

Download TRMM Precipitation Data in NetCDF (Network Common Data Form) (*.nc4) using Wget and a software
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1. Introduction

To download: Daily data (Follow same process for Monthly data)

Website: <https://disc.gsfc.nasa.gov/>

(Change the following data as per requirement)

Start Date: 2007-01-01

End Date: 2007-12-31

Latitude Limit: [20, 35] °N

Longitude Limit: [75, 84] °E

Data version: TRMM_3B42_Daily_7

3 → Level

B → Sensor Side (A or B)

42 → 40 – Series (42 for daily data and 43 for Monthly data)

2. Steps to choose data and create link

2.1. Go to Data website

Go to Website: <https://disc.gsfc.nasa.gov/>

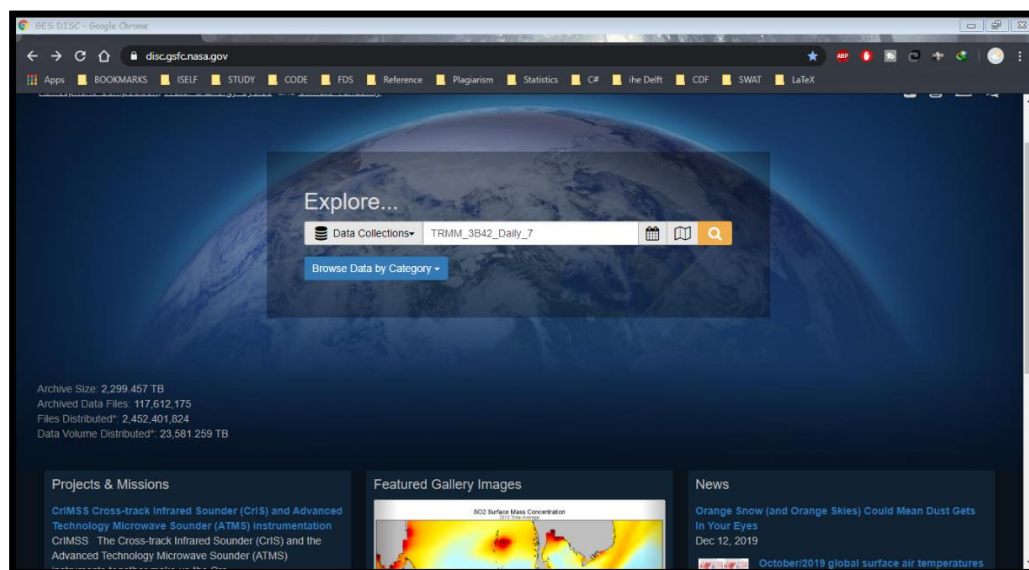


Figure 1: Website to download TRMM Data

2.2. Select Date Range

Select date range as follows-

Start Date: 2007-01-01

End Date: 2007-12-31

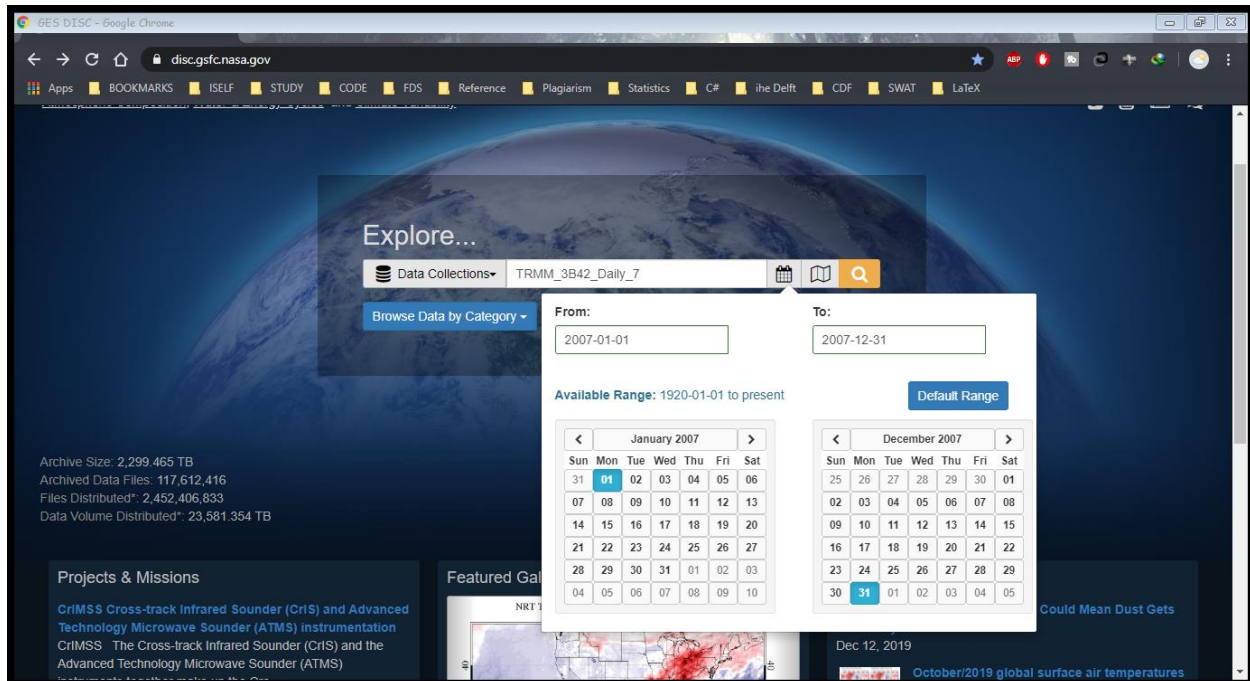


Figure 2: Select Date Range

2.3. Enter Spatial Range (Lat Long)

Select Latitude and Longitude of rectangle of area of interest as below-

Latitude Limit: [20, 35] ON

Longitude Limit: [75, 84] °E

Lat and Long should be entered in format: 75,20,84,35

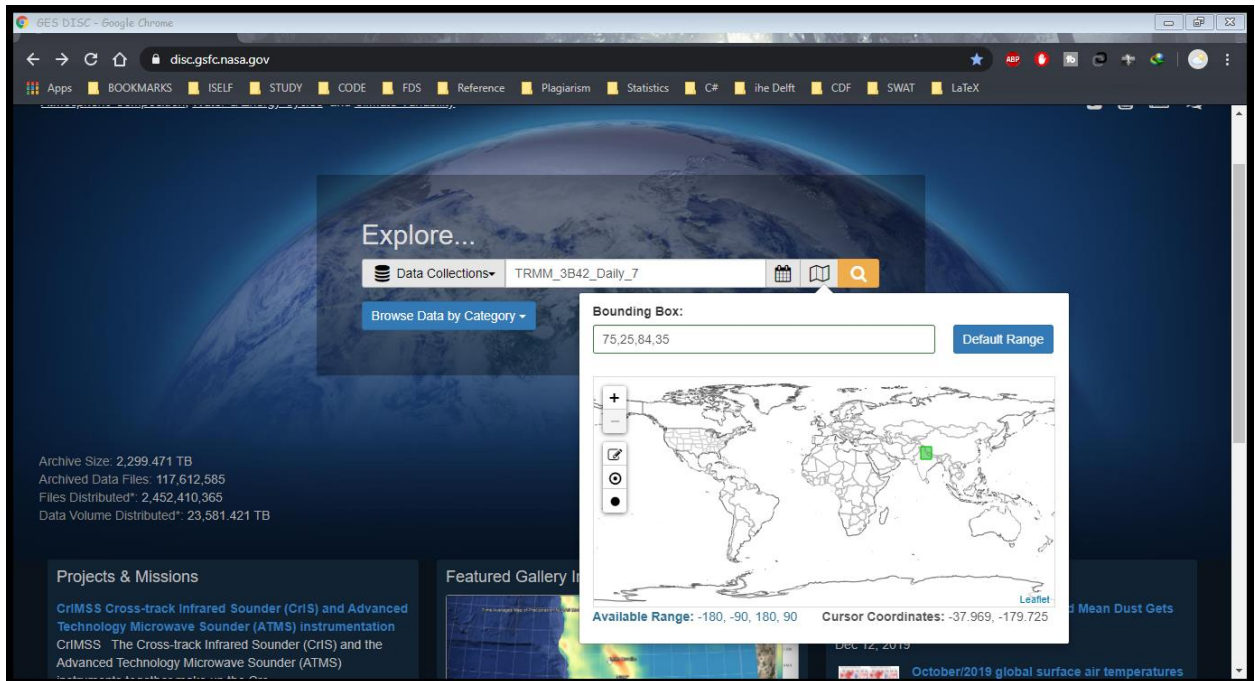


Figure 3: Enter Latitude and Longitude (Spatial Range)

2.4. Click on Search

Click on Subset/Get Data

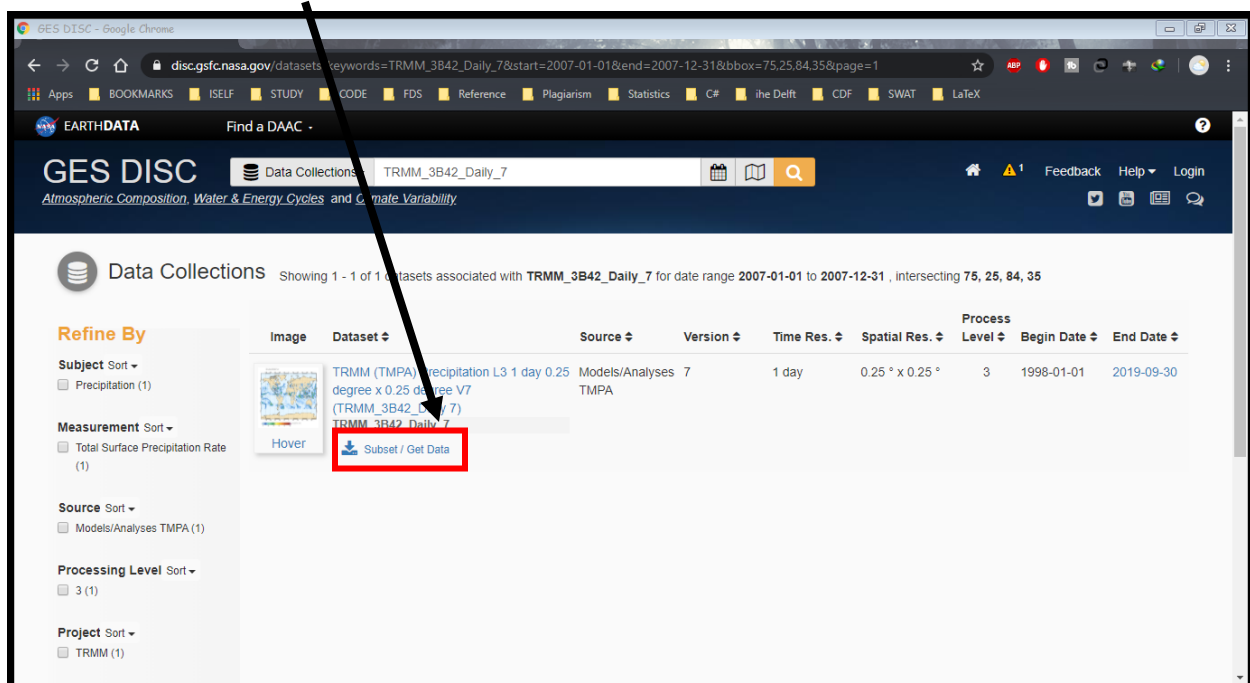


Figure 4: Search Result

2.5. Subset/Get Data

After clicking Subset/Get Data, expand Variables and check on “precipitation”. You can also choose “IRprecipitation” or “HQprecipitation”. If no option is chosen, all variables will be downloaded.

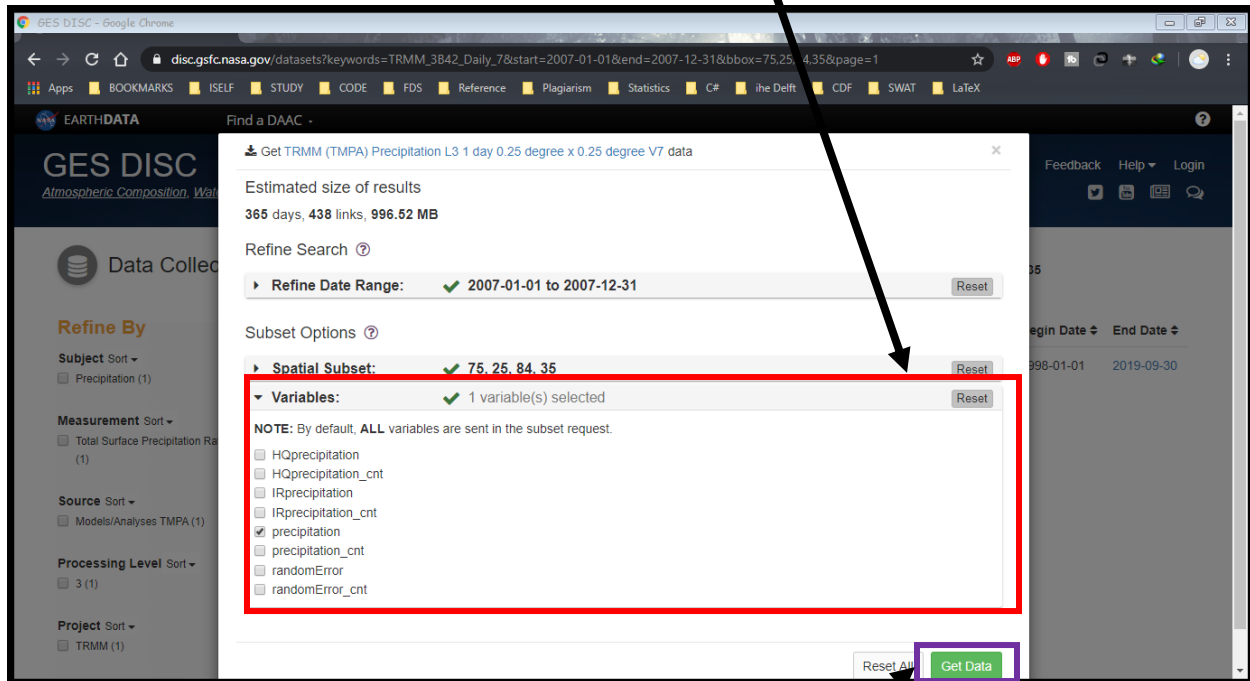


Figure 5: Subset/ Get Data and choose variable

After choosing variables, click on **Get Data**.

If necessary, you can modify date range or latitude longitude limits.

2.6. Get Data and Download Link List in text file Format

Click on the **Download Link List**. You can get **instruction for downloading**.

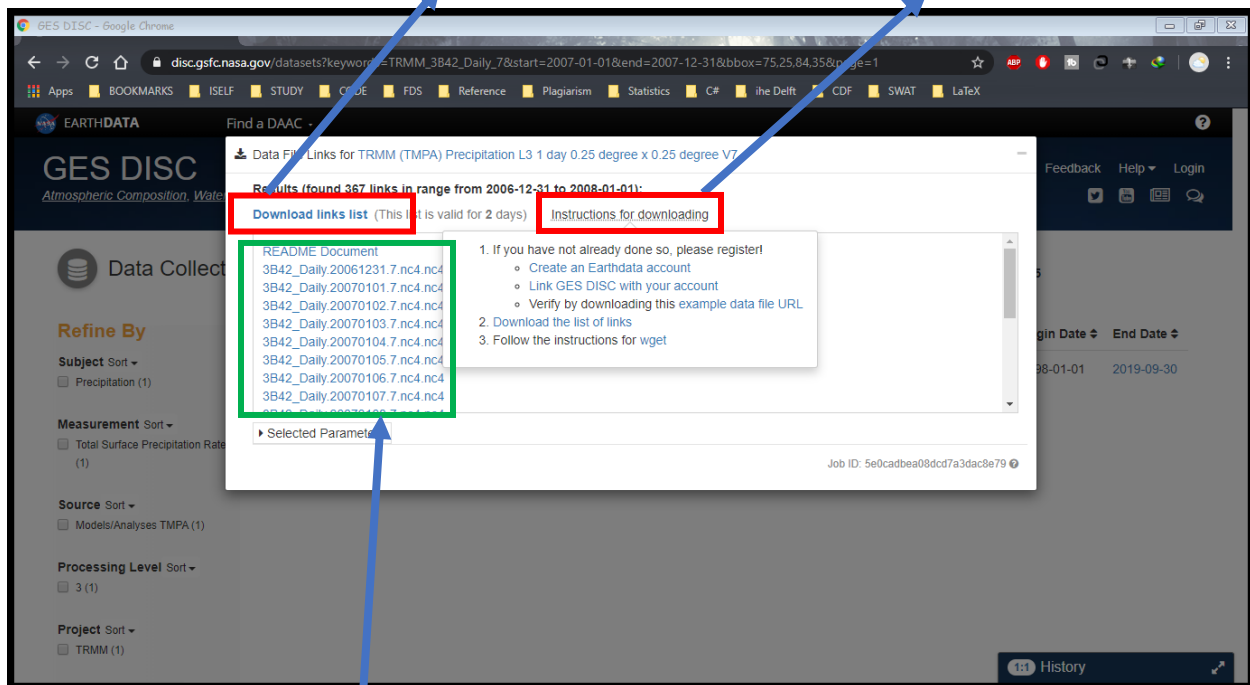


Figure 6: Get data and download link list

You can **download individual file** by clicking on each file (which is tedious and time consuming).

We will see how to automate the download process in next section. For now, only download link list.

2.7. Download link list File

You will get text file with name:

subset_TRMM_3B42_Daily_7_20200101_144425.txt

Rename the file to ***myfile.txt***

Save the file in known location

e.g. **F:\AY\SWAT\Manual\TRMM\Link_Lists**

This text file looks like in the Figure 7.

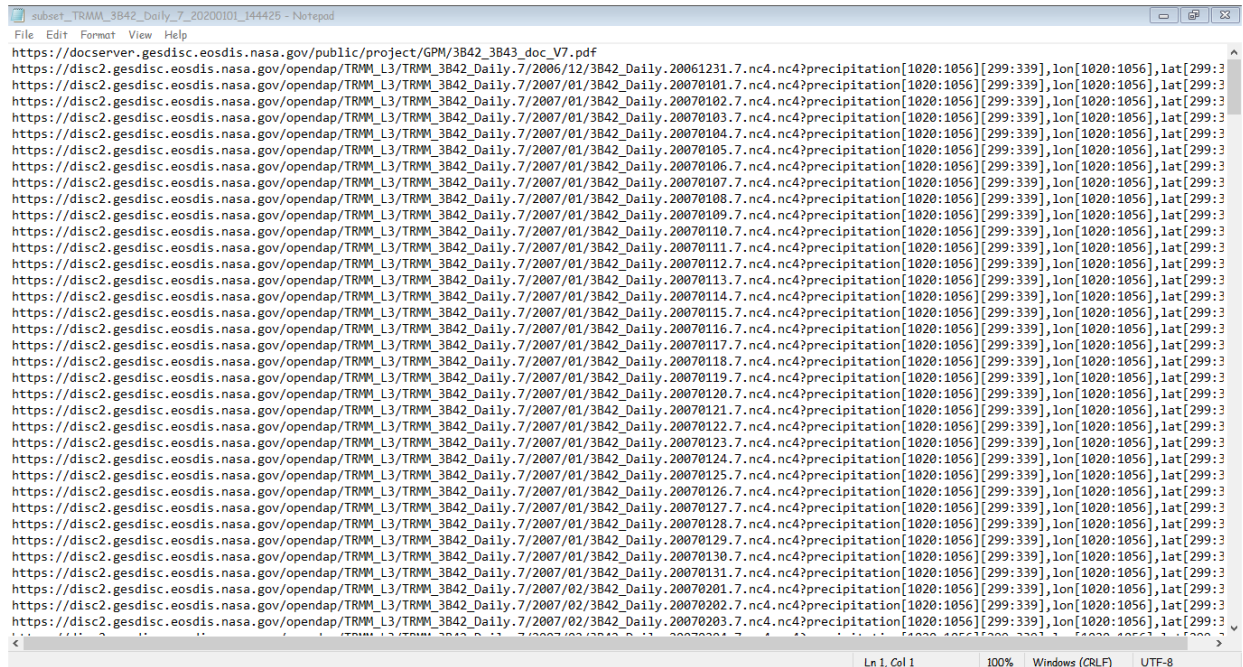


Figure 7: Text file containing list of all link of *.nc4 file and readme file in .pdf

3. Create Earthdata account and link to GES DISC account

3.1. Create Earthdata account

Go to link: <https://urs.earthdata.nasa.gov/users/new>

EARTHDATA LOGIN

Register for an Earthdata Login Profile

Profile Information

Username: *

Password: *

Password Confirmation: *

Required field

Username must:

- Be a Minimum of 4 characters
- Be a Maximum of 30 characters
- Use letters, numbers, periods and underscores
- Not contain any blank spaces
- Not begin, end or contain two consecutive special characters (_)

Password must contain:

- Minimum of 8 characters

Figure 8: Register in EarthData

Enter username, password, your name, Country, etc.

e.g. username = ajay
password = trmmData123
country = Nepal, etc.

Then click on “Register for EarthData Login”

You may be asked to verify through email address.

After email verification, verify your Login by going to link:

<https://urs.earthdata.nasa.gov/home>

3.2. Link your Earthdata account to GES DISC account

To link you Earthdata account, you need to follow the instruction given in GED DISC website through the following link-

<https://disc.gsfc.nasa.gov/earthdata-login>

4. Download Wget

Wget is a free software using which you can download files from any website.

Download Wget from link: <https://eternallybored.org/misc/wget/>

Download the .exe file 32-bit or 64-bit as per your requirement.

The screenshot shows the GNU Wget website with a table of download links. A green arrow points to the '32-bit' column header. The table lists various versions of Wget with links for 32-bit and 64-bit executables and source code. A sidebar on the right contains links to Windows ports, scripts, and other resources.

Version	32-bit	64-bit	Notes
1.20.3	ZIP EXE	ZIP EXE	OpenSSL 1.1.1b, ZLib 1.2.11, gpgme-1.13.0, pcre2 10.32, libpsl 0.20.2, taskbar progressbar , Windows certificate store support , manual ;
1.20	ZIP EXE	ZIP EXE	the binaries have been updated and now work fine with SSL connections OpenSSL 1.1.1a, ZLib 1.2.11, gpgme-1.12.0, pcre2 10.32, libpsl 0.20.2, taskbar progressbar , Windows certificate store support , manual ;
1.19.4	ZIP EXE	ZIP EXE	XP support dropped OpenSSL 1.1.0g, ZLib 1.2.11, gpgme-1.10.0, taskbar progressbar , Windows certificate store support , manual
1.19.3	ZIP EXE	ZIP EXE	OpenSSL 1.1.0g, ZLib 1.2.11, gpgme-1.10.0, taskbar progressbar , Windows certificate store support , manual
1.19.2	ZIP EXE	ZIP EXE	OpenSSL 1.1.0f, ZLib 1.2.11, taskbar progressbar , Windows certificate store support , manual
1.19.1	ZIP EXE	ZIP EXE	OpenSSL 1.1.0e, ZLib 1.2.11, taskbar progressbar , Windows certificate store support , manual
1.18	ZIP EXE	ZIP EXE	OpenSSL 1.0.2h, ZLib 1.2.8, taskbar progressbar , Windows certificate store support , manual
1.17.1	ZIP EXE	ZIP EXE	OpenSSL 1.0.2e, ZLib 1.2.8, taskbar progressbar , Windows certificate store support , manual
1.17	ZIP EXE	ZIP EXE	OpenSSL 1.0.2d, ZLib 1.2.8, taskbar progressbar , manual
1.16.3	ZIP EXE	ZIP EXE	OpenSSL 1.0.2a, ZLib 1.2.8, taskbar progressbar , manual
1.16.2	ZIP EXE	ZIP EXE	OpenSSL 1.0.2, ZLib 1.2.8, taskbar progressbar , manual
1.16.1	ZIP EXE	ZIP EXE	OpenSSL 1.0.1j, ZLib 1.2.8, taskbar progressbar , manual
1.16	ZIP EXE	ZIP EXE	OpenSSL 1.0.1j, ZLib 1.2.8, taskbar progressbar , manual
1.15	ZIP EXE	ZIP EXE	OpenSSL 1.0.1f, ZLib 1.2.8
1.13.4	ZIP EXE	ZIP EXE	OpenSSL 1.0.0f, ZLib 1.2.5
1.13	ZIP EXE	ZIP EXE	OpenSSL 1.0.0d, ZLib 1.2.5

[Source code](#)

Windows ports
[Gifcat](#)
[NetCat](#)
[PCL Utilities](#)
[GNU Wget](#)

Scripts
[AutoHotKey for \(he\)lchat for VMware ESXi](#)

Other things
[GIMP-related stuff](#)

Provided by [Jernej Rimcic](#)
[Donate](#)

Figure 9: Download Wget

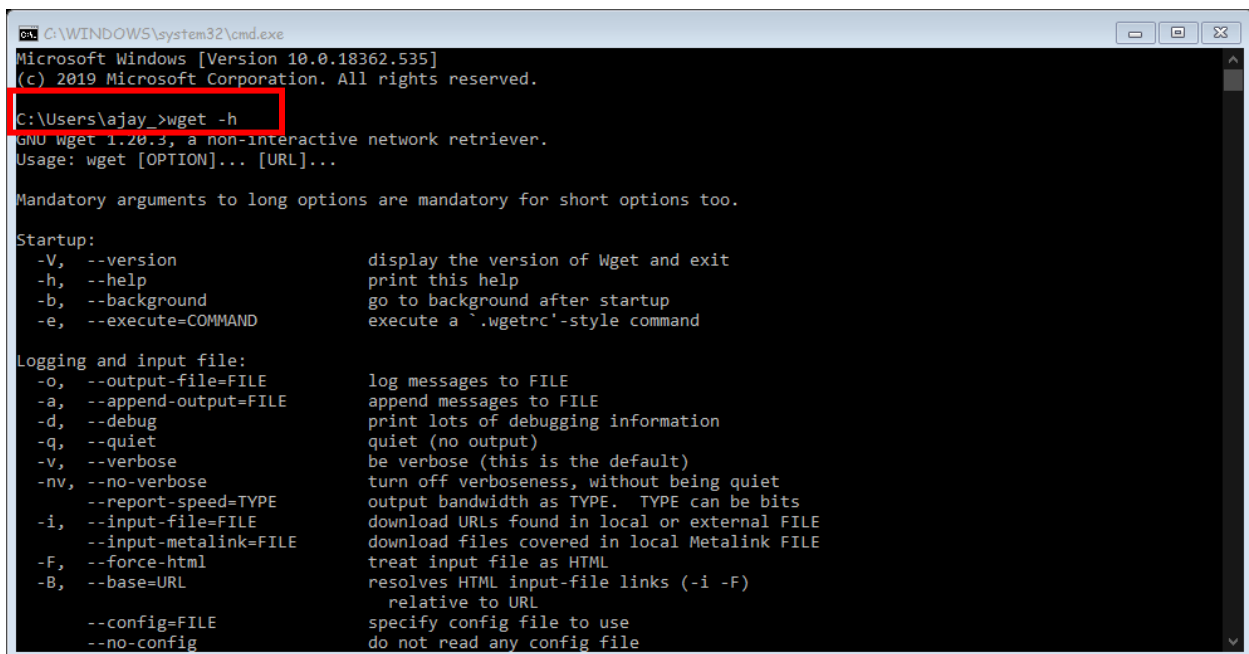
After downloading Wget.ext, copy the file and paste into location-

C:\Windows\System32

Pasting into this location will allow you to run Wget from any Drive. To check whether Wget is working or not follow the process-

- ✓ Press **Windows Key + R**
- ✓ Type **"cmd"** and press enter
- ✓ Type **Wget -h**

You will get as in Figure 10.



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows [Version 10.0.18362.535]
(c) 2019 Microsoft Corporation. All rights reserved.

C:\Users\ajay>wget -h
GNU Wget 1.20.3, a non-interactive network retriever.
Usage: wget [OPTION]... [URL]...

Mandatory arguments to long options are mandatory for short options too.

Startup:
  -V, --version           display the version of Wget and exit
  -h, --help             print this help
  -b, --background       go to background after startup
  -e, --execute=COMMAND  execute a '.wgetrc'-style command

Logging and input file:
  -o, --output-file=FILE  log messages to FILE
  -a, --append-output=FILE append messages to FILE
  -d, --debug            print lots of debugging information
  -q, --quiet            quiet (no output)
  -v, --verbose          be verbose (this is the default)
  -nv, --no-verbose      turn off verbosity, without being quiet
  --report-speed=TYPE    output bandwidth as TYPE. TYPE can be bits
  -i, --input-file=FILE  download URLs found in local or external FILE
  --input-metalink=FILE  download files covered in local Metalink FILE
  -F, --force-html       treat input file as HTML
  -B, --base=URL         resolves HTML input-file links (-i -F)
                        relative to URL
  --config=FILE          specify config file to use
  --no-config            do not read any config file
```

Figure 10: Test Run for Wget

Now you have got everything required to automate the download process.

5. Creating Cookies

Open **cmd.exe** and go to the folder (Directory) you want to create the cookies in.

To change drive type **drive name** followed by **colon**

e.g. **C:\> F:** results in **F:\>**

To go to required folder use command **cd** (change directory)

e.g. **F:\>cd AY** results in **F:\AY>**

To list directories and files, use command **dir** and it will list all directory.

After navigating to the required directory, enter **NUL > .urs_cookies**

e.g. **F:\AY\SWAT\Manual\TRMM\TRMM_COOKIES>NUL > .urs_cookies**

This will create. **urs_cookies** file in the folder **TRMM_COOKIES**.

You may get “Access Denied” error. Ignore this error but ensure that the cookie is created in the chosen folder.

6. Download TRMM Data in NetCDF format using Wget

Open **cmd.exe** and go to the folder (Directory) you want to download the TRMM Data in NetCDF (*.nc4) file.

e.g. **F:\AY\SWAT\Manual\TRMM\TRMM_2007>**

Now, we will use the following code:

```
wget --load-cookies C:\.urs_cookies --save-cookies C:\.urs_cookies --auth-no-  
challenge=on --keep-session-cookies --user=<your username> --ask-password --  
content-disposition -i <url.txt>
```

You need to change only the colored portion of the above code.

C: will be changed to the folder where you created the cookies, which is

F:\AY\SWAT\Manual\TRMM\TRMM_COOKIES

<your username> will be changed to your username created in section **3 Create Earthdata account**, which is

ajay

--ask-password will be changed to your password created in section **3 Create Earthdata account**, which is

--password=trmmData123

<url.txt> will be changed to the full file path of the text file downloaded, renamed and saved in section **2.7 Download link list File**, which is

F:\AY\SWAT\Manual\TRMM\Link_Lists

The final code will be:

```
wget --load-cookies F:\AY\SWAT\Manual\TRMM\TRMM_COOKIES\.urs_cookies  
--save-cookies F:\AY\SWAT\Manual\TRMM\TRMM_COOKIES\.urs_cookies --  
auth-no-challenge=on --keep-session-cookies --user=ajay --  
password=trmmData123 --content-disposition -i  
F:\AY\SWAT\Manual\TRMM\Link_Lists\myfile.txt
```

Now, paste the above code in **cmd.exe** after navigating to the folder where you want to download the files as given below-

```
F:\AY\SWAT\Manual\TRMM\TRMM_2007> wget --load-cookies  
F:\AY\SWAT\Manual\TRMM\TRMM_COOKIES\.urs_cookies --save-cookies  
F:\AY\SWAT\Manual\TRMM\TRMM_COOKIES\.urs_cookies --auth-no-  
challenge=on --keep-session-cookies --user=ajay --password=trmmData123 --  
content-disposition -i F:\AY\SWAT\Manual\TRMM\Link_Lists\myfile.txt
```

Note:

- ✓ *There shouldn't be any white space in the full path of any file path used here.*
- ✓ *There should be proper spacing before "--" in the above code*

7. Software to Download TRMM Data

7.1. Introduction to Software

Instead of downloading and writing codes in wget, you can download the software and give following input, **CSAY TRMM DATA DOWNLOADER** (<https://github.com/ajayyadavay/CSAYTRMMDATADOWNLOADER>),

- ✓ Username of EarthData account
- ✓ Password of EarthData account
- ✓ download link list file (*.txt or *.dat format) and
- ✓ project name (optional i.e. you may leave it blank)

When you click **Download TRMM Data**, a folder name entered in project name text box is created in the root directory in which this software is.

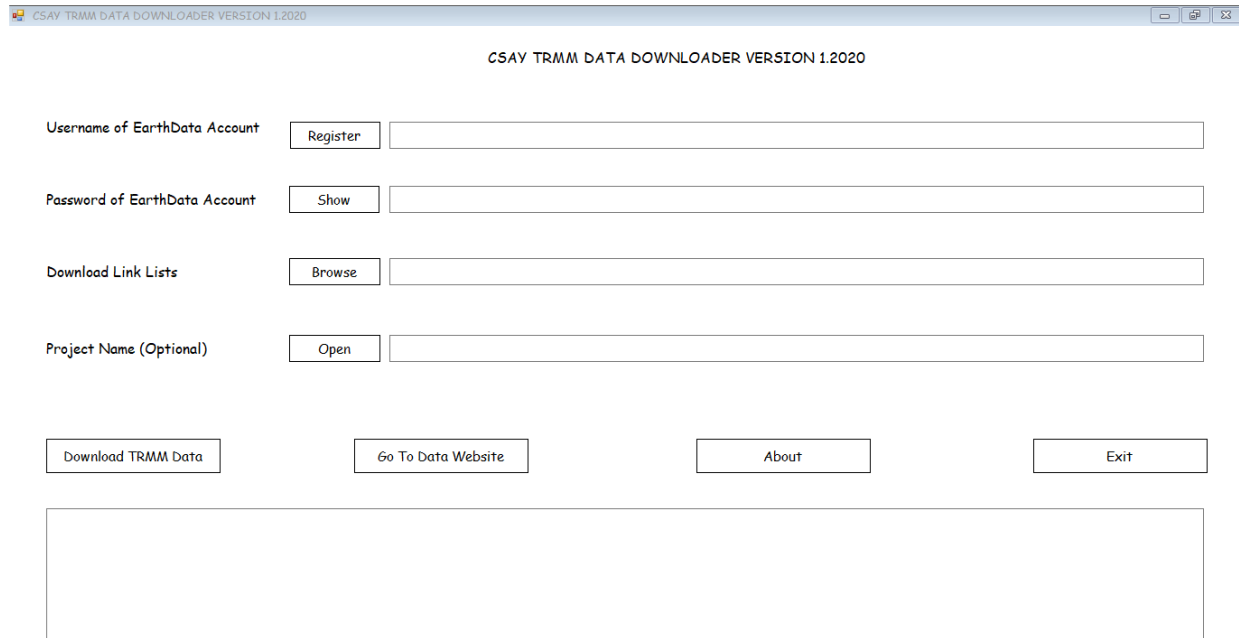


Figure 11: CSAY TRMM DATA DOWNLOADER

The software can be run by double clicking the **CSAY TRMM DATA DOWNLOADER.exe** file located in \CSAY TRMM DATA DOWNLOADER\CSAY TRMM DATA DOWNLOADER\bin\Debug\CSAY TRMM DATA DOWNLOADER.exe

7.2. Functions of Button

- ✓ **Register:** Clicking this software will open login page of EarthData.
- ✓ **Show:** This will show the password and turns into “**Hide**”. When you click “**Hide**”, it will again hide the password by character ‘*’.
- ✓ **Browse:** By clicking the button, you can navigate to the file containing list of download link as in Figure 7.
- ✓ **Open:** By default, it will open the folder containing this software. When project name is entered and TRMM Data has been downloaded, clicking it will open the folder containing the downloaded data. When project name is not entered, the software generates folder name in format-
TRMMData_yyMMddTHSS
- ✓ **Download TRMM Data:** This will download TRMM Data according to the download link in the *.txt or *.dat file.
- ✓ **Go To Data Website:** This will open web page from where, TRMM Data can be generated and link list file can be downloaded.

- ✓ **About:** This will open a window containing information about the software and its creator.
- ✓ **Exit:** This will close the program.

8. Software to extract NetCDF (*.nc4) to SWAT Format (*.txt) and one *.csv

8.1. Introduction to Software

The software, **NetCDF Extractor to SWAT Format**

(<https://github.com/ajayyadavay/NetCDFExtractorToSWATFormat>) is written in R Programming and uses Shiny library for its GUI. It is self-explanatory software, where instruction is given as label of text box, header of dialog box and bottom caption. Also, there is a tab named **“About”**.

This software should be used after downloading NetCDF (*.nc4) using software of section 7 or 6.

This software is portable like the software explained in section 7. This software runs on portable browser. Therefore, you don't need to download libraries, browser, R Programming, etc.

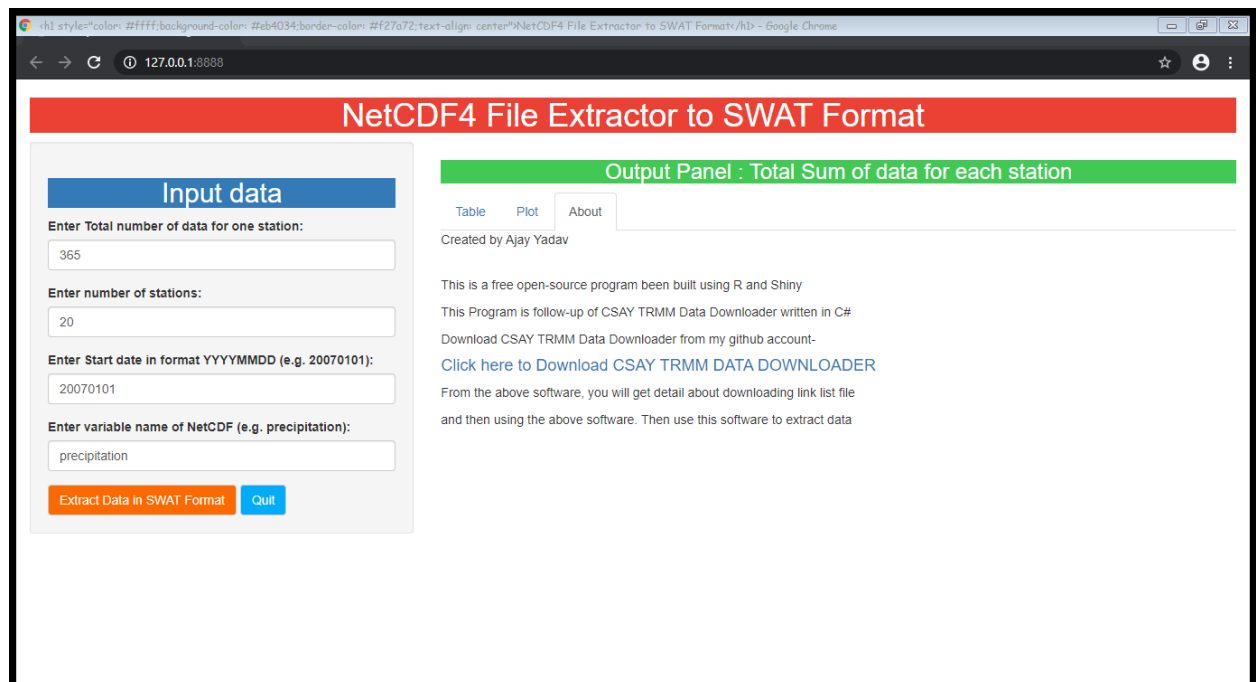


Figure 12: NetCDF Extractor to SWAT Format Software with About tab

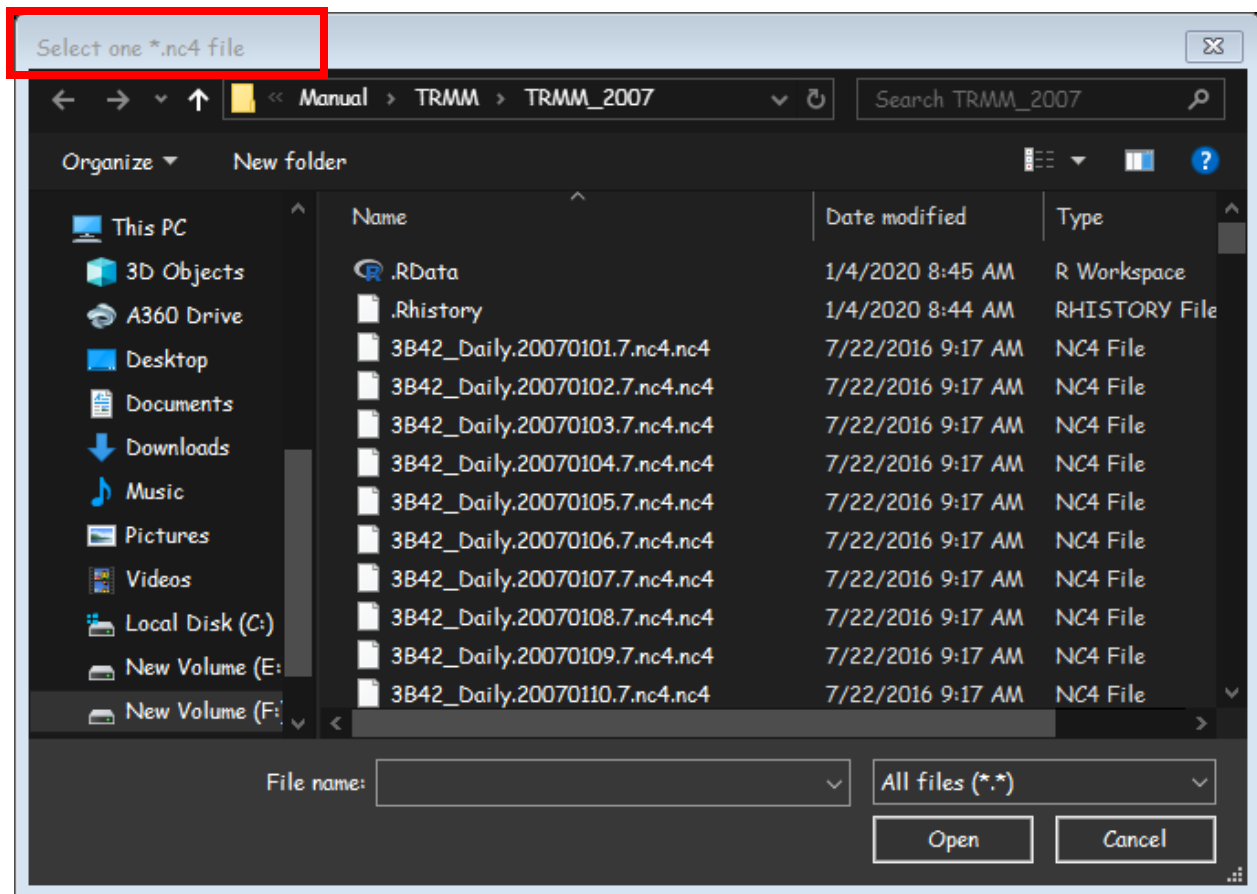


Figure 13: First dialog appearing after clicking Extract data in SWAT Format button

The software can be run by double clicking the **run.vbs** file located in `\NetCDFExtractorToSWATFormat\run.vbs`.

8.2.Features/Steps of software NetCDF Extractor to SWAT Format

8.2.1. Input Data

- ✓ **Enter Total number of data for one station:** You need to enter how many data you have for one station. For example: if you want daily data for years 2006, 2007, 2008 and 2009 in *.nc4 format to SWAT Format or in one .csv file the put them in one folder then in the text field enter 1461 (i.e. 365+365+366+365).
- ✓ **Enter number of stations:** Enter the number of stations, you want to extract data for.
- ✓ **Enter start date in format YYYYMMDD:** Enter start date. For example: 20070101 (YYYY = 2007, MM = 01, DD = 01)

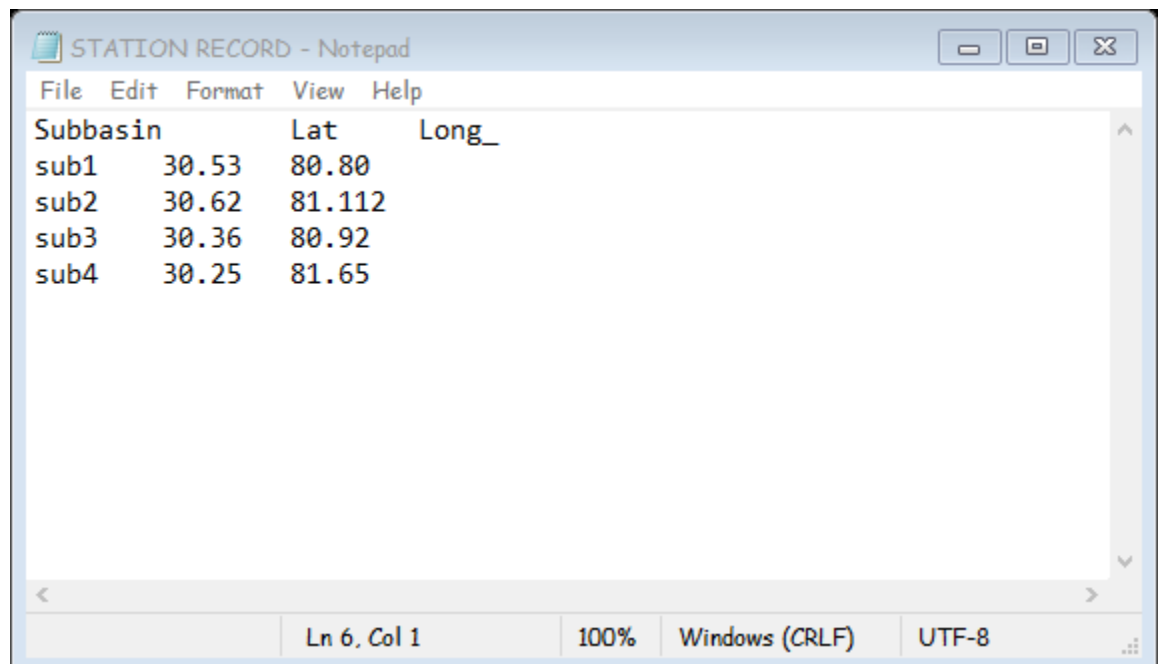
- ✓ **Enter variable of NetCDF:** Enter variable of NetCDF, you want to extract. For example: precipitation, IRprecipitation, HQprecipitation, etc. Remember that the variable names are case sensitive. Variable names are same as shown in section 2.5.

8.2.2. Process Data

- ✓ **Extract data in SWAT Format:** Click this button only after entering all the input information of section 8.2.1. After clicking on this button, you will be asked to choose -
 - one *.nc4 file (choose any one of the downloaded *.nc4 file) as in Figure 13
 - Folder containing all *.nc4 files
 - Output folder to store the output *.txt and .csv file
 - .txt file containing record of stations

Wait for a while and then you will get message “Data exported to SWAT Format (*.txt) and one .csv”

*Note: Read the title (or header) of dialog appearing after clicking button **Extract data in SWAT Format** to know what to select as shown in red box of Figure 13.*



The screenshot shows a Notepad window with the title 'STATION RECORD - Notepad'. The window contains a table with four columns: 'Subbasin', 'Lat', and 'Long_'. The data rows are as follows:

Subbasin		Lat	Long_
sub1	30.53	80.80	
sub2	30.62	81.112	
sub3	30.36	80.92	
sub4	30.25	81.65	

The status bar at the bottom indicates 'Ln 6, Col 1', '100%', 'Windows (CRLF)', and 'UTF-8'.

Figure 14: Format for text file containing Station Records

8.2.3. Output

There are three tabs-

- ✓ **Table:** This tab contains table of sum of all data of each stations. You can copy the data by selecting all data and paste to excel or text file.
- ✓ **Plot:** This tab contains plot of data of tab Table. You can right click to save the bar chart.
- ✓ **About:** This contains information about its creation and creator and link to download **CSAY TRMM DATA DOWNLOADER**.

You will get all the *.txt file and one .csv file in the folder you selected to store output when you clicked **“Extract data in SWAT Format”**.

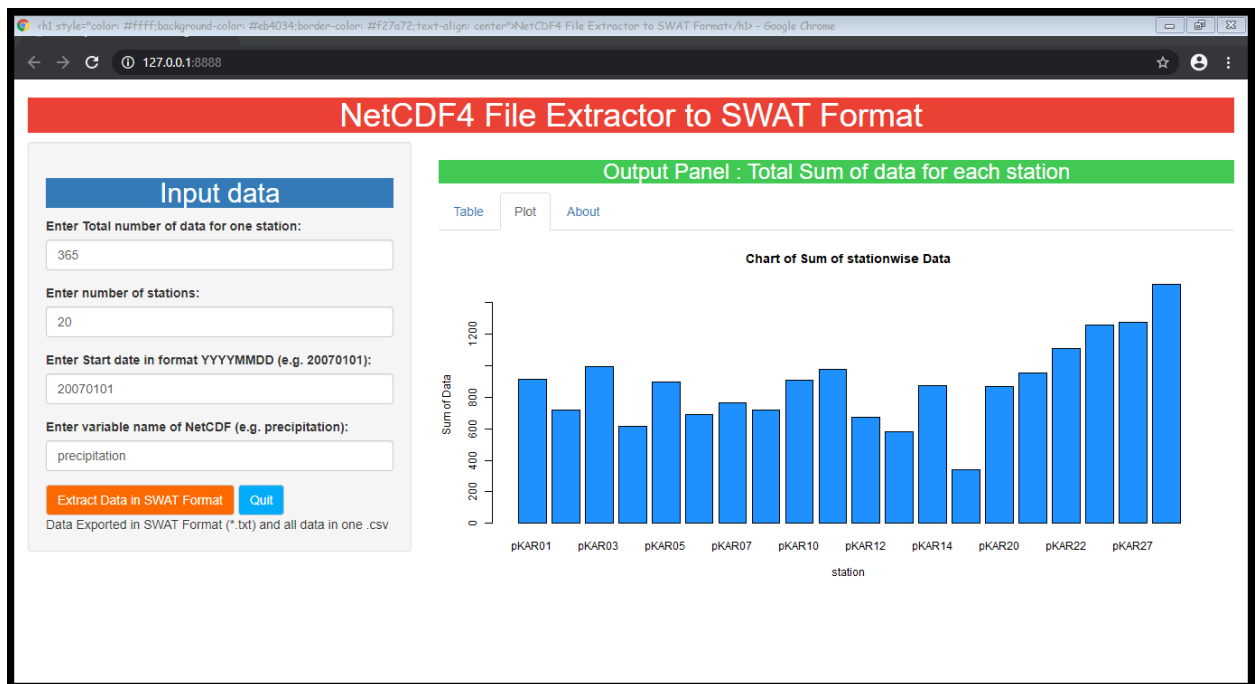


Figure 15: NetCDF Extractor to SWAT Format with output bar chart

*Note: While closing the application, don't click on button **“Quit”** because it will only close R Programming and not the browser so it is better suggested to click **close button (X)** of browser because it will close R Programming as well as browser.*