

AMS Mathematical Moments & Mathematics of Planet Earth 2013

Harnessing Wind Power

Mathematicians contribute to the process of converting wind power into usable energy. Large-scale weather models are used to find suitable locations for wind farms, while more narrowly focused models—incorporating meteorological data—help determine optimal turbine placement. From factors such as wind direction and speed to terrain, wind farms are specifically sited to maximize individual turbines' output. A farm is also sited, comparatively speaking, to maximize the farm's overall energy output. This helps decrease the cost of wind energy, and keep more jobs and money in the United States.



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Sounding the Alarm

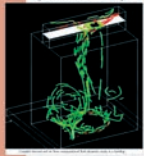
Nothing is more common than hearing... may an extremely powerful event of nature. But in many cases, however, it is difficult to predict the exact time and location of the event. In order to provide advance warning to those at risk, mathematicians have developed partial differential equations to model the behavior of waves and other phenomena. These models help predict the time and location of an event well in advance of its occurrence, so that those at risk can take the necessary steps to avoid or minimize damage.



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Building Efficiently


Building an air conditioning system that uses the least amount of energy is a challenge. By one-half would be equivalent to using energy to build a house that is twice as big. This is because air conditioning systems are done with hybrid cars. This integrated approach allows for the use of hybrid cars. This integrated approach allows for the use of hybrid cars. This integrated approach allows for the use of hybrid cars.



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Knowing Rogues

It doesn't take a perfect storm to generate a rogue wave—its appearance was much larger and more massive than its neighbors. The waves were much larger and more massive than its neighbors. The waves were much larger and more massive than its neighbors. The waves were much larger and more massive than its neighbors.



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Resisting the Spread of Disease

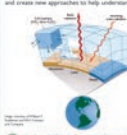
One of the most useful tools in studying the spread of disease is a system of nonlinear equations that reflect the dynamics among two or more categories of populations: susceptible, infected, and recovered. These equations help predict the spread of disease from analysis to the field. To predict the spread of a particular disease, it is important to understand the parameters associated with it, such as the average number of people that a typical infected person will infect. Mathematical models estimate these parameters by applying statistical methods to gathered data, which aren't complete because, for example, some cases aren't reported. Armed with reliable models, mathematicians help public health officials track the complex, rapidly changing world of modern disease.



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Predicting Climate


What is more for our climate and life? It is an extremely complex question whose answer requires physics, chemistry, earth science, and mathematics. By using mathematical models, scientists can simulate the atmosphere, hydrosphere, and other systems to predict future climate. These models help predict the time and location of an event well in advance of its occurrence, so that those at risk can take the necessary steps to avoid or minimize damage.



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Going with the Floes

Sea ice is one of the most understudied components of our climate. Naturally, its abundance or scarcity is a telling sign of climate change. But sea ice is also an important part of the climate system. It helps regulate the temperature of the ocean and the atmosphere. By using mathematical models, scientists can simulate the behavior of sea ice and predict its future behavior.



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Getting It Together

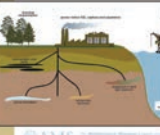
The collective motion of many groups of animals can be surprising. Flocks of birds and schools of fish are able to remain together for long periods of time, and their behavior is often coordinated. By using mathematical models, scientists can simulate the behavior of these groups and predict their future behavior.



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Burying Carbon Dioxide

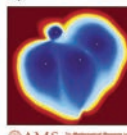
One possible way to mitigate the impact of carbon dioxide on climate change is to capture and store it underground. This process is called carbon capture and storage (CCS). By using mathematical models, scientists can simulate the behavior of CCS and predict its future behavior.



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Finding Oil

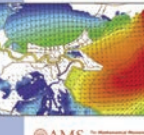
As high as gas prices are, they would be much higher if we didn't have oil. Oil is a valuable resource, and it is important to understand how it is formed and how to find it. By using mathematical models, scientists can simulate the behavior of oil and predict its future behavior.



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Predicting Storm Surge

Storm surge is often the most devastating part of a hurricane. It is caused by the wind pushing the water towards the shore. By using mathematical models, scientists can simulate the behavior of storm surge and predict its future behavior.



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Locating, locating, locating

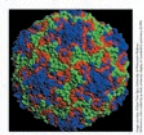
Originally designed for military use, the Global Positioning System (GPS) has become a common tool for many people. By using mathematical models, scientists can simulate the behavior of GPS and predict its future behavior.



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Defeating Disease


From modeling infectious diseases to creating the structure of a vaccine, mathematics is essential to defeating disease. By using mathematical models, scientists can simulate the behavior of disease and predict its future behavior.



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Revealing Nature's Secrets

Mathematical models are a powerful tool for understanding nature. By using mathematical models, scientists can simulate the behavior of nature and predict its future behavior.



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Forecasting Weather

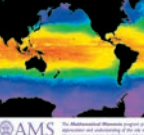
Forecasting the weather is a challenging task. By using mathematical models, scientists can simulate the behavior of the weather and predict its future behavior.



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Describing the Oceans

Understanding the oceans is essential to understanding our planet. By using mathematical models, scientists can simulate the behavior of the oceans and predict its future behavior.



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See how math is connected to understanding our planet and its many dynamic processes at www.ams.org/mathmoments and ams.org/samplings/mpe-2013.