MANUAL FOR WORKING WITH MODIS IMAGES IN SEADAS 4.9.4 – Draft version 1

By : Vera De Cauwer, Polytechnic of Namibia

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The manual is written for the Linux computer of the Department of Land Management. The operating system is Fedora Core 4. The images used are MODIS Aqua provided by NASA.

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A. Downloading MODIS images

Select and download images from the website :
http://oceancolor.gsfc.nasa.gov/cgi/browse.pl?sen=am

Time Period: Entire mission
Sensors: MODIS(Aqua)
Area of Interest: Namibia : region bounded by N: -17.0S, S: -28.0S, W: 10.0 and E:16.0.

Click on **Find Swaths**

Have a better look at the most cloud free images by clicking on the thumbnailes.

If an image is of satisfactory quality, then :

- Print the page of the image,
- Right click on each picture (quasi true colour, chlorophyll and SST) and save the pictures under a directory with a name reflecting the date of the image e.g. '2004_12_01,
- Order the image by clicking on **Select this scene** (for in case you order a batch of files at the same time – your order will be placed on a temporary ftp site).

  OR : Right click on the hyperlinks for the bzip2 compressed hdf files of the L1 and L2 products. Select **Copy link location**. Open Getright. Click on **File > Enter new URL to download**. Click **OK**. Indicate the correct directory and **Save**.

B. Decompressing MODIS images

The MODIS images that are downloaded from NASA are in a compressed format (*.gz or *.bz2). Unzipping of *.gz files or *.bz2 files can be done as follows :

Open the Terminal window with following functions : **Applications/System Tools/Terminal**

To decompress a file, you have to be in the same directory than the compressed file is in. To be sure do the following :

1. Checking and changing directory

Type **ls** {enter}
If the file is there, you're ready to go (go to 2.). If not, make sure you change the directory to the directory containing all MODIS images :
cd MODIS_images {enter}
Type **ls -l**
All directories containing MODIS images are listed ; they are sorted by date. Change to the directory containing the image you want to decompress :
Type **cd <name directory>**

You can now start the actual decompressing.

2. Decompressing files

If a file ends in .bz2 (e.g. file.bz2) type:
bunzip2 -dv file.bz2

If a file ends in .tar (e.g., file.tar) type:
tar -xvf file.tar
If a file ends in .gz (for example, file.gz) type:
gzip -d file.gz

If a file ends in .tar.gz (e.g. file.tar.gz) type:
gunzip -c file.tar.gz | tar xvpf -

OR :

gzip -d file.tar.gz
and then
tar -xvf file.tar

C. Processing in SeaDAS

1. Start SeaDAS

Open Applications/System Tools/Terminal
Type 'seadas -em'
The SeaDAS main menu will appear.

2. Displaying MODIS products

2.1 L2 products

Level 2 or L2 products refer to :

- chlorophyll a concentration : chlor_a (in mg/m^3)
- normalised water-leaving radiances for six wavelengths : nLw_412, nLw_443, nLw_488, nLw_531, nLw_551, nLw_667
- sea surface temperature : sst (in degrees Celsius)
- eps_78
- K_490
- angstrom_531
- tau_869
- 12_flags

2.1.1 Display L2 product

To display one or more of the L2 products :

Click on **Display**
Select the subdirectory where your image is stored (click only once for selecting a directory) -
The MODIS images are saved under the directory : /home/vera/MODIS_images/
Select the image you want to load *(remember that you are loading an L2 product !)*
Click **OK**

The Product Selection for MODIS file window appears.

Leave pixel and line sample rate on 1.
Select the product(s) you want to display : for example **chl_a** or **Select All**
Click **Load**

The Band List Selection Menu will appear.

Select the band (product) you want to display and click **Display**.

The L2 product will be displayed in gray scale in a new window. You can close this window by clicking on **Quit**.

2.1.2 Give color to L2 image

Select : **Functions > Color LUT > Load LUT**

- If you are loading a predefined color table (LUT) :
  Select a color table of **1. IDL predefined color tables**, e.g. Blue/Green/Red/Yellow
  Click **Apply**
  Click **Quit**

  It is advised to rescale the data for the maximum Chl *a* values recorded in the area :
  Select **Functions > Rescale**
  Type **40** as Maximum value.
  Click **Redisplay** and **Quit**.

- If you want to create your own LUT :
  Load a predefined LUT and make changes with :
  - **Options :** you can adjust the sliders **Stretch Bottom** and **Stretch Top** to change the parameters
  - **Functions > Rescale** : to rescale

  Save the color LUT by selecting : **Functions > Color LUT > Save LUT**
  Choose **ASCII LUT file**
  Save

- If you are loading a LUT you created :
  Under **3. Load from ASCII or HDF file**, click on **Select**
  Remove the *.hdf filter
  Browse to /home/vera/OC Research Results and select the color LUT file (make sure you scroll to bottom of files in directory)

2.1.3 Projecting images

Projecting an image and creating a subscene for the study area is done at the same time with this procedure :

- Make sure the image you want to project is loaded in the Band List Selection Menu
- **Utilities > Data Manipulation > Map Projection**
- Select a dataset to project by clicking on it in the selection list (you can select more than one band, they will all be projected with the same projection parameters)
- Missing value : -1
- Mapping option : individual
- Automatically load defaults : Yes
- Projections : **Transverse Mercator**
- Central latitude : **-22**, central longitude : **15**
- Scroll down (right side of window)
- Keep **Unset Scale** selected
- Indicate latitude and longitude limits (boundaries of study area)
  - for Walvis Bay : Lat Limit : -24, -22, Lon Limit : 10, 15
  - for Luderitz : Lat Limit : -27.5, -25, Lon Limit : 11, 16

- Indicate the output size :
  - for Walvis Bay : x = 515, y = 222
  - for Luderitz : x = 515, y = 167
- Click **Go** (the projecting make take some time)
- Quit
- The mapped image will be added to the Band List Selection Menu
- Display the mapped image
- Save the image with **Functions > Output > Display**
- First as a picture (**Image Display**)
- Then the **Image Data**

2.1.4 Creating true colour images

- Load an image as indicated in 2.1.1 : you should load at least 3 bands that will represent green, red and blue (you can load L1b bands, projected bands, L2 bands)
- Display the bands that you will use for the RGB and have a good look at the scatterplots with Functions > Scatterplot (or the histogram : **Functions > Histogram**). This will allow you to determine an appropriate slope and intercept. For example if the maximum value of a band is 30,000, the corresponding slope could be S = 30,000/255 or less.
- Go to : **Utilities** > **Data Visualization > Load True color image**
- Select **Band List**
- Select the band numbers (if all bands were loaded : **6 – 5 – 3 (or 4)** for nLw_667 (R), nLw_551 (G) and nLw_488 (B)
- Enter the slopes and intercepts for each band (you will have to try a few combinations before obtaining a good composite)
- Click **Load**
- Select the true colour image in the Band List Selection Window (will be last band added to the list)
- Click **Display**

2.1.5 Exploring the L2 product

It is easier to explore the L2 product by making sure the roam and zoom windows are on by selecting : **Functions > Roam Window On** and **Functions > Zoom Window On**.

To find the coordinates of a certain pixel (e.g. Pixels of top left and bottom right corners), select : **Functions > Read and Profile**. This function can be used to define the pixels of certain longitudes and latitudes, i.e. those indicating the study area.

2.1.6 Creating a profile plot

- Make sure the projected image is loaded and displayed
- **Functions > Read and Profile**
- Change the latitude to that of the profile you want to create, for example -23 for the Walvis Bay monitoring line (with longitude preferably 14.3)
- Click on **Move to lat/lon**

If you want to create the plot in SeaDAS :

- Click on **Profile plot setup**
- Data source : Geophysical
- Interactive :ode : On
- Log scaling : No
- Set Min to 0 and test Max
- Quit
- Click on **Plot Row Profile**
- Click on Output
- Save as Postscript, Colour
- Manually add the extension *.eps to the file name

If you want to create the plot in Excel :

- Click on Output ...

2.1.7 Layout

Before saving a picture of an L2 product, make sure following elements are indicated :

- Grid :
    - Change the color of the grid to white or black with : **Setups > Grid**
    - Change the value for the latitude grid to **1**
    - Indicate NO for labels
    - Click **Go**
    - Close window
- Landmask :
    - Change the color of the coastline to white with : **Setups > Landmask**
    - **Go**

2.1.8 Saving as a picture

Save the L2 products as a picture with **Functions > Output > Display**.

- Change type to : **Image Display**
- Indicate **Color Bar On**
- Choose as **color bar background light**
- If necessary : Indicate the area of which you want to save a picture (start/end column and row).
- Chose as file type *.png so it can be inserted in a document at a later stage.

The files are automatically saved to the home directory /home/vera and have to be moved to the /home/vera/OC Research Results directory afterwards.

2.1.9 Display flags

As data is processed by msl12 from Level 1 to Level 2, checks are made for different defined conditions. When certain tests and conditions are met for a given pixel, a **flag** is applied to that pixel for that condition. The msl12 **Level 2 processing flags** are stored in the Level 2 data file as the "l2_flags" product. (Mike, Ocean Color Forum, 2006)

Make sure both the 12_flags bands are loaded and the L1 or L2 image on which you want to apply them is displayed.

- **Utilities > Data Visualization > Level 2 Flags Display**
- Band number of loaded flag array : slide to number of band that contains the 12 flags
- Display window for flag to be applied : slide to number of window that contains band on which you want to display flags
- Adapt flag type to **MODIS (DAAC) Common flags**
- Indicate the flags you want to visualise
- Click on **Load** Multiple Flags

However, pictures can not be saved with the flags !

2.2 L1 products

L1 products are uncalibrated raw radiances referred to as ev_412, ev_443, ev_488, ev_531, ...

- geolocation : L1A to geo processing,
- modis_l1bgen : L1A to L1B processing,