Lab 13 SeaDAS Ocean color Processing

13. 1 Interactive SeaDAS Processing: *MODIS*

The purpose of this exercise is to present an overview of the basic steps involved in processing **the MODIS data that you ordered from the Ocean Color 'Level 1 and 2 Browser'**.

A. Generate a MODIS geolocation file from one of your Level-1A files

1. Change into the directory of your downloaded MODIS data and start SeaDAS:

   cd ~/Lab13/Data
   seadas -em

2. Using the *SeaDAS Main Menu* window, select ***Process→MODIS→geogen_modis*** to bring up the *MODIS Geolocate File Generation Program* window.

3. On the far right side of "**Input MODIS L1A file**", click [**Select**] to bring up the file selection window and select one of your MODIS L1A files for input. Notice the GUI will automatically create a name for the new GEO file you will be generating.

4. Now click the [**Run**] button to create the GEO file (leaving all the other options set to their defaults). Processing will commence and a new GEO (A2014215185000.GEO) file will be created.

B. Process the Level-1A file to Level-1B *(L1B is calibrated at-aperture radiances)*

1. Using the *SeaDAS Main Menu*, select ***Process→MODIS→l1bgen_modis*** to bring up the *MODIS L1B File Generation Program* window.

2. On the far right side of "**Input MODIS L1A file**", click [**Select**] to bring up the file selection window and select the same L1A MODIS file (A2014215185000.L1A_LAC.x.hdf) from **Step A** for input. The GUI will automatically fill in the GEO file and the default L1B output filenames.

3. Now click the [**Run**] button to commence L1A→L1B processing.
   Your outputs will overwrite the old L1B files (Three files: A2014215185000.L1B_HKM,A2014215185000.L1B_LAC, and A2014215185000.L1B_QKM).

C. Display your new MODIS Level-1B file

1. Within the *SeaDAS Main Menu* window, click [**Display**] to bring up the *Please Select a File for Reading* window, and select the new MODIS L1B file (A2014215185000.L1B_LAC) you created

in **Step B**. (The GEO file should then automatically be detected by the GUI.)

2. In the *Product Selection For MODIS File* window, choose the product named **EV_1KM_RefSB_547_12** and then click [**Load**] to load this band.

3. Using the *Band List Selection* window, highlight the 547**nm** band and click [**Display**]. (Note the image has been padded on the left and right sides to be the full width of a MODIS swath, so you might have to scroll horizontally to find the portion of the image containing your data. These edges exist due to the processing software.)

4. Add a coastline using ***Functions→Coastline***, and then use ***Functions→Rescale*** to rescale your image, decreasing the scale maximum in order to better see the data.

5. **[QUIT]** the display window, and click the [**DELETE**] button to delete the band. Close all windows except for the primary *SeaDAS Main Menu* window.

D. <u>Process the MODIS Level-1B file to Level-2</u> *(estimated geophysical variables such as normalized water leaving radiances, chlorophyll concentration, SST, etc.)*

Using the *SeaDAS Main Menu* window, select **Process→MODIS→l2gen,4** to open the *SeaDAS MODIS L2 File Generating Program* window.

On the far right side of "**MODIS L1B input**" click [**Select**] to bring up the file selection window and select your new L1B file. When you highlight your file and click [**OK**], a window will pop up that first says “Auto detecting ancillary data..”. This indicates the optimum MET and OZONE files are being selected/downloaded for you. The window will close by itself.

Next to "**L2 output file 1**" a filename for the Level 2 output file will be automatically filled in for you. Leave this name as is.

Click the [**Select L2 Products**] button next to the L2 filename to get a list of the many products that l2gen can compute. Select
`sst,chlor_a,cdom_index,Kd_490,nLw_412,nLw_443,nLw_469,nLw_488,nLw_531,nLw_555,nLw_645,nLw_667,nLw_678, click [OKay],`

Click [**Run**]. This process will take a few minutes. The progress can be monitored by viewing the xterm window from which you launched SeaDAS. SeaDAS will print “Processing complete.” when it is done.

Click [**Quit**] in the l2gen GUI window when the processing is complete.

<u>E Display your new MODIS Level-2 file as you Display your new MODIS Level-1B file but load chlor-a</u>

<u>To exit the SeaDAS program, click the *SeaDAS Main Menu*'s [**Quit**] button.</u>

13.2 SeaDAS Unix Commands: MODIS High-Resolution Processing

Motivation – Most SeaDAS data processing can be performed directly on the Unix command-line. Processing on the Unix command-line is generally more efficient than using the GUI or the SeaDAS (IDL) command-line. Also, it is often easier to automate processing using Unix shell scripts that include SeaDAS commands versus using SeaDAS IDL batch scripts. This exercise demonstrates the simplicity of using the Unix command-line to carry out an advanced processing scenario: processing a MODIS L0 file to high-resolution Level 2 products. The steps in this processing chain are as follows:

1. L1A/GEO file → GEO file
2. L1A/GEO → Level-1B 1KM, HKM, QKM files
3. Run scripts to auto-download the required ancillary data for Level-2 processing
4. L1B/GEO → Level-2 file containing high-resolution products

Introduction to Hi-Res Processing - The 36 spectral channels of the MODIS instrument were selected to support observation of clouds, land, and oceans. The traditional channels used for ocean color observation are the 9 1-km resolution bands in the 412-869 nm spectral regime. These ocean bands were designed with high sensitivity over the dynamic range of reflectance typical over open oceans, including contributions from the surface and the atmosphere. Over highly turbid coastal and inland waters these bands can saturate, leaving the true signal unknown. Other bands on MODIS were specifically designed for land and cloud observations, with both increased spatial resolution and reduced sensitivity. These land/cloud bands overlap the spectral range of the ocean bands and extend into the short-wave infrared (SWIR). The SeaDAS L1→L2 processing code (l2gen) can make use of these land/cloud bands, especially for application to coastal and inland waters. This capability is still very young, though it is expected that the research community will evaluate this approach and provide algorithm/application development.

A. <u>Change directory into ~/Lab13/Data/</u> where data are located.

```
cd  ~/Lab13/Data
```

B. Generate a geolocation file from the MODIS L1 file

When SeaDAS is installed, the $SEADAS/bin/ and $SEADAS/etc/ directories are added to your command path. This means that from any directory, you can execute commands that exist in either the $SEADAS/bin/ or $SEADAS/etc/ directory. (All the SeaDAS Unix commands exist in these directories.)

1. On the Unix command-line execute the command:

```
modis_GEO.py
```

(Executing Unix commands alone prints usage help text to the xterm window.)

if it shows command not found, you may have to source ~/seadas6.4/config/seadas.env

2. On the Unix command-line execute the command:

```
modis_GEO.py A2014215185000.L1A_LAC.x.hdf
```

This command will generate the associated geolocation file A2014215185000.GEO.x.hdf.

C. Process the L1A file to Level-1B *(calibrated at-aperture radiances)*

1. On the Unix command-line execute the command:

```
modis_L1B.py A2014215185000.L1A_LAC.x.hdf A2014215185000.GEO
```

(Notice that the two files should be in the same directory, otherwhite, need specify the full path)

D. Determine and retrieve the required MET and OZONE ancillary data *(required for optimal Level-2 data processing)*

SeaDAS has automatic search/download functions that determine the optimum MET, OZONE, and OISST ancillary data files for l2gen processing. These automatic functions are available via the GUI, SeaDAS command-line, or the Unix command-line.

1. On the Unix command-line execute the commands:

```
getanc.py  A2014215185000.L1B_LAC
```

This two commands download the required ancillary data if it is not already present on the hard disk,

also creating the text files **A2014215185000.L1B_LAC.anc** in the current directory (for later use with l2gen).

G. Process the Level-1B file to Level-2 *(estimated geophysical variables such as normalized water leaving radiances, chlorophyll concentration, SST)*

The **l2gen** SeaDAS Unix binary is used to process Level-1 data to Level-2 for all sensors (retrieving oceanic optical properties and various derived products from the observed top-of-atmosphere (TOA) radiances). l2gen is designed to be as general as possible, with many parameters available to control the processing, and a user-specifiable output content. Input parameters are passed to the program through a series of keyword/value pairs, which can be specified directly on the command-line or inserted as single lines in an input parameter text file. **It is also possible to use both methods simultaneously, if for instance the user wanted to use a standard parameter file but vary the input and output files on the command-line.** The most basic l2gen calling sequence is simply:

```
% l2gen  ifile=input_file_name  ofile1=output_file_name
OR
% l2gen  par=parameter_file_name
```

...where the file specified by *parameter_file_name* would contain the two lines:

```
ifile=input_file_name
ofile1=output_file_name
```

Calling l2gen in this manner will produce a Level-2 HDF output file containing the default OBPG suite of standard ocean products processed with the default parameters.

1. Create an l2gen parameter text file in the same directory as your MODIS files called "**hires.par"** (using xedit, vi, etc.) containing the following lines of text (where the l2prod1 line is **one long line**):

```
ctl_pt_incr=1
resolution=250
l2prod1=sst,chlor_a,cdom_index,Kd_490,nLw_412,nLw_443,nLw_469,nLw_488,nLw_531,nLw_555,nLw_645,nLw_667,nLw_678,l2_flags
```

(Note the 250m resolution is specified. Other L2 products/parameters can be specified.)

2. Now run the l2gen Unix command specifying this parameter file along with the MET and OZONE text files created in **Step F** (notice you can use a back-slash (\) to spread long Unix commands over multiple lines):

```
l2gen  ifile=A2014215185000.L1B_LAC geofile=A2014215185000.GEO  par=hires.par
par=A2014215185000.L1B_LAC.anc
```

3. Use SeaDAS to display the **`Kd_490`** 250m product in the A2014215185000.L2_LAC_OC file, and overlay a coastline. (This band is a good indicator of turbidity.)