Instruction to Work with M3 Level2 Data with LOLA DEM in ENVI

Part 1. Data downloading from ODE

https://ode.rsl.wustl.edu/moon/indexProductSearch.aspx

 Download the Level2 M3 REFIMG data from ODE, e.g., <u>m3g20090609t095022 v01 rfl.img</u>, please download the ENVI header *_rfl.hdr and label file *_L2.LBL together with the PDS *_rfl.img data file.



Fig. 1 Product detail page of the search result 'm3g20090609t095022_v01_rfl.img'

Find the Location Data

- Open the label file M3G20090609T095022 V01 L2.LBL, find the information as copied below.
 - /* Level 1B radiance image product and the associated observational */
 - /* geometry and pixel location (longitude, latitude, and radius) */

/* files used as sources for this reflectance product.

SOURCE_DATA_SET_ID CH1:RADIANCE_IMAGE_FILE_NAME CH1:PIXEL_LOCATION_FILE_NAME

- = "CH1-ORB-L-M3-4-L1B-RADIANCE-V3.0"
- SOURCE PRODUCT ID = "M3G20090609T095022 V03 RDN"
 - = "M3G20090609T095022_V03_RDN.IMG"
- CH1:OBS_GEOMETRY_FILE_NAME = "M3G20090609T095022_V03_OBS.IMG"
 - = "M3G20090609T095022_V03_LOC.IMG"

*/

• So the file 'M3G20090609T095022_V03_LOC.IMG' is the corresponding location data related to the reflectance product, which can be downloaded by clicking the Related Products tab in Fig. 1 in Slide 1.

Download the Location Data

M3G20090609T095022_V01_RFL CH1-ORB M3 Reflectance Image (REFIMG) (Derived Data)	?
Product Description and Data Set Documents (click to show)	
Browse Meta Data Label Related Products Map Context	
Associated Products	
Current Product - Related and Source Products ~	
Products Found: 1	
Sort Order Misson/Instrument V Ascending V Sort	
CH1-ORB M3 Calibrated Image Version 3 (CALIV3) (Calibrated Data) M3G20090609T095022 V03 RDN Obs Time: 2009-06-09T10:05:06	

Fig. 2 Related Products for the reflectance product 'm3g20090609t095022_v01_rfl.img'

 As shown in Fig. 2, click the link for product 'M3G20090609T095022_V03_RDN', it opens another window as shown in Fig. 3, the pixel location data (*_LOC.IMG) and the observation geometry data (*_OBS.IMG) together with their ENVI headers (*.hdr) can be downloaded from the webpage directly.

🖸 Home	🔇 Data Product	Search	Map Search		🔞 Tools		🔁 Da	ata S
Browse	Meta Data	Labe	I)	Related Prod	ucts	Map Co	ontext	

Additional browse images exist below on this page Browse Image - the image below is not the actual data product

Indicates a download link from anothe PDS Product Files Derived Files	r PDS data node.
Product Files & Labels	КВ
m3q20090609t095022 v03 l1b.lbl Product Label File	21
m3q20090609t095022_v03_loc.hdr Product Data File	1
m3q20090609t095022_v03_loc.img # Product Data File	121,001
m3q20090609t095022_v03_obs.hdr Product Data File	1
m3q20090609t095022 v03 obs.img	201,001

Remove Product from Cart

Cart & Download Helr

Add Product to Cart

Fig. 3

Part 2. Georeference from IGM in ENVI (using ENVI 5.4 as an example)

 Start ENVI 5.4, go to File -> Data Manager

📋 Data Manager	_		×
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Open			
 File Information 			
 Band Selection 			
		.oad in Ne	w View
2 Lo	ad Data	Load Gra	yscale

Fig. 4 Data manager window

• From Data Manager, click the yellow folder to open the reflectance product m3g20090609 t095022 v01 r fl.img' and the location file 'M3G20090609 T095022 V03 LOC.IMG



Georeference from IGM – Con't

In Toolbox, go to Geometric Correction, double click Georeference from IGM (Fig. 6). In the pop-up 'Input Data File' window, select the reflectance product as the select input file as shown in fig. 7. Click OK.

Toolbox	3A	💽 Input Data File	×
Search the toolbox	C		
/Geometric Correction/Georeference from IGM		Select Input File:	File Information:
Favorites Anomaly Detection Anomaly Detection Anomaly Detection Anomaly Detection Geometric Change Detection Geometric Constant Filter Geometric Correction Geometry File by Sensor Geometrate GCPs from Reference Image Georeference by Sensor Georeference by Sensor Georeference form GLT		M3G20090609T095022_V03_LOC.IMG M3G20090609T095022_V01_RFL.IMG	File: D:\test\user_M3\M3G20090609T095022_V01 Dims: 304 x 17374 x 85 [BIL] Size: [Floating Point] 1,795,776,640 bytes. File Type : ENVI Standard Sensor Type: Unknown Byte Order : Host (Intel) Projection : None Wavelength : 460.99 to 2976.2 Nanometers Upper Left Comer: 1,1 Description: Cumulative Processing Steps follow:M3 Global Mode Calibrated Data version u2;Raw image;Dark signal subtraction;Bad detector element
Georeference from IGM Map Coordinate Converter Orthorectification Georeference from IGM		Spatial Subset Full Scene	Select By File
Fig. 6		Spectral Subset 83/85 Bands OK Cancel Previous Open -	

Georeference from IGM – Con't

 In the next pop-up 'Input X Geometry Band' window, select Longitude band of the location product 'M3G20090609T095022_V03_LOC.IMG' as shown in Fig. 8. Click OK. And in the pop-up 'Input Y Geometry Band' window, select Latitude band of the same location product as shown in Fig. 9. Click OK again.





Set Projection Information for The Input And Output

 In the pop-up 'Geometry Projection Information' window, set the projection information as shown in Fig. 10, click OK.

Input Projection of Geometry Bands New Arbitrary Geographic Lat/Lon UTM State Plane (NAD 27) State Plane (NAD 83) Argentina - Zone 1 Argentina - Zone 2 Argentina - Zone 3 Datum D_Moon_2000 Units Degrees	~
Arbitrary Geographic Lat/Lon UTM State Plane (NAD 27) State Plane (NAD 83) Argentina - Zone 1 Argentina - Zone 1 Argentina - Zone 2 Argentina - Zone 3 Datum Datum D_Moon_2000 Units Degrees	•
Geographic Lat/Lon UTM State Plane (NAD 27) State Plane (NAD 83) Argentina - Zone 1 Argentina - Zone 2 Argentina - Zone 3 Datum D_Moon_2000 Units Degrees	-
UTM State Plane (NAD 27) State Plane (NAD 83) Argentina - Zone 1 Argentina - Zone 2 Argentina - Zone 3	-
State Plane (NAD 27) State Plane (NAD 83) Argentina - Zone 1 Argentina - Zone 2 Argentina - Zone 3	_
State Plane (NAD 83) Argentina - Zone 1 Argentina - Zone 2 Argentina - Zone 3 Datum D_Moon_2000 Units Degrees	_
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Argentina - Zone 2 Argentina - Zone 3 Datum D_Moon_2000 Units Degrees	
Datum D_Moon_2000 Units Degrees	- -
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Moon Equirectangular C0	
Moon Equirectangular C180	
Mars Equirectangular C180	
Mars Equirectangular Lat 15C180	
Mars Equirectangular 3396km C0	
Mars Equirectangular 3396km C180	/
Datum D Moon 2000	٦
Datum	
Matan	
Units Meters	

- In the pop-up 'Build Geometry Lookup File Parameters' window, use the default setting for the pixel size, set ouput rotation as 0 and set the outputfile name as shown in Fig. 11, click OK.
- ENVI will start the process of Georeference from IGM. It might take a while to get the output result 'm3g20090609t095022_v01_rfl_prj.dat'

💽 Build Geometry Lookup File Parameters 🛛 🗙
GLT Parameters
Output Pixel Size 444.300000
Output Rotation 0
Output Result to File Memory
Enter Output GLT Filename Choose
Georeference Background Value 0.000000
Output Result to File Memory
Output Georef Filename Choose Compress
D:\test\M3G20090609T095022_V01_RFL_prj.dat
OK Cancel

Fig. 11

Part 3. Check the Results of Georeference from IGM

- Use Gdal commands below to translate the LOLA DEM from PDS IMG format to Geotif, overlay them with the 'm3g20090609t095022_v01_rfl_prj.dat' in ENVI (Fig. 12) or ArcGIS (Figures 13, 14), you can compare features from both data products. (*Note: the reason to use Gdal to translate the PDS IMG to Geotif is because the JP2 data downloaded from PDS cannot be read into ENVI with the correct map projection information. But the JP2 data work fine with ArcGIS.*)
 - gdal_translate -of GTiff D:\test\user_M3\ldem_1024_45s_30s_330_360.lbl
 D:\test\user_M3\ldem_1024_45s_30s_330_360_Gdal.tif
 - gdal_translate -of GTiff D:\test\user_M3\ldem_45s_100m.lbl
 D:\test\user_M3\ldem_45s_100m_Gdal.tif

Fig. 12 Compare 'm3g20090609t095022_v 01_rfl_prj.dat' with Idem_1024_45s_30s_330 _360 in ENVI



Q check1.mxd - ArcMap

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Q check2.mxd - ArcMap



Fig. 14 Compare 'm3g20090609t095022_v01_rfl_prj.dat' with ldem_45s_100m in ArcGIS

Further Data Registration If Needed

- You can further register the 'm3g20090609t095022_v01_rfl_prj.dat' to LOLA DEM in ENVI using Geometric Correction-> Registration->Image Registration Workflow in the toolbox.
- Before registration, we would recommend to use only a subset of the projected M3 data 'm3g20090609t095022_v01_rfl_prj.dat', since lots of the M3 data are out of the boundary of the LOLA DEM. The cut will make a better display and operation in ENVI.