

This instruction is for PSI analysis using stamps and SNAP in Windows Subsystem for Linux (WSL). The Windows Subsystem for Linux (WSL) is a great feature introduced in Windows 10. It is a compatibility layer for running Linux binary executables natively on Windows 10, and allows the use of a rather real Linux installation, without using a virtual machine (Andrea Fortuna web site)

I tried my best to keep everything short and easy to grasp. However, it is not guaranteed to be empty of any error. Before starting, I strongly recommend that the user take a look at the following links and provided documentation. I wrote this tutorial based on my own experiences and with the help of the documents and information which are provided by the SNAP forum, especially by the super users like **Thorsten Hoesser**, Andreas Braun, Ekaterina Smolianinova, Jose Manuel, Marco Peters, Falah Fakhri, and others.

Tutorial videos for this document ([VIDEO 1](#), [VIDEO 2](#))

To begin, I added some links that I have found more helpful so far. Although I tried to cover the main steps for the user, this tutorial is still not that much in detail as I wanted it a brief instruction. For more details, the following links along with SNAP Forum, should be studied by the user.

A-Step by step instruction of snap-stamps workflow by **Thorsten Hoesser** (some details has to be updated for the latest version of snap and StaMPS)

Forum link>> <https://forum.step.esa.int/t/how-to-prepare-sentinel-1-images-stack-for-psi-sbas-in-snap/4981/512>

B-StaMPS manual >>

https://homepages.see.leeds.ac.uk/~earahoo/stamps/StaMPS_Manual_v4.1b1.pdf

C- StaMPS-Visualizer, SNAP-StaMPS Workflow

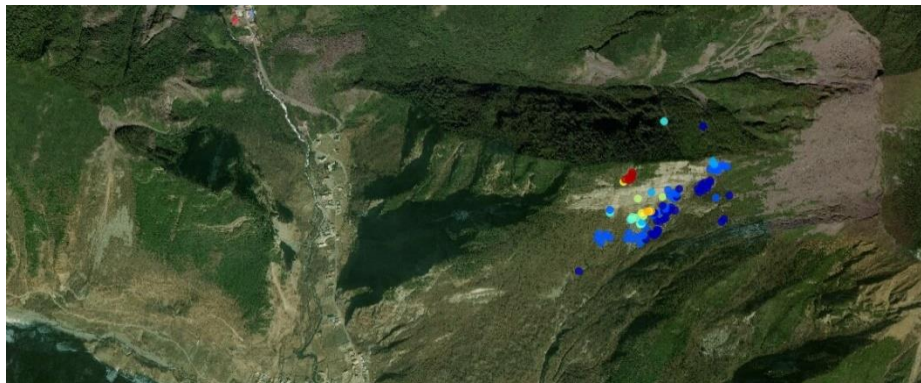
<https://forum.step.esa.int/t/stamps-visualizer-snap-stamps-workflow/9613>

D-Latest code for STaMPS-Visualizer

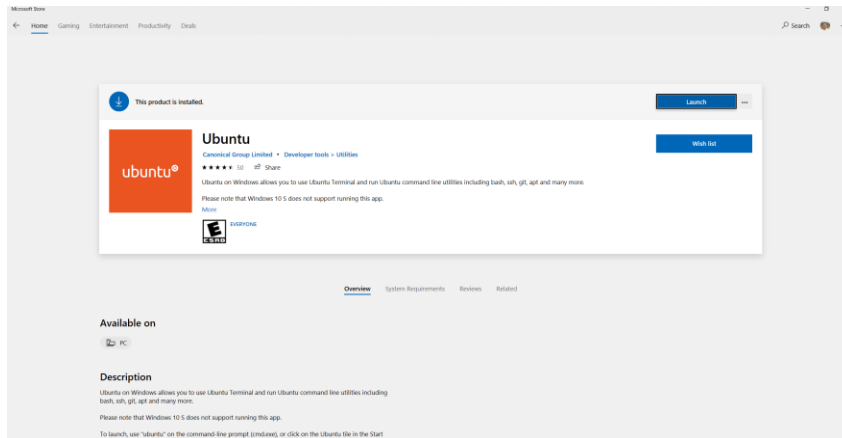
https://github.com/thho/StaMPS_Visualizer

*** Very helpful documents and links recommended by Andreas Braun in SNAP forum:

<https://forum.step.esa.int/t/stamps-detailed-instructions/8140>



1- Installing WSL from Microsoft store

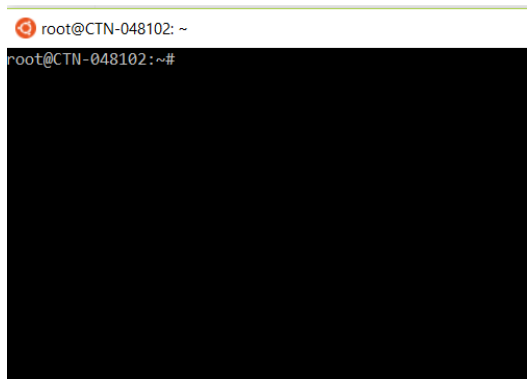


2- Installing the desktop (GUI) in WSL

It put us much more on ease for the following steps.

After typing the Ubuntu in the windows search bar and finding and running it, we are going to see the ubuntu terminal

A useful link in this regard: <https://docs.microsoft.com/en-us/windows/wsl/install-win10>



Then we should use the following commands in opened ubuntu terminal

```
sudo apt update  
sudo apt upgrade
```

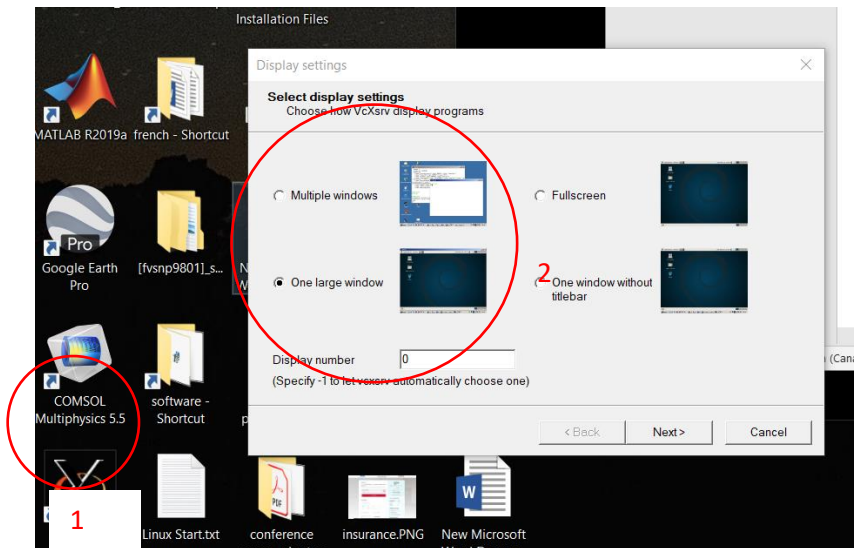
then by the following command, we can install the light ubuntu desktop

```
sudo apt install lxde
```

In the next step, the [VcXsrv Windows](https://sourceforge.net/projects/vcxsrv/files/latest/download) X Server utility should be installed in windows.

[Link https://sourceforge.net/projects/vcxsrv/files/latest/download](https://sourceforge.net/projects/vcxsrv/files/latest/download)

After installation, we should open VCXsrv software and set the Initial setting in the software as the picture

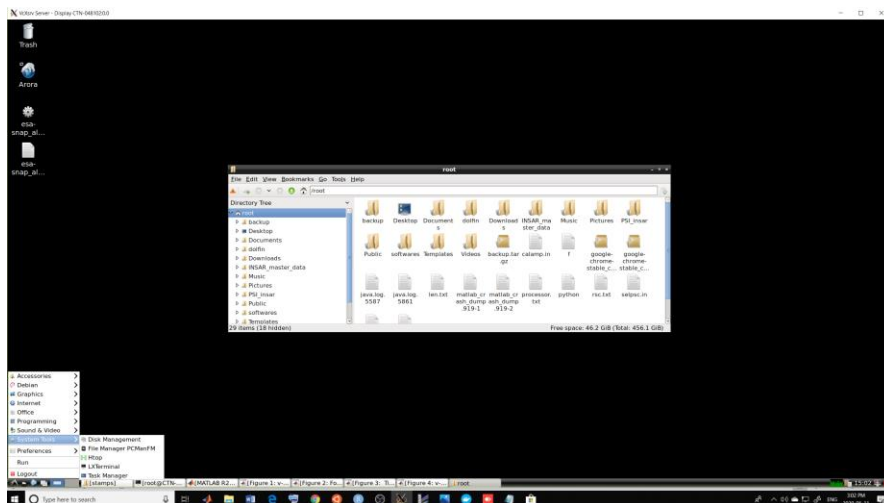


Then we should run the following commands in ubuntu terminal

```
export DISPLAY=:0  
export LIBGL_ALWAYS_INDIRECT=1
```

startlxde (main command to run the desktop)

then we see the lxde desktop, each time that we want to use it we should rerun the last three commands



The more detailed instruction can be found in the following link

<https://www.makeuseof.com/tag/linux-desktop-windows-subsystem/>

3- Matlab installation in WSL

The MATLAB 2018a version is suggested for the latest WSL(2019-2020), for the older version you have to update some ubuntu packages

** it is important that the user name that you chose when you install the Ubuntu and the username that you want to use the MATLAB should be the same. Otherwise, you would face the user name problem

The Matlab 2018a version should be downloaded for Linux and be installed like other software in the Linux platform.

The following link might be helpful

<https://www.mathworks.com/matlabcentral/answers/308911-can-i-install-matlab-in-bash-on-ubuntu-on-windows>

you might face other problems depending on which Pc you are working with. In that case, just google the errors. You would find plenty of helpful stuff on the internet. In my case, with the visual desktop, I have not experienced any errors other than user name mismatching.

In case you couldn't figure it out how to install it, it is also possible to just move the prepared package by STaMPS to windows and also copy and paste all the files in stamps\MATLAB folder to the same folder and continue the rest of the steps in windows.

4-Then the following software should also be installed in MATLAB

I recommend to install them using ubuntu repository by **sudo apt-get install...** command in the ubuntu terminal

First, it is recommended to use `>>> sudo apt-get update`

Then,

4-1 **gawk** `>>>>>>>>>>>>>>> sudo apt-get install gawk`

4-2-**tcsh** `>>>>>>>>>>>>>>>sudo apt-get install tcsh`

4-3-**matlab-support**`>>>> sudo apt-get install`

4-4-**Make**`>>>> sudo apt-get make`

4-5-**build essential** `>> sudo apt-get install build-essential`

4-6-**tringle**`>>>sudo apt-get install triangle-bin`

4-7-**snaphu**`>> I personally recommend the latest version 2.0.3`

You can also install snaphu through the ubuntu repository. But in that case, you install the older version.

For the 2.03 or newer version you can check the following video that I uploaded on YouTube before

<https://www.youtube.com/watch?v=FVv2SF8jK3Q&t=455s>

5-installation of StaMPS

I strongly recommend the latest [version 4.1.B](#)

However, you need to do some of the following steps in different ways. You have to change some files with adjusted versions, and you should use another command for preparing the data depending on the version of the edited files that you are going to use.

More information >>

<https://forum.step.esa.int/uploads/default/original/2X/9/94a7012eb9807cb8ec03fd68a31807de007acf6f.zip>

For stamps installation

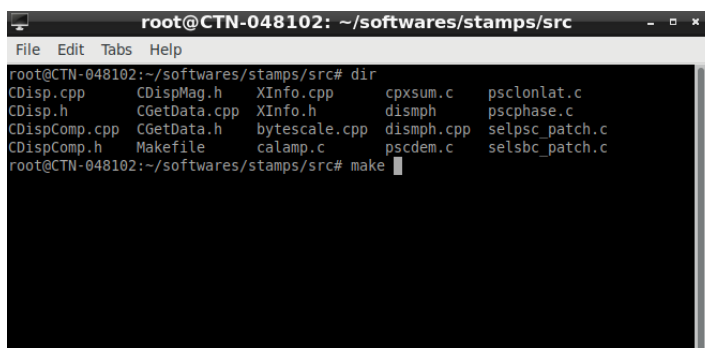
5-1, we should first extract the package in Ubuntu

5-2 we go to `src` folder

Then

`sudo make`

`sudo make install`

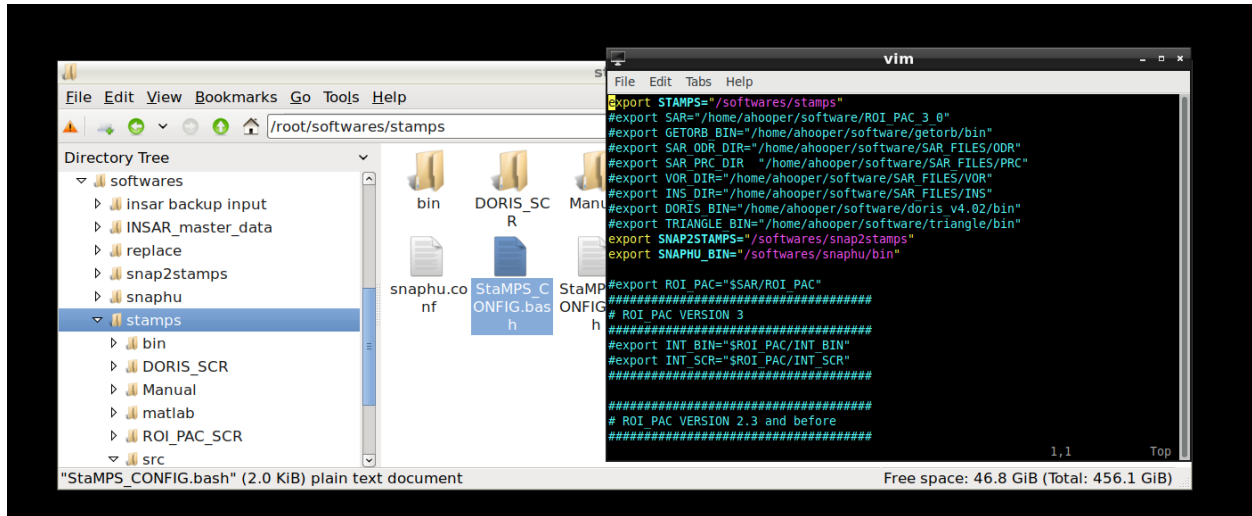


```
root@CTN-048102: ~/softwares/stamps/src
File Edit Tabs Help
root@CTN-048102:~/softwares/stamps/src# dir
CDisp.cpp      CDispMag.h    XInfo.cpp     cpxsum.c      psclonlat.c
CDisp.h        CGetData.cpp  XInfo.h       dismph        pscphase.c
CDispComp.cpp  CGetData.h    bytescale.cpp dismph.cpp    selpsc_patch.c
CDispComp.h    Makefile      calamp.c      pscdem.c     selssc_patch.c
root@CTN-048102:~/softwares/stamps/src# make
```

5-3 then we should return back to StaMPS main folder and edit the `StaMPS_CONFIG.bash` file

It is really important that this file should be edited in Ubuntu. If you do this using windows editor or WordPad, it would not work for you.

So in Ubuntu we can use the Nano editor (I personally recocomend) or any other on like vimeditor(lxdesktop original one) and we should adjust the file then save it after.



The only part that should be edited is the first paragraph. I put my file as a sample

```

export STAMPS="/softwares/stamps"
#export SAR="/home/ahooper/software/ROI_PAC_3_0"
#export GETORB_BIN="/home/ahooper/software/getorb/bin"
#export SAR_ODR_DIR="/home/ahooper/software/SAR_FILES/ODR"
#export SAR_PRC_DIR "/home/ahooper/software/SAR_FILES/PRC"
#export VOR_DIR="/home/ahooper/software/SAR_FILES/VOR"
#export INS_DIR="/home/ahooper/software/SAR_FILES/INS"
#export DORIS_BIN="/home/ahooper/software/doris_v4.02/bin"
#export TRIANGLE_BIN="/home/ahooper/software/triangle/bin"
export SNAP2STAMPS="/softwares/snap2stamps"
export SNAPHU_BIN="/softwares/snaphu/bin"

#export ROI_PAC="$SAR/ROI_PAC"
#####
# ROI_PAC VERSION 3
#####
#export INT_BIN="$ROI_PAC/INT_BIN"
#export INT_SCR="$ROI_PAC/INT_SCR"
#####

```

make inactive the command

Where we installed STaMPS

If you installed any of these softwares you should do the same as above here

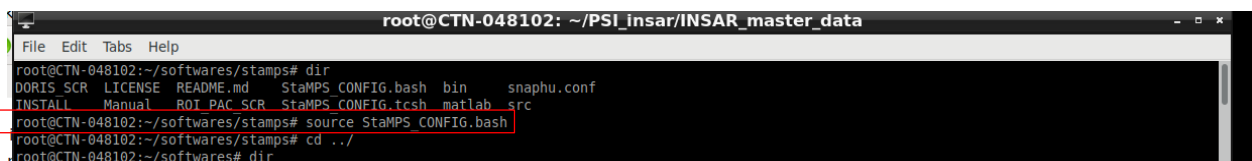
As it installed with repository, there is no need to export the path

You don't need it, you should put # before it

In case you installed the **SNAPHU** without repository, you need to export the path of the installation folder like this

After finishing the edit. Each time we should source this bash file before using StaMPS. By sourcing this file, the edited paths would be added to main ubuntu bash root.

After editing we should source the file:



6-Possible errors and useful commands in Ubuntu

6-1-If you face this error that Ubuntu has not the permission to access a folder

You can use the following command to fix it:

```
sudo chmod -R a+rwX /..... ← path of that folder
```

6-2 if you install the STaMPs and edit and source the bash file but still the mt_prep_snap doesnot work, you can check the same command when you are in the stamps bin folder path. In that case, the path to stamps **bin** folder should be added to the main .bashrc file in WSL root folder in order to make it available from every path.

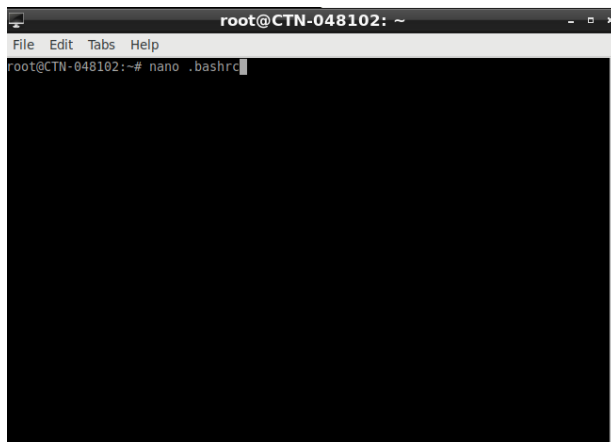
Wsl root folder:

I put my own WSL path as a sample here

```
C:\Users\tech\AppData\Local\Packages\CanonicalGroupLimited.UbuntuonWindows_79  
rhkp1fndgsc\LocalState\rootfs\root
```

Yours should also be in a similar place

6-3 so similar to what we have done before for stamps bash file, here, we also have to edit the .bashrc file with nano or vim editor



Then the following command should be added to end of the file
`export PATH=$PATH:~/softwares/stamps/bin`

```
root@CTN-048102: ~
File Edit Tabs Help
GNU nano 2.9.3 .bashrc
. ~/.bash_aliases
fi
# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
#if [ -f /etc/bash_completion ] && ! shopt -oq posix; then
#   . /etc/bash_completion
#fi
export PATH=$PATH:~/softwares/stamps/bin
```

Then we save the file, since then you might not face this error again and STaMPS command can be run from everywhere in Ubuntu

6-4 If you want to work with an older version of STaMPS, you have to add an adjusted file such as `mt_prep_gamma_snap` to Stamps bin folder. In that case, you have to give permission to bash to have access to that file. Otherwise, you get a bash error.

To overcome this problem, you should use the following command

```
>>>> chmod u+x /softwares/stamps/bin/mt_prep_gamma_snap
```

Complete path to that file

Useful commands in Ubuntu:

Mounting the Windows drive>> `cd /mnt` (in WSL with desktop, you already have the mounted windows drive in you explorer)

`Cd <folder name>` to open a folder

`Cd ../` to return back to folder path that contains the subfolder

`Dir` show all files and folder in the current path

`<Command> ./` to use the command in current folder

`echo $SHELL` to find your active shell (tcsh or bash)

`chsh -s /usr/bin/tcsh` to switch to tcsh shell

`chsh -s /bin/bash` to swith to bash shell

other basic commands >>>

<https://techlog360.com/basic-ubuntu-commands-terminal-shortcuts-linux-beginner/>

7-STaMPS visualization with R & R-studio (Working with the R-based STaMPS visualization code can be done entirely in windows)

7-1 we should first install the [R package for windows](#)

7-2 we should install the [r studio \(free version \)](#)

7-3 [Downloading](#) the visualization package written by **Thorsten Höser**

7-4 Extracting a package somewhere in windows (This package can be further used by adding an exported file result from STaMPS-Matlab to the extracted folder- tutorial 2)