Working with L1B (radiance) data and creation of "I/F"

Converting Radiance to I/F

- If working with L1b (radiance) data, I/F can be derived in a straightforward manner:

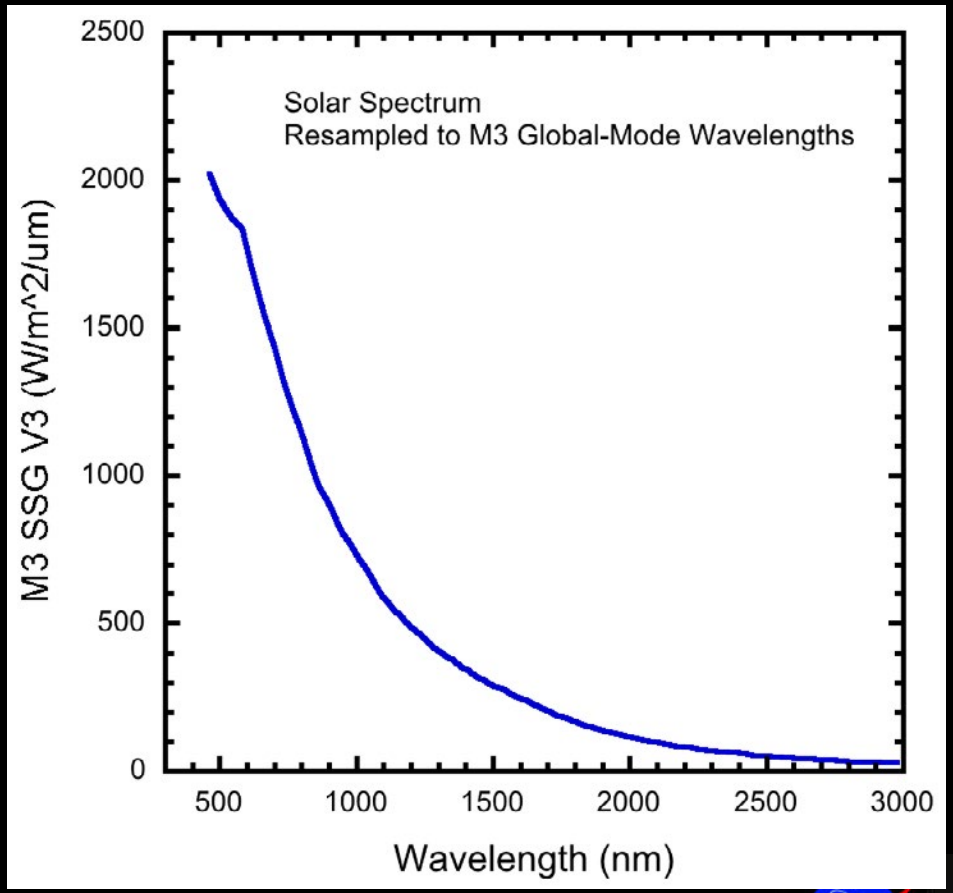
$$IoF = \frac{I\pi d^2}{F}$$

- Where:
  - I = radiance in W/m^2/Sr/µm
  - F = solar flux (solar spectrum) in W/m^2/µm
  - d = Moon-Sun distance in AU

Download M3 Solar Spectrum

http://m3.jpl.nasa.gov/docs/solar_spec_global85.txt

http://m3.jpl.nasa.gov/docs/solar_spec_target256.txt



- MODTRAN-based
  (See Green et al., 2011)
- Global and target resolution version can be downloaded in ASCII format from the above links
- See http://m3.jpl.nasa.gov/m3data.html for more

Download M3 Solar Spectrum

http://m3.jpl.nasa...spec_global85.

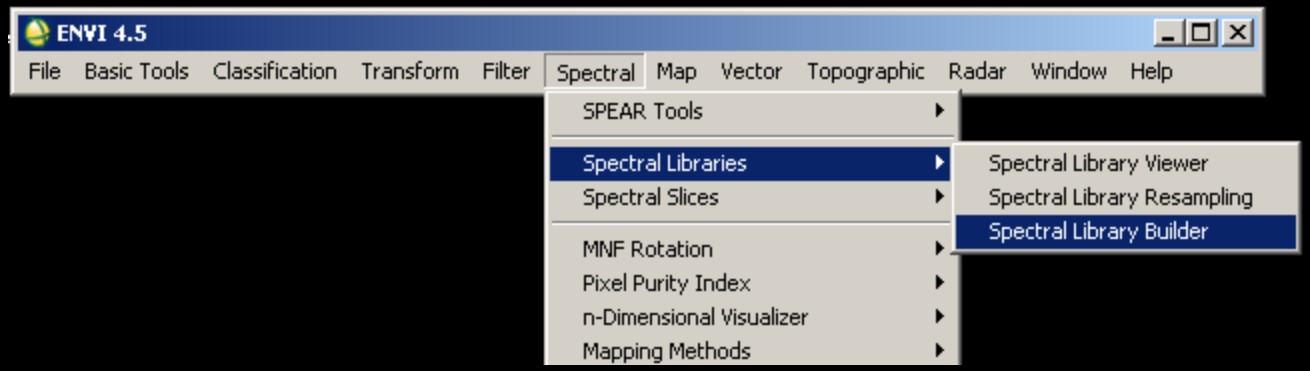
```
ENVI ASCII Plot File [Mon Nov 22 17:44:36 2010]
Column 1: Wavelength(nm)
Column 2: M3 SSG V3 (W/m^2/um)~~1
   460.989990  2022.662109
   500.920013  1934.504639
   540.840027  1875.621826
   580.765015  1833.137451
   620.689941  1689.644409
   660.609985  1550.267334
   700.537537  1428.238281
   730.479980  1324.721680
   750.440002  1271.074707
   770.400024  1216.917114
   790.364990  1162.946045
   810.330017  1107.837036
   830.290039  1053.718018
   850.250000   985.262878
   870.209961   946.577942
   890.174988   920.729126
   910.140015   879.042053
   930.099976   838.584351
```

- File is tab-delimited ASCII text
- 3 lines of header information to be skipped when importing

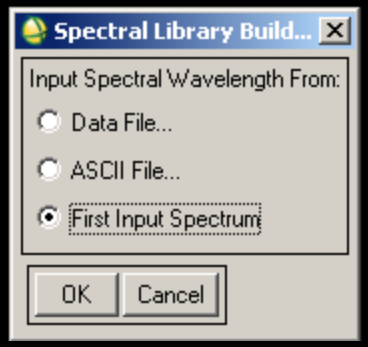
Steps to convert radiance to I/F in ENVI

Step 1: Import M3 Spectral Library

- Step 1:



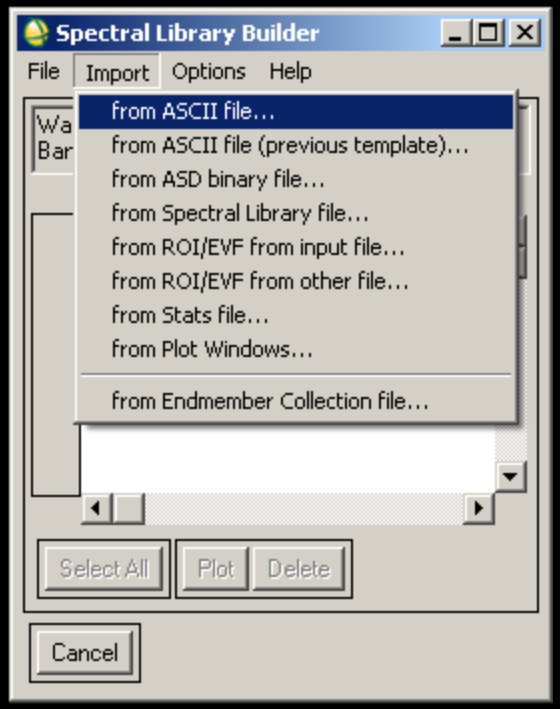
- Step 2:



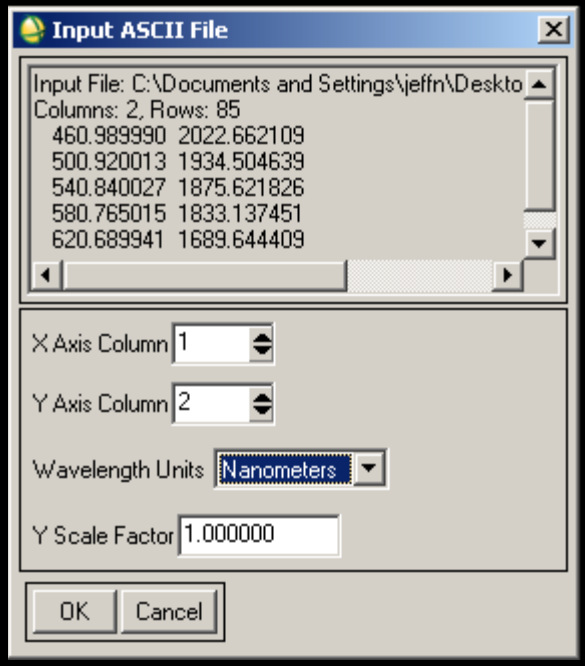
(Can also choose “ASCII File….” here but that has more steps)

Step 1: Import M3 Spectral Library

Step 3:

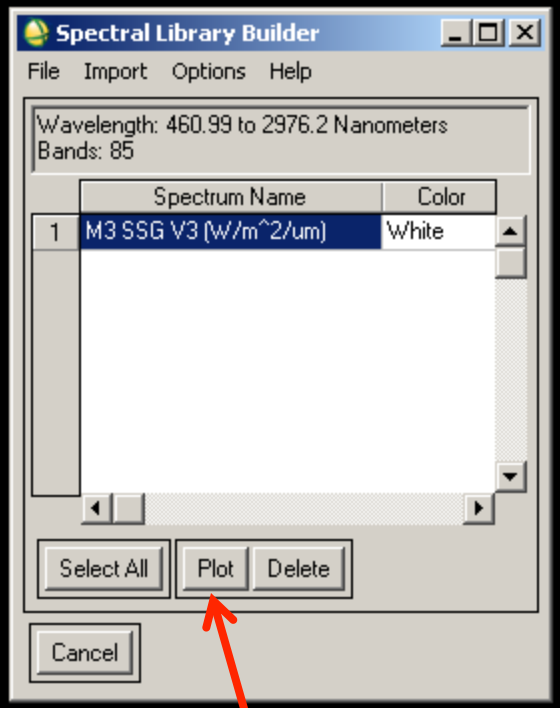


Step 4:



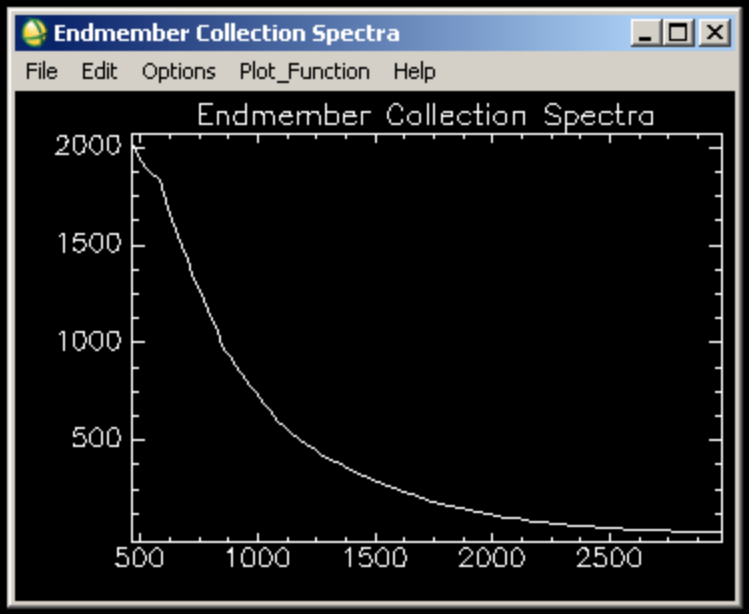
Step 1: Import M3 Spectral Library

Step 3:



Click Plot

Done!

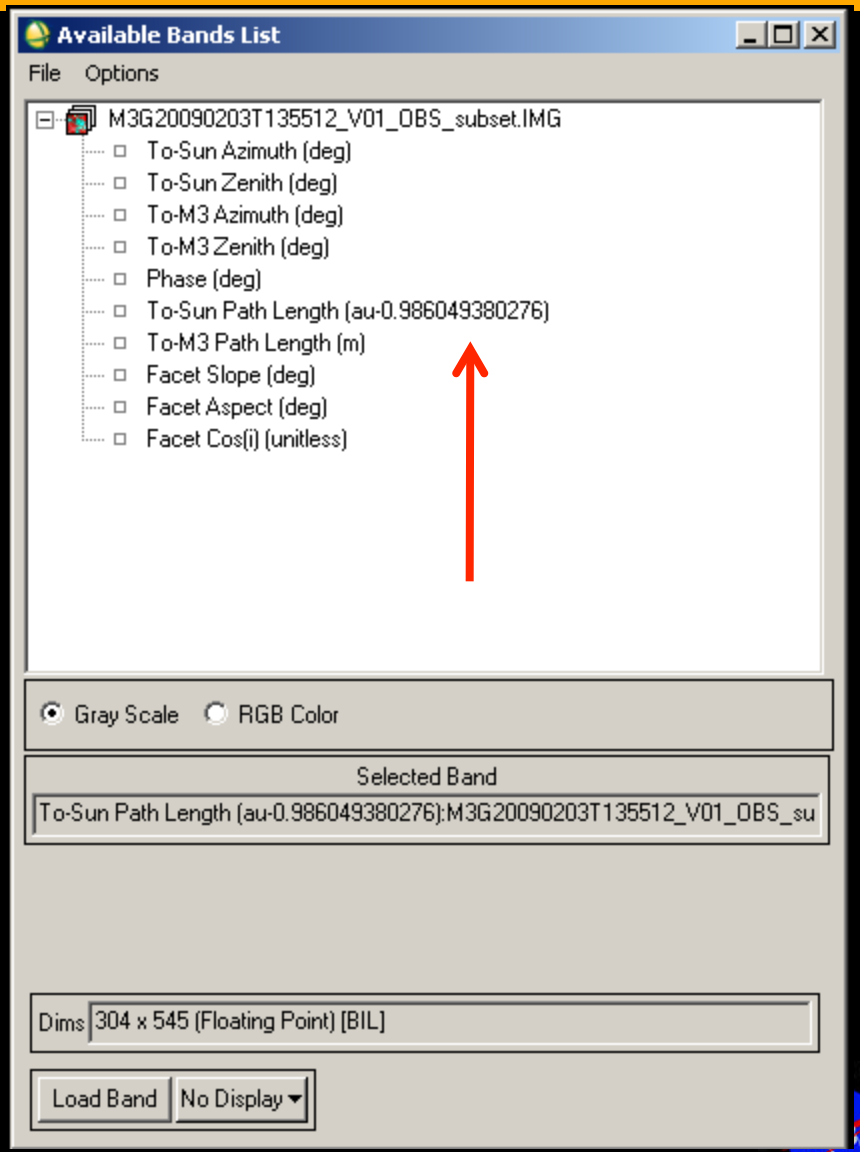


(Can save file as spectral library from File menu)

Step 2: Open Files

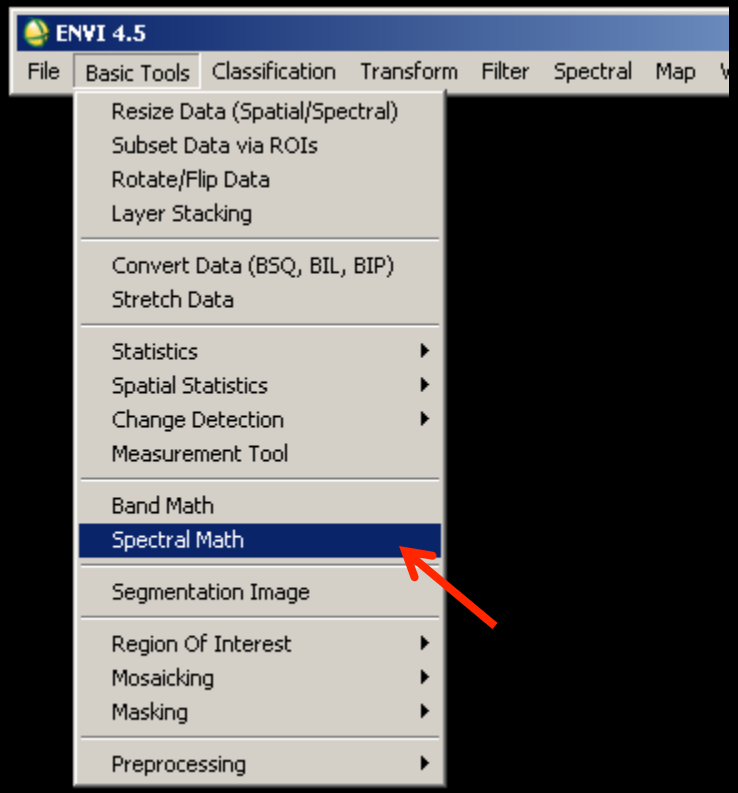
- Open radiance (RDN) file in ENVI:
  - File > Open Image File
- Open observations (OBS) file also
  - This step can be skipped if you want to use 1.0 AU for the Moon-Sun distance (~2% error)
- Open and plot the M3 solar spectrum if you have not already

Step 3: Get the Moon-Sun Distance



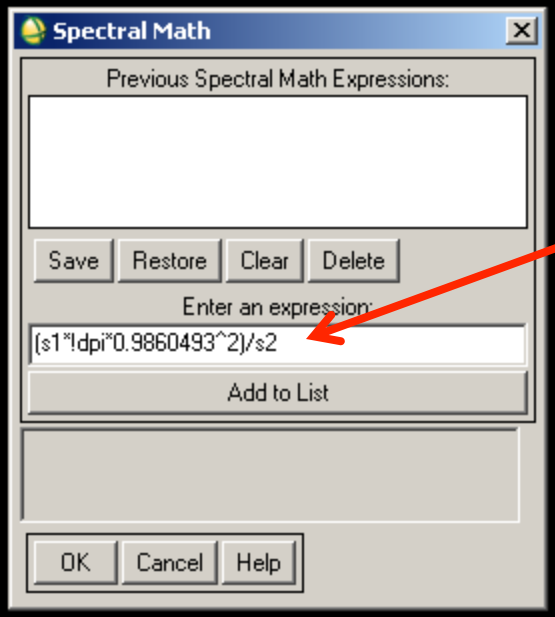
- Get mean distance from list of band names of the OBS file
- Could use per-pixel values in the To-Sun Path Length Band (band math)

Step 4: Call Spectral Math



- Select Spectral Math under Basic Tools menu (also under Spectral menu)

Step 5: Enter the expression



- Expression is:

float((s1*!dpi*0.9860493^2)/s2)

Radiance

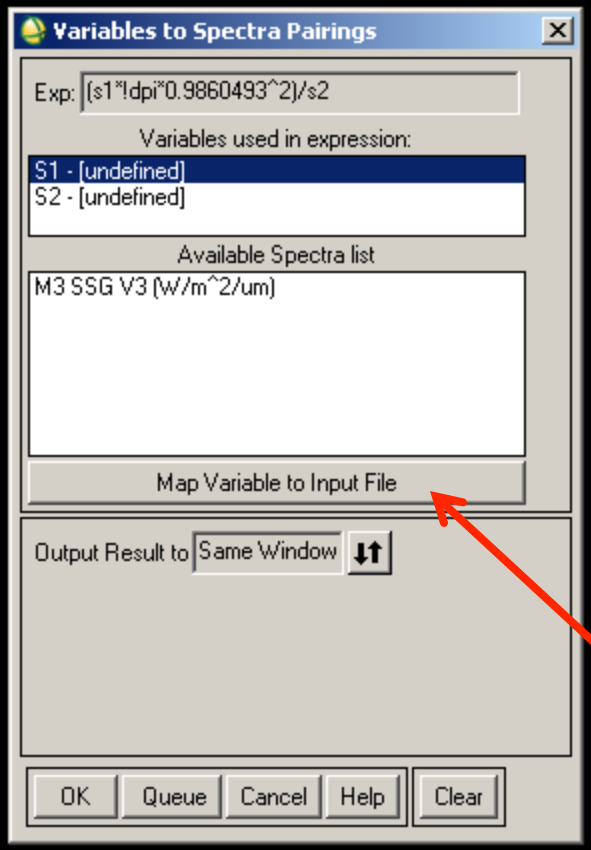
Double precision π

Moon-Sun distance squared; variable per file…

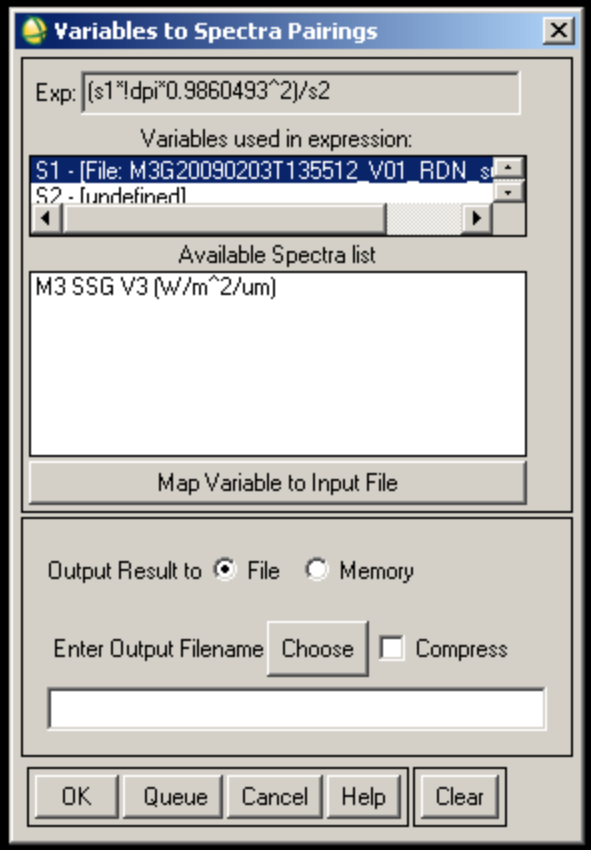
Solar Spectrum

Step 6: Define s1

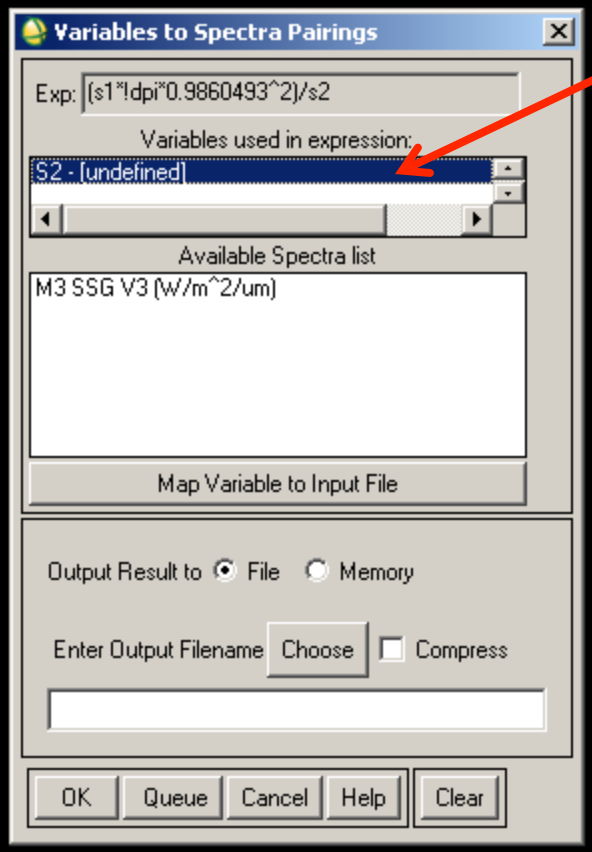
Click “Map Variable to Input File” and select your radiance (RDN) file



Should end up with this:

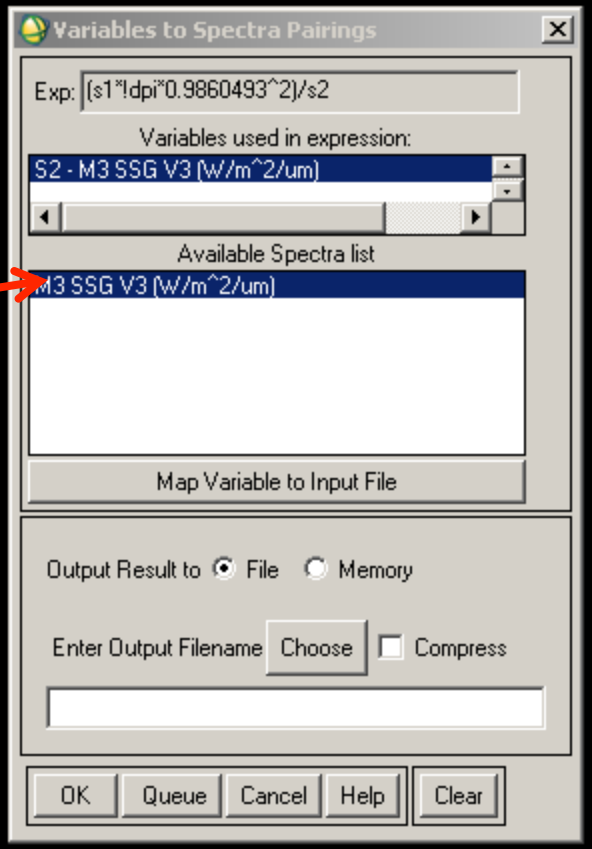


Step 7: Define s2

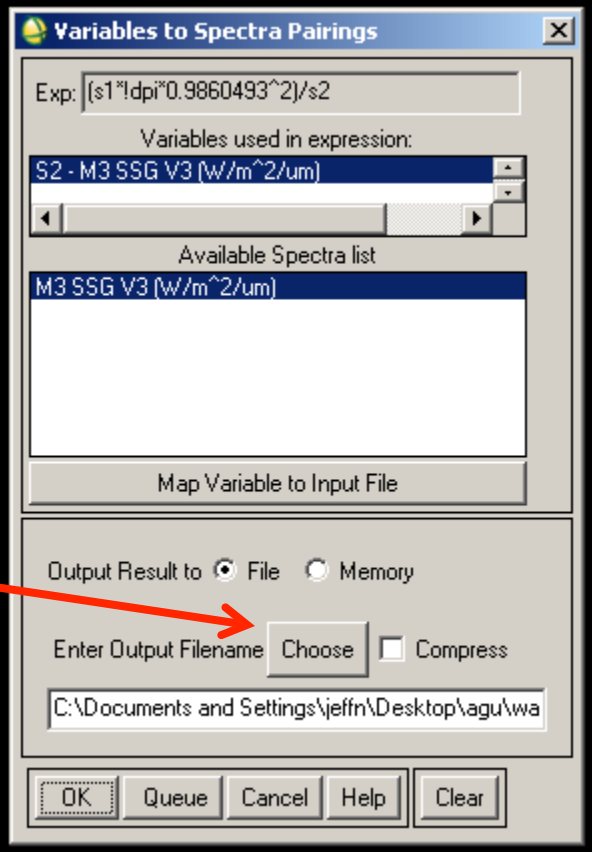


First Click

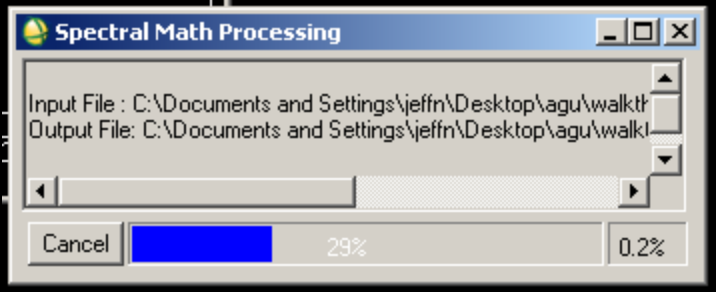
Second Click



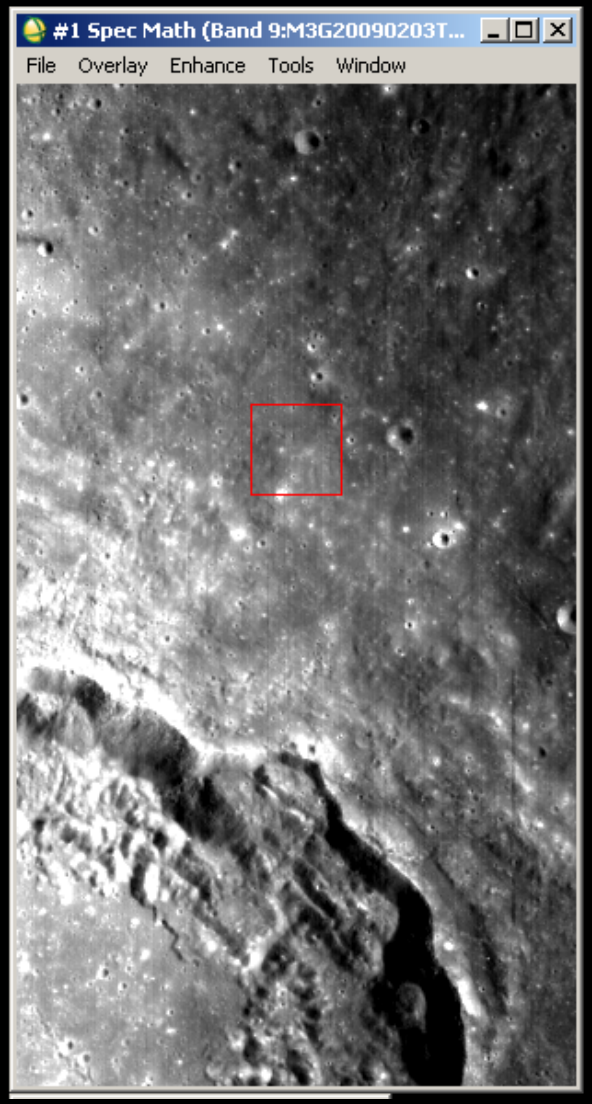
Step 8: Choose Output File

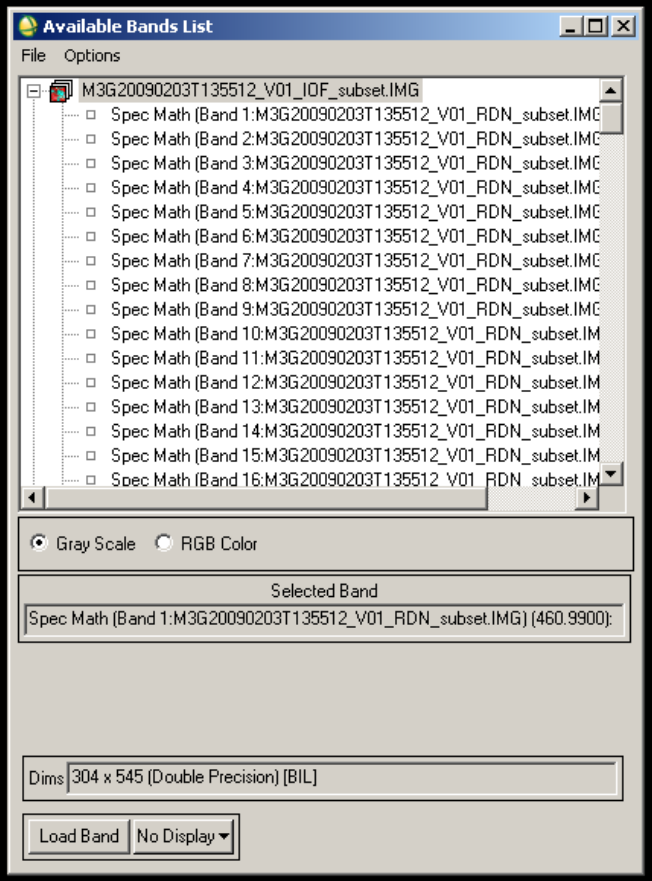


- Then click “OK” and ENVI goes to work…



Last Step: Enjoy!





Check your work!

- Example radiance, observations, and I/F file posted to M3 website so that you can make sure you get the same answer we do:
- http://m3.jpl.nasa.gov/m3data.html
- Filename: M3_TestSubsetCube_M3G20090203T135512_R4.zip
- Note: radiance cube is in older R4 radiance calibration, not U2 as delivered 9/30/11