USER GUIDE

RUS Working Environment & Virtual Desktop
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1. Introduction

1.1 Document purpose

This document is the RUS Working Environment & Virtual Desktop User Guide of the “Research and User Support for Sentinel Core Products - Service Operations - RUS” project. The document presents the basic functionalities of the RUS user working environment and virtual desktop.

1.2 Document structure

This document is structured as follows:

- This chapter “Introduction” gives the purpose and the structure of the document. It also defines the list of project acronyms and abbreviations;
- Chapter 2 explains how the user can access the working environment;
- Chapter 3 reminds the working environment default parameters and explains how the user can customize it;
- Chapter 4 presents some basic functionalities of the working environment and explains how the user can use them;
- Chapter 5 presents the functionalities available to monitor the user’s working environment and explains how he/she can use them;
- Chapter 6 presents the functionalities available to manage the user’s working environment and explains how he/she can use them;
- Chapter 7 introduces the tool available in the working environments delivered by the RUS Service to retrieve Sentinel data from the Copernicus Open Access Hub.

1.3 Acronyms and abbreviations

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<td>EO</td>
<td>Earth Observation</td>
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<td>ESA</td>
<td>European Space Agency</td>
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<td>PSSH</td>
<td>Parallel Secure Shell</td>
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2. Accessing your working environment

This section explains how the user can access the working environment from the dashboard on the RUS Portal.

Once you are logged in on this portal as a RUS user, browse the Your RUS service menu and click on the Your dashboard tab. You will get a complete view of the functions available through this dashboard including those marked in blue which correspond to the currently active ones. Then click on the Access my desktop environment button (Figure 1).

![Figure 1. Accessing to your working environment from the RUS Web portal](image)

Then, when the second window opens (Figure 2), enter the credentials (login and password) of the Virtual Machine that have been provided to you at the time of the opening of your working environment and click on the Login button.
Figure 2. Entering the credentials of a Virtual Machine
3. Customizing your working environment

This chapter reminds the working environment default parameters and explains how the user can customize it.

Once you have opened a connection, you will see a real-time view of the remote display (Figure 3). The remote display will take up the entire browser window. With the intent of providing a seamless experience, options specific to remote desktop are hidden within the RUS desktop menu, which can be opened as needed as described in the next section.

You can interact with this display just as you would do with your normal desktop. Your mouse and keyboard will function as if they were connected directly to the remote machine.

![Figure 3. Overview of the RUS desktop menu](image)

3.1 Desktop menu

This section reminds the default configuration for the desktop menu of the working environment and explains how the user can customize it.
The desktop menu is in a sidebar which is hidden until explicitly shown (Figure 4):

- On a desktop or other device which has a hardware keyboard, you can show this menu by pressing **Ctrl+Alt+Shift**. To hide the menu, you press **Ctrl+Alt+Shift** again.

- If you are using a mobile or touchscreen device that lacks a keyboard, you can also show the menu by swiping right from the left edge of the screen. To hide the menu, you swipe left across the screen.

### 3.2 Mousepad or touch device

This section reminds the default configuration for the mousepad available in the working environment and explains how the user can customize it. This customisation can be achieved through the desktop menu.

The RUS desktop is designed to work equally well across all HTML5 browsers, including those of mobile devices. It will automatically handle input from a touch screen or a traditional mouse (or both, if you happen to have such a computer) and provides alternative input methods for devices which lack a physical keyboard.

#### 3.2.1.1 Mouse emulation

If your device has a touchscreen and lacks a mouse, the RUS desktop will emulate a mouse for the sake of interacting with remote desktops that expect mouse input. By default, the RUS desktop uses "absolute" mouse emulation. This means that the mouse pointer is positioned at the location of each tap on the screen.
In both absolute and relative modes, you can click-and-drag by tapping the screen and then quickly placing your finger back down. This gesture only causes the mouse button to press down, but does not release it again until you lift your finger back up.

3.2.1.2 Absolute mode (touchscreen)

Absolute mouse emulation is the default as it tends to be what people expect when using a touch device to interact with applications designed for mouse input.

Each tap on the screen is translated into a left-click at that position. Right-clicking is accomplished through pressing and holding your finger on the screen. If parts of the remote display are off-screen, you can drag your finger around the screen to pan the off-screen parts back into view.

Although absolute mouse emulation works generally well, a finger makes for a very inaccurate pointing device. To address this, the RUS desktop also offers "relative" mouse emulation, which provides a way to deal with the need for accurate pointer control, when a true pointer device is not present.

3.2.1.3 Relative mode (touchpad)

RUS desktop's relative mouse emulation behaves similarly to the touchpad present on most modern laptops: you drag your finger across the display to move the mouse pointer, and tap the display to left-click. The pointer moves relative to the motion of your finger. Right-clicking is accomplished with a two-finger tap, and middle-clicking with a three-finger tap. The mouse scroll wheel can be operated by dragging two fingers up or down.

Because the relative mouse emulation reserves so many gestures for the different mouse buttons and actions, common touch gestures like panning and pinch-to-zoom will not work while relative mouse emulation is enabled. Instead, the screen will automatically pan to keep the mouse pointer in view, and you can zoom through the buttons in the menu.

3.3 Display

This section reminds the default configuration for the display available in the working environment and explains how the user can customize it.

The RUS Desktop will default to shrinking or expanding the remote display to fit the browser window exactly, but this is not necessarily ideal. If the remote display is much larger than your local display,
the screen may be impossible to see or interact with. This is especially true for mobile phones, whose screens need to be small enough to fit in the average hand.

You can scale the display on touch devices by using the familiar pinch gesture: place two fingers on the screen and bring them closer together to zoom out or further apart to zoom in.

If your device lacks a touch screen, you can also control the zoom level through the menu. The controls for zooming in and out are located at the bottom of the menu. The current zoom level is displayed between the "-" and "+" buttons which control the zoom level by 10% increments.

![Display zoom menu](Figure 6. The RUS display zoom menu)

### 3.4 Language

This section reminds the default configuration for the language of the working environment and explains how the user can customize it. This customisation can be achieved through the desktop menu.

The RUS desktop interface is currently available in English, Dutch, French, German, Italian and Russian. By default, the RUS Desktop will attempt to determine the appropriate display language by checking the language preferences of the browser in use. If this fails, or the browser is using a language not yet available within the RUS desktop, English will be used as a fall-back.

If you wish to override the current display language, you can do so by selecting a different language within the Display language field. The change will take effect immediately.

### 3.5 Keyboard

This section reminds the default configuration for the keyboard available in the working environment and explains how the user can customize it.

Some key combinations are impossible to press within a Web application because they are reserved by the operating system (for example Ctrl+Alt+Del or Alt+Tab) or by the Web browser. If you press one of these reserved combinations, the effect will be observed locally, not remotely, and the remote desktop will receive only some of the keys.

The RUS desktop provides an on-screen keyboard which allows keys to be sent to the remote desktop without affecting the local system (Figure 7 and Figure 8). If the device you are using does not have certain keys which the remote desktop depends on, such as the arrow keys or the Ctrl key,
you can use the on-screen keyboard for this too. You can show the on-screen keyboard by selecting the *On-screen keyboard* option from the menu.

![On-screen keyboard](image)

**Figure 7. Accessing the RUS on-screen keyboard**
Clicking (or tapping) the buttons of the on-screen keyboard has the same effect as pressing the same buttons on a real one, except that the operating system and browser will not intercept these keypresses, which will only be sent to the remote desktop.

The RUS desktop default keyboard language is **English US**. If you want to change it,

- Open the desktop contextual menu and go to the section *Applications > Settings > Keyboard.*
Select the *Layout* tab and uncheck the *Use system defaults* option to enable the other options.
Figure 11. Changing the keyboard language (step 2)

Press the Add button to make the Keyboard layout selection window appear, then select the layout you desire and press OK to add this layout to the Keyboard layout list.

Figure 12. Changing the keyboard language (step 3)
At last, select the layout you desire in the **Keyboard layout** list and bring it to the top of the list using the arrow button.

![Keyboard layout list](image)

**Figure 13. Changing the keyboard language (step 4)**

### 3.6 Shortcuts

This section reminds the default configuration for the shortcuts available in the working environment.

These shortcuts aim at accessing rapidly to the most used or most relevant applications. They are split in 2 groups:

- **Direct shortcuts** (at the right of the screen): these shortcuts can be used to access some clearly identified applications among those specifically installed in the working environment for the RUS users (SNAP, Monteverdi or BRAT for image processing, QGIS for GIS management or Firefox for Web browsing). Other shortcuts can be added by the users at their convenience.

- **Generic shortcuts** (at the bottom of the screen): these shortcuts can be used to access standard applications or commands available in the RUS working environment (minimisation of all opened windows, terminal emulator, file manager, Web browser, application finder, access to the user home folder).
Figure 14. Shortcuts available on the RUS virtual desktop
4. Using your working environment

This chapter presents some basic functionalities of the working environment and explains how the user can use them.

4.1 File edition

This section presents the tools available to edit files in the user’s working environment and explains how he/she can use them.

Depending on the type and length of file you are working with, and the kind of edition you are doing, you may select one the following tools which are available in your working environment for file edition:

- Mousepad
- Vim
- LibreOffice Writer

4.2 File exchange

This section presents the tools available to exchange files between the user’s working environment and own PC and explains how to use them.

4.2.1 Single file import in your working environment

This section explains how the user can import a single file from a local PC to the working environment.

If you want to transfer a file from a remote PC, just select the file in the file browser window of this PC and drag and drop it to the RUS desktop. The file will automatically be stored on the desktop. You will then be able to move it to another folder.

Beware this applies to import only one file at a time. If you need to transfer for instance a folder including several files, you should first gather this folder and its content in an archive file, then transfer the archive file which will be considered as a single item.

The maximum allowed size for a file to import is set to 10 GB. Beyond that limit, the integrity of the imported file is not ensured.

4.2.2 Single file transfer from or to your working environment

This section explains how the user can transfer a single file between a working environment and a local PC.

A file can be transferred between the RUS working environment and a remote PC through the file browser located in the RUS desktop menu:

- Clicking on the Devices filesystem opens a file browser which lists the files and directories within that filesystem.
Double-clicking on any folder will move the file browser current location to that folder, updating the list of files shown as well as the "breadcrumbs" at the top of the file browser. Clicking on any of the folder names listed in the breadcrumbs will bring you back to that directory, and clicking on the drive icon on the far left will bring you all the way back to the root level.

Downloads are initiated by double-clicking on any file shown, while uploads are initiated by clicking the Upload Files button. Clicking Upload Files will open a file browsing dialog where you can choose one or more files from your local computer, ultimately uploading the selected files to the directory currently displayed within the file browser.

The state of all file uploads can be observed within the notification dialog that appears once an upload begins, and can be cleared once completed by clicking the "Clear" button. Downloads are tracked through your browser's own download notification system.
4.2.3 File transfer using FTP

This section explains how the user can transfer files between a local PC and the working environment using the FTP client available in the latter.

To transfer files to or from your working environment using FTP, you must proceed as follows:

✔ Activate the FileZilla FTP client by browsing the Applications > Network menu and selecting the FileZilla item

![FileZilla FTP client](image)

**Figure 17. Accessing to the FileZilla FTP client**

✔ Define the FTP server you want to connect to through the File > Site Manager menu and entering the corresponding parameters
Figure 18. Defining a FTP server using the FileZilla interface

✓ Connect to the FTP server and retrieve the file(s) you are interested in.

4.3 Remote sensing data retrieval

This section explains how the user can retrieve remote sensing data directly from the working environment.

Several options are available with regard to that point:

✓ Retrieving remote sensing data through to the Copernicus Open Access Hub;
✓ Retrieving remote sensing data from other Internet based sources;
✓ Retrieving remote sensing data using file transfer.

4.3.1 Remote sensing data retrieval through to the Copernicus Open Access Hub

This section explains how the user can retrieve remote sensing data from the working environment using the Copernicus Open Access Hub. This approach only applies to Sentinel-1, 2 and 3 imagery and requires the user to have an account on the Copernicus Open Access Hub.

4.3.1.1 Direct retrieval

To retrieve directly Sentinel-1, 2 or 3 from the Copernicus Open Access Hub, you must proceed as follows:

✓ Once you are connected to your working environment, open up the Web browser and browse the Copernicus Open Access Hub (https://scihub.copernicus.eu) (Figure 19)
Connect to the Open Hub with your corresponding credentials (Figure 20)

Build your data query through the Open Access Hub interface (Figure 21). Should you need more information at this stage, please refer to the Copernicus Open Access Hub User Guide.
Once the results of your query are available (Figure 22), select each image you want to retrieve and download it or select the images you are interested in by group and add them to your download cart (NB: if you use the Select all option, please be aware that it applies only to all the images visible at the same time on the result page and not to all the results of your query).

Figure 22. Retrieving the results of a query on the Copernicus Open Access Hub
The images you have selected will be downloaded as a standard in the `/home/rus` folder of your working environment. In order to ensure an optimized use of the available storage, it is recommended to transfer them to the `/shared` folder or to any subfolder of the latter.

### 4.3.1.2 Script based retrieval

It is also possible to retrieve Sentinel-1, 2 and 3 data from the Copernicus Open Access Hub in an automated way using the command line tool `scihub_download`.

This tool is based on the `Sentinelsat` utility (documented at [https://sentinelsat.readthedocs.io](https://sentinelsat.readthedocs.io)). It also requires the use of a configuration file with the extension `.yml` or `.yaml`.

Detailed information related to the use of this command line tool and of its configuration file is given in Appendix 1 - Retrieving Sentinel data from the Copernicus Open Access Hub.

### 4.3.2 Remote sensing data retrieval from Internet

This section explains how the user can retrieve remote sensing data from the working environment using Internet based catalogues. This approach applies to imagery provided by any sensor except Sentinel-1, 2 and 3 and requires the user already has an account on the corresponding sensor online catalogue.

To retrieve remote sensing data from Internet, you must proceed as follows:

✔ Once you are connected to your working environment, open up the Web browser and browse the catalogue corresponding to the sensor you are interested in.

✔ Connect to this catalogue with your corresponding credentials (if any).

✔ Build your data query on this catalogue using the available query tool (if any).

✔ Once the results of your query are available, select the images you want to retrieve and download them.

The images you have selected will be downloaded as a standard in the `/home/rus` folder of your working environment. In order to ensure an optimized use of the available storage, it is recommended to transfer them to the `/shared` folder or to any subfolder of the latter.

### 4.3.3 Remote sensing data retrieval using file transfer

This section explains how the user can retrieve remote sensing data from the working environment using file transfer. This approach applies to imagery already available at your premises.

To retrieve remote sensing data from your PC, select the corresponding file on your local environment and refer to section 4.2.1 regarding file import.

### 4.4 Other data retrieval

This section explains how the user can retrieve other data directly from the working environment.

Several options are available with regard to that point:

✔ Retrieving other data from Internet based sources;

✔ Retrieving other data using file transfer.
4.4.1 Other data retrieval from Internet

This section explains how the user can retrieve other data from the working environment using Internet based catalogues. This approach may require the user already has an account on the corresponding data online catalogue.

To retrieve other data from Internet, you must proceed as follows:

✓ Once you are connected to your working environment, open up the Web browser and browse the catalogue corresponding to the type of data you are interested in.
✓ Connect to this catalogue with your corresponding credentials (if any).
✓ Build your data query on this catalogue using the available query tool (if any).
✓ Once the results of your query are available, select the files you want to retrieve and download them.

The files you have selected will be downloaded as a standard in the /home/rus folder of your working environment. In order to ensure an optimized use of the available storage, it is recommended to transfer the files to the /shared folder or to any subfolder of the latter.

4.4.2 Other data retrieval using file transfer

This section explains how the user can retrieve other data from the working environment using file transfer. This approach applies to data already available in your premises.

To retrieve other data from your PC, select the corresponding file on your local environment and refer to section 4.2.1 concerning file import.
5. Monitoring your working environment

From the portal, the user can access a monitoring dashboard to visualize the environment’s resources consumption (processor, memory etc.). When the environment is composed of a cluster, it is possible to select either a global view or a view of a specific node.

![Monitoring dashboard screenshot](image)

**Figure 23. Access to the monitoring dashboard from the portal**
Figure 24. Monitoring dashboard view (desktop version)

A user can also monitor a virtual machine from a mobile phone.
Figure 25. Monitoring dashboard view (mobile version)
6. Managing your working environment

This chapter presents the functionalities available to manage the user’s working environment and explains how to use them.

6.1 Virtual Machine management

6.1.1 Freeze (unfreeze) your working environment

When the environment is not used, it is possible to stop it from the portal dashboard with the “Freeze/Unfreeze” link. This operation is equivalent to power off your computer when you leave your office so take care of closing properly all your running tasks before doing so. When you want to use your environment again, go to the dashboard and click on the link to unfreeze it. This operation may take a few moments before your environment is ready.

![Figure 26. How to freeze a Virtual Machine](image)

6.1.2 Report a technical incident

Whenever you encounter troubles to access your environment or if it is non-responsive, you can submit a technical incident report from your portal dashboard. This report will be treated and tracked by our support which will contact you in case more detailed information is needed.
6.2 Software and library installation

This section explains how the user can install software and libraries he needs on the working environment. A list of software already available in RUS working environments can be found in the “RUS Preinstalled Software List” document.

The `sudo` command offers a mechanism to provide trusted users with administrator access to a system without sharing the password of the root user. When a user who has been granted access via this mechanism precedes an administrator command with `sudo`, the command is executed as if run by the root user.

The `rus` user is a trusted user so you can use `sudo` command to install libraries and tools.

The tools described in the following chapters are command line tools you can access from a terminal.

To open a terminal, click on the terminal icon on your desktop toolbar (Figure 28).
6.2.1 Update software with Apt tool

When entering your environment for the first time, we recommend you update the list of files available in apt repositories that listed in the configuration file /etc/apt/sources.list. To do this, run:

```
>> sudo apt update
```

*Warning:* we recommend you execute this command line on a regular basis to keep your work environment up-to-date. Note that only software listed in the configuration file will be updated.

6.2.2 Install an Ubuntu package

To install an Ubuntu package you can use the command line tool apt, for example the command

```
>> sudo apt install r-cran-cmdr
```

installs the Rcmdr tool.
6.2.3 Install Python libraries with Pip

To install a python package, you can install either `pip` for python 2.7 packages or `pip3` for python 3.5 packages.

For example, the command `sudo pip install glumpy` installs glumpy library for python 2.7 and the command `sudo pip3 install glumpy` install glumpy library for python 3.5.

6.2.4 Install Git client

To install a git client, run the following command:

```
>> sudo apt install gitk gitg
```

6.2.5 Limitations

As demonstrated in previous sections, RUS users can install software in the working environment. Installation and use of such software must comply with the license under which it has been released, whether it is free or commercial.

We request RUS users to read carefully the software license before proceeding with any installation in their working environment.
6.3 Cluster management for advanced users

In this section, we will see how to setup your environment to get benefit from your cluster to perform distributed tasks through Secure Shell (SSH) with DASK, a “flexible parallel computing library for analytic computing”. We will first setup SSH keys to connect remotely to your nodes, then we will setup Parallel SSH (PSSH) to send one command to all your nodes in one shot, and eventually we will show you how to run a MapReduce operation with DASK.

6.3.1 Cluster configuration

A cluster is composed of one front machine that is accessible using the Web remote desktop environment and between 0 and 10 computing nodes:

- The front node is named front-<usr id>, for example: front-test-000.
- Computing nodes are named node-<usr id>_X where X is the node number. Nodes are numbered from zero.

For example a cluster of 3 nodes, your environment is composed of a front node (front-test-000) and 2 computing nodes: node-test-000_0 and node-test-000_1.

On the computing nodes the user rus is defined and the password of this user is rus.

![](image)

Figure 30. Test if your node is accessible with the ping command
6.3.2 **SSH keys configuration to connect to your nodes**

This section explains how the user can configure SSH keys when a working environment includes a cluster of Virtual Machines. SSH keys are necessary to connect to your nodes without password requirement (useful when you write scripts).

6.3.2.1 **Generate SSH key**

With OpenSSH, an SSH key is created using `ssh-keygen`. In the simplest form, just run `ssh-keygen` and answer the questions:

![Image of SSH key generation process]

```
Generating public/private rsa key pair.
Enter file in which to save the key (/home/rus/.ssh/id_rsa): 
Created directory '/home/rus/.ssh'.
Enter passphrase (empty for no passphrase): 
Enter same passphrase again: 
Your identification has been saved in /home/rus/.ssh/id_rsa.
Your public key has been saved in /home/rus/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:VLTba8Cqg40y/T+T7QUtBSzwLkgW6bMXusyGpaUdmPY rus@front-test-000
The key's randomart image is:

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rus@front-test-000:/$
```

Creating a key pair (public key and private key) takes a minute only. The key files are usually stored in the `~/.ssh` directory.

6.3.2.2 **Copy SSH key to server**

Once a key has been created, the `ssh-copy-id` command can be used to install it as an authorized key on the server. Once the key has been authorized for SSH, it grants access to the server without a password. The key based authentication is called public key authentication.

Use a command like the following to copy SSH key:

```
>> ssh-copy-id -i ~/.ssh/id_rsa front-test-000
```

Repeat the procedure for all your computing nodes: node-test-000_0, node-test-000_1.
Figure 32. Using ssh-copy-id

This logs into the server host, and copies keys to the server, and configures them to grant access. The copying may ask for a password or other authentication for the server.

Only the public key is copied to the server. The private key should never be copied to another machine.

6.3.2.3 Test the new key

Once the key has been copied, it is better to test it:

```
ssh node-test-000_0
```

The login should now complete without asking for a password. Note, however, that the command might ask for the passphrase you specified for the key.

6.3.3 PSSH configuration

This section explains how the user can configure Parallel Secure Shell (PSSH) keys when a working environment includes a cluster of Virtual Machines.

PSSH provides parallel versions of SSH and related tools. Included are pssh, pscp, prsync, pnuke, and pslurp.

6.3.3.1 Install

PSSH install is straightforward:

```
sudo pip install pssh
```

6.3.3.2 Configuration

For a cluster of 3 nodes named test-000, your environment is composed of a front node (front-test-000) and 2 computing nodes: node-test-000_0 and node-test-000_1.

In the your home directory create a file named .cluster
6.3.3.3 Examples

To test the configuration run

```
$ pssh -h ~/cluster -P uname
```

![Figure 33. Testing the PSSH configuration](image)

6.3.4 DASK configuration

This section explains how the user can configure DASK when a working environment includes a cluster of Virtual Machines.

Dask.distributed is a lightweight library for distributed computing in Python that meets the following needs:
✓ **Low latency:** Each task suffers about 1ms of overhead. A small computation and network roundtrip can complete in less than 10ms.

✓ **Peer-to-peer data sharing:** Workers communicate with each other to share data. This removes central bottlenecks for data transfer.

✓ **Complex Scheduling:** Supports complex workflows (not just map/filter/reduce) which are necessary for sophisticated algorithms used in nd-arrays, machine learning, image processing, and statistics.

✓ **Data Locality:** Scheduling algorithms cleverly execute computations where data lives. This minimizes network traffic and improves efficiency.

✓ **Familiar APIs:** Compatible with the concurrent.futures API in the Python standard library. Compatible with DASK API for parallel algorithms

### 6.3.4.1 Install

DASK install is very simple once pssh has been configured (see chapter 6.3.3)

```
pssh -h ~/.cluster -P sudo pip install paramiko dask[complete]
```

Installation can be checked as follows:

```
pssh -h ~/.cluster -P “pip list | grep dask”
```

![Figure 34. Checking DASK configuration](image)

### 6.3.4.2 Configuration

Running a DASK cluster is very easy:

```
dask-ssh --hostfile ~/.cluster
```
6.3.4.3 Examples

The figure below illustrates how running a MapReduce using DASK is simple.

To go further in the usage of DASK please read:
7. Appendix 1 - Retrieving Sentinel data from the Copernicus Open Access Hub

This appendix explains how to retrieve Sentinel data from the Copernicus Access Hub in batch mode.

7.1 The scihub_download command line tool

The `scihub_download` command line tool has been developed to support Sentinel data retrieval in batch mode.

The main steps to use it on your working environment consist in:

- Open a terminal and create a folder that will become your data repository:
  
  `mkdir -p /shared/mydata`

- Generate an empty configuration file for the `scihub_download` command line tool:
  
  `scihub_download --example my_file.yml`

- Edit the configuration file and adapt the parameters to your data query.

  If the `username` and `password` fields are not mentioned in the configuration file, you will be prompted to enter them. They can also be overloaded using command line options `-u` for the `username` and `-p` for the password. In this last case, you will be prompted for them even if the corresponding fields are not empty in your configuration file.

- Test the configuration file through a dry run:
  
  `scihub_download -n my_file.yml`

  This command list the files selected for downloading. It will also allow you to assess the storage capacity needed to retrieve the products you are interested in.

  You can also get additional information on the products through a verbose dry run with the `-v` flag:

  `scihub_download -vn my_file.yml`

  If you provide more verbose flags (up to 3, like “-nvvv”), you will see the whole product metadata. of the products

- Start download:
  
  `scihub_download my_file.yml`

7.2 The `scihub_download` configuration file

The `scihub_download` configuration file includes 3 sections: `general`, `query_options` and `filtering_options`. All fields in the file have a comment to explain their purpose and how to fill them.

Before using such a file, you should at least fill the following fields:

- **destination**: this field indicates the folder where your data will be downloaded. It is prefilled with `/shared` and we strongly recommend to use this path as a parent directory for your data destination folder as it is the mount point of your data disk. Unlike your system disk, your data disk should be large enough to store all your data.
✓ **platformname**: name of the platform from where data come from.
✓ **beginposition**: date of the first sensing time.
✓ **endposition**: date of the last sensing time.
✓ **footprint type**: type of the footprint considered for data retrieval (coordinates, point, geojson or wkt).
✓ **footprint source** or **footprint value**: if you want to use a geojson or wkt file, use the source field with the path to the corresponding file. Otherwise, use the value field. With the coordinates type, value consists in 4 key-value pairs corresponding to the coordinates of two opposite corners of a rectangular footprint.

A special field is the **minimum_overlap** percentage under the filtering_options section: after having downloaded the metadata of the products that fulfill your request, their footprint will be compared of the products against your area of Interest. Only select the products overlapping this area at least for the give percentage will be retrieved.

### 7.3 Limitations

Some constraints are introduced by the Copernicus Open Access Hub:

✓ As some time is necessary to propagate your credentials for the Copernicus Open Access Hub to the endpoint used by the scihub_download tool to connect to the data catalogue, you might not be able to run the command line tool right after you have registered to the Copernicus Open Access Hub and have to wait a couple of days. This is also the case if you change your password on the Copernicus Open Access Hub.

✓ The maximum simultaneous number of connections allowed for a given user to the Copernicus Open Access Hub is set to 2. Therefore, if you run more than 2 data retrieval operations at the same time, one of them might end up in error.

Other constraints are related to the use of a GIS layer to define your area of interest in the scihub_download configuration file:

✓ If this GIS layer is a Shapefile entitled my_Aoi, you should first convert it to the GeoJSON format with the following command:

```
ogr2ogr -f geoJSON -lco COORDINATES_PRECISION=2 my_Aoi.json my_Aoi.shp
```

✓ If the GIS layer representing your area of interest is very detailed, it may overrides the capacity of the Copernicus Open Access Hub (the maximum number points for the definition of a footprint is 200).

In this case, you will need to process to an extra step and simplify your geoJSON file. This can be done for instance interactively through the MapShaper website (http://mapshaper.org) where you can load your geoJSON file, enter a simplification rate, visualize the result and export it if your needs are satisfied.