ePOM

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CHAPTER

ONE

IN BRIEF

The **e-learning Python for Ocean Mapping** (ePOM) project provides collections of Jupyter notebooks to learn Python with a focus on Ocean Mapping.

1.1 Rationale

Given the variety of backgrounds of Ocean Mapping students and the fact that some of them have limited programming experience, there is a need to ensure a minimum common level of programming skills. Python is a natural choice as a means to provide those skills. The language is simple to learn for inexperienced programmers, increasing popular, and freely available.

Based on such considerations, the ePOM project was established.

The teaching goals are to familiarize Ocean Mapping students with key programming concepts and, at the same time, to teach them programming habits and skills that can be potentially translated to other programming languages. Given the popularity of Python, there is a lot of online material about the language. This can be overwhelming. Thus, ePOM aims to help the students to navigate their way through the huge amount of help and online resources. Last but not least teaching goal, ePOM aims to provide enough basic Python skills to ease the first lab assignments.

CHAPTER

TWO

HOW TO ACCESS THE NOTEBOOKS

The **e-learning Python for Ocean Mapping** (ePOM) notebooks can be accessed in the three alternative ways:

- By accessing the CCOM/JHC *servers*.
- By installing NOAA Pydro *(Windows-only)*.
- By cloning the ePOM's GitHub repositories.

2.1 Access to the CCOM/JHC ePOM Servers

This option relies on the CCOM/JHC ePOM *servers*. It is the easiest way to obtain access to the ePOM notebooks. You only need:

- An updated, modern *browser* (e.g., Mozilla Firefox, Google Chrome, Apple Safari).
- An Internet connection.

The CCOM/JHC ePOM *servers* are configured with a Python environment that has JupyterHub and all the required packages to run the notebooks. In order to access the CCOM/JHC ePOM *servers*, you need an username. For obtaining an username, write to epom@ccom.unh.edu.

Once obtained the username, read the following instructions:

- *Programming Basics with Python - Quick Start*
- *Introduction to Ocean Data Science - Quick Start*

2.2 Installation of NOAA Pydro

NOAA Pydro is a free suite of open-source software tools used to support hydrography and cartography. You can download the NOAA Pydro installers from the NOAA Pydro download page. Pydro **only** works on Windows.

To have a full NOAA Pydro installation, download the following two files into the same folder, then run the *PydroSetup* installer. It will automatically find and install the *PydroSupplemental* installer.

The ePOM notebooks are part of NOAA Pydro. Once that you have installed NOAA Pydro, you can access the notebooks through a menu entry in Pydro Explorer (Fig. 2.1).

Pydro Explorer also provides the option to remove all the applied changes and thus restore the initial notebooks.

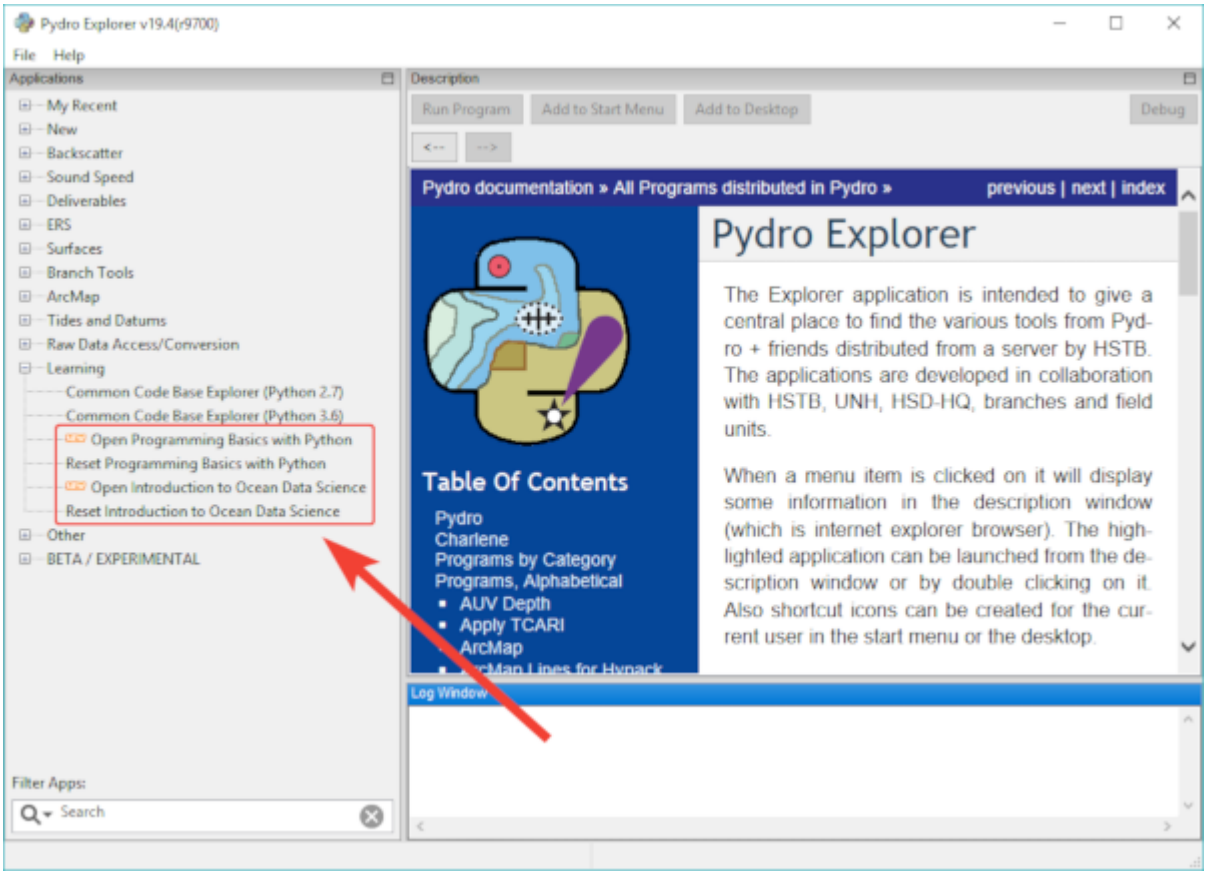


Fig. 2.1: The **Programming Basics with Python** menu entry in Pydro Explorer.

2.3 Cloning the GitHub Repositories

This third option assumes some previous knowledge on how to use git and create a NOAA Pydro environment.

A common use case for this option is the willingness to contribute to the ePOM project by proposing improvements.

You can access (and clone) the ePOM's GitHub repositories at the following urls:

- Programming Basics with Python
- Introduction to Ocean Data Sciene

CHAPTER

THREE

PROGRAMMING BASICS WITH PYTHON - QUICK START

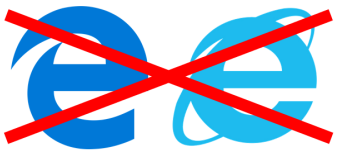
3.1 Introduction

Programming Basics with Python is a collection of *notebooks* that aims to teach you *programming* basics in *Python*, assuming *zero knowledge* on the subject, in preparation for the labs and exercises in the Ocean Mapping courses.

You will **not** need to install *Python* on your computer, since the *notebooks* run on a CCOM/JHC *server* that has *Python* already installed.

Thus, what you need for this course is just:

- An updated, modern *browser* (e.g., Mozilla Firefox, Google Chrome, Apple Safari).
- An Internet connection.



To avoid visualization issues, please do **not** use Microsoft Edge, Microsoft Internet Explorer, or an outdated *browser* (e.g., Apple Safari is no longer updated for Windows). If you need to use one of these browsers, please contact us for specific instructions.

If you do not have access to a computer, you may use a tablet or a smartphone. In such a case, your user experience might be not optimal (due to the limited screen size and a few visualization issues).

3.2 First-time Access

If you landed on this page, you have likely got an email from CCOM/JHC. With the same email you should have also received:

- The following **quick-access url** to access the *notebooks* collection on the *server*: quick-access url.
- Your personal **username** to access the CCOM/JHC *server*.

Fig. 3.1: The login prompt that provides access to the CCOM/JHC *server*.

Each time that you use the **quick-access url** with your *browser*, you will be welcomed by a login prompt (Fig. 3.1).

The very first time that you follow the **quick-access url**, you have to put in the login prompt:

- In the **Username** field, the username that you received by email.
- In the **Password** field, a strong password of your choice.

You need to remember the chosen password since it will be used any time that you want to access again the CCOM/JHC *server*.

For any following access, use the **quick-access url**, your assigned **username**, and the **chosen password**.

3.3 Welcome Notebook

After the login to the *server*, a welcome *notebook* will be open (Fig. 3.2).

This *notebook* will provide you with:

- The minimal set of notions required to begin to use a *notebook*.
- Directions on how to access the other available *notebooks*.

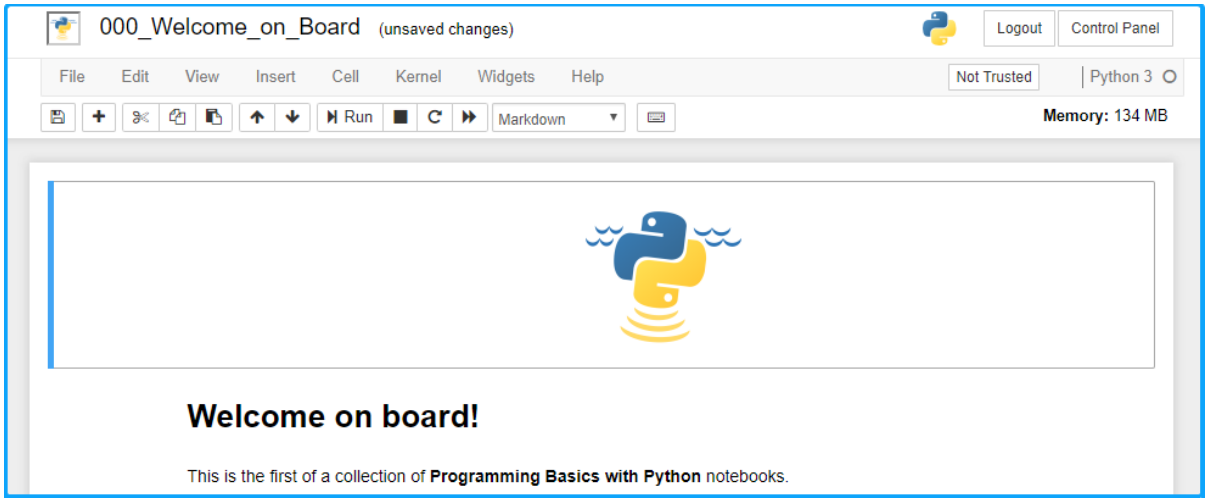


Fig. 3.2: The welcome *notebook*.

3.4 Support

If you experience difficulties in completing the **Programming Basics with Python** training, it is important to seek help from all sources before your arrival at CCOM/JHC, including fellow students and instructors. We are always willing to help!

For issues or suggestions related to the above directions, write to epom@ccom.unh.edu.

3.5 Supplementary Material

- *Cheat Sheets*
- *Past Evaluations*

Now you should be ready to go!

CHAPTER

FOUR

INTRODUCTION TO OCEAN DATA SCIENCE - QUICK START

4.1 Introduction

Introduction to Ocean Data Science is a collection of *notebooks* that aims to teach you basic concepts in ocean data science.

The notebooks assume the level of *Python* knowledge described in **Programming Basics with Python** notebooks. If you are not familiar with these latter notebooks, you should start from *Programming Basics with Python - Quick Start*.

4.2 Quick-Access Url

If you have already executed the *Programming Basics with Python* notebooks, you should know the mechanism on how to access the CCOM/JHC *server*. If you are not, see *First-time Access*.

The following **quick-access url** gives access to the *notebooks* collection on the *server*: quick-access url.

4.3 Support

For issues or suggestions related to the above directions, write to epom@ccom.unh.edu.

Fig. 4.1: The login prompt that provides access to the CCOM/JHC *server*.

CHAPTER

FIVE

INTRODUCTION TO OCEAN DATA SCIENCE - SLIDES

- Object-Oriented Programming
- Data Visualization
- Scientific Computing
- Raster and Vector Data Formats

For comments or suggestions related to the above slides, write to gmasetti@ccom.unh.edu.

CHAPTER

SIX

FUNDAMENTALS OF RESEARCH SOFTWARE DEVELOPMENT - SLIDES

- Introduction
- Integrated Development Environment
- Code Version Control

For comments or suggestions related to the above slides, write to gmasetti@ccom.unh.edu.

CHAPTER

SEVEN

SIGNAL CONDITIONING AND FILTERING - QUICK START

7.1 Introduction

Signal Conditioning and Filtering is a collection of *notebooks* that aims to teach you basic concepts in digital signal processing.

The notebooks assume the level of *Python* knowledge described in **Programming Basics with Python** notebooks. If you are not familiar with these latter notebooks, you should start from *Programming Basics with Python - Quick Start*.

7.2 Quick-Access Url

If you have already executed the *Programming Basics with Python* notebooks, you should know the mechanism on how to access the CCOM/JHC *server*. If you are not, see *First-time Access*.

The following **quick-access url** gives access to the *notebooks* collection on the *server*: quick-access url.

7.3 Support

For issues or suggestions related to the above directions, write to epom@ccom.unh.edu.

Fig. 7.1: The login prompt that provides access to the CCOM/JHC *server*.

CHAPTER

EIGHT

HOW TO USE GIT - QUICK START

8.1 How to open a terminal

Once logged on the CCOM/JHC *server*, a preliminary step to use `git` is the opening of a terminal (Fig. 8.1).

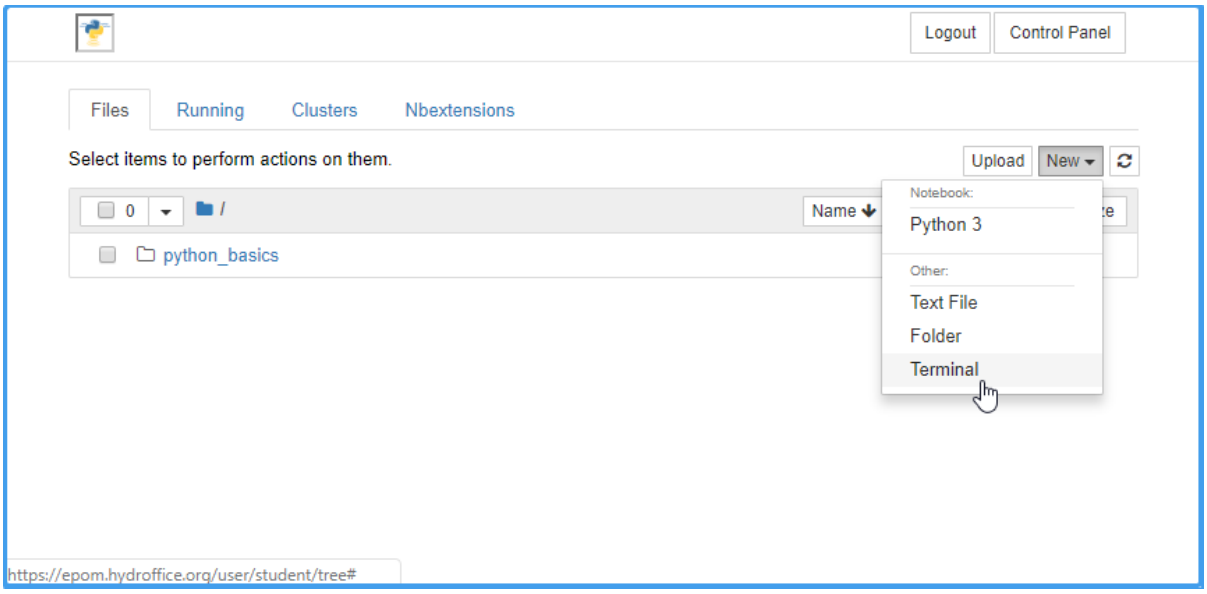


Fig. 8.1: How to open a terminal on the CCOM/JHC *server*.

8.2 How to create a new local repository

To create a new local `git` repository (Fig. 8.2):

- Create an empty folder with a name of your choice (e.g., `mkdir my_repo`).
- From within the created folder (e.g., `cd my_repo`), execute `git init`.

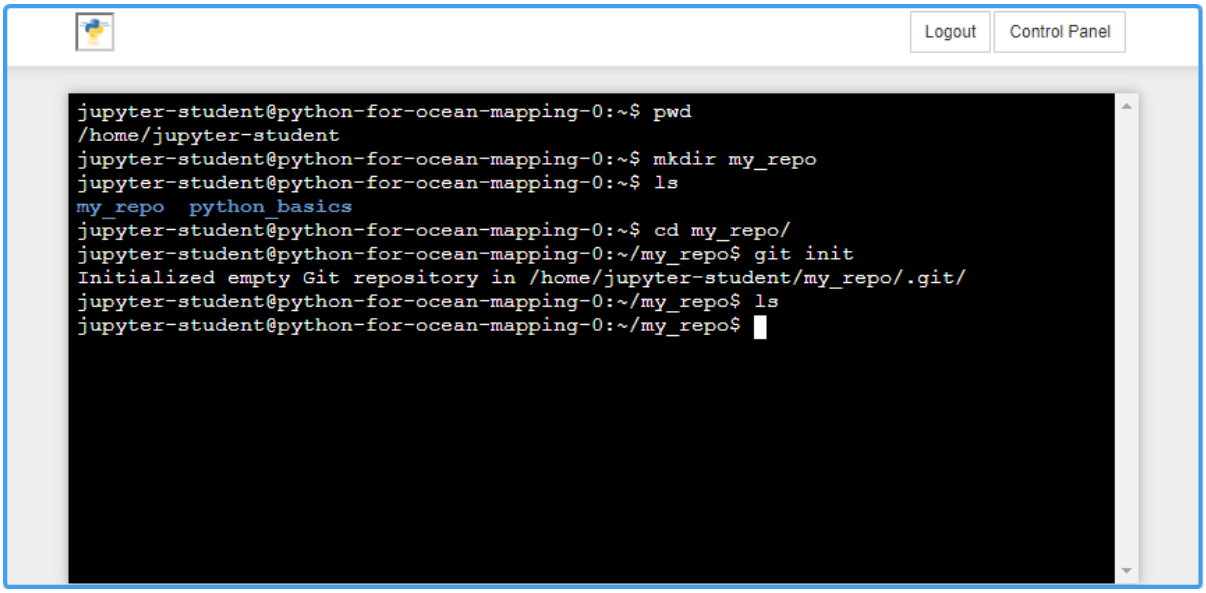


Fig. 8.2: How to create a new `git` repository.

8.3 How to make the first commit

Before committing the code, you need to set name and email to identify who submitted a change:

```
git config --global user.email "my_email@example.com"
git config --global user.name "My Name"
```

Now an example of commit (Fig. 8.3). We first create a file (i.e., a README file) with a basic welcome message, then:

- The created file is added to the tracked files with `git add`.
- The above change to the repository is committed with `git commit`.

```
echo "Welcome to my repository!" >> README.rst
git add README.rst
git commit -m "First commit"
```

8.4 How to set and push to a remote repository

You first need to create a repository on an `git` hosting services such as GitHub (Fig. 8.4), GitLab, and BitBucket.

Once that that a remote repository is created, an url similar to the following one will be available:

- `https://github.com/hydroffice/my_repo.git`

You set the above url as the remote repository (this operation usually only happens once, at the creation time):

```
git remote add origin https://github.com/hydroffice/my_repo.git
```

Then, you push to the remote repository each time that you want to remotely store your changes:

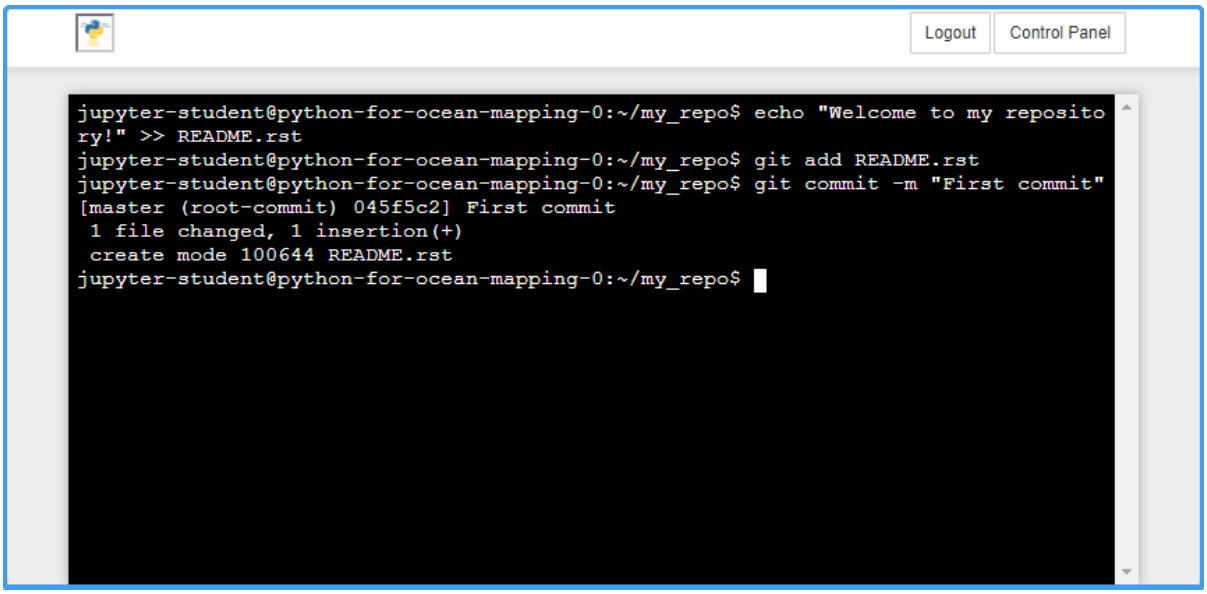


Fig. 8.3: Example of first commit.

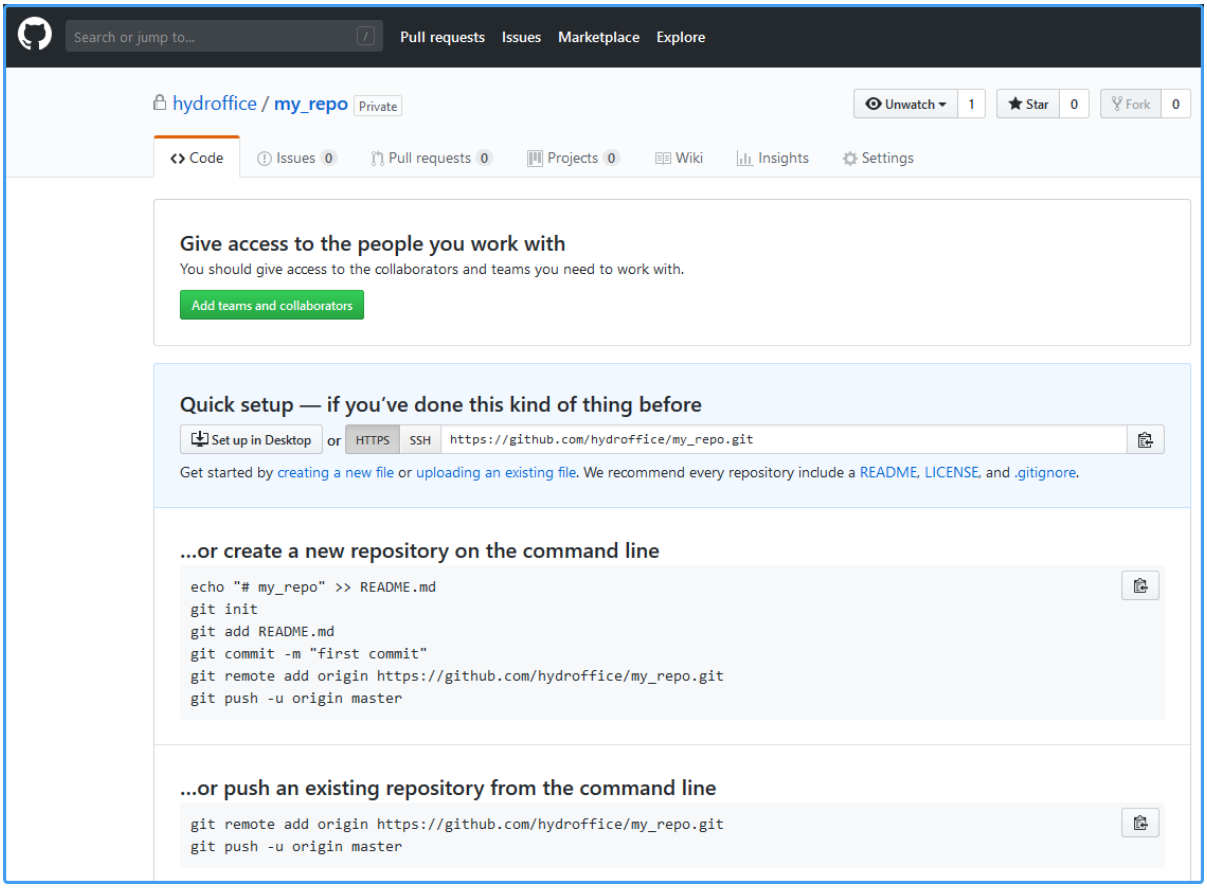


Fig. 8.4: Example of remote repository created on GitHub.

```
git push -u origin master
```

You will be asked to authenticate yourself on the hosting service of your choice (Fig. 8.5).

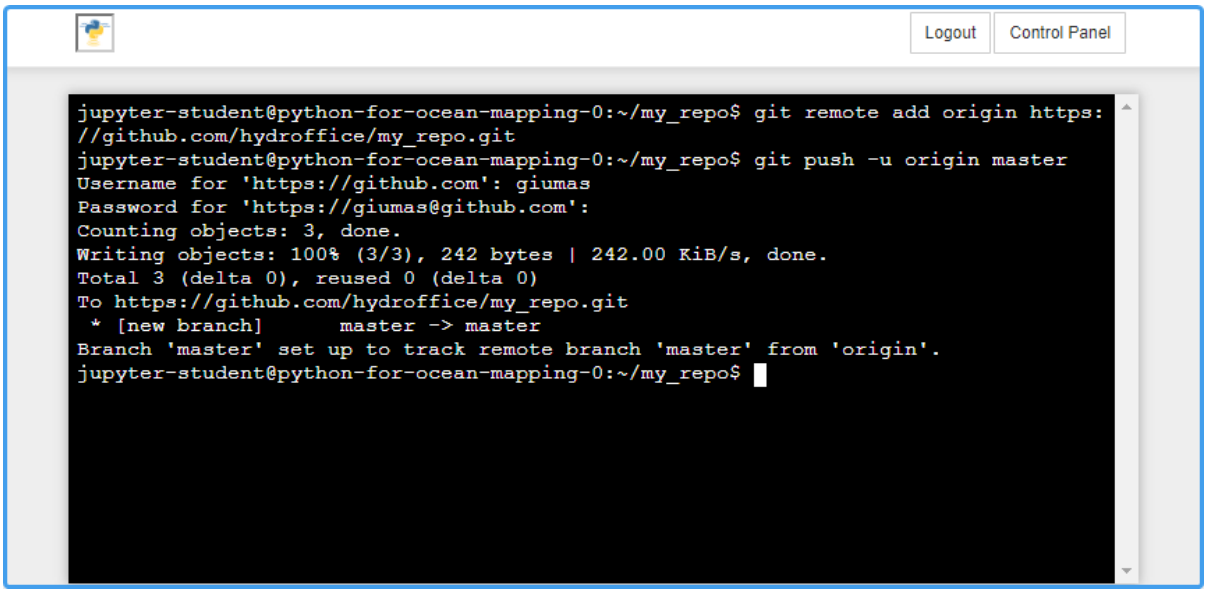


Fig. 8.5: Example of how to push changes to a GitHub repository.

After that the `push` operation is completed, you should be able to visualize your updated code on the hosting service (Fig. 8.6).

8.5 Other useful `git` operations

- To display all the changes for both tracked and un-tracked files:

```
git status
```

- To display changes only to tracked files:

```
git diff
```

- To add a specific file (e.g., "Lecture0.ipynb") to the tracking for the next commit:

```
git add Lecture0.ipynb
```

- To commit all local changes in tracked files (`-a`) with a message (`-m "Latest changes"`)

```
git commit -a -m "Latest changes"
```

- To download all changes from a remote repository (e.g., "origin"):

```
git pull origin
```

- To discard all the local changes to tracked files. **You will lose all the unpushed changes!!!**

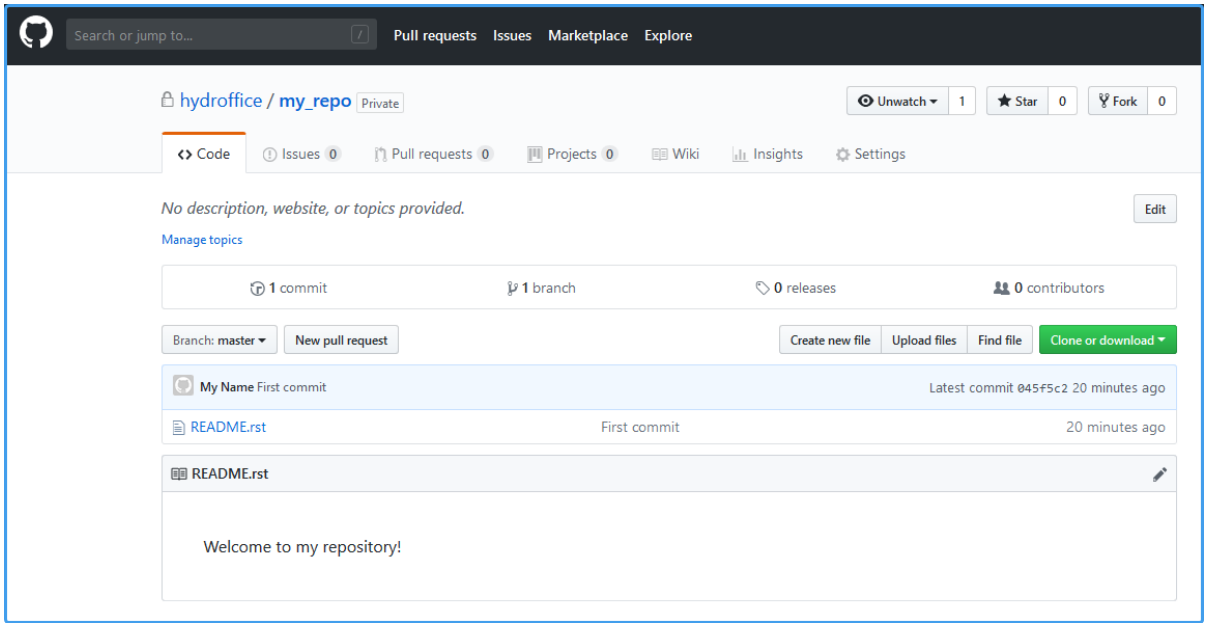


Fig. 8.6: Results on the GitHub repository after the `push` action for a first commit.

```
git reset -hard HEAD
```

8.6 Useful references

- git Documentation
- GitHub's git cheat sheet
- Tower's git cheat sheet

CHAPTER

NINE

CHEAT SHEETS

- Programming Basics with Python - Cheat Sheet
- Matplotlib - Cheat Sheet (external link)
- Numpy - Cheat Sheet (external link)

CHAPTER

TEN

PAST EVALUATIONS

- Programming Basics with Python
  - Evaluation 000 (see Solutions for Evaluation 000).
  - Evaluation 001 (see Solutions for Evaluation 001).

CHAPTER

ELEVEN

GLOSSARY

browser Software that allows to retrieve and display web pages.

notebook An interactive computing environment with text, code, and multimedia content in a single file.

programming The process of creating a computer program to achieve one or more computing tasks.

Python A very popular programming language with applications in widely different fields.

server A computer which manages the access to network resources and/or services.

CHAPTER

TWELVE

CREDITS

12.1 Authors

The e-learning Python for Ocean Mapping (ePOM) project is developed and maintained by:

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Feel free to contact us for comments and suggestions.

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12.2 Contributors

The following wonderful people contributed directly or indirectly to this project:

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- Jeff Douglas
- Jenn Dijkstra
- Mike Smith
- Tomer Ketter
- Val Schmidt
- Jordan Chadwick

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