory for the exercises of this introduction.

- **openifs_data**: it contains the results of the OpenIFS runs. It is actually a link to the directory located at ~/openifs_data.

OpenIFS data

Open folder 'openifs_data' (double-click or right-click **edit** on the icon). You should see a separate folder for all the OpenIFS runs and one for the analysis.

Please note that the output GRIB files of the experiments were **post-processed with Metview** for the purpose of this course. Only a set of surface and pressure level parameters were kept and the u and wind components were derived from divergence and vorticity. On top of that all the spectral fields were transformed to a regular Gaussian grid (keeping the resolution) and a subarea of the Hurricane Sandy domain were cut out.

The OpenIFS GRIB files have a specific naming convection and each forecast step is stored in a separate file. Open folder 'T511_ctl' (or the folder of any other run) to see how these GRIB files look like:
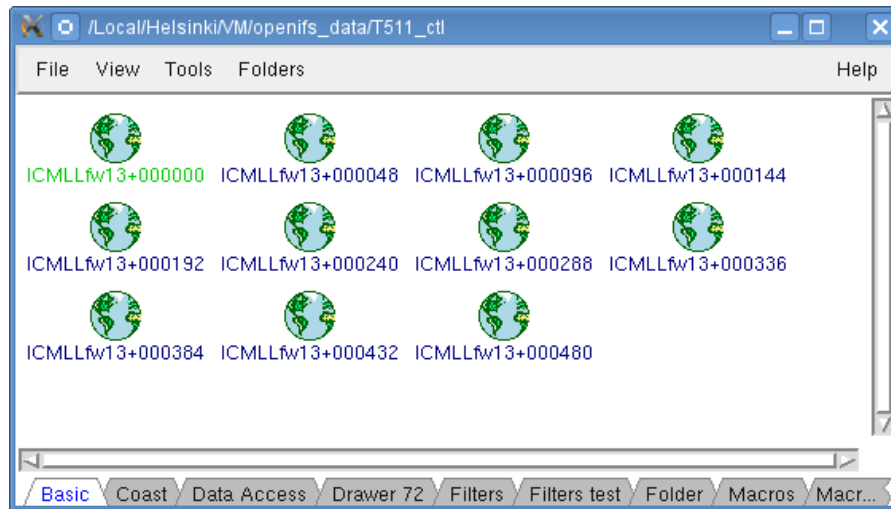
Please note that folder 'T1279_an' contains the high-resolution analysis fields. In this folder there are only two GRIB files: one for the surface and one for pressure levels (both containing several dates and times).

In the next steps we will work in folder 'openfs_intro' using only a small subset of this data. So please enter this folder before continuing with the next chapter.

Examining Data

In folder 'openifs_intro' you will see one GRIB file only: this is a copy of one of the forecast files from the T511_ctl run.

To see what this GRIB file contains, right-click and select **examine** form the popup menu This brings up Metview's GRIB examiner tool.

Each GRIB message is represented by a row in the message list on the left-hand side. In this list a set of GRIB_API keys are displayed for each message. The right-hand side shows detailed meta-information for the selected message, presented in a number of different ways (try changing between **Tree view** and **Plain text**; try different **Dump mode**s).

You can sort the fields by clicking on the different column headers. The GRIB examiner message list can be fully customised allowing displaying an arbitrary set of GRIB API keys.
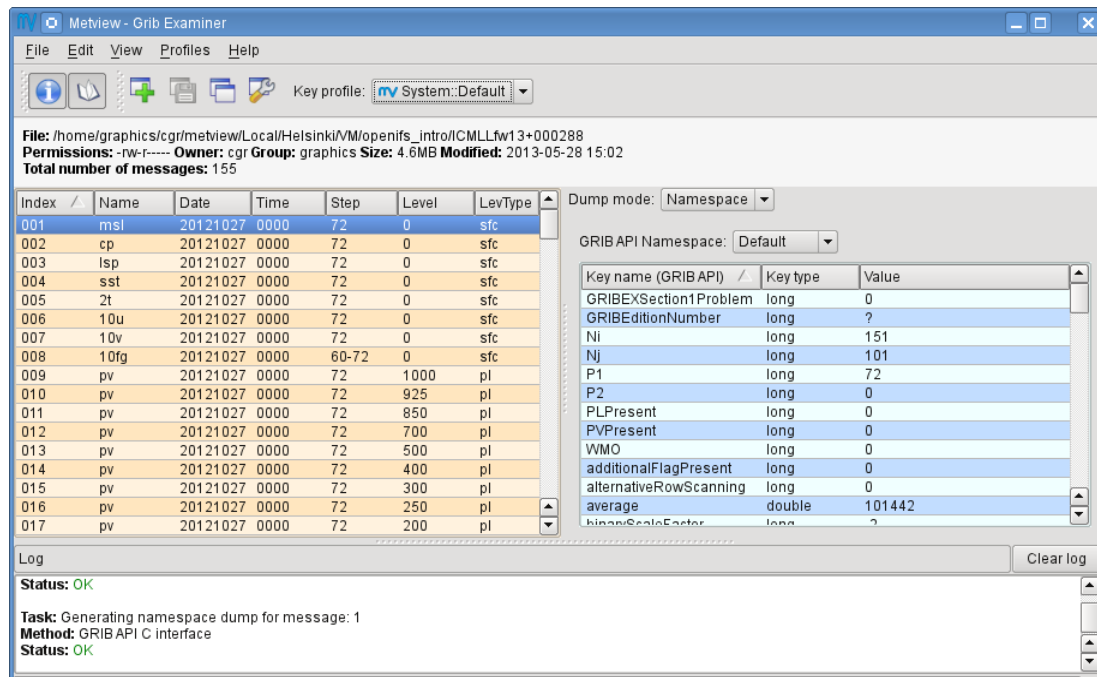
Visualising Data

To visualise this data, right-click on its icon and select **visualise**. You will now see the **Display Window**. Its toolbars can all be moved, docked, undocked and hidden to suit your preferences.
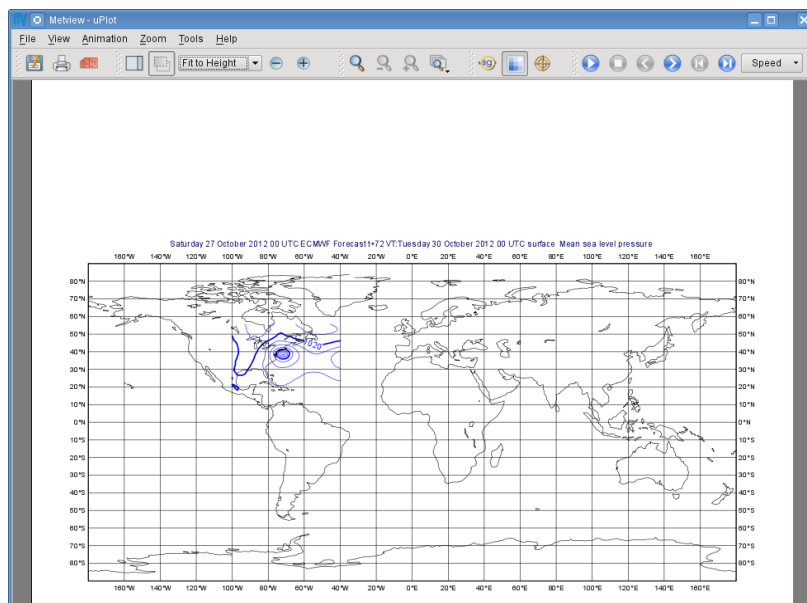
Antialiasing

To the right of the zoom buttons should be the **Antialias** button.

When active, a smoothing is applied to the lines in the plot – it is worth doing although it comes at the cost of a small amount of plotting speed. This setting will be remembered the next time you visualise data. Note that the antialiasing is not carried through to the various export image formats (see later) – it is active only in the interactive window.

Zooming in a Plot
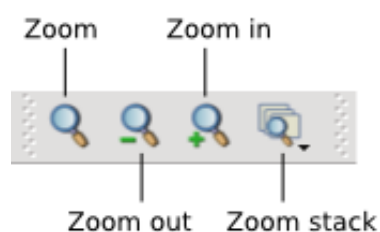
The above diagram shows the **Zoom** toolbar at the top of the **Display Window**. Click the **Zoom** button to enter 'zoom mode'. Now you can select an area by dragging with the left mouse button. You can zoom in as many times as you like. In order to 'undo' or 'redo' a zoom, click the **Zoom out** or **Zoom in** buttons respectively. The **Zoom stack** provides quick visual access to the current zoom history. Notice that when a new area is selected, the contours are recalculated - you see more detail as you zoom into a smaller area; you may also see more detailed coastlines.

Using the Magnifier

The **Magnifier** button in the toolbar toggles the magnifier tool on and off. Unlike **Zoom**, this is a purely graphical enlargement of the plot. It is used mainly to inspect small text such as contour labels. The magnifying glass can be moved and resized using the mouse, and the magnification scale on its left-hand side can also be adjusted.
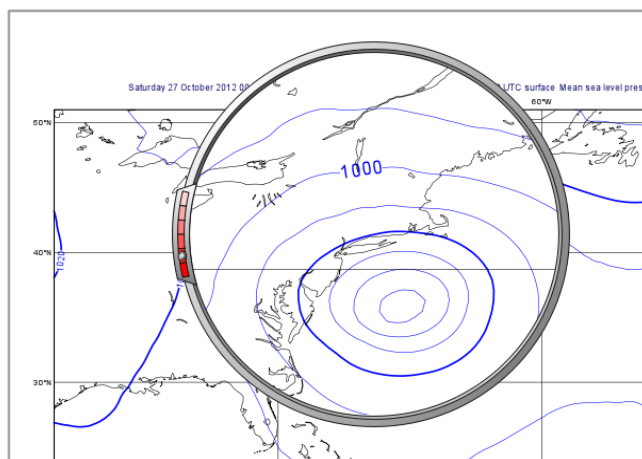
Cursor Data

For a closer inspection of data values in a plot without having to apply a special contour icon, the cursor data tool can be used.

When activated, the cursor data box follows the mouse cursor around the plot, displaying data for the nearest grid point(s). To 'dock' the data box, left-click; to 'undock', left-click again and the box will retain its current offset from the cursor. The cursor data tool is available regardless of whether grid value plotting is on or not.

Animation Frames

The **Frames** tab to the right of the plot shows us that our GRIB file contains multiple fields (if you cannot see this panel please make the sidebar visible via the View menu or toolbar). You can move between fields by clicking within this tab, by using the animation control buttons or by using the cursor keys. Note that each plot is computed only when you select a field. Generated plots are cached, indicated in the **Frames** tab through shading. This can quicken their rendering when the plots are complex. Note that modifying the plot in any way (such as zooming) clears the cache.
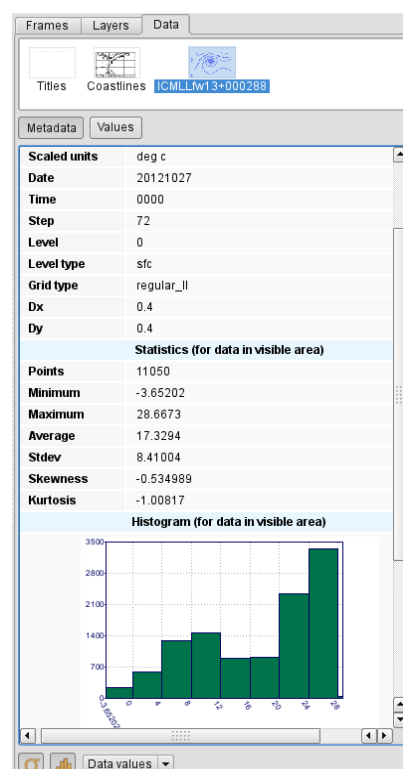
Frame /	Name	Date	Time	Step	Level
1	msl	20121027	0000	72	0
2	cp	20121027	0000	72	0
3	lsp	20121027	0000	72	0
4	sst	20121027	0000	72	0
5	2t	20121027	0000	72	0
6	10u/10v	20121027	0000	72	0
7	10fg	20121027	0000	60-72	0
8	pv	20121027	0000	72	1000
9	pv	20121027	0000	72	925
10	pv	20121027	0000	72	850
11	pv	20121027	0000	72	700

Layer Meta-data

There are three tabs in this panel - **Frames**, **Layers** and **Data**. Now select the **Data** tab.

This reveals a page of meta-data for the current layer, including a histogram.

If you zoom into a smaller are of the plot the meta-data is updated to include only the data points which are visible.

Scaled units	deg c
Date	20121027
Time	0000
Step	72
Level	0
Level type	sfc
Grid type	regular_ll
Dx	0.4
Dy	0.4
Statistics (for data in visible area)	
Points	11050
Minimum	-3.65202
Maximum	28.6673
Average	17.3294
Stdev	8.41004
Skewness	-0.534989
Kurtosis	-1.00817

Changing the Map Projection

Since our data is not global it is worth customising the map projection settings to define an area best fitting to our data coverage.

First, create a new *Geographical View* icon. You can find a set of 'default' icons in the *icon drawers* at the bottom of the **Metview desktop**. Each holds a set of icons corresponding to a given category, such as **Basic** or **Data Access**.

By clicking on the rightmost tab, scroll along until you see the **Views** drawer. Open it by clicking on it. Drag the *Geographical View* icon onto the desktop area - a copy is made. You can close the drawer by clicking on its tab again.
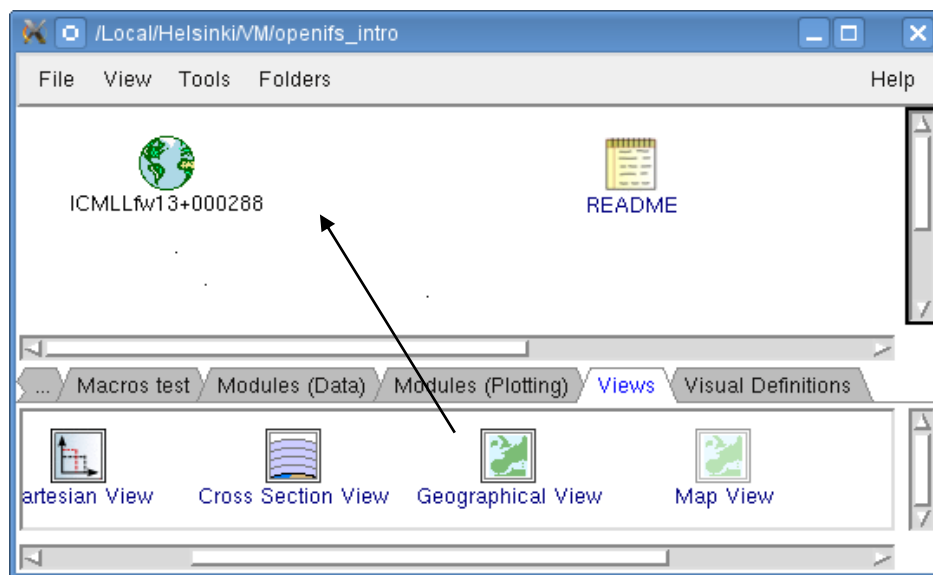

First rename your icon 'map_Sandy' (by clicking into its name label). Then edit it by either double-clicking on it or else right-click, **edit** (double-clicking an icon always performs the **edit** action). This brings up the *icon editor* for map projections. All user-selectable parameters for map projections are here. Set the following parameters:

Map Area Definition	Corners
Area	17/-97/51/-45
	Note: you must hit return after editing a raw text field like this

After making these changes, click the **Apply** button to save and exit the editor.

Visualise the data again, and drag your new *Geographical View* icon into the **Display Window**.
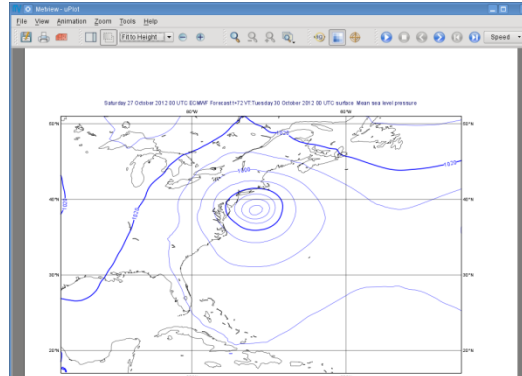
Drag and drop is also working the other way around: first visualise your 'map_Sandy' icon and drop your GRIB icon into it. You should get the same plot as before!

Changing the Coastlines

We will improve our plot by changing the coastline settings. Create a new *Coastlines* icon by taking a copy from the **Visual Definitions** drawer at the bottom of your Metview desktop.


Rename it 'coast_grey' then edit it, setting the following parameters:

|	
Map Coastline Resolution	Low
Map Coastline Land Shade	On
Map Coastline Land Shade Colour	Grey
Map Coastline Sea Shading	On
Map Coastline Sea Shade Colour	Sky

Please note that by setting the resolution to 'Low' we can significantly improve the rendering speed of plots containing smaller areas.

For colour-based parameters, there is a small arrow in the editor - click it to reveal a list of possible colours.
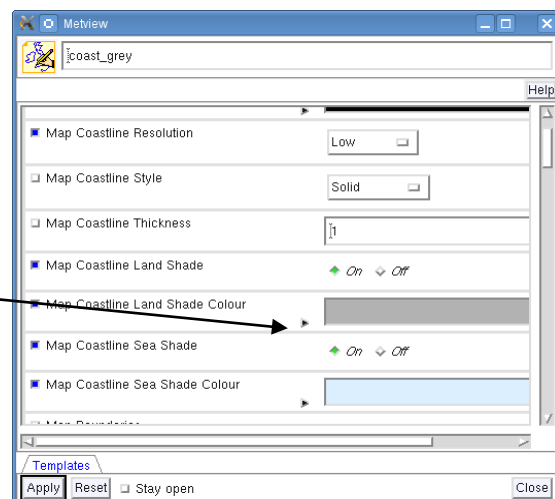
After making these changes, click the **Apply** button to save and exit the editor and drag your new *Coastlines* icon into the **Display Window**.
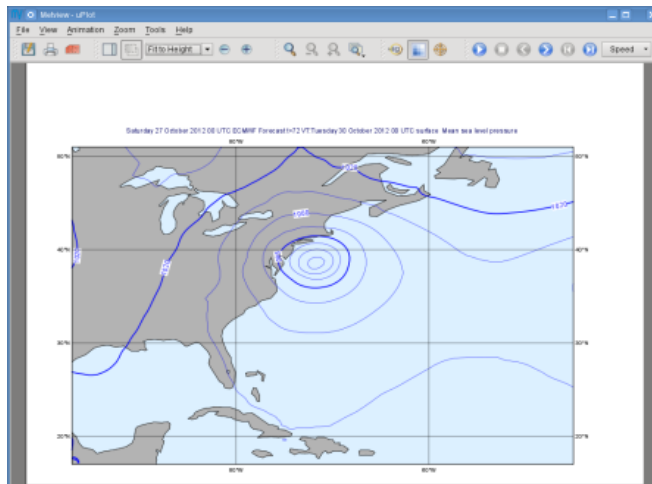
Embedded Icons

Some Metview icons can contain other icons. For example *Geographical View* can contain a *Coastlines* icon defining the coastlines properties of the visualised map area. This is quite a useful feature so we well use it as well.

Open you 'map_Sandy' icon and drop your 'coast_gey' icon into the **Coastlines** icon field.
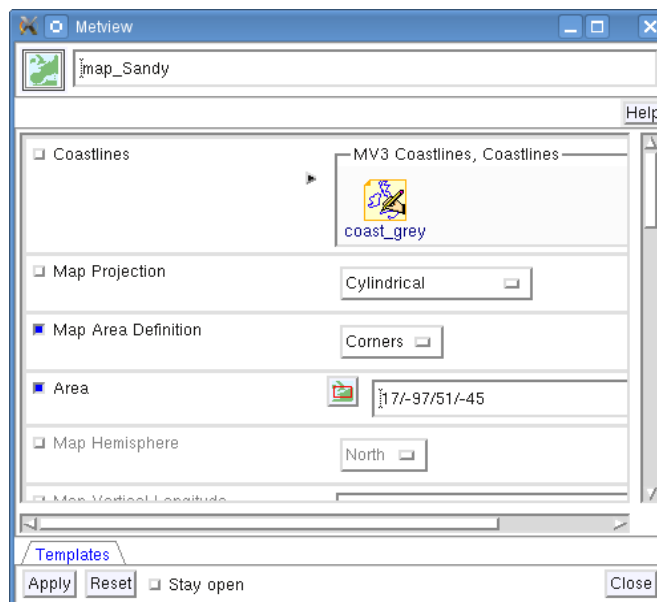
Save you settings and **visualise** 'map_Sandy' again to see that your coastlines settings were immediately applied to the plot.

Modifying the Contouring

Now we will change the contouring so that it could better fit to mean sea level pressure (the first field in our GRIB file).

Create a new *Contouring* icon by taking a copy from the **Visual Definitions** drawer at the bottom of your Metview desktop and rename it 'mslp_black'.

Edit it, setting the following parameters so that we could plot black contour lines with a 5 hPa interval:

Contour Line Colour	Black
Contour Highlight	Off
Contour Level Selection Type	Interval
Contour Interval	5

Apply the changes, **visualise** the first filed in your GRIB data and drag the contouring icon into the **Display Window**.
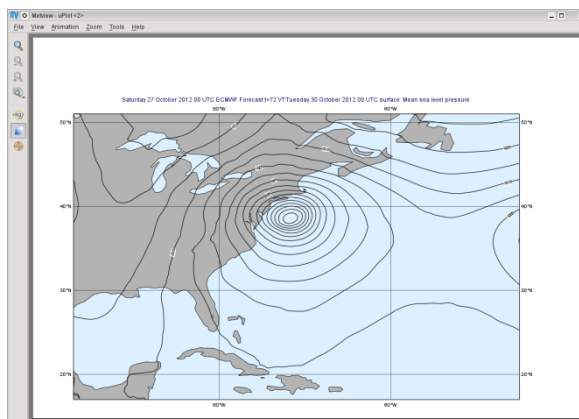
Multiple Contouring Settings

We can apply multiple contouring settings at the same time. In your folder you will find two other contouring icons called 'mslp_975' and 'mslp_1000'. They highlight only the 975 and 1000 hPa lines in red and black, respectively. Now select these icons and 'mslp_black' together (you can do it with the mouse using "rubberband selection", or by holding down the shift key while clicking on the icons) and drop them into the plot.
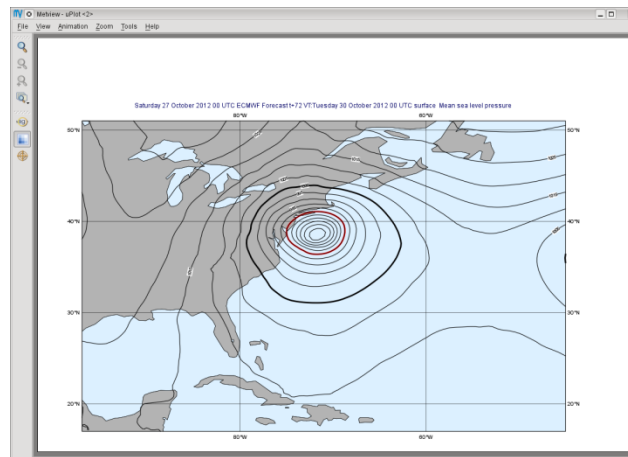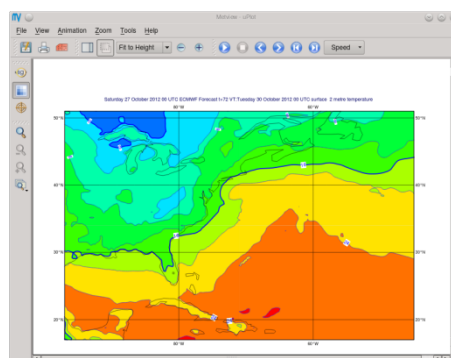
Using Contour Shading

Contour shading is also possible in Metview. We will learn how to do it by visualising the 2m temperature field.

First visualise your GRIB file and step to the 2m temperature field (it is the fifth field in the file). Second, create a new *Contouring* icon and rename it 't2_shade' and edit it, setting the following parameters:

Contour Shade	On
Contour Shade Method	Area Fill
Contour Shade Max Level Colour	Red
Contour Shade Min Level Colour	Blue
Contour Shade Colour Direction	Clockwise

Last, apply the changes and drag the contouring icon into the **Display Window**.

Our palette is automatically generated from a colour wheel. Try setting **Contour Shade Colour Direction** to Anti Clockwise to see the difference in the generated palette.
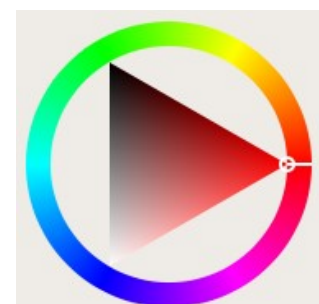
Creating a Legend

Create a legend by changing the first parameter in the Contour editor and dragging the icon into the **Display Window** again:

Legend	On

Plotting Grid Values

We will now plot grid values. Create a new *Contouring* icon and rename it *grid_8x8*. Edit it and find the set of parameters close to the bottom of the editor which control the plotting of grid values. Activate grid value plotting, set it to plot **both** values and markers, and set the lat/long frequency each to 8. Then visualise your GRIB file again on the Hurricane Sandy domain and drop your new icon into it.
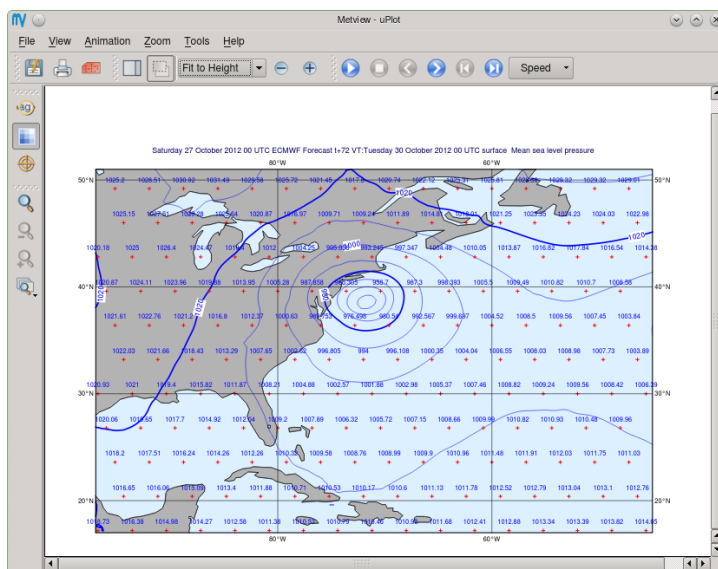
If you zoom into smaller areas, you may want to see every grid point - duplicate *grid_8x8* and call it *grid_1x1*. Set the lat/long frequency to 1 - one fast way to do this is to click on the **small blue button** next to the parameter.

This button does two things: it indicates that a parameter has been altered from its default, and it restores the parameter to its default when clicked.