Projet Météo – CY-Tech 2022/2023

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PREING2-Grp2

English Version

Summary:

- Task distribution :

  Matthias : Shell, Gnuplot

  Audrey : C

- Planning :

  11/12 :

  Begining of the project. Task separation.

  17/12-02/01:

  Bash: Checking the bases of getops. First file sorts.

  In C: Creation of base functions for ABR, AVL, and Doubly Linked List sorts.

  Gnuplot: First researches.

  03/01:

  Bash: Finalization of file sorting management.

  In C: Beginning of the creation of more accurate sorting functions.

  14/01:

  Bash: Finalization of argument management/ Changes in sorting methods depending on communes.

  In C: Finalization of ABR method sorting functions.

  18/01:

  Gnuplot: Gnuplot researches continuation and a few first tests.

  Git repository creation.

  26/01:

  In C: Finalization of AVL method sorting functions.

  29/01:

  In C: Last sorting functions for List sorting method finished.

  30/01:

  Bash: Commentary + linking Gnuplot and Bash together

  In C: End of most of the commentary. Changes on wind calculation.

  Gnuplot: All graphs finished except multilines (demands not understood)

  02/02:

  Finalization of the PDF and ReadMe.

  03/02:

  Last details finished for the PDF.

- Commands :

Bash:

Data to sort can be chosen using: -p(1, 2, 3), -t(1, 2, 3), -w, -h, -m **
Sorted areas can be chosen using the arguments: -F, -G, -S, -A, -O, -Q
The file can be chosen using -f or with the file name ending in .csv if placed at the end

Ex: - ./test -Q -h meteo_filtered_data_v1.csv
- ./test -f meteo_filtered_data_v1.csv -h -A

Default sorting method is AVL but it can be changed using the following arguments
"--abr" / "--tab" / "-- avl"
"--help" if help is needed
Bonus:
-d -a -g are functional for respectively the altitude, latitude and longitude using the structure -d "date1 date2" for example.
It isn't mandatory to put them in the correct order ("2020-02-01 2012-02-01" is valid)

C:

The C execution command is the following :

./sort "a.txt" "b.txt" –r –"sorttype" –"sortingmethod"

a.txt: Input file.
To be valid each line of the file has to have the following structure:
" ID Year-Month-DayTHour:00:00+utc:00 v1 v2 x y "
b.txt: Output file.
If it doesn't exist it will be created during the execution.
-r: Reverse mode.
It will only affect the altitude and moisture modes in which if anything else then "-r" is given the output of these sorts will be in rising order instead of their base decreasing order.
-"sorttype": Choice of type of sort.
6 modes available: -m1, -m2, -m3, -w, -h, -m

-m1: Sorting by ID (in rising order) displaying the average, maximum and minimum values of the sorted data (Temperature or Pressure).

-m2: Sorting by chronological order displaying the average values for all the stations for each date. (Temperature or Pressure)

-m3: Sorting by chronological order displaying the values of each station (in rising order) for each date. (Temperature or Pressure)

-w: Sorting by ID displaying the average x and y coordinates of its wind vector and its station's GPS coordinates.

-h: Sorting by altitude value in decreasing order also displaying its station's GPS coordinates.

-m: Sorting by max moisture value in decreasing order also displaying its station's GPS coordinates.

--"sortingmethod": Choice of sorting method.

3 modes available: --abr, --tab, --avl

--abr: Sorting using Binary Search Tree.

--tab: Sorting using Doubly Linked List.

--avl: Sorting using AVL mode (balanced ABR).

If any other argument is given the data will still be sorted by AVL method.

- ## Limits and known errors :

Due to Gnuplot all Gnuplot related files have to be in the same folder as the main bash script.

Bash & Gnuplot:

An error message will be sent if input file has any type of issue (not found/ wrong name), same case if any of the arguments has issues.
If no choice is made the type of data to sort (see **) or if none has been given, it will be signaled to the user.
Graphs P3 and T3 are not functional but all the others are.

En C:

Error code 1 will be given if there is any issue with the given arguments.
Error code 2 will be given if there is any type of issue with the input file (incorrect data or if it isn't openable)
Error code 3 will be given if output file isn't openable.
Error code 4 will be given if any other issue is encountered.

The program will directly shut down if following situations are encountered:

- More than 6 arguments have been given.
- Input file's data isn't properly ordered or if the given file isn't readable.
- The type of sorting method (-m1, -m2, -m3, -w, -h, -m) isn't properly specified or incorrect.

Given that for each station the altitude sometime changes, each station's altitude will be defined by the first value encountered for each ID.
Reverse mode is only available for Altitude (-h) and Moisture (-m).

- # Program execution examples :

Pressure using mode 1:

User viewpoint:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ ./test -p1 meteo_filtered_data_v1.csv
|    Program correctly executed    |
```

Data file after first Shell sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head tmpsort
07558 2010-01-05T10:00:00+01:00 91870.0 0 44.1185 3.0195
07027 2010-01-05T13:00:00+01:00 99880.0 0 49.18 -0.456167
07110 2010-01-05T13:00:00+01:00 99580.0 0 48.444167 -4.412
07591 2010-01-05T13:00:00+01:00 89870.0 0 44.565667 6.502333
71805 2010-01-05T13:00:00+01:00 98920.0 0 46.766333 -56.179167
07015 2010-01-05T16:00:00+01:00 99900.0 0 50.57 3.0975
07149 2010-01-05T16:00:00+01:00 99410.0 0 48.716833 2.384333
81408 2010-01-05T16:00:00+01:00 101140.0 0 3.890667 -51.804667
89642 2010-01-05T16:00:00+01:00 99480.0 0 -66.663167 140.001
07020 2010-01-05T19:00:00+01:00 99950.0 0 49.725167 -1.939833
```

Data file after C sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head endsort
7005    100767.140625   96100.000000 104000.000000
7015    101054.835938   96590.000000 104280.000000
7020    101481.164062   96330.000000 104780.000000
7027    100871.992188   95750.000000 104040.000000
7037    99850.054688   94950.000000 102920.000000
7072    100546.195312   96260.000000 103530.000000
7110    100533.367188   95240.000000 103610.000000
7117    100968.070312   95640.000000 104120.000000
7130    101240.585938   95580.000000 104250.000000
7139    99979.187500   94640.000000 102910.000000
```

Temperature using mode 2:

User viewpoint:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ ./test -t2 meteo_filtered_data_v1.csv
|    Program correctly executed    |
```

Data file after first Shell sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head tmpsort
07558 2010-01-05T10:00:00+01:00 2.6000000000000227 0 44.1185 3.0195
61976 2010-01-05T10:00:00+01:00 32.30000000000001 0 -15.887667 54.520667
07027 2010-01-05T13:00:00+01:00 0.5 0 49.18 -0.456167
07110 2010-01-05T13:00:00+01:00 3.8000000000000114 0 48.444167 -4.412
07591 2010-01-05T13:00:00+01:00 1.3000000000000114 0 44.565667 6.502333
71805 2010-01-05T13:00:00+01:00 1.900000000000034 0 46.766333 -56.179167
78925 2010-01-05T13:00:00+01:00 25.900000000000034 0 14.595333 -60.995667
07015 2010-01-05T16:00:00+01:00 1.7000000000000455 0 50.57 3.0975
07149 2010-01-05T16:00:00+01:00 -0.5 0 48.716833 2.384333
81408 2010-01-05T16:00:00+01:00 30.100000000000023 0 3.890667 -51.804667
```

Data file after C sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head endsort
2010-1-1   1:00:00+1          9.894829
2010-1-1   4:00:00+1          9.726315
2010-1-1   7:00:00+1          9.422415
2010-1-1   10:00:00+1          9.370689
2010-1-1   13:00:00+1          9.834481
2010-1-1   16:00:00+1          9.617241
2010-1-1   19:00:00+1          8.353449
2010-1-1   22:00:00+1          7.439655
2010-1-2   1:00:00+1          6.587931
2010-1-2   4:00:00+1          6.255173
```

Temperature using mode 3:

User viewpoint:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ ./test -t3 meteo_filtered_dat
|    Program correctly executed    |
```

Data file after first Shell sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head tmpsort
07558 2010-01-05T10:00:00+01:00 2.6000000000000227 0 44.1185 3.0195
61976 2010-01-05T10:00:00+01:00 32.30000000000001 0 -15.887667 54.520667
07027 2010-01-05T13:00:00+01:00 0.5 0 49.18 -0.456167
07110 2010-01-05T13:00:00+01:00 3.8000000000000114 0 48.444167 -4.412
07591 2010-01-05T13:00:00+01:00 1.3000000000000114 0 44.565667 6.502333
71805 2010-01-05T13:00:00+01:00 1.900000000000034 0 46.766333 -56.179167
78925 2010-01-05T13:00:00+01:00 25.900000000000034 0 14.595333 -60.995667
07015 2010-01-05T16:00:00+01:00 1.7000000000000455 0 50.57 3.0975
07149 2010-01-05T16:00:00+01:00 -0.5 0 48.716833 2.384333
81408 2010-01-05T16:00:00+01:00 30.100000000000023 0 3.890667 -51.804667
```

Data file after C sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head endsort
2010-1-1    1:00:00+1     7005   0.500000
2010-1-1    1:00:00+1     7015   0.200000
2010-1-1    1:00:00+1     7020   5.600000
2010-1-1    1:00:00+1     7027   3.000000
2010-1-1    1:00:00+1     7037   0.300000
2010-1-1    1:00:00+1     7110   4.800000
2010-1-1    1:00:00+1     7117   5.700000
2010-1-1    1:00:00+1     7130   3.900000
2010-1-1    1:00:00+1     7139   1.000000
2010-1-1    1:00:00+1     7149   0.800000
```

Wind sort:

User viewpoint:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ ./test -w meteo_filtered_data_v1.csv
|    Program correctly executed    |
```

Data file after first Shell sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head tmpsort
07558 2010-01-05T10:00:00+01:00 260 1.5 44.1185 3.0195
07027 2010-01-05T13:00:00+01:00 200 3.6 49.18 -0.456167
07110 2010-01-05T13:00:00+01:00 210 4.1 48.444167 -4.412
71805 2010-01-05T13:00:00+01:00 210 9.8 46.766333 -56.179167
78925 2010-01-05T13:00:00+01:00 30 0.5 14.595333 -60.995667
07015 2010-01-05T16:00:00+01:00 190 1.5 50.57 3.0975
07149 2010-01-05T16:00:00+01:00 10 2.6 48.716833 2.384333
81408 2010-01-05T16:00:00+01:00 80 4.1 3.890667 -51.804667
89642 2010-01-05T16:00:00+01:00 120 4.1 -66.663167 140.001
07020 2010-01-05T19:00:00+01:00 200 11.8 49.725167 -1.939833
```

Data file after C sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head endsort
7005    -0.021753 0.021545    50.136002 1.834000
7015    -0.065470 0.012557    50.570000 3.097500
7020    -0.019498 0.020812    49.725166 -1.939833
7027    -0.073753 0.026906    49.180000 -0.456167
7037    -0.069363 0.015093    49.382999 1.181667
7072    -0.011131 0.048915    49.209667 4.155333
7110    -0.042048 -0.009540    48.444168 -4.412000
7117    -0.081901 0.021334    48.825832 -3.473167
7130    -0.068914 0.051357    48.068832 -1.734000
7139    -0.088751 0.003570    48.445499 0.110167
```

Altitude Sort:

User viewpoint:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ ./test -h meteo_filtered_data_v1.csv
|    Program correctly executed    |
```

Data file after first Shell sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head tmpsort
07558 2010-01-05T10:00:00+01:00 712 0 44.1185 3.0195
61976 2010-01-05T10:00:00+01:00 7 0 -15.887667 54.520667
07027 2010-01-05T13:00:00+01:00 67 0 49.18 -0.456167
07110 2010-01-05T13:00:00+01:00 94 0 48.444167 -4.412
07591 2010-01-05T13:00:00+01:00 871 0 44.565667 6.502333
71805 2010-01-05T13:00:00+01:00 21 0 46.766333 -56.179167
78925 2010-01-05T13:00:00+01:00 3 0 14.595333 -60.995667
07015 2010-01-05T16:00:00+01:00 47 0 50.57 3.0975
07149 2010-01-05T16:00:00+01:00 89 0 48.716833 2.384333
81408 2010-01-05T16:00:00+01:00 6 0 3.890667 -51.804667
```

Data file after C sort:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head endsort
7591 871.000000    44.565666 6.502333
7471 833.000000    45.074501 3.764000
7558 712.000000    44.118500 3.019500
7627 414.000000    43.005333 1.106833
7434 402.000000    45.861168 1.175000
7621 360.000000    43.188000 0.000000
7181 336.000000    48.581001 5.959833
7460 331.000000    45.786835 3.149333
7299 263.000000    47.614334 7.510000
7535 260.000000    44.744999 1.396667
```

Moisture sort:

User viewpoint:

```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ ./test -m meteo_filtered_data_v1.csv
|    Program correctly executed    |
```

Data file after first Shell sort:

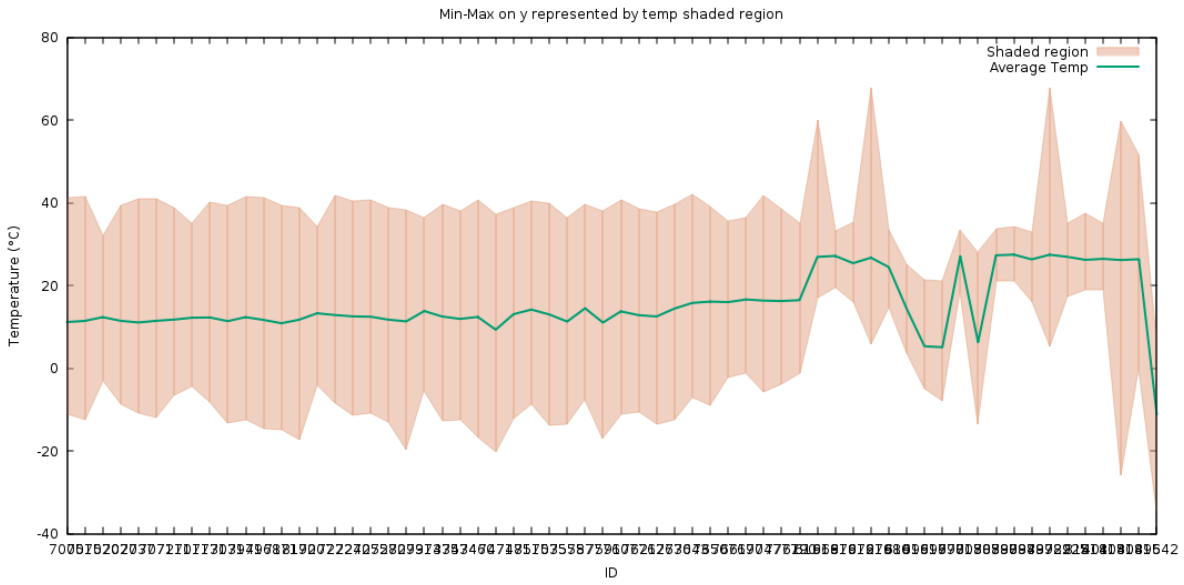
```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head tmpsort
07558 2010-01-05T10:00:00+01:00 100 0 44.1185 3.0195
61976 2010-01-05T10:00:00+01:00 69 0 -15.887667 54.520667
07027 2010-01-05T13:00:00+01:00 87 0 49.18 -0.456167
07110 2010-01-05T13:00:00+01:00 73 0 48.444167 -4.412
07591 2010-01-05T13:00:00+01:00 67 0 44.565667 6.502333
71805 2010-01-05T13:00:00+01:00 99 0 46.766333 -56.179167
78925 2010-01-05T13:00:00+01:00 83 0 14.595333 -60.995667
07015 2010-01-05T16:00:00+01:00 78 0 50.57 3.0975
07149 2010-01-05T16:00:00+01:00 69 0 48.716833 2.384333
81408 2010-01-05T16:00:00+01:00 69 0 3.890667 -51.804667
```

Data file after C sort:

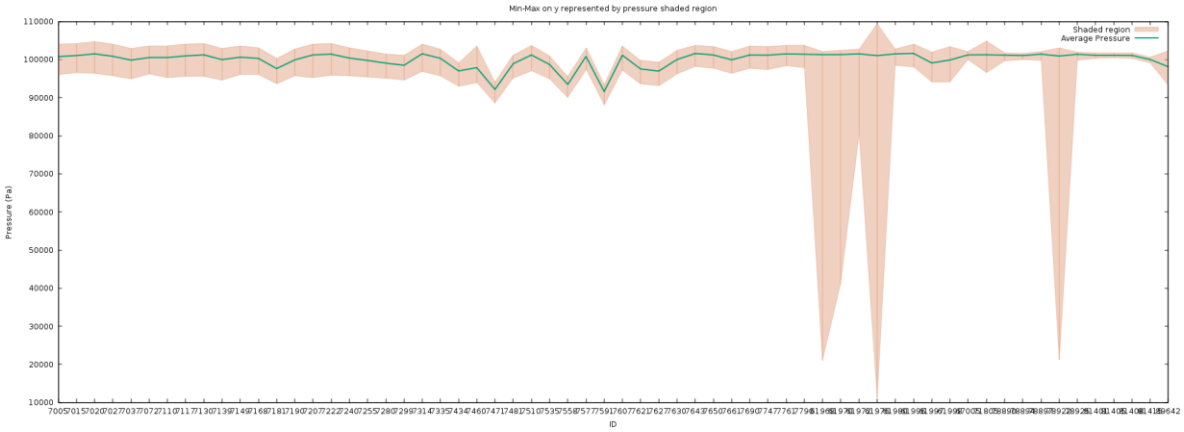
```
labaguette@LAPTOP-QE5KD6D0:~/Projet-M-t-o-2022-2023-Audrey-Matthias$ head endsort
89642 100.000000    -66.663170 140.001007
81415 100.000000    3.640167 -54.028332
81408 100.000000    3.890667 -51.804668
81405 100.000000    4.822333 -52.365334
81401 100.000000    5.485500 -54.031666
78925 100.000000    14.595333 -60.995667
78922 100.000000    14.774500 -60.875332
78897 100.000000    16.264000 -61.516335
78894 100.000000    17.901501 -62.852165
78890 100.000000    16.334999 -61.004002
```

- ## Gnuplot Graphs :

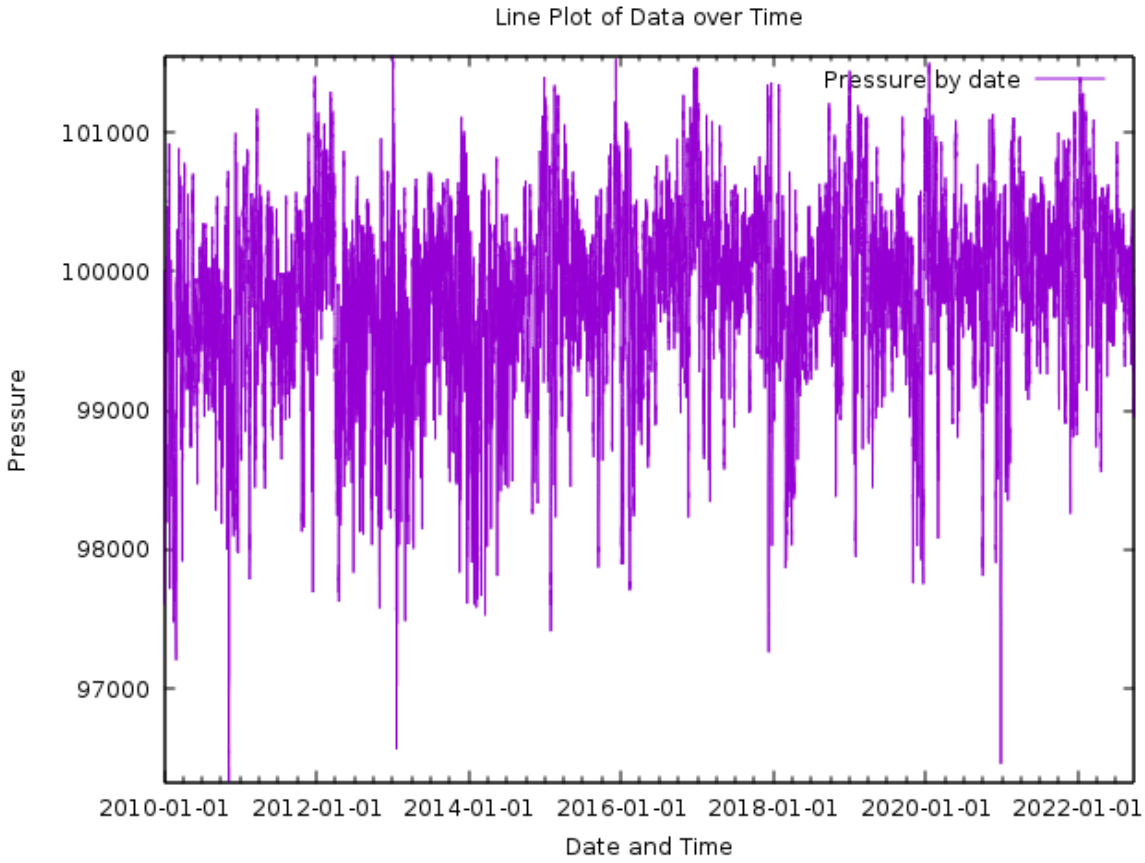
All of these files are also available in the "Last_files" folder.



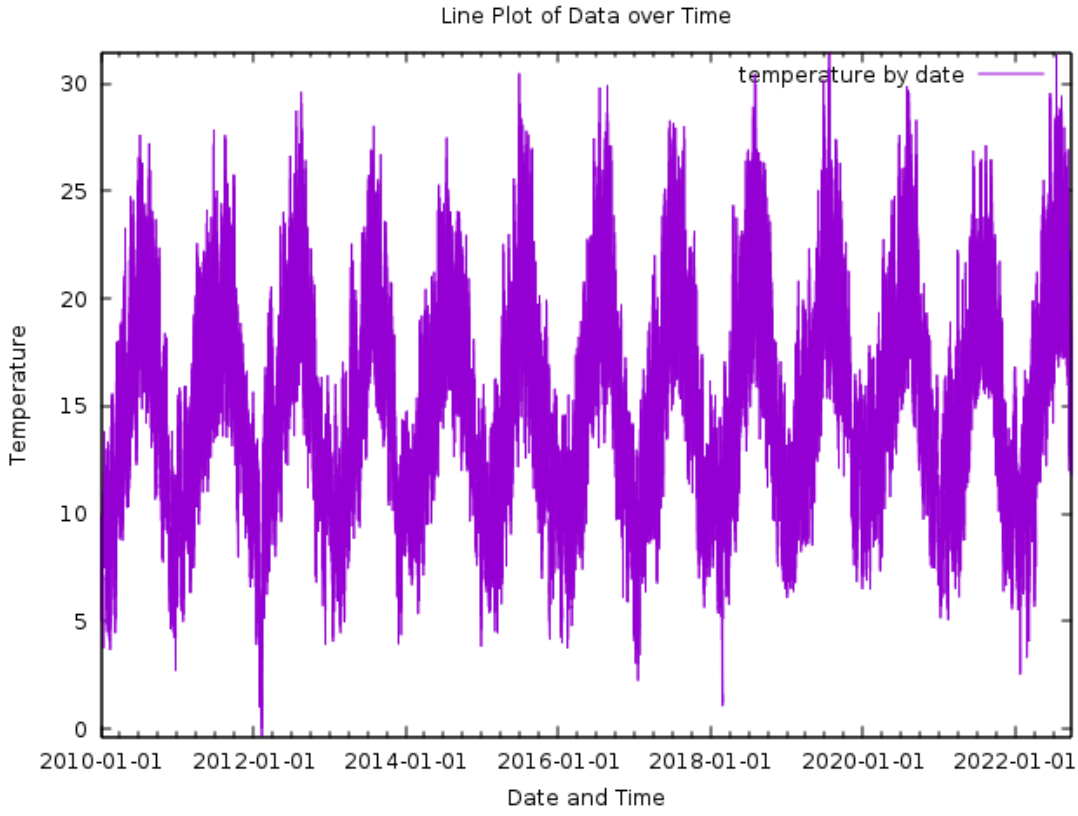
Temperature sort using mode 1.



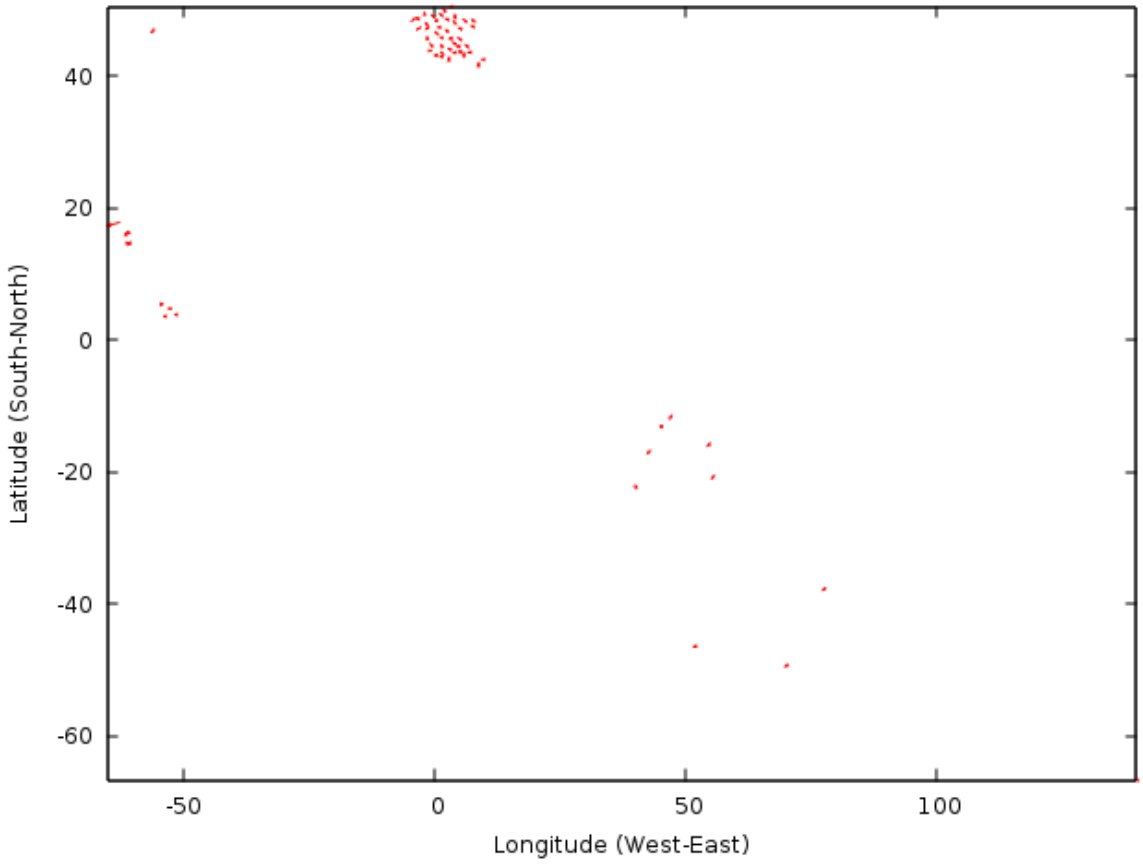
Pressure sort using mode 1.



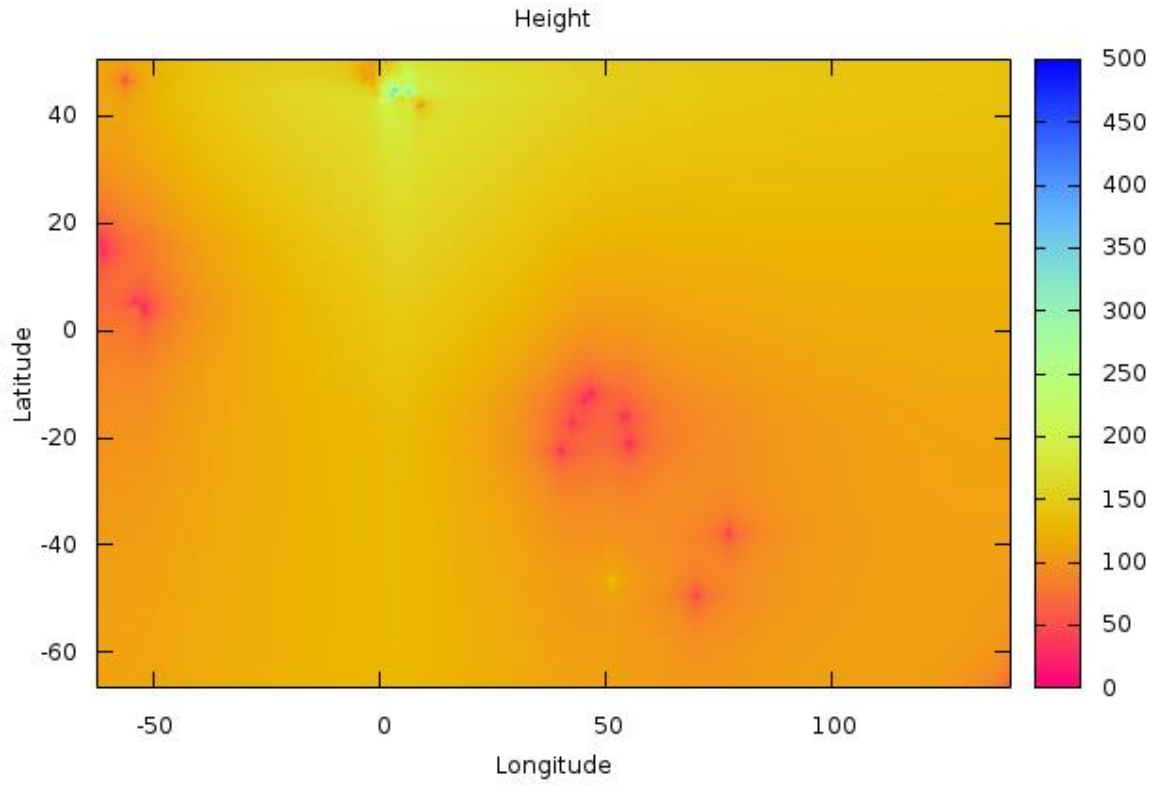
Pressure sort using mode 2:



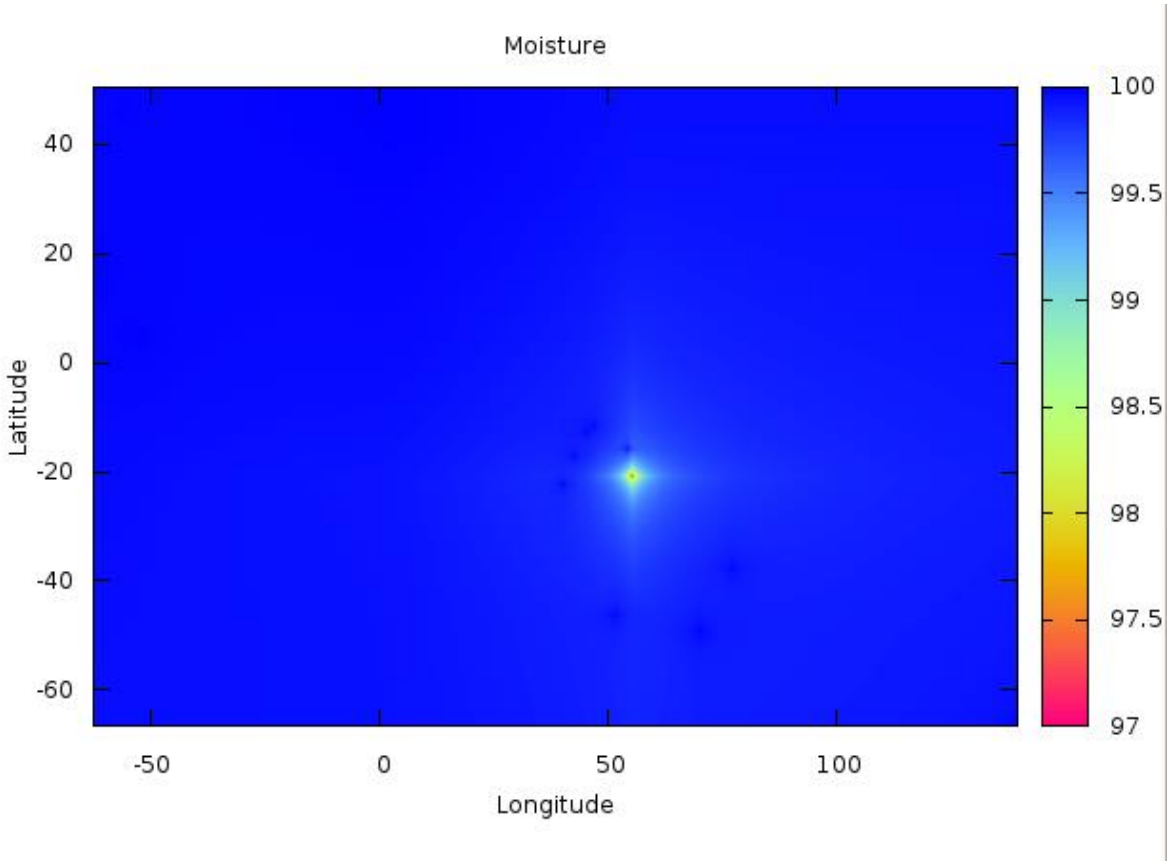
Temperature sort using mode 2.



Wind sort.



Altitude sort.



Moisture sort.