

Laboratory Exercise - 5 & 6 : Working with tide gauge data

CE670a: Environmental Geodesy
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Objective:

The main objective of this exercise is to study and plotting tide gauge data.

Tasks

1. Download monthly tide gauge data from given link-
<https://www.psmsl.org/data/obtaining/rlr.monthly.data/43.rlrdata>

Information about the data -

The monthly files list the date (year-month in decimal form), mean sea level value for the month, number of missing days of data in the month and flag for attention. If there is no data for a month between the first and last date values, then the mean sea level value for that month will be set to -99999.^[1]

2. Add 3.850m to data values from 1878-1936 to refer data to Revised Local Reference (RLR) and Add 4.460m to data values 1937 onwards to refer to RLR^[2].
3. Compute mean sea level from RLR using the whole dataset.
4. You will notice that the original dataset has some data gaps. Choose the longest part of data which has continuous values without any missing values. Follow instructions of step 2 and compute mean sea level using this dataset.
5. Compare results obtained from both methods. Why is there difference in both results?
6. Find anomaly for both dataset by subtracting mean sea level values for each dataset.
7. Plot time series for anomaly value for both dataset.
8. Compute mean, median, mode, standard deviation and variance for both datasets.
9. Seasonal adjustment-
Compute seasonal mean for every month (In the sea level data which you get after step 2). Remove seasonal mean values for each month from their respective sea level values.
10. Plot histogram, barplot and violin plot for seasonal adjusted anomaly data and anomaly data computed from continuous data in step 4.
11. Comment on what difference do you see after plotting diagrams for both datasets.
12. Apply 3σ test and 6MAD (mean absolute deviation) test on the anomaly from seasonal adjusted data and anomaly from continuous data to remove outliers.

13. Find trends in the data by fitting a linear line $Y=AX+B$ for all three anomaly dataset.
14. Plot these lines on a single plot and see the difference in trend.
15. Perform 5 year moving average filtering on data and plot it.
16. Compute the Lomb-Scargle Periodogram.
Lomb–Scargle periodogram is an algorithm for detecting and characterizing periodic signals in unevenly sampled data. You can use scipy library or astropy library to compute the LombScargle Periodogram. You can take help of given tutorials-
<https://docs.scipy.org/doc/scipy/reference/generated/scipy.signal.lombscargle.html>
<https://docs.astropy.org/en/stable/api/astropy.timeseries.LombScargle.html>

Notes

1. No marks will be given for late submission.
2. This is a total of two week exercise but you have to submit work upto step-8 till Feb 14,2020. Final submission date for the whole exercise is Feb 28,2020.
3. There is provision of bonus marks in this lab. Person who completes tasks after step-8 and submits it before Feb 14, will get bonus marks based on how much extra work they have submitted.

References-

1. <https://www.psmsl.org/data/obtaining/notes.php>
2. https://www.psmsl.org/data/obtaining/rlr_diagrams/43.php
3. <https://www.psmsl.org/data/obtaining/stations/43.php>