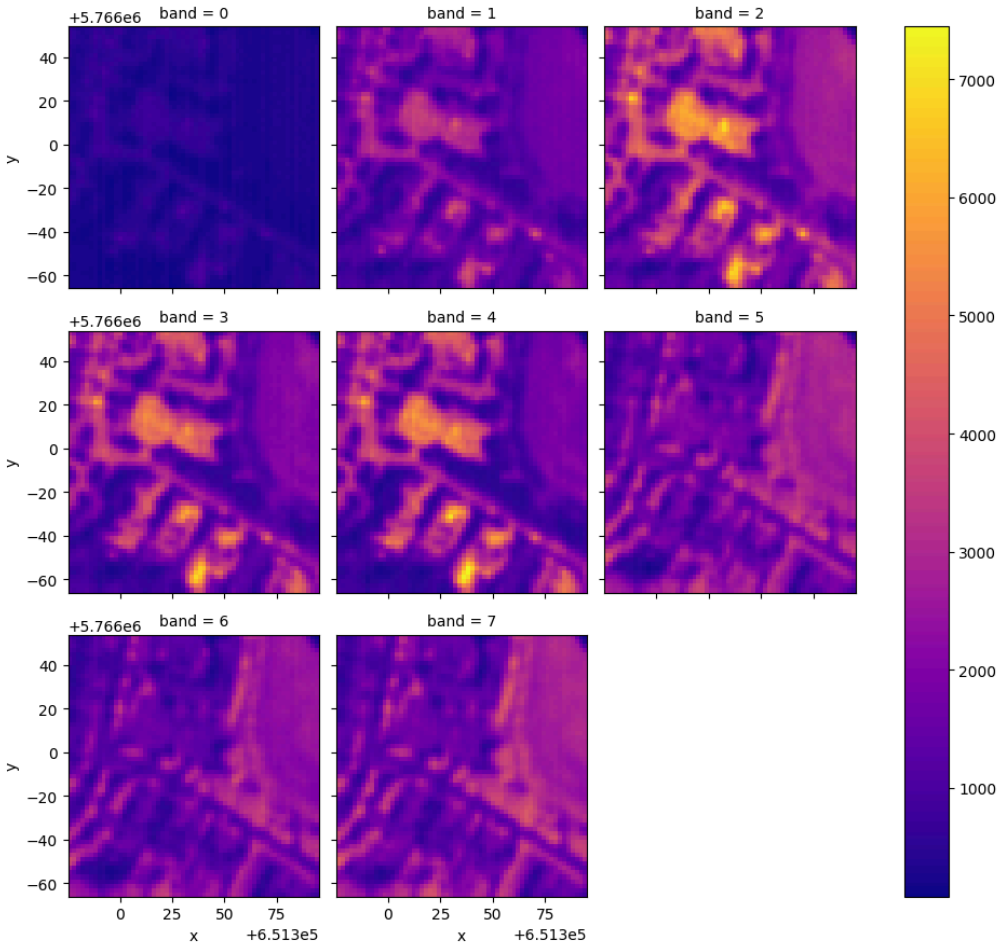


PANGEOS Case Study 3B: Simulating Optical Satellite Imagery for Uncertainty Analysis

Pre-Workshop Tasks

1. Introduction

In Case Study 3B (Thursday 3rd October, PM) we will be using an Open Source imagery emulator built in Python called PyEOSim. As we will be working with Jupyter Labs examples, please install Anaconda Python and the specific emulator software before the workshop (details below). If you have any issues with the method, please get in touch joseph.fennell@open.ac.uk.

2. Getting Started

This section contains step-by-step instructions for installing and testing the software needed for the workshop. I have tested this on a 2020 Macbook Pro (Intel) and a CentOS Linux machine. If possible, please do this before the session at 2pm on Thursday 3rd October.

2.1. Download Anaconda

Visit the Anaconda Download Page:
Go to the official Anaconda website: https://www.anaconda.com/products/distribution.
Choose the Installer:
Select the installer that matches your operating system and the Python version you want (usually, the latest version is recommended). Installers are available for:

Windows (64-bit)
macOS (Intel 64-bit, Apple M1/ARM64)
Linux (64-bit, x86 architecture)

2.2. Install Anaconda

For Windows

Run the Installer:

Locate the downloaded .exe file and double-click it to start the installation process.

Setup Instructions:

Welcome Screen: Click "Next".
License Agreement: Read the agreement, then click "I Agree" to continue.
Installation Type: Choose "Just Me" unless you want to install Anaconda for all users.
Destination Folder: Select the folder where you want to install Anaconda. The default location is usually fine (e.g., C:\Users\<YourUsername>\Anaconda3).
Advanced Options:

Add Anaconda to my PATH environment variable: **Not recommended** due to potential conflicts. Instead, use the Anaconda Prompt.
Register Anaconda as my default Python: Check this box if you want Anaconda to be the default Python.

Finish Installation:

Click "Install" to start the installation. This may take several minutes.

Once the installation is complete, click "Next" and then "Finish".

Verify the Installation:

Open the **Anaconda Prompt** from the Start Menu.

Type conda list and press Enter. This command should list all installed packages, confirming the installation was successful.

For macOS

Run the Installer:

Open the downloaded .pkg file by double-clicking it.

Setup Instructions:

Introduction: Click "Continue".

Read Me: Click "Continue" after reading the instructions.

License: Read the license agreement and click "Continue". Then click "Agree".

Installation Type: You can choose to install for all users or just for yourself. Click "Continue".

Install Location: Select the installation location. The default location is typically fine (/Users/<YourUsername>/anaconda3).

Finish Installation:

Click "Install" to start the installation. You may need to enter your system password.

Once the installation is complete, click "Close".

Verify the Installation:

Open the **Terminal** (you can find it using Spotlight Search).

Type conda list and press Enter. This command should list all installed packages, confirming the installation was successful.

For Linux

Run the Installer:

Open a terminal window.

Navigate to the directory where the installer was downloaded (e.g., cd ~/Downloads).

Make the downloaded script executable:

```
chmod +x Anaconda3-<version>-Linux-x86_64.sh
```

Replace <version> with the actual version number of the downloaded file.

Setup Instructions:

Run the installer script:

```
./Anaconda3-<version>-Linux-x86_64.sh
```

Follow the prompts:

Welcome Message: Press Enter to continue.

License Agreement: Press Enter to scroll through the license. Once at the end, type yes to agree.
Install Location: The default installation location is usually fine (/home/<YourUsername>/anaconda3). Press Enter to confirm or specify a different directory.

Initialize Conda:

After installation, the script may ask if you wish to initialize Anaconda. This means adding Anaconda to your PATH for easier command-line access. Type yes to initialize.
Close the terminal window and open a new one to refresh the shell.

Verify the Installation:

In the terminal, type conda list and press Enter. This command should list all installed packages, confirming the installation was successful.

2.3. Update Anaconda (optional)

After installation, it's a good practice to update Anaconda to ensure you have the latest packages:

Open the Anaconda Prompt (Windows) or Terminal (macOS/Linux).
Run the following commands:

```
conda update conda
conda update anaconda
```

2.4. Install Py6S

Py6S is a Python binding to the 6SV Atmospheric Simulation library. It is strongly advised to install Py6S in advance of the workshop. There are detailed instructions available here:

https://py6s.readthedocs.io/en/latest/installation.html

But the following should work (also installs ipython and jupyterlab):

```
conda create -n py6s-env -c conda-forge py6s
conda activate py6s-env
conda install ipython jupyterlab
```

2.5. Install PyEOSim

The repository is located on github: https://github.com/joe-fennell/pyeosim

Navigate to or create a write-access working directory then clone the repository:

```
mkdir ~/pangeos
cd ~/pangeos
git clone https://github.com/joe-fennell/pyeosim.git
```

Change directory to the pyeosim repository and install:

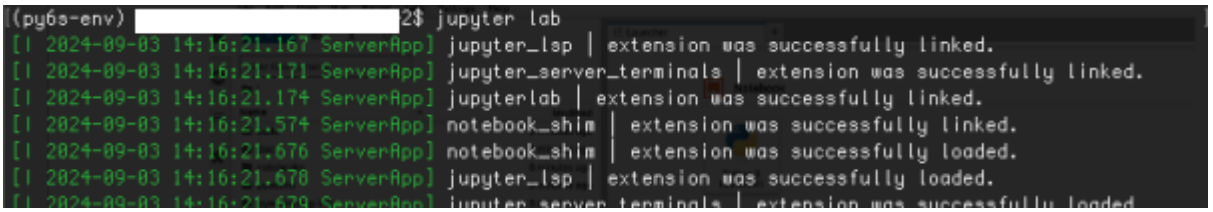
```
cd pyeosim
pip install .
```

2.6. Test your installation

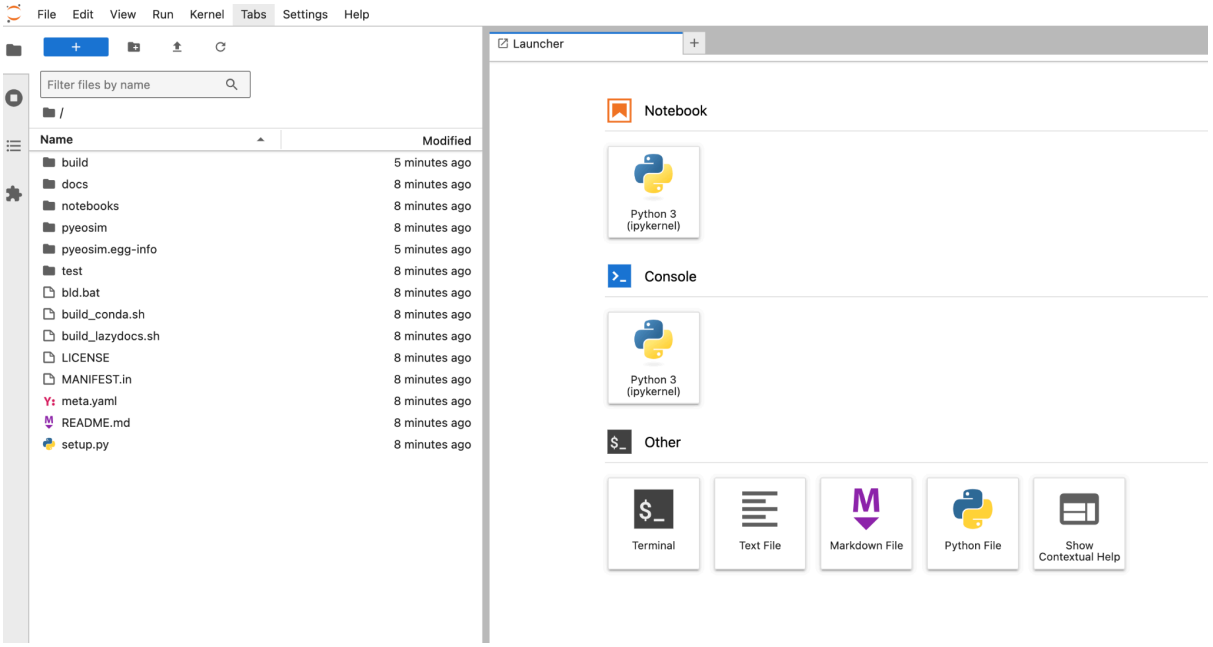
Launch a jupyter lab instance:

```
jupyter lab
```

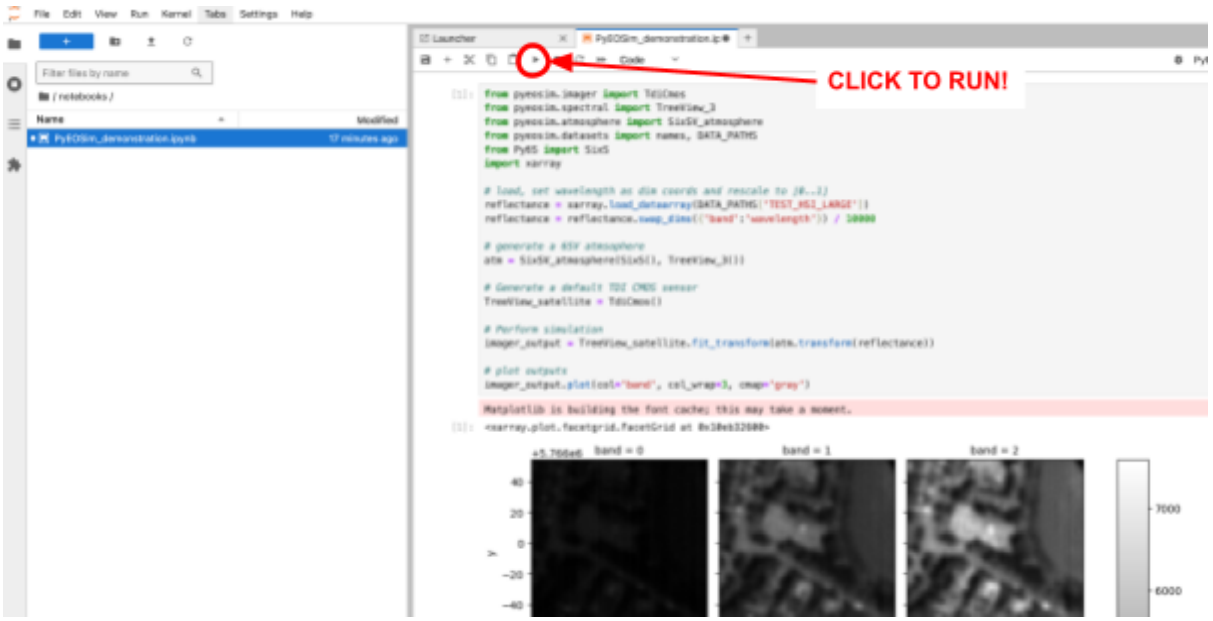
You should see something like this in your terminal:



And something like this in your web browser:



Navigate to the `notebooks' subdirectory of pyeosim by clicking on the link in the left hand pane and there is a single notebook called PyEOSim_demonstration.ipynb that can be opened with a click.



If you see the plots below the cell, the Jupyter Notebook has been successfully run on your machine and you are ready to begin the workshop.

If you prefer not to use jupyter lab, you can run the following code in an ipython terminal:

```
from pyeosim.imager import TdiCmos
from pyeosim.spectral import TreeView_3
from pyeosim.atmosphere import SixSV_atmosphere
from pyeosim.datasets import names, DATA_PATHS
from Py6S import SixS
import xarray

# load, set wavelength as dim coords and rescale to [0..1]
reflectance = xarray.load_dataarray(DATA_PATHS['TEST_HSI_LARGE'])
reflectance = reflectance.swap_dims({'band':'wavelength'}) / 10000

# generate a 6SV atmsophere
atm = SixSV_atmosphere(SixS(), TreeView_3())

# Generate a default TDI CMOS sensor
TreeView_satellite = TdiCmos()

# Perform simulation
imager_output =
TreeView_satellite.fit_transform(atm.transform(reflectance))

# plot outputs
imager_output.plot(col='band', col_wrap=3, cmap='gray')
```

If this runs without error, you have successfully installed PyEOSim and its dependencies. Congratulations!