Why is There Water in my Backyard?

New Mexico Adventures in Supercomputing Challenge
Final Report
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Team 036

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Executive Summary

For centuries, ocean travel has been limited by one major factor. The tides. The tides have always affected our ocean and our world. Tides happen because the gravitational pull of the moon on the earth pulls the water from one side of the earth to the other. This can affect our lives more than we think. In our project, we hope to find the tidal differences if the moon was moved. Since the moon is moving 4 centimeters each year we wanted to predict what this effect will do to the tides. This is important beca! use we would be able to predict tides and we would be prepared for possible disasters if the moon was moved, such as a major coastal city being sunk due to the tidal change. We had hypothesized that the tidal range would have less and less effect on the tides each year. We planned to use Newtons gravity law and substitute in numbers for the movement of the moon and the years that have passed. It would have been a good project, but we did not have enough time to complete our project. Procrastination takes its tolls.

Introduction

Tide - the rise and fall of the surface level of the ocean. Our team is doing a project on tides. Before you go on any farther we would like you to know the importance of our project. The first and foremost importance of our project is that we will be able to help prevent oil spills. In order to calculate this we are using Newtons gravity equation. Also there has been a study that the moon is getting farther and farther away by about 4 centimeters a year. So enjoy the rest of our report.

Description

Unfortunately, we did not complete our project when we were supposed to finish nigh the middle of March. We have had many setbacks that we could not control and it is a marvel we have got this far. Our main engine of research was the Internet, which we used to get our research and find our math model. We also used the scientific method.

Results

Unfortunately, due to certain events we didnt have enough time to make a computer program. We have a rough draft of a math model, but were not entirely sure if it works. It is $F = G * M_1 * M_2 / R^2$. We have learned that it isnt good at all to procrastinate. At many times in the process of our project we thought we had plenty of time and then found out that we didnt, which is why were so far behind. We furthered our knowledge in many ways throughout the process of the Super Computing Challenge. We learned that the moon is moving away about 4 centimeters per year, which will eventually make the tidal range be very low, if any at all. We also found out that when the earth, moon, and sun are all in a row the tide is high on that side of the earth their on, also that when they are in a right triangle the tide is low on that side of the earth. Now back to the computer program. If we would have had one it would show what would happen to the tides the further away the moon moves. Also eventually the sun would affect the tides more than the moon. It would also have had an option where you could have entered in how ! far the moon is moved away from the earth.

Conclusions

As we stated in our results we didnt have enough time to finish our

Project, we procrastinated. Again our math model is:

Call the distance from the Earths center to the Moons center, D. Call the radius of the Earth R. Anything on the Earths surface when the Moon is directly overhead is at (D-R) distance from the Moons center.
So the moon attracts it with an acceleration of $F/M_1 = G*M_{moon} / (D-R)^2$

. The Earth itself is being accelerated by the moon at $F/M_{earth} = G*M_{moon} /(D)^2$. The effective tidal effect on our object is then just the DIFFERENCE of these accelerations, or $(G*M_{moon}) * ((1/(D-R)^2)-(1/D^2))$. Simplifying, this becomes $G*M_{moon} * (2 * D * R$ $R^2) / (D R)^2)$. Since R is small compared to D (about 1/60 of it) this is nearly equal to $G * M_{moon} * (2 * D * R) / D^4$, or (a constant) / D^3. Tidal effect is therefore approximately proportional to the CUBE of the distance of the attracting body. As it happens the moon is about 400 times closer than the Sun, so it causes a tidal effect! equal to 400^3 or 64 million times that of an identical mass. But the Moons mass is only about one 1/27,000,000 that of the Sun. The result is that the Moon causes a tidal effect that is about 64,000,000/27,000,000 or 64/27, or a little more than double of that of the sun. Its possible to even estimate the size of the tides! Using that same result above, $G * M_{moon} * (2 * D * R) / D^4$, or $G * M_{moon} * 2 * R) / D^3$. We know the values of all those quantities! In the metric system, G = 6.673 E-11 M_{moon} = 7.3483E+22 kg, R = 6.37814E+06, D = 3.844E+08. This gives a result for the relative acceleration as being 1.102! E-06 m/s^2, about one nine millionth of the acceleration of the Earths gravity on us. (Notice that this differential tidal effect is much smaller than the simple attraction effect we mentioned earlier.

Our most significant achievement is that we learned never to procrastinate. We should have finished our project, and then goofed off, but we also learned what would be expected of us if we were doing this for a real job. Lastly, this project has been a very cool learning experience for us all. We plan to do the Ais challenge next year since we recently were informed that you got the grant money needed to fund the challenge next year.

Recommendations

Our project could have been more advanced in other areas, but due to the lack of time, we couldnt do them. One of our wishes was to have a separate project of an asteroid hitting the moon and moving it in any direction and seeing the tidal change from there.

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Reference List

http://mb-soft.com/public/tides.html