



# ***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:

$$I_0 F = \frac{I \pi d^2}{F}$$

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

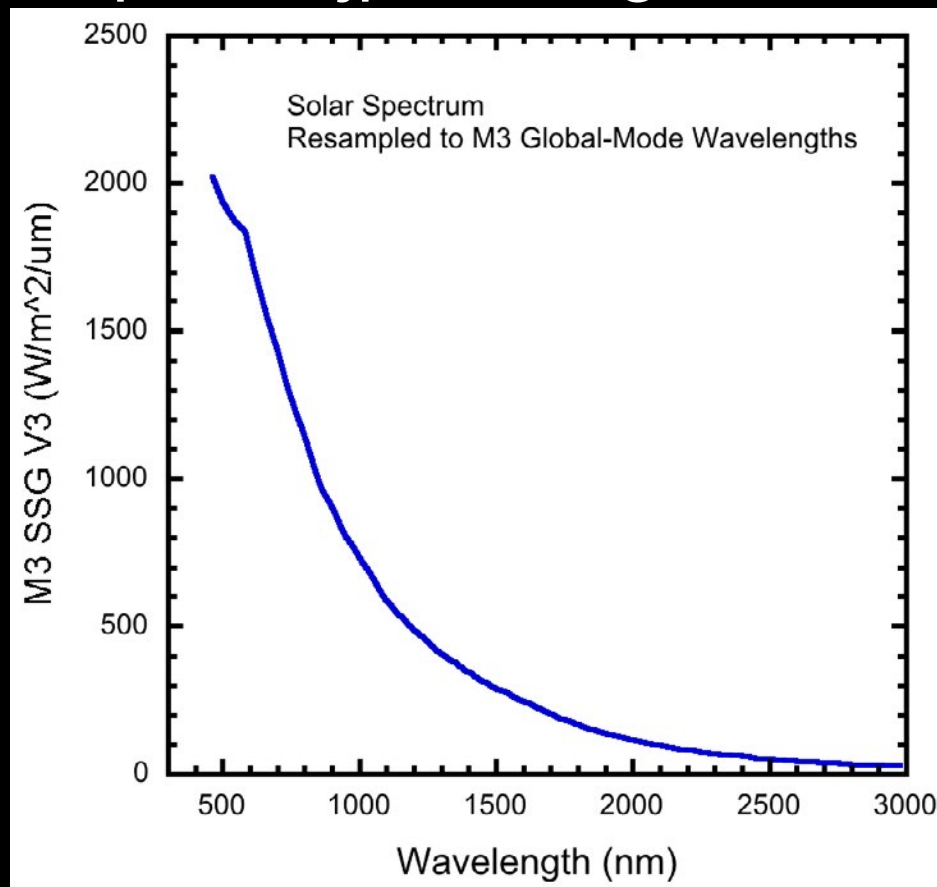




## Download M3 Solar Spectrum

[http://m3.jpl.nasa.gov/docs/solar\\_spec\\_global85.txt](http://m3.jpl.nasa.gov/docs/solar_spec_global85.txt)

[http://m3.jpl.nasa.gov/docs/solar\\_spec\\_target256.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

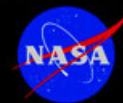




# Download M3 Solar Spectrum

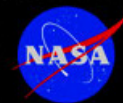
```
http://m3.jpl.nasa...spec_global85.  
ENVI ASCII Plot File [Mon Nov 22 17:44:36 2010]  
Column 1: Wavelength(nm)  
Column 2: M3 SSG V3 (W/m^2/um) ~~1  
460.989990 2022.662109  
500.920013 1934.504639  
540.840027 1875.621826  
580.765015 1833.137451  
620.689941 1689.644409  
660.609985 1550.267334  
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





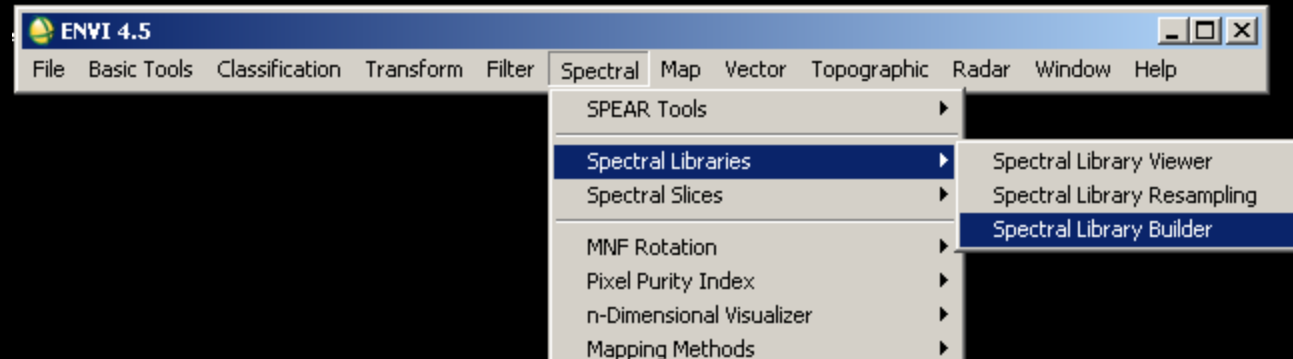
# ***Steps to convert radiance to I/F in ENVI***



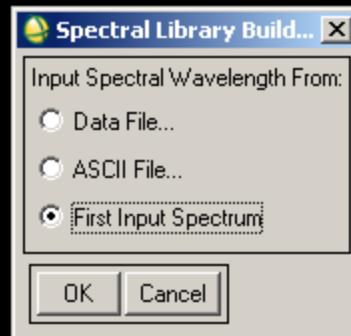


# Step 1: Import M3 Spectral Library

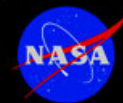
- Step 1:



- Step 2:



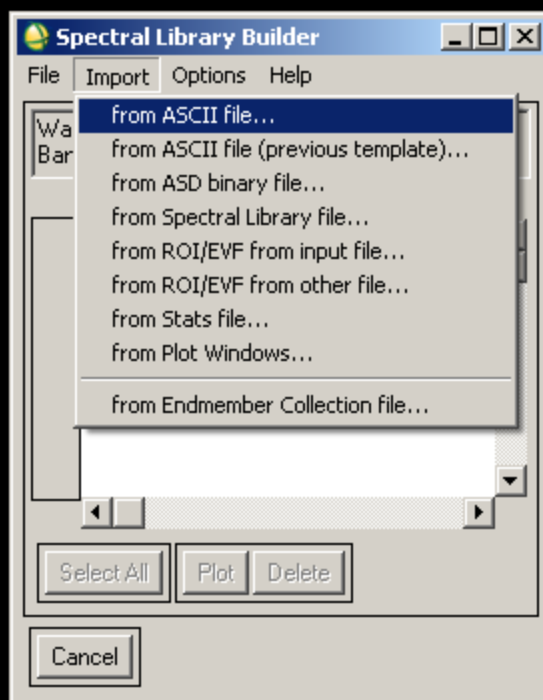
(Can also choose “ASCII File....” here but that has more steps)



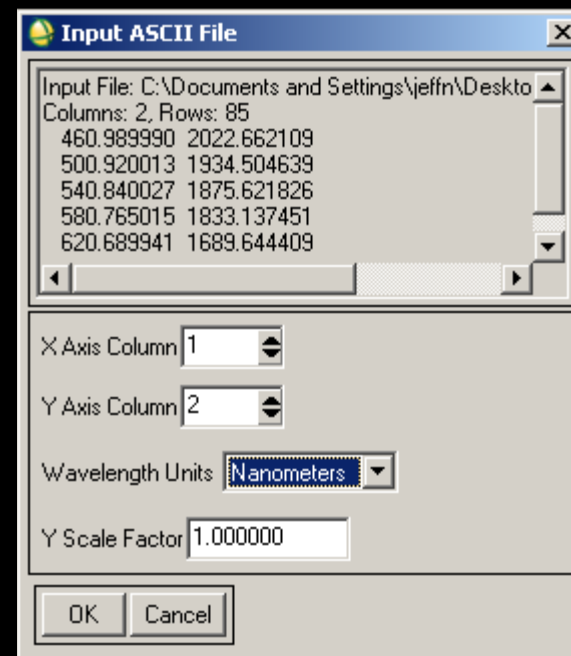


# Step 1: Import M3 Spectral Library

Step 3:



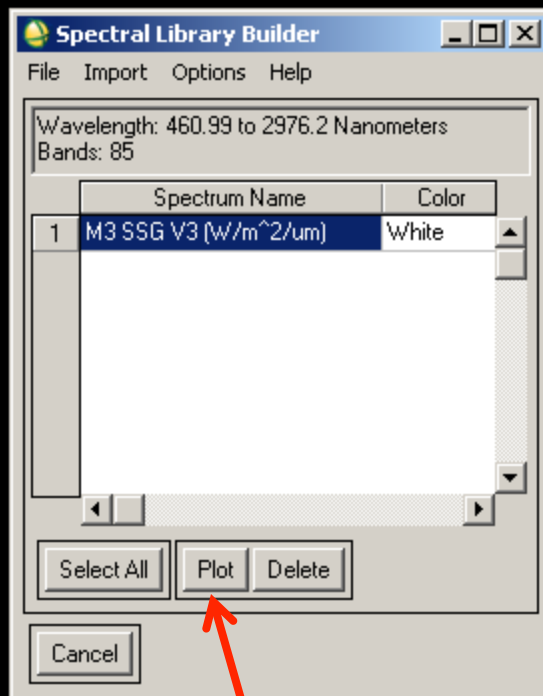
Step 4:





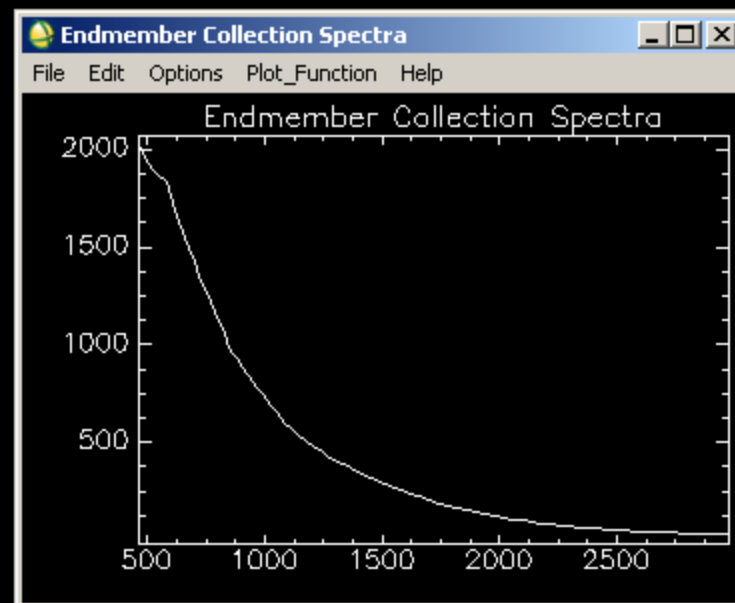
# Step 1: Import M3 Spectral Library

Step 3:



Click Plot

Done!



(Can save file as spectral library from File menu)







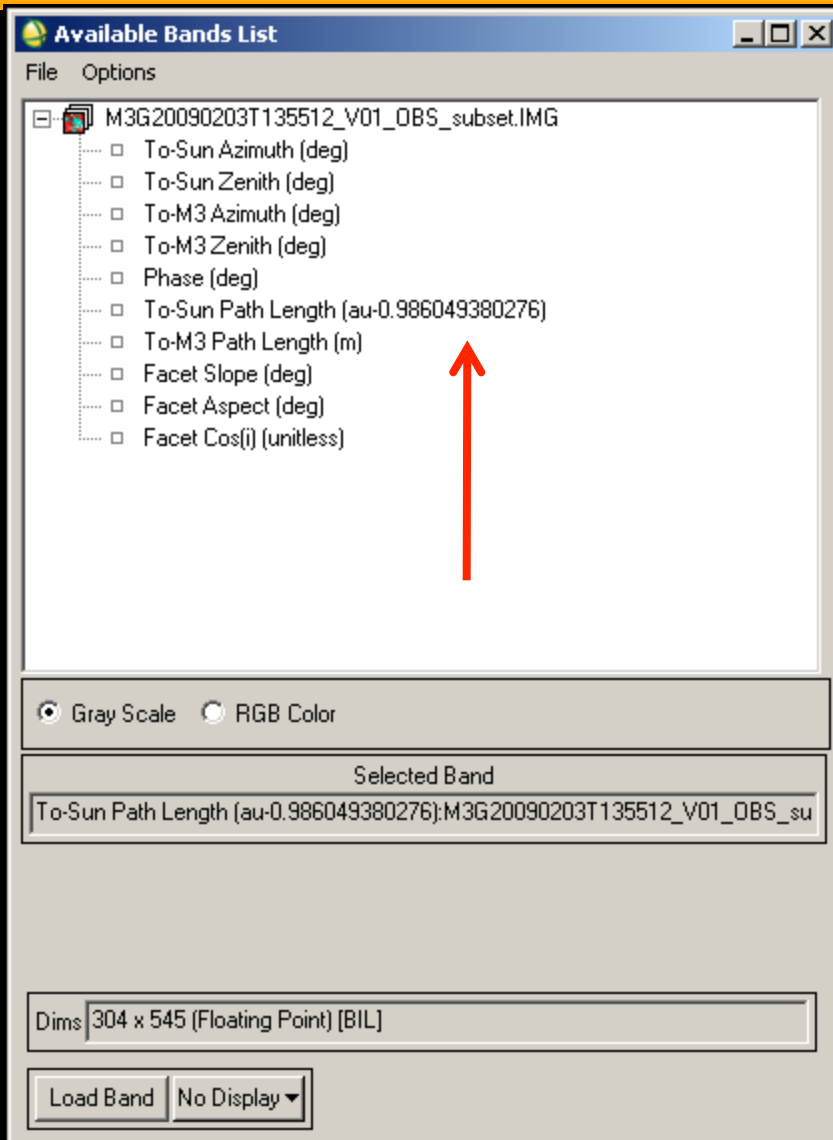
## Step 2: Open Files

- 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

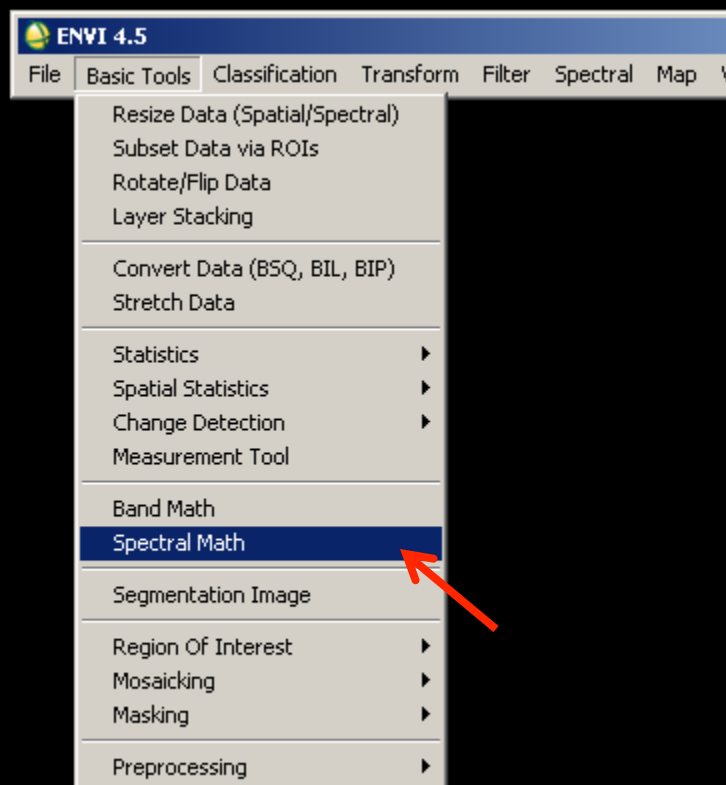


- Get mean distance from list of band names of the OBS file
- Could use per-pixel values in the To-Sun Path Length Band (band math)





## Step 4: Call Spectral Math

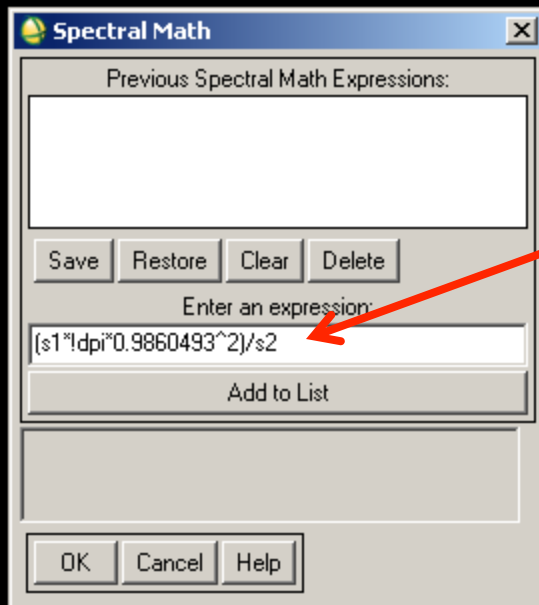


- Select Spectral Math under Basic Tools menu (also under Spectral menu)





## Step 5: Enter the expression



- Expression is:

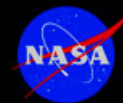
$\text{float}((s1 * \pi * 0.9860493^2) / s2)$

Radiance

Double  
precision  $\pi$

Moon-Sun  
distance  
squared;  
variable  
per file...

Solar  
Spectrum

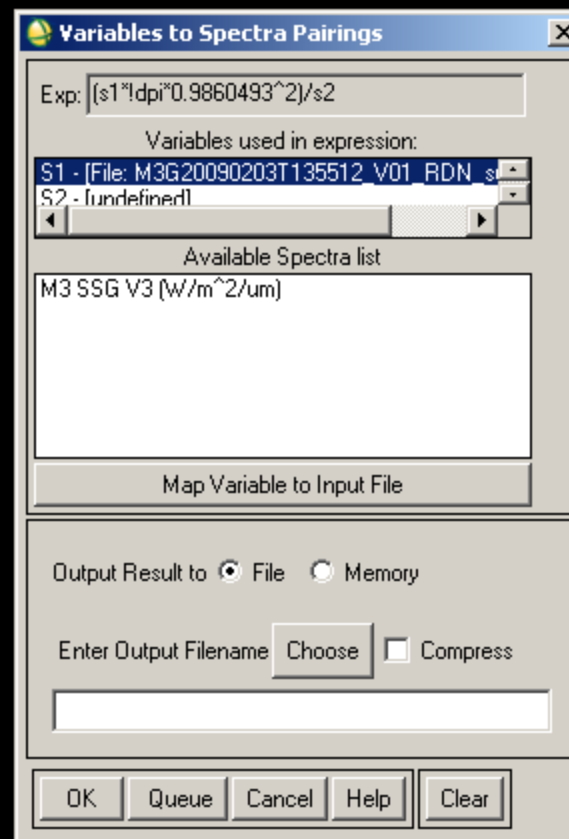
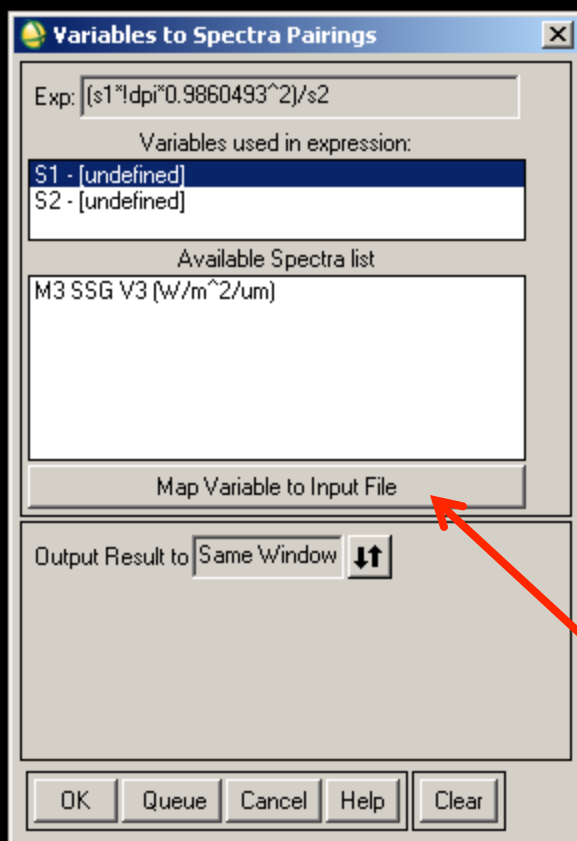




## Step 6: Define s1

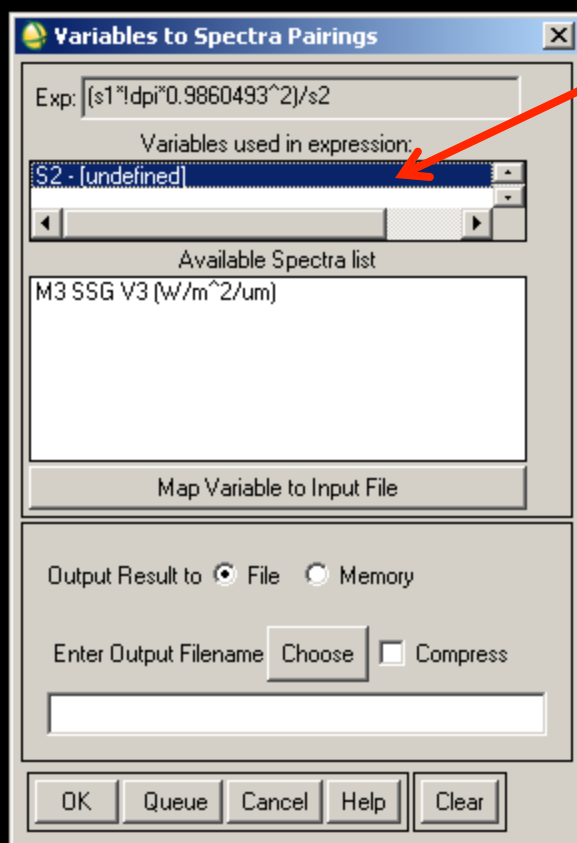
Click “Map Variable to Input File” and select your radiance (RDN) file

Should end up with this:



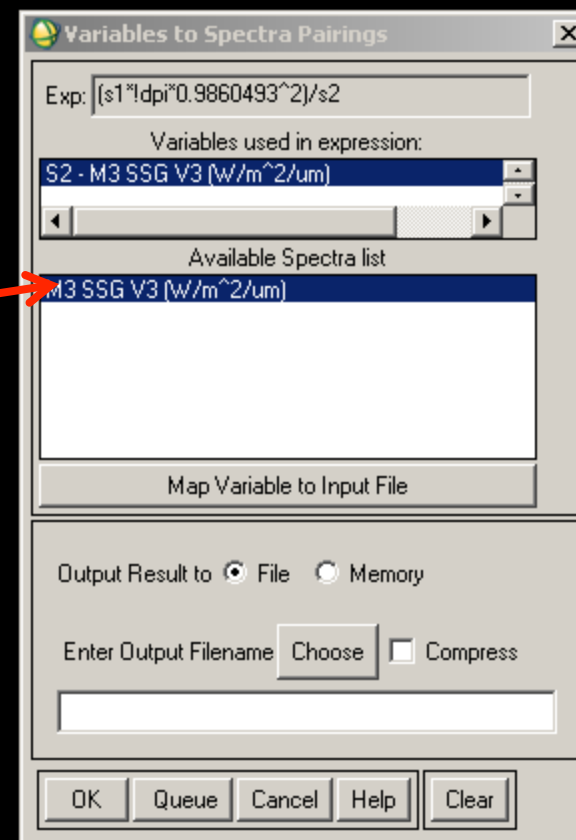


# Step 7: Define s2



First Click

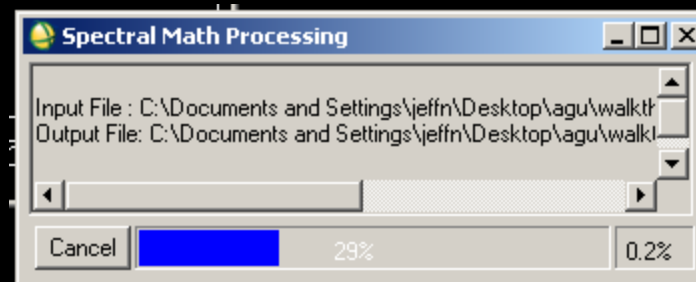
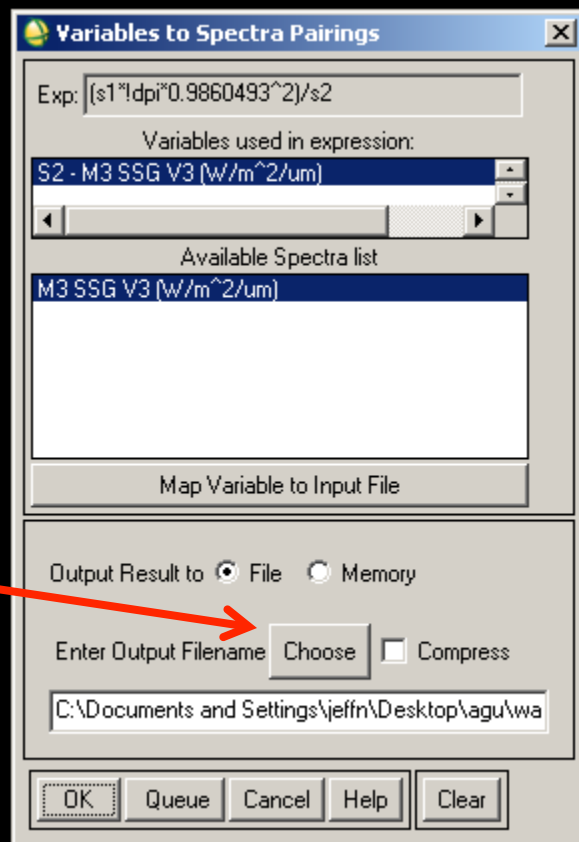
Second Click





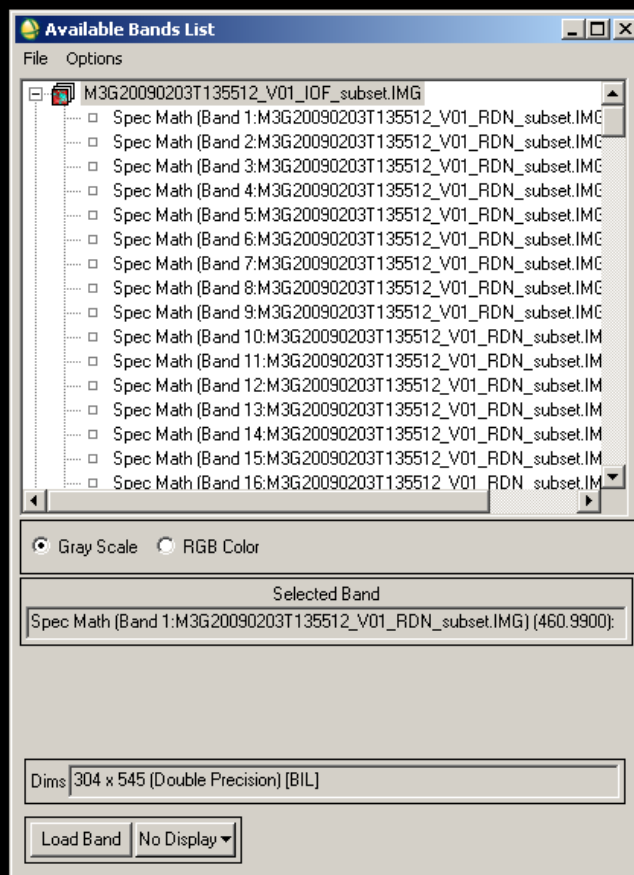
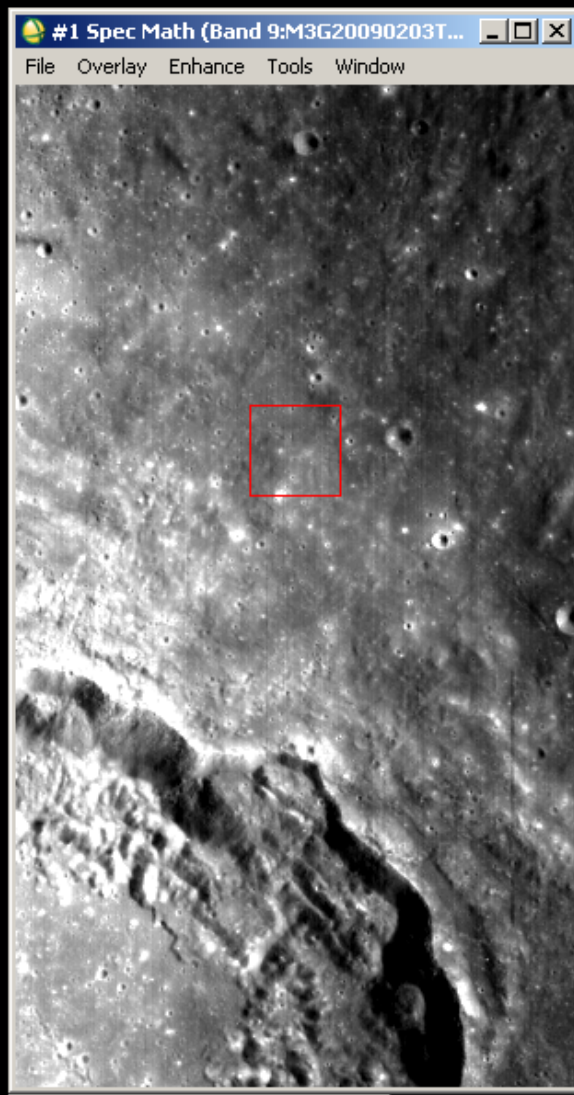
## Step 8: Choose Output File

- 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

