
Subject: Create ortho-rectified radiance image from HDF5 data

Posted by [Sean Hartling](#) on Tue, 10 Nov 2015 20:38:52 GMT

[View Forum Message](#) <> [Reply to Message](#)

Hello,

Does anyone have any advice on how to create an ortho-rectified ENVI data file that is geolocated from the lat/longs of HDF swath data?

Here is the code I am working with. This code produces a radiance image; however, it is not ortho-rectified according to the lat/lon from the HDF swath data, rather it creates the array from the tie point. I would like to tie the lat/lons from the original HDF5 data to each radiance pixel in the output. Any advice would be greatly appreciated.

```
PRO Hdf5_classic_VIS_projection
  compile_opt idl2
  ;
  ;e = ENVI(/HEADLESS)
  ; First restore all the base save files. This programs uses some ENVI routines
  envi, /restore_base_save_files
  ; Initialize ENVI and send all errors and warnings to the file batch.txt
  envi_batch_init, log_file='batch.txt'
  ;
  file_path = 'C:\Users\Sean\Desktop\Ball\
  file = file_path + 'L1B_20150216_VIS.he5'
  ;
  ; Use a graphical user interface for viewing and reading HDF5 files.
  ; Result = H5_BROWSER(file)
  ; Define file dimentions
  exponent = intarr(1033, 99, 1072)
  Mantissa = intarr(1033, 99, 1072)
  L_lambda = fltarr(1033, 99, 1072)
  lat = fltarr(1033, 99)
  lon = fltarr(1033, 99)
  Solar_Zenith_Angle = fltarr(1033, 99)
  Sensor_refl = fltarr(1033, 99, 1072)
  surface_refl = fltarr(1033, 99, 1072)
  ; sample, row, spectral bands
  ;Dimensions: [1033, 99, 1072]
  ;
  ; Open the file
  file_id = H5F_OPEN(file)
  ; Accessing the datasets.
  ; This is located within '\SWATHS\').
  ; We could also have used H5G_OPEN to open up the group first.
  ;
  ; open, read and close radiance information
  dataset_id_exponent= H5D_OPEN(file_id,
```

```

'/HDFEOS/SWATHS/Radiance/DataFields/RadianceExponent')
  exponent = H5D_Read(dataset_id_exponent) ; read teh file
  H5D_CLOSE, dataset_id_exponent ; Close identifiers so we don't leak resources.
  dataset_id_Mantissa= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/DataFields/RadianceMantissa')
  Mantissa = H5D_Read(dataset_id_Mantissa)
  ; Open up the dataspace associated with the Mantissa image.
  ; dataspace_id = H5D_GET_SPACE(dataset_id_Mantissa)
  H5D_CLOSE, dataset_id_Mantissa
  ; Calculate the radiance
  Radiance = Mantissa*10.^(Exponent)
  ;
  ; open, read and close geolocation information
  dataset_id_lat= H5D_OPEN(file_id, '/HDFEOS/SWATHS/Radiance/GeolocationFields/Latitude')
  lat = H5D_Read(dataset_id_lat) ; read teh file
  H5D_CLOSE, dataset_id_lat ; Close identifiers so we don't leak resources.
  dataset_id_lon= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/Longitude')
  lon = H5D_Read(dataset_id_lon)
  H5D_CLOSE, dataset_id_lon
  ;
  ; open, read and close Earth Sun Distance (ESD) information
  ; just one value, 1.5155510e+011
  dataset_id_ESD= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/EarthSunDistance' )
  Earth_Sun_Distance = H5D_Read(dataset_id_ESD) ; read the distance file in meters
  ESD = Earth_Sun_Distance*6.68458712*10.^(-12) ; should be in astronomical units
  H5D_CLOSE, dataset_id_ESD ; Close identifiers so we don't leak resources.
  ; print, Earth_Sun_Distance
  ;
  ; read solar zenith angle (SZA)
  dataset_id_SZA= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/SolarZenithAngle' )
  Solar_Zenith_Angle = H5D_Read(dataset_id_SZA)
  SZA = !pi*Solar_Zenith_Angle/180 ; convert degrees to radian
  H5D_CLOSE, dataset_id_SZA
  ;
  ; Convert photon radiance Lq(nm) to spectral radiance L_lambda(um)
  h = 6.626*10.^(-34) ; Planck's constant in Jeol per second J s
  c = 2.99*10.^8 ; Speed of light in m/s
  Wavelength_index = FINDGEN(1072) + 1.0
  Wavelength = 0.279772*Wavelength_index + 404.68 - 3 ; wavelengths in VIS (nm)
  ;lambda = 550. ; Wavelength in nm
  lambda = Wavelength*10.^(-9); Wavelength in meters
  ;Lq = 1.86*10.^13 ; extracted radiance value from GeoTASO image in Photons/(s cm^2 sr nm)
  ; conver the units of radiance to standard units
  Lq = Radiance/(10.^(-4)*10.^(-3)) ; radiance in W/(m^2 sr um) <-- 1cm sq = 10.^(-4) sq m; nm =
10.^(-3) um

```

```

; read the solar constant for each wavelenghts
ESUN=5000
; now calculate radiance
FOR k=0, n_elements(lambda)-1 DO BEGIN
  L_lambda[*,*,k]= Lq[*,*,k] * ((h*c)/lambda[k]) ; spectral radiance in W/(m^2 sr um)
  Sensor_refl[*,*,k] = !pi*L_lambda[*,*,k]*(ESD)^2/(ESUN*cos(SZA))
  ; surface_refl= Sensor_L_lambda[*,*,k]/((ts*tv)+(1-sp))
ENDFOR
;
; use IDL routines to write the radiance file into a directory
Outputfile = 'C:\Users\Sean\Desktop\Ball\Out\Radiance_6.dat'
OpenW, Lun, Outputfile, /GET_LUN
WriteU,lun,L_lambda
Free_lun, Lun
;
; extract the lon/lat of the the first pixel
lo0 = lon[0] ; longitude of the first pixel
la0 = lat[0] ; latitude of the first pixel
;print, la0, lo0
;
units = envi_translate_projection_units('Degrees')
ps = [0.00007735D, 0.00246768D] ; Set the pixel size in degree (default)
mc = [0D, 0D, lo0, la0] ;and map tie point, -90.5597, 38.7053
map_info = envi_map_info_create(/geographic, mc=mc, ps=ps, units = units)

;create the header of file
ENVI_SETUP_HEAD, fname=outputfile, $
  ns=1033, nl=99, nb=1072, $
  interleave=0, data_type=4, $
  Sensor_type=Sensor_type, $
  map_info=map_info,$
  WAVELENGTH_UNIT=1, WL=Wavelength, $
  offset=0, /write, /open
; close the batch mode
;Envi_Batch_Exit
END

```

Subject: Re: Create ortho-rectified radiance image from HDF5 data
 Posted by [Christopher Anderson](#) on Tue, 10 Nov 2015 23:12:58 GMT
[View Forum Message](#) <> [Reply to Message](#)

I've never used HDF swath format, but this should be possible if you have an array of longitudes and latitudes that correspond to each pixel of your radiance imagery.

You can build a geographic look-up table (GLT) using ENVI_GLT_DOIT (http://www.exelisvis.com/docs/ENVI_GLT_DOIT.html). The GLT is an intermediate product that can be used to orthorectify imagery to map space. Since this procedure relies on using ENVI File

IDs (FIDs) instead of an array of values, you may want to write your lon/lat data as ENVI format or, if ENVI supports it, just use ENVI_OPEN_FILE to open your lon/lat data.

Once you've built your GLT you can then apply it to your radiance imagery using ENVI_GEOREF_FROM_GLT_DOIT (http://www.exelisvis.com/docs/ENVI_GEOREF_FROM_GLT_DOIT.html). Each input, again, requires you open files using ENVI_OPEN_FILE and getting FIDs.

Hope this gets you started.

On Tuesday, November 10, 2015 at 12:39:01 PM UTC-8, Sean Hartling wrote:

```
> Hello,
>
> Does anyone have any advice on how to create an ortho-rectified ENVI data file that is
geolocated from the lat/longs of HDF swath data?
>
> Here is the code I am working with. This code produces a radiance image; however, it is not
ortho-rectified according to the lat/lon from the HDF swath data, rather it creates the array from
the tie point. I would like to tie the lat/lons from the original HDF5 data to each radiance pixel in
the output. Any advice would be greatly appreciated.
>
> PRO Hdf5_classic_VIS_projection
> compile_opt idl2
> ;
> ;e = ENVI(/HEADLESS)
> ; First restore all the base save files. This programs uses some ENVI routines
> envi, /restore_base_save_files
> ; Initialize ENVI and send all errors and warnings to the file batch.txt
> envi_batch_init, log_file='batch.txt'
> ;
> file_path = 'C:\Users\Sean\Desktop\Ball\
> file = file_path + 'L1B_20150216_VIS.he5'
> ;
> ; Use a graphical user interface for viewing and reading HDF5 files.
> ; Result = H5_BROWSER(file)
> ; Define file dimentions
> exponent = intarr(1033, 99, 1072)
> Mantissa = intarr(1033, 99, 1072)
> L_lambda = fltarr(1033, 99, 1072)
> lat = fltarr(1033, 99)
> lon = fltarr(1033, 99)
> Solar_Zenith_Angle = fltarr(1033, 99)
> Sensor_refl = fltarr(1033, 99, 1072)
> surface_refl = fltarr(1033, 99, 1072)
> ; sample, row, spectral bands
> ;Dimensions: [1033, 99, 1072]
> ;
> ; Open the file
```

```

> file_id = H5F_OPEN(file)
> ; Accessing the datasets.
> ; This is located within '\SWATHS\'.
> ; We could also have used H5G_OPEN to open up the group first.
> ;
> ; open, read and close radiance information
> dataset_id_exponent= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/DataFields/RadianceExponent')
> exponent = H5D_Read(dataset_id_exponent) ; read teh file
> H5D_CLOSE, dataset_id_exponent ; Close identifiers so we don't leak resources.
> dataset_id_Mantissa= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/DataFields/RadianceMantissa')
> Mantissa = H5D_Read(dataset_id_Mantissa)
> ; Open up the dataspace associated with the Mantissa image.
> ; dataspace_id = H5D_GET_SPACE(dataset_id_Mantissa)
> H5D_CLOSE, dataset_id_Mantissa
> ; Calculate the radiance
> Radiance = Mantissa*10.^(Exponent)
> ;
> ; open, read and close geolocation information
> dataset_id_lat= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/Latitude')
> lat = H5D_Read(dataset_id_lat) ; read teh file
> H5D_CLOSE, dataset_id_lat ; Close identifiers so we don't leak resources.
> dataset_id_lon= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/Longitude')
> lon = H5D_Read(dataset_id_lon)
> H5D_CLOSE, dataset_id_lon
> ;
> ; open, read and close Earth Sun Distance (ESD) information
> ; just one value, 1.5155510e+011
> dataset_id_ESD= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/EarthSunDistance' )
> Earth_Sun_Distance = H5D_Read(dataset_id_ESD) ; read the distance file in meters
> ESD = Earth_Sun_Distance*6.68458712*10.^(-12) ; should be in astronomical units
> H5D_CLOSE, dataset_id_ESD ; Close identifiers so we don't leak resources.
> ; print, Earth_Sun_Distance
> ;
> ; read solar zenith angle (SZA)
> dataset_id_SZA= H5D_OPEN(file_id,
'/HDFEOS/SWATHS/Radiance/GeolocationFields/SolarZenithAngle' )
> Solar_Zenith_Angle = H5D_Read(dataset_id_SZA)
> SZA = !pi*Solar_Zenith_Angle/180 ; convert degrees to radian
> H5D_CLOSE, dataset_id_SZA
> ;
> ; Convert photon radiance Lq(nm) to spectral radiance L_lambda(um)
> h = 6.626*10.^(-34) ; Plank's constant in Jeol per second J s
> c = 2.99*10.^8 ; Speed of light in m/s

```

```

> Wavelength_index = FINDGEN(1072) + 1.0
> Wavelength = 0.279772*Wavelength_index + 404.68 - 3 ; wavelengths in VIS (nm)
> ;lambda = 550. ; Wavelength in nm
> lambda = Wavelength*10.^(-9); Wavelength in meters
> ;Lq = 1.86*10.^13 ; extracted radiance value from GeoTASO image in Photons/(s cm^2 sr nm)

> ; convert the units of radiance to standard units
> Lq = Radiance/(10.^(-4)*10.^(-3)) ; radiance in W/(m^2 sr um) <-- 1cm sq = 10.^(-4) sq m; nm
= 10.^(-3) um
> ; read the solar constant for each wavelengths
> ESUN=5000
> ; now calculate radiance
> FOR k=0, n_elements(lambda)-1 DO BEGIN
>   L_lambda[* ,*,k]= Lq[* ,*,k] * ((h*c)/lambda[k]) ; spectral radiance in W/(m^2 sr um)
>   Sensor_refl[* ,*,k] = !pi*L_lambda[* ,*,k]*(ESD)^2/(ESUN*cos(SZA))
>   ; surface_refl= Sensor_L_lambda[* ,*,k]/((ts*tv)+(1-sp))
> ENDFOR
> ;
> ; use IDL routines to write the radiance file into a directory
> Outputfile = 'C:\Users\Sean\Desktop\Ball\Out\Radiance_6.dat'
> OpenW, Lun, Outputfile, /GET_LUN
> WriteU,lun,L_lambda
> Free_lun, Lun
> ;
> ; extract the lon/lat of the the first pixel
> lo0 = lon[0] ; longitude of the first pixel
> la0 = lat[0] ; latitude of the first pixel
> ;print, la0, lo0
> ;
> units = envi_translate_projection_units('Degrees')
> ps = [0.00007735D, 0.00246768D] ; Set the pixel size in degree (default)
> mc = [0D, 0D, lo0, la0] ;and map tie point, -90.5597, 38.7053
> map_info = envi_map_info_create(/geographic, mc=mc, ps=ps, units = units)
>
> ;create the header of file
> ENVI_SETUP_HEAD, fname=outputfile, $
> ns=1033, nl=99, nb=1072, $
> interleave=0, data_type=4, $
> Sensor_type=Sensor_type, $
> map_info=map_info,$
> WAVELENGTH_UNIT=1, WL=Wavelength, $
> offset=0, /write, /open
> ; close the batch mode
> ;Envi_Batch_Exit
> END

```