

Copernicus Data Space Ecosystem for access to open and free Copernicus data

<https://dataspace.copernicus.eu/>

Introduction

This new open access cloud service is current providing direct access to data acquired by the Sentinel suite of satellites. To get access to the data use can be made of a Jupyter notebook environment, in conjunction with a backend processing engine, for example 'OpenEO'. This document will shortly describe the main steps to access, select Sentinel imagery, conduct required pre-processing, download the dataset in the assigned cloud environment and conduct further image processing and analysis.

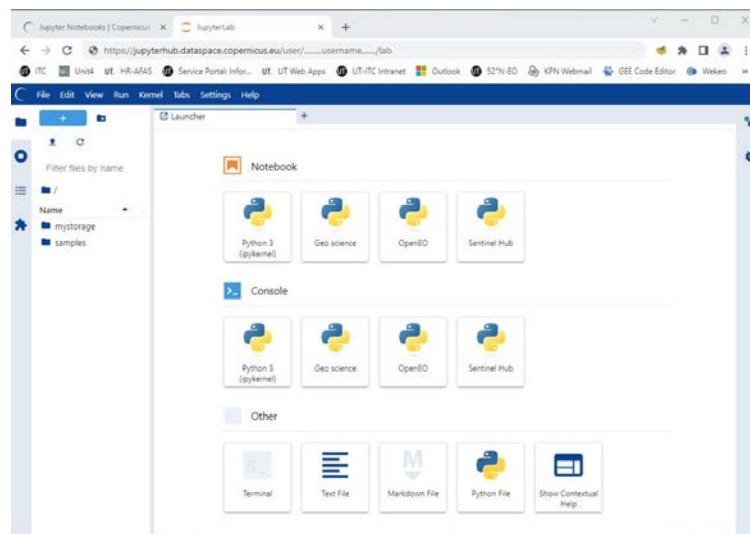
See also: <https://documentation.dataspace.copernicus.eu/Applications/JupyterHub.html>.

Connecting to the Copernicus DataSpace using OpenEO

Navigate, using your web browser, to the address indicated at the top. If you don't have an account already, select the option 'Login' and 'Register'. Complete the registration form and register and 'sign in'. You will receive a verification email and once the link in this email is confirmed you should be able to login with the provided email address and password.

Review the information provided under the dropdown menus 'explore data', 'ecosystem' and 'analyse data'. Having reviewed the information provided, under the dropdown menu 'analyse data', select the option 'Jupyter Notebooks' and 'Access Jupyter Notebooks', click the box 'sign in with keycloak', select a preferred server option, e.g. 'large server' and press 'Start'. A new virtual processing environment instance is created. You will be directed to your local resources, which are automatically created and is consisting of 2 folders, 'my storage' and 'samples'.

Figure 1: Starting the Jupyter Notebook environment in the Copernicus Data Space



Within the 'samples' folder, check the content of the 'openeo' folder, eventually run the notebook entitled 'basics.ipynb' to check if you can establish a connection to the Copernicus Data Space Ecosystem using the openEO back-end.

Installing additional resources

Within the Copernicus Data Space environment, the system is 'cleaned' on a daily basis, but files situated within the folder 'mystorage' are retained. This storage area, having a size of 10 GB, is preserved when you logout. It will be kept for up to 15 days from your last login, and you will receive a notification to log in to the Jupyter Hub to reset the timer if you want to keep the data preserved. If you do not log in, then after 15 days your files will be deleted.

A notebook entitled 'Install_Training_Package' (containing the listing as given in the annex) is prepared to upload all required training resources, like software tools, notebooks and sample-data. Execute the code fields in the notebook and wait until all the files have been retrieved, unzipped, etc.

Upon completion of this notebook, you have the following folder structure in your folder 'mystorage':

- Notebooks (with notebooks "Install_Traing_package" – see also annex 1 - and "Setup_OpenEO_ILWISPy", "openeo_first_steps" notebooks in the root of the folder)
 - ILWISPy (with readme, notebooks and html files in the root of the folder)
 - ILWISPy_ImageClassification (containing sample data)
 - Intro_ILWISPy (containing sample data)
 - Intro_RS_ILWISPy (containing sample data)
 - Intro_Satpy2ILWISPy (containing sample data)
 - Intro_Timeseries_ILWISPy (containing sample data)
 - Notebook_results (html files showing results of execution of the notebooks)
 - Intro_Descriptive_Statistics_Interpolation
 - Intro_Pyhton_Matplotlib
 - Python4Hydrology
- Documents (containing python resources)
- Software (including latest version of ILWISPy for python 3.11 and required libraries)

Wait until all required resources have been transferred. Open the notebook:

"Setup_OpenEO_ILWISPy"

From the notebook menu, select the tab 'Kernel' and use the option 'Restart Kernel and Run All Cells..'

All required resources have been loaded and now you can start exploring the Copernicus Data Space, in order to do so open the notebook 'openeo_first_steps'. Note that a new folder, 'data', will be created in your notebook directory to store your retrieved / processed results. Now run the cells of the notebook in a sequential order.

To visualize the results also use can be made of ILWIS 386, to download the processed results to your local system, select the respective files, press the right mouse button and download the files to a local working directory. Open ILWIS 386, navigate to your local working directory and display the results. ILWIS386 can be downloaded from <https://filetransfer.itc.nl/pub/52n/ILWIS386/Software/>, select the latest version. For installation instruction see 'ILWIS_installation_instructions.pdf', available at: <https://filetransfer.itc.nl/pub/52n/ILWIS386/Tutorial/>.

Install_Training_Package

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```
[ ]: #start with installing the last version of openEO
!pip install openeo

[ ]: #retrieve required software and sample notebook to check if you can retrieve
↳some images from the Copernicus Data Space Ecosystem
!wget -r -np -nH --cut-dirs=3 -R "index.html*" https://filetransfer.itc.nl/pub/
↳52n/Copernicus_DataSpace/

[ ]: #install ilwispy
!pip install ./software/ilwis-1.0.20230718-cp311-cp311-linux_x86_64.whl

[ ]: #install matplotlib
!pip install matplotlib

[ ]: #copy required libraries
!cp ./software/lib* /home/jovyan/.local/lib/

[ ]: #load all required libraries
from ctypes import *
lib1 = cdll.LoadLibrary(r'/home/jovyan/.local/lib/libGLdispatch.so.0.0.0')
lib1 = cdll.LoadLibrary(r'/home/jovyan/.local/lib/libGLX.so.0.0.0')
lib1 = cdll.LoadLibrary(r'/home/jovyan/.local/lib/libGL.so.1.7.0')

lib1 = cdll.LoadLibrary('/opt/conda/lib/libpython3.11.so.1.0')
lib1 = cdll.LoadLibrary('/opt/conda/envs/openeo/lib/libQt5Gui.so.5')
lib1 = cdll.LoadLibrary('/opt/conda/envs/openeo/lib/libQt5Sql.so.5')
lib1 = cdll.LoadLibrary('/opt/conda/envs/openeo/lib/libQt5Concurrent.so.5')

[ ]: #check is ilwispy can be loaded
import ilwis
ilwis.version()

[ ]: #preparing a new folder structure to store the sample data
import os
# list the current working directory - the location of this notebook
cwd = os.getcwd()
print(cwd)
```

```

#local sample data folder should be located within the ILWISPy notebook folder
dst_dir = (cwd) + '/notebooks/ILWISPy/'
print(dst_dir)

os.chdir(dst_dir)
cwd = os.getcwd()
print(cwd)

file_listing = os.listdir()
print(file_listing)

```

```

[ ]: #retrieve the sample data
!wget -r -np -nH --cut-dirs=4 -R "index.html*" https://filetransfer.itc.nl/pub/
↳52n/ilwis_py/sample_data/

```

```

[ ]: # unzip the downloaded sample data in the folder ILWISPy
#the unzip is creating new folders with same foldername as the notebook name.
↳The new folders are containing the sample data required to execute the
↳notebooks
import glob
from zipfile import ZipFile
zips = glob.glob('*.zip')
for zip in zips:
    print('Extracting', zip)
    with ZipFile(zip, 'r') as z:
        z.extractall()
print('Done!')

```

```

[ ]: #move downloaded zip files to backup folder
!mkdir zip_backup
!mv *.zip './zip_backup'

```

Enjoy the capability offered by the software tools provided and executing these within the new Copernicus Data Space Ecosystem. Open the Notebook ‘openeo_first_steps’ and process some Sentinel-2 data.

After successful completion of the notebook ‘openeo_first_steps’, navigate to the folder ‘notebooks’.

Inspect the content of the folder ‘notebooks’:

- **Intro_Python_Matplotlib:** this folder is containing a number of notebooks providing an introduction to Python and Matplotlib.
- **Intro_Descriptive_Statistics_Interpolation:** some add-on notebooks which can be used as further introduction to descriptive statistics and interpolation using python and matplotlib.
- **ILWISPy:** this folder is containing a number of notebooks to get you familiar with the ILWISPy functionality offered together with a number of other python sitepackages. Note

that the sample data required to run these notebooks are provided in a sub-directory available within the notebook folder. For notebooks that do not require sample-data a sub-directory is created when running the notebook.

For a new ILWISPy user best sequence of reviewing / running the current notebooks is described in the file: **README_notebook_sequence**. The files with the notebook_name and suffix `*'name_notebook'_result.html*` can be consulted in case you would like to see the result of the code field execution in the various notebooks. These can be opened by double clicking the file.

[]: