Period 4

30 October 2008

Tide Modeling Around the World

Every place in the world has a tide that is unique to it. The following project discusses tidal behavior and the changes in tides. Practical applications are used to show how tides can have an important affect on people's lives.

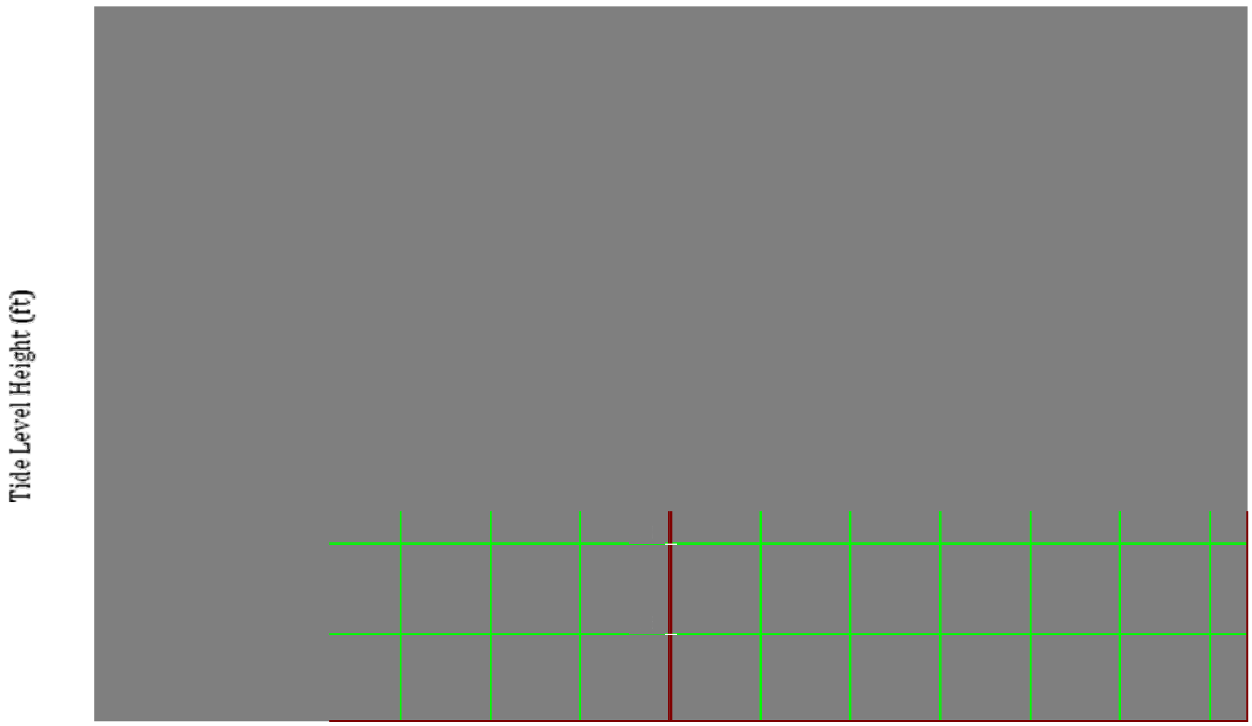
Part 1

The following data is a 24 hour period of tide levels for Atka Alaska. The recorded tide levels start on October 28th, 2008 at 0:00:00 and ends on October 29th, 2008 at 0:00:00.

Date/Time (Local Time)		**Obs.** (ft.)
10/28/2008 00:00:00	YDT	0.25
10/28/2008 01:00:00	YDT	-0.00
10/28/2008 02:00:00	YDT	0.14
10/28/2008 03:00:00	YDT	0.54
10/28/2008 04:00:00	YDT	0.79
10/28/2008 05:00:00	YDT	1.39
10/28/2008 06:00:00	YDT	1.91
10/28/2008 07:00:00	YDT	2.28
10/28/2008 08:00:00	YDT	2.47
10/28/2008 09:00:00	YDT	2.77
10/28/2008 10:00:00	YDT	2.73
10/28/2008 11:00:00	YDT	2.78
10/28/2008 12:00:00	YDT	2.92
10/28/2008 13:00:00	YDT	2.82
10/28/2008 14:00:00	YDT	2.87
10/28/2008 15:00:00	YDT	2.88
10/28/2008 16:00:00	YDT	2.82
10/28/2008 17:00:00	YDT	2.81
10/28/2008 18:00:00	YDT	2.76
10/28/2008 19:00:00	YDT	2.52
10/28/2008 20:00:00	YDT	2.04
10/28/2008 21:00:00	YDT	1.61
10/28/2008 22:00:00	YDT	1.05
10/28/2008 23:00:00	YDT	0.49
10/29/2008 00:00:00	YDT	0.01

Part 2

Tide Height Versus Time of Day



Time of Day (hrs)

I graphed the equation **y=1.5+1.8sin(.205387x-1)**. My graphs showed that for October 28th, 2008 for Atka, Alaska the tide's maximum was (12,3.3) and the tide's two minimums were at (-2,-.3) This means that there wasn't even a lowest tide in the 24 hours period of October 28th, but that it was the day before around 10:00 PM at -.3 feet. The highest tide was after 12 hours at 3.3 feet.

Part 3

For this graph, the function represents y=d+asin(bx-c)

In this case, will represent the time of day as the x value for each specific one hour interval. The variable will represent the height of the specific tide level as our y value.

In the equation y=d+asin(bx-c), a represents the amplitude. Amplitude is the absolute value of a added and subtracted to the midline of the graph. To find the amplitude of the graph, one must take the maximum value minus the minimum value and divide by 2. Therefore, the equation for the amplitude of this graph will be: 3-0/2 which means that the amplitude is 1.5.

In the equation y=d+asin(bx-c), b represents the period, or how often the graph repeats. To get the period, one must use the equation 2π/b. The variable b represents the point at which the graph starts repeating. Therefore, in this graph, b equals 30. So the equation for the period of this graph will be b=2π/30. The period of the graph is b= π/15, or .2094395.

In the equation y=d+asin(bx-c), c represents a horizontal shift. There is no equation to find c, so one must just look at the graph and see how far the graph is shifted from zero. When looking at this graph, we can see that the graph is shifted 1 unit to the left, therefore making c=1.

In the equation y=d+asin(bx-c), d represents a vertical shift in the graph. To find the variable d, one must take the maximum value and subtract the amplitude from this value. Therefore, for this graph, the equation for d is d=3-3/2. The variable d is equal to 1.5.

A=1.5

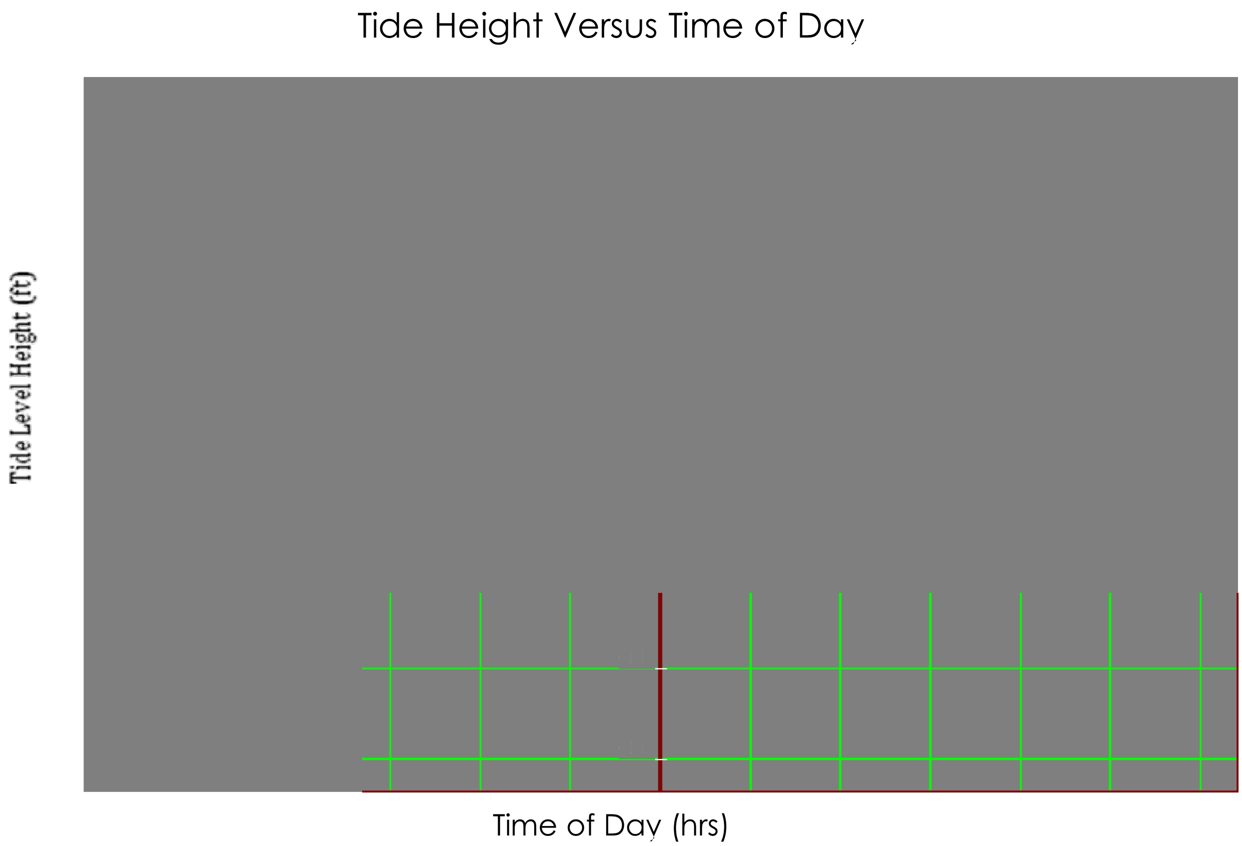
B= .2094395

C=1

D=1.5

Therefore, our final equation is **y=1.5+1.5sin(.2094395x - 1)**

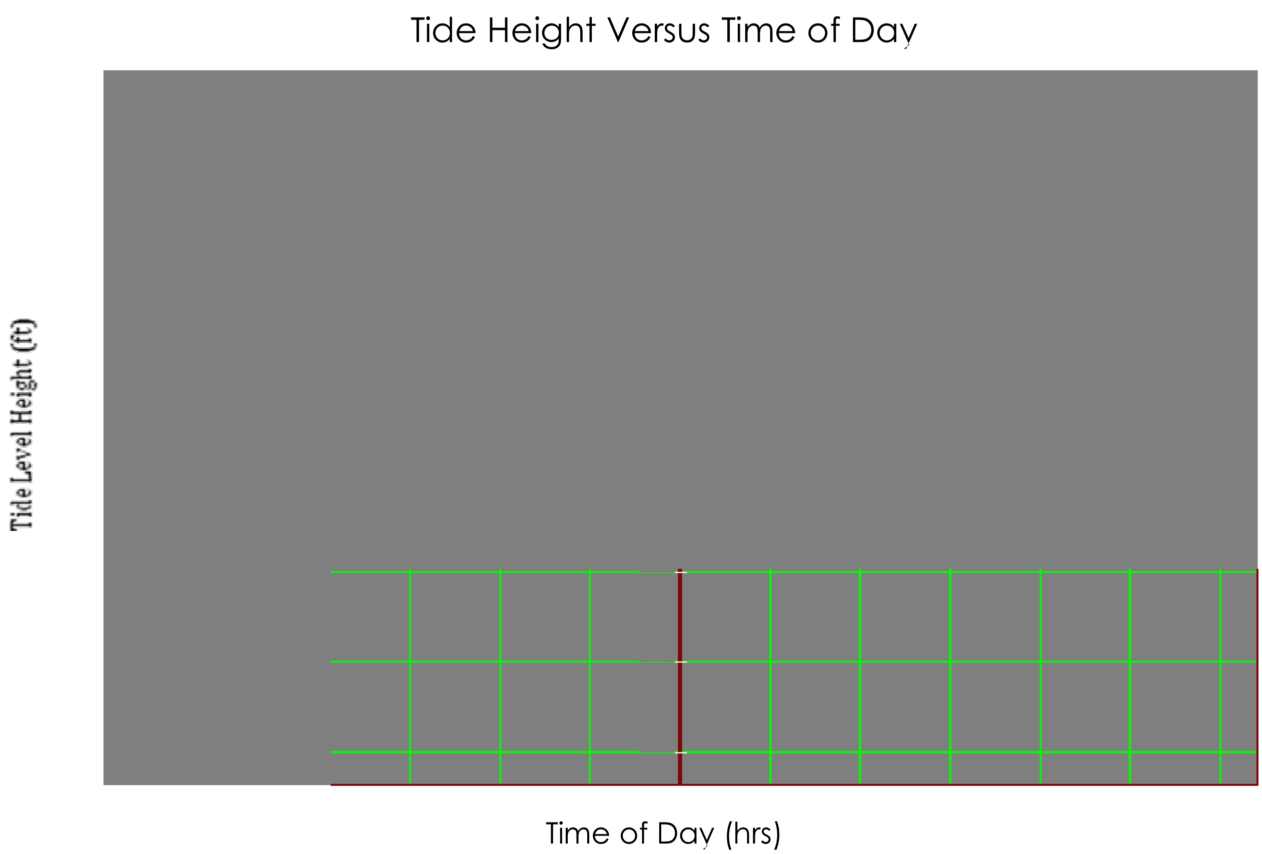
Part 4



The function fits the data quite well. The maximum and minimum points are fairly consistent with the maximum and minimum points of the original function. The maximum point of this graph is (12,3) and the minimum point is (-2, 0). Once again, this means that the low tide didn't even happen in the 24 hour period of October 28th, but rather it was at around 10:00 PM October 27th at 0 feet. The highest tide was at around 12 PM at 3 feet.

Part 5 The original function I created and graphed was **y=1.5+1.8sin(.205387x-1)**. Even though this function was fairly close, I feel the amplitude could be more accurate. Recall that to find the amplitude one must take the maximum value minus the minimum value and divide by 2. I am going to change my maximum value from 3 to 3.2, since that is more accurate. Therefore my equation for amplitude will now be 3.2-0/2. Amplitude now equals 1.6

Therefore, our new equation is **$y=1.5+1.6\sin(.2094395x - 1)$**



This function fits the data better than the previous one. It matches almost exactly with the original function. The maximum point is (12,3.1) and the minimum is (-2,-.1) Once again, there is no lowest tide on October 28th, but rather on October 27th at around 10:00 PM at -.1 feet. The highest tide is at 12:00 PM at 3.1 feet.

Part 6

For a sailor to launch their boat at the opportune time, they should launch their boat at the time that is the highest tide in the day, or, for the graph, the maximum value. They should launch it at that time because the tide would be receding after that point. By looking at the function above, the best time for a sailor to go out would be around 11 A.M to 12 P.M.

Part 7

A jogger would obviously like to take a jog on the beach at low tide as to not get hit by the water. For the function above, there tide is never at its lowest on October 28th, however, the lowest point for this date would be at 12:00 AM. The jogger would either want to take a jog at 12:00 AM or at 10:00 PM the night before.

Part 8

A= 1.71960247

B=.20137807

C=-1.085725843

D= 1.438293135

y= 1.438293135+1.71960247sin(.20137807x-1.085725843)

This equation represents the best fit function for the graph.

Tide Height Versus Time of Day

Time of Day (hrs)

Part 9

When observing the regression model, I found that the minimum points were (-2.40,-.28) and (26.4, -.087) This means that a jogger would not even want to jog on October 28th, because there is no minimum tide on this day. There is no specific lowest point on October 28th, but the hour at which the tides are very low and close to the minimum is 12:00 AM. They would have had to go on October 27th at 10:16 PM or they will have to wait until 2:05 AM on October 29th to go jogging if they want to go at the absolute lowest tide.

Part 10

Because the tides of this particular area of Atka, Alaska do not repeat in a 24 hour period, runners would have to go running every other day if they wanted to go at the lowest tide.

Part 11

My original model fits the tides relatively accurately. The maximum point for my original function was (12, 3.3) and the minimum was (-2, -.3). The maximum point for the regression function was (13, 3.1) and the minimum was (-2.40,-.28). The horizontal shift and period were all consistent between the two graphs. The amplitude and vertical shift both had to be slightly altered to fit the local tide trends better.

Surfline Model

These are the tides predicted for Salt Creek Beach, California. My model does not fit even remotely close to this data. This data has two maximums and two minimums, which automatically means my function would not work for this one, considering in a 24 hour period my tides only have one maximum point.

2008-10-30 3:34 AM PDT 1.83 feet Low Tide
2008-10-30 9:46 AM PDT 5.92 feet High Tide
2008-10-30 4:59 PM PDT -0.27 feet Low Tide

2008-10-30 11:16 PM PDT   3.56 feet High Tide

Works Cited

http://www.surfline.com/surf-report/salt-creek_4233/

http://www.graphmatica.com/