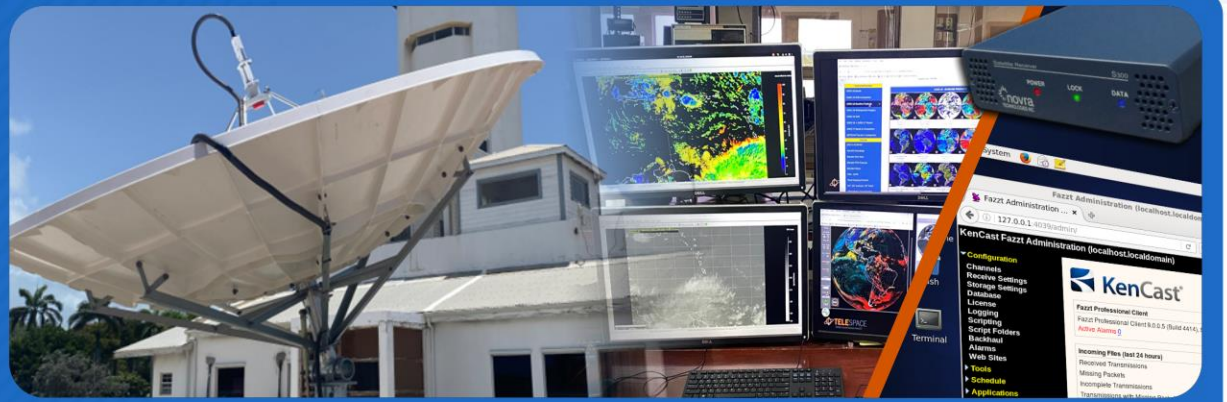
GEONETCast-Americas Training for the Eastern Caribbean States

Day 5 - May 12th

Session 2:

Hands-on
Introduction to Visual Studio Code



Diego Souza
diego.souza@inpe.br

DISSM - Meteorological Satellites and Sensors' Division
CGCT - General Coordination of Earth Sciences
INPE - National Institute for Space Research

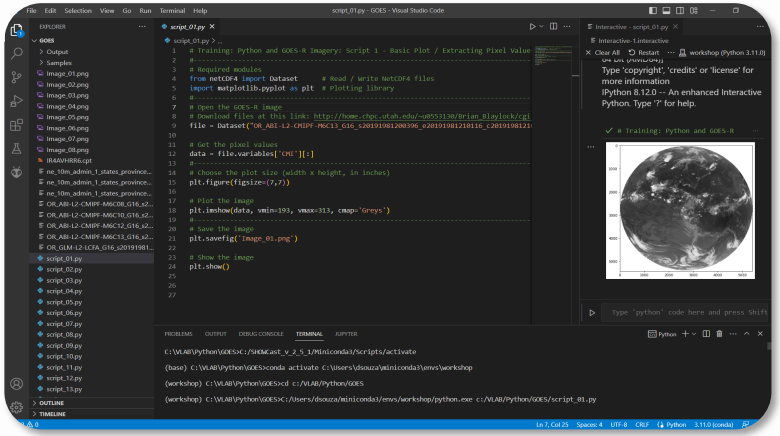
SDCR PROJECT
Strengthening Disaster and Climate Resilience in the Eastern and Southern Caribbean

USAID FROM THE AMERICAN PEOPLE

Caribbean Institute for Meteorology and Hydrology

Presentation Outline

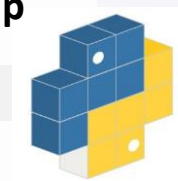
- Running Scripts Locally (Review)
- Installing Visual Studio Code
- Configuring and Running Scripts
- Extra Features



Running Scripts Locally

- Python
- Package Manager
- Virtual Environment Manager

pip



- Text Editor / IDE (Integrated Development Environment)

VS Code

PyCharm

and many others!

- Sample Data

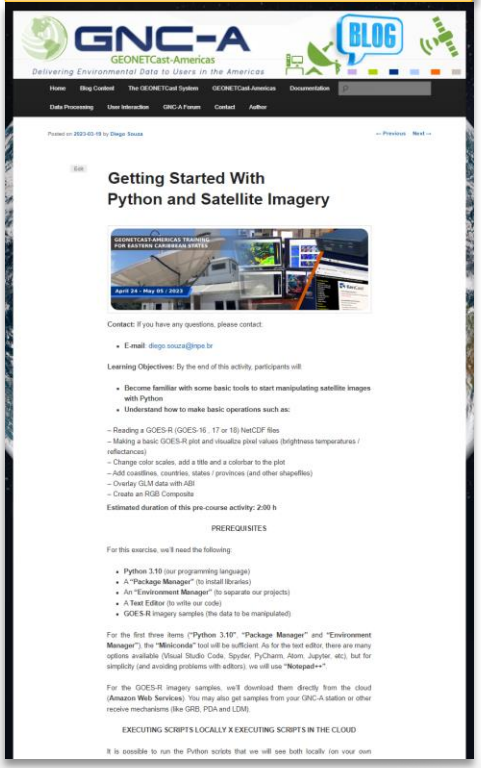
A variety of mechanisms available

Running Scripts Locally

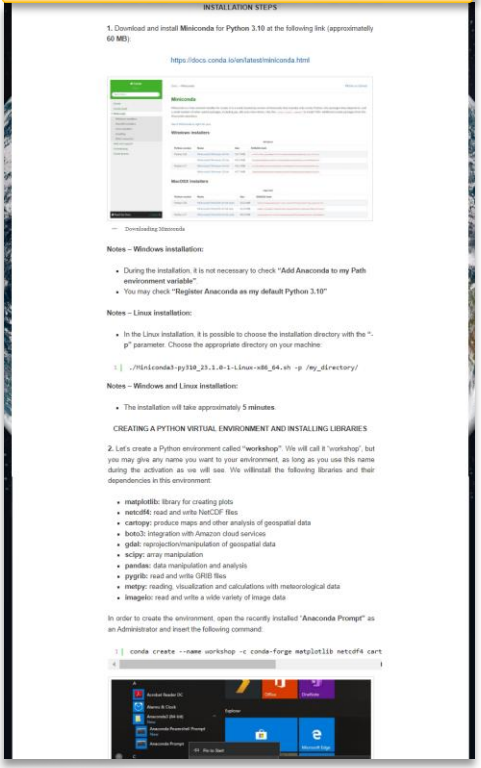
password: workshop

https://geonetcast.wordpress.com/2023/03/19/getting-started-with-python-and-satellite-imagery/

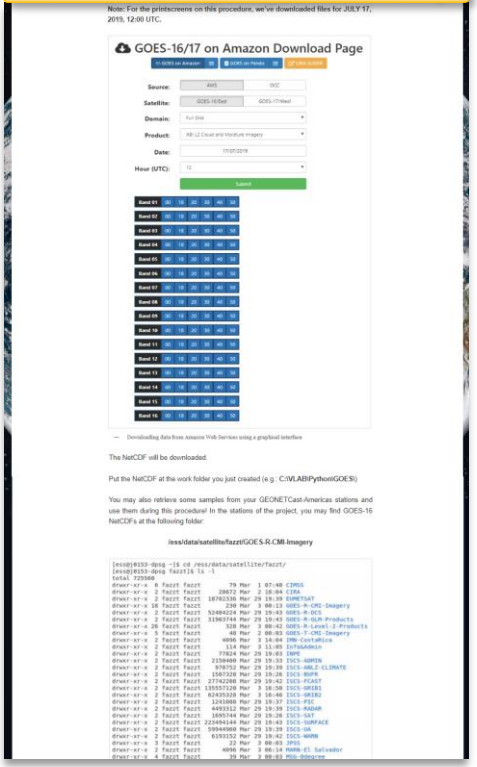
Objectives of the Activity



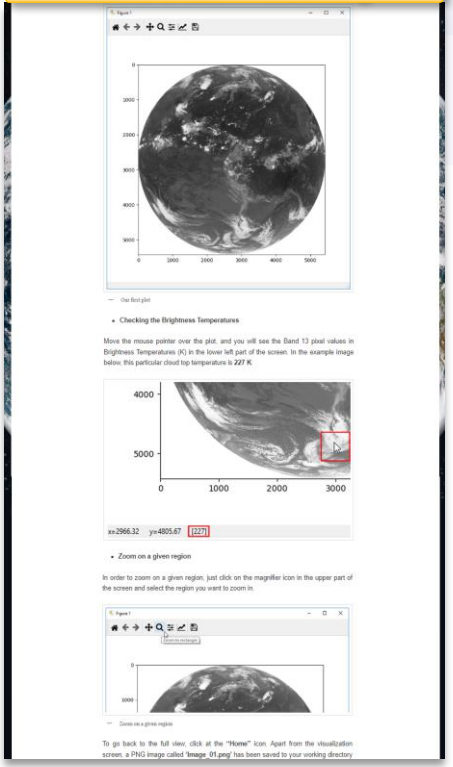
Installation of Tools



Access to Samples (GNC or Cloud)



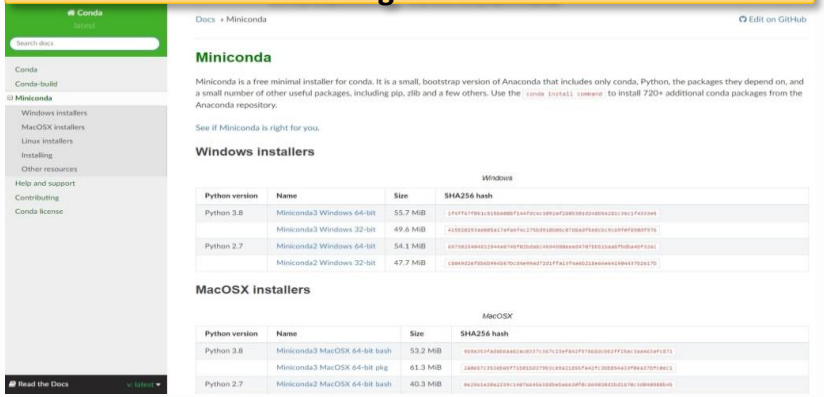
Local Data Processing



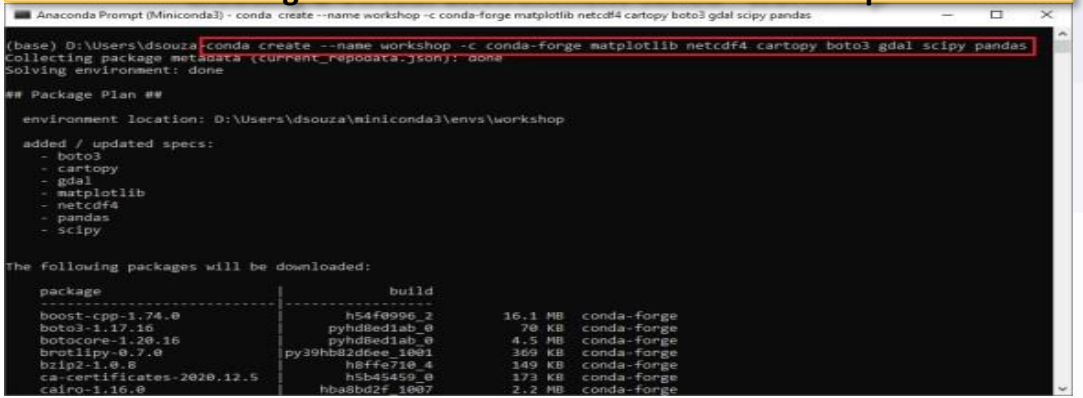
Running Scripts Locally: Summary

https://geonetcast.wordpress.com/2023/03/19/getting-started-with-python-and-satellite-imagery/

Installing Miniconda

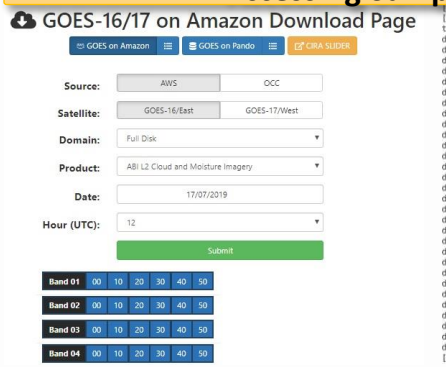


Creating a Virtual Environment called "workshop"

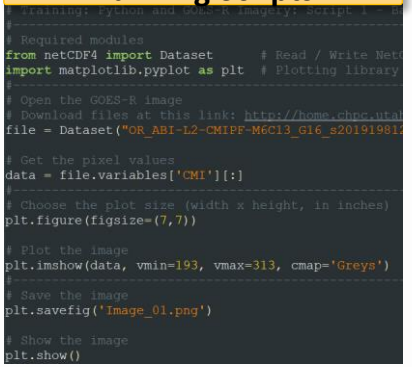


Installing a Text Editor

Accessing Sample Imagery



Running Scripts



Until Now, We Have Used Notepad++ (Locally)

C:\VLAB\Python\GOES\script_01.py - Notepad++

Arquivo Editar Localizar Visualizar Formatar Linguagem Configurações Ferramentas Macro Executar Plugins Janela ?

script_01.py

```
# Training: Python and GOES-R Imagery: Script 1 - Basic Plot / Extracting Pixel Values
#-------------------------------------------------------------------------------------------------------------------
# Required modules
from netCDF4 import Dataset       # Read / Write NetCDF4 files
import matplotlib.pyplot as plt   # Plotting library
#-------------------------------------------------------------------------------------------------------------------
# Open the GOES-R image
# Download files at this link: http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi-bin/goes16_download.cgi
file = Dataset("OR_ABI-L2-CMIPF-M6C13_G16_s20191981200396_e20191981210116_c20191981210189.nc")

# Get the pixel values
data = file.variables['CMI'][:]
#-------------------------------------------------------------------------------------------------------------------
# Choose the plot size (width x height, in inches)
plt.figure(figsize=(7,7))

# Plot the image
plt.imshow(data, vmin=193, vmax=313, cmap='Greys')
#-------------------------------------------------------------------------------------------------------------------
# Save the image
plt.savefig('Image_01.png')

# Show the image
plt.show()
```

Python file | length : 1,195 lines : 27 | Ln : 1 Col : 1 Pos : 1 | Windows (CR LF) | UTF-8 | INS

For simplicity and to avoid configuration issues not related to scripts, so far we have worked with Notepad++, a simple but nice option.

Until Now, We Have Used Notepad++ (Locally)

C:\VLAB\Python\GOES\script_01.py - Notepad++

Arquivo Editar Localizar Visualizar Formatar Linguagem Configurações Ferramentas Macro Executar Plugins Janela ?

script_01.py

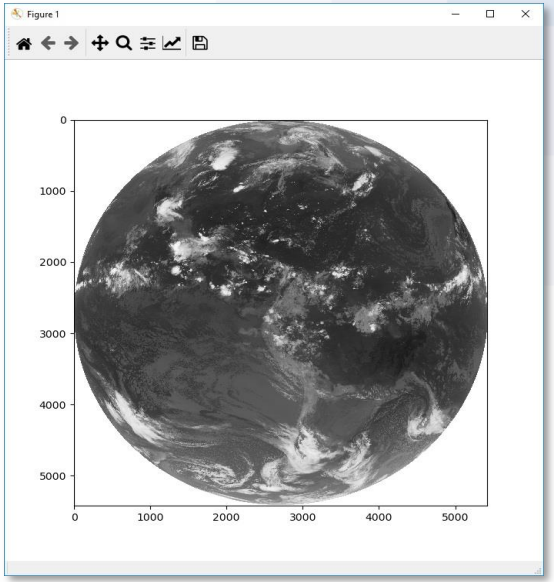
```
# Training: Python and GOES-R Imagery: Script 1 - Basic Plot / Extracting Pixel Values
#-----------------------------------------------------------------------------------------------------------
# Required modules
from netCDF4 import Dataset      # Read / Write NetCDF4 files
import matplotlib.pyplot as plt  # Plotting library
#-----------------------------------------------------------------------------------------------------------
# Open the GOES-R image
# Download files at this link: http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi-bin/goes16_download.cgi
file = Dataset("OR_ABI-L2-CMIPF-M6C13_G16_s20191981200396_e20191981210116_c20191981210189.nc")

# Get the pixel values
data = file.variables['CMI'][:]
#-----------------------------------------------------------------------------------------------------------
# Choose the plot size (width x height, in inches)
plt.figure(figsize=(7,7))

# Plot the image
plt.imshow(data, vmin=193, vmax=313, cmap='Greys')
#-----------------------------------------------------------------------------------------------------------
# Save the image
plt.savefig('Image_01.png')

# Show the image
plt.show()
```

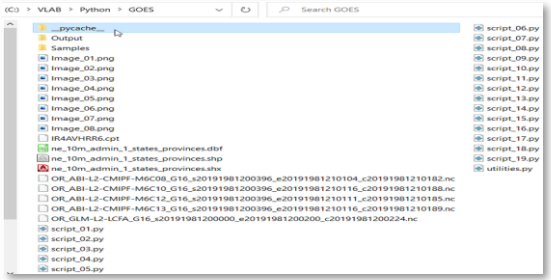
Python file

Anaconda Prompt (miniconda3)

```
(base) C:\Users\dsouza>conda activate workshop

(workshop) C:\Users\dsouza>cd c:\VLAB\Python\GOES

(workshop) c:\VLAB\Python\GOES>python script_01.py
```

Figure 1





Let's See How to Start Using an IDE: Visual Studio Code

IDE: Integrated Development Environment
Everything in a single interface!

File Edit Selection View Go Run Terminal Help — script_01.py - GOES - Visual Studio Code

EXPLORER

GOES
- Output
- Samples
- Image_01.png
- Image_02.png
- Image_03.png
- Image_04.png
- Image_05.png
- Image_06.png
- Image_07.png
- Image_08.png
- IR4AVHRR6.cpt
- ne_10m_admin_1_states_province...
- ne_10m_admin_1_states_province...
- ne_10m_admin_1_states_province...
- OR_ABI-L2-CMIPF-M6C08_G16_s2...
- OR_ABI-L2-CMIPF-M6C10_G16_s2...
- OR_ABI-L2-CMIPF-M6C12_G16_s2...
- OR_ABI-L2-CMIPF-M6C13_G16_s2...
- OR_GLM-L2-LCFA_G16_s20191981...
- script_01.py
- script_02.py
- script_03.py
- script_04.py
- script_05.py
- script_06.py
- script_07.py
- script_08.py
- script_09.py
- script_10.py
- script_11.py
- script_12.py
- script_13.py

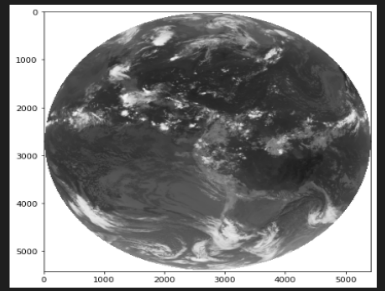
OUTLINE
TIMELINE

script_01.py

```python
# Training: Python and GOES-R
#-------------------------------------------------------------------------------
# Required modules
from netCDF4 import Dataset      # Read / Write NetCDF4 files
import matplotlib.pyplot as plt  # Plotting library
#-------------------------------------------------------------------------------
# Open the GOES-R image
# Download files at this link: http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi
file = Dataset("OR_ABI-L2-CMIPF-M6C13_G16_s20191981200396_e20191981210116_c2019198121

# Get the pixel values
data = file.variables['CMI'][:]
#-------------------------------------------------------------------------------
# Choose the plot size (width x height, in inches)
plt.figure(figsize=(7,7))

# Plot the image
plt.imshow(data, vmin=193, vmax=313, cmap='Greys')
#-------------------------------------------------------------------------------
# Save the image
plt.savefig('Image_01.png')

# Show the image
plt.show()
```

workshop (Python 3.11.0)

```
Type 'copyright', 'credits' or 'license' for more information
IPython 8.12.0 -- An enhanced Interactive Python. Type '?' for help.

✓ # Training: Python and GOES-R
```



Type 'python' code here and press Shift

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL JUPYTER — Python

```
C:\VLAB\Python\GOES>C:/SHOWCast_v_2_5_1/Miniconda3/Scripts/activate

(base) C:\VLAB\Python\GOES>conda activate C:\Users\dsouza\miniconda3\envs\workshop

(workshop) C:\VLAB\Python\GOES>cd c:/VLAB/Python/GOES

(workshop) C:\VLAB\Python\GOES>C:/Users/dsouza/miniconda3/envs/workshop/python.exe c:/VLAB/Python/GOES/script_01.py
```

⊗ 0 ⚠ 0 — Ln 7, Col 25 Spaces: 4 UTF-8 CRLF Python 3.11.0 (conda)

IDE: Everything in a Single Interface

File Edit Selection View Go Run Terminal Help — script_01.py - GOES - Visual Studio Code

EXPLORER

- Output
- Samples
- Image_01.png
- Image_02.png
- Image_03.png
- Image_04.png
- Image_05.png
- Image_06.png
- Image_07.png
- Image_08.png
- IR4AVHRR6.cpt
- ne_10m_admin_1_states_province...
- ne_10m_admin_1_states_province...
- ne_10m_admin_1_states_province...
- OR_ABI-L2-CMIPF-M6C08_G16_s2...
- OR_ABI-L2-CMIPF-M6C10_G16_s2...
- OR_ABI-L2-CMIPF-M6C12_G16_s2...
- OR_ABI-L2-CMIPF-M6C13_G16_s2...
- OR_GLM-L2-LCFA_G16_s20191981...
- script_01.py
- script_02.py
- script_03.py
- script_04.py
- script_05.py
- script_06.py
- script_07.py
- script_08.py
- script_09.py
- script_10.py
- script_11.py
- script_12.py
- script_13.py

OUTLINE

TIMELINE

SCRIPT

script_01.py

```python
# Training: Python and GOES-R Imagery: Script 1 - Basic Plot / Extracting Pixel Value
#--------------------------------------------------------------------------------
# Required modules
from netCDF4 import Dataset      # Read / Write NetCDF4 files
import matplotlib.pyplot as plt  # Plotting library
#--------------------------------------------------------------------------------
# Open the GOES-R image
# Download files at this link: http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi
file = Dataset("OR_ABI-L2-CMIPF-M6C13_G16_s20191981200396_e20191981210116_c2019198121

# Get the pixel values
data = file.variables['CMI'][:]
#--------------------------------------------------------------------------------
# Choose the plot size (width x height, in inches)
plt.figure(figsize=(7,7))

# Plot the image
plt.imshow(data, vmin=193, vmax=313, cmap='Greys')
#--------------------------------------------------------------------------------
# Save the image
plt.savefig('Image_01.png')

# Show the image
plt.show()
```

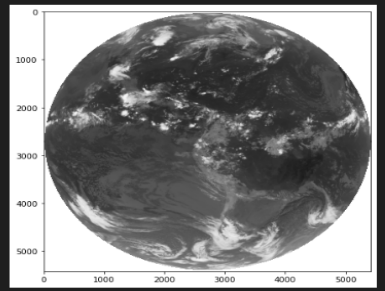
OUTPUT

Interactive

Clear All Restart workshop (Python 3.11.0)

Type 'copyright', 'credits' or 'license' for more information
IPython 8.12.0 -- An enhanced Interactive Python. Type '?' for help.

✓ # Training: Python and GOES-R



Type 'python' code here and press Shift

TERMINAL

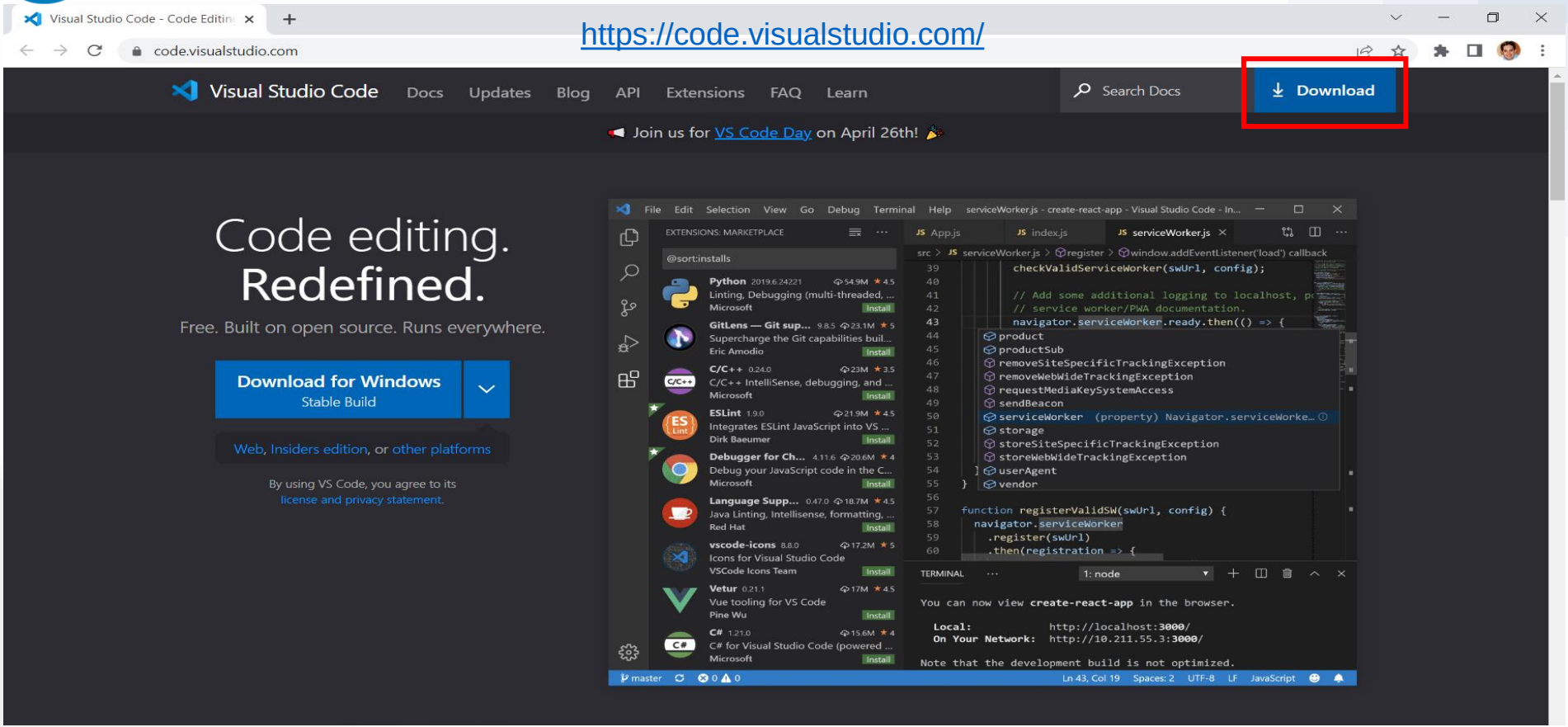
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL JUPYTER — Python

```
C:\VLAB\Python\GOES>C:/SHOWCast_v_2_5_1/Miniconda3/Scripts/activate

(base) C:\VLAB\Python\GOES>conda activate C:\Users\dsouza\miniconda3\envs\workshop

(workshop) C:\VLAB\Python\GOES>cd c:/VLAB/Python/GOES

(workshop) C:\VLAB\Python\GOES>C:/Users/dsouza/miniconda3/envs/workshop/python.exe c:/VLAB/Python/GOES/script_01.py
```

⊗ 0 ⚠ 0 — Ln 7, Col 25 Spaces: 4 UTF-8 CRLF Python 3.11.0 (conda)

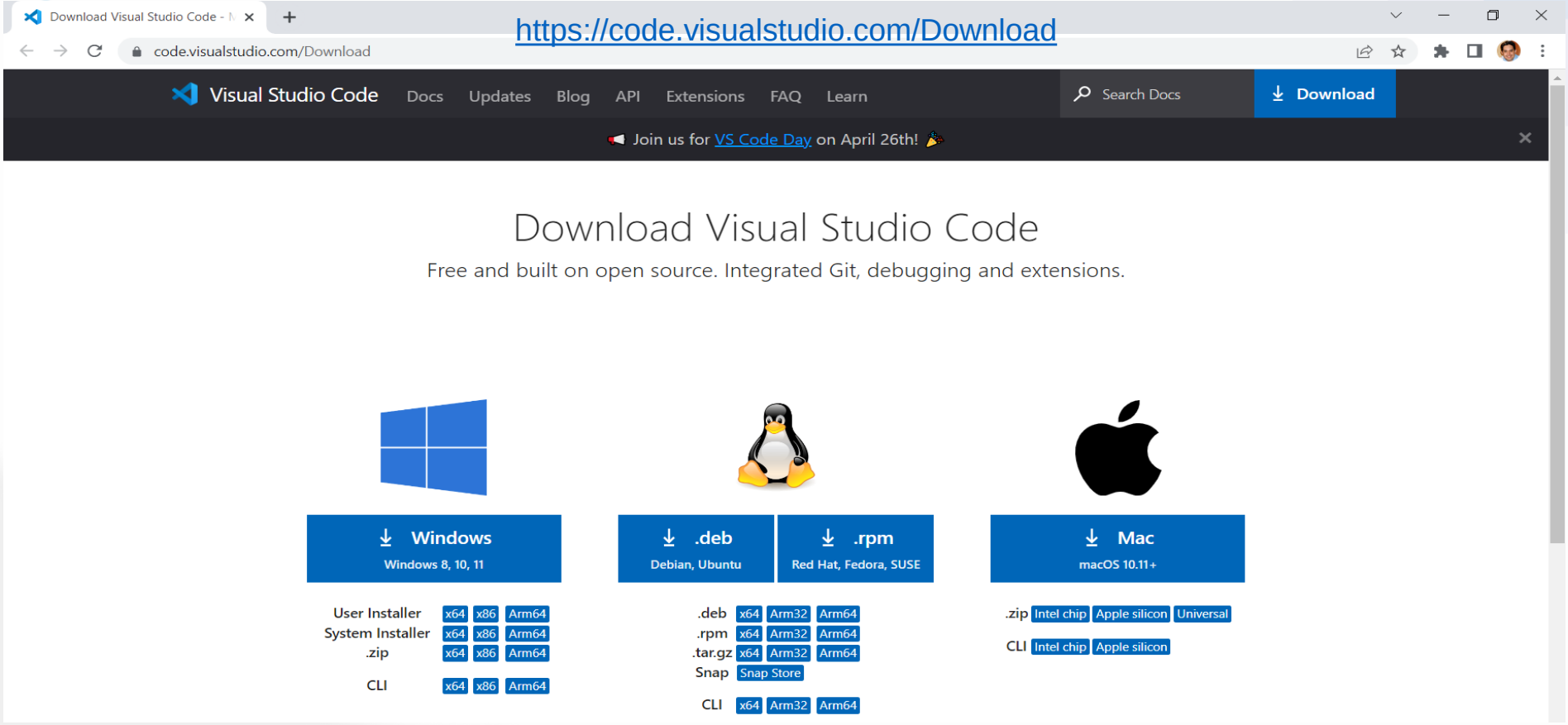
1. Download and Install Visual Studio Code (VSCode)

https://code.visualstudio.com/

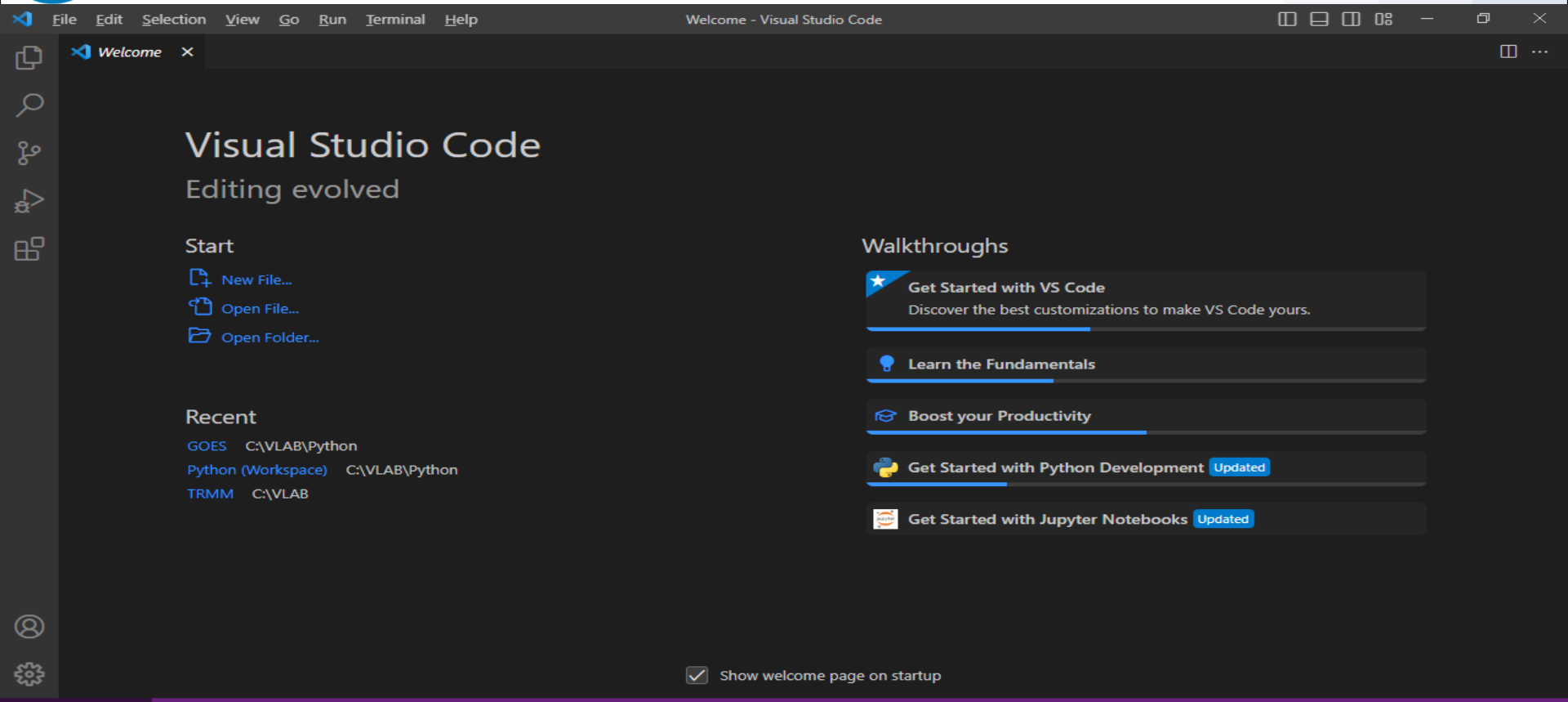


1. Download and Install Visual Studio Code (VSCode)

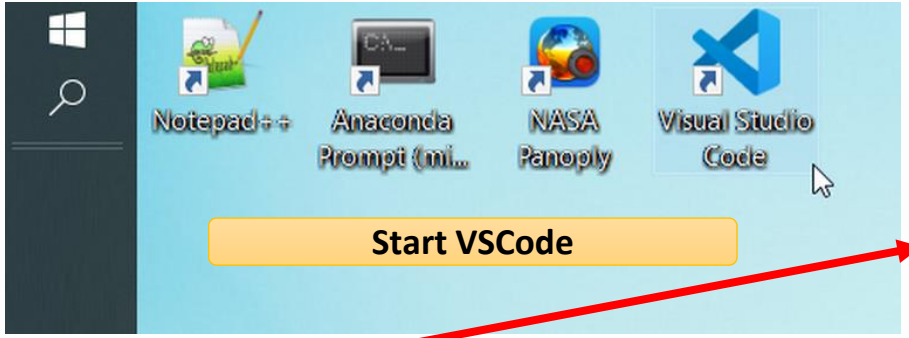
https://code.visualstudio.com/Download



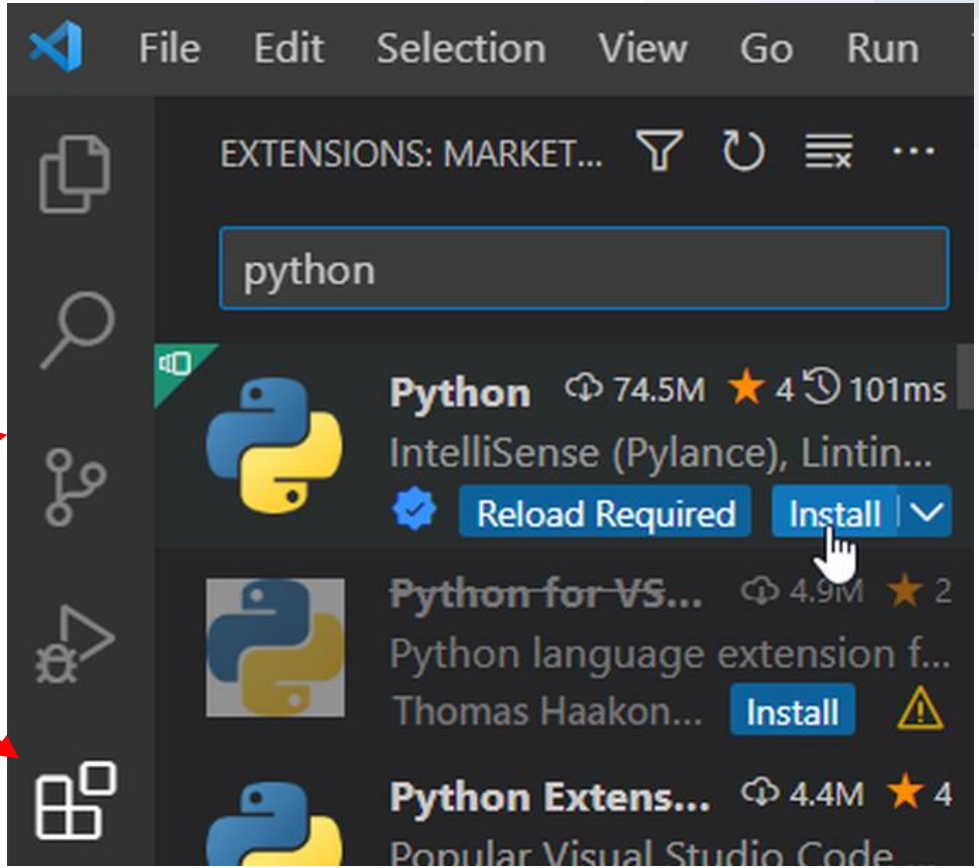
When Opening for the First Time, This is What You See



2. Install the Python Extension for VSCode



In the **left toolbar**, select **"Extensions"**, search for **"Python"** and click **"Install"**



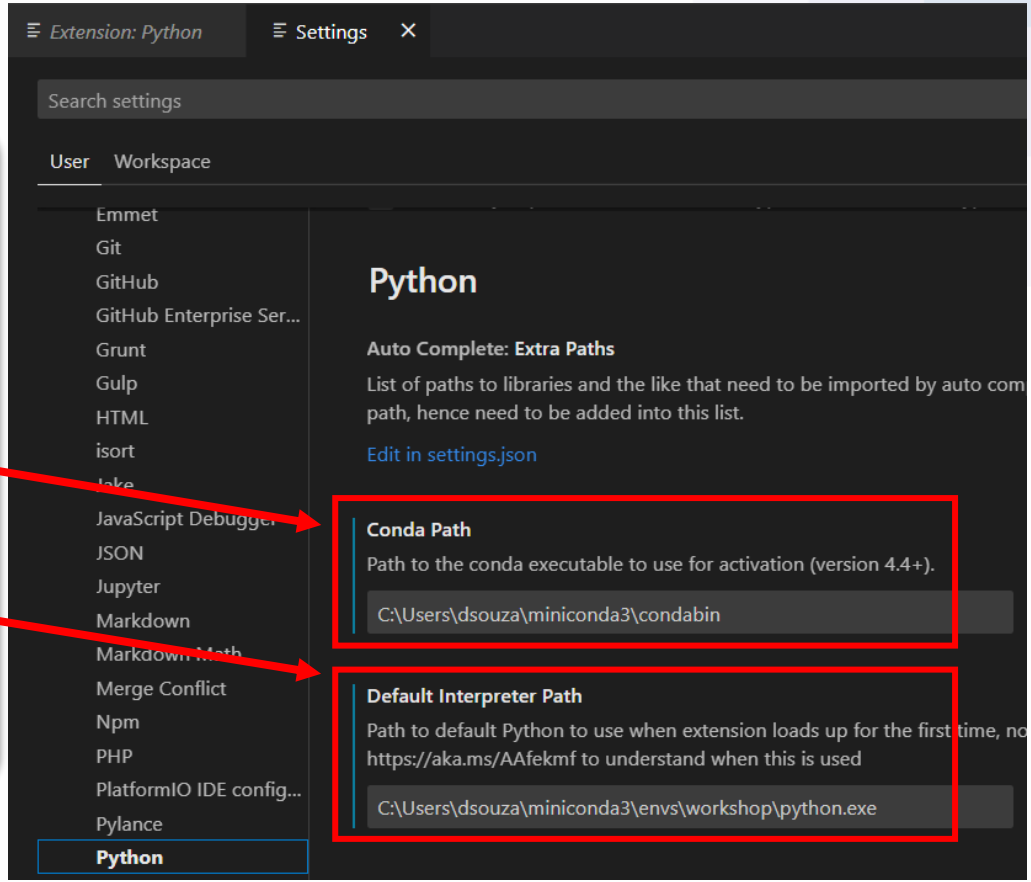
3. Insert the Conda Path and Default Interpreter Path

3.a. Go to:
“File” > “Preferences” > “Settings” > “Extensions” > “Python”

3.b. In **“CondaPath”** insert the path to the conda executable, in my case:
C:\Users\dsouza\miniconda3\condabin

3.c. In **“Default Interpreter Path”**, insert the default Python to use, in my case:
C:\Users\dsouza\miniconda3\envs\workshop\python.exe

Now we are ready to create our Python script that will be executed with our conda env.



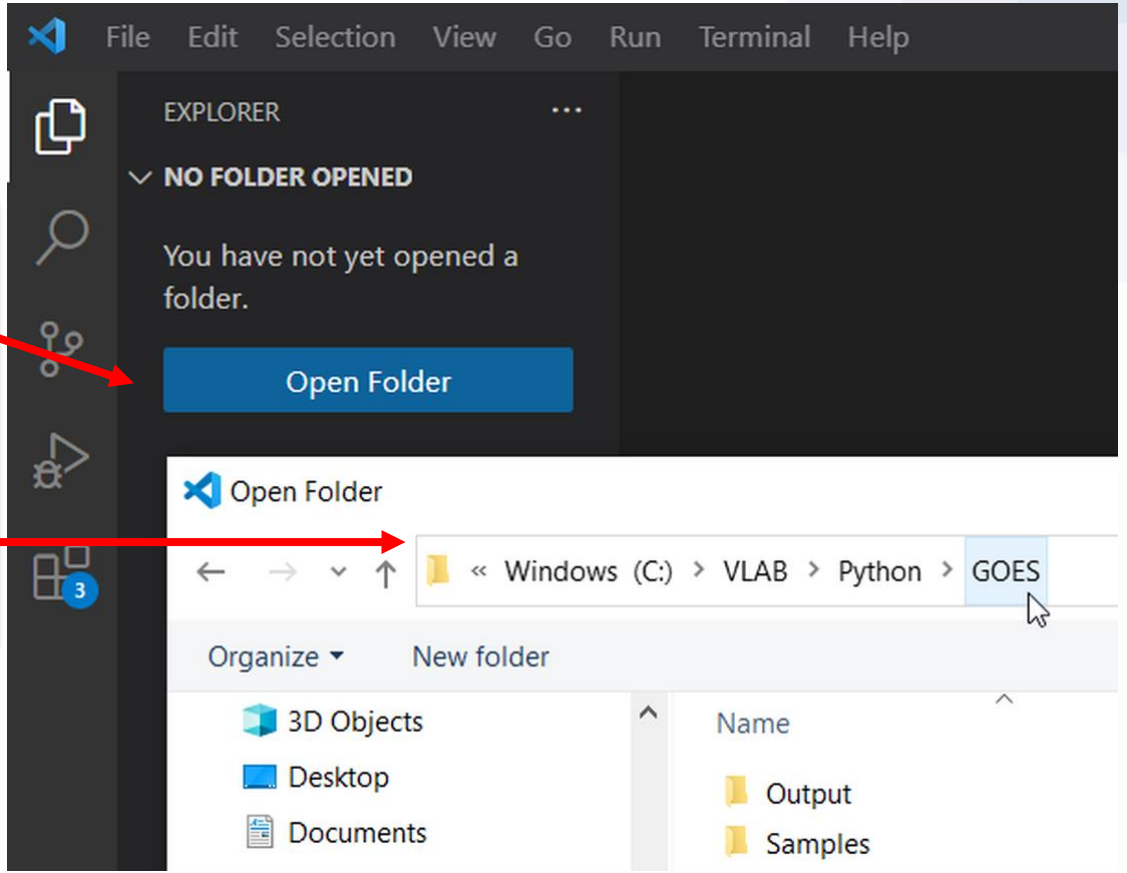
4. Select Your Working Folder

In the left toolbar, select **“Explorer”** (first icon), click at **“Open Folder”**

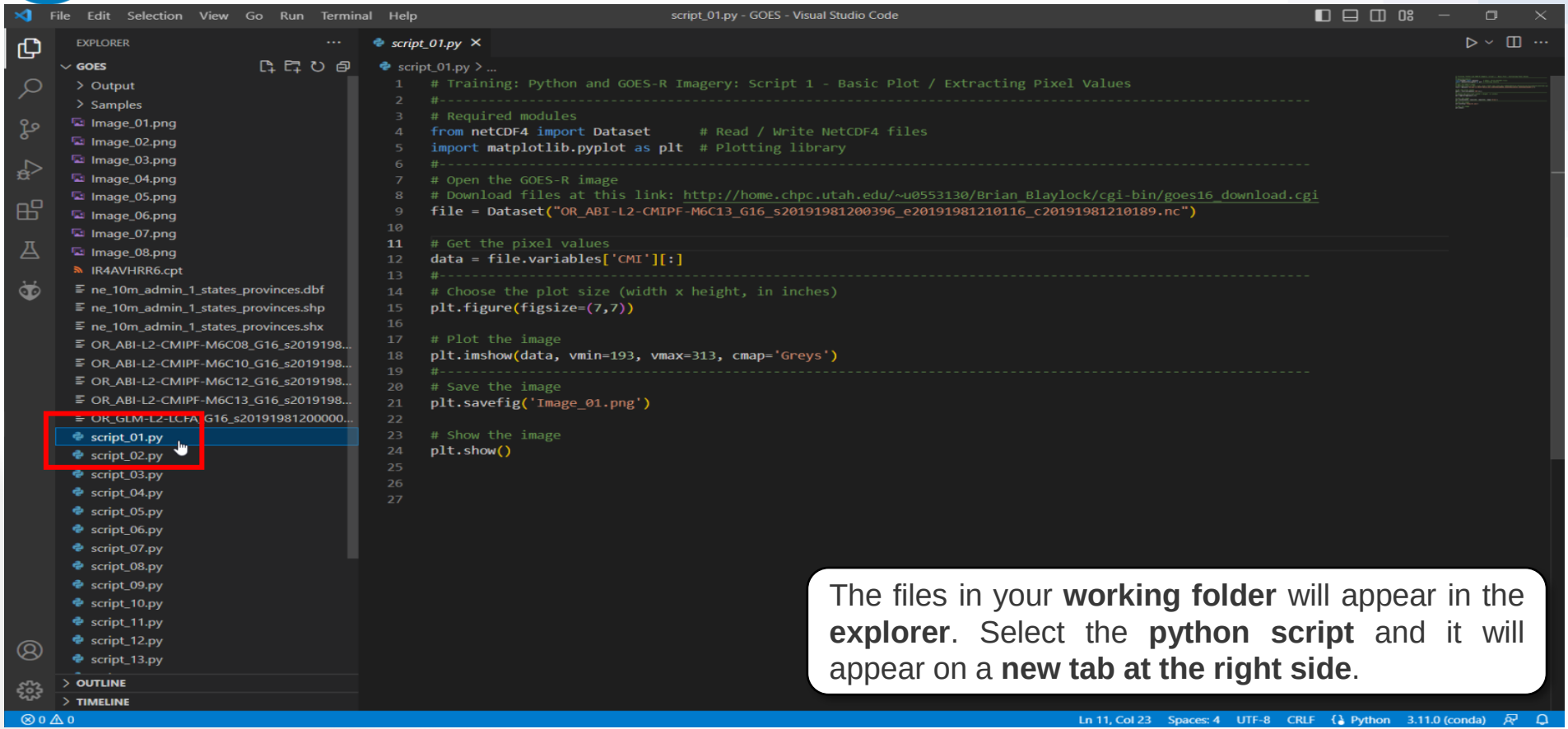
and **select the folder where you have your scripts / files**:

In this example, we’ll select: C:\VLAB\Python\GOES

But it may be **any folder you want**.



5. Open Your Script



The files in your **working folder** will appear in the **explorer**. Select the **python script** and it will appear on a **new tab at the right side**.

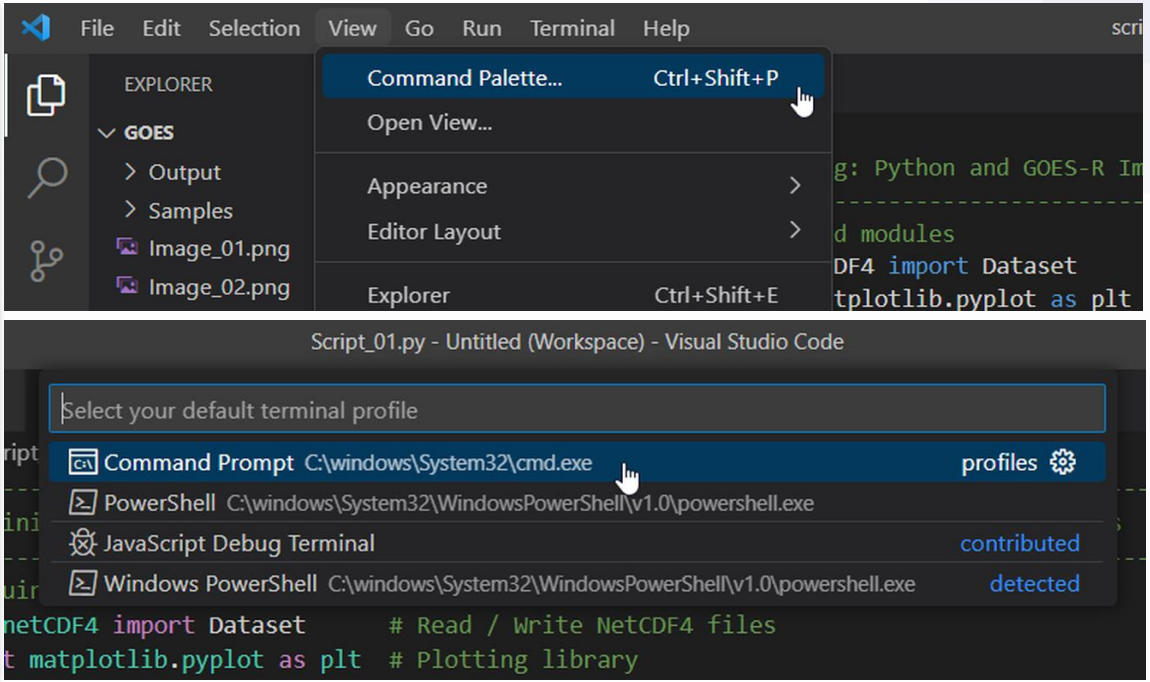
6. Changing the Default Terminal

If we want to execute conda commands (to list the installed libraries for example) directly in the terminal available in Visual Studio Code, we need to change the default terminal to the Windows **Command Prompt** (reference):

1. Open the command palette:
View > "Command Palette…"
(or **Control+Shift+P**)

2. Search for
"Terminal: Select Default Profile"

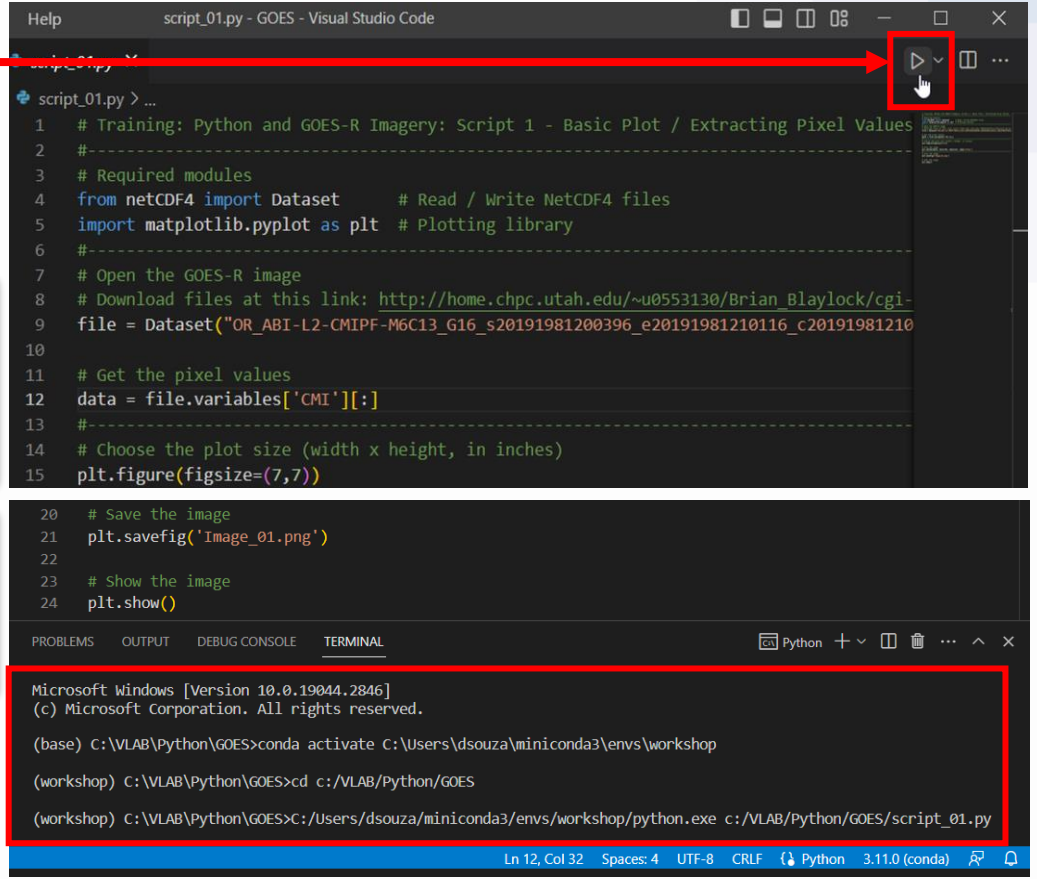
3. Select the desired default terminal (**"Command Prompt"** in my case).



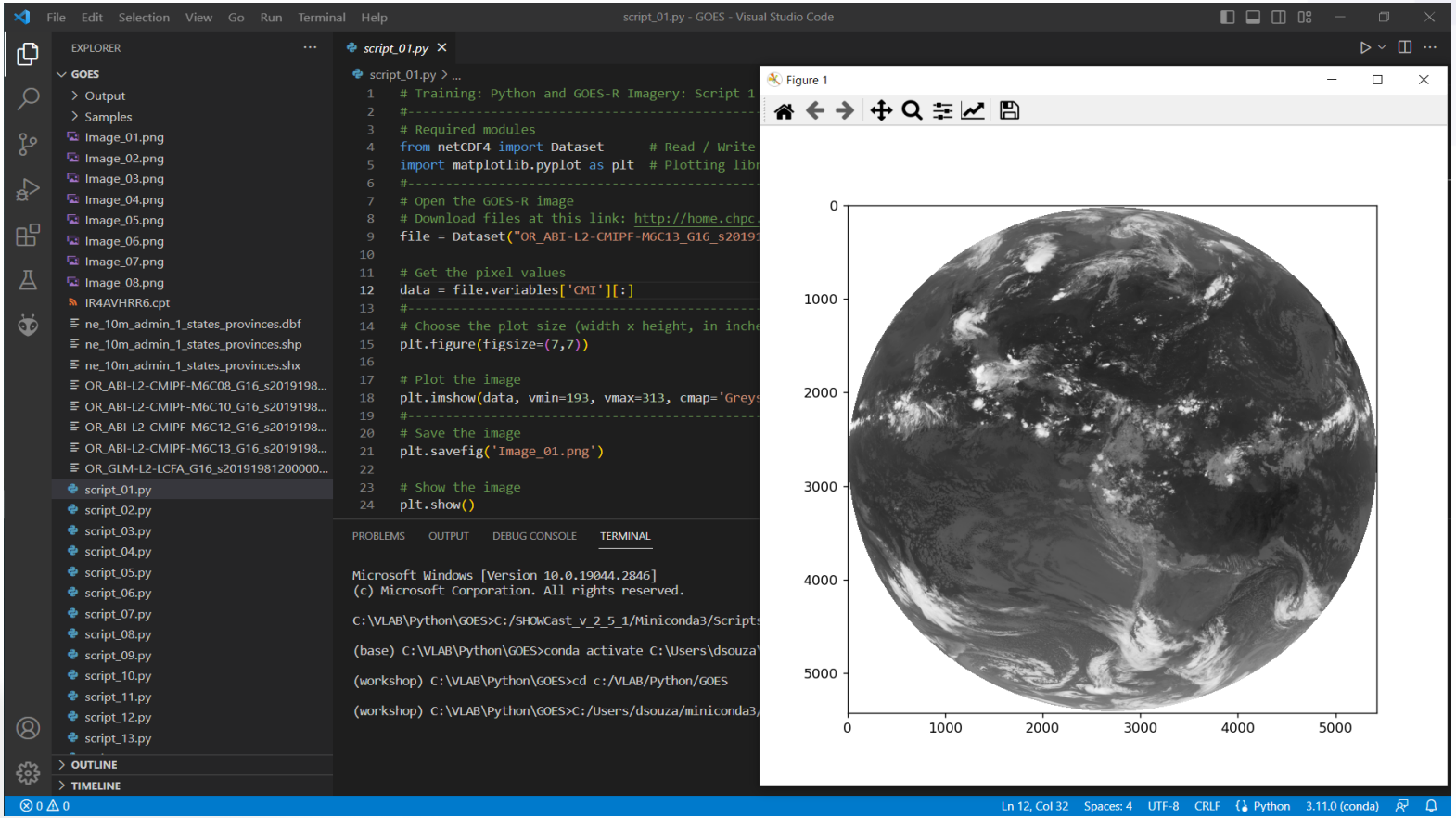
7. Running Scripts With the Conda Environment

After all these steps, if you click **“Run Python File”** (play button) in the upper right, the selected python script will be executed with the default conda env selected in Step 5.

You will see your default conda environment (**“workshop”** in this case) being activated and the python script being executed automatically in the terminal.



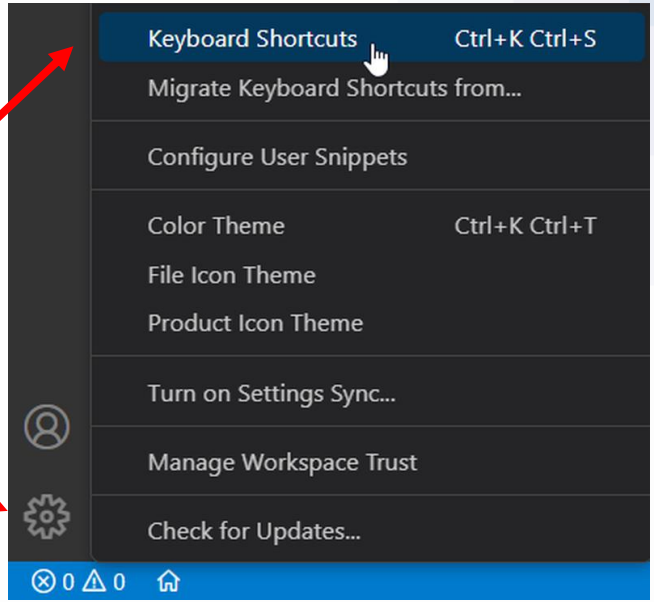
8. The Plot Will Appear

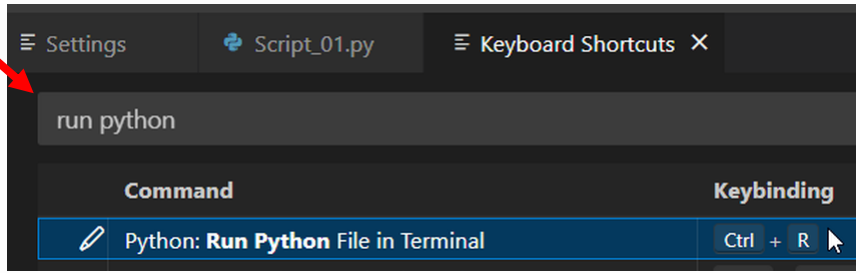


9. Extra: Using a Keyboard Shortcut to Run Python Scripts

By default, you need to click on the “Run Python File” (Play button) in the upper right corner, as seen on the previous step. If you want to use a shortcut, click on the **gear icon** in the lower left and select **“Keyboard shortcuts”** (reference).

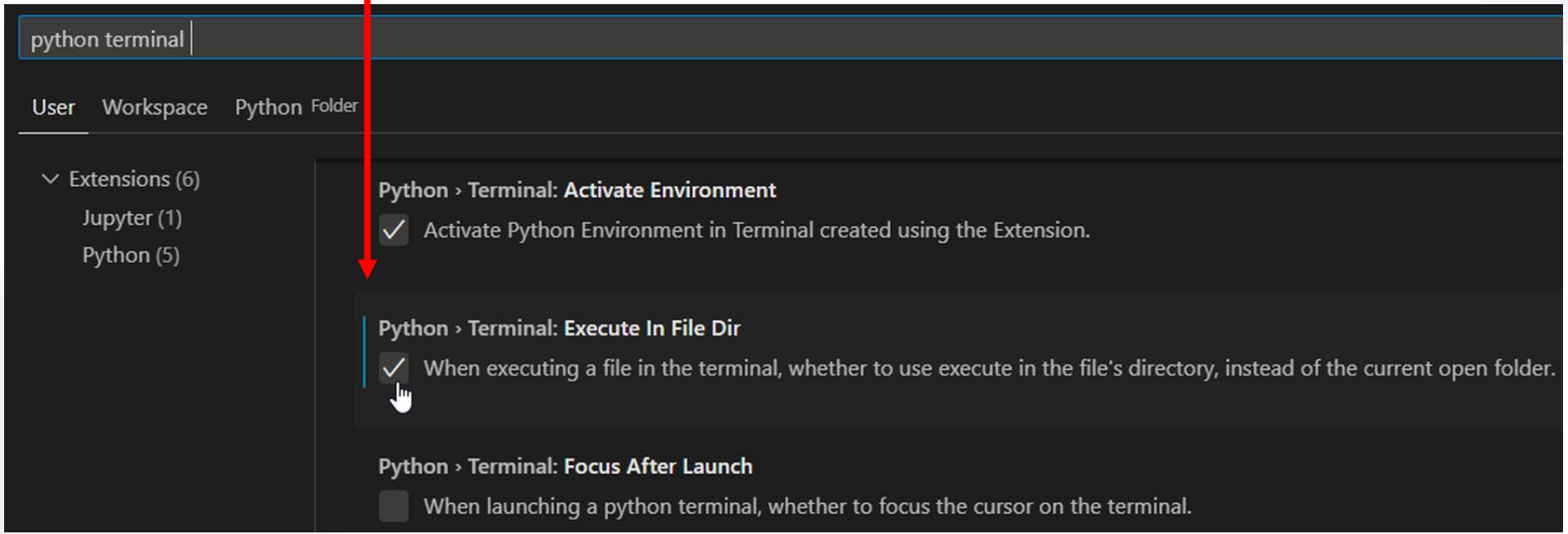
Search for **“run python in terminal”**, select **“Python: Run Python File in Terminal”** and assign the desired shortcut (**“Ctrl+R”**, in this example).





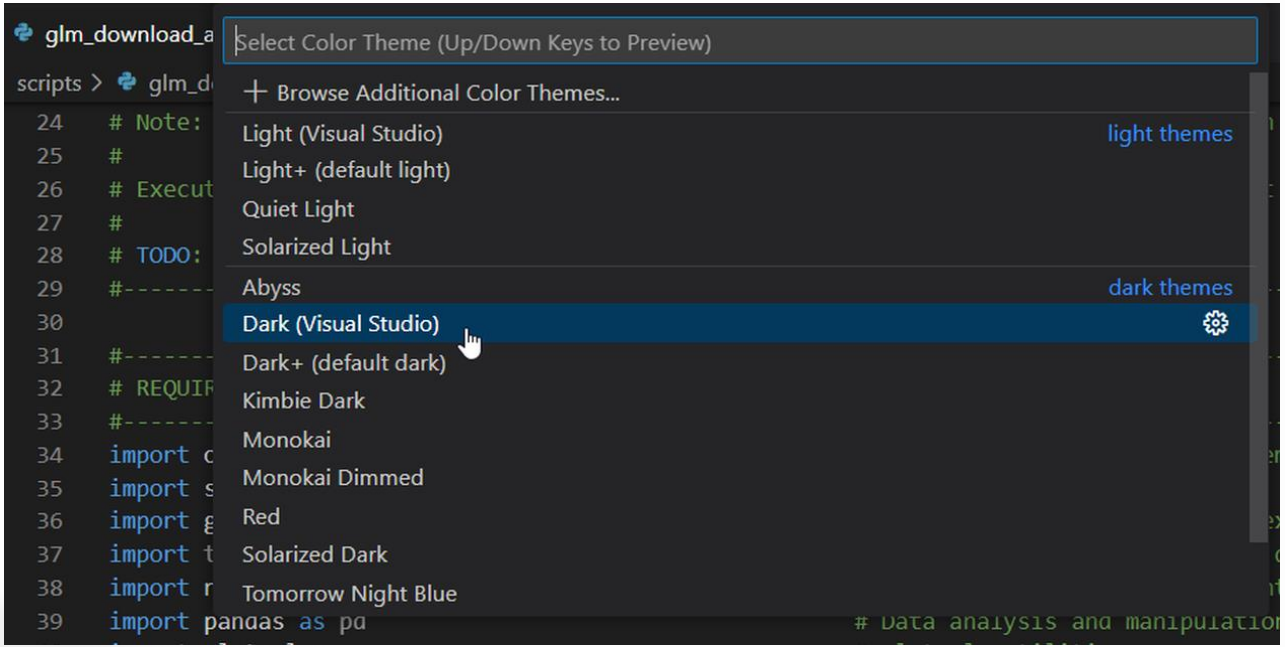
10. Extra: Reading Files in the Same Work Folder

By default you need to specify the full path where a given file is. If you want to put the file in the same folder and **just insert the file name in the code**, access the **User Settings (Gear icon > Settings)**, search for **“python terminal execute in file dir”** and check this option (reference).



11. Extra: Changing the Editor Color Scheme

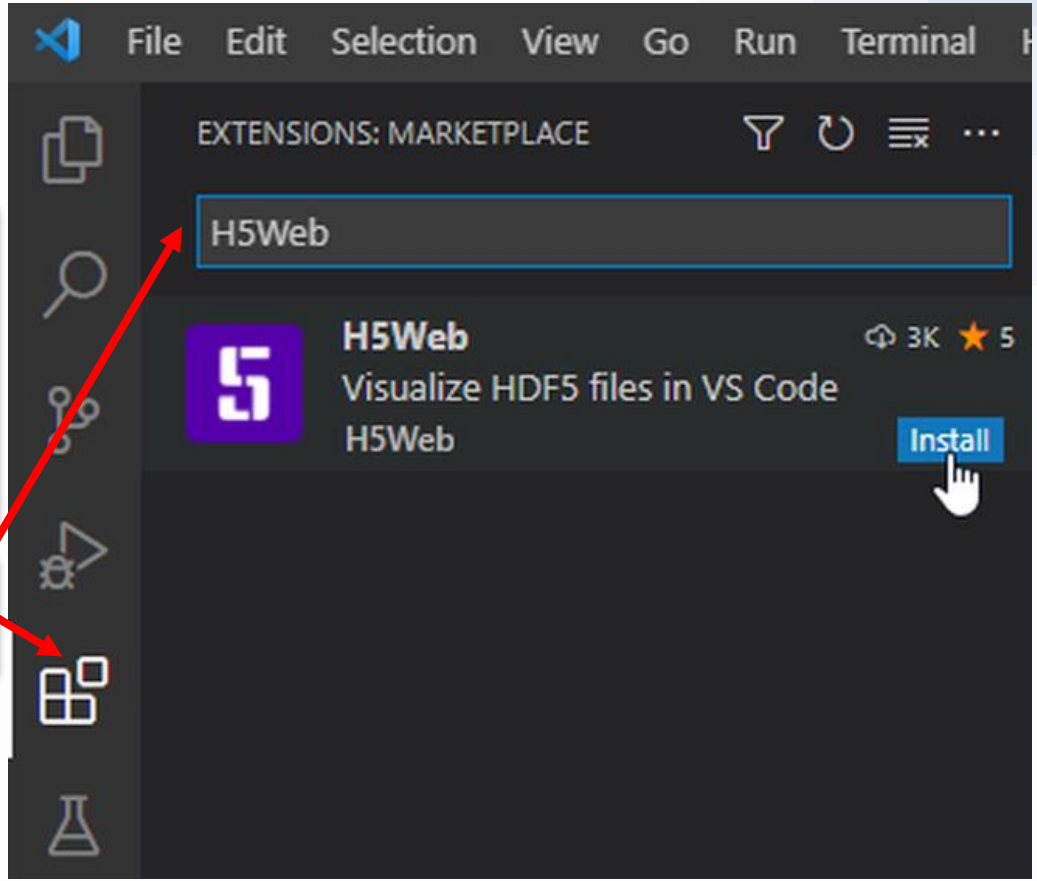
Personally, I don't like the default color scheme of the editor, called the **"Dark+ (default dark)"**.
If you want to change the color scheme, go to
File > **Preferences** > **Theme** > **Color Theme** and select your preferred theme.



12. Extra: Installing Extensions

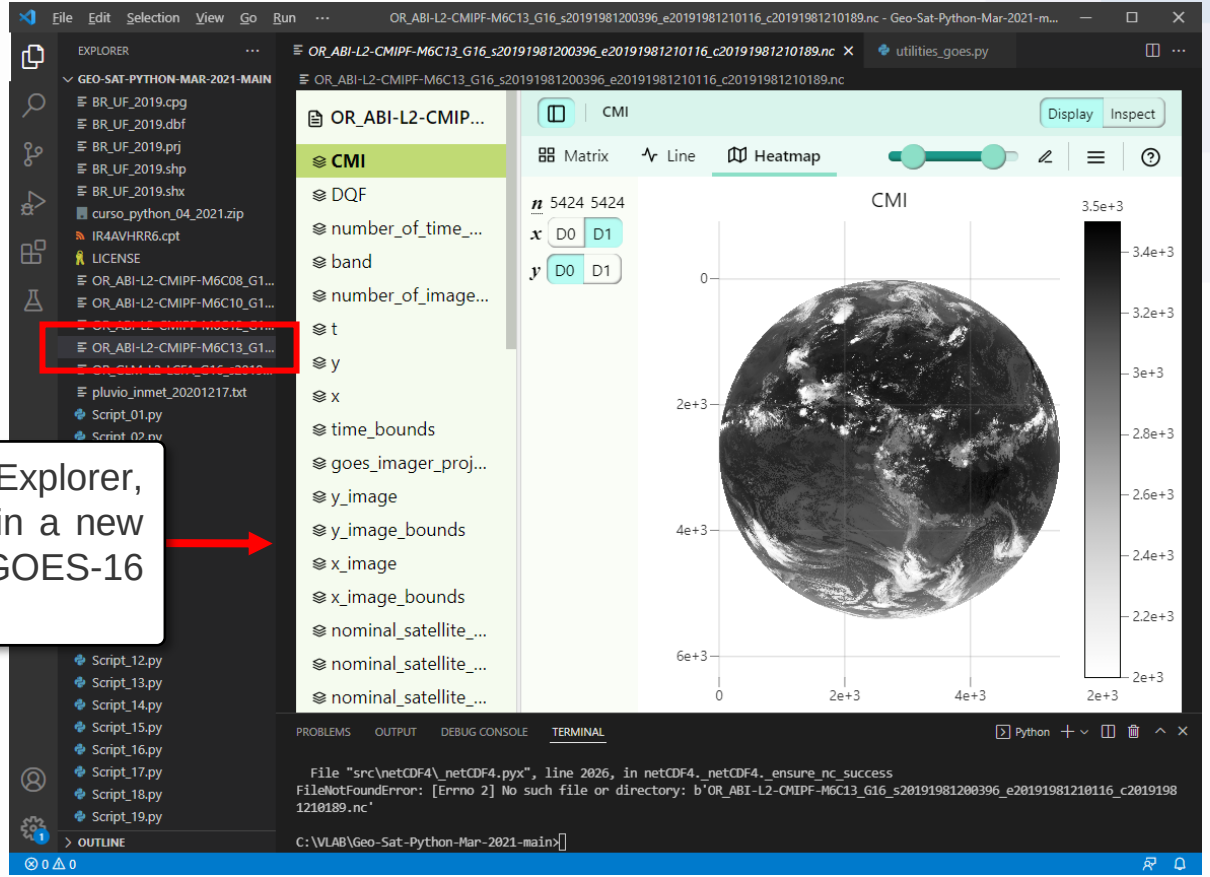
The H5Web extension for **VSCode** allows you to explore and visualize **HDF5 / NetCDF** files **directly in the IDE**, which is a great feature to have during the development of new scripts. It really makes things faster, as you don't need to use a separate tool like NASA's Panoply for example.

To install it, access the **"Extensions"** in the VSCode left toolbar and search for **"H5Web"**.



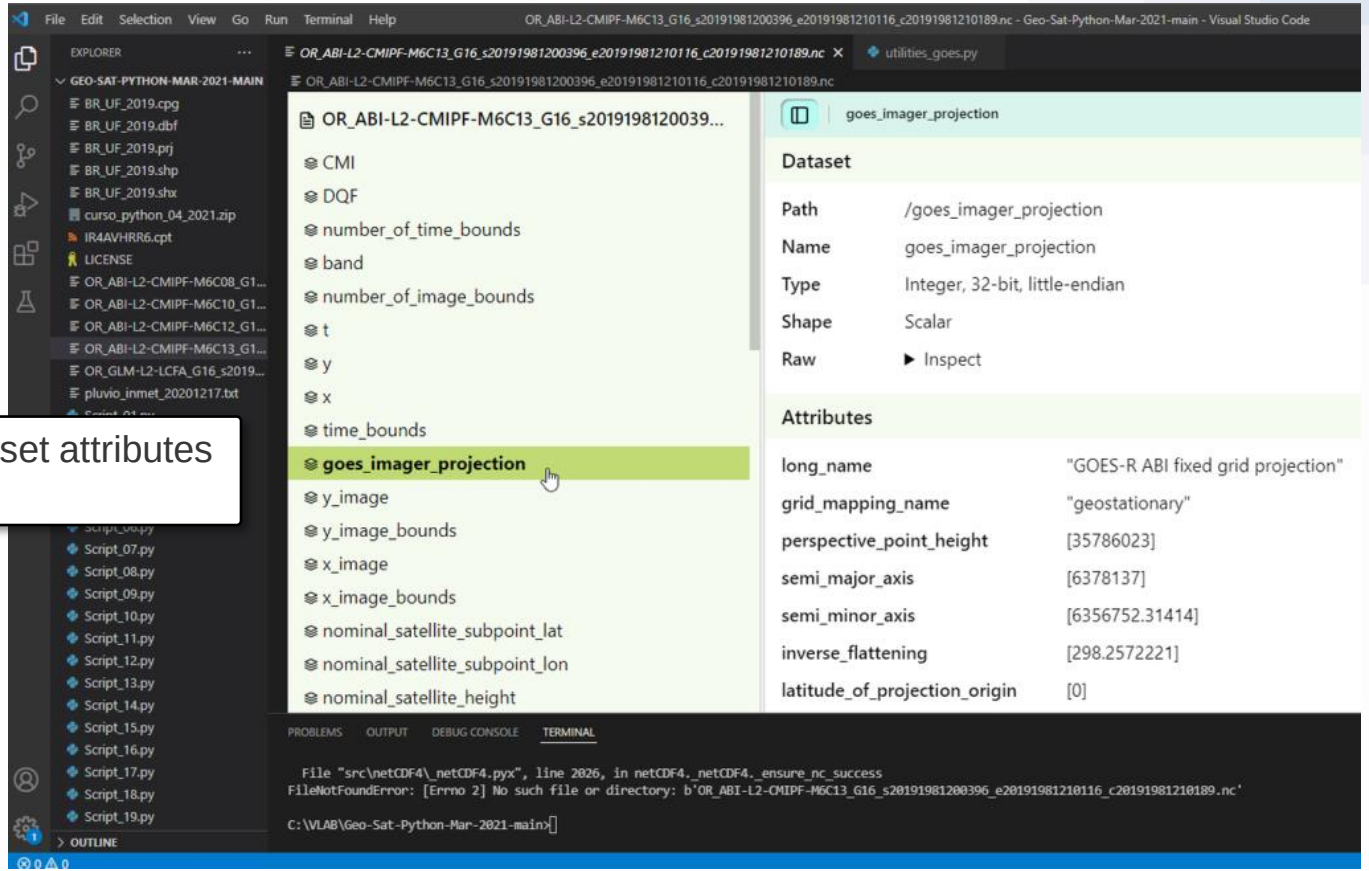
12. Extra: Installing Extensions

After the installation, in the VSCode Explorer, click on a file and it will be visualized in a new tab. In this example, I'm displaying a GOES-16 NetCDF (CMI dataset).

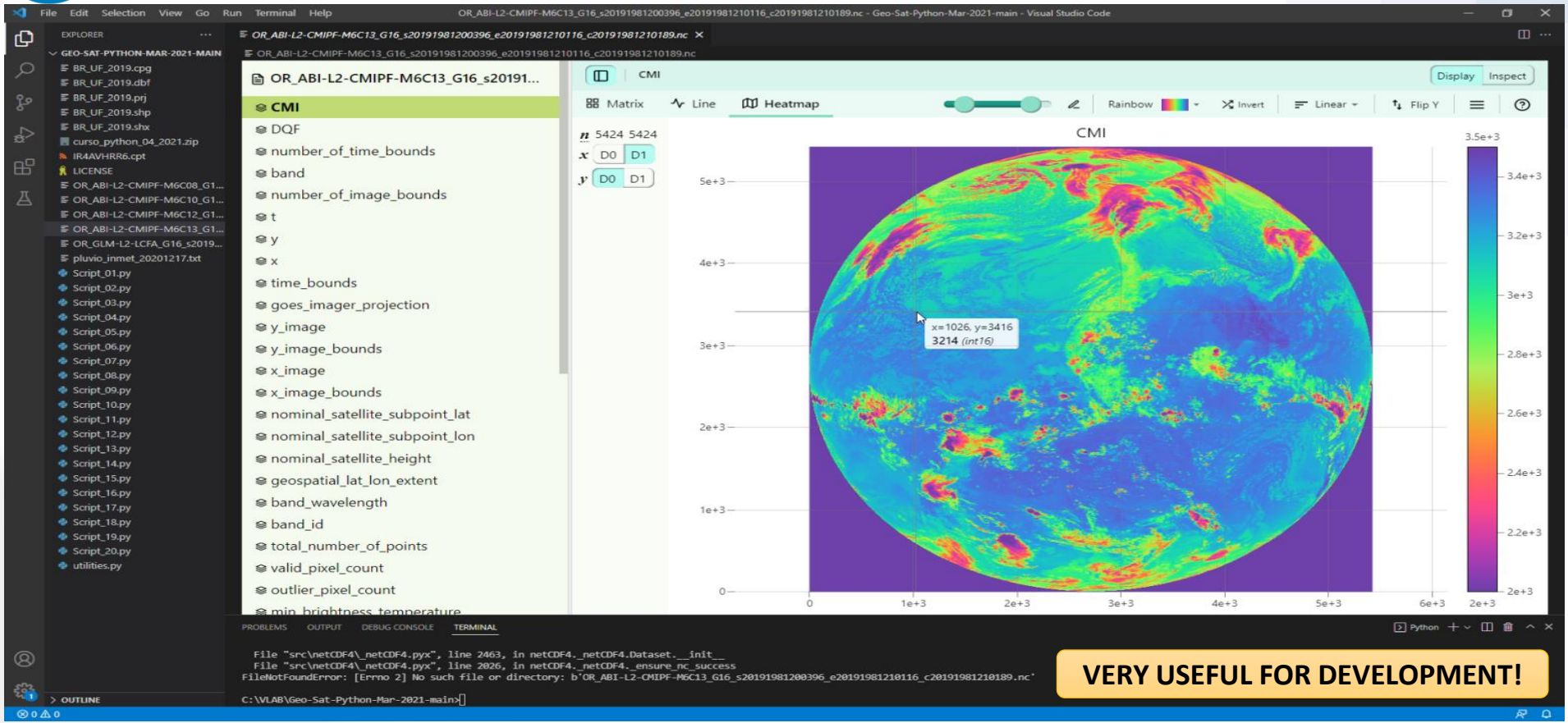


12. Extra: Installing Extensions

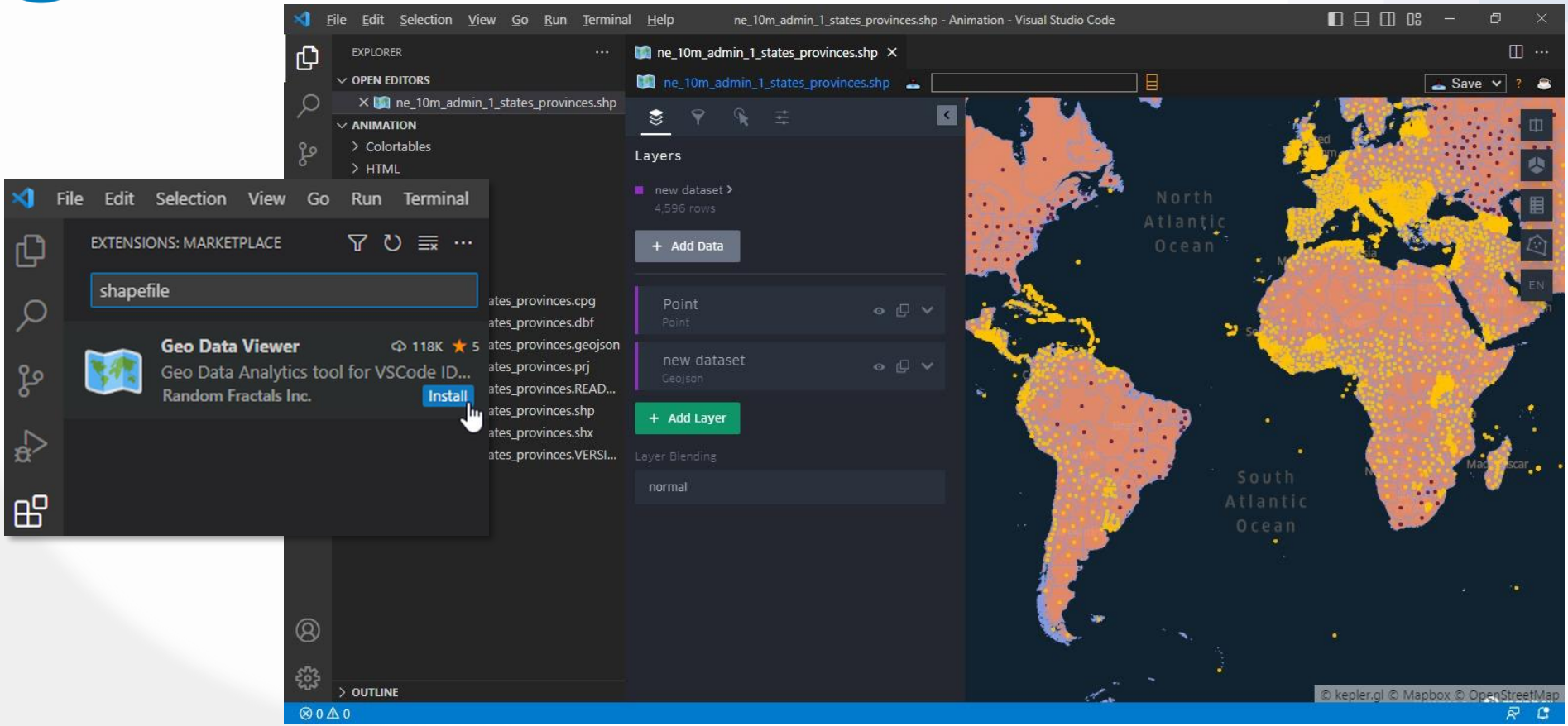
You can also inspect the dataset attributes instead of displaying it.



12. Extra: Installing Extensions

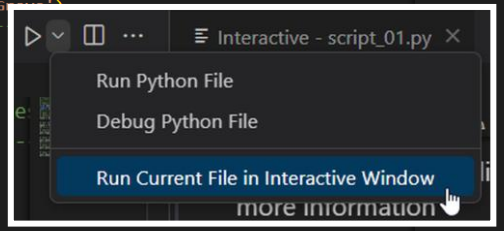


12. Extra: Installing Extensions



13. Extra: Running Script in Interactive Window

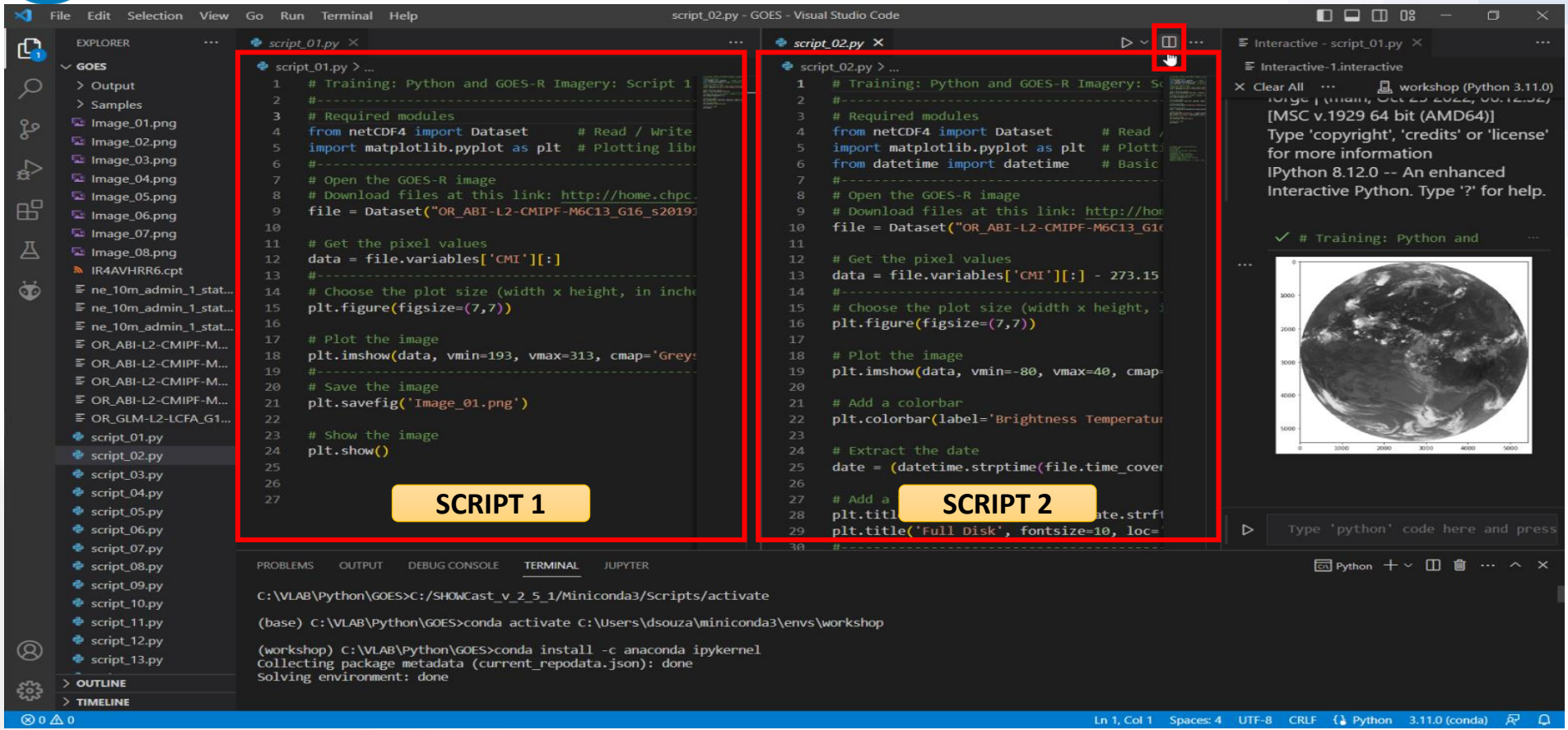
```
# Training: Python and GOES-R Imagery: Script 1 - Basic Plot / Extracting Pixel Value
#-----------------------------------------------------------------------------------
# Required modules
from netCDF4 import Dataset      # Read / Write NetCDF4 files
import matplotlib.pyplot as plt  # Plotting library
#-----------------------------------------------------------------------------------
# Open the GOES-R image
# Download files at this link: http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi
file = Dataset("OR_ABI-L2-CMIPF-M6C13_G16_s20191981200396_e20191981210116_c2019198121

# Get the pixel values
data = file.variables['CMI'][:]
#-----------------------------------------------------------------------------------
# Choose the plot size (width x height, in inches)
plt.figure(figsize=(7,7))

# Plot the image
plt.imshow(data, vmin=193, vmax=313, cmap='G
#-----------------------------------------------------------------------------------
# Save the image
plt.savefig('Image_01.png')

# Show the image
plt.show()
```



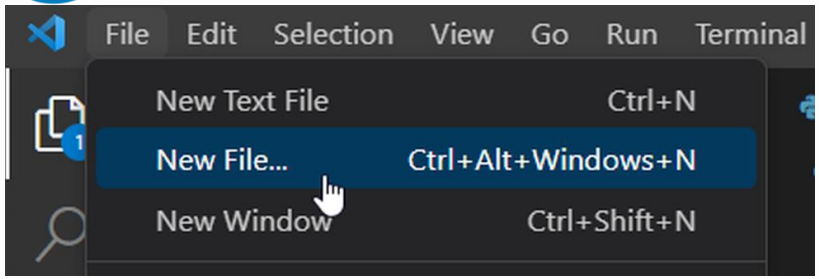

```
C:\VLAB\Python\GOES>C:/SHOWCast_v_2_5_1/Miniconda3/Scripts/activate

(base) C:\VLAB\Python\GOES>conda activate C:\Users\dsouza\miniconda3\envs\workshop

(workshop) C:\VLAB\Python\GOES>cd c:/VLAB/Python/GOES

(workshop) C:\VLAB\Python\GOES>C:/Users/dsouza/miniconda3/envs/workshop/python.exe c:/VLAB/Python/GOES/script_01.py
```

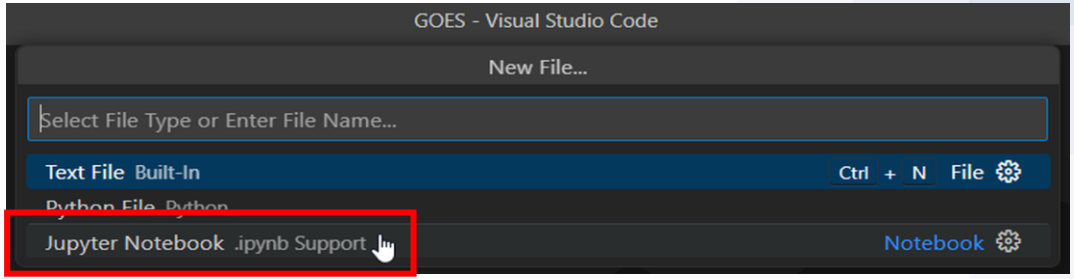
Note: necessary to install ipykernel
conda install -c anaconda ipykernel

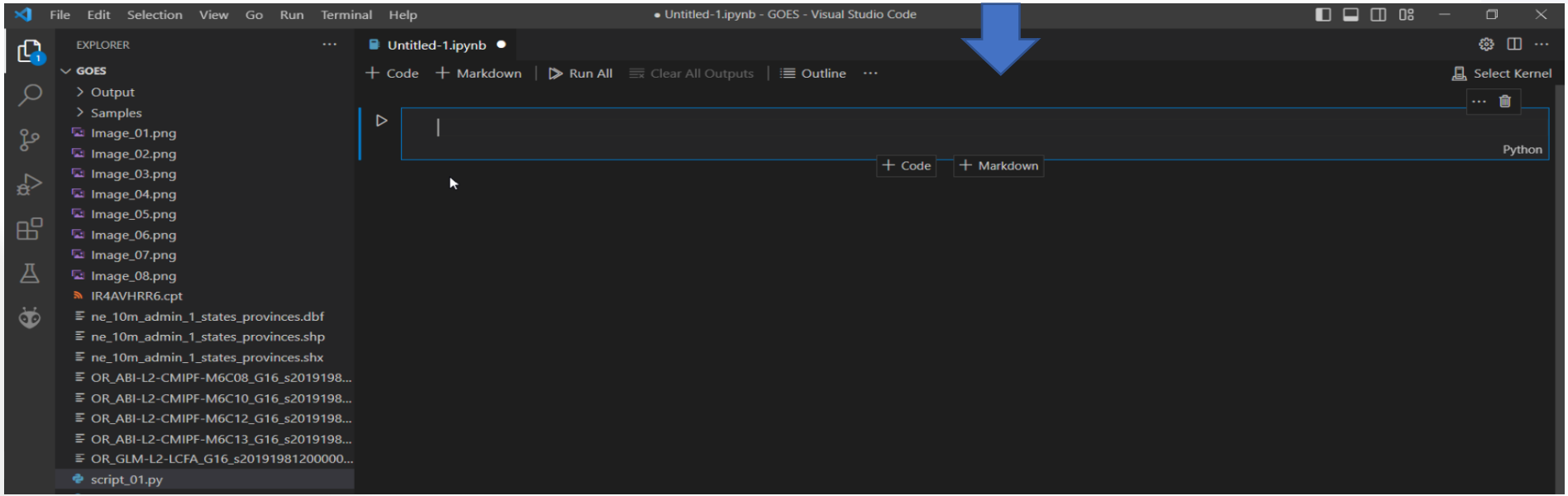
14. Extra: Split Editor



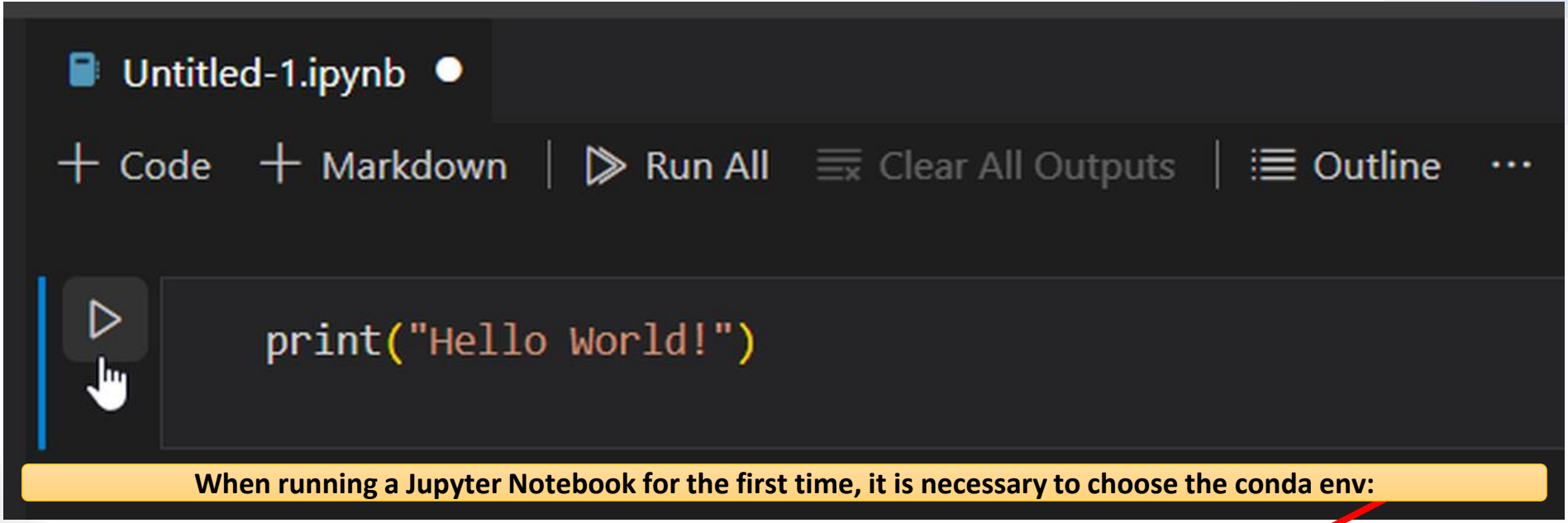
Creating a Jupyter Notebook



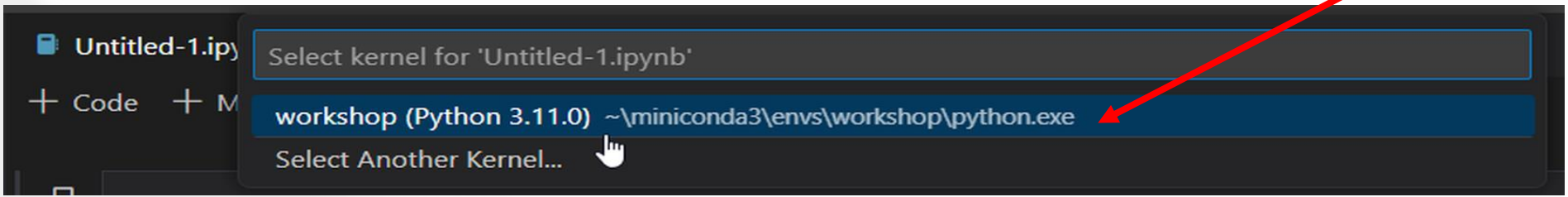




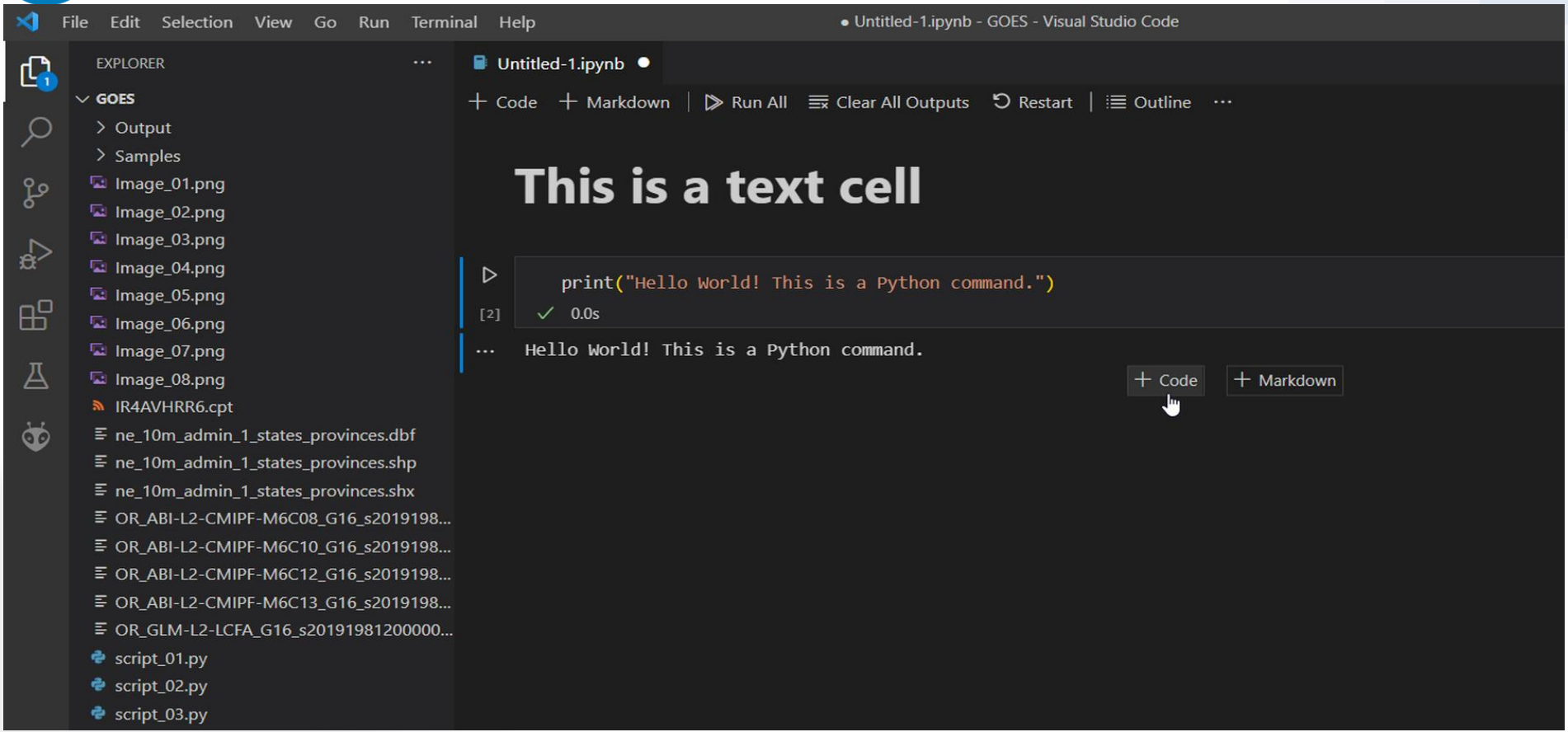
Creating a Jupyter Notebook



When running a Jupyter Notebook for the first time, it is necessary to choose the conda env:



Creating a Jupyter Notebook



IDE: Everything in a Single Interface

File Edit Selection View Go Run Terminal Help — script_01.py - GOES - Visual Studio Code

EXPLORER

- Output
- Samples
- Image_01.png
- Image_02.png
- Image_03.png
- Image_04.png
- Image_05.png
- Image_06.png
- Image_07.png
- Image_08.png
- IR4AVHRR6.cpt
- ne_10m_admin_1_states_province...
- ne_10m_admin_1_states_province...
- ne_10m_admin_1_states_province...
- OR_ABI-L2-CMIPF-M6C08_G16_s2...
- OR_ABI-L2-CMIPF-M6C10_G16_s2...
- OR_ABI-L2-CMIPF-M6C12_G16_s2...
- OR_ABI-L2-CMIPF-M6C13_G16_s2...
- OR_GLM-L2-LCFA_G16_s20191981...
- script_01.py
- script_02.py
- script_03.py
- script_04.py
- script_05.py
- script_06.py
- script_07.py
- script_08.py
- script_09.py
- script_10.py
- script_11.py
- script_12.py
- script_13.py

OUTLINE

TIMELINE

SCRIPT

script_01.py

```python
# Training: Python and GOES-R Imagery: Script 1 - Basic Plot / Extracting Pixel Value
#--------------------------------------------------------------------------------
# Required modules
from netCDF4 import Dataset      # Read / Write NetCDF4 files
import matplotlib.pyplot as plt  # Plotting library
#--------------------------------------------------------------------------------
# Open the GOES-R image
# Download files at this link: http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi
file = Dataset("OR_ABI-L2-CMIPF-M6C13_G16_s20191981200396_e20191981210116_c2019198121

# Get the pixel values
data = file.variables['CMI'][:]
#--------------------------------------------------------------------------------
# Choose the plot size (width x height, in inches)
plt.figure(figsize=(7,7))

# Plot the image
plt.imshow(data, vmin=193, vmax=313, cmap='Greys')
#--------------------------------------------------------------------------------
# Save the image
plt.savefig('Image_01.png')

# Show the image
plt.show()
```

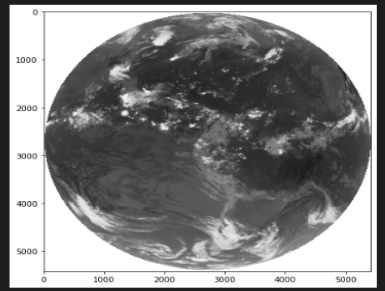
OUTPUT

Interactive

Clear All Restart workshop (Python 3.11.0)

Type 'copyright', 'credits' or 'license' for more information
IPython 8.12.0 -- An enhanced Interactive Python. Type '?' for help.

✓ # Training: Python and GOES-R



Type 'python' code here and press Shift

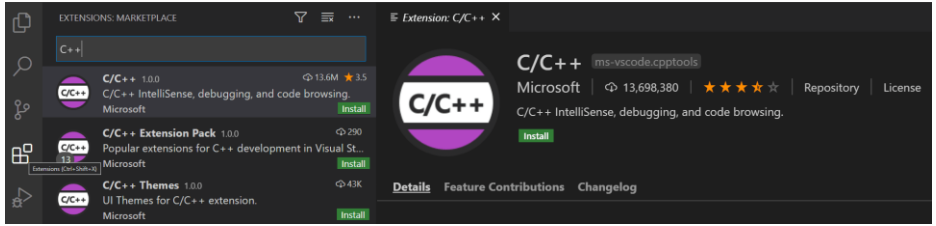
TERMINAL

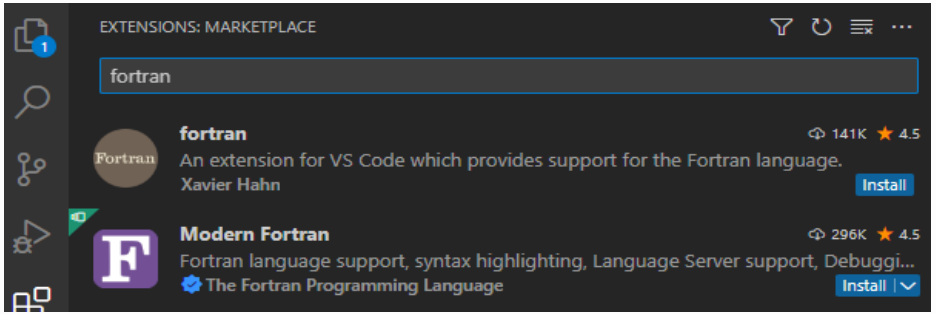
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL JUPYTER — Python

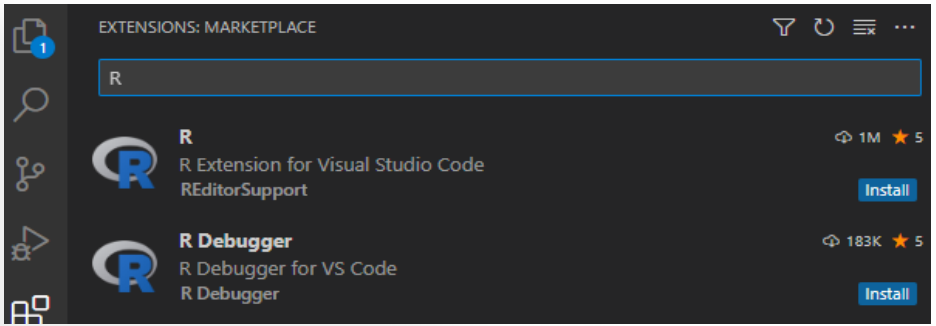
```
C:\VLAB\Python\GOES>C:/SHOWCast_v_2_5_1/Miniconda3/Scripts/activate

(base) C:\VLAB\Python\GOES>conda activate C:\Users\dsouza\miniconda3\envs\workshop

(workshop) C:\VLAB\Python\GOES>cd c:/VLAB/Python/GOES

(workshop) C:\VLAB\Python\GOES>C:/Users/dsouza/miniconda3/envs/workshop/python.exe c:/VLAB/Python/GOES/script_01.py
```

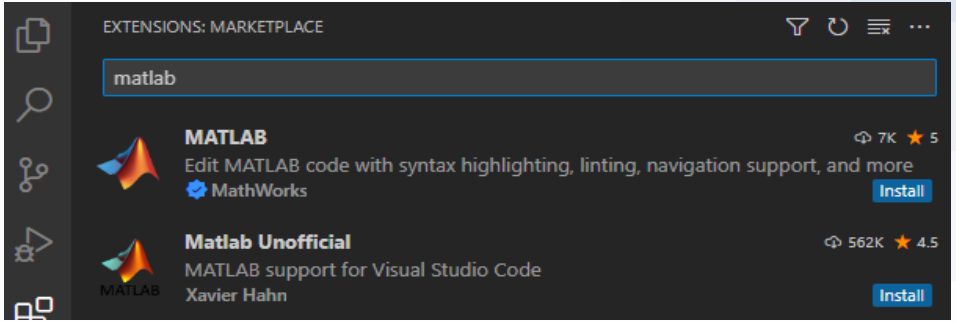
⊗ 0 ⚠ 0 — Ln 7, Col 25 Spaces: 4 UTF-8 CRLF Python 3.11.0 (conda)

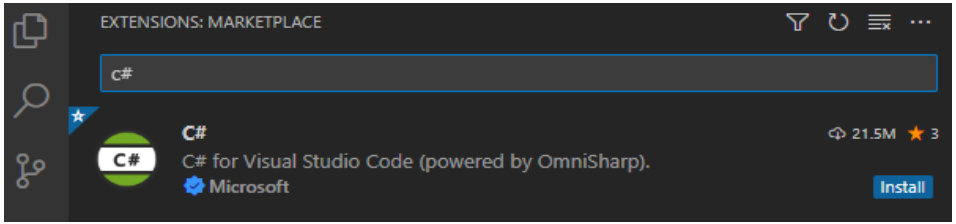
You Can Use VSCode With Many Languages

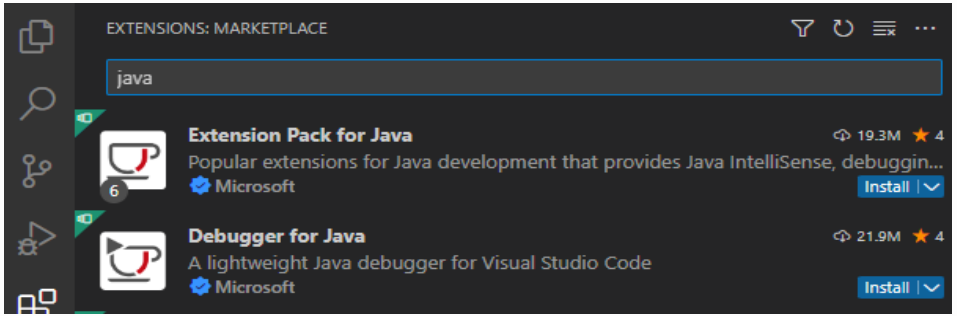




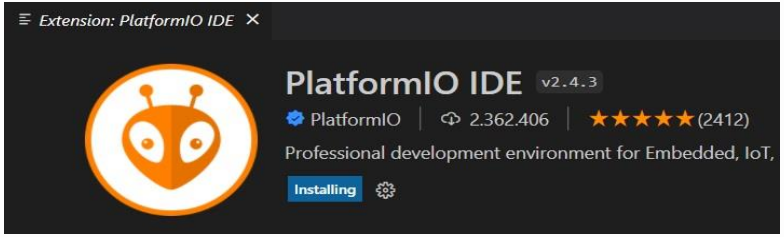


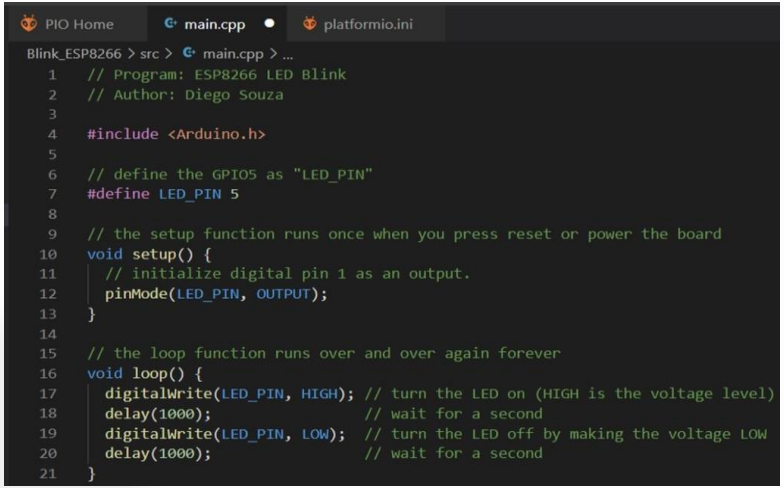


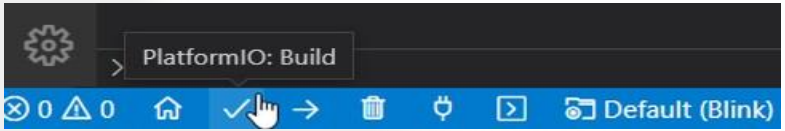


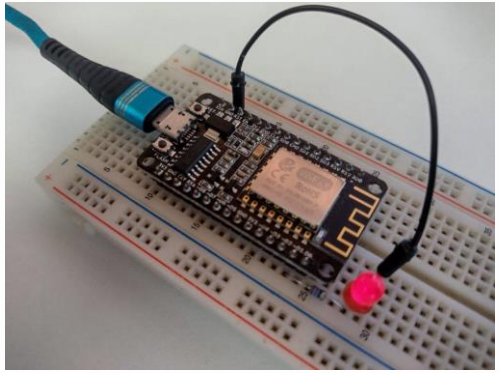


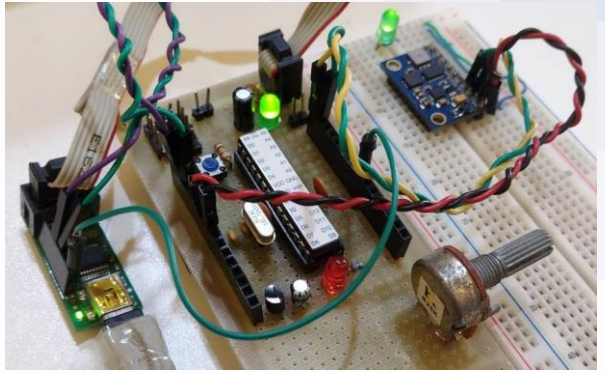
You Can Use VSCode For Many Applications

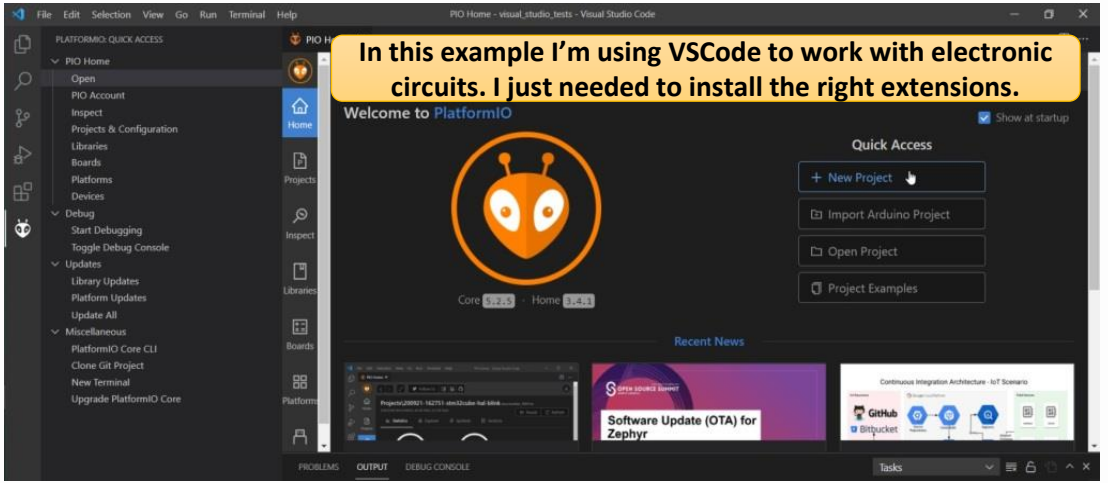












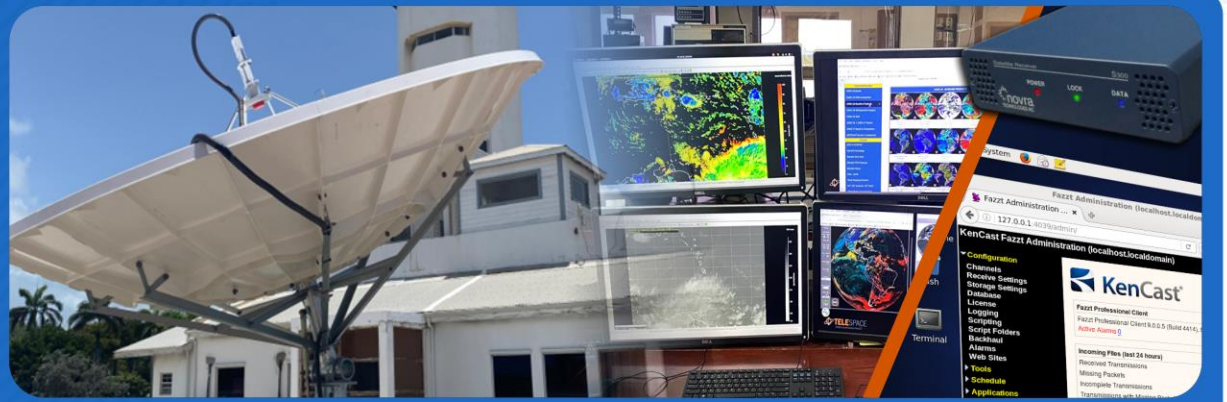
GEONETCast-Americas Training for the Eastern Caribbean States

Day 5 - May 12th

Session 2:

Hands-on
Introduction to Visual Studio Code

THANK YOU! QUESTIONS?



Diego Souza
diego.souza@inpe.br

DISSM - Meteorological Satellites and Sensors' Division
CGCT - General Coordination of Earth Sciences
INPE - National Institute for Space Research

This is made possible by the generous support of the American people through the United States Agency for International Development (USAID)