Introduction to Metview (OpenIFS meeting in Stockholm)

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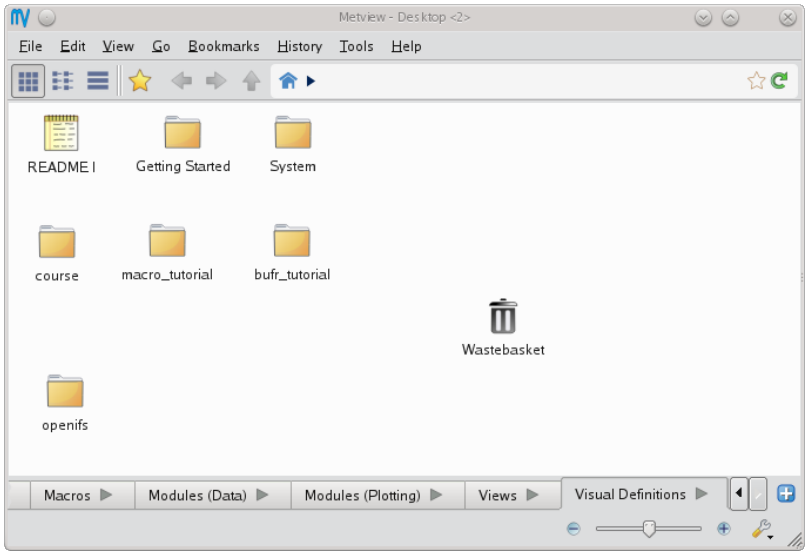
1 Getting started

First, start Metview up as described below:

- Start virtual machine (see separate handout)
- Open a terminal window by clicking on the 'terminal' icon in the system tray
- Type the command:

```
metview -desktop
```

Now you should see something like this:

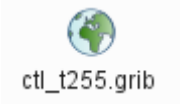


This sort of window is called a **Metview desktop**. The yellow folder icons represent directories in the file system, in the Metview world these are just referred to as **folders**.

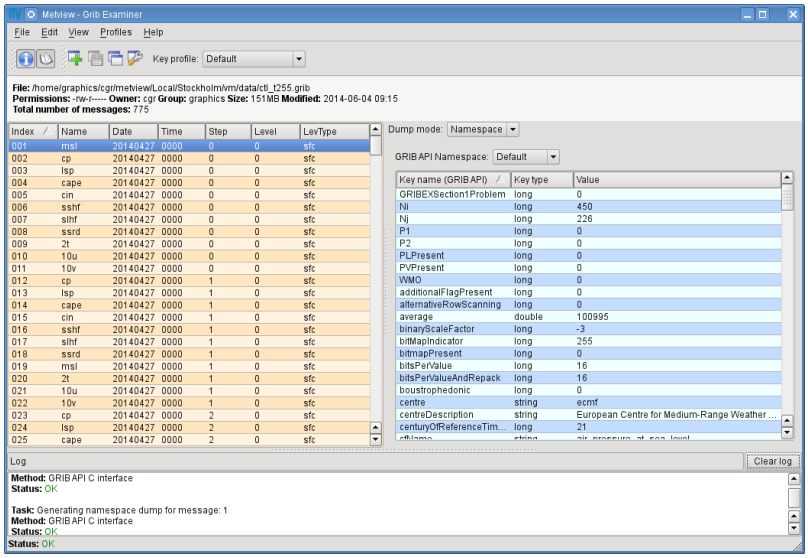
Open folder openifs (double-click or right-click **open** on the icon), then enter folder intro .

2 Examining Data

In folder intro you will see one GRIB file only: this contains the post-processed output of a T255 IFS simulation (it is interpolated onto a global 0.8x0.8 degree grid).



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

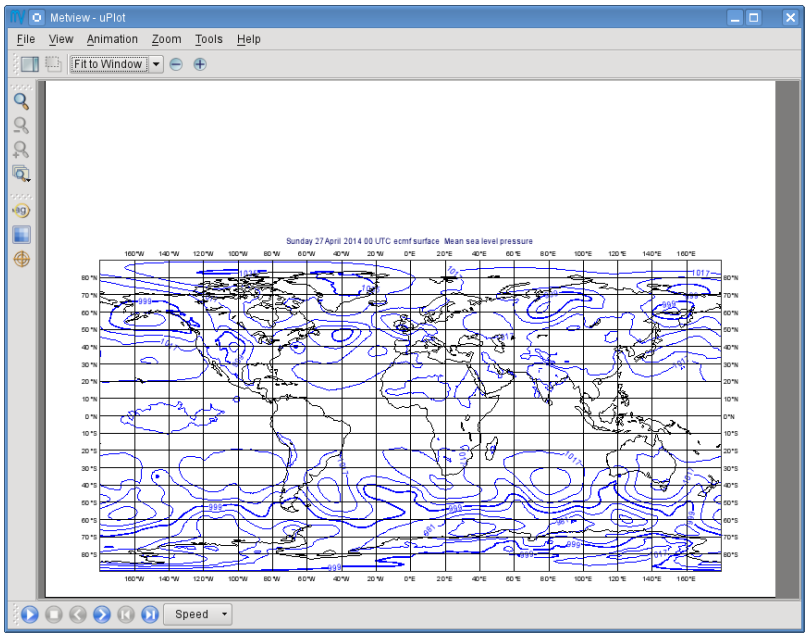


Each GRIB message is represented by a row in the message list on the left-hand side. In this list a set of GRIB_API keys are displayed for each message. The right-hand side shows detailed meta-information for the selected message, presented in a number of different ways (try changing between **Tree view**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

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.

3 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.



3.1 Antialiasing

Below the zoom buttons should be the **Antialias** button.

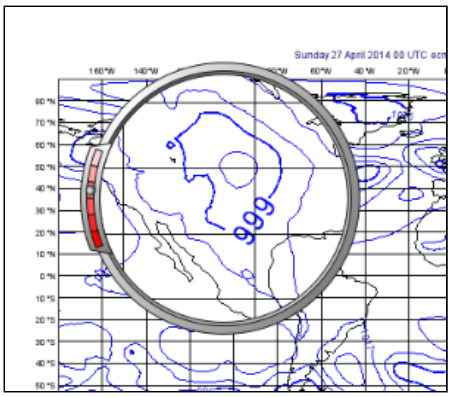
When active, a smoothing is applied to the lines in the plot – it is worth doing although it comes at the cost of a small amount of plotting speed. This setting will be remembered the next time you visualise data.

3.2 Zooming in a Plot

The diagram on the right 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.

3.3 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.



3.4 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.

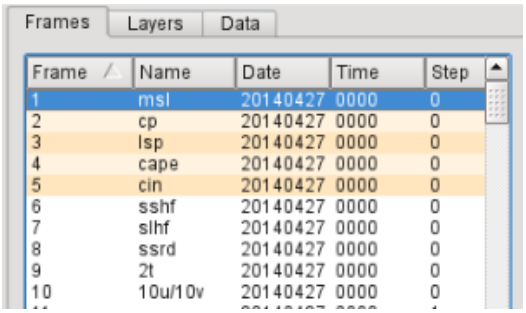
When activated, the cursor data box follows the mouse cursor around the plot, displaying data for the nearest grid point(s). To ‘dock’ the data box, left-click; to ‘undock’, left-click again and the box will retain its current offset from the cursor. The cursor data tool is available regardless of whether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

3.5 Animation Frames

There is sidebar panel on the right hand side of the **Display window**, which can be made visible/hidden with this button in the toolbar:

There are three tabs in this panel - **Frames**, **Layers** and **Data**.

Now select the **Frames** tab. This shows us that our GRIB file contains multiple fields.



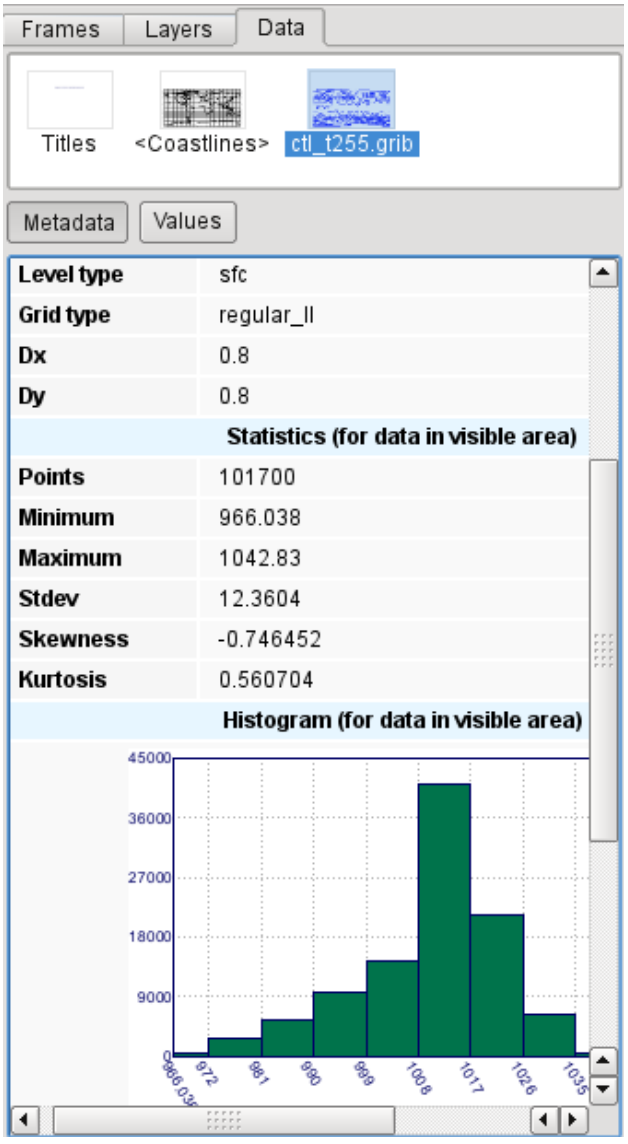
You can move between fields by clicking within this tab, by using the animation control buttons

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.

3.6 Layer Meta-data

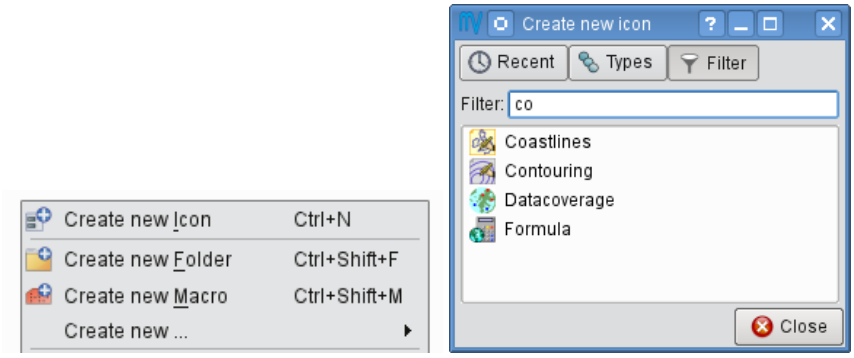
The **Data** tab in the sidebar panel reveals a page of meta-data for the current layer, including a histogram.

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



4 Changing the Coastlines

We will improve our plot by changing the coastline settings. First, create a new *Coastlines* icon. You can right-click within the **Metview Desktop** to obtain a context menu from where the option **Create new icon** is available (shortcut: `CTRL+N`)



This brings up a dialog from where you can find the *Coastlines* icon (e.g. using the filter as illustrated); double-click the icon to create a new instance.

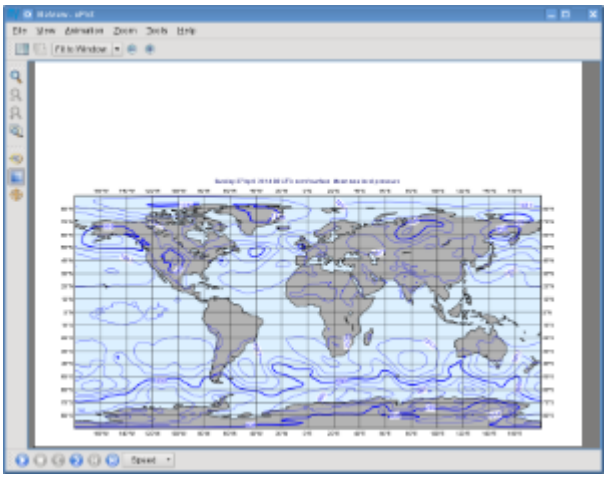
Rename it 'coast_grey' by clicking into its icon label and typing the new name. Then edit the icon's contents by either double-clicking on it or else right-click, **edit**. This brings up the icon editor for coastline plotting. Set the following parameters:

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

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

Visualise the data again and drag your new *Coastlines* icon into the **Display Window**.

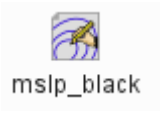
> Please note that by setting the resolution to 'Low' you can significantly improve the rendering speed of plots containing smaller areas.



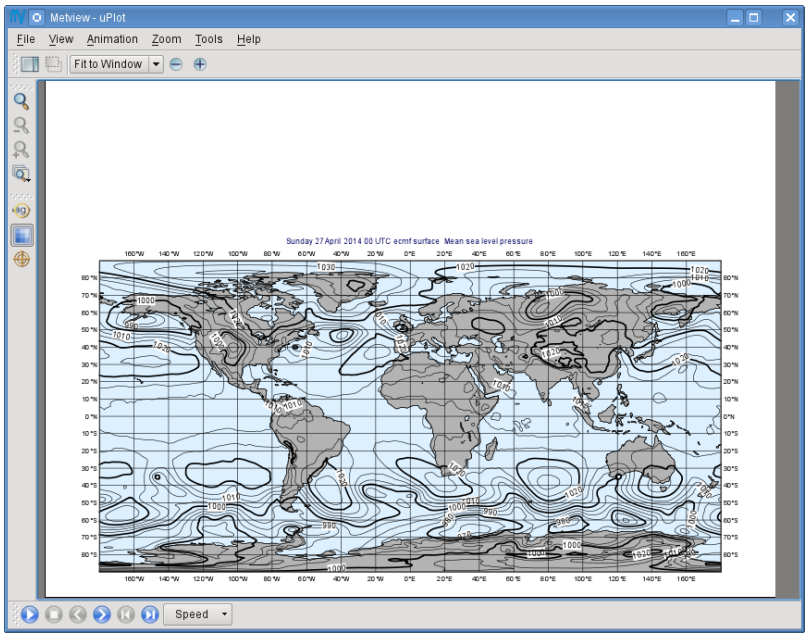
5 Modifying the Contouring

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

In your folder you will find the mslp_black contouring icon defining black contour lines with a 5 hPa interval:



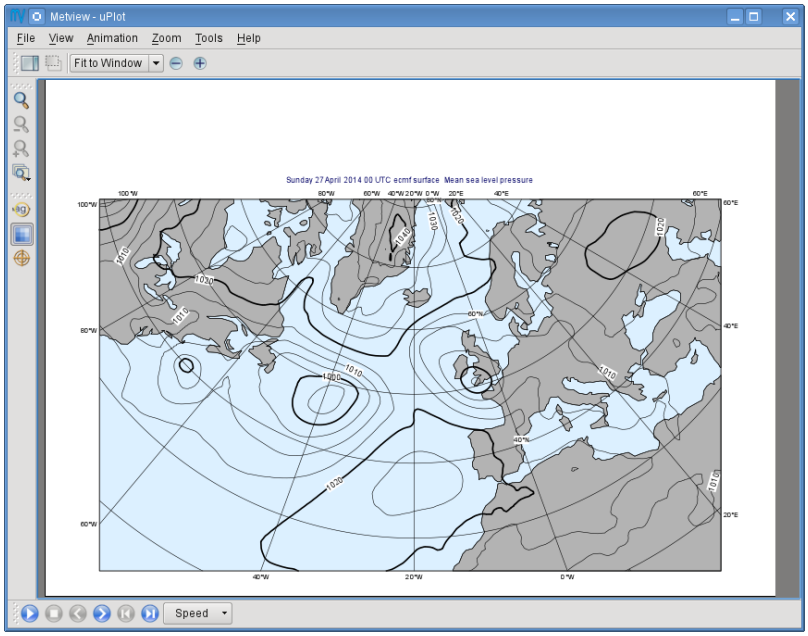
When you drop this icon into the plot you should see something like this:



6 Changing the map projection

Map projection settings, just like anything else, can be stored in a Metview icon. You will find a *Geographical View* icon named map_atlantic in your folder defining a map view for the North-Atlantic region on a polar stereographic projection:

When you drop this icon into the plot you will see the projection change immediately:



You can use the *Geographical View* icon as a starting point of your plot generation. Now close the display window and follow the steps below:

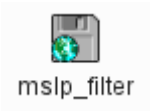
- first, visualise your map_atlantic *Geographical View* icon
- next, drop your *GRIB* icon into the plot
- finally, drop your *mslp_black* contouring icon into the plot

You should get the same plot as above!

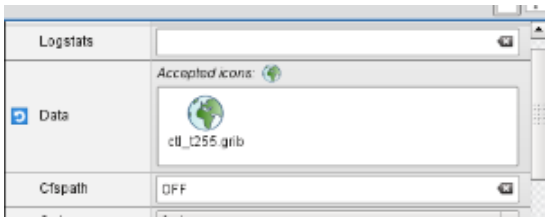
7 Filtering GRIB fields

As you could see, your GRIB file contains a lot of different fields, one after the other. This means that to provide animation only for a given parameter you need to filter the GRIB file.

Create a new *Grib Filter* icon and rename it 'mslp_filter':



Now open its editor and drop your GRIB file into the Data field:

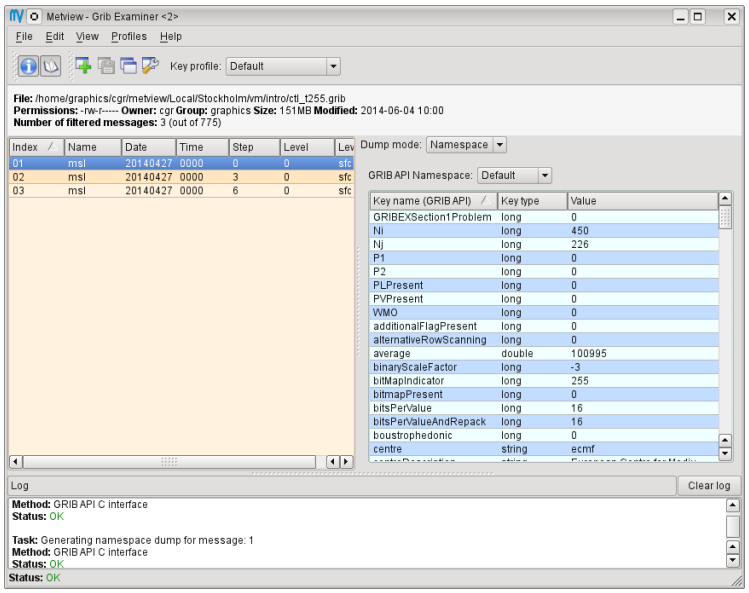


Then edit the following parameters:

Param	msl
Step	0/3/6

By doing so you specified that mean sea level pressure for steps 0, 3 and 6 h will be filtered from your GRIB file.

Now right-click **examine** the mslp_filter icon to see if the filter works and there should be only three fields in the resulting GRIB file.



Next **visualise** the icon, you will see that there are only three mean sea level pressure fields fields there to animate.

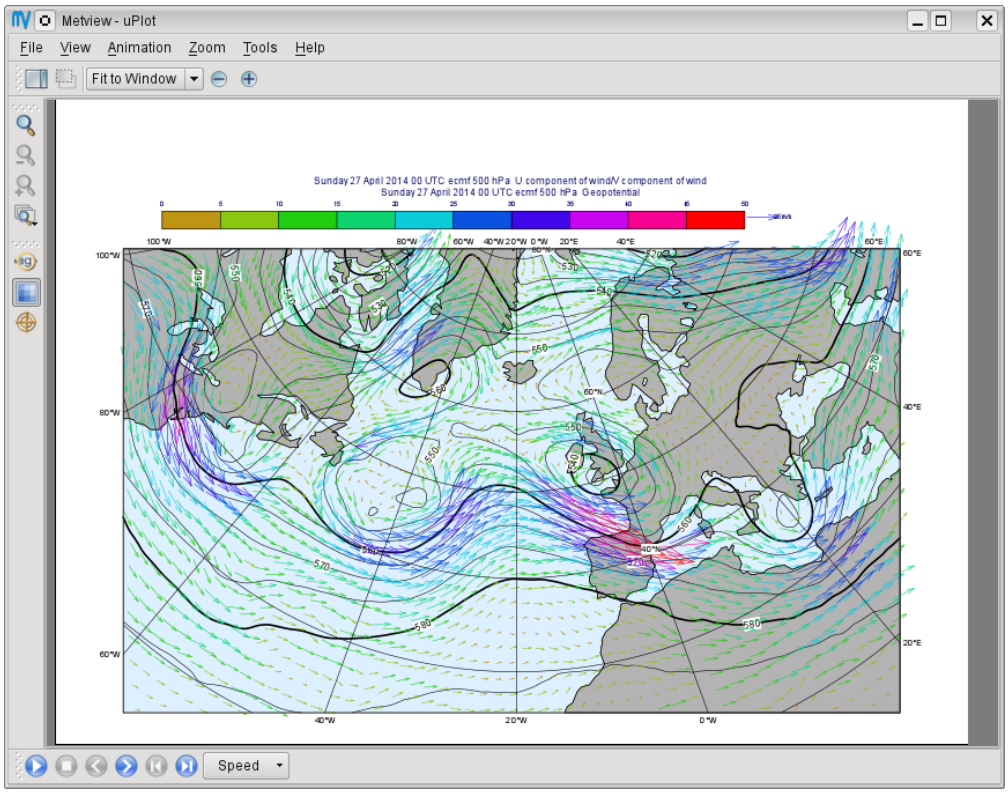
8 Overlaying fields

Will will overlay 500 hPa geopotential and wind from our GRIB file. In order to do it we need to filter the needed geopotential and wind fields separately. The icons together with the appropriate *Contouring* and *Wind plotting* icons are already prepared for you:

To get an overlay plot execute the following steps:

- First, visualise your map_atlantic *Geographical View* icon.
- Next, drop your z_filter and z_black icons together into the plot (you can select them by either drawing a rectangle around them with the mouse or by pressing down CTRL while you click on them).
- Finally, drop wind_filter and wind_arrows together into the plot.

You should see something like this:

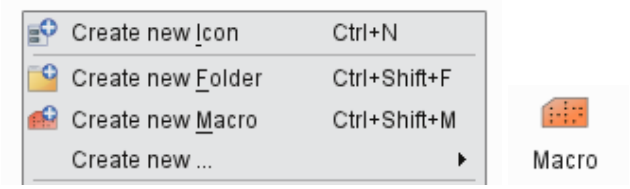


9 Metview Macro

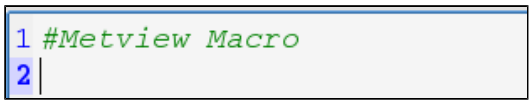
Macro is Metview's own scripting language. It provides an easy way to manipulate and display meteorological data. It extends the use of Metview as it allows the writing of complex scripts that may run in batch at user defined times.

Metview Macro is a huge topic in itself. Here you will only learn the very basics and see how to reuse your existing icons in Macro. The task to solve here is to write a macro that reproduces the same plot as we generated for the mean sea level pressure animation previously.

First, create a new *Macro* icon. You can right-click within the **Metview Desktop** to obtain a context menu from where the option **Create new Macro** is available.



Next, edit the Macro and move the cursor to the second line like this:



Next, drag your map_atlantic *Geographical View* icon into the macro editor. You should see that the macro code for the icon (and for its embedded *Coastlines* icon as well) is automatically generated for you:

```
#Metview Macro
# Importing : /Local/Stockholm/vm/intro/coast_grey

coast_grey = mcoast(
        map_coastline_resolution    :   "low",
        map_coastline_land_shade    :   "on",
        map_coastline_land_shade_colour :   "grey",
        map_coastline_sea_shade :   "on",
        map_coastline_sea_shade_colour  :   "RGB(0.86,0.94,1)"
        )

# Importing : /Local/Stockholm/vm/intro/map_atlantic

map_atlantic = geoview(
        map_projection  :   "polar_stereographic",
        map_area_definition :   "corners",
        area    :   [14.02,-56.73,40.42,60.66],
        map_vertical_longitude  :   -20,
        coastlines  :   coast_grey
        )
```

Now drag your mslp filter icon into the editor below the existing code. Then also drag mlsp_black in a similar fashion.

As the last step, you just need to add this line to tell Metview to generate a plot:

```
34 plot(map_atlantic,mslp_filter,mslp_black)
```

When it is finished run the macro by pressing the "play" button in the Macro editors' toolbar:

You should now see your original plot recreated.

This macro could be also run by saving it then right-clicking **visualise** from the pop-up menu.