CS2035 - Assignment 4 - 2019

London Weather Analysis

Out: Tuesday, March 19th, 2019
In: Sunday, April 7th, 2019 at 11:55pm via Owl

Introduction

This assignment requires you to do some simple (and **primitive**) analysis on London weather data from 1941 to 2013. Is the weather in London becoming warmer? Is there less snowfall? More precipitation? Your friendly neighbourhood professor has obtained some weather data, mostly from the London International Airport (1941-2005) and from an automated weather station and a volunteer (2006-2013). This data is available via a mat file:

`london_weather_1941_2013.mat`

available on the course webpage.

This file has the following data: year, month, element and data for up to 31 days (data element 32 specifies the number of data items), saved in a 4D array, named **climate**. The data is for years 1941 to 2013, 12 months a year (29 days in February in leap years), 7 data elements (types of data) followed by the data for the specified element and month for some year. There are 7 data elements stored for most days:

1. max daily temperature degrees (C)
2. min daily temperature degrees (C)
3. ave daily temperature degrees (C)
4. total rainfall (mm)
5. total snowfall (cm)
6. total precipitation (mm)
7. snow on the ground (cm)

Note that 10mm is 1cm. A true fact is that 1cm of snow is equal to 0.1cm or 1mm of rain. Sometimes data elements are missing (not recorded or lost). In this case, `nan` (not a number) is recorded as the value. Note that you cannot use `nan` numbers in your calculations (any calculation with `nan` is `nan`) but you can plot graphs with `nan` (these values are ignored). Note that for array `x`, `mean(x(~isnam(x)))` will compute the average of all non-`nan` values in `x`. Lastly, note that there is missing precipitation data in the climate data; these values are read as 0, the error bars will be computed as 0 as well.

Do the following for this assignment:

1. Compute the average monthly maximum and average precipitation values. The monthly minimum precipitation will almost certainly be 0 and so is not interesting to plot. Instead we plot the sum of the maximum monthly rain and the maximum monthly snow (scaled by 0.1) as the minimum errorbar. Of course, this should in theory be equal to the total precipitation, so the error plot should be symmetrical. Plot this data as errorbar graphs for each month. Each point on the graph is the average precipitation with the minimum and maximum error bars corresponding to the sum of maximum rain and snow amounts and maximum precipitation. This will give you 12 graphs, one for each month. Chose your coloring scheme to make the graphs look like those on the assignment handout.

2. Perform 1^{st} (linear), 2^{nd} (quadratic), 3^{th} (cubic), 4^{th} (quartic) and 5^{th} (quintic) regression on these average data and for each month from 1941 to 2013 and plot these curves as solid coloured lines. Again, use the coloring scheme as on the assignment handout. Note that the data points appear as cyan. You should obtain 12 graphs in total, one for each month.

Comments

Figures 1 and 2 show examples of errorbar plots for the average monthly precipitation for the January and July data for the years from 1941 to 2013 while Figures 3 and 4 show the 1^{st} to 5^{th} order polynomial fits for the same months. A file **ass4_shell_2019.m** is available on the course webpage. Add your MatLab code to make these plots to that file. Full documentation on the errorbar calculation can be found on the webpage:

`http://www.mathworks.com/help/matlab/ref/errorbar.html`

Note that you have to compute errorbar plots of the form `errorbar(X,Y,L,R)`, where `L` and `R` are the sum of the maximums of rain and snow and the maximum precipitation values as the minimum and maximum error bars of the graph and where the average precipitation values (`Y`) are plotted against year (`X`).

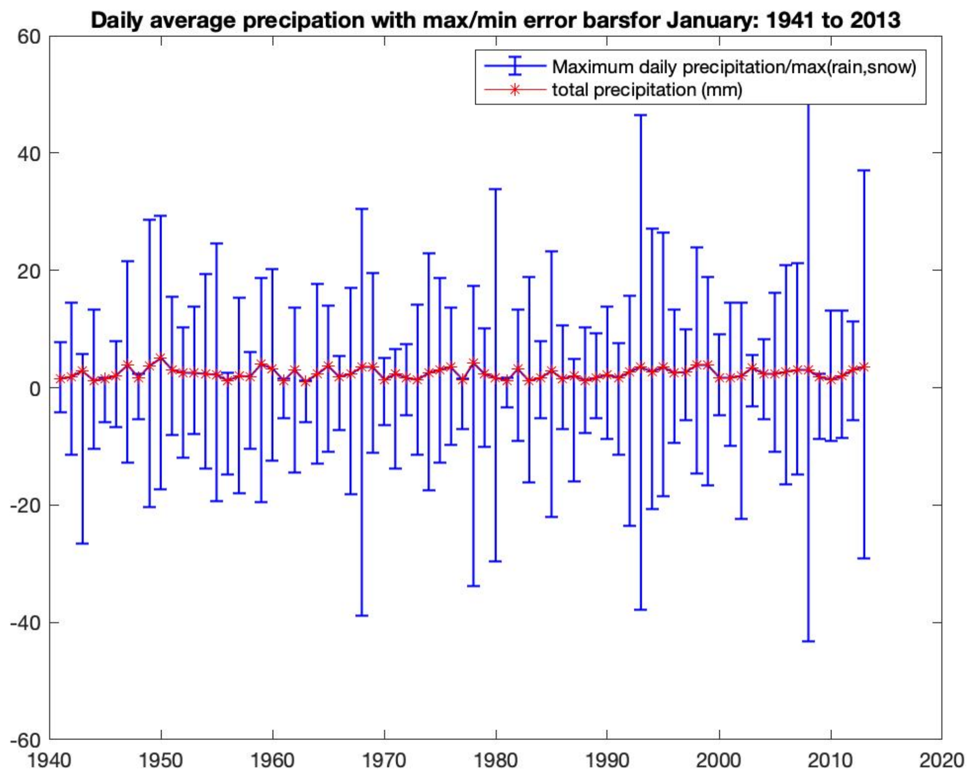

Figure 1: Error bar plot of the average January precipitation from 1941 to 2013. Each month's temperature is bound by its sum of maximum rain and snow and the maximum average precipitation.

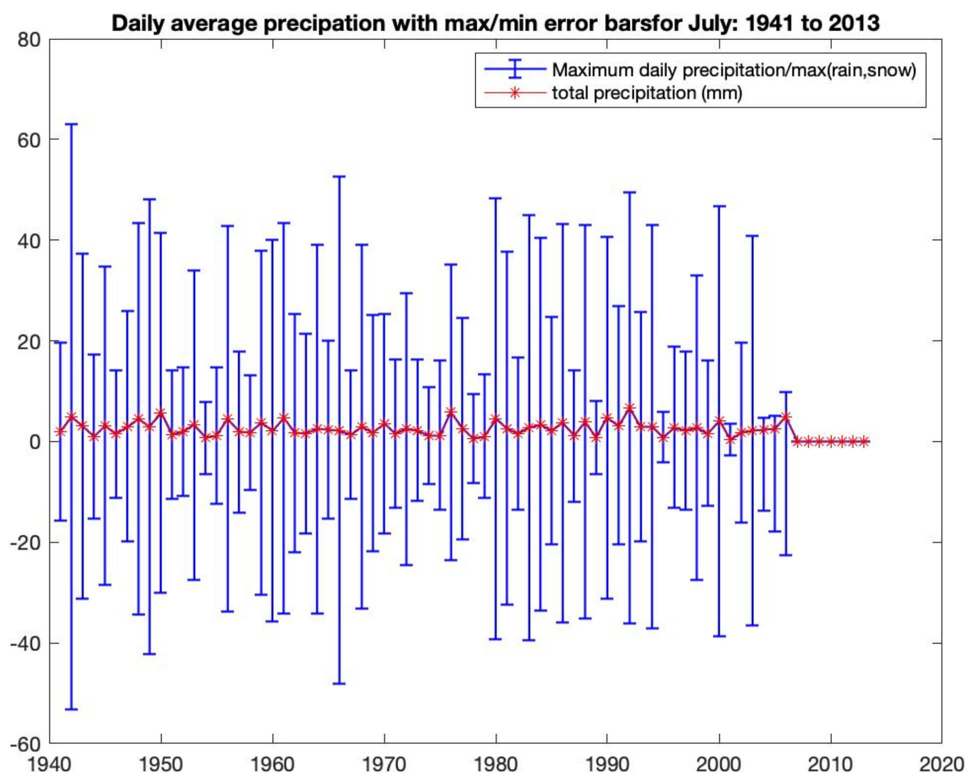

Figure 2: Error bar plot of the average July precipitation from 1941 to 2013. Each month's temperature is bound by its sum of maximum rain and snow and the maximum average precipitation. Note the missing precipitation data from 2010 on.

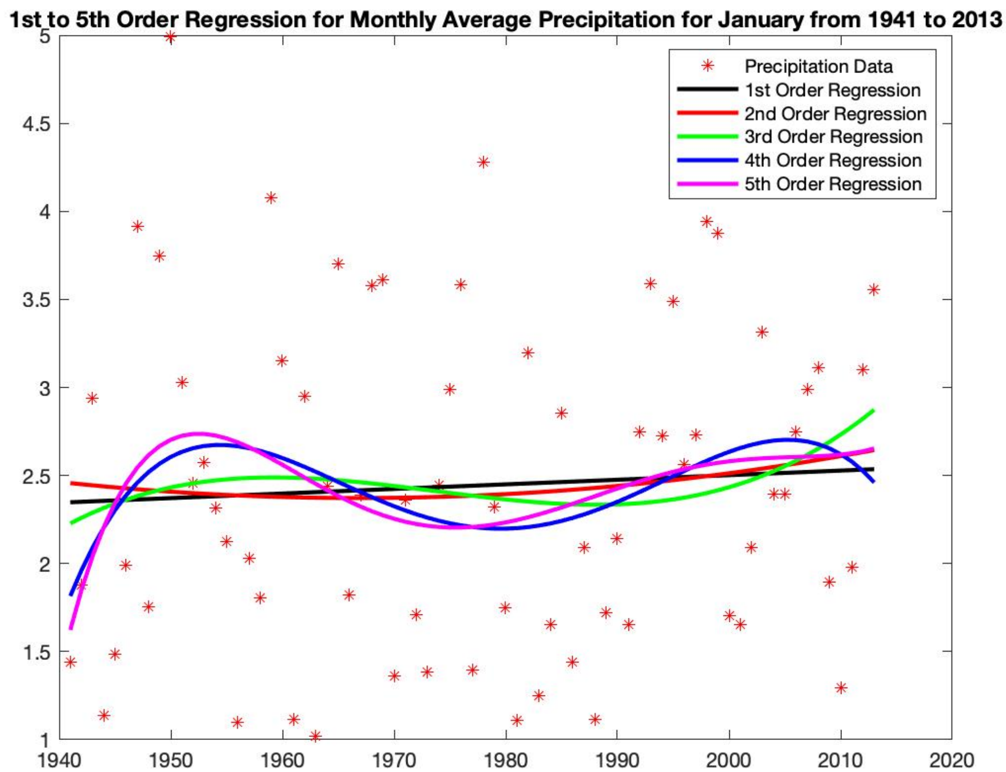

Figure 3: Superimposed 1^{st} to 5^{th} order polynomials plots for the average January precipitation data (shown as asterisks) from 1941 to 2013.

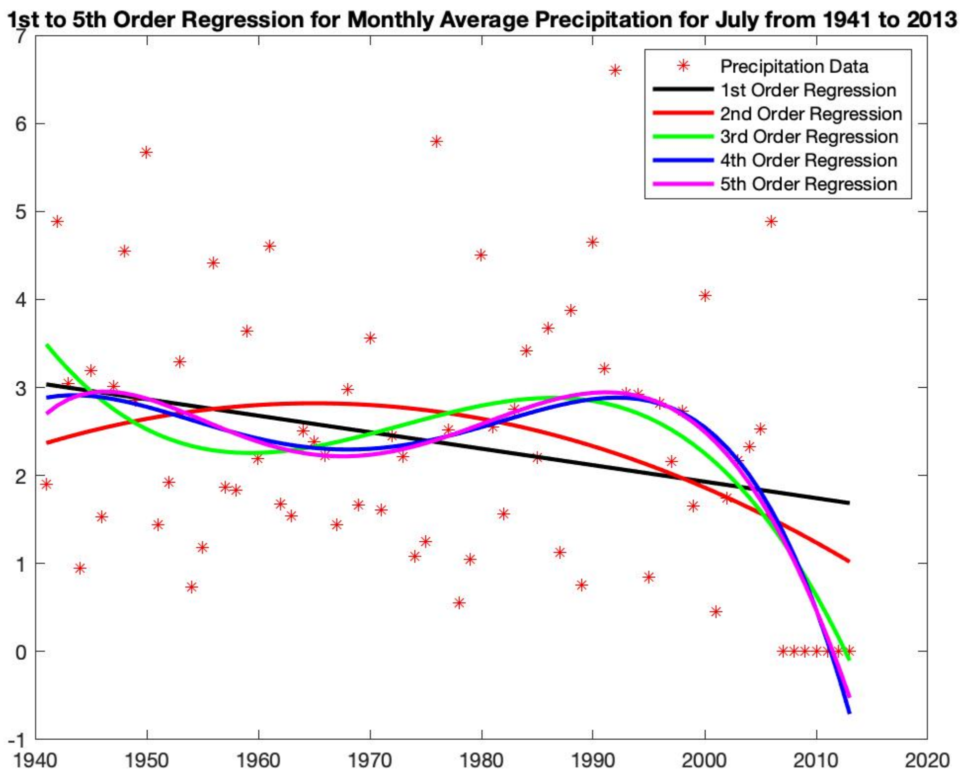

Figure 4: Superimposed 1^{st} to 5^{th} order polynomials plots for the average July precipitation data (shown as asterisks) from 1941 to 2013.