

哨兵二号 (Sentinel-2) 卫星数据处理

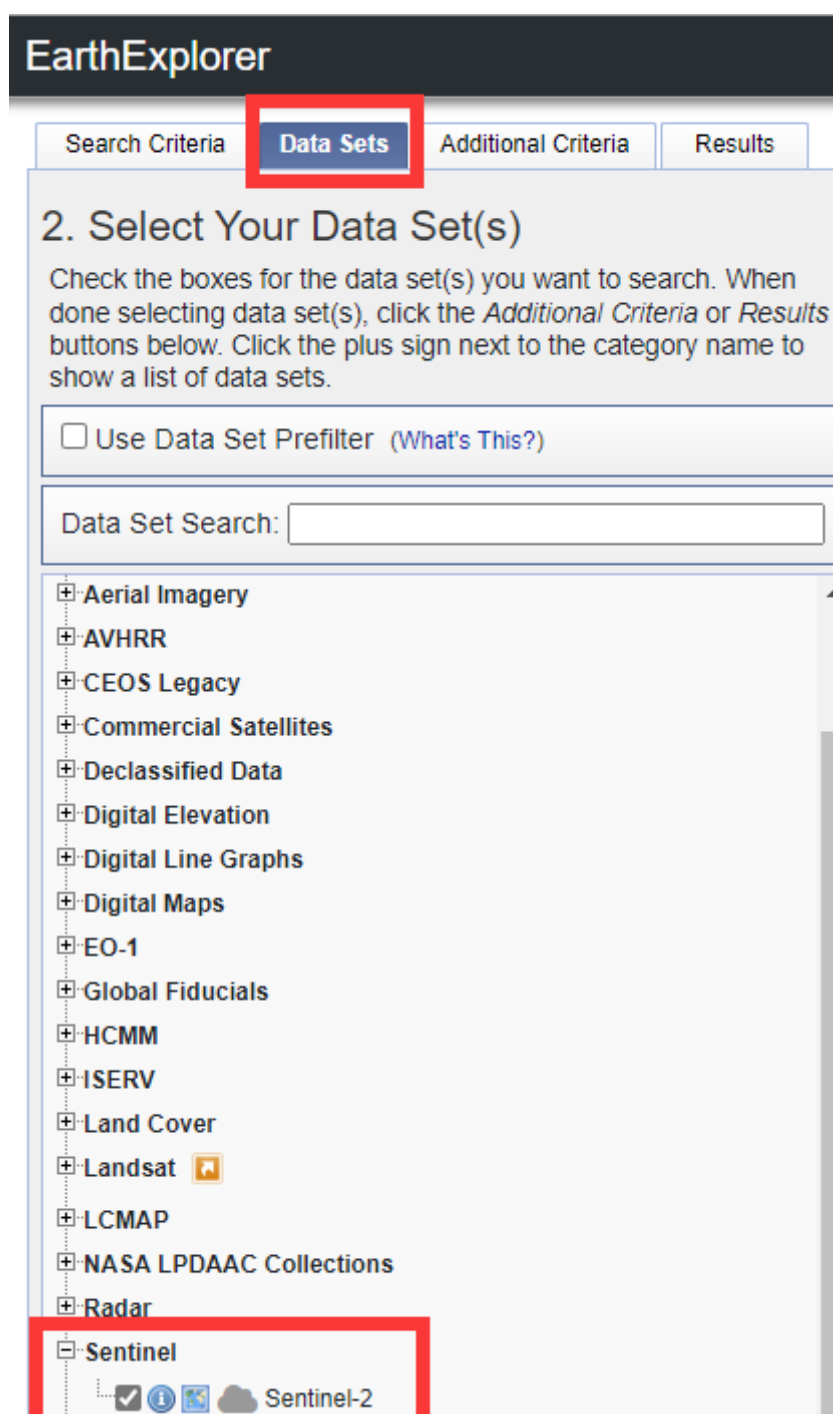
特别提醒：本文所有操作所需时间都很长，因此在自己电脑上操作的朋友记得将睡眠模式关闭。

一、数据下载

1. 打开网址：

- [USGS](https://earthexplorer.usgs.gov/) ;

2. 选择数据集：



3. 选择地区：

EarthExplorer

Search Criteria | Data Sets | Additional Criteria | Results

1. Enter Search Criteria

To narrow your search area: type in an address or place name, enter coordinates or click the map to define your search area (for advanced map tools, view the [help documentation](#)), and/or choose a date range.

Geocoder | KML/Shapefile Upload

Select a Geocoding Method
Address/Place ▼

Address/Place
shaanxi

Show Clear

Click on an Address/Place to show the location on the map and add coordinates to the Area of Interest Control.

| Num | Address/Place | Latitude | Longitude |
|-----|---------------|----------|-----------|
| 1 | 中国陕西省 | 34.2649 | 108.9542 |

- 点击最下方红框中的陕西省即可选择；
- 该步骤如果搜索不到国内的省份，要么是省份的英文写错了，要么是需要科学上网。

4. 选择日期和云度：

Date Range | Cloud Cover | Result Options

Search from 01/01/2021 to: mm/dd/yyyy

Search months: (all) ▼

Data Sets » Additional Criteria » Results »

Date Range | Cloud Cover | Result Options

Cloud Cover Range: 0% - 30%

Unknown Cloud Cover Values Included ▼

This filter will only be applied to data sets that support cloud cover filtering (☁ in the data set list denotes cloud cover support).

Data Sets » Additional Criteria » Results »

5. 选择其他参数（可选）：

Search Criteria

Data Sets



















Additional Criteria

Results

3. Additional Criteria (Optional)

If you have more than one data sets selected, use the dropdown to select the additional criteria for each data set.

Data Sets:
Sentinel-2 ▼

| | |
|-------------------|---|
| Entity ID |   |
| Tile Number |   |
| Cloud Cover |   |
| Orbit Number |   |
| Orbit Direction |   |
| Platform |   |
| Vendor Product ID |   |
| Vendor Tile ID |   |
| Image_Referencing |   |

6. 生成结果：

Search Criteria

Data Sets

Additional Criteria

Results

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.


Show Result Controls

Data Set
[Click here to export your results »](#)








Sentinel-2


« First < Previous 1 of 1 Next > Last »

Displaying 1 - 82 of 82











ID: L1C_T49SCT_A024783_20211204T033114
Acquisition Date: 2021/12/04
Platform: SENTINEL-2B
Tile Number: T49SCT











ID: L1C_T49SCU_A024783_20211204T033114
Acquisition Date: 2021/12/04
Platform: SENTINEL-2B
Tile Number: T49SCU










ID: L1C_T49SCT_A024740_20211201T032117
Acquisition Date: 2021/12/01
Platform: SENTINEL-2B
Tile Number: T49SCT



ID: L1C_T49SCU_A024740_20211201T032117
Acquisition Date: 2021/12/01
Platform: SENTINEL-2B
Tile Number: T49SCU

View Item Basket »

Submit Standing Request »

7. 选择图像:

4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Hide Result Controls

- ☐ Show All Footprints From Current Page
- ☐ Show All Browse From Current Page
- ☒ Add All Results From Current Page to Bulk Download
- ☐ Add All Results From Current Page to Order

Compare Browse: Map Overlay All Scenes Compare

Browse Opacity: 100%

Data Set

[Click here to export your results »](#)

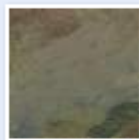
Sentinel-2

« First < Previous 1 of 1 Next > Last »

Displaying 1 - 82 of 82



ID: L1C_T49SCT_A024783_20211204T033114
Acquisition Date: 2021/12/04
Platform: SENTINEL-2B
Tile Number: T49SCT



ID: L1C_T49SCU_A024783_20211204T033114
Acquisition Date: 2021/12/04
Platform: SENTINEL-2B
Tile Number: T49SCU



ID: L1C_T49SCT_A024740_20211201T032117
Acquisition Date: 2021/12/01
Platform: SENTINEL-2B
Tile Number: T49SCT



ID: L1C_T49SCU_A024740_20211201T032117
Acquisition Date: 2021/12/01
Platform: SENTINEL-2B
Tile Number: T49SCU



- 对每一页都做相同操作，可以看到图中的纸箱子 icon 变成了绿色，表示选定；

8. 生成下载链接:

Data Set [Click here to export your results »](#)

Sentinel-2

| | |
|---|---|
|  | Platform: SENTINEL-2B Tile Number: T49SCT  |
|  | ID: L1C_T49SCT_A024497_20211114T033006 Acquisition Date: 2021/11/14 Platform: SENTINEL-2B Tile Number: T49SCT  |
|  | ID: L1C_T49SCU_A024497_20211114T033006 Acquisition Date: 2021/11/14 Platform: SENTINEL-2B Tile Number: T49SCU  |
|  | ID: L1C_T49SCU_A024354_20211104T032917 Acquisition Date: 2021/11/04 Platform: SENTINEL-2B Tile Number: T49SCU  |
|  | ID: L1C_T49SCT_A033191_20211030T033728 Acquisition Date: 2021/10/30 Platform: SENTINEL-2A Tile Number: T49SCT  |

[View Item Basket »](#) [Submit Standing Request »](#)


9. 安装下载器:

Bulk Download - 82 Scenes

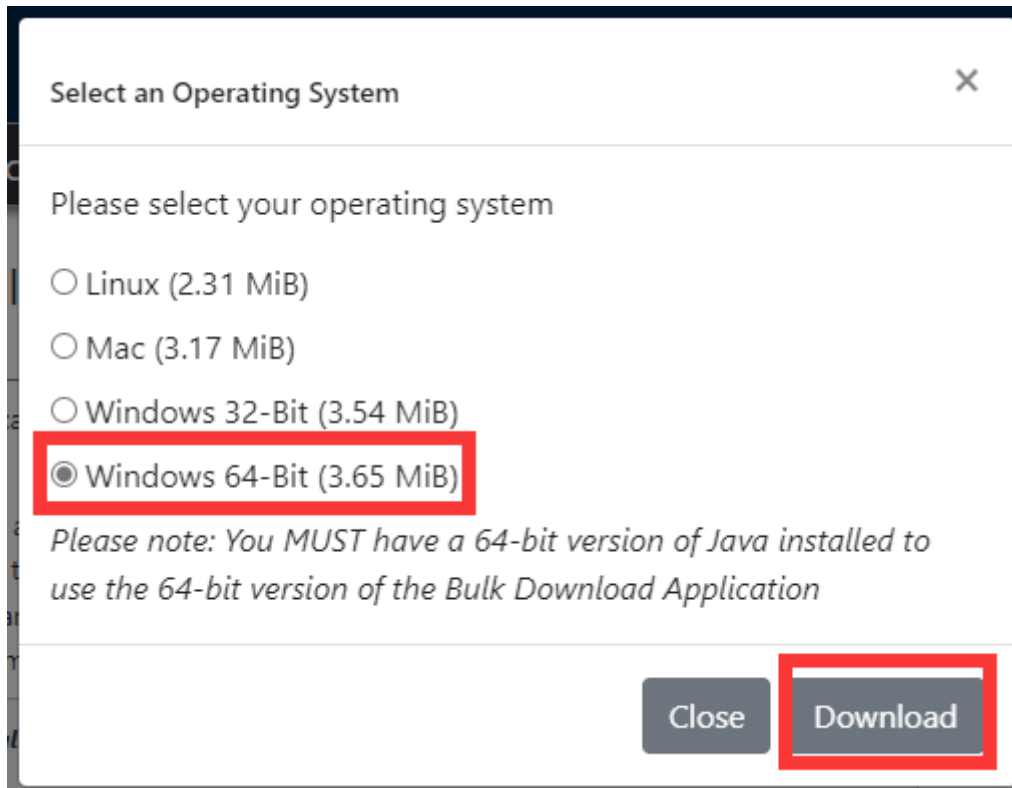
The Bulk Download Application is an easy-to-use tool for downloading large quantities of satellite imagery and geospatial data. This application allows users to submit groups of downloads that can be executed without the user physically downloading every scene. The current implementation operates as a Java desktop application. The application can be downloaded [here](#).

[Start Order](#)

Please note, you must install the application to a directory for which you have read/write permissions.

 Download For Windows 32-Bit

[Do you have a different operating system?](#)



- 要安装该软件，还需要安装 java 10 64bit，安装方法请自行百度；
- 配好 java 的环境变量后，就可以安装该软件了；

10. 提交下载链接：

Bulk Download - 82 Scenes

The Bulk Download Application is an easy-to-use tool for downloading large quantities of satellite imagery and geospatial data. This application allows users to submit groups of downloads that can be executed without the user physically downloading every scene. The current implementation operates as a Java desktop application. The application can be downloaded [here](#).

[Start Order](#)

Bulk Download - 82 Scenes

The Bulk Download Application is an easy-to-use tool for downloading large quantities of satellite imagery and geospatial data. This application allows users to submit groups of downloads that can be executed without the user physically downloading every scene. The current implementation operates as a Java desktop application. The application can be downloaded [here](#).

☒ Sentinel-2 (82 scenes pending selection)

Bulk Download



Order Name - Optional

Submit Product Selections

Bulk Download - 82 Scenes

The Bulk Download Application is an easy-to-use tool for downloading large quantities of satellite imagery and geospatial data. This application allows users to submit groups of downloads that can be executed without the user physically downloading every scene. The current implementation operates as a Java desktop application. The application can be downloaded [here](#).

☒ Sentinel-2 (82 scenes pending selection)

Displaying 1 - 82 of 82

Results Per Page: 100

< First

< Previous

1

Next >

Last >

Options

Remove Dataset

Product Selection

Select All Products



Product List

L1C Tile in JPEG2000 format

Full Resolution Browse in GeoTIFF format

Selections will be applied to all scenes within this dataset - this does not remove other selections

Select Products

Close

11. 通过软件下载:

- 打开 bda 软件;
- 登录账号;
- 在打开的 Open Order 窗口选择你的下载申请, 若该窗口关闭, 可在 File 菜单栏打开;
- 选择你的目标 order ;
- 点击 Begin Download 进行下载;
- 所下载的文件在 bda 软件的安装目录下;
- 一般晚上 1 点下载速度较快且连接稳定;
- 如果下载失败, 出现了 error , 不要点击 Redownload , 该操作会删除下载失败的文件。此时应先下载完其他文件, 最后重启 bda , Select 错误的部分点击 Begin Download 即可继续下载;
- 当 error 发生后还有一种可行的方法就是不去管它, 有时候 bda 软件会自动重新接续下载;
- 重启 bda 不成功, 可能是因为它在后台运行, 需要先打开资源管理器关闭它的进程。

二、数据介绍

1. 文件介绍

以 S2AMSIL1C20190122T025021N0208_R132T50RNV_20190122T065329.zip 为例:

1. S2A: 表示 Sentinel-2A 卫星;
2. MSL: 表示多光谱数据;
3. L1C: 表示产品等级为 L1C 级别, 该级别只经过了几何校正, L2A 级别产品还经过了辐射校正, 但该级别需要用户自己处理;
4. 20190122T025021: 表示数据获取时间, 即 2019 年 1 月 22 日凌晨 2 点 50 分 21 秒, 该时间为格林威治时间, 比北京时间提前 8 个小时;
5. N0208_R132: 处理基线编号与相对轨道编号;
6. T50RNV: 拼接域编号;
7. 20190122T065329: 估计是产品生成的时间;

2. 卫星介绍

| | | S2A | S2A | S2B | S2B | |
|-------------|---------------------|-------------------------|----------------|-------------------------|----------------|------------------------|
| Band Number | Band name | Central wavelength (nm) | Bandwidth (nm) | Central wavelength (nm) | Bandwidth (nm) | Spatial resolution (m) |
| 1 | Coastal aerosol | 443.9 | 27 | 442.3 | 45 | 60 |
| 2 | Blue | 496.6 | 98 | 492.1 | 98 | 10 |
| 3 | Green | 560.0 | 45 | 559 | 46 | 10 |
| 4 | Red | 664.5 | 38 | 665 | 39 | 10 |
| 5 | Vegetation Red Edge | 703.9 | 19 | 703.8 | 20 | 20 |
| 6 | Vegetation Red Edge | 740.2 | 18 | 739.1 | 18 | 20 |
| 7 | Vegetation Red Edge | 782.5 | 28 | 779.7 | 28 | 20 |
| 8 | NIR | 835.1 | 145 | 833 | 133 | 10 |
| 8A | Narrow NIR | 864.8 | 33 | 864 | 32 | 20 |
| 9 | Water vapour | 945.0 | 26 | 943.2 | 27 | 60 |
| 10 | SWIR – Cirrus | 1373.5 | 75 | 1376.9 | 76 | 60 |
| 11 | SWIR | 1613.7 | 143 | 1610.4 | 141 | 20 |
| 12 | SWIR | 2202.4 | 242 | 2185.7 | 238 | 20 |

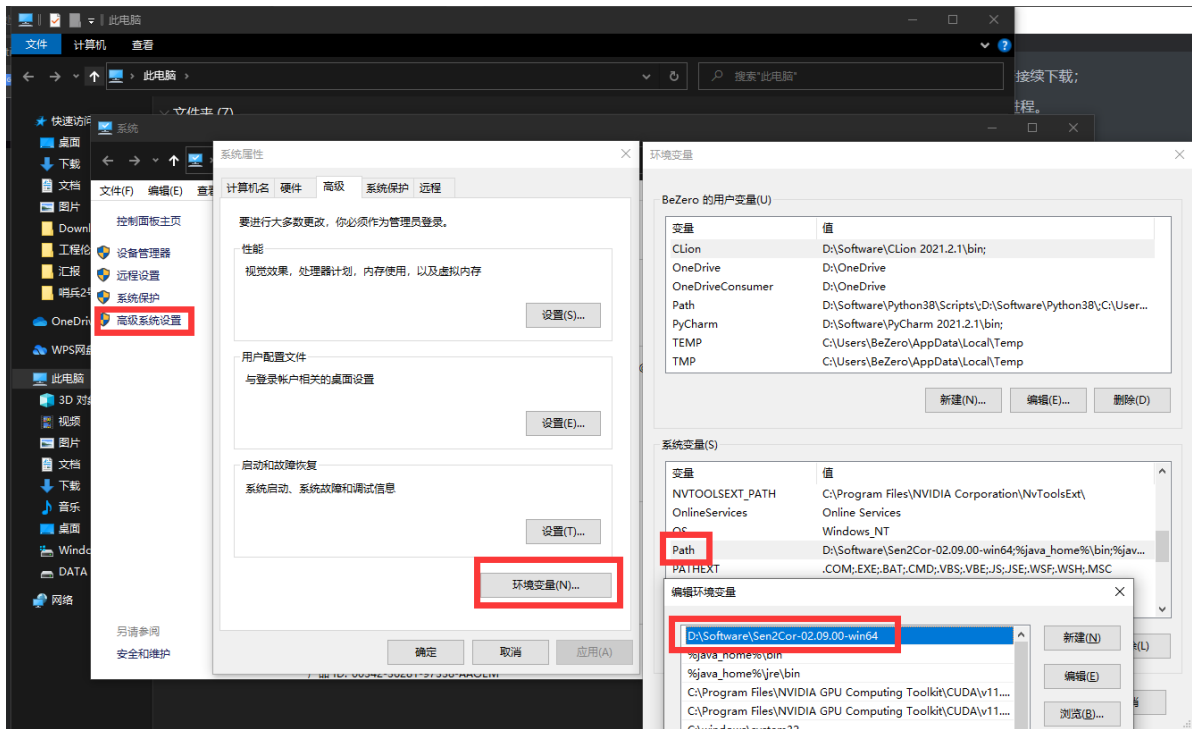
三、数据显示与处理

1. 软件下载：

- 打开网址下载图像处理工具：[SNAP](#)；
- 还需下载大气校正工具：[Sen2Cor](#)；

2. 软件安装：

- SNAP 无脑下一步，需要 Python 环境的用户请注意软件支持的版本；
- Sen2Cor 解压即可，如果想要在任意文件夹下使用该工具，需要将其添加入系统环境变量；



3. 大气校正：

- 将所有数据文件进行解压，放入一个单独的文件夹 Sentinel-2 中；
- 打开 cmd ；
- 进入 Sen2Cor 文件夹（如果添加了环境变量可跳过该步骤）；
- 输入命令： `for /D %s in (D:\Documentation\Project\Sentinel-2\S2A_MSIL1C*) do L2A_process --resolution=10 %s`，其中 `--resolution=10` 表示处理分辨率为 10 的图像；`D:\Documentation\Project\Sentinel-2\S2A_MSIL1C*` 表示所下载的数据集的位置；
- 如果需要处理 S2B 星的数据，仅需要将上述操作中的 `S2A_MSIL1C*` 改为 `S2B_MSIL1C*` 即可。
- 等待系统处理即可；

```

命令提示符 - L2A_process --resolution=10 D:\Documentation\Project\Sentinel-2\S2A_MSIL1C_20210103T033131_N0209_R018_T49SCT_202...
D:\Software\Sen2Cor-02.09.00-win64>L2A_process --resolution=10 D:\Documentation\Project\Sentinel-2\S2A_MSIL1C_20210103T033131_N0209_R018_T49SCT_20210103T033131_N0209_R018_T49SCT_20210103T054855.SAFE
Sen2Cor 2.9.0, created: 2020.11.30, supporting Level-1C product version 14.2 - 14.6
Operation mode: TOOLBOX
Processing baseline: 99.99
Application started ...
Progress[%]: 0.00 : Generating datastrip metadata
L2A datastrip successfully generated
Selected resolution: 10 m
Progress[%]: 0.05 : PID-23760, L2A_ProcessTile: 20 m resolution must be processed first, elapsed time[s]: 1.244, total: 0:00:04.580000
Progress[%]: 0.08 : PID-23760, L2A_ProcessTile: processing with resolution 20 m, elapsed time[s]: 0.767, total: 0:00:05.347000
Progress[%]: 0.08 : PID-23760, L2A_ProcessTile: start of pre processing, elapsed time[s]: 0.005, total: 0:00:05.352000
Progress[%]: 0.09 : PID-23760, L2A_Tables: start import, elapsed time[s]: 0.115, total: 0:00:05.467000
Progress[%]: 0.11 : PID-23760, L2A_Tables: band B01 imported, elapsed time[s]: 0.533, total: 0:00:06
Progress[%]: 0.25 : PID-23760, L2A_Tables: band B02 imported, elapsed time[s]: 3.218, total: 0:00:09.218000
Progress[%]: 0.42 : PID-23760, L2A_Tables: band B03 imported, elapsed time[s]: 4.131, total: 0:00:13.349000
Progress[%]: 0.63 : PID-23760, L2A_Tables: band B04 imported, elapsed time[s]: 5.049, total: 0:00:18.398000
Progress[%]: 0.72 : PID-23760, L2A_Tables: band B05 imported, elapsed time[s]: 2.318, total: 0:00:20.716000
Progress[%]: 0.78 : PID-23760, L2A_Tables: band B06 imported, elapsed time[s]: 1.349, total: 0:00:22.065000
Progress[%]: 0.86 : PID-23760, L2A_Tables: band B07 imported, elapsed time[s]: 1.876, total: 0:00:23.941000
Progress[%]: 0.95 : PID-23760, L2A_Tables: band B08 imported, elapsed time[s]: 2.231, total: 0:00:26.172000
Progress[%]: 0.97 : PID-23760, L2A_Tables: band B09 imported, elapsed time[s]: 0.541, total: 0:00:26.713000
Progress[%]: 1.01 : PID-23760, L2A_Tables: band B10 imported, elapsed time[s]: 0.844, total: 0:00:27.557000
Progress[%]: 1.07 : PID-23760, L2A_Tables: band B11 imported, elapsed time[s]: 1.387, total: 0:00:28.944000
Progress[%]: 1.12 : PID-23760, L2A_Tables: band B12 imported, elapsed time[s]: 1.350, total: 0:00:30.294000
Progress[%]: 1.13 : PID-23760, L2A_ProcessTile: start of Scene Classification, elapsed time[s]: 0.127, total: 0:00:30.421000
  
```

4. 导出 TIFF：

- 创建一个 Python 环境；
- 下载 [gdal](#) (注意版本须与 python 版本匹配)；
- 将其放入你的 python 环境中的 Scripts 文件夹中（推荐使用虚拟环境）；

- 在 Terminal 中激活你的 python（通常是在同一目录下执行 activate.bat 文件）；
- 在 Terminal 中输入： `pip install GDAL-xxxxxxx`，注意是你自己的 GDAL 版本；
- 按需配置其他环境（例如 numpy 等）；
- 使用下述代码进行批处理：

```

1  from osgeo import gdal
2  import os
3  import numpy as np
4  from osgeo import gdal, osr, ogr
5  import glob
6  # os.environ['CPL_ZIP_ENCODING'] = 'UTF-8'
7
8  def S2tif(filename):
9      # 打开栅格数据集
10     print(filename)
11     root_ds = gdal.Open(filename)
12     # print(type(root_ds))
13     # 返回结果是一个list，list中的每个元素是一个tuple，每个tuple中包含了对数据集的
    路径，元数据等的描述信息
14     # tuple中的第一个元素描述的是数据子集的全路径
15     ds_list = root_ds.GetSubDatasets() # 获取子数据集。该数据以数据集形式存储
    且以子数据集形式组织
16     visual_ds = gdal.Open(ds_list[0][0]) # 打开第1个数据子集的路径。ds_list
    有4个子集，内部前段是路径，后段是数据信息
17     # print(visual_ds)
18     print(f'打开数据为: {ds_list[0][1]}')
19     # print(f'投影信息: {visual_ds.GetProjection()}')
20     # print(f'栅格波段数: {visual_ds.RasterCount}')
21     # print(f'栅格列数（宽度）: {visual_ds.RasterXSize}')
22     # print(f'栅格行数（高度）: {visual_ds.RasterYSize}')
23     visual_arr = visual_ds.ReadAsArray() # 将数据集中的数据读取为ndarray
24
25     # 创建.tif文件
26     band_count = visual_ds.RasterCount # 波段数
27     xsize = visual_ds.RasterXSize
28     ysize = visual_ds.RasterYSize
29     out_tif_name = filename.split(".SAFE")[0] + ".tif"
30     driver = gdal.GetDriverByName("GTiff")
31     out_tif = driver.Create(out_tif_name, xsize, ysize, band_count,
    gdal.GDT_Float32)
32     out_tif.SetProjection(visual_ds.GetProjection()) # 设置投影坐标
33     out_tif.SetGeoTransform(visual_ds.GetGeoTransform())
34
35     for index, band in enumerate(visual_arr):
36         band = np.array([band])
37         for i in range(len(band[:])):
38             # 数据写出
39             out_tif.GetRasterBand(index + 1).WriteArray(band[i]) # 将每
    个波段的数据写入内存，此时没有写入硬盘
40     out_tif.FlushCache() # 最终将数据写入硬盘
41     out_tif = None # 注意必须关闭tif文件
42
43 if __name__ == "__main__":
44     from osgeo import gdal
45     SAFE_Path = (r'D:\Documentation\Project\Grassland
    ecology\Sentinel2_pretreatment\data')

```

```

46 data_list = glob.glob(SAFE_Path + "\\*.SAFE")
47
48 for i in range(len(data_list)):
49     data_path = data_list[i]
50     filename = data_path + "\\MTD_MSIL2A.xml"
51     s2tif(filename)
52     print(data_path + "-----转tif成功")
53 print("-----转换结束-----")

```

- 代码中第 17 行是取第一个数据子集 (band 2、3、4、8)，要使用其他 band 须自行更改 (第 18 行代码可以查看每个数据子集的信息)；
- 由于读取子数据集时，gdal 工具会将波段进行重组，导致波段的顺序与原数据集 (sentinel-2 原始数据集) 的波段顺序不同，因此可以通过 `gdalinfo` [文件名或子数据集名] 来获取重组后波段的顺序结构，方法如下：
 - 首先，打开并进入你所下载的 gdal 文件夹下的 `Lib\site-packages\osgeo` 目录；
 - 该目录下检查是否有一个 `gdalinfo.exe` 程序；
 - 在该目录下打开 cmd 命令行；
 - 输入 `gdalinfo xxx/xxx.xml` 查看数据信息，下面给出一个具体的例子以供参考：

```

1  $ gdalinfo
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/MT
   D_MSIL2A.xml
2  # 上面这行是我的输入，其中数据文件夹为
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE
3  # 由于 gdalinfo 不能直接读取 S2A 的文件，因此应该读取 xml 文
   件: /MTD_MSIL2A.xml
4  # 程序支持写入相对或绝对路径，此处我是将数据文件放入了该目录下进行读取
5  # 下面是文件信息的输出：
6  Driver: SENTINEL2/Sentinel 2
7  Files:
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/MT
   D_MSIL2A.xml
8  Size is 512, 512
9  Metadata:
10     AOT_QUANTIFICATION_VALUE=1000.0
11     AOT_QUANTIFICATION_VALUE_UNIT=none
12     AOT_RETRIEVAL_ACCURACY=0.0
13     BOA_QUANTIFICATION_VALUE=10000
14     BOA_QUANTIFICATION_VALUE_UNIT=none
15     CLOUD_COVERAGE_ASSESSMENT=1.049327
16     CLOUD_SHADOW_PERCENTAGE=0.440092
17     DARK_FEATURES_PERCENTAGE=30.990644
18     DATATAKE_1_DATATAKE_SENSING_START=2021-02-02T03:29:41.024Z
19     DATATAKE_1_DATATAKE_TYPE=INS-NOBS
20     DATATAKE_1_ID=GS2A_20210202T032941_029330_N99.99
21     DATATAKE_1_SENSING_ORBIT_DIRECTION=DESCENDING
22     DATATAKE_1_SENSING_ORBIT_NUMBER=18
23     DATATAKE_1_SPACECRAFT_NAME=Sentinel-2A
24     DEGRADED_ANC_DATA_PERCENTAGE=0.0
25     DEGRADED_MSI_DATA_PERCENTAGE=0
26     FOOTPRINT=POLYGON((108.8262199395114 34.3223655300343,
   110.01937756706981 34.3377366079947, 110.03062458149692
   33.347577738129736, 108.85113286341723 33.3327671075422,
   108.8262199395114 34.3223655300343))

```

```

27  FORMAT_CORRECTNESS=PASSED
28  GENERAL_QUALITY=PASSED
29  GENERATION_TIME=2021-12-10T13:10:28.715000Z
30  GEOMETRIC_QUALITY=PASSED
31  HIGH_PROBA_CLOUDS_PERCENTAGE=0.061825
32  MEDIUM_PROBA_CLOUDS_PERCENTAGE=0.484693
33  NODATA_PIXEL_PERCENTAGE=0.000043
34  NOT_VEGETATED_PERCENTAGE=47.824116
35  PREVIEW_GEO_INFO=Not applicable
36  PREVIEW_IMAGE_URL=Not applicable
37  PROCESSING_BASELINE=99.99
38  PROCESSING_LEVEL=Level-2A
39  PRODUCT_START_TIME=2021-02-02T03:29:41.024Z
40  PRODUCT_STOP_TIME=2021-02-02T03:29:41.024Z
41  PRODUCT_TYPE=S2MSI2A
42  PRODUCT_URI=S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T
131028.SAFE
43  RADIATIVE_TRANSFER_ACCURACY=0.0
44  RADIOMETRIC_QUALITY=PASSED
45  REFLECTANCE_CONVERSION_U=1.03080315559675
46  SATURATED_DEFECTIVE_PIXEL_PERCENTAGE=0.000000
47  SENSOR_QUALITY=PASSED
48  SNOW_ICE_PERCENTAGE=0.002857
49  SPECIAL_VALUE_NODATA=0
50  SPECIAL_VALUE_SATURATED=65535
51  THIN_CIRRUS_PERCENTAGE=0.502809
52  UNCLASSIFIED_PERCENTAGE=10.570553
53  VEGETATION_PERCENTAGE=6.625548
54  WATER_PERCENTAGE=2.496857
55  WATER_VAPOUR_RETRIEVAL_ACCURACY=0.0
56  WVP_QUANTIFICATION_VALUE=1000.0
57  WVP_QUANTIFICATION_VALUE_UNIT=cm
58  Subdatasets:
59      SUBDATASET_1_NAME=SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R
018_T49SCT_20211210T131028.SAFE/MTD_MSIL2A.xml:10m:EPSG_32649
60      SUBDATASET_1_DESC=Bands B2, B3, B4, B8 with 10m resolution, UTM
49N
61      # 上述两行，第一行是子数据的位置信息，第二行是子数据的波段信息
62
63      SUBDATASET_2_NAME=SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R0
18_T49SCT_20211210T131028.SAFE/MTD_MSIL2A.xml:20m:EPSG_32649
64      SUBDATASET_2_DESC=Bands B5, B6, B7, B8A, B11, B12, AOT, CLD, SCL,
SNW, WVP with 20m resolution, UTM 49N
65      SUBDATASET_3_NAME=SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R
018_T49SCT_20211210T131028.SAFE/MTD_MSIL2A.xml:60m:EPSG_32649
66      SUBDATASET_3_DESC=Bands B1, B9, AOT, CLD, SCL, SNW, WVP with 60m
resolution, UTM 49N
67      SUBDATASET_4_NAME=SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R
018_T49SCT_20211210T131028.SAFE/MTD_MSIL2A.xml:TCI:EPSG_32649
68      SUBDATASET_4_DESC=True color image, UTM 49N
69  Corner Coordinates:
70  Upper Left ( 0.0, 0.0)
71  Lower Left ( 0.0, 512.0)
72  Upper Right ( 512.0, 0.0)
73  Lower Right ( 512.0, 512.0)
74  Center ( 256.0, 256.0)

```

```

1 $ gdalinfo
  SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_2021121
  0T131028.SAFE/MTD_MSIL2A.xml:10m:EPSG_32649
2 # 上面一行代码的作用是获取第一个子数据集的信息，子数据集的位置在上一节代码中有注
  释
3 ERROR 1: PROJ: proj_create_from_database: Cannot find proj.db
4 ERROR 1: PROJ: proj_create: no database context specified
5 ERROR 1: PROJ: proj_create: no database context specified
6 ERROR 1: PROJ: proj_create: no database context specified
7 ERROR 1: PROJ: proj_create: no database context specified
8 Driver: SENTINEL2/Sentinel 2
9 Files:
  S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
  MTD_MSIL2A.xml
10
  S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
  GRANULE/L2A_T49SCT_A029330_20210202T032944/MTD_TL.xml
11
  S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
  GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R10m/T49SCT_20
  210202T032941_B04_10m.jp2
12
  S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
  GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R10m/T49SCT_20
  210202T032941_B03_10m.jp2
13
  S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
  GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R10m/T49SCT_20
  210202T032941_B02_10m.jp2
14
  S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
  GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R10m/T49SCT_20
  210202T032941_B08_10m.jp2
15 # 上面的输出结果显示了波段重组后的信息
16 Size is 10980, 10980
17 Origin = (300000.0000000000000000,3800040.0000000000000000)
18 Pixel Size = (10.000000000000000,-10.000000000000000)
19 Metadata:
20   AOT_QUANTIFICATION_VALUE=1000.0
21   AOT_QUANTIFICATION_VALUE_UNIT=none
22   AOT_RETRIEVAL_ACCURACY=0.0
23   BOA_QUANTIFICATION_VALUE=10000
24   BOA_QUANTIFICATION_VALUE_UNIT=none
25   CLOUD_COVERAGE_ASSESSMENT=1.049327
26   CLOUD_SHADOW_PERCENTAGE=0.440092
27   DARK_FEATURES_PERCENTAGE=30.990644
28   DATATAKE_1_DATATAKE_SENSING_START=2021-02-02T03:29:41.024Z
29   DATATAKE_1_DATATAKE_TYPE=INS-NOBS
30   DATATAKE_1_ID=GS2A_20210202T032941_029330_N99.99
31   DATATAKE_1_SENSING_ORBIT_DIRECTION=DESCENDING
32   DATATAKE_1_SENSING_ORBIT_NUMBER=18
33   DATATAKE_1_SPACECRAFT_NAME=Sentinel-2A
34   DEGRADED_ANC_DATA_PERCENTAGE=0.0
35   DEGRADED_MSI_DATA_PERCENTAGE=0
36   FORMAT_CORRECTNESS=PASSED
37   GENERAL_QUALITY=PASSED
38   GENERATION_TIME=2021-12-10T13:10:28.715000Z
39   GEOMETRIC_QUALITY=PASSED

```

```

40 HIGH_PROBA_CLOUDS_PERCENTAGE=0.061825
41 MEDIUM_PROBA_CLOUDS_PERCENTAGE=0.484693
42 NODATA_PIXEL_PERCENTAGE=0.000043
43 NOT_VEGETATED_PERCENTAGE=47.824116
44 PREVIEW_GEO_INFO=Not applicable
45 PREVIEW_IMAGE_URL=Not applicable
46 PROCESSING_BASELINE=99.99
47 PROCESSING_LEVEL=Level-2A
48 PRODUCT_START_TIME=2021-02-02T03:29:41.024Z
49 PRODUCT_STOP_TIME=2021-02-02T03:29:41.024Z
50 PRODUCT_TYPE=S2MSI2A
51 PRODUCT_URI=S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_2021121
  OT131028.SAFE
52 RADIATIVE_TRANSFER_ACCURACY=0.0
53 RADIOMETRIC_QUALITY=PASSED
54 REFLECTANCE_CONVERSION_U=1.03080315559675
55 SATURATED_DEFECTIVE_PIXEL_PERCENTAGE=0.000000
56 SENSOR_QUALITY=PASSED
57 SNOW_ICE_PERCENTAGE=0.002857
58 SPECIAL_VALUE_NODATA=0
59 SPECIAL_VALUE_SATURATED=65535
60 THIN_CIRRUS_PERCENTAGE=0.502809
61 UNCLASSIFIED_PERCENTAGE=10.570553
62 VEGETATION_PERCENTAGE=6.625548
63 WATER_PERCENTAGE=2.496857
64 WATER_VAPOUR_RETRIEVAL_ACCURACY=0.0
65 WVP_QUANTIFICATION_VALUE=1000.0
66 WVP_QUANTIFICATION_VALUE_UNIT=cm
67 Image Structure Metadata:
68   COMPRESSION=JPEG2000
69 Corner Coordinates:
70   Upper Left ( 300000.000, 3800040.000)
71   Lower Left ( 300000.000, 3690240.000)
72   Upper Right ( 409800.000, 3800040.000)
73   Lower Right ( 409800.000, 3690240.000)
74   Center ( 354900.000, 3745140.000)
75 # 下面的代码详细介绍了波段重组后各波段的信息
76 Band 1 Block=128x128 Type=UInt16, ColorInterp=Red
77   Description = B4, central wavelength 665 nm
78   Overviews: 5490x5490, 2745x2745, 1373x1373, 687x687, 344x344
79   Metadata:
80     BANDNAME=B4
81     BANDWIDTH=30
82     BANDWIDTH_UNIT=nm
83     SOLAR_IRRADIANCE=1512.06
84     SOLAR_IRRADIANCE_UNIT=W/m2/um
85     WAVELENGTH=665
86     WAVELENGTH_UNIT=nm
87 Band 2 Block=128x128 Type=UInt16, ColorInterp=Green
88   Description = B3, central wavelength 560 nm
89   Overviews: 5490x5490, 2745x2745, 1373x1373, 687x687, 344x344
90   Metadata:
91     BANDNAME=B3
92     BANDWIDTH=35
93     BANDWIDTH_UNIT=nm
94     SOLAR_IRRADIANCE=1823.24
95     SOLAR_IRRADIANCE_UNIT=W/m2/um
96     WAVELENGTH=560

```



```

97     WAVELENGTH_UNIT=nm
98 Band 3 Block=128x128 Type=UInt16, ColorInterp=Blue
99     Description = B2, central wavelength 490 nm
100    Overviews: 5490x5490, 2745x2745, 1373x1373, 687x687, 344x344
101    Metadata:
102        BANDNAME=B2
103        BANDWIDTH=65
104        BANDWIDTH_UNIT=nm
105        SOLAR_IRRADIANCE=1959.66
106        SOLAR_IRRADIANCE_UNIT=W/m2/um
107        WAVELENGTH=490
108        WAVELENGTH_UNIT=nm
109 Band 4 Block=128x128 Type=UInt16, ColorInterp=Undefined
110    Description = B8, central wavelength 842 nm
111    Overviews: 5490x5490, 2745x2745, 1373x1373, 687x687, 344x344
112    Metadata:
113        BANDNAME=B8
114        BANDWIDTH=115
115        BANDWIDTH_UNIT=nm
116        SOLAR_IRRADIANCE=1041.63
117        SOLAR_IRRADIANCE_UNIT=W/m2/um
118        WAVELENGTH=842
119        WAVELENGTH_UNIT=nm

```

```

1  $ gdalinfo
   SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_2021121
   0T131028.SAFE/MTD_MSIL2A.xml:20m:EPSG_32649
2  ERROR 1: PROJ: proj_create_from_database: Cannot find proj.db
3  Driver: SENTINEL2/Sentinel 2
4  Files:
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   MTD_MSIL2A.xml
5
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   GRANULE/L2A_T49SCT_A029330_20210202T032944/MTD_TL.xml
6
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
   210202T032941_B05_20m.jp2
7
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
   210202T032941_B06_20m.jp2
8
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
   210202T032941_B07_20m.jp2
9
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
   210202T032941_B8A_20m.jp2
10
   S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
   GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
   210202T032941_B11_20m.jp2

```

11 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
210202T032941_B12_20m.jp2

12 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
210202T032941_AOT_20m.jp2

13 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/QI_DATA/MSK_CLDPRB_20m.
jp2

14 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
210202T032941_SCL_20m.jp2

15 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/QI_DATA/MSK_SNOWPRB_20m.
jp2

16 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R20m/T49SCT_20
210202T032941_WVP_20m.jp2

17 Size is 5490, 5490

18 Origin = (300000.0000000000000000,3800040.0000000000000000)

19 Pixel size = (20.0000000000000000,-20.0000000000000000)

20 Metadata:

21 AOT_QUANTIFICATION_VALUE=1000.0

22 AOT_QUANTIFICATION_VALUE_UNIT=none

23 AOT_RETRIEVAL_ACCURACY=0.0

24 BOA_QUANTIFICATION_VALUE=10000

25 BOA_QUANTIFICATION_VALUE_UNIT=none

26 CLOUD_COVERAGE_ASSESSMENT=1.049327

27 CLOUD_SHADOW_PERCENTAGE=0.440092

28 DARK_FEATURES_PERCENTAGE=30.990644

29 DATATAKE_1_DATATAKE_SENSING_START=2021-02-02T03:29:41.024Z

30 DATATAKE_1_DATATAKE_TYPE=INS-NOBS

31 DATATAKE_1_ID=GS2A_20210202T032941_029330_N99.99

32 DATATAKE_1_SENSING_ORBIT_DIRECTION=DESCENDING

33 DATATAKE_1_SENSING_ORBIT_NUMBER=18

34 DATATAKE_1_SPACECRAFT_NAME=Sentinel-2A

35 DEGRADED_ANC_DATA_PERCENTAGE=0.0

36 DEGRADED_MSI_DATA_PERCENTAGE=0

37 FORMAT_CORRECTNESS=PASSED

38 GENERAL_QUALITY=PASSED

39 GENERATION_TIME=2021-12-10T13:10:28.715000Z

40 GEOMETRIC_QUALITY=PASSED

41 HIGH_PROBA_CLOUDS_PERCENTAGE=0.061825

42 MEDIUM_PROBA_CLOUDS_PERCENTAGE=0.484693

43 NODATA_PIXEL_PERCENTAGE=0.000043

44 NOT_VEGETATED_PERCENTAGE=47.824116

45 PREVIEW_GEO_INFO=Not applicable

46 PREVIEW_IMAGE_URL=Not applicable

47 PROCESSING_BASELINE=99.99

48 PROCESSING_LEVEL=Level-2A

49 PRODUCT_START_TIME=2021-02-02T03:29:41.024Z

50 PRODUCT_STOP_TIME=2021-02-02T03:29:41.024Z

```

51 PRODUCT_TYPE=S2MSI2A
52 PRODUCT_URI=S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_2021121
    OT131028.SAFE
53 RADIATIVE_TRANSFER_ACCURACY=0.0
54 RADIOMETRIC_QUALITY=PASSED
55 REFLECTANCE_CONVERSION_U=1.03080315559675
56 SATURATED_DEFECTIVE_PIXEL_PERCENTAGE=0.000000
57 SENSOR_QUALITY=PASSED
58 SNOW_ICE_PERCENTAGE=0.002857
59 SPECIAL_VALUE_NODATA=0
60 SPECIAL_VALUE_SATURATED=65535
61 THIN_CIRRUS_PERCENTAGE=0.502809
62 UNCLASSIFIED_PERCENTAGE=10.570553
63 VEGETATION_PERCENTAGE=6.625548
64 WATER_PERCENTAGE=2.496857
65 WATER_VAPOUR_RETRIEVAL_ACCURACY=0.0
66 WVP_QUANTIFICATION_VALUE=1000.0
67 WVP_QUANTIFICATION_VALUE_UNIT=cm
68 Image Structure Metadata:
69 COMPRESSION=JPEG2000
70 Corner Coordinates:
71 Upper Left ( 300000.000, 3800040.000)
72 Lower Left ( 300000.000, 3690240.000)
73 Upper Right ( 409800.000, 3800040.000)
74 Lower Right ( 409800.000, 3690240.000)
75 ERROR 1: PROJ: proj_create: no database context specified
76 ERROR 1: PROJ: proj_create: no database context specified
77 ERROR 1: PROJ: proj_create: no database context specified
78 ERROR 1: PROJ: proj_create: no database context specified
79 ERROR 1: PROJ: proj_create: no database context specified
80 ERROR 1: PROJ: proj_create: no database context specified
81 ERROR 1: PROJ: proj_create: no database context specified
82 ERROR 1: PROJ: proj_create: no database context specified
83 ERROR 1: PROJ: proj_create: no database context specified
84 ERROR 1: PROJ: proj_create: no database context specified
85 ( 300000.000, 3690240.000)
86 Center ( 354900.000, 3745140.000)
87 Band 1 Block=128x128 Type=UInt16, ColorInterp=Undefined
88 Description = B5, central wavelength 705 nm
89 Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
90 Metadata:
91 BANDNAME=B5
92 BANDWIDTH=15
93 BANDWIDTH_UNIT=nm
94 SOLAR_IRRADIANCE=1424.64
95 SOLAR_IRRADIANCE_UNIT=W/m2/um
96 WAVELENGTH=705
97 WAVELENGTH_UNIT=nm
98 Band 2 Block=128x128 Type=UInt16, ColorInterp=Undefined
99 Description = B6, central wavelength 740 nm
100 Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
101 Metadata:
102 BANDNAME=B6
103 BANDWIDTH=15
104 BANDWIDTH_UNIT=nm
105 SOLAR_IRRADIANCE=1287.61
106 SOLAR_IRRADIANCE_UNIT=W/m2/um

```

```

107     WAVELENGTH=740
108     WAVELENGTH_UNIT=nm
109 Band 3 Block=128x128 Type=UInt16, ColorInterp=Undefined
110     Description = B7, central wavelength 783 nm
111     Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
112     Metadata:
113         BANDNAME=B7
114         BANDWIDTH=20
115         BANDWIDTH_UNIT=nm
116         SOLAR_IRRADIANCE=1162.08
117         SOLAR_IRRADIANCE_UNIT=W/m2/um
118         WAVELENGTH=783
119         WAVELENGTH_UNIT=nm
120 Band 4 Block=128x128 Type=UInt16, ColorInterp=Undefined
121     Description = B8A, central wavelength 865 nm
122     Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
123     Metadata:
124         BANDNAME=B8A
125         BANDWIDTH=20
126         BANDWIDTH_UNIT=nm
127         SOLAR_IRRADIANCE=955.32
128         SOLAR_IRRADIANCE_UNIT=W/m2/um
129         WAVELENGTH=865
130         WAVELENGTH_UNIT=nm
131 Band 5 Block=128x128 Type=UInt16, ColorInterp=Undefined
132     Description = B11, central wavelength 1610 nm
133     Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
134     Metadata:
135         BANDNAME=B11
136         BANDWIDTH=90
137         BANDWIDTH_UNIT=nm
138         SOLAR_IRRADIANCE=245.59
139         SOLAR_IRRADIANCE_UNIT=W/m2/um
140         WAVELENGTH=1610
141         WAVELENGTH_UNIT=nm
142 Band 6 Block=128x128 Type=UInt16, ColorInterp=Undefined
143     Description = B12, central wavelength 2190 nm
144     Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
145     Metadata:
146         BANDNAME=B12
147         BANDWIDTH=180
148         BANDWIDTH_UNIT=nm
149         SOLAR_IRRADIANCE=85.25
150         SOLAR_IRRADIANCE_UNIT=W/m2/um
151         WAVELENGTH=2190
152         WAVELENGTH_UNIT=nm
153 Band 7 Block=128x128 Type=UInt16, ColorInterp=Undefined
154     Description = AOT, Aerosol Optical Thickness map (at 550nm)
155     Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
156     Metadata:
157         BANDNAME=AOT
158 Band 8 Block=128x128 Type=UInt16, ColorInterp=Undefined
159     Description = CLD, Raster mask values range from 0 for high
confidence clear sky to 100 for high confidence cloudy
160     Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
161     Metadata:
162         BANDNAME=CLD
163 Band 9 Block=128x128 Type=UInt16, ColorInterp=Undefined

```

```

164 Description = SCL, Scene Classification
165 Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
166 Categories:
167     0: NODATA
168     1: SATURATED_DEFECTIVE
169     2: DARK_FEATURE_SHADOW
170     3: CLOUD_SHADOW
171     4: VEGETATION
172     5: NOT_VEGETATED
173     6: WATER
174     7: UNCLASSIFIED
175     8: CLOUD_MEDIUM_PROBA
176     9: CLOUD_HIGH_PROBA
177    10: THIN_CIRRUS
178    11: SNOW_ICE
179 Metadata:
180     BANDNAME=SCL
181 Band 10 Block=128x128 Type=UInt16, ColorInterp=Undefined
182 Description = SNW, Raster mask values range from 0 for high
confidence NO snow/ice to 100 for high confidence snow/ice
183 Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
184 Metadata:
185     BANDNAME=SNW
186 Band 11 Block=128x128 Type=UInt16, ColorInterp=Undefined
187 Description = WVP, Scene-average Water Vapour map
188 Overviews: 2745x2745, 1373x1373, 687x687, 344x344, 172x172
189 Metadata:
190     BANDNAME=WVP

```

```

1 $ gdalinfo
SENTINEL2_L2A:S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_2021121
0T131028.SAFE/MTD_MSIL2A.xml:60m:EPSG_32649
2 ERROR 1: PROJ: proj_create_from_database: Cannot find proj.db
3 ERROR 1: PROJ: proj_create: no database context specified
4 ERROR 1: PROJ: proj_create: no database context specified
5 ERROR 1: PROJ: proj_create: no database context specified
6 ERROR 1: PROJ: proj_create: no database context specified
7 ERROR 1: PROJ: proj_create: no database context specified
8 ERROR 1: PROJ: proj_create: no database context specified
9 ERROR 1: PROJ: proj_create: no database context specified
10 Driver: SENTINEL2/Sentinel 2
11 Files:
S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
MTD_MSIL2A.xml
12
S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/MTD_TL.xml
13
S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R60m/T49SCT_20
210202T032941_B01_60m.jp2
14
S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R60m/T49SCT_20
210202T032941_B09_60m.jp2

```

15 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R60m/T49SCT_20
210202T032941_AOT_60m.jp2

16 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/QI_DATA/MSK_CLDPRB_60m.
jp2

17 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R60m/T49SCT_20
210202T032941_SCL_60m.jp2

18 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/QI_DATA/MSK_SNOWPRB_60m.
jp2

19 S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_20211210T131028.SAFE/
GRANULE/L2A_T49SCT_A029330_20210202T032944/IMG_DATA/R60m/T49SCT_20
210202T032941_WVP_60m.jp2

20 Size is 1830, 1830

21 Origin = (300000.00000000000000,3800040.00000000000000)

22 Pixel Size = (60.00000000000000,-60.00000000000000)

23 Metadata:

24 AOT_QUANTIFICATION_VALUE=1000.0

25 AOT_QUANTIFICATION_VALUE_UNIT=none

26 AOT_RETRIEVAL_ACCURACY=0.0

27 BOA_QUANTIFICATION_VALUE=10000

28 BOA_QUANTIFICATION_VALUE_UNIT=none

29 CLOUD_COVERAGE_ASSESSMENT=1.049327

30 CLOUD_SHADOW_PERCENTAGE=0.440092

31 DARK_FEATURES_PERCENTAGE=30.990644

32 DATATAKE_1_DATATAKE_SENSING_START=2021-02-02T03:29:41.024Z

33 DATATAKE_1_DATATAKE_TYPE=INS-NOBS

34 DATATAKE_1_ID=GS2A_20210202T032941_029330_N99.99

35 DATATAKE_1_SENSING_ORBIT_DIRECTION=DESCENDING

36 DATATAKE_1_SENSING_ORBIT_NUMBER=18

37 DATATAKE_1_SPACECRAFT_NAME=Sentinel-2A

38 DEGRADED_ANC_DATA_PERCENTAGE=0.0

39 DEGRADED_MSI_DATA_PERCENTAGE=0

40 FORMAT_CORRECTNESS=PASSED

41 GENERAL_QUALITY=PASSED

42 GENERATION_TIME=2021-12-10T13:10:28.715000Z

43 GEOMETRIC_QUALITY=PASSED

44 HIGH_PROBA_CLOUDS_PERCENTAGE=0.061825

45 MEDIUM_PROBA_CLOUDS_PERCENTAGE=0.484693

46 NODATA_PIXEL_PERCENTAGE=0.000043

47 NOT_VEGETATED_PERCENTAGE=47.824116

48 PREVIEW_GEO_INFO=Not applicable

49 PREVIEW_IMAGE_URL=Not applicable

50 PROCESSING_BASELINE=99.99

51 PROCESSING_LEVEL=Level-2A

52 PRODUCT_START_TIME=2021-02-02T03:29:41.024Z

53 PRODUCT_STOP_TIME=2021-02-02T03:29:41.024Z

54 PRODUCT_TYPE=S2MSI2A

55 PRODUCT_URI=S2A_MSIL2A_20210202T032941_N9999_R018_T49SCT_2021121
0T131028.SAFE

56 RADIATIVE_TRANSFER_ACCURACY=0.0

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57  RADIOMETRIC_QUALITY=PASSED
58  REFLECTANCE_CONVERSION_U=1.03080315559675
59  SATURATED_DEFECTIVE_PIXEL_PERCENTAGE=0.000000
60  SENSOR_QUALITY=PASSED
61  SNOW_ICE_PERCENTAGE=0.002857
62  SPECIAL_VALUE_NODATA=0
63  SPECIAL_VALUE_SATURATED=65535
64  THIN_CIRRUS_PERCENTAGE=0.502809
65  UNCLASSIFIED_PERCENTAGE=10.570553
66  VEGETATION_PERCENTAGE=6.625548
67  WATER_PERCENTAGE=2.496857
68  WATER_VAPOUR_RETRIEVAL_ACCURACY=0.0
69  WVP_QUANTIFICATION_VALUE=1000.0
70  WVP_QUANTIFICATION_VALUE_UNIT=cm
71  Image Structure Metadata:
72    COMPRESSION=JPEG2000
73  Corner Coordinates:
74  Upper Left  ( 300000.000, 3800040.000)
75  Lower Left  ( 300000.000, 3690240.000)
76  Upper Right ( 409800.000, 3800040.000)
77  Lower Right ( 409800.000, 3690240.000)
78  Center      ( 354900.000, 3745140.000)
79  Band 1 Block=128x128 Type=UInt16, ColorInterp=Undefined
80    Description = B1, central wavelength 443 nm
81    Overviews: 915x915, 458x458, 229x229
82    Metadata:
83      BANDNAME=B1
84      BANDWIDTH=20
85      BANDWIDTH_UNIT=nm
86      SOLAR_IRRADIANCE=1884.69
87      SOLAR_IRRADIANCE_UNIT=W/m2/um
88      WAVELENGTH=443
89      WAVELENGTH_UNIT=nm
90  Band 2 Block=128x128 Type=UInt16, ColorInterp=Undefined
91    Description = B9, central wavelength 945 nm
92    Overviews: 915x915, 458x458, 229x229
93    Metadata:
94      BANDNAME=B9
95      BANDWIDTH=20
96      BANDWIDTH_UNIT=nm
97      SOLAR_IRRADIANCE=812.92
98      SOLAR_IRRADIANCE_UNIT=W/m2/um
99      WAVELENGTH=945
100     WAVELENGTH_UNIT=nm
101  Band 3 Block=128x128 Type=UInt16, ColorInterp=Undefined
102    Description = AOT, Aerosol Optical Thickness map (at 550nm)
103    Overviews: 915x915, 458x458, 229x229
104    Metadata:
105      BANDNAME=AOT
106  Band 4 Block=128x128 Type=UInt16, ColorInterp=Undefined
107    Description = CLD, Raster mask values range from 0 for high
confidence clear sky to 100 for high confidence cloudy
108    Overviews: 915x915, 458x458, 229x229
109    Metadata:
110      BANDNAME=CLD
111  Band 5 Block=128x128 Type=UInt16, ColorInterp=Undefined
112    Description = SCL, Scene Classification
113    Overviews: 915x915, 458x458, 229x229

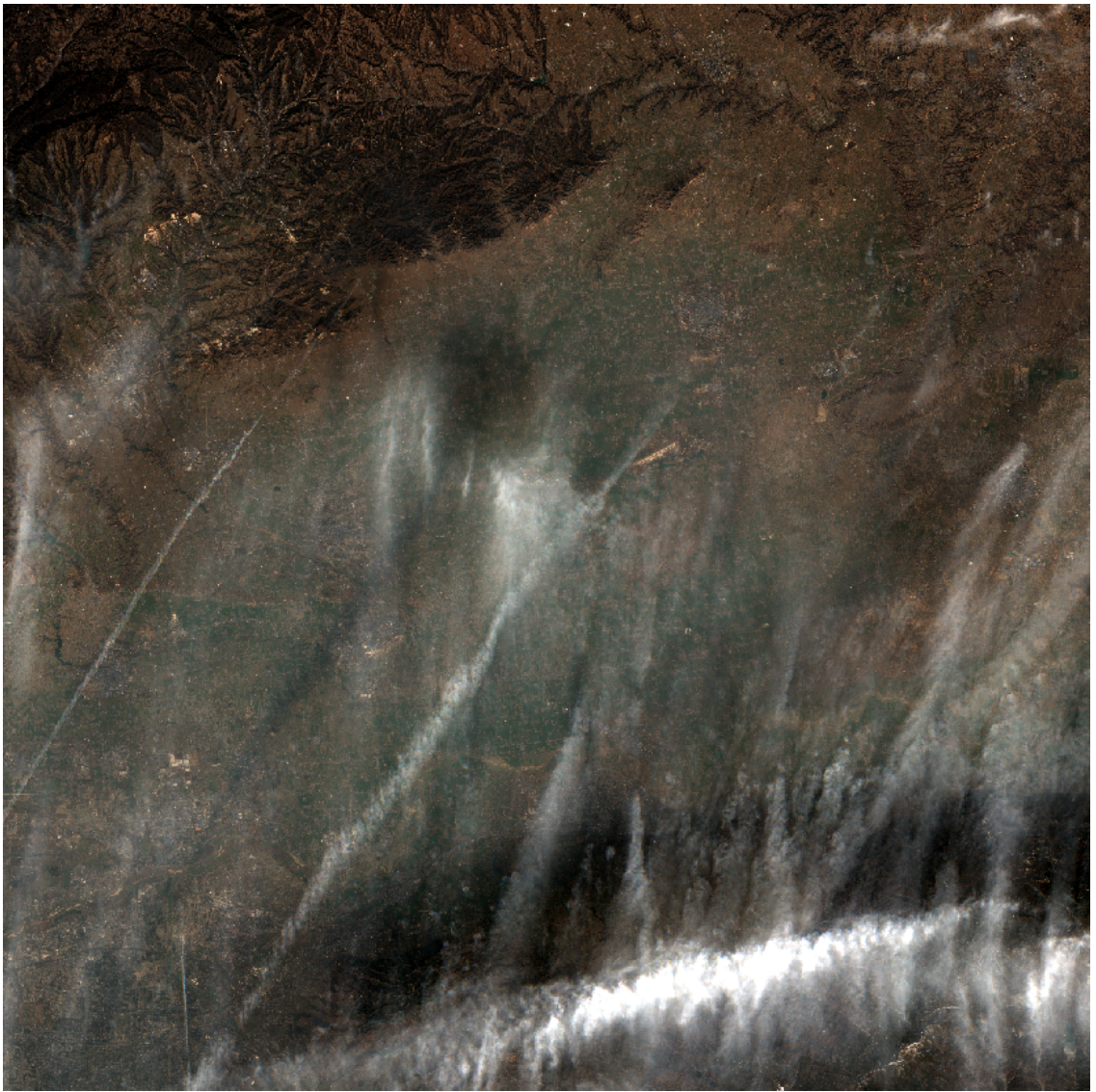
```

```

114 Categories:
115     0: NODATA
116     1: SATURATED_DEFECTIVE
117     2: DARK_FEATURE_SHADOW
118     3: CLOUD_SHADOW
119     4: VEGETATION
120     5: NOT_VEGETATED
121     6: WATER
122     7: UNCLASSIFIED
123     8: CLOUD_MEDIUM_PROBA
124     9: CLOUD_HIGH_PROBA
125     10: THIN_CIRRUS
126     11: SNOW_ICE
127 Metadata:
128     BANDNAME=SCL
129 Band 6 Block=128x128 Type=UInt16, ColorInterp=Undefined
130 Description = SNW, Raster mask values range from 0 for high
confidence NO snow/ice to 100 for high confidence snow/ice
131 Overviews: 915x915, 458x458, 229x229
132 Metadata:
133     BANDNAME=SNW
134 Band 7 Block=128x128 Type=UInt16, ColorInterp=Undefined
135 Description = WVP, Scene-average Water Vapour map
136 Overviews: 915x915, 458x458, 229x229
137 Metadata:
138     BANDNAME=WVP

```

- rgb 图像展示:



- 通过改变代码中的子数据集以及 gdalinfo 工具查询的信息可以获取 Sentinel-2 数据集的不同波段。

参考文献

[1] KilllerQueen. Python脚本批量读取哨兵2号（Sentinel2）影像并另存为Geotiff格式[EB/OL]. 2021-03-10[2022-01-13]. <https://blog.csdn.net/KilllerQueen/article/details/114637970>.