Lab 1
Introduction to ENVI and basic image processing

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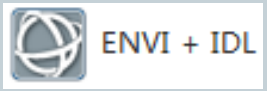
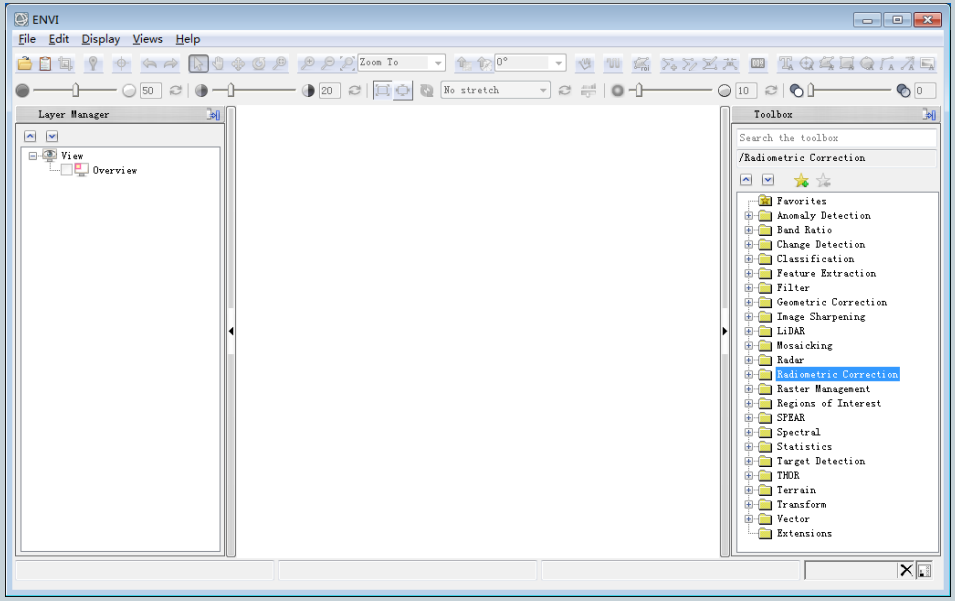
Why ENVI?

- One of the best remote sensing software packages in the world
- Very popular in academic institutions
- Famous for hyperspectral analysis
- Developed using the programming language IDL and therefore easy to be extended with IDL

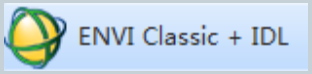
ENVI versions

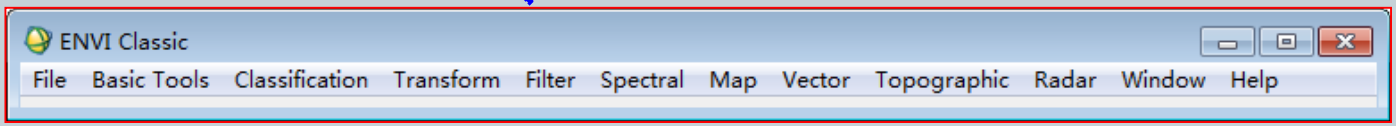
Installed version:
ENVI 5.3 + IDL 8.4





- A significant change in the interface
- Changes in ENVI and IDL programming

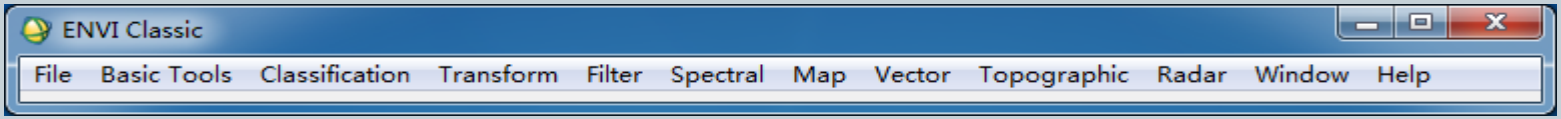




- ENVI 5.3 Classic has the ENVI heritage interface.
- If you are a long time ENVI user since ENVI 4.0, you may want to use the Classic one. Run your old IDL scripts in ENVI Classic.

ENVI

- Start-> Programs-> ENVI 5.3 -> Tools -> ENVI Classic
- After ENVI Classic is started, you should see a menu as below:

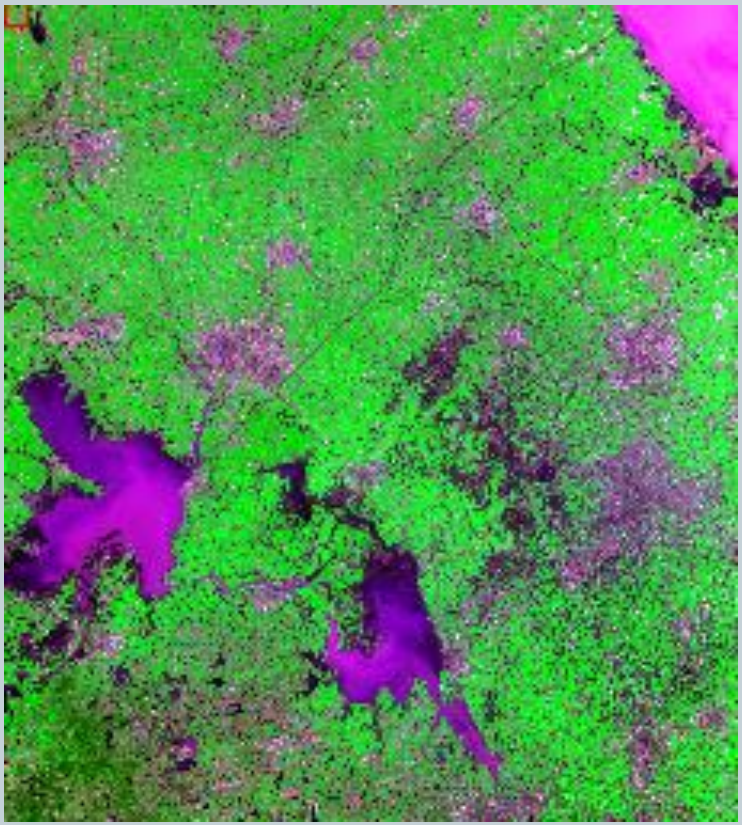


- *Interactive Displays*
- *File management*
- *Basic Tools*
- *Classification Tools*
- *Transform Tools*
- *Filter Tools*
- *Spectral Tools*
- *Map Tools*
- *Vector Tools*
- *Topographic Tools*
- *Radar Tools*

Review of **GF-1** band designations

GF-1/WFV Orbital height 645 km Time:10:30 am Launched April 26, 2013	**Spectral band**	**Wavelength (μm)**	**Band center (μm)**	**Resolution (m)**
	Band 1 – Blue	0.45 - 0.52	0.485	16
	Band 2 – Green	0.52 - 0.59	0.555	16
	Band 3 – Red	0.63 - 0.69	0.660	16
	Band 4 - Near Infrared (NIR)	0.77 - 0.89	0.830	16

Test data: a GF-1/WFV Scene

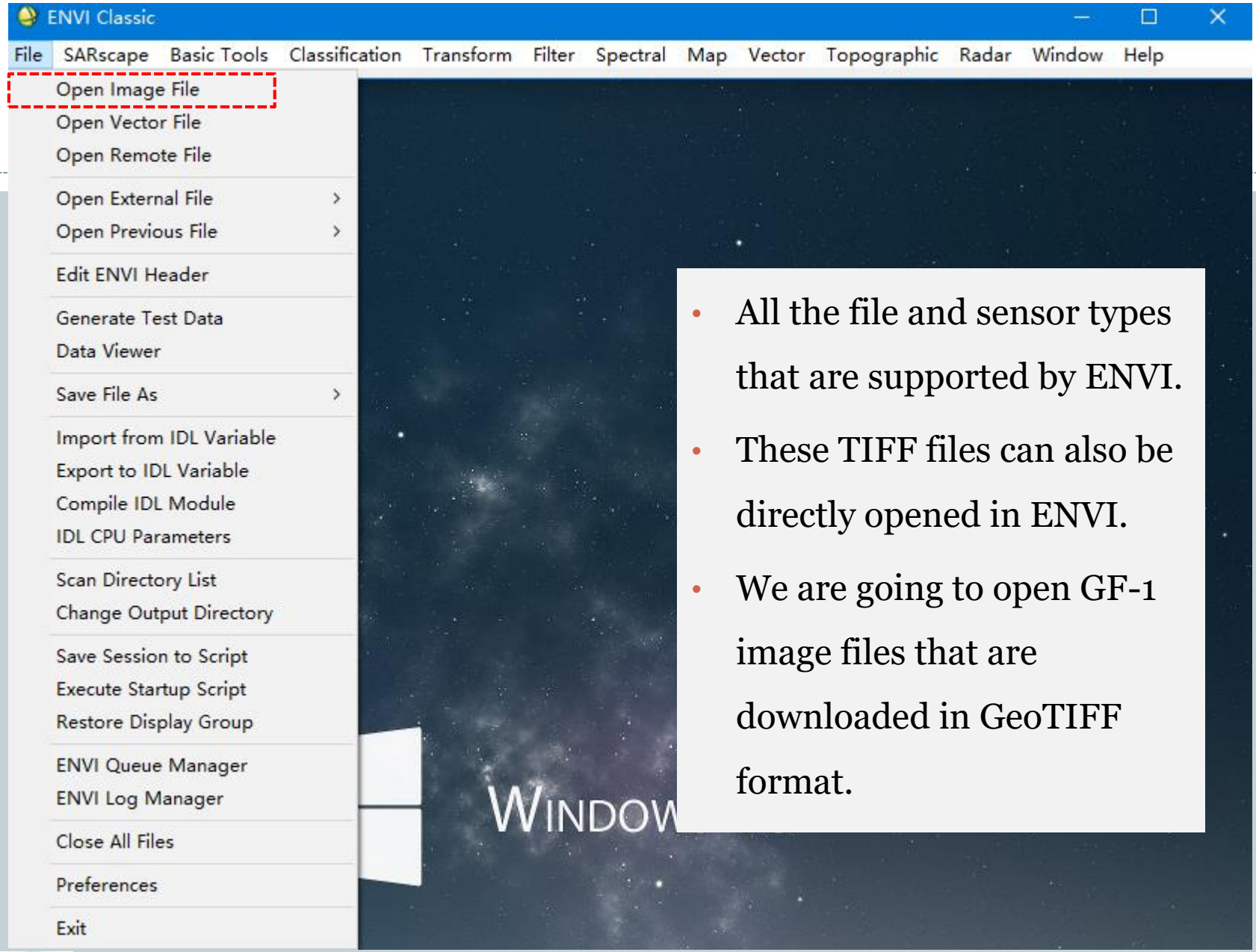


A GF-1/WFV false color composite (3-4-2)

- Collected by the WFV camera on GF-1
- Time of acquisition: 2022-04-03, 10:27:50
- Data type = "L1A" **(GF Level 1 Relative radiation correction)**
- Data format: 16-bit unsigned integer
- GF_SCENE_ID = "GF1_WFV3_E119.4_N33.4_20220403_L1A0006386724"
- Data download: http://www.gscloud.cn/
- Data files
  - 1 TIFF file and 1 xml file
- We use the 4 multispectral bands.

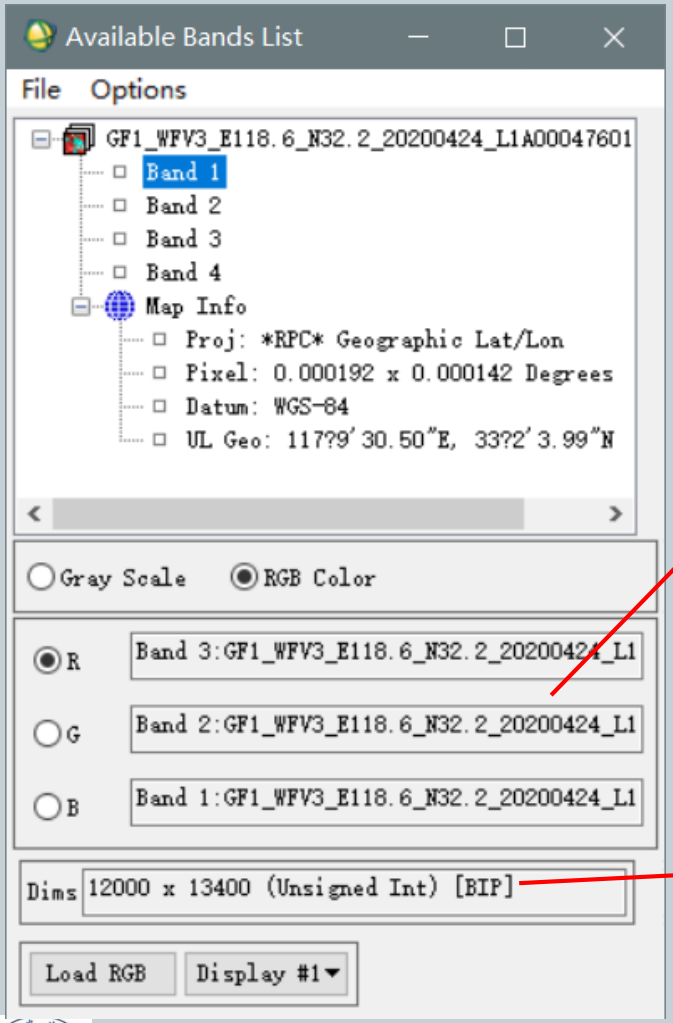
What to do with this GF-1 scene in ENVI?

1. Image loading
2. Image displaying
3. Radiometric correction
4. Image cropping



- All the file and sensor types that are supported by ENVI.
- These TIFF files can also be directly opened in ENVI.
- We are going to open GF-1 image files that are downloaded in GeoTIFF format.

Load your data



- Once your files are loaded into ENVI, you should see this window (Available Bands List).

Display mode

Gray Scale: individual bands

RGB Color: band combinations (e.g. R-NIR-G)

Try making different color composites

Data info:

Dims 12000 x 13400:

# of columns x # of rows

Unsigned Int: data type =

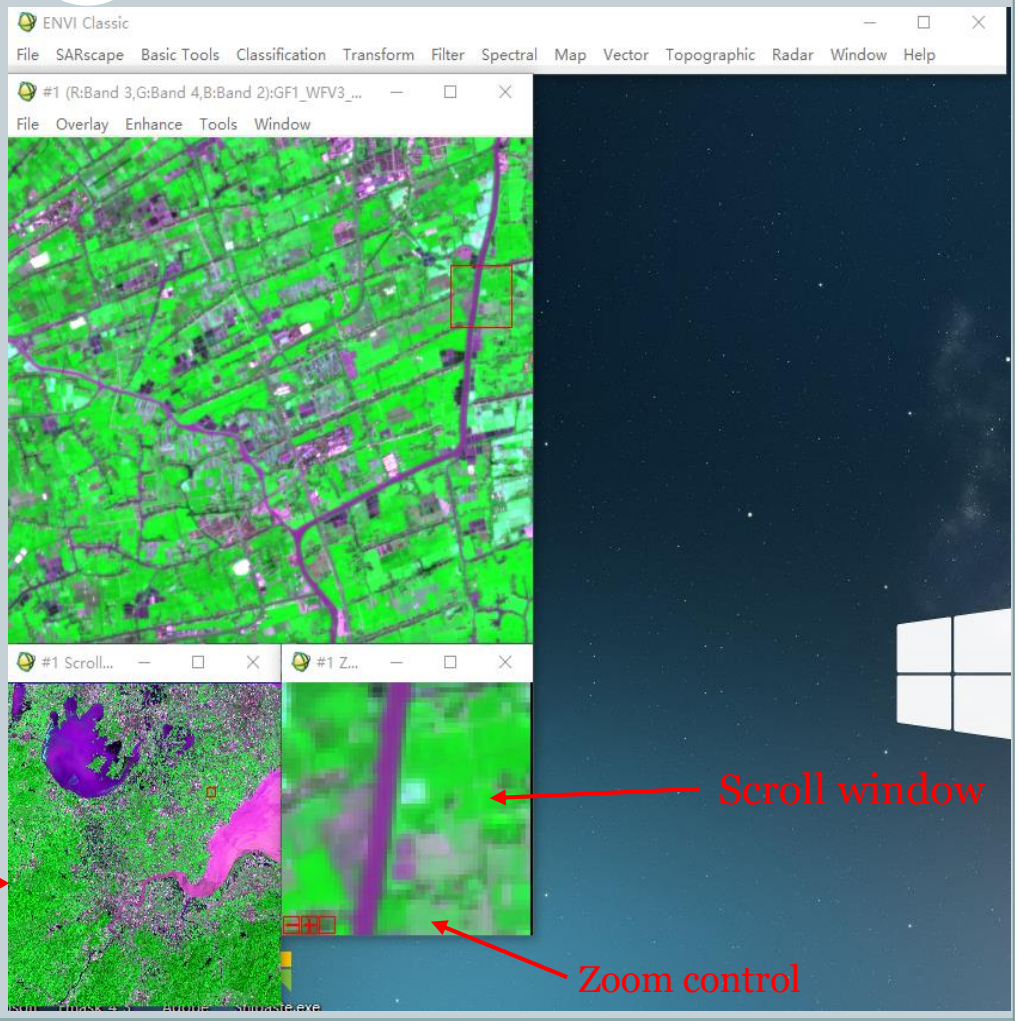
Unsigned integer (16 bit) (data range?)

BIP: data storage method

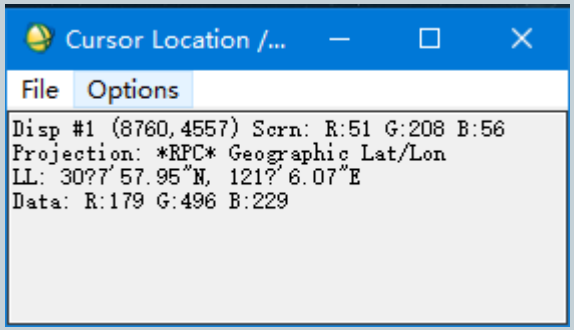
*What is the file size of a 4-band GF-1/WFV image in ENVI Standard format?

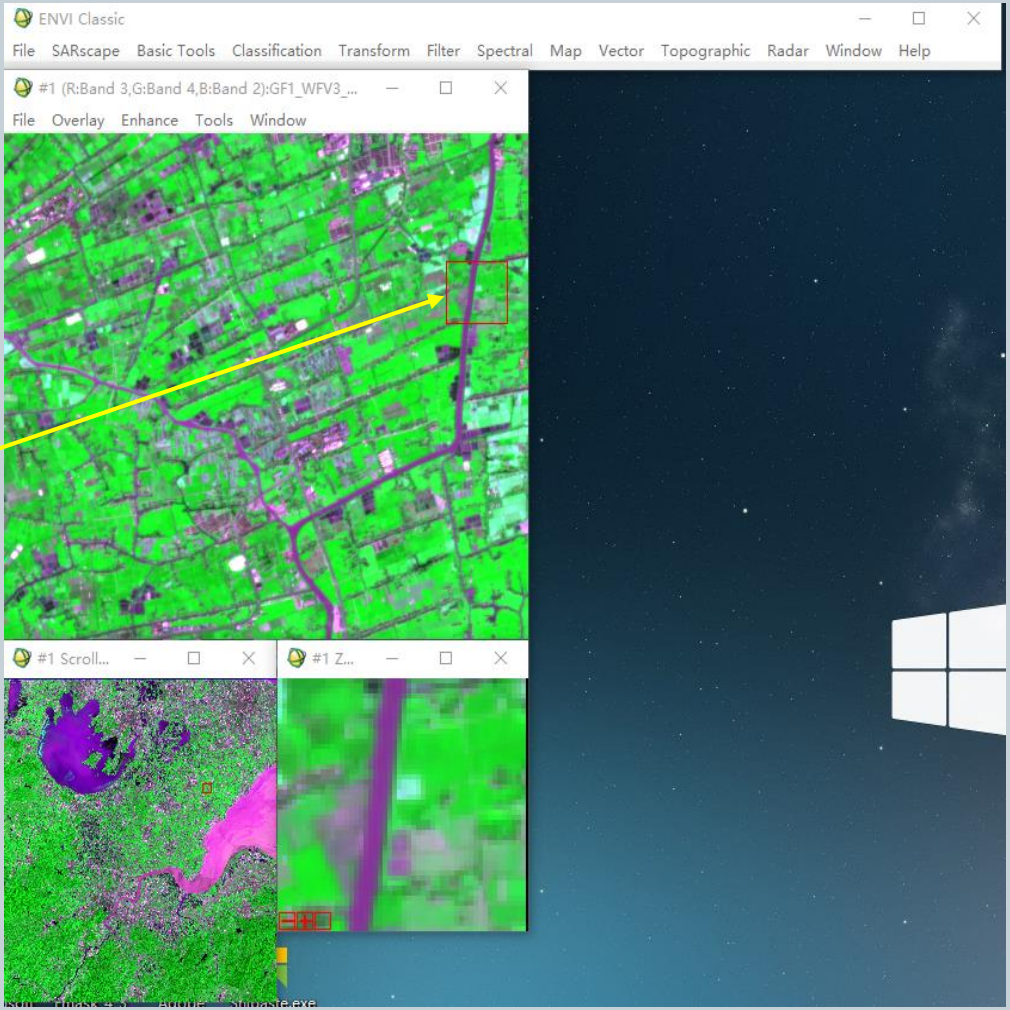
Interactive displays

1. Be familiar with the display group. Navigate on your image and focus on your target area.



2. Double click in the Image window to display cursor info.

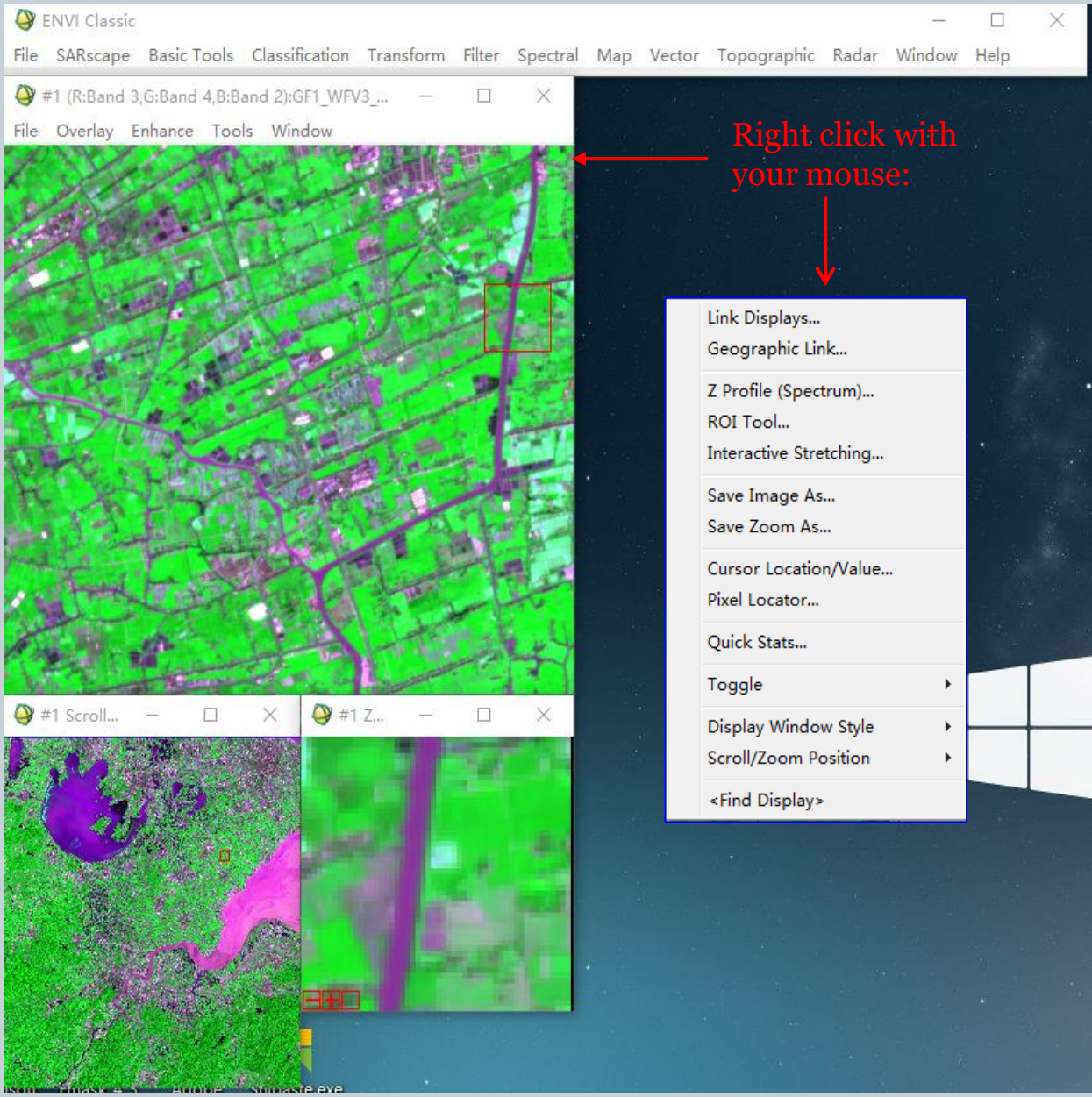




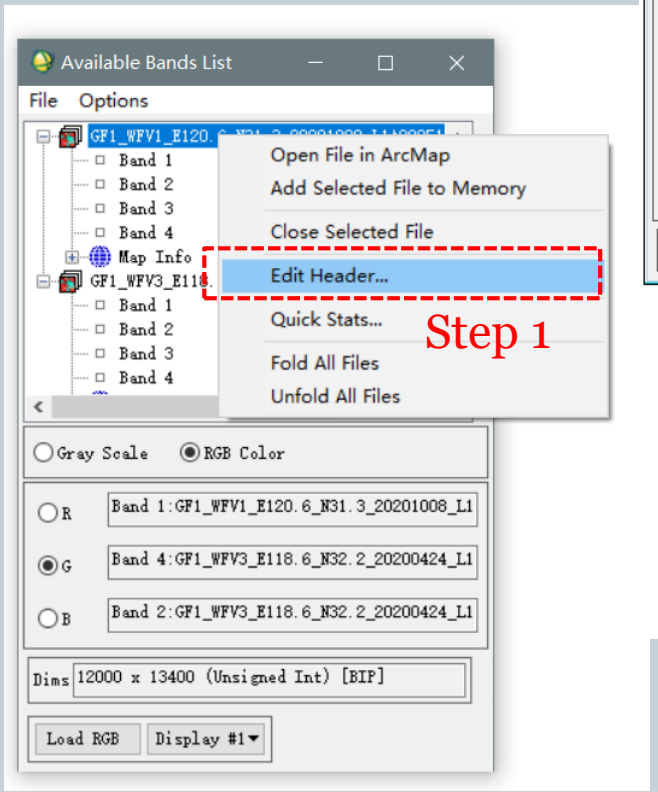
How to read these values:
Disp #: (col #, row #)
Scrn: screen values (0~255)
Projection: coordinate system
Map: coordinates in m
LL: coordinates in Lat/Lon
Data: DN for the RGB bands

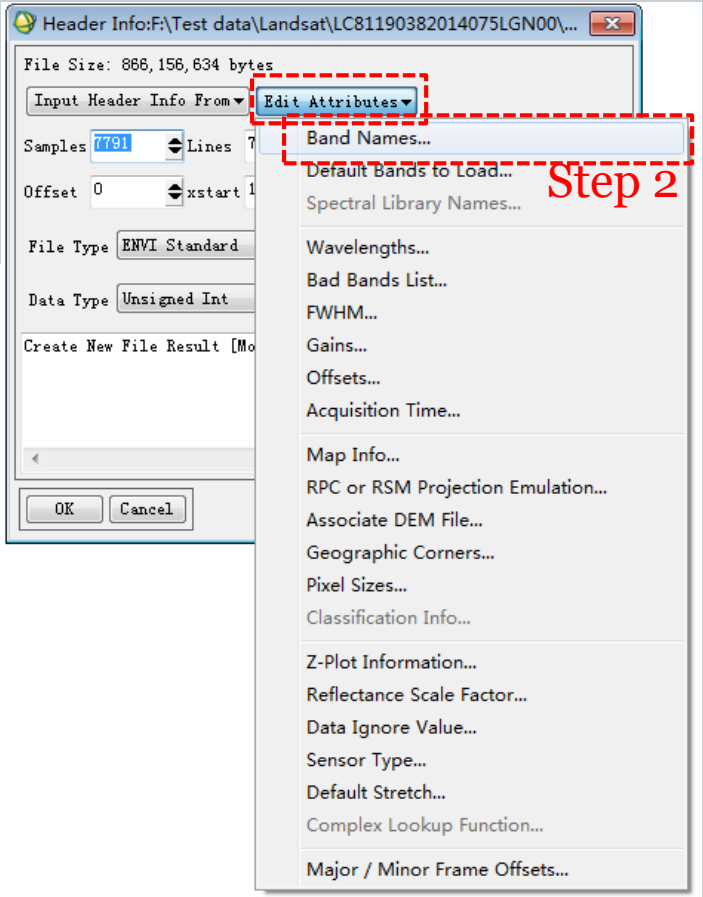
3. Right click in any window to bring up a box with commonly used functions.

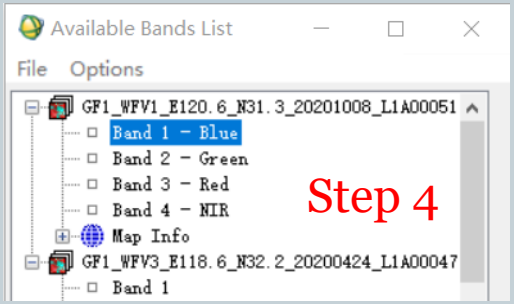
How to locate the pixel for Xinghua (32.45598 °N, 119.76102 °E)?



Edit band names

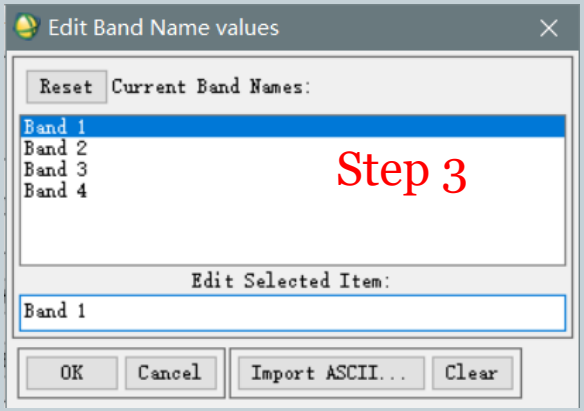






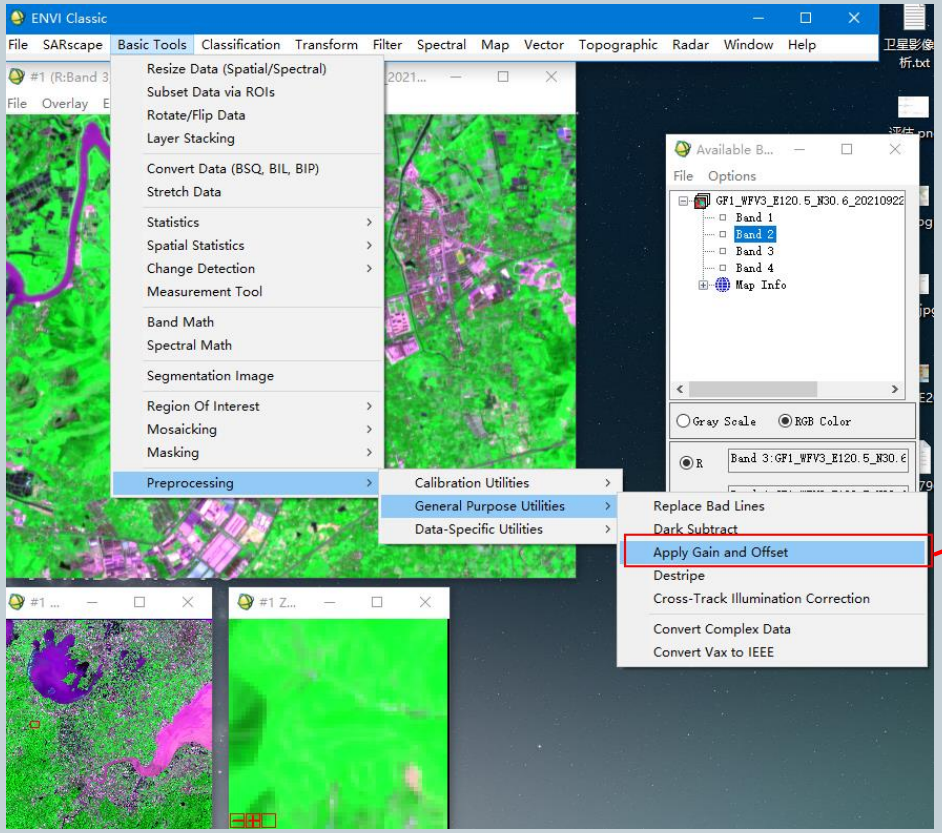
- Find this file in your working directory.
- Check if the file size matches the number you calculated in slide 9.

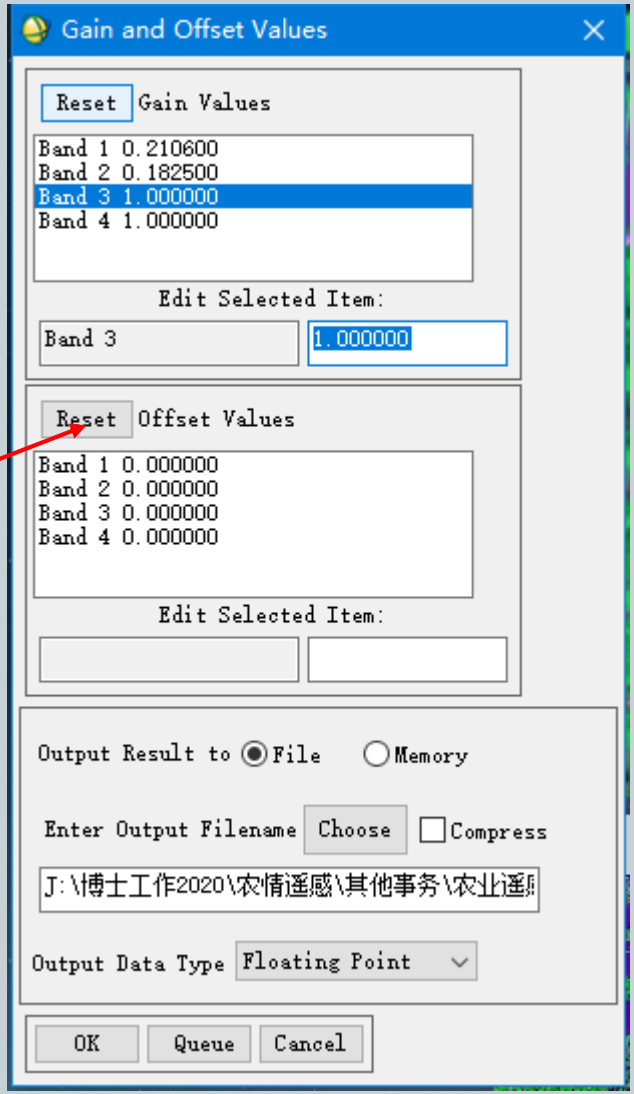
Assign meaningful band names.



Radiometric correction by ENVI Classic

L = Gain*DN + Bias

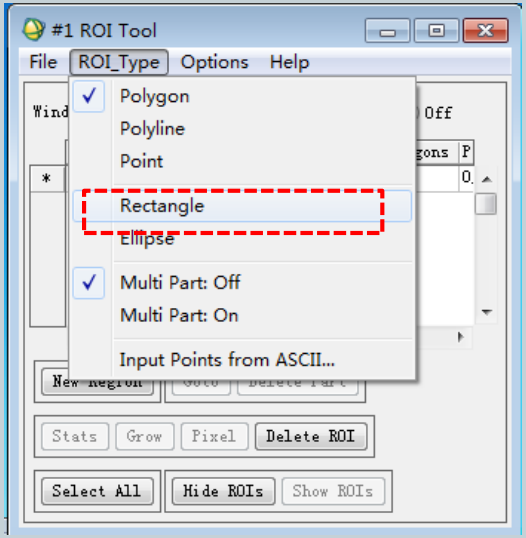


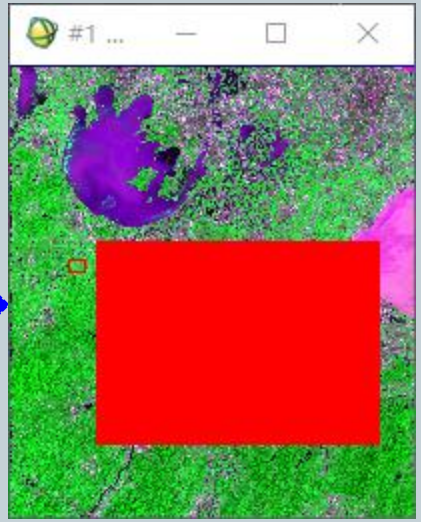


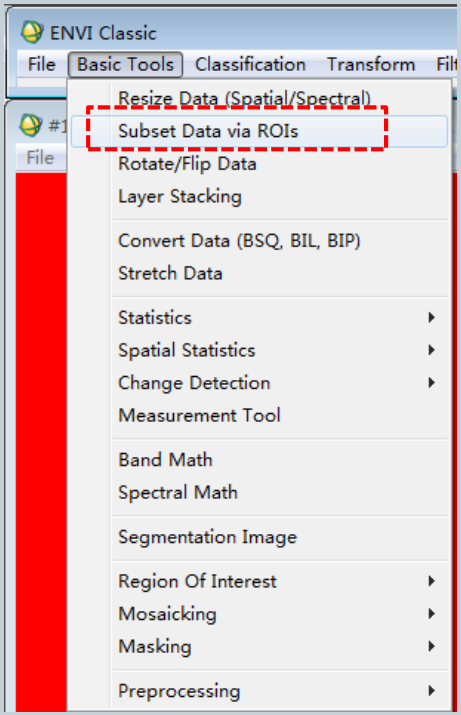
GF-1 radiometric calibration coefficient in 2022

Sensor	PAN (Gain)	B1 (Gain)	B2 (Gain)	B3 (Gain)	B4 (Gain)
GF1_WFV1	/	0.1889	0.1495	0.1228	0.1352
GF1_WFV2	/	0.1585	0.1223	0.0997	0.1111
GF1_WFV3	/	0.2085	0.1743	0.1385	0.1438
GF1_WFV4	/	0.2148	0.1607	0.1317	0.1288

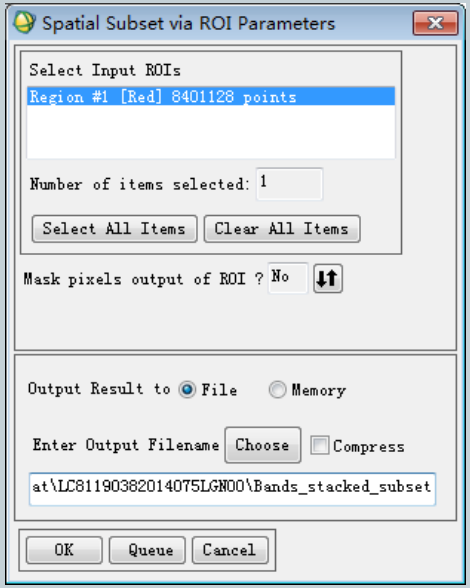
Image cropping: create a subset image

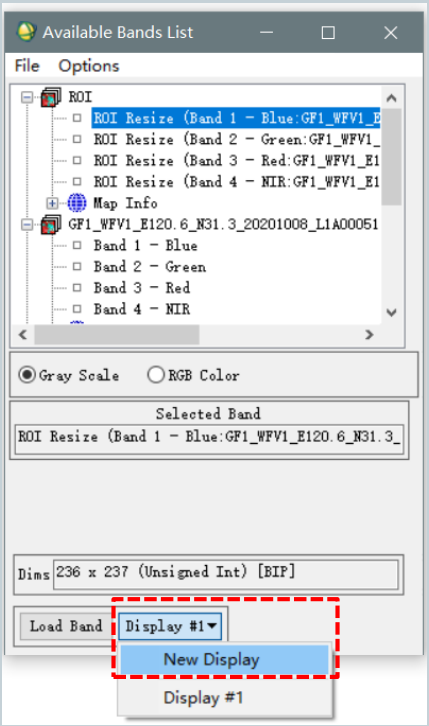


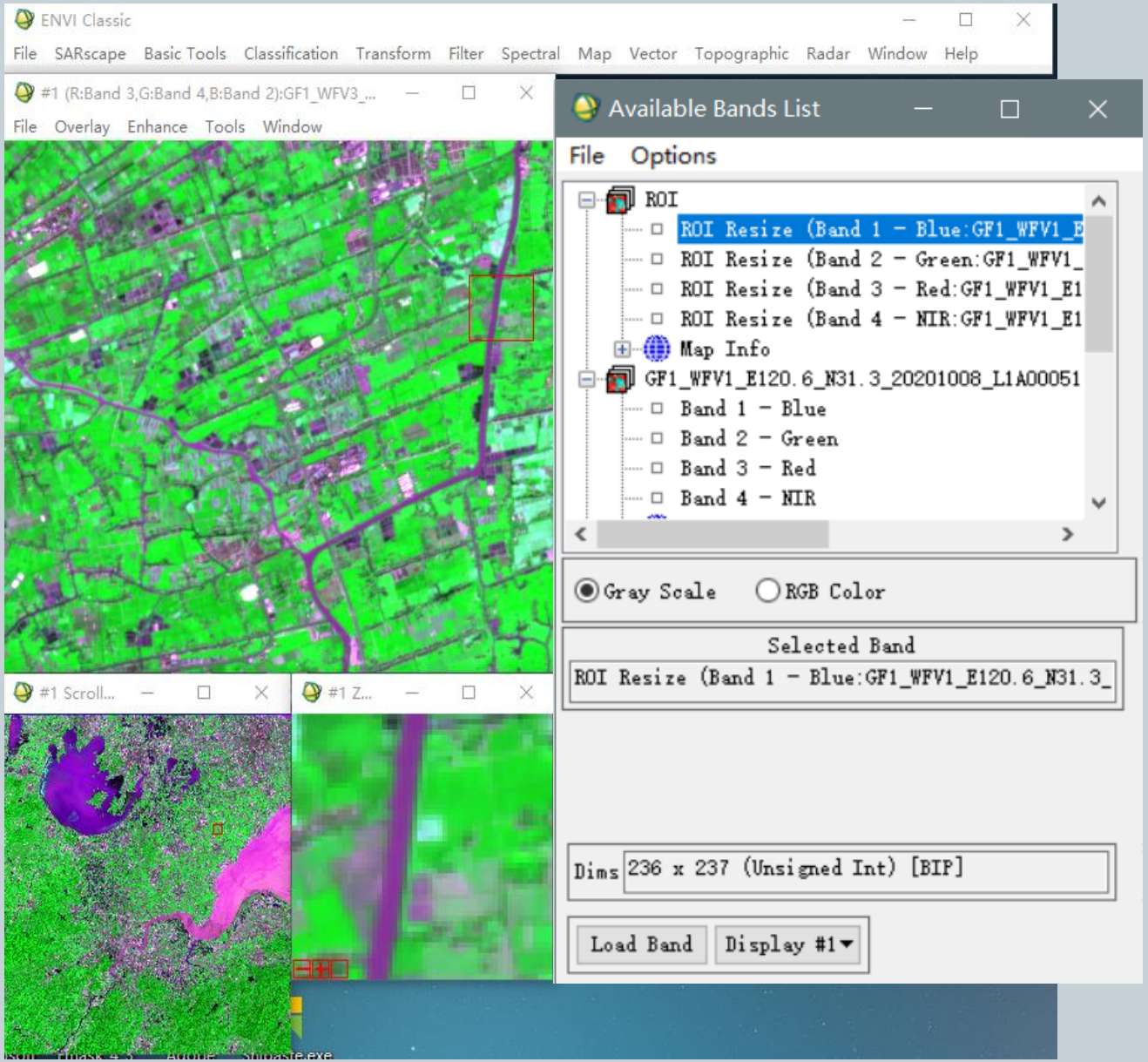




Step 1: draw a rectangle ROI in the Scroll window to include your study area (hold left key and drag, right click to select).



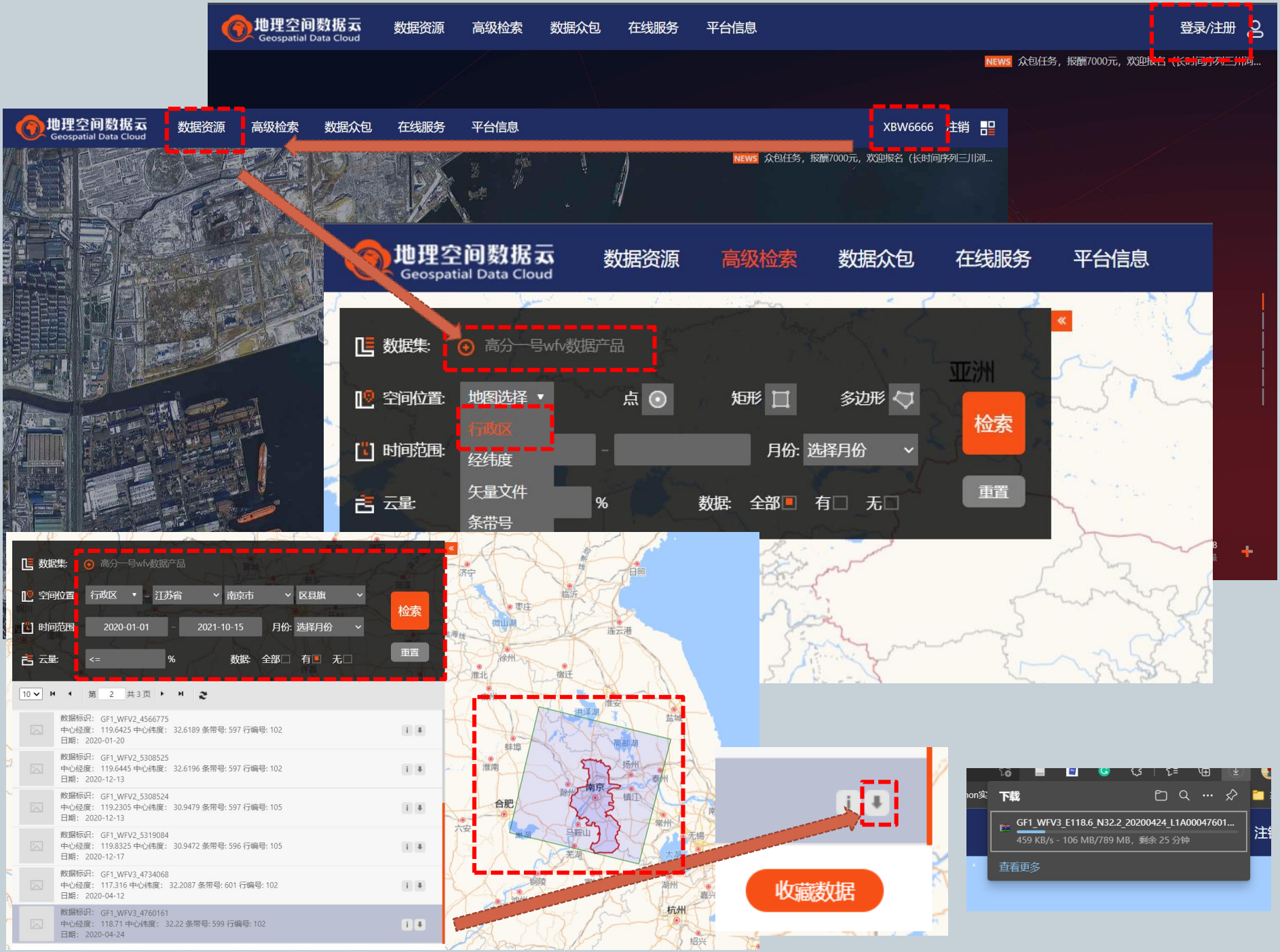




The subset image is in display.

GF-1 download

- Geospatial Data Cloud:
  http://www.gscloud.cn/ (for domestic students)
- China Centre For Resources Satellite Date and Application:
  http://www.cresda.com (for domestic & international students)
- Radiometric calibration coefficients of Chinese satellites (2008-2022)
  https://www.cresda.com/zgzywxyyzx/zlxz/article/20230410112855288395031.html


地理空间数据云
Geospatial Data Cloud
数据资源
高级检索
数据众包
在线服务
平台信息
登录/注册
NEWS 众包任务，报酬7000元，欢迎报名（长时间序列三川河...
XBW6666
注销
数据集:
高分一号wfv数据产品
空间位置:
地图选择
点
矩形
多边形
行政区
经纬度
矢量文件
条带号
时间范围:
月份:
选择月份
云量:
%
数据:
全部
有
无
检索
重置
亚洲
江苏省
南京市
区县旗
2020-01-01
2021-10-15
<=
数据标识: GF1_WFV2_4566775
中心经度: 119.6425 中心纬度: 32.6189 条带号: 597 行编号: 102
日期: 2020-01-20
数据标识: GF1_WFV2_5308525
中心经度: 119.6445 中心纬度: 32.6196 条带号: 597 行编号: 102
日期: 2020-12-13
数据标识: GF1_WFV2_5308524
中心经度: 119.2305 中心纬度: 30.9479 条带号: 597 行编号: 105
日期: 2020-12-13
数据标识: GF1_WFV2_5319084
中心经度: 119.8325 中心纬度: 30.9472 条带号: 596 行编号: 105
日期: 2020-12-17
数据标识: GF1_WFV3_4734068
中心经度: 117.316 中心纬度: 32.2087 条带号: 601 行编号: 102
日期: 2020-04-12
数据标识: GF1_WFV3_4760161
中心经度: 118.71 中心纬度: 32.22 条带号: 599 行编号: 102
日期: 2020-04-24
南京
合肥
杭州
收藏数据
下载
GF1_WFV3_E118.6_N32.2_20200424_L1A00047601...
459 KB/s - 106 MB/789 MB，剩余 25 分钟
查看更多

Notes

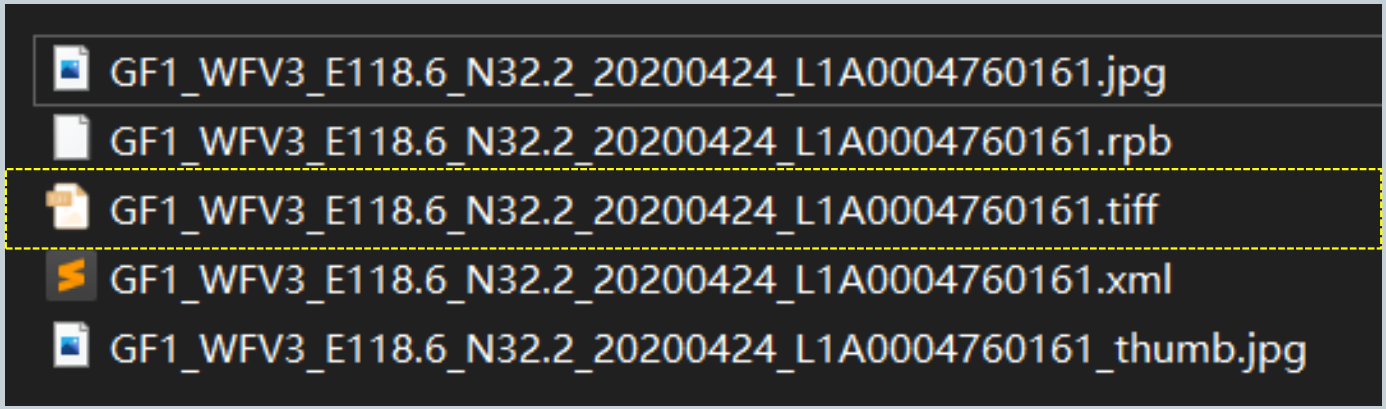
Things to prepare:

- A Geospatial Data Cloud account
- Stable internet connection

General Steps:

- Registration for GScloud account
- Log in
- Set up parameters to search data
- Search data
- Check results and select data
- Order data (free)
- Download and unpack “TAR” compression file

Files in the downloaded folder



Lab 1 assignments

Exercises:

1. **Image downloading.** Download a GF-1/WFV image scene for your hometown area for 2022. The scene should cover agricultural lands and be acquired for the peak growing season of specific crops (wheat, rice, cotton, potato, etc.).
2. **Radiometric correction.** Covert DN values to radiance.
3. **Image cropping.** Draw a rectangle ROI to cover the agricultural land area of your interest on the image scene. Crop the four-band file with this ROI to extract the four-band data for your subset area.
4. **Image compositing.** Generate a false color composite with the subset image based on the band combination 3-4-2 (R:3, G:4, B:2). Use the band combination 3-2-1 to generate a true-color composite.
5. **File Saving.** Save the image file you need in ENVI Standard format. (two files)

Questions

1. Calculate the file size of the four-band subset image. Show the calculation step by step in the report. (60%)

2. Display the false-color composite in your report, and explain the colors on the composite for major land cover types (e.g., vegetation, urban, bare land, water). (20%)

3. Compare this false-color composite to the true-color composite and explain which one is preferable for displaying vegetated areas. (20%)

Questions

Note: Submit image files in ENVI Standard format and a PDF report with your answers. Make sure the submitted ENVI files can be opened up by the instructor for grading. Put all your files in a zipped folder and copy it to the instructor before next class (Naming convention: Student Number + Name).

Email: 2022201004@stu.njau.edu.cn

Deadline: November 3, 2023

Reminders for Lab 1 assignment

- File size calculation:
  - Whole scene or subset?
- Open/save file in ENVI (use ENVI classic)
- Visual interpretation on true-color VS false-color composite images
- Band combination (be specific!)

Radiometric correction by ENVI 5.3