# Homework 1

**Submit via Webcourses until Sunday 27 Sept 11:59 AM (late submissions will not be accepted!); use file name conversion as outlined in the syllabus.**

I have uploaded multiple excel files with data from tide gauges around the world, the files include time and monthly mean sea level **in mm**. There is also a separate file that has the tide gauge locations (longitude and latitude). Use that information and find the one that is closest to the city you were born in. This tool can help to get the exact distance: http://www.nhc.noaa.gov/gccalc.shtml. Use the monthly sea level data from the tide gauge closest to "home" and perform the following analyzes (each one counts 2 points for 20 points total):

a. Calculate the linear trend (in **mm/yr**) and **99%** confidence interval for the entire data record
b. Calculate the acceleration (in mm/yr$^2$) for the entire data record (note that acceleration is defined as **twice the quadratic coefficient**!)
c. Calculate the linear trends (in mm/yr) for the first and second halves of the time series
d. Based on the **95% confidence levels** determine if the trends derived in (c) are significantly different from each other (i.e. confidence levels do not overlap).
e. Calculate the amplitude (in cm) of the average annual cycle for the entire period and identify the month when it peaks (remove the linear trend from (a) for detrending)
f. Same as (e) but separately for the first 5 years of the record and last 5 years of the record (**note:** use the same detrended time series as in (e), DO NOT detrend the first/last five years of data again)
g. Identify the largest (positive or negative) monthly anomaly above or below the average seasonal cycle (**note:** create a time series of the average seasonal cycle and subtract it from the raw data with linear trend removed)
h. Calculate the range of decadal variability (defined as difference between max and min value after applying a 8-year moving average to the raw data with the linear trend removed; note that raw data is given at **monthly** resolution)
i. Produce a plot of the raw data with linear trend and quadratic trend in the same panel
j. Produce a plot with the de-trended raw data (i.e. linear trend removed) and 8-year moving average in the same panel

In a word or PDF document, provide the numbers/answers to the questions and the two plots. Also copy the code that you used (no matter which language) at the end of the file.