

## Aerosol and HDFLook Exercise #1

The purpose of these exercises is to become familiar with some of the MODIS atmosphere products while simultaneously becoming familiar with some of the HDFLook functionality.

To start the program type HDFLook (exactly as written) in the xwindow. When HDFLook opens you will see two windows. The **HDF\_read\_files** window is used to navigate between directories to find the files you want to load. If the windows are too large to fit completely on your screen quit the application. Restart using the command HDFLook -z 80. This will zoom the display windows to 80% of normal size.

Navigate to the directory where the files are located. Once you see the list of files select the file to be loaded. For this exercise the first file we will load is:

**MYD04\_L2.A2014212.2000.006.2014213165536.hdf**

Click on this file name to load it. Once it is loaded the file name will appear in the title bar at the top of the second window. In this window will be the list of all the parameters contained in this file.

Before we begin this exercise we need to know exactly which parameters we will be working with and something about their information content.

Use the following link to open up the correct page on the MODIS-atmos site:  
[http://modis-atmos.gsfc.nasa.gov/MOD04\\_L2/format.html](http://modis-atmos.gsfc.nasa.gov/MOD04_L2/format.html)

This lists the parameters (Scientific Data Sets – SDS) available in the MOD04 and MYD04 files. Find the following parameters and record the missing information from the website or HDFLook window as needed. **Items below in bold are found in the HDFLook window in the “SDS list” field:**

1. OPTICAL DEPTH LAND AND OCEAN
  - a. What wavelength is given in this parameter?
  - b. What are the Maximum and Minimum values Reported?
  - c. Parameter number in the HDFLook window**
  - d. What are the dimensions of this SDS?**
  - e. What is the common name for this parameter?
2. CORRECTED OPTICAL DEPTH LAND
  - a. What wavelengths are given in this parameter?

- b. **Parameter number in the HDFLook window**
  - c. **What are the dimensions of this SDS?**
  - d. What is the common name for this parameter?
3. Dark\_Target\_Deep\_Blue\_Optical\_Depth\_550\_Combined
- a. What wavelengths are given in this parameter?
  - b. **Parameter number in the HDFLook window**
  - c. **What are the dimensions of this SDS?**
  - d. What is the common name for this parameter?

**Basic File Information:**

Make sure you know how to decode the information contained in the MODIS file name.

Fill in the following information from the MOD04 file we have selected

File date: \_\_\_\_\_ Year: \_\_\_\_\_ Julian Day: \_\_\_\_\_ Month: \_\_\_\_\_ Day: \_\_\_\_\_

Time of day: \_\_\_\_\_ Collection: \_\_\_\_\_

Year of Processing: \_\_\_\_\_ Which Sensor: Terra or Aqua \_\_\_\_\_

**HDFLook Functionality**

HDFLook has functionality to display data as both raw rectangular images and reprojected images that are stretched to conform to a geophysical display on the surface of the earth. Controls for raw image display are on the left-hand side of the parameter selection window. Reprojected images are displayed using controls on the right-hand side.

Throughout this exercise if you see something like this (Plot → Histogram), it means use the pull-down menu “Plot” and choose the option “Histogram.”

**Parameter Selection**

**a) Select parameter to display**

In the “SDS list” window highlight the SDS Optical\_Depth\_Land\_And\_Ocean.

What are the dimensions of this parameter? \_\_\_\_\_

**Show Attributes**

To find out details about the parameter you are displaying click on the “Show attributes” button located to the right of the SDS selection window.

What wavelengths for AOD are included in this parameter? \_\_\_\_\_

What quality of data is included in this parameter? \_\_\_\_\_

## **Image Displays**

Note the globe in the display control window showing the location of this granule.

### **a) Reprojected Image Display**

Click and hold the “Display a MODIS reprojected image” button and select “Show one layer” from the drop down menu.

You can resize the image window by grabbing the lower right corner of the display window and dragging.

**Adjust the contrast:** In the HDF\_set\_stretch window enter “0” in the low cut-off window, 0.83 in the high cut off window and click “Apply”

**Set map addings:** Click and hold the menu just above the globe. By default it should read “Set reprojection geometry”. Select “Set map addings”. Play with the selections and colors to try to find something that contrast well with the existing color display.

It is suggested that you turn on at least “Draw Coasts,” “Draw Boundaries” and in the “River addings” section, “Permanent major.” You will need to once again click on the “Show one layer” button to update the display.

### **b) Raw Image Display**

Click “Show SDS as an image”

The display will by default have the mask on and display values as raw numbers. To turn off the bright pink mask click the “automatic mask detection” box. To turn the raw values into AOD click on “No predefined scaling” and choose  $y=ax+b$  from the drop down menu.

Resize the image and adjust the contrast stretch to match the raw image display.

### **c) Color scale and contrast stretch**

Make sure that both images are displayed in a color palette that makes sense to you. Use the pull down menu under “color” in each display box and choose a few of the color palettes to try.

For each image use the contrast stretch (HDF\_set\_stretch window) and play with different ranges of values to see how it affects the image display.

Note that whenever you change the stretch values the display will not change until you click the “Apply button”

## Data Analysis AOD

### e) Finding data values for AOD

In the window that is displaying the raw image select (Window → cursor values). An HDF\_pixel\_value window will open. Click in the areas of the image you wish to explore. The top of this window will show the x and y locations, the scaling applied to the values, the value of center (the pixel at the x, y location) and the mean of the pixels around the center pixel.

You can choose to analyze and display values in a 3x3, 5x5 or 9x9 pixel area around where you are clicking in the image. The pixel you click on is displayed with asterisks on either side.

**Click and highlight the Corrected Optical Depth Land SDS.** Note that there is now an extra dimension for the SDS. Use the “Show attributes” button to determine which wavelengths are available in this SDS and to answer the questions below. Display it as both a raw and reprojected image. Explore the area of high values in the raw image using (Window → cursor values). Click in the areas of the image you wish to explore. You can choose to display a 3x3, 5x5 or 9x9 pixel area around where you are clicking in the image. The pixel you click on is displayed with asterisks on either side.

What is the range of the high AOD values at 0.47?

At 0.55?

At 0.66?

There are 2 ways to find values in multiple wavelengths at one time. Try both methods.

*Method A: Enter “\*” in the first dimension box and click “Show SDS as and image”  
Selecting “All Layers” in the pixel value box will show the mean and center value for all layers (in this case wavelengths) at the same time*

Look at the image when all three wavelengths are displayed. In general what happens to AOD values as you move from shorter to longer wavelengths? \_\_\_\_\_

*Method B: Use (Window → cursor values) value display from the reprojected image.*

## Plotting Values

### f) Plotting transects

Switch back to a display of just the 0.55 in the raw image. Plot a transect across the image (Plot → Transect) . Notice that when you make this selection the cursor arrow will

change color to green. Click and drag horizontally across the image. You can also draw vertical transects but for our exercise we will make a horizontal transect.

**Adjust Axes:**

To change the axis values select (Settings → Axis settings). To eliminate negative values and to allow for 2 decimal places select the Y axis from the drop down menu at the top of the window. In the “Mini” box enter “0”. In the “Label C format” box enter “4.2f” (This is essentially a formatting statement) and then click “Apply”

If you have time after completing all three activities you may wish to come back to this step and play with titles and other features.

Use the show values feature (Drawing\_area → Show values) and move the crosshairs over the values to find the exact value of the highest point in your transect.

**Data Analysis – Aerosol size**

**g) Aerosol size**

Select and display the SDS Optical\_Depth\_Ratio\_Small\_Land\_And\_Ocean as a raw image. Adjust the contrast stretch to display a range of values from 0 – 1.

What is the simple name for this parameter? \_\_\_\_\_

Is the plume is dominated by large or small particles? \_\_\_\_\_

**Level 1B Radiance Data File**

**MYD02HKM.A2014212.2000.005.2014213154402.hdf**

**Level 2, 3km Aerosol Data**

**MYD04\_3K.A2014212.2000.006.2014213163948.hdf**