The Climate Monitoring Tools for gauges

CMT-G

Version Beta+

Climate Map-making Tools integrating gauges weather, climate data to inform humanitarian response planning. Generating user-friendly products from weather and climate data.

by

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12/5/2019

This simplified package of **CMT-Gauge** is developed by NOAA/CPC International Desks. It is used to ingest gauge data and generate user-friendly products in the form of time series plots at station location.

A. Introduction:

General

The CPC's **CMT-Gauge** is a web-based tool designed to monitor the evolution of seasonal climate conditions. The package contains tools that perform complex tasks organized into smaller and more manageable components/modules. The individuals modules are easy to use and maintain, and also can be run as independent tools. The **CMT-Gauge** modules contain codes written in C and FORTRAN programming languages, and GrADS and shell scripts. This version of **CMT-Gauge** is designed for command-line usage, to maximize flexibility in using the tools.

System Requirements

The package can be installed in Windows/Cygwin or Linux environments. For effective installation and use of the **CMT-Gauge** package, we recommend a computer with minimum of 10GB disk space and 4GB of memory. System recommendations include:

- **Os versions – Operating System:**

  Windows (32 or 64 bit, version 7.0 or later) + Cygwin (or any other virtual Machine), Linux or Mac

- **Required Packages:**

  GrADS (v2.0.2.oga.2), unzip, GNU FORTRAN Compiler, GNU precision calculator (bc), Wget, ImageMagick, GDAL (v2.1.2 or later). The installation procedures of these packages are provided separately in the PPT presentation. **It's extremely important that you read instructions and install all the prerequisite packages in your machine prior trying to install and run CMT.**

CMT-Gauge Structure Modules

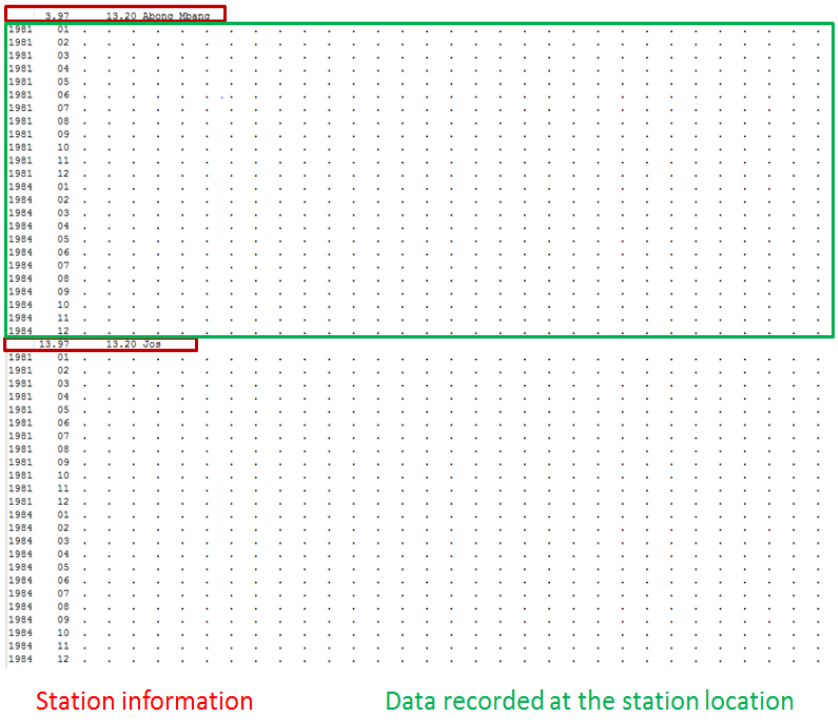
Most tasks in the current version of **CMT-Gauge** run in the background, and users may not have a chance to see tasks in in the intermediate steps (between running the initial shell script and getting the final web-based products). To get a general grasp on **CMT-Gauge**, one must understand what is going on "under the hood". Fig 1 illustrates the sequences of **CMT-Gauge** package run. When you run the main (initial) script, the embedded scripts and programs will - compute and generate time series plots and maps of rainfall performance at station location, - and finally you will see a pop up, on your browser, a web page on which plot of cumulative time-series and spatial maps of precipitation observed at station location are displayed.

Run the initial shell (bash) script on command line.	Ingest historical and near real time daily rainfall data at station location.	Process Cumulative Precipitation Time Series Graphs for the last 7, 10, 30, 60, 90 and 180 day at station locations	A web browser pops up showing the products (spatial and time series plots). The current CMT-Gauge output products include: ✓ ***Cumulative Precipitation Time-series – Spatial distribution of rainfall performance:*** *provides users with near-real time monitoring of daily evolution of rainfall - useful for early drought detection.*

B. CMT-Gauge Setup

1. **Make your gauges data ready for CMT-G**. This is a crucial step for the proper functioning of **CMT-G**, Here we intend to describe how to build the single file, containing the data recorded at all the stations of the domain to monitor. This file should be named *country*_**stns_data_cmt.txt**, where country stand for the name of the country or the area to monitor. For its smooth running, **CMT-G** requests to have this file in a very specific format.

   The figure to the right gives an overview of the contents of this file. In general, the data it contains are of two categories: - one relate to the information (coordinates and name) on the station - the second concerns the data recorded at each station.



   A more detailed description of the content and the edition is provide at end of this tutorial (see the section Data Pre-Processing for CMT-G).

2. **The first step in setting up CMT-Gauge is to define the right geographical domain for your area of your interest.** The following steps will guide you through setting up your geographical domain:

   - Using your text editor, open a new text file name *country*_**latlon,** where *country* refers to the region or area of interest (e.g. Philippines). You need to enter geographical domain information for your area of interest in the following format:

Country_name S_lat N_Lat W_lon E_Lon xlint ylint title_ypos colorbar_ydisp

By default, you may consider the following values, or you may use your own:
xlint=2, ylint=2, title_ypos=10.0 and colorbar_ydisp=-0.1.

For example if the target area is *Philippines*, you may assume that Philippines is embedded in a domain box of [4°N-22°N/116°E-127°E]. The *country*_**latlon** filename becomes **philippines_latlon**. Then we can enter the following values using our text editor, and save the text file as niger_latlon and:

philppines 4 22 116 127 2 2 10.0 -0.1

   - Create another new text file, with a name *country*_**stns_latlon.txt,** where *country* refers to the region or area of interest. This file is used to enter locations and names of your ground stations in the following format :

Lat	***Lon***	***longname***	***Shortname***
stn_lat1	*stn_lon1*	*station_name1*	*stn_nm1*
stn_lat2	*stn_lon2*	*station_name2*	*stn_nm2*
.	.	.	.
.	.	.	.
.	.	.	.

   - Download GIS shapefiles of the international and administrative boundaries for area of interest. These files are available online at: http://www.diva-gis.org/gdata.
     - Using the above link download shapefiles of your country. The name of the downloaded file may look like, *CNTRYISO*_***adm.zip****, where CNTRYISO* is the international ISO Code of the country of interest. For example, if your area of interest is Philippines, its ISO code is PHL and the downloaded file will assume a file name, ***PHL_adm.zip.*** In the case of Nigeria (NGA), the file will be named ***NGA_adm.zip***.

     - Uncompress the zip file using either a window utility, or use the ***unzip*** command if you operate under the Linux environment. The name of the uncompressed file will have a form that looks like *CNTRYISO*_***adm***. Under Linux environment, you may uncompress and rename the file using a single command:

```
unzip CNTRYISO_adm.zip -d CNTRYISO_adm
```

3. At this step make sure that you have copy of the compressed CMT-Gauge code, **CMTK_Stn_SOFTWARE.tar.gz.**

- You need to create your working directory (CMTK_country), and uncompress the file using the following command :

```
mkdir CMTK_Stn_country
```

where, *country* is the name of the country or area of interest (eg. CMTK_Stn_philippines).

- Change your directory to CMTK_*country,* using the following command line

```
cd CMTK_Stn_country
```

- Make sure that the compressed package (CMTK_SOFTWARE.tar.gz) is in your current folder (CMTK_Stn_country) and run the following command:

```
tar -xzvf CMTK_Stn_SOFTWARE.tar.gz --strip-components=1
```

4. Copy your data and domain related files to appropriate directories.

- Copy your *country***_stns_data_cmt.txt,** *country***_latlon** and *country***_stns_latlon.txt** (see section B; 1, 2.a and 2.b), files into:
  `CMTK_Stn_country/input_data/`

- Copy the folder containing your administrative shapefiles (`CNTRYISO_adm` see 1.c) into:
  `CMTK_Stn_country/ToolKit/gis_resources/countries/`

- Finally, from your current directory (CMTK_country), make all the scripts in executable :

```
chmod a+x *
./do_this_first.sh
```

5. Configuration of the folder named *country***_grid (eg : philippines_grid)**

Under the **CMT_Stn_country** *folder*, run the bash script named, ***script_getpixcoord_plot_gridmap.sh*** in the following way:

```
./script_getpixcoord_plot_gridmap.sh country CNTRYISO
```

where,

- *country:* represent the name of the target country or area (Ethiopia, Nigeria, Philippines, ...)
- *CNTRYISO: represent the* ISO code of the target country. For example use ETH for Ethiopia, NGA for Nigeria, PHL for Philippines, ...

This will generate two important files,

- ✓The first, named *country***_grid.png** is located under the folder **ToolKit/*fix*** folder**.** The result is a map displaying the country of interest along with the marks representing the stations locations.
- ✓The second, named *country****_stns_pixel_info.txt*** can be founded under ***ToolKit/fix*** folder. The file contains the pixel coordinates of all the marks appearing on the above *png* image.

6. Editing the “pix body html” and other html files.

These files are used to organize your times series plots on a web page. To do so, from your **CMTK_Stn_***country folder, run the* ***generate_dedicated_HTML.sh script in the following way***:

`./generate_dedicated_HTML.sh` *country*,

where, *country* is the name of the target country (eg Philippines).

7. **Monitoring the Climate**

Once the steps from 1 to 6 have been properly completed, your CMT-Gauge is ready to run. Once your CMT-Gauge setup is done for your area of interest, you don’t need to repeat steps 1 – 6. At this stage, you are good to go with generating products that will help to monitor climate over your region of interest. From your **CMT_Stn_country** directory run ***zstart.sh*** script in the following way:

`./zstart.sh` *country CNTRYISO Nyr Yr1 ClmYr1 ClmYr2 PrdBgnDate PrdEndDate [stnmarkorshd]*

where,

- ***country****:* name of the target country or area (Ethiopia, Nigeria, Philippines, ...)
- ***CNTRYISO****:* represent the ISO code of the target country. For example use ETH for Ethiopia, NGA for Nigeria, PHL for Philippines, ...
- ***Nyr****:* Total number of year in the records
- ***Yr1:*** first year (YYYY) in the records
- ***ClmYr1***: first year (YYYY) of the climatological period
- ***ClmYr2:*** last year (YYYY) of the climatological period
- ***PrdBngDate:*** start date (YYYYMMDD) of the period to monitor.
- ***PrdEndDate:*** end date (YYYYMMDD) of the period to monitor.
- *[**stnmarkorshd** optional]:* an integer (0 or 1) indicating whether the output maps are displayed in form of filled circle at station location or shaded contour based on the available stations (interpolation at 0.5° grid). Default value is 0.

By default, it’s assumed that your web page browser is google-chrome or firebox.

CMT-G : Climate Monitoring Tools for Gauge data

A short guide on

Data Pre-Processing for CMT-G

Data file structure

```
        3.97      13.20 Abong_Mbang
1981    01  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    02  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    03  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    04  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    05  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    06  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    07  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    08  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    09  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    10  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    11  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    12  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    01  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    02  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    03  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    04  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    05  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    06  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    07  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    08  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
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1984    11  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    12  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
       13.97      13.20 Jos
1981    01  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    02  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    03  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    04  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    05  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    06  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
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1981    08  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
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1981    10  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    11  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1981    12  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    01  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    02  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    03  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    04  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    05  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    06  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    07  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    08  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    09  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    10  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    11  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
1984    12  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```
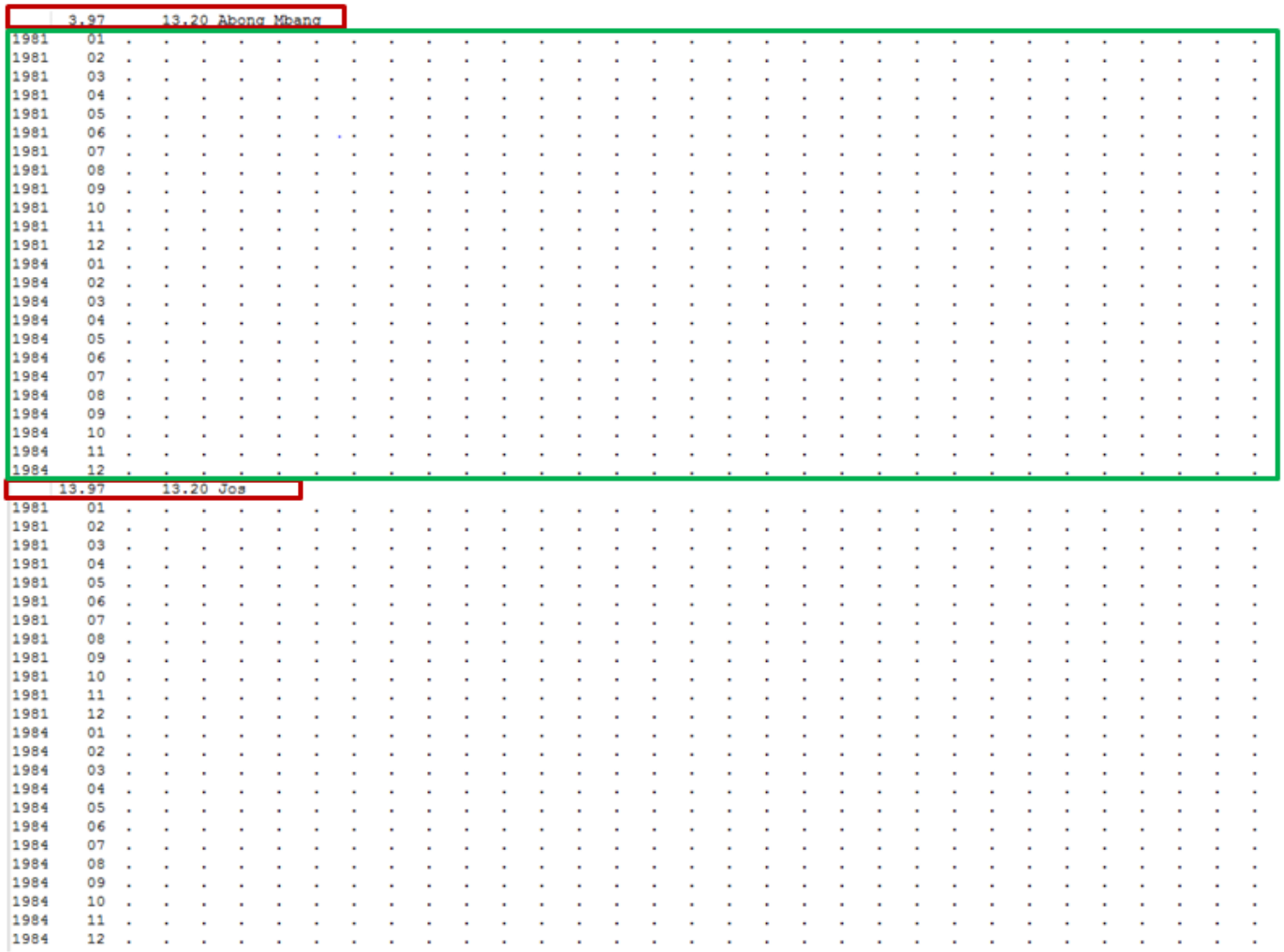

<u>Important notice to the users :</u>

- ❑ The records length should be the same for each stations (e.g. 30 years for each station)
- ❑ Each stations should have a continuous record, from the beginning to end.

Data file structure : General Description

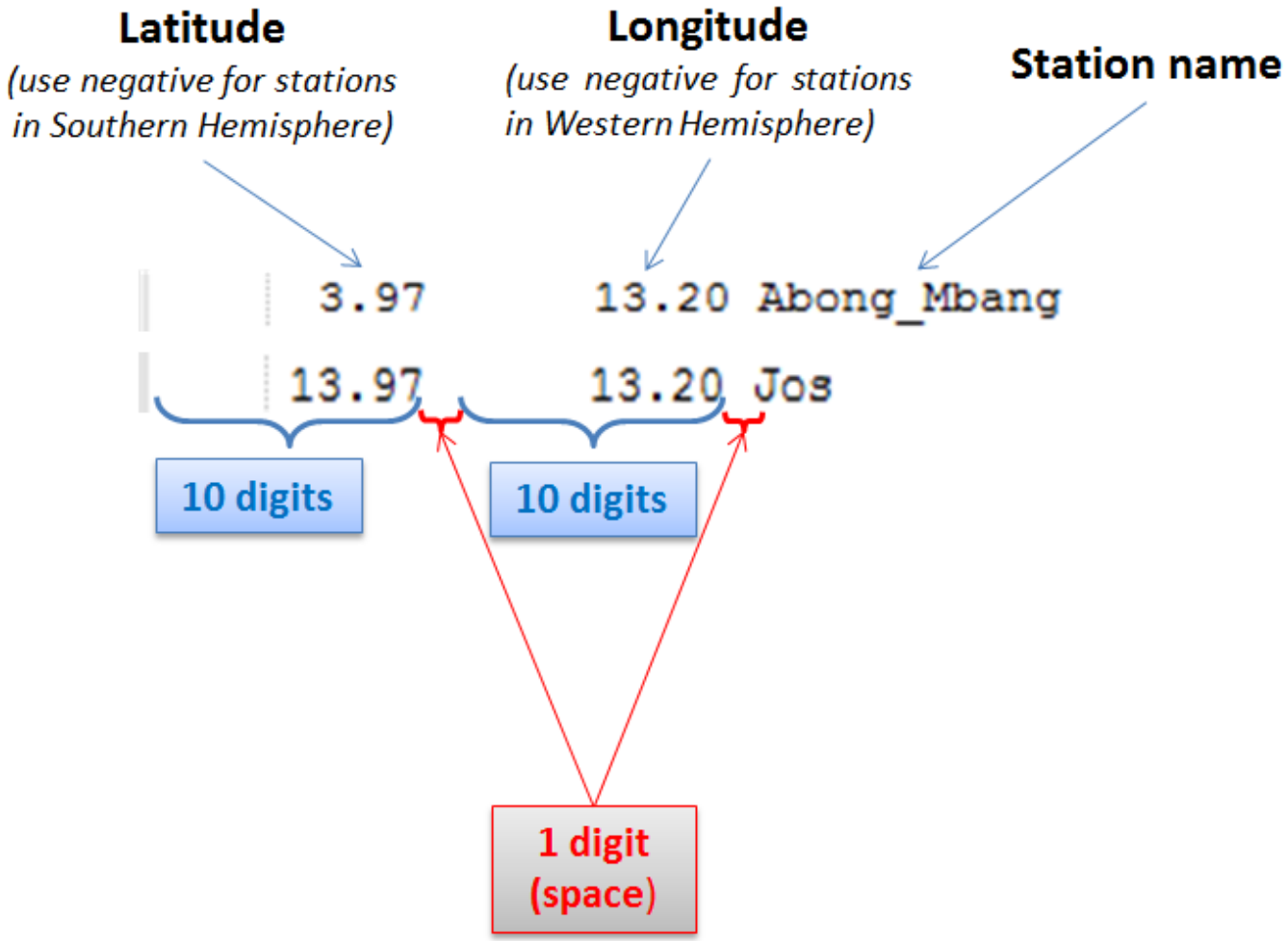


Station information

Data recorded at the station location

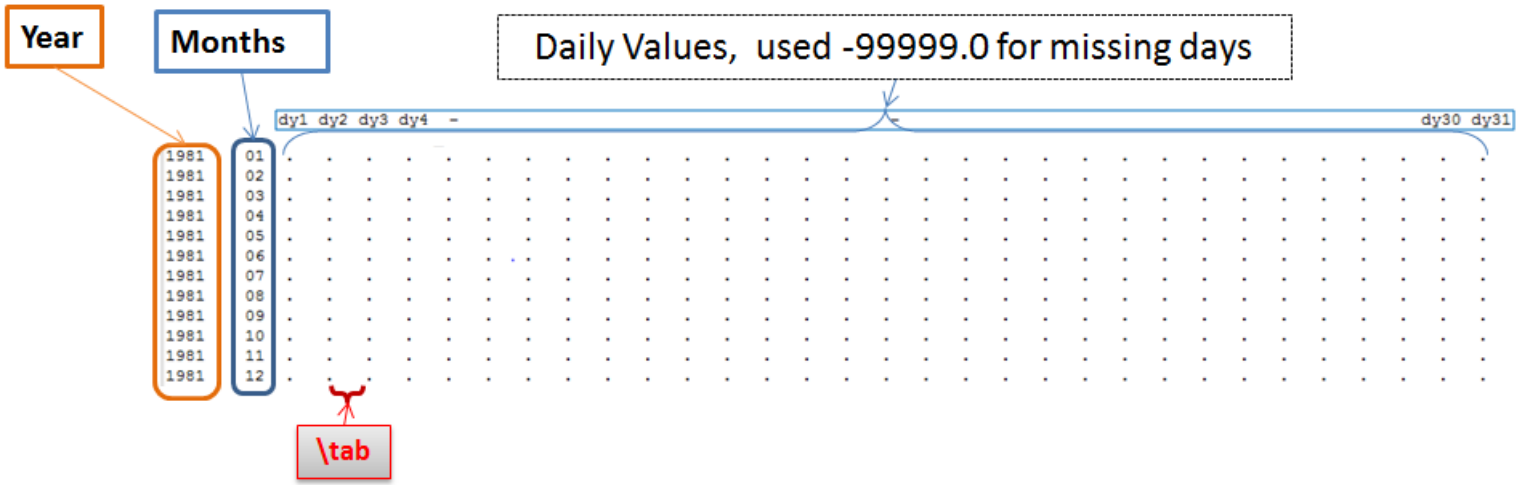
Data file structure :

Formatting the Station information



Data file structure :

Formatting Data recorded at the station location



- ✓ It's assumed that each month has 31 records
  - ➢ for April, June, September and November ; dy31 = -99999.0
  - ➢ for February :
    - o leap year : dy30 and dy31 = -99999.0
    - o non-leap : dy29, dy30 and dy31 = -99999.0
- ✓ Each year in the record should contain a complete year data. If you are in the middle of a year, fill out the remaining days with missing value (-99999.0)