MNXB01 Project Report

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For this project, we produced a total of 5 graphs. 3 of them were proposed as examples in the "projectInstructions.pdf" file, while 2 others were original graphs. Please find all the code referenced in this report at `https://github.com/AnttonLA/MNXB01-project`.

1 Reproducing example plots

1.1 tempOnDay()

The first of the proposed graphs was a histogram that will show all the temperatures recorded over the years for a single day. The member function of tempTrender that deoes this was called "tempOnDay()".

There are two variants proposed for the tempOnDay member function in the instructions file: one that takes two int values as input (month and day) and one that takes a number between 0 and 365, corresponding to a specific day of the year. We implemented both.

Data parsing was done by skipping the headers of the files and then reading all of the rest of the lines. If the date of a line corresponded with the desired date, the value for that date was included into the histogram. No data preprocessing was done.

The second graph is identical to the first one, with the exception of the legend, where the day number is shown instead of the date.

1.2 tempPerDay()

The third graph we created was the second example graph proposed in the instructions file. It shows the mean temperature for each day of the year. It is produced by the member function of tempTrender called "tempPerDay(). Conceptually, it is similar to stacking 365 of the "tempOnDay()" histograms vertically. It was created by using the ROOT histogram class "TProfile". Data parsing was identical to the parsing done for graphs 1 and 2.

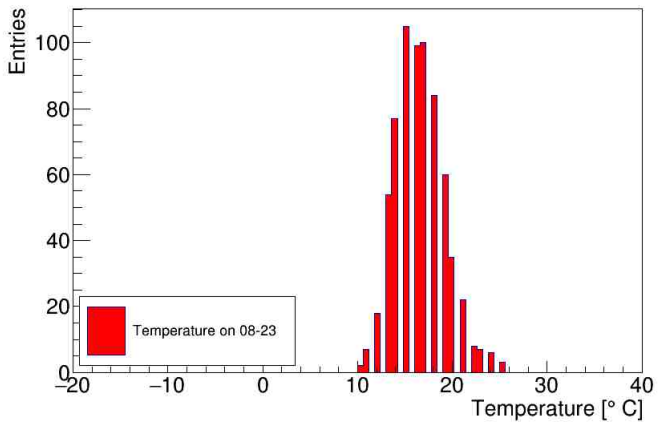

Figure 1: Temperature for a specific day. Histogram produce by tempOnDay(month, day)

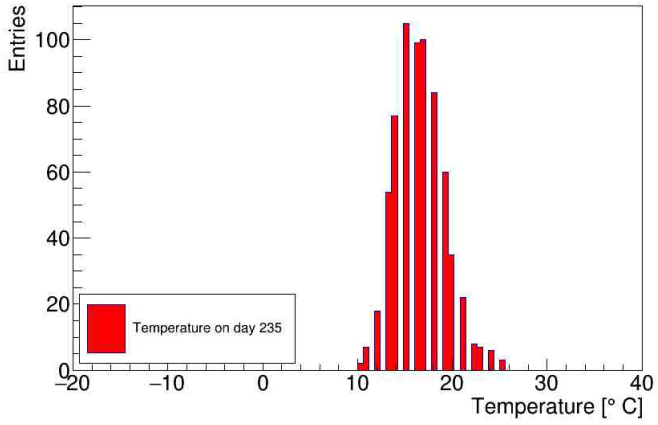

Figure 2: Temperature for a specific day. Histogram produce by tempOnDay(DayNumber)

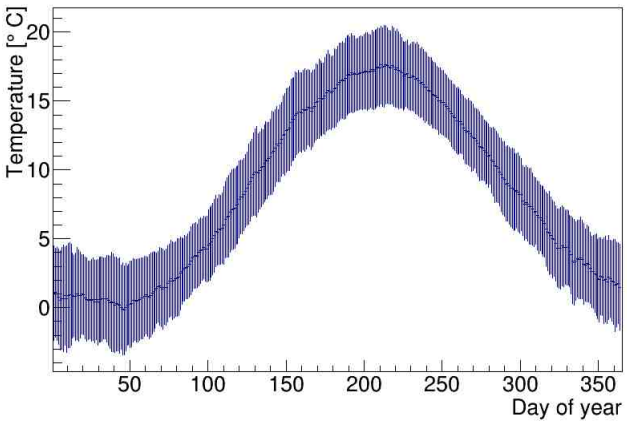

Figure 3: Histogram showing the mean temperature on each day of the year. Produced by "tempPerDay()".

2 Temperature for each month over all the years in Falun

In these calculations, in figure 4, the temperature average is measured for all years in Falun (northern Sweden), grouped by the month. The input to the function that calculates this is the month, and the function calculates the temperature average and outputs the graph to the screen and to a file. In order to obtain the graphs for all years the calculation was run for each month. Besides the temperature average for each year, the graph also shows a fitted line over the data.

An interesting observation from the fitted lines on the measurements is that for the majority of the months the temperature average has been increasing over the years.

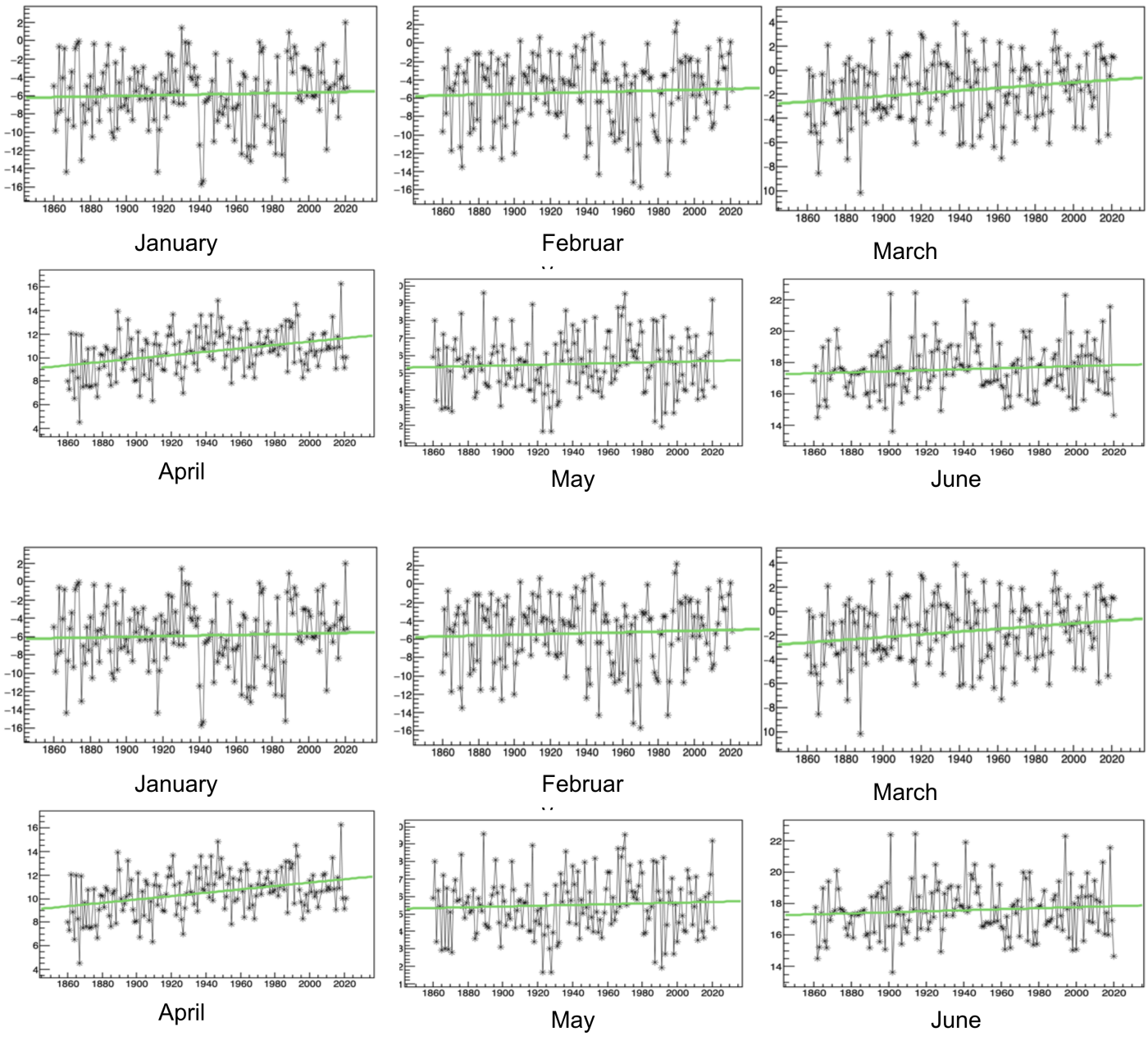

Figure 4: 2 Figures side by side

3 Yearly Average Temperatures in Falsterbo, 1967-2017

With the release of the International Panel on Climate Change (IPCC)'s Sixth Assessment Report[1] in August 2021 having further highlighted the global increase in average temperatures the topic has once again returned to the forefront of public discourse. The global increase in average temperatures is hardly a novel line of inquiry, however the analysis of temperature trends locally may still be of interest (particularly to those local to the area in question). The data analysed for this section was measured at a measuring station located in Falsterbo in southwestern Skåne, at a height of 1.541m above sea level, at coordinates (in decimal degrees) 55.3837 latitude, 12.8167 longitude.

The data was provided in CSV-format as part of a SMHI-dataset, and analysed using a custom C++ function and plotted using ROOT. The data was handled using line-by-line reading of the data and slicing into strings, slicing the date and temperature in separate strings, the former being used to further create a substring consisting only of the year. This substring is then converted to an integer and used to check first whether the data in question belongs to the relevant range of years. The entire date string is then checked to see wheter or not the data for a new day is being parsed, if not the temperature data is added to a sum and a count of the number of entries for a specific day increased by one, and if yes, the same actions are performed after first taking the average of the sum, pushing it to a vector containing the daily average temperatures of a whole year and zeroing the sum and entry counter. A similar process is used whenever a new year is being iterated upon, in which case the average of the vector containing the daily averages is calculated using a small utility function which loops over all elements, after which it is stored in both a separate vector and in a TGraph object. This is repeated for all lines containing years in the specified range, after which the rest of the lines are just read and then a graph of the data is then plotted from the TGraph object. Worth noting is that the code is unable to account for the quality of the data (in the data set indicated by a G, for controlled and accepted values, and Y for suspect or aggregated values, from roughly checked archive data or real-time data.), nor detect or account missing data.

Although no explicit trendline was plotted, the resulting graph still shows a clear upwards trend in temperatures over the period, shifting both high and low peaks towards higher temperatures, which is as expected considering global trends. An abnormaly cold period in the latter half of the 1980's (1986-1988) was noted, although there's no direct indication that this is due to not accounting for missing data or other shortcoming of the code, however the possibility cannot be dismissed.

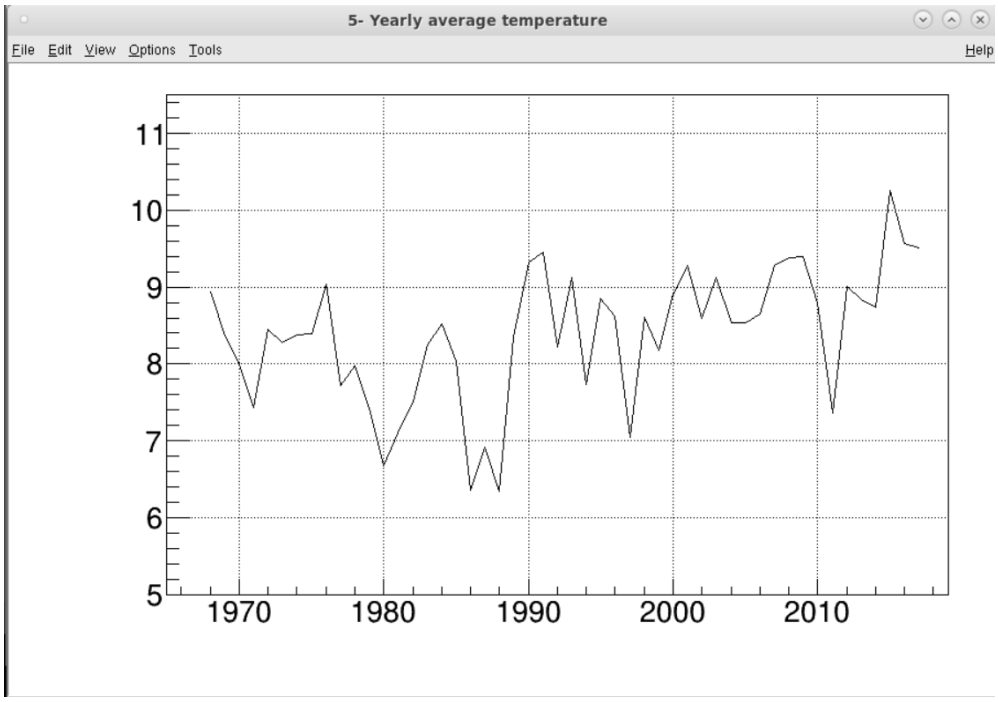

Figure 5: The yearly average temperatures measured at Falsterbo during 1967-2017.

4 Refrences

References

[1] IPCC, *Climate Change 2021 The Physical Science Basis, Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*