



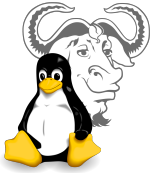
# Technical Aspects

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## I.1 How to open the terminal



### GNU/Linux

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You can either:

- ✓ Open the Dash by clicking the Ubuntu icon in the upper-left, type "terminal", and select the Terminal application from the results that appear.
- ✓ Hit the keyboard shortcut `Ctrl-Alt + T`



### MacOS

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- ✓ Press `cmd /⌘ +` . The search bar will open.
- ✓ Write "terminal" and press the return key `↵`





### Windows

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- ✓ Press `Win + R` to open RUN dialog box.
- ✓ Write "cmd", and click/tap on OK.

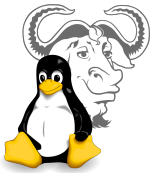
## I.II Paths and useful commands

GNU/Linux and MacOS are based on UNIX, therefore all the commands are similar for both OS. Windows, on the other hand, uses different command lines.

			
<b>Path</b>	Comment	Paths are written using "/"	Paths are written using "\"
	Example	/Users/user/Desktop	c:\Users\user\Desktop
<b>Change directory</b>	Command	<b>cd</b>	<b>cd</b>
	Example	cd dirname	cd dirname
<b>Create a new directory</b>	Command	<b>mkdir</b>	<b>mkdir</b>
	Example	mkdir dirname	mkdir dirname
<b>View the contents of a directory</b>	Command	<b>ls</b>	<b>dir</b>
<b>Print current working directory</b>	Command	<b>pwd</b>	<b>cd</b>
<b>Move (rename) a file/directory</b>	Command	<b>mv</b>	<b>move</b>
	Example	mv infile outfile	move infile outfile
<b>Copy a file</b>	Command	<b>cp</b>	<b>copy</b>
	Example	cp file filecopy	copy file filecopy
<b>Copy a directory</b>	Command	<b>cp -r</b>	<b>xcopy</b>
	Example	cp -r dir dircopy	xcopy dir dircopy
<b>Remove a file</b>	Command	<b>rm</b>	<b>del</b>
	Example	rm filename	del filename
<b>Remove a directory</b>	Command	<b>rm -r</b>	<b>rd</b>
	Example	rm -r dirname	rmdirname

## I.III Text editors (suggestions)

This is a list of some text editor that may be useful for this course.





### GNU/Linux

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- ✓ You can use the default text editors in GNU/Linux: **Emacs** or **Vim**.

Quick reference cards:



1. [Emacs reference card](#) 
2. [Vim quick reference card](#) 



### MacOS

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- ✓ You can install **Emacs** or **Vim** for Mac.

- Emacs: <https://emacsformacosx.com> 
- Vim (macVim): <https://github.com/macvim-dev/macvim> 

- ✓ Another alternative is to install **Xcode** (it may be useful in the future).

- Open up the App Store application and search for "*Xcode - the suite of tools for developers*"
- Agree to Xcode licence. Once Xcode is downloaded, open up the Terminal app and type:  

```
sudo xcodebuild -license
```
- Hit spacebar a few times as directed and then type: 'agree'.



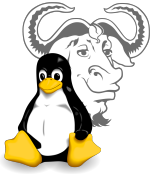
### Windows

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- ✓ You can use the default text editors in Windows: **Notepad** or **Wordpad**.

- ✓ Another recommended alternative is **Notepad++**. You can download it from:

<https://notepad-plus-plus.org/download/v7.3.html> 



### GNU/Linux

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- ✓ GNU/Linux should include by default the gfortran libraries. However, in case it is not installed, open up the terminal and type:


```
sudo apt-get install gfortran
```



### MacOS

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- ✓ The "**GCC Wiki**" **implementation** described in the following procedure is typically the newest binary release of gfortran, but requires that you download a version appropriate for your architecture.

I - Visit the [GCC Wiki GFortranBinaries](#)  page and scroll to the MacOS section.

II - Download [gfortran-macosx-x86.dmg](#)  (Intel) or [gfortran-macosx-ppc.dmg](#)  (PowerPC).

III - If your browser did not automatically mount the disk image, the double-click the dmg file to mount and open it.

IV - Open the unmounted `gfortran-macosx-{architecture}-{version}` folder, double-click `gfortran.pkg`, and follow the prompts to install it.



### Windows

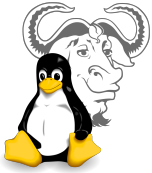
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- ✓ Stand-alone [gfortran binaries](#)  for Windows are available as an [installer](#) .

I - Download the installer, and run it.

II - Accept the GNU Public License, choose an directory to install gfortran, and let it work for you.

III - The installer sets your PATH environment variable, so that simply typing gfortran in a command prompt will run the compiler.




### GNU/Linux

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#### ✓ **Alternative I - Use a package manager to download libraries**

This approach is generally the easiest one provided you find a library which was compiled with the same compiler you plan to use (gnu gfortran for example). Make sure you install development libraries and Fortran interface libraries.

#### ✓ **Alternative II - Download the libraries from the source page**

You can download the gzipped tar file with the source code from:  
<http://www.unidata.ucar.edu/downloads/netcdf/index.jsp> 

To install it do the following. Untar the downloaded file and enter the directory with downloaded code:

```
tar -xzf netcdf-3.6.3.tar.gz
cd netcdf-3.6.3
```

Choose a directory where you want to install NetCDF, say `"/opt/netcdf/3.6.3"` (make sure that directory above it exists and is writable to you). Make sure that Fortran compiler is installed and is functional. Now, start the installation process. Inform the system which Fortran compiler you are going to use

```
export FC=gfortran
```

Configure the package giving it the desired location for installation

```
./configure --prefix=/opt/netcdf/3.6.3
```

Compile and install the package

```
make
make install
```



### MacOS

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*Taken from <http://mazamascience.com/WorkingWithData/?p=1474>*

#### I - Install Xcode

Open up the App Store application and search for Xcode — the suite of tools for developers.

#### II - Agree to Xcode license

Once Xcode is downloaded, open up the Terminal app and type:

```
sudo xcodebuild -license
```

Hit spacebar a few times as directed and then type: 'agree'.

#### III - Install MacPorts

Download the appropriate version of MacPorts from [www.macports.org/install.php](http://www.macports.org/install.php). Then click on the package to open up the package installer. After installation has finished you should close any Terminal windows and open up a new one that will now be aware of the new port command. Try it out with:

```
port help
...
port info netcdf
```

#### IV - Install netcdf libraries and associated tools

Each of the following installations will automatically install any dependencies.

```
sudo port install netcdf
...
port port install ncview
```

#### V - Make sure you have X11

To install X11 just open the Utilities folder on your machine and click on the X11 icon. If X11 is not installed you will be prompted to install it. This will take you to the <https://xquartz.macosforge.org> where you can download the disk image for the latest version of XQuartz.

Once the download is finished, double click on the XQuartz.dmg file and again on the XQuartz package and walk through the installer. The last instruction is to log out and back in again.



### Windows

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*Instructions provided by Jimmy Thelander*

#### I - Download MSYS2:

32 bit: <http://repo.msys2.org/distrib/i686/msys2-i686-20161025.exe>

64 bit: [http://repo.msys2.org/distrib/x86\\_64/msys2-x86\\_64-20161025.exe](http://repo.msys2.org/distrib/x86_64/msys2-x86_64-20161025.exe)

#### II - Install MSYS2

#### III - Start MSYS2

#### IV - Install compilers and dependencies

Type in the MSYS2 terminal (all in one line):

For 32-bit:

```
pacman -S mingw-w64-i686-gcc mingw-w64-i686-hdf5 gcc gcc-fortran tar zlib make
```

For 64-bit:

```
pacman -S mingw-w64-x86_64-gcc mingw-w64-x86_64-hdf5 gcc gcc-fortran tar zlib make
```

#### V - Download NetCDF

```
cd ~  
wget ftp://ftp.unidata.ucar.edu/pub/netcdf/netcdf-4.4.1.1.tar.gz
```

#### VI - Build netcdf (replace mingw64 with mingw32 if 32-bit system)

```
tar xfvz netcdf-4.4.1.1.tar.gz  
cd netcdf-4.4.1.1
```

The following command goes in one single line:

```
LDFLAGS="-L/mingw64/lib" CFLAGS="-I/mingw64/include" CPPFLAGS="-I/mingw64/include"  
./configure --prefix=/mingw64/  
  
make  
make install
```

#### VII - Download NetCDF-Fortran

```
cd ~  
wget ftp://ftp.unidata.ucar.edu/pub/netcdf/netcdf-fortran-4.4.4.tar.gz
```

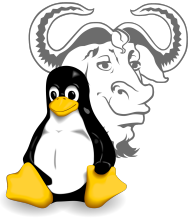
#### VIII - Build NetCDF-Fortran (replace mingw64 with mingw32 if 32-bit system)

```
tar xfvz netcdf-fortran-4.4.4.tar.gz  
cd netcdf-fortran-4.4.4
```

The following command goes in one single line:


```
LDFLAGS="-L/mingw64/lib" CFLAGS="-I/mingw64/include" CPPFLAGS="-I/mingw64/include"  
./configure --prefix=/mingw64/  
  
make  
make install
```





### GNU/Linux and MacOS

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- ✓ Mac and Linux come with SSH clients that can help connecting to remote servers. However, X11 (the graphical user interface) is no longer included with OS X. X11 server and client libraries for OS X are available from the XQuartz project (<http://xquartz.macosforge.org> )



#### I - Login by typing

```
ssh -XY <userid>@<hostname> <press enter>  
<remote_password> <press enter>
```



### Windows

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- ✓ Both SSH and the graphical user interface X11 are not included by default in Windows. There are many options available but in this guide we will present how to install PuTTY. PuTTY is a free implementation of Telnet and SSH for Windows, along with a xterm terminal emulator:

#### I - Download and install Xming:

<http://sourceforge.net/projects/xming/> 

Select Multiple Windows and type the number 0 for Display number.

#### II - Download and install PuTTY:

<https://the.earth.li/~sgtatham/putty/latest/x86/putty.exe> 

After you have downloaded the installer for Windows, run it, and follow through the steps. Unless you know what you are doing, stick with the default installation options. After download completes, you are done with the installation.

To connect to a remote server using PuTTY, provide the hostname of the remote server and the port number on which the SSH server is listening. The default port is 22. Make sure the connection type is ssh.

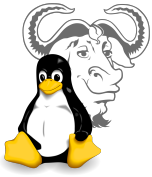
#### III - Configure the X11 forwarding.

Scroll to Connection > SSH > X11. Check the box next to Enable X11 Forwarding. By default the X Display location is empty. You can enter localhost:0. The remote authentication should be set to MIT-Magic-Cookie-1.

#### IV - Login to the remote server

Go back to Session. Click Open to bring up the terminal and login using your userid/password.

Instructions taken from <http://docs.enthought.com/canopy/quick-start> ↗



### GNU/Linux

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#### I - Download Canopy:

Canopy 2.7 for LINUX: <https://store.enthought.com/downloads/installer/74/> ↗

#### II - Install Canopy

Open the terminal and type the following commands:

```
cd ~/Downloads  
bash canopy-2.0.0-rh5-64.sh
```

#### III - Launch Canopy

Canopy can be launched by executing the following command in the terminal:

```
~/Canopy/canopy
```



### MacOS

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#### I - Download Canopy:

Canopy 2.7 for MacOS: <https://store.enthought.com/downloads/installer/70/> ↗

#### II - Install Canopy

The Mac OSX version of Canopy is distributed as a disk image (.dmg) file. Opening this file displays the installation window shown below. Canopy can be installed by dragging the Canopy icon to the Applications folder in the window, to the computer Desktop, or to another folder. If you drag it to the Applications folder, it will show as "Canopy" along with your other applications.



### Windows

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#### I - Download Canopy:

32 bit: <https://store.enthought.com/downloads/installer/78/> ↗

64 bit: <https://store.enthought.com/downloads/installer/82/> ↗

#### II - Install Canopy

To start the installer, double-click the downloaded file. Verify that the publisher is listed as Enthought, Inc. and click Run.

#### Environment Setup for all OS:

When Canopy is launched for the first time, it will automatically configure your Python environment in the default location unless specified otherwise by a command-line option or a preference setting.



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**NOTE: Make sure you have the following Python Packages installed in the Canopy after installation**

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1. NumPy
2. SciPy
3. matplotlib
4. Basemap
5. netCDF4
6. Pandas
7. TkInter
8. Jupyter



**Installing packages in Canopy for all OS:**

In the editor window of Canopy, go to **Tools>Package Manager**. A new window will pop-up, you can search the desired package here and then just click on **install**. The majority of the packages listed above are already installed by default.