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% ENGR 132
% Program Description
%   This program manipulates the data that is targeted to figure out
%   the global mean sea level which is a indicator of the sea level
%   rise. Specifically, the program compares the regression lines of
%   the data points of two different measurement methods: tide gauge
%   and satellite-based altimeters.
% Assigment Information
%   Assignment:     PS 04, Problem 3
%   Author:         Tomoki Koike, koike@purdue.edu
%   Team ID:        008-02
%   Contributor:    no contributor
%   My contributor(s) helped me:
%     [ ] understand the assignment expectations without
%         telling me how they will approach it.
%     [ ] understand different ways to think about a solution
%         without helping me plan my solution.
%     [ ] think through the meaning of a specific error or
%         bug present in my code without looking at my code.
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```

INITIALIZATION

```
% Importing the two datas
tideGaugeData = csvread('Data_CSIRO_gmsl_mo_2013.csv', 1,0);
```

```
                               % tide gauge
altmData = load('Data_NASA_altimeter_gmsl_meas.txt');
                               % altimeter

% Setting the relevant columns in the data as column vectors
TG_year = tideGaugeData(:,1);  % The year columns of the time
                               % gauge data
TG_gmsl = tideGaugeData(:,2);  % The GMSL columns of the time
                               % gauge data
altm_year = altmData(:,2);     % The year columns of the satellite
                               % -based altimeter data
altm_gmsl = altmData(:,5);     % The GMSL columns of the satellite
                               % -based altimeter data

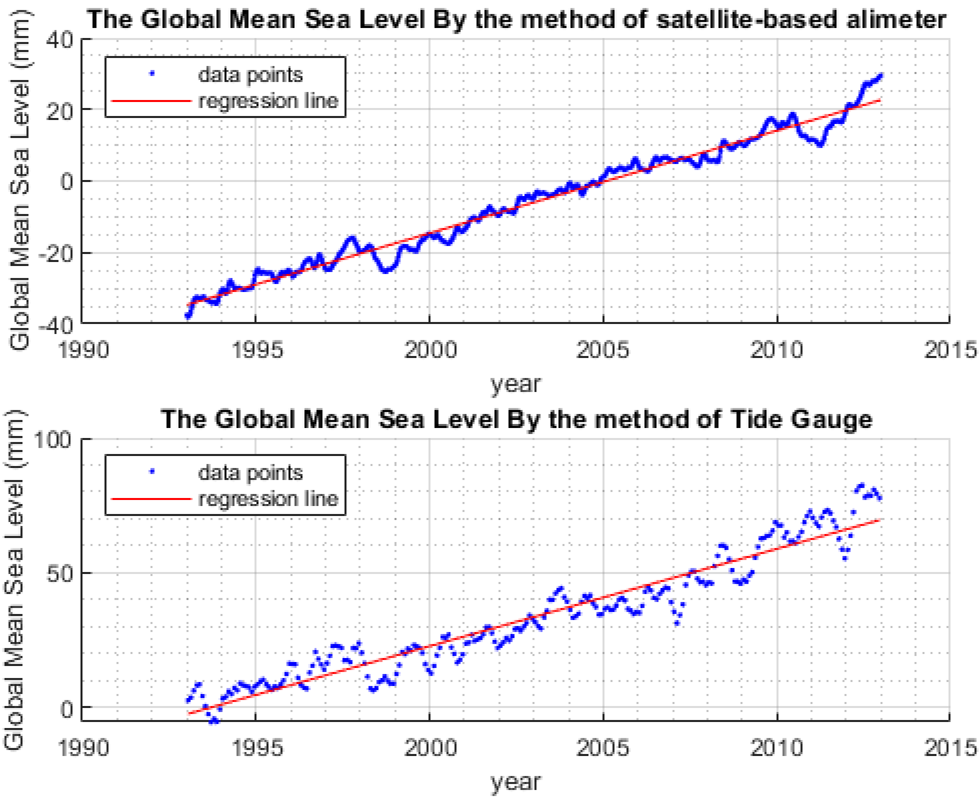
% Manipulating the column vectors to find the data corresponding the
% 1993 to 2013 time span
% tide gauge
TG93_13_year = TG_year(1993<=TG_year & TG_year<=2013);
TG93_13_index = find(1993<=TG_year & TG_year<=2013);
TG93_13_gmsl = TG_gmsl(TG93_13_index);
% satellite-based altimeter
altm93_13_year = altm_year(1993<=altm_year & altm_year<=2013);
altm93_13_index = find(1993<=altm_year & altm_year<=2013);
altm93_13_gmsl = altm_gmsl(altm93_13_index);
```

CALCULATIONS

```
% Computing the best fit regression line for each of the data set, and
% calculating the SSE, SST, and coefficient of determination
% tide gauge
TG_pFit = polyfit(TG93_13_year,TG93_13_gmsl,1);
TG_pVal = polyval(TG_pFit,TG93_13_year);
TG_pVal_a = TG_pFit(1,1);
TG_pVal_b = TG_pFit(1,2);
TG_gmsl_mean = mean(TG93_13_gmsl);
TG_SSE = sum((TG93_13_gmsl - TG_pVal).^2);
TG_SST = sum((TG93_13_gmsl - TG_gmsl_mean).^2);
TG_rSquare = 1 - TG_SSE / TG_SST;
% Satellite-based altimeter
altm_pFit = polyfit(altm93_13_year,altm93_13_gmsl,1);
altm_pVal = polyval(altm_pFit,altm93_13_year);
altm_pVal_a = altm_pFit(1,1);
altm_pVal_b = altm_pFit(1,2);
altm_gmsl_mean = mean(altm93_13_gmsl);
altm_SSE = sum((altm93_13_gmsl - altm_pVal).^2);
altm_SST = sum((altm93_13_gmsl - altm_gmsl_mean).^2);
altm_rSquare = 1 - altm_SSE / altm_SST;
```

FIGURE DISPLAY

```
% The plotting of the graph for the tide gauge data
figure
subplot(2,1,2)
scatter(TG93_13_year,TG93_13_gmsl,".b")
title("The Global Mean Sea Level By the method of Tide Gauge")
xlabel("year")
ylabel("Global Mean Sea Level (mm)")
grid on
grid minor
hold on
plot(TG93_13_year,TG_pVal,"-r")
legend('data points','regression line','location','northwest')
hold off
% Plotting the scattered data points and the regression model
% for the satellite-based altimeter
subplot(2,1,1)
scatter(altm93_13_year,altm93_13_gmsl,".b")
title("The Global Mean Sea Level By the method of satellite-based
 alimeter")
xlabel("year")
ylabel("Global Mean Sea Level (mm)")
grid on
grid minor
hold on
plot(altm93_13_year,altm_pVal,"-r")
legend('data points','regression line','location','northwest')
hold off
```



TEXT DISPLAY

```
% Displaying the results on the command window
fprintf("The regression model for the satellite-based altimeter
 measurement is y = %.4fx + %.4f .\n", altm_pVal_a, altm_pVal_b);
fprintf("The regression model for the tide gauge measurement is y =
 %.4fx + %.4f .\n", TG_pVal_a, TG_pVal_b);
fprintf("The SSE for the satellite-based altimeter measurement is
 %.4f .\n", altm_SSE);
fprintf("The SSE for the tide gauge measurement is %.4f .\n", TG_SSE);
fprintf("The SST for the satellite-based altimeter measurement is
 %.4f .\n", altm_SST);
fprintf("The SST for the tide gauge measurement is %.4f .\n", TG_SST);
fprintf("The coefficient of determinant of the satellite-based
 altimeter measurement is %.4f .\n", altm_rSquare);
fprintf("The coefficient of determinant of the tide gauge measurement
 is %.4f .\n", TG_rSquare);
```

```
The regression model for the satellite-based altimeter measurement is
 y = 2.8669x + -5748.4692 .
The regression model for the tide gauge measurement is y = 3.6081x +
 -7193.3059 .
The SSE for the satellite-based altimeter measurement is 4784.5550 .
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```
The SSE for the tide gauge measurement is 8768.0280 .
The SST for the satellite-based altimeter measurement is 206744.1469 .
The SST for the tide gauge measurement is 112911.2380 .
The coefficient of determinant of the satellite-based altimeter
 measurement is 0.9769 .
The coefficient of determinant of the tide gauge measurement is
 0.9223 .
```

ANALYSIS

Q1

Given the coefficient of determination from the data of each measurements it is clear that both measurements have relatively a highly accurate regression model. When comparing the two the coefficient of determination of the satellite-based altimeter is statistically accurate because its value is closer to 1.

Q2

The variation of data is much more evident in the data set of the tide gauge measurement becuase the coefficient of determination is lower. This is because R^2 (coefficient of determination) is specifically the ratio of data that are certain, and if that ratio is low the amount of variation is higher due to more deviation from the regresson model.

Q3

From the slope of each regression model the tide gauge has a higher slope meaning that the tide gauge has a higher rate of global mean sea level rise.

Q4

By plugging in 2019 as the x-value for both regression models of of the satellite-based altimeter and the tide gauge the estimation of the GMSL is possible. For the former the result is 39.8019 and the for the latter the result is 91.4480. This shows the predicted GMSL for the tide gauge is indicating three times than that of the satellite-based altimeter.

ACADEMIC INTEGRITY STATEMENT

I have not used source code obtained from any other unauthorized source, either modified or unmodified. Neither have I provided access to my code to another. The script I am submitting is my own original work.

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