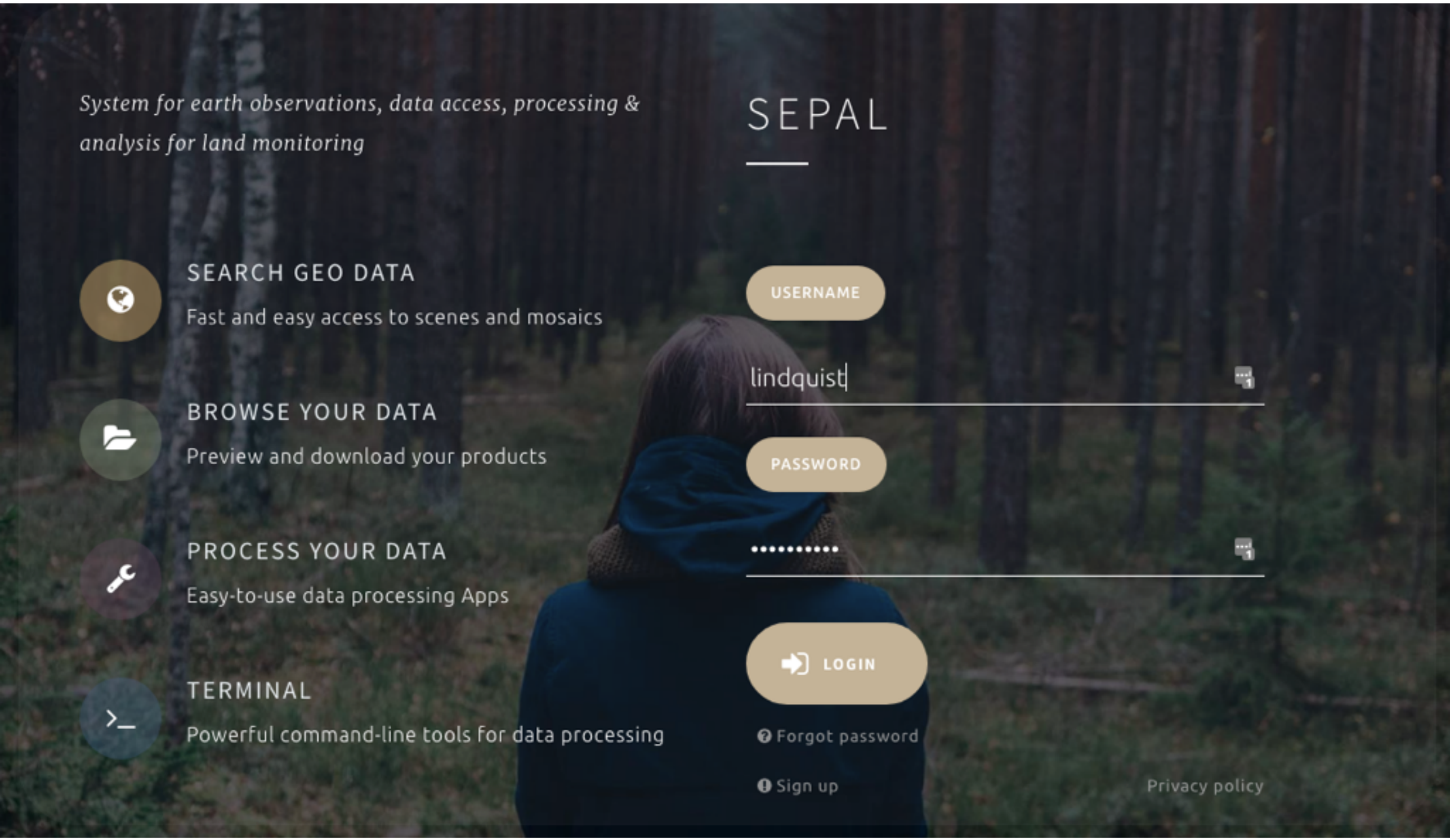
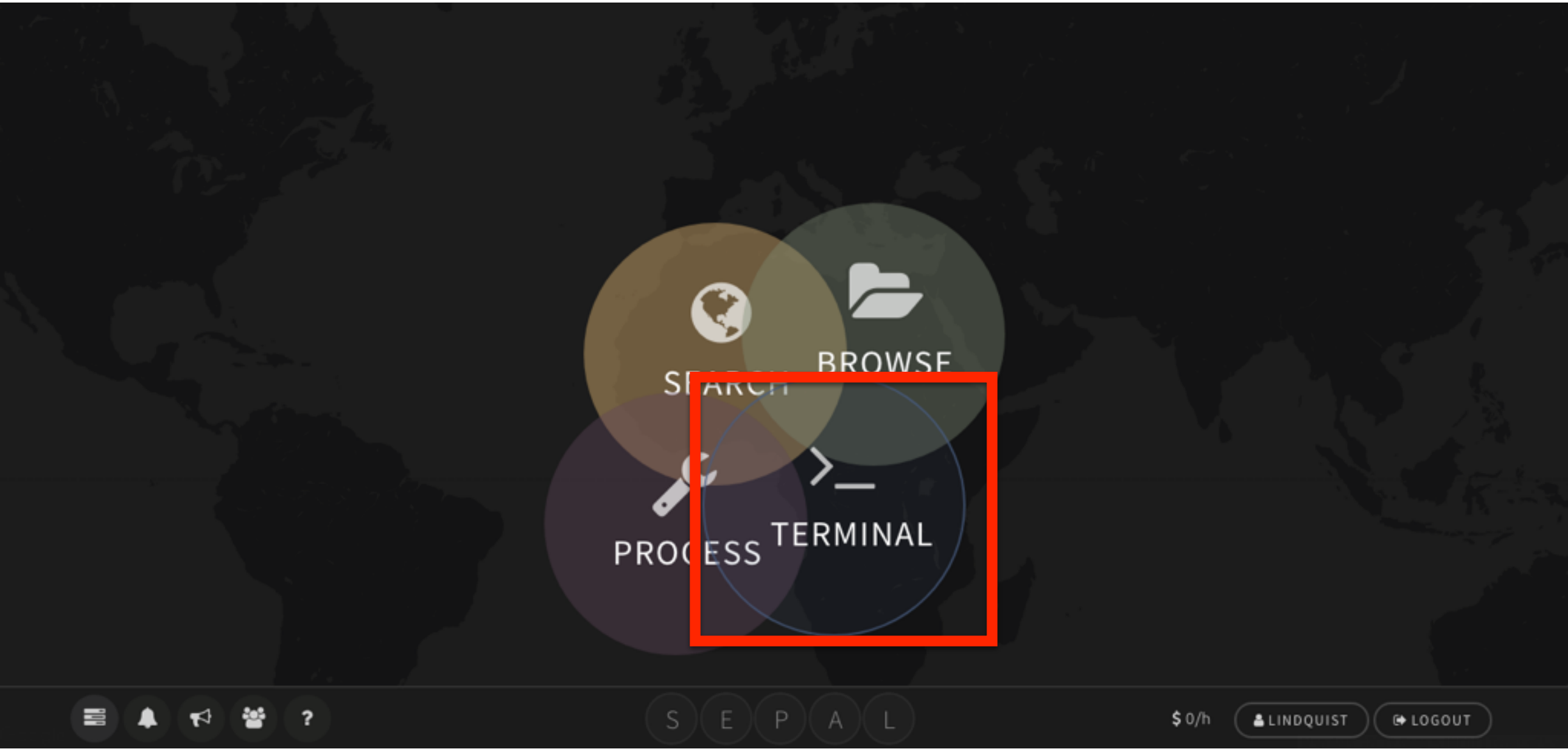
Sentinel-1 Soil Moisture Estimation

a practical exercise with SEPAL

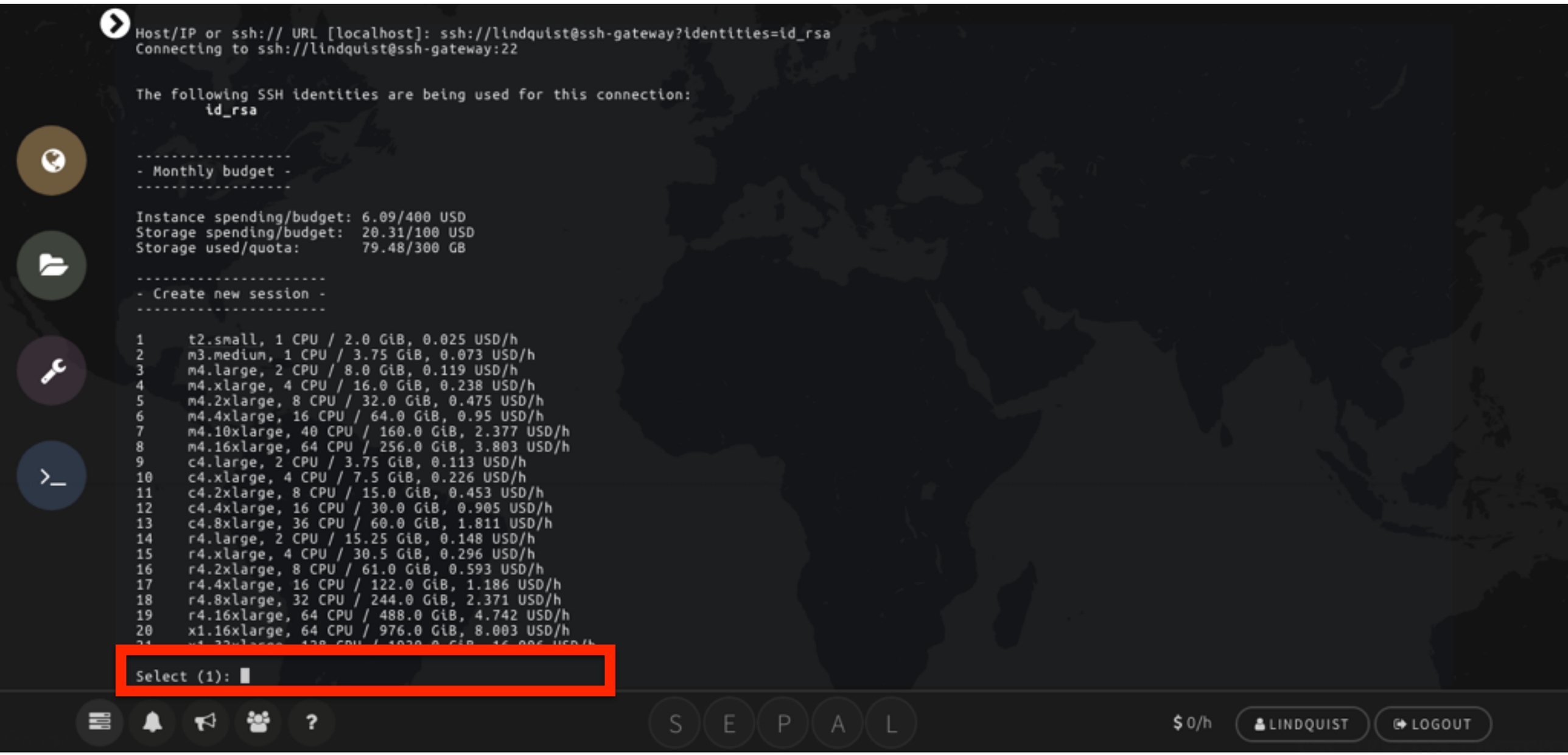
Log in to SEPAL



Start a Cloud Computer #2



Start a Cloud Computer #2



Make a directory

```
~$ mkdir    smm test
```

Enter into the new directory

```
~$ cd    smm test
```

Make a virtual environment

```
~$ virtualenv -p python2.7 env --system-site-packages
```

A virtual environment let's us experiment without messing up everything.

Activate the virtual environment

```
~$ source env/bin/activate
```

Activating a virtual environment means you are using the tools within that environment to process

Install python soil moisture monitor pysmm

```
~$ pip install pysmm
```

pip - is a python installer.

Update pysmm with improved files

```
~$ wget https://goo.gl/JZLCo9
```

wget - get’s files from a URL

Re-name downloaded file

```
~$ mv JZLCo9 pysmm_upgrade.zip
```

Replace old files with updates

```
~$ unzip pysmm_upgrade.zip -d env/lib/python2.7/site-packages
(A)ll
```

Install a jupyter kernel

```
~$ python -m ipykernel install --user --name=env
```

Download the Jupyter Notebook

```
~$ wget https://goo.gl/NbpUWr
```

Re-name the Jupyter Notebook

```
~$ mv NbpUWr run_pysmm.ipynb
```

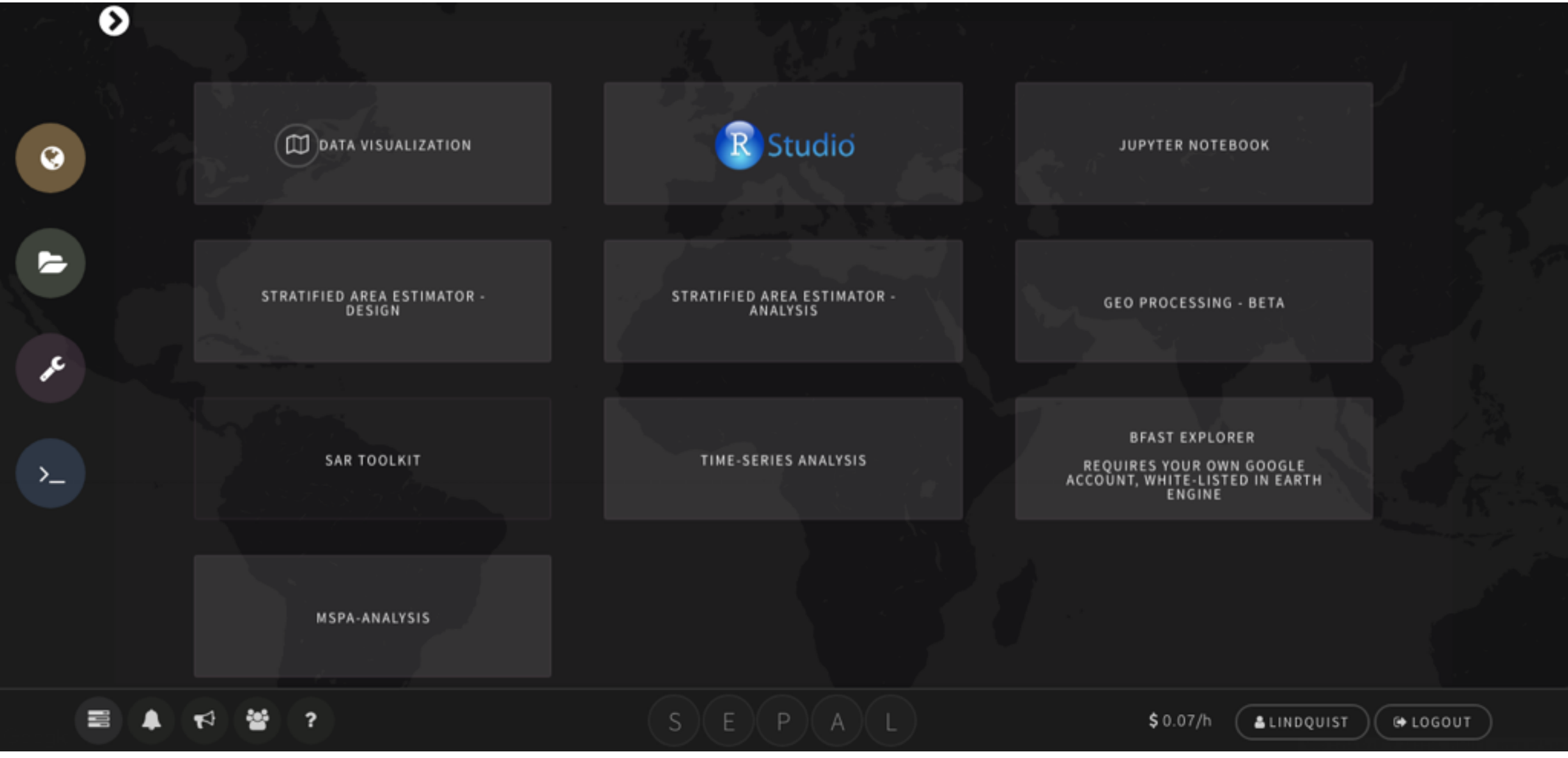
Exit the Virtual Environment

```
~$ deactivate
```

to re-activate a virtual environment:

```
~$ source env/bin/activate
```

Open the Jupyter Notebook in SEPAL



Open the Jupyter Notebook in SEPAL

Run the Jupyter Notebook in SEPAL

jupyter run_pysmm Last Checkpoint: 15 minutes ago (autosaved)

File Edit View Insert Cell Kernel Widgets Help Trusted smm_env

Run Markdown

Import Python modules to run PYSMM

In [1]:
```
import pysmm,os
from pysmm.derive_SM import get_map
import sys
import ee
import itertools
#ee.Initialize()
path = os.path.dirname(pysmm.__file__)
```

Print variables to make sure paths are correct

In [2]:
```
print path

print str(sys.argv)
```

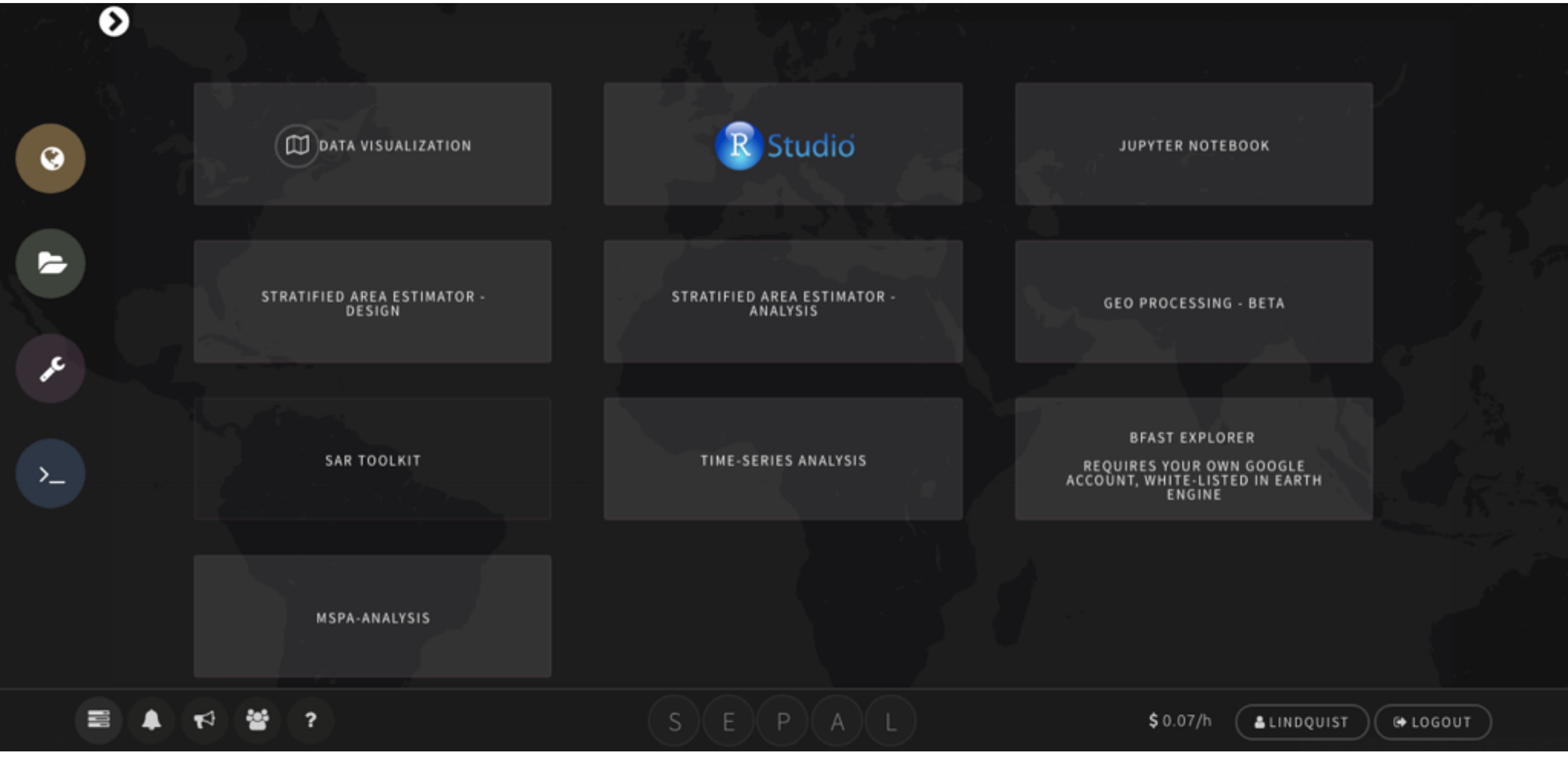
```
/home/lindquist/python_environments/smm_env/local/lib/python2.7/site-packages/pysmm
['/usr/local/lib/python2.7/dist-packages/ipykernel_launcher.py', '-f', '/home/lindquist/.local/share/jupyter/runtime/
kernel-cbdd5884-de53-44a6-8e74-aeace4ebaf51.json']
```

Modify the Year, Month, and Day parameters as desired

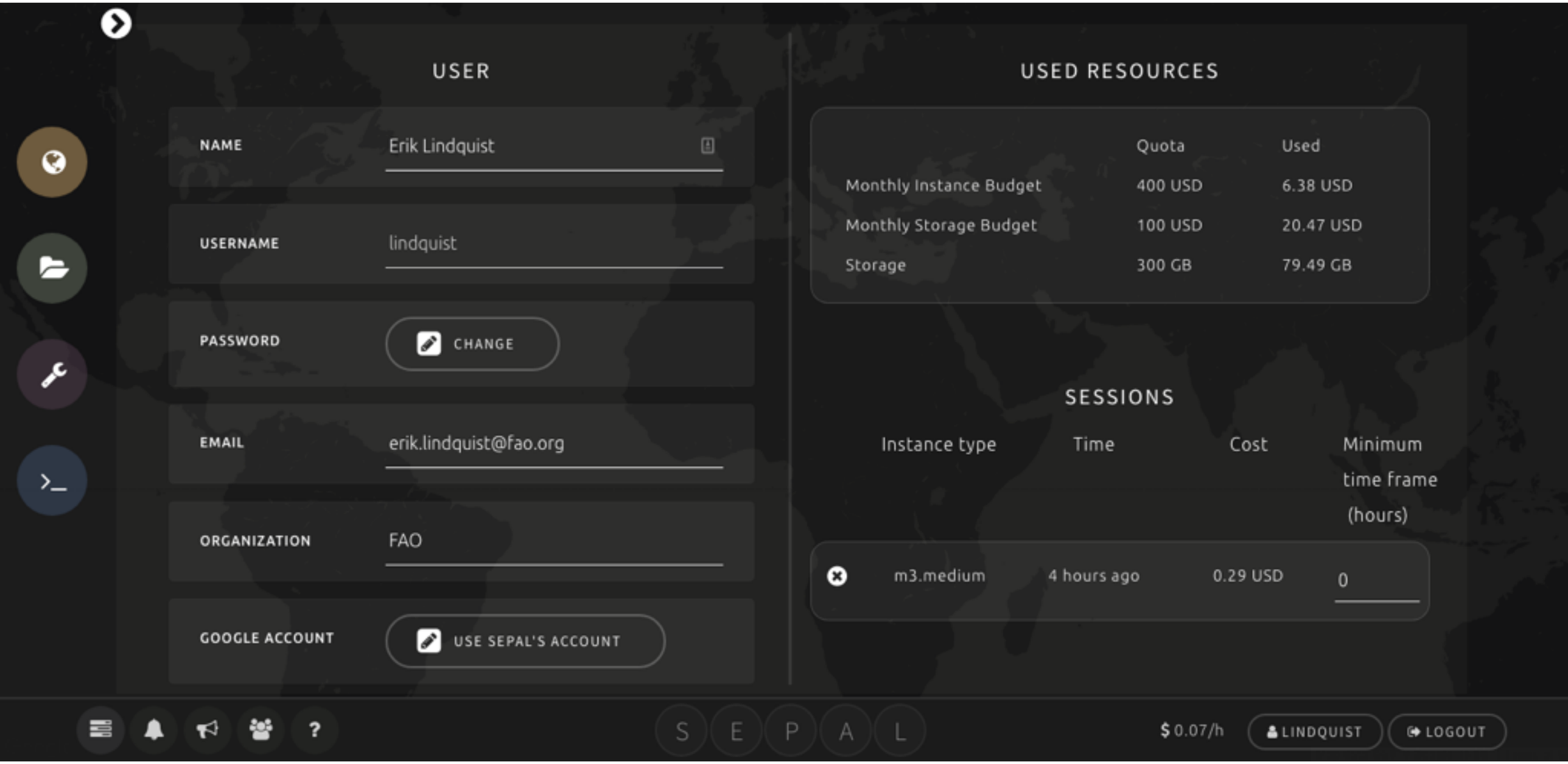
In [3]:
```
year = [2016]
month = [11]
day = [1,15]
```

Go back to SEPAL

Extend the time your computer will run



Extend the time your computer will run



What are we doing?

1. Running Python code to pre-process Sentinel-1 RADAR
2. Combining S1 data with GLDAS data
3. And a model trained on International Soil Moisture Network
4. To create 100m surface soil moisture estimates in kg/m2

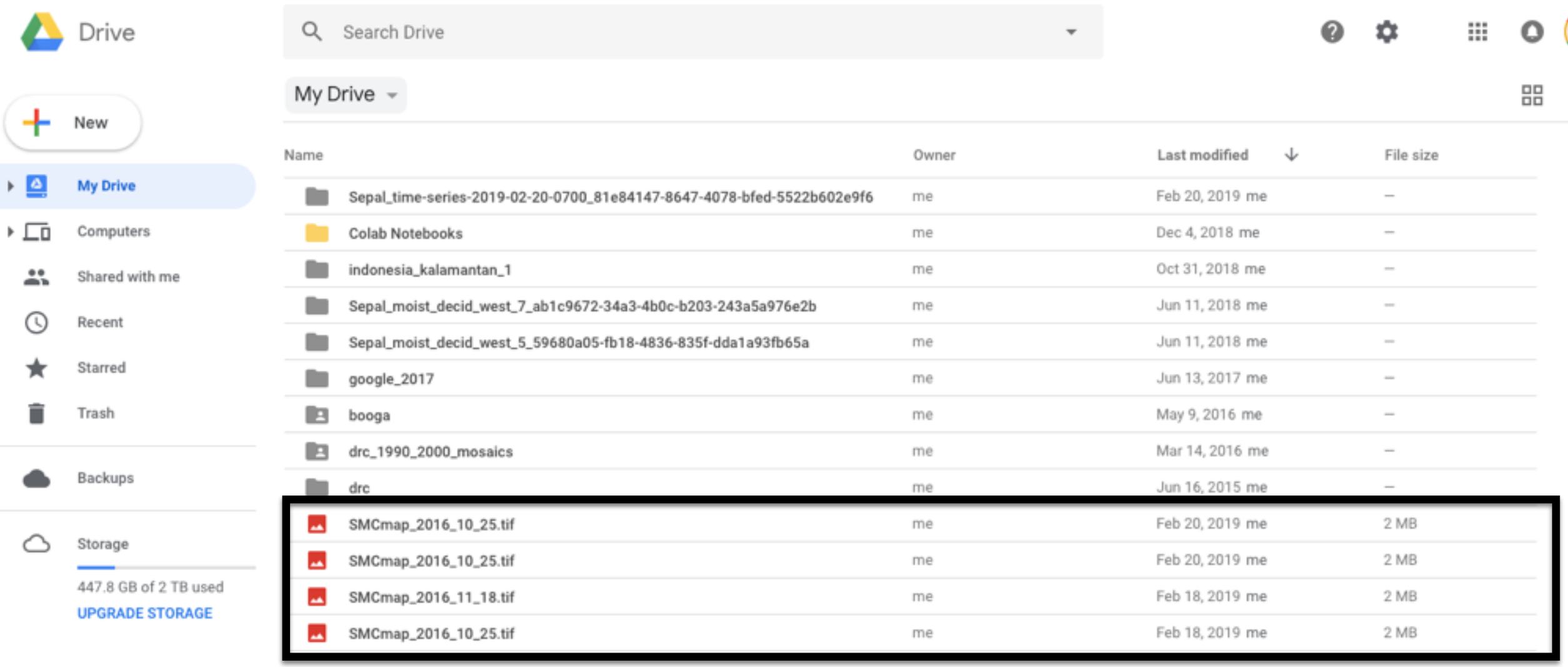
Limitations

1. These are estimates based on training data from far away.
2. C-band SAR is affected by vegetation canopy
3. So…tree areas are not suitably monitored by this method
4. There are a lot of other limitations…

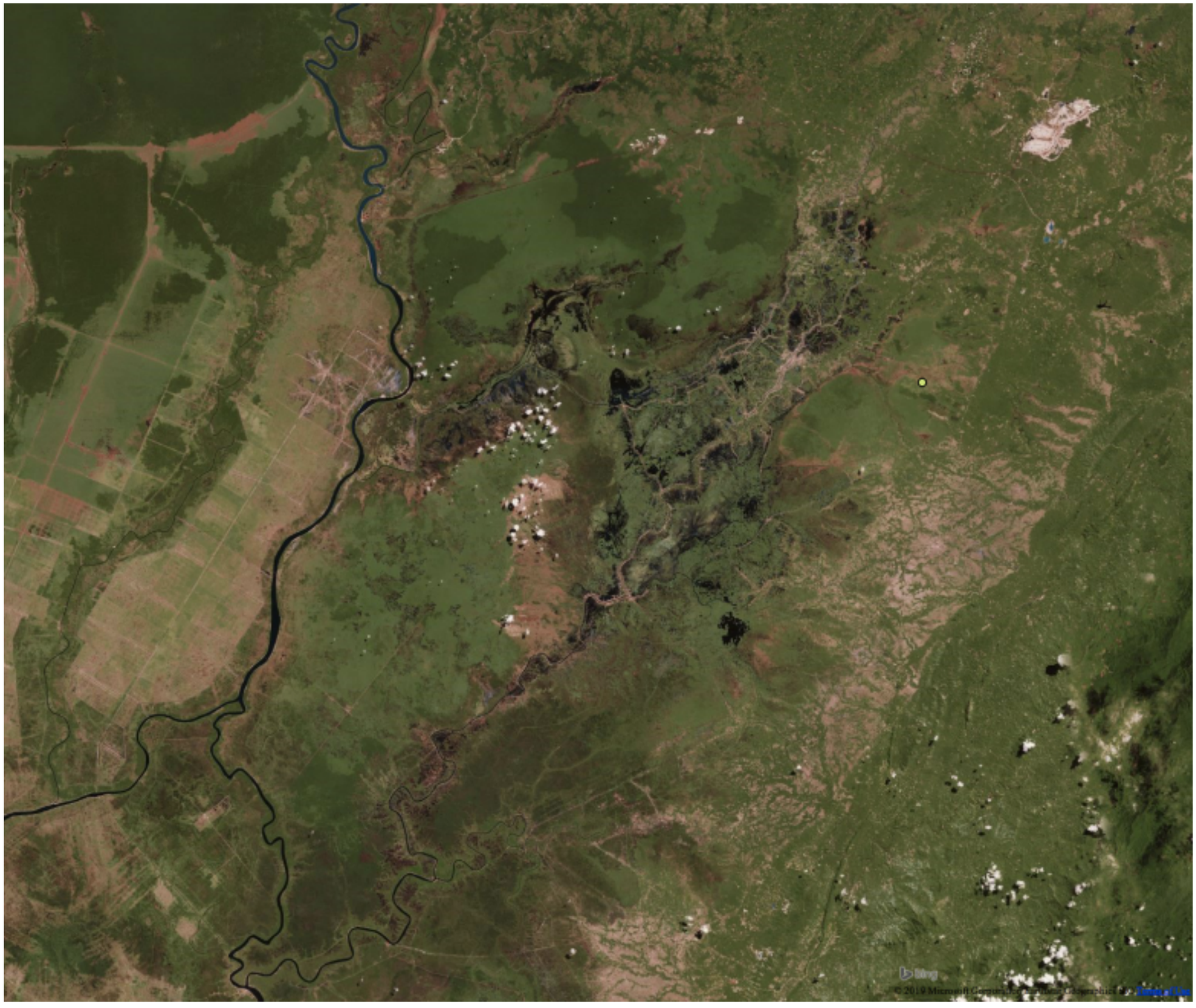
Sources:

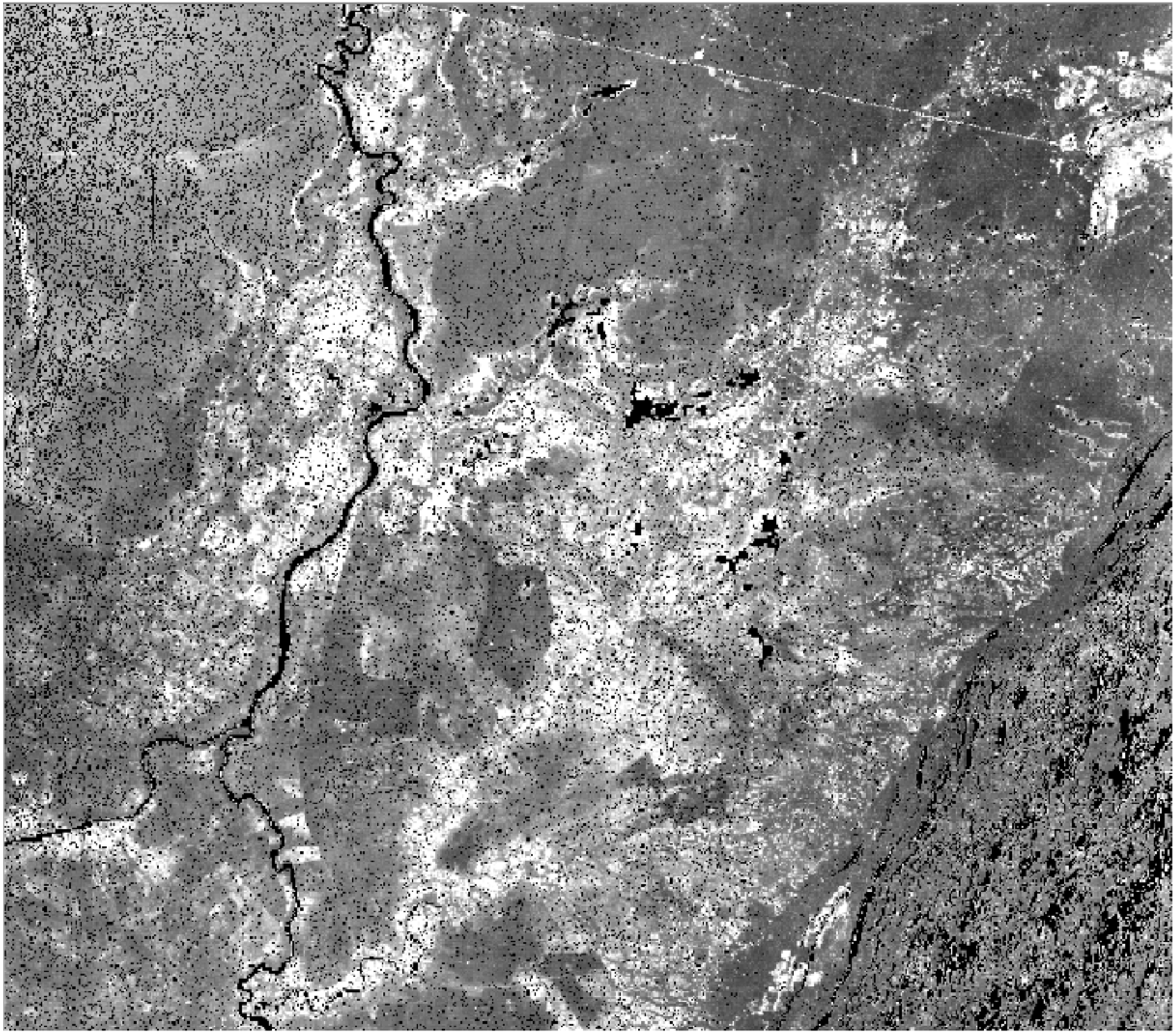
1. https://www.mdpi.com/2072-4292/7/12/15841
2. https://journals.ametsoc.org/doi/pdf/10.1175/BAMS-85-3-381
3. https://ieeexplore.ieee.org/abstract/document/7005430
4. https://ieeexplore.ieee.org/abstract/document/6723717
5. https://pubs.geoscienceworld.org/vzj/article-abstract/15/6/vzj2015.03.0048/315717/from-point-to-pixel-scale-an-upscaling-approach?redirectedFrom=fulltext

Download the Results from Google Drive



Open a GIS





PYSMM Soil Moisture Mapping Algorithm from:

Greifeneder et. al. *Submitted*

and code documentation here:
https://pysmm.readthedocs.io/en/latest/

with edits and improvements made by SEPAL team