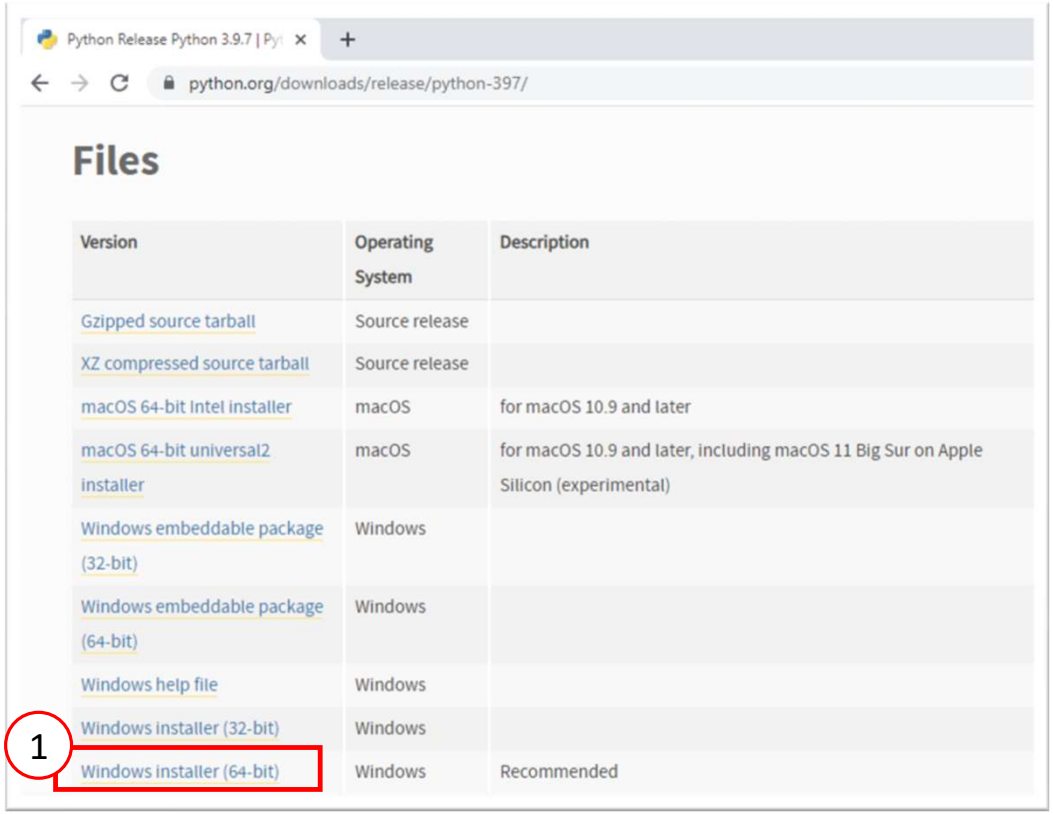
SAET

Shoreline and **A**nalysis **E**xtraction **T**ool

Installation tutorial (STEP BY STEP)

1 Installing Python. Download the versión 3.9.7 from Python.org (https://www.python.org/downloads/release/python-397).

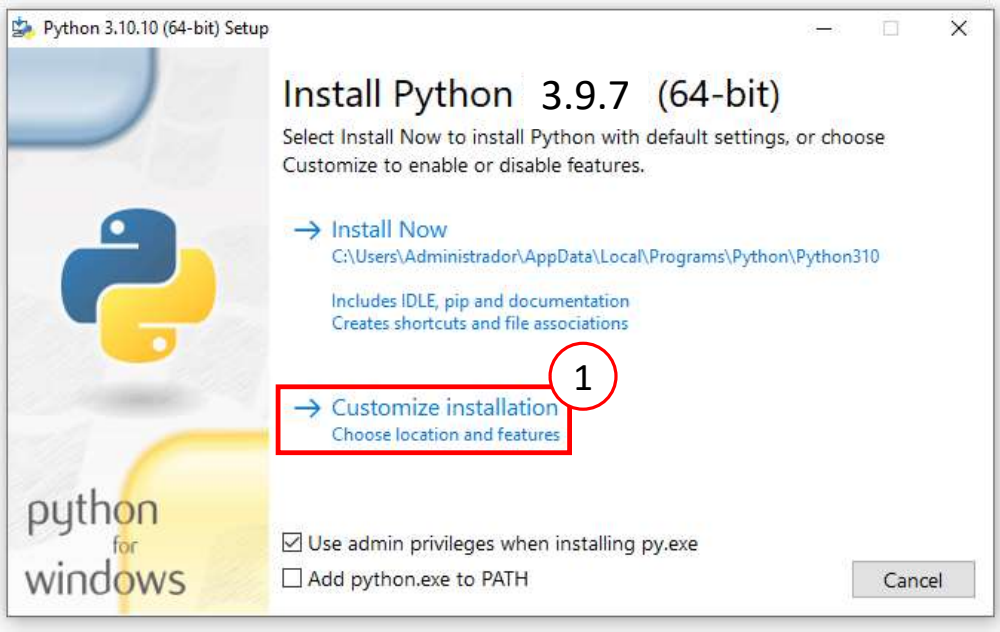
1 Select Windows 64 bits versión (recommended).

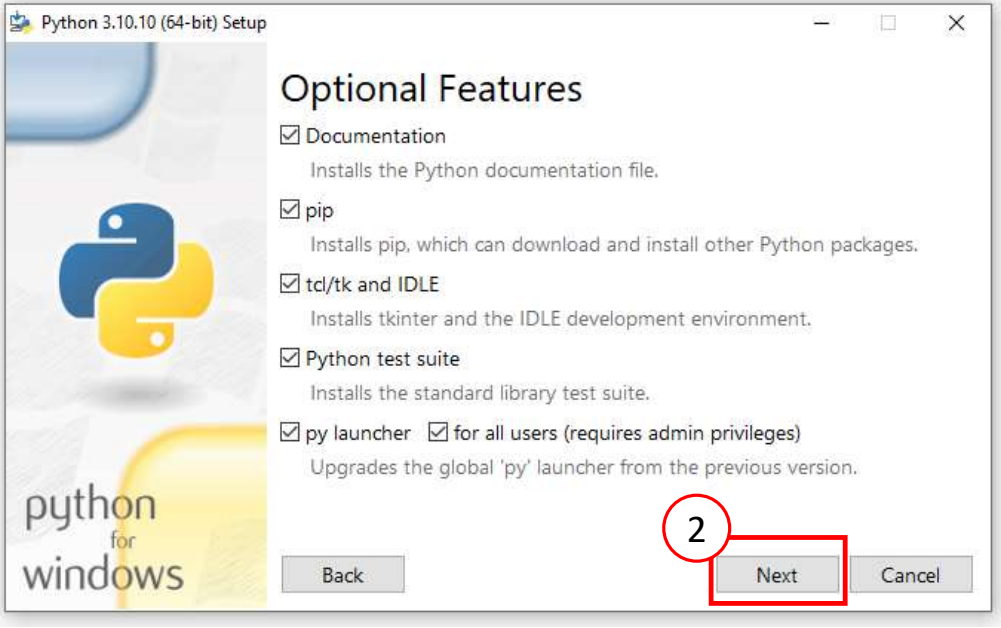


1 Installing Python. Execute the installation file.

1 Choose “Customize installation” to install Python in the folder specified by the user.

2 Click on “next”

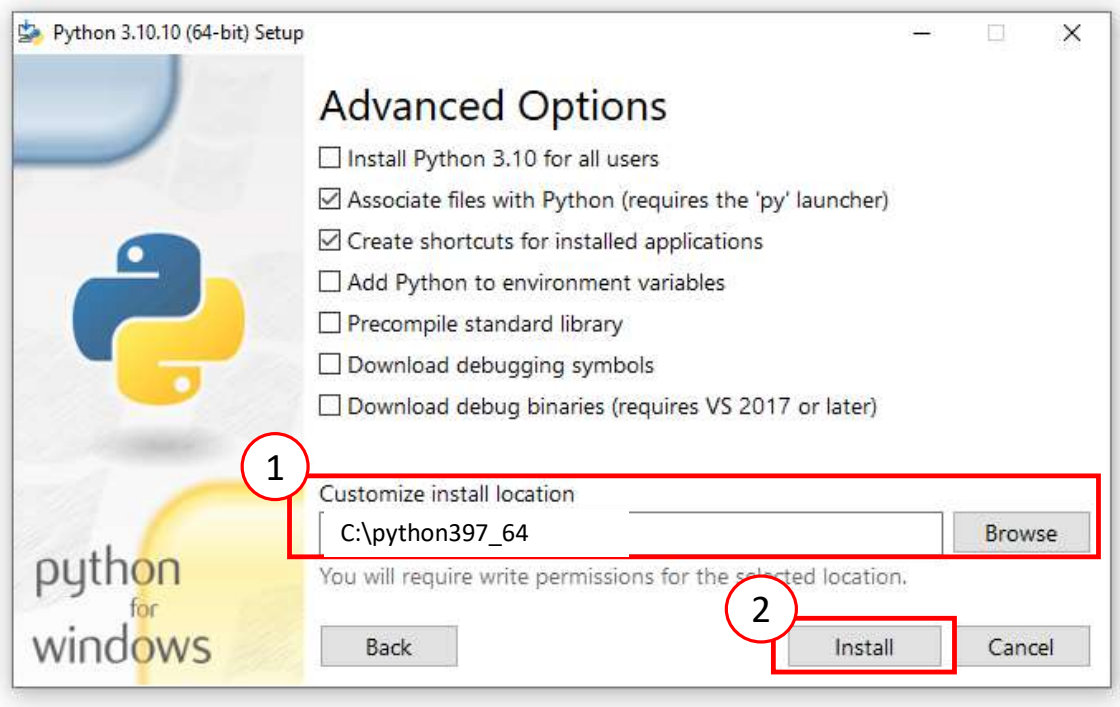




1 Installing Python. Set the installation folder

1 Type the name of the folder to install Python (for exemple “c:\python397_64”).

2 Click on “install”.

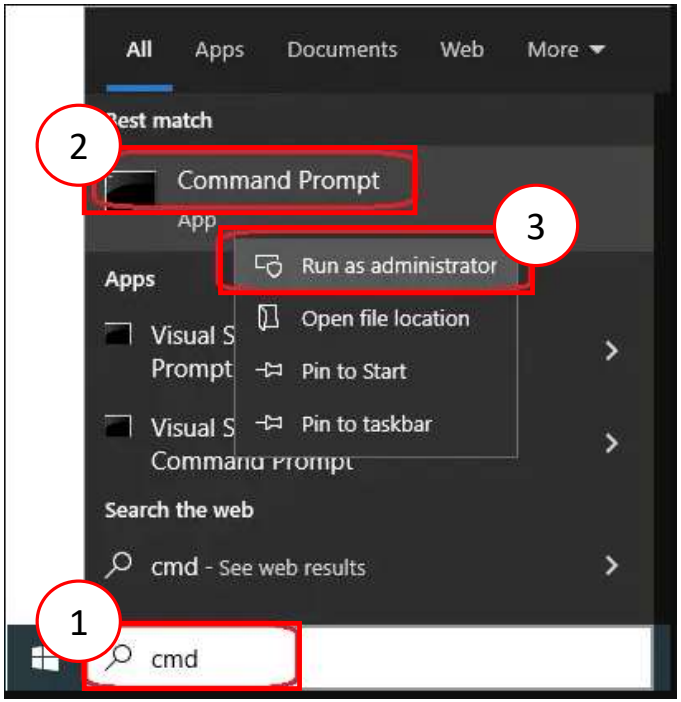


2 Run the command prompt.

1 Type “cmd” in the search bar of Windows.

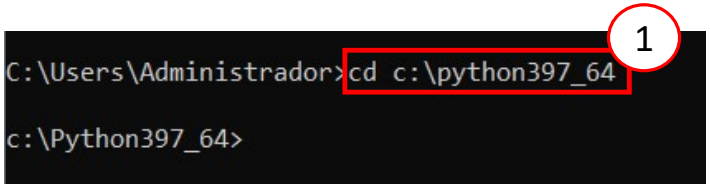
2 Right-click on the “Command prompt” icon.

2 Select “Run as administrator”.

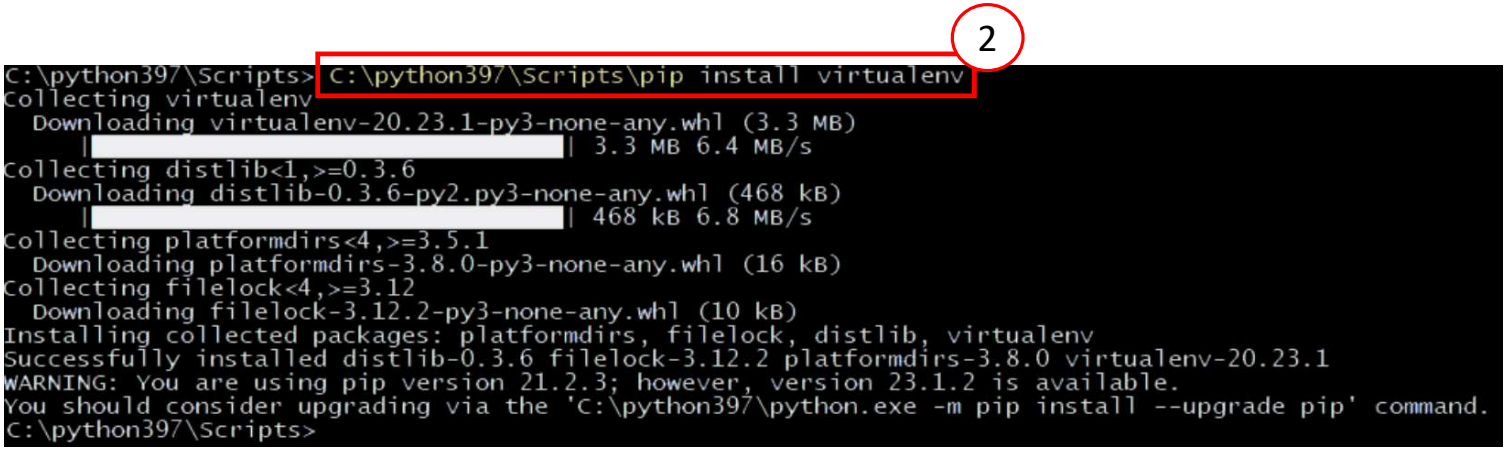


3 Go to the cmd window and change the current folder to the Python installation folder.

1 Type “cd c:\python397_64” and press ENTER.

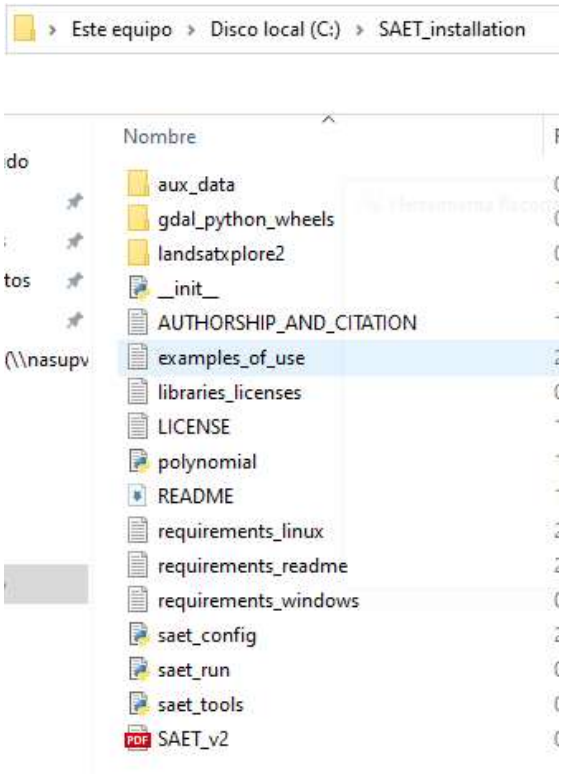


2 Install the library “virtualenv” by typing: “c:\python397_64\Scripts\pip install virtualenv”



4 Create a new folder for SAET (for example SAET_installation) and copy all files to this folder.

5 In the cmd window, change the current folder to the SAET installation folder: type “cd c:\SAET_installation”



7 Create a new virtual environment (VE) called “env”. This will create a new folder called “env” inside the SAET installation folder. Type “c:\python397_64\Scripts\virtualenv env”.

```
C:\SAET_installation> C:\python397\Scripts\virtualenv env
created virtual environment CPython3.9.7.final.0-64 in 3922ms
  creator CPython3Windows(dest=C:\SAET_installation\env, clear=False, no_vcs_ignore=False, global=False)
  seeder FromAppData(download=False, pip=bundle, setuptools=bundle, wheel=bundle, via=copy, app_data_dir=C:\Users\[redacted]\AppData\
Local\pypa\virtualenv)
    added seed packages: pip==23.1.2, setuptools==67.8.0, wheel==0.40.0
  activators BashActivator,BatchActivator,FishActivator,NushellActivator,PowerShellActivator,PythonActivator
C:\SAET_installation>
```

8 Check your current versión of Python by typing “python“. Ensure your active versión is 3.9.7 (64 bits). Type “quit()” to close python. Type “env\Scripts\activate” (1) to activate the VE called “env”. The prompt will change like that: “(env) c:\SAET_installation”. This “(env)” means that your VE is active. If you want to deactivate your VE (2), type “env\Scripts\deactivate” (2).

```
Microsoft Windows [Versión 10.0.18363.1679]
(c) 2019 Microsoft Corporation. Todos los derechos reservados.

C:\Windows\system32>python
Python 3.9.7 (tags/v3.9.7:1016ef3, Aug 30 2021, 20:19:38) [MSC v.1929 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> quit()

C:\Windows\system32>cd C:\SAET_installation

C:\SAET_installation>env\Scripts\activate

(env) C:\SAET_installation>
```

1

```
(env) C:\SAET_installation>env\Scripts\deactivate
C:\SAET_installation>
```

2

9 **Optional but very useful**. Batch file creation to open the command prompt window with the virtual environment activated

If you don't want to repeat the step VE activation every time you want to run SAET, do the next:

1. Open a new text file.
2. Type the next sentences and save the file as bat (for exmple: "env_activation.bat"). Be careful to change the name of your SAET installation forlder and the name of your VE if needed.

```
@echo off
start "" cmd /k "cd /d C:\saet_installation && call env\Scripts\activate.bat"
```

3. Run the batch file (env_activation.bat) by double-clicking on it.

10 Install the required libraries for SAET. Being the VE “env” active, type “pip install –r requirements_Windows.txt”. 1

1

```
(env) C:\SAET_installation>pip install -r requirements_windows.txt
Processing c:\saet_installation\gdal_python_wheels\gdal-3.3.3-cp39-cp39-win_amd64.whl (from -r requirements_windows.txt (line 4))
Collecting python-dateutil>=2.2.8 (from -r requirements_windows.txt (line 1))
  Using cached python_dateutil-2.8.2-py2.py3-none-any.whl (247 kB)
Collecting numpy>=1.21.2 (from -r requirements_windows.txt (line 2))
  Downloading numpy-1.25.0-cp39-cp39-win_amd64.whl (15.1 MB)
     ---------------------------------------- 15.1/15.1 MB 32.8 MB/s eta 0:00:00
Collecting matplotlib>=3.4.3 (from -r requirements_windows.txt (line 3))
  Using cached matplotlib-3.7.1-cp39-cp39-win_amd64.whl (7.6 MB)
Collecting sentinelsat>=1.1.0 (from -r requirements_windows.txt (line 5))
  Downloading sentinelsat-1.2.1-py3-none-any.whl (48 kB)
     ---------------------------------------- 48.8/48.8 kB 2.4 MB/s eta 0:00:00
Collecting Shapely>=1.7.1 (from -r requirements_windows.txt (line 6))
  Downloading shapely-2.0.1-cp39-cp39-win_amd64.whl (1.4 MB)
     ---------------------------------------- 1.4/1.4 MB 90.6 MB/s eta 0:00:00
Collecting pyshp>=2.1.3 (from -r requirements_windows.txt (line 7))
  Downloading pyshp-2.3.1-py2.py3-none-any.whl (46 kB)
     ---------------------------------------- 46.5/46.5 kB 2.3 MB/s eta 0:00:00
Collecting scikit-image>=0.18.3 (from -r requirements_windows.txt (line 8))
  Downloading scikit_image-0.21.0-cp39-cp39-win_amd64.whl (22.9 MB)
     ---------------------------------------- 22.9/22.9 MB 28.5 MB/s eta 0:00:00
Collecting scikit-learn>=1.0.2 (from -r requirements_windows.txt (line 9))
  Downloading scikit_learn-1.2.2-cp39-cp39-win_amd64.whl (8.4 MB)
     ---------------------------------------- 8.4/8.4 MB 31.6 MB/s eta 0:00:00
Collecting scipy>=1.7.1 (from -r requirements_windows.txt (line 10))
  Downloading scipy-1.11.0-cp39-cp39-win_amd64.whl (44.1 MB)
```

(11) Check SAET by typing “python saet_run.py --h" (1)

(1)

```
(env) C:\SAET_installation>python saet_run.py --h
usage: saet_run.py [-h] --rm {os,dp,od,op} --fp FP --sd SD --cd CD --ed ED --mc [0-100] --lp {landsat_8_c1,landsat_ot_c2_l1,landsat_ot_c2_l2,NONE} --ll LL
                   --sp {S2MSI1C,S2MSI2A,NONE} --sl SL [--bc BC] [--of OF] [--wi {aweish,aweinsh,mndwi,kmeans}] [--th {0,1,2}] [--mm {erosion,dilation}]
                   [--cl {0,1,2}] [--ks {3,5}] [--np NP]

optional arguments:
  -h, --help            show this help message and exit
  --rm {os,dp,od,op}    Run mode (only search [s] / download and process [dp] / only donwload [od] / only process [op]). --rm=os / --rm=dp / --rm=od /
                        --rm=op. Default: os
  --fp FP               path of the roi file for searching scenes (fp=c:\data oi.geojson), coordinates long/lat in this format:
                        fp=long_min,lat_min,long_max,lat_max. Default: NONE
  --sd SD               Start date for searching scenes (YYYYMMDD). --sd=20210101. Default:20200101
  --cd CD               Central date for storm (YYYYMMDD). --sd=20210101. Default:20200102
  --ed ED               End date for searching scenes (YYYYMMDD). --sd=20210101. Default:20200103
  --mc [0-100]          maximum cloud coverture for the whole scene [0-100]. --mc=10
  --lp {landsat_8_c1,landsat_ot_c2_l1,landsat_ot_c2_l2,NONE}
                        Landsat 8 product type. --l8=landsat_8_c1 or landsat_ot_c2_l1 or landsat_ot_c2_l2 or NONE. Default: landsat_8_c1
  --ll LL               List of scenes for Landsat 8 (number of 6 digits). --ll=198032,199031. Default: NONE
  --sp {S2MSI1C,S2MSI2A,NONE}
                        Sentinel 2 product type (S2MSI1C / S2MSI2A). --s2=S2MSI1C / --s2=S2MSI2A / NONE. Default: S2MSI1C
  --sl SL               List of scenes for Sentinel 2 (string of 5 characters). --sl=31TCF,30TYK. Default: NONE
  --bc BC               beach code filter list. --bc=520,548 Default: NONE
  --of OF               output data folder. --of=c:\data (windows) --of=/data. Default: SAET_HOME_PATH
  --wi {aweish,aweinsh,mndwi,kmeans}
                        Water index type (aweish, aweinsh,mndwi,kmeans). --wi=aweinsh. Default: aweinsh
  --th {0,1,2}          Thresholding method (0: standard 0 value, 1: Otsu bimodal, 2: Otsu multimodal 3 classes). --th=0. Default: 0
  --mm {erosion,dilation}
                        Morphological method (erosion, dilation). --mm=dilation, Default: dilation
  --cl {0,1,2}          Cloud mask level (0: no masking, 1: only opaque clouds, 2: opaque clouds + cirrus + cloud shadows). Default: 0
  --ks {3,5}            Kernel size for points extraction. Default: 3
  --np NP               List of number of products for download (only if --rm=d and --rm=p). [0,2,5,3] / [*] / [5-10]. Default: NONE

(env) C:\SAET_installation>
```

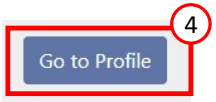
12 **Very important**. Before running SAET you must change your credentials (user, password) for the two servers (USGS and ESA-copernicus). Open the file “saet_config.py” and replace the sterisk symbols with your credentials.

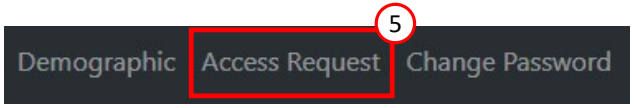
```
os.environ['USER_ESA'] = os.getenv('USER_ESA', '********')
os.environ['PASS_ESA'] = os.getenv('PASS_ESA', '********')
os.environ['USER_USGS'] = os.getenv('USER_USGS', '********')
os.environ['PASS_USGS'] = os.getenv('PASS_USGS', '********')
```

1 Credentials for Copernicus Scihub service: go to the website of Copernicus Open Access Hub and register on the next website: https://scihub.copernicus.eu/dhus/#/self-registration. Once you have registered correctly, you will be able to access the website https://scihub.copernicus.eu/dhus with your new credentials.

2 Credentials for USGS Landsat Explorer service: In this case, you need to do two things: register on the Landsat Explorer website and make a request to access the service “machine to machine” (m2m).

For the first requirement, you must register on the website https://ers.cr.usgs.gov/register. Once you have your credentials, access the website https://earthexplorer.usgs.gov, and go to your profile settings. 3 Click on the button “Go to Profile” 4 and finally, on the option “Access Request”. 5 There you can make a new request to the m2m service by filling out a form.





13 In the file “examples_of_use.txt” you can find some examples to test SAET for different proposals. For example, with this sentence `python saet_run.py --rm=os --fp=-0.3199,39.1034,-0.1414,39.2503 --sd=20220901 --cd=20221001 --ed=20221201 --mc=30 --lp=NONE --ll=NONE --sp=S2MSI1C --sl=NONE` we are searching for Sentinel-2 (level 1C) images between 2022/09/01 and 2022/12/01 arround the date of análisis (2022/10/01), with les than 30% of cloud coverage. The result offers an ordered-by-date list of images displaying a basic information for each found producto (id, cloud coverage and availavility [only in case of Sentinel-2 images]).

```
(env) C:\SAET_installation>python saet_run.py --rm=os --fp=-0.3199,39.1034,-0.1414,39.2503 --sd=20220901 --cd=20221001 --ed=20221201 --mc=30 --lp=NONE --ll=NONE --sp=S2MSI1C --sl=NONE
2023-06-27 17:57:53,306 INFO Starting SAET algorithm...

2023-06-27 17:57:53,307 INFO Searching for S2 images...

2023-06-27 17:57:53,641 INFO Found 15 products
Scene: S2A_MSIL1C_20221106T105241_N0400_R051_T31SBD_20221106T143018 Cloud coverage: 0.0 availability: offline
Scene: S2A_MSIL1C_20221106T105241_N0400_R051_T30SYJ_20221106T143018 Cloud coverage: 0.0 availability: offline
Scene: S2B_MSIL1C_20221101T105109_N0400_R051_T30SYJ_20221101T125432 Cloud coverage: 0.07 availability: offline
Scene: S2B_MSIL1C_20221101T105109_N0400_R051_T31SBD_20221101T125432 Cloud coverage: 0.18 availability: offline
Scene: S2A_MSIL1C_20221017T105041_N0400_R051_T30SYJ_20221017T143219 Cloud coverage: 27.24 availability: offline
Scene: S2B_MSIL1C_20221002T104759_N0400_R051_T31SBD_20221002T125745 Cloud coverage: 0.0 availability: offline
Scene: S2B_MSIL1C_20221002T104759_N0400_R051_T30SYJ_20221002T125745 Cloud coverage: 0.0 availability: offline
Scene: S2A_MSIL1C_20220927T104821_N0400_R051_T30SYJ_20220927T142921 Cloud coverage: 15.91 availability: online
Scene: S2A_MSIL1C_20220927T104821_N0400_R051_T31SBD_20220927T142921 Cloud coverage: 21.92 availability: offline
Scene: S2B_MSIL1C_20220922T104649_N0400_R051_T31SBD_20220922T125326 Cloud coverage: 18.95 availability: offline
Scene: S2B_MSIL1C_20220922T104649_N0400_R051_T30SYJ_20220922T125326 Cloud coverage: 14.22 availability: offline
Scene: S2A_MSIL1C_20220907T105041_N0400_R051_T31SBD_20220907T143122 Cloud coverage: 0.88 availability: offline
Scene: S2A_MSIL1C_20220907T105041_N0400_R051_T30SYJ_20220907T143122 Cloud coverage: 3.72 availability: offline
Scene: S2B_MSIL1C_20220902T104619_N0400_R051_T30SYJ_20220902T125405 Cloud coverage: 18.45 availability: offline
Scene: S2B_MSIL1C_20220902T104619_N0400_R051_T31SBD_20220902T125405 Cloud coverage: 22.76 availability: offline


[0] Scene: S2A_MSIL1C_20221106T105241_N0400_R051_T31SBD_20221106T143018 Cloud coverage: 0.0% 36 days Offline
[1] Scene: S2A_MSIL1C_20221106T105241_N0400_R051_T30SYJ_20221106T143018 Cloud coverage: 0.0% 36 days Offline
[2] Scene: S2B_MSIL1C_20221101T105109_N0400_R051_T30SYJ_20221101T125432 Cloud coverage: 0.07% 31 days Offline
[3] Scene: S2B_MSIL1C_20221101T105109_N0400_R051_T31SBD_20221101T125432 Cloud coverage: 0.18% 31 days Offline
[4] Scene: S2A_MSIL1C_20221017T105041_N0400_R051_T30SYJ_20221017T143219 Cloud coverage: 27.24% 16 days Offline
[5] Scene: S2B_MSIL1C_20221002T104759_N0400_R051_T31SBD_20221002T125745 Cloud coverage: 0.0% 1 days Offline
[6] Scene: S2B_MSIL1C_20221002T104759_N0400_R051_T30SYJ_20221002T125745 Cloud coverage: 0.0% 1 days Offline
[*******] Central date:20221001
[7] Scene: S2A_MSIL1C_20220927T104821_N0400_R051_T30SYJ_20220927T142921 Cloud coverage: 15.91% -4 days Online
[8] Scene: S2A_MSIL1C_20220927T104821_N0400_R051_T31SBD_20220927T142921 Cloud coverage: 21.92% -4 days Offline
[9] Scene: S2B_MSIL1C_20220922T104649_N0400_R051_T31SBD_20220922T125326 Cloud coverage: 18.95% -9 days Offline
[10] Scene: S2B_MSIL1C_20220922T104649_N0400_R051_T30SYJ_20220922T125326 Cloud coverage: 14.22% -9 days Offline
[11] Scene: S2A_MSIL1C_20220907T105041_N0400_R051_T31SBD_20220907T143122 Cloud coverage: 0.88% -24 days Offline
[12] Scene: S2A_MSIL1C_20220907T105041_N0400_R051_T30SYJ_20220907T143122 Cloud coverage: 3.72% -24 days Offline
[13] Scene: S2B_MSIL1C_20220902T104619_N0400_R051_T30SYJ_20220902T125405 Cloud coverage: 18.45% -29 days Offline
[14] Scene: S2B_MSIL1C_20220902T104619_N0400_R051_T31SBD_20220902T125405 Cloud coverage: 22.76% -29 days Offline


2023-06-27 17:57:56,695 INFO Time passed: 0hour:0min:3sec

2023-06-27 17:57:56,695 INFO SAET algorithm have finished successfully.
```

14 Along with the results in the command prompt window, an html file called “search_result.html” is opened automatically, showing the quicklooks for each product. This Will help the selection of the suitable products to be downloaded and processed.