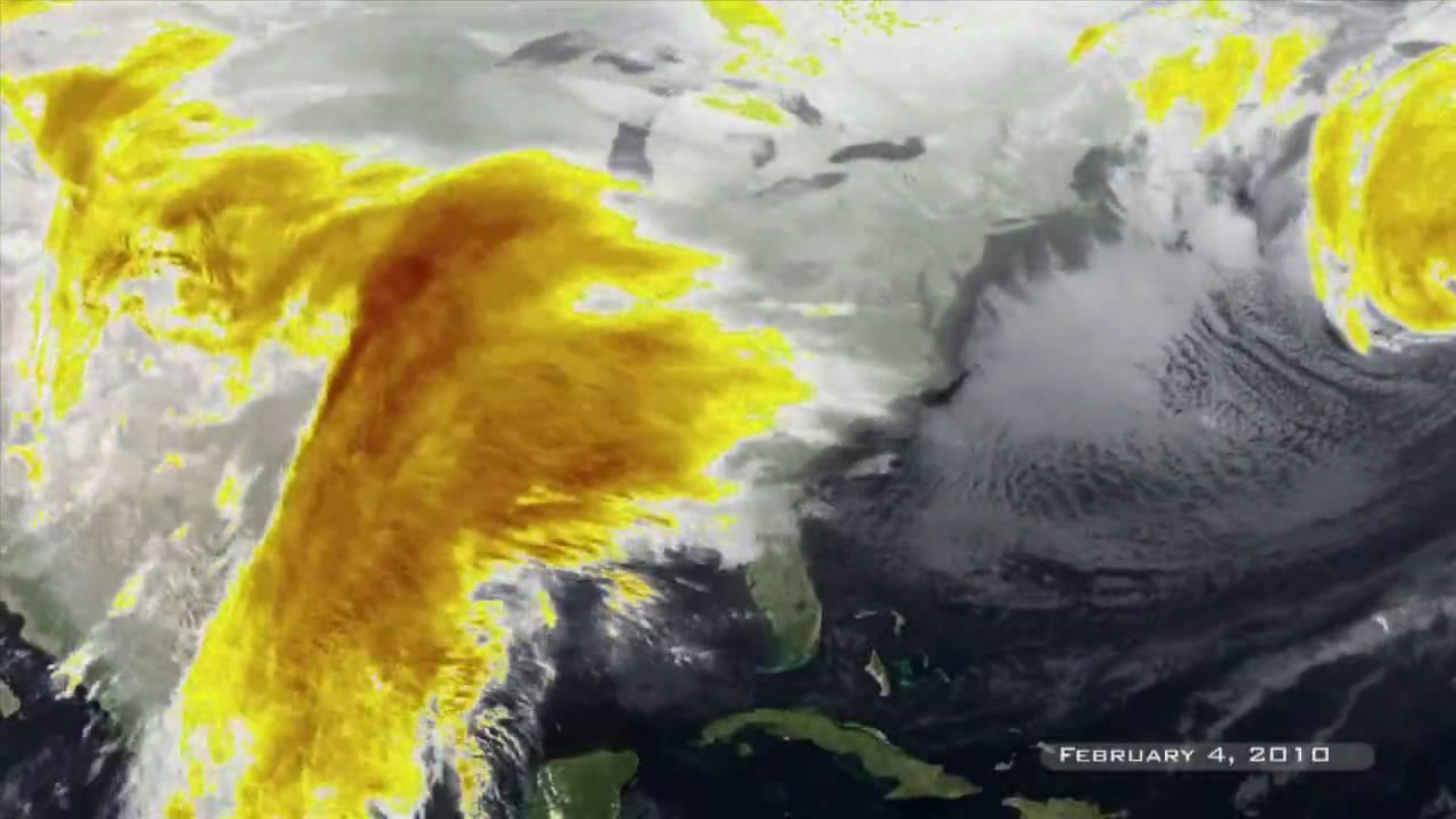
February 4, 2010

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[Narrator] Weather forecasters use them to create the nightly weather report.

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Airline pilots use them to learn how to fly planes. Experts use them in virtually every

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industry and discipline. They are computer models. At NASA,

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scientists use computer models to enhance their understanding of the earth, the solar system

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and the universe. NASA satellites orbiting the earth

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relay immense amounts of data to scientists on the ground, who then enter that data

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into computer model simulations. [Cynthia Rosenzweig] We have then, equations and then

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computer code which solves those equations on a day-to-day basis.

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[Narrator] NASA is the source for most of the research satellite observations of the atmosphere,

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land and oceans. [Phil Webster] So the NASA scientists will look at the observational data and

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make theoretical projections about what a model might look like and they will build a numerical model

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based on the data and then run that on our computers and compare that to reality.

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[Narrator] With rapid increases in computer technology, models are becoming

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evermore powerful and sophisticated, allowing us to simulate our complex environment in greater detail.

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NASA uses a variety of weather models such as the Goddard Earth Observing System model.

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It creates an extraordinarily high resolution, realistic-looking

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image of our atmosphere. These GEOS-5 simulations showcase the model's

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ability to capture fine-scale cloud features worldwide, like the swirling clouds in the Atlantic

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Ocean off the coast of North America.

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The goal of weather models is to give the most accurate prediction of weather in the next week to ten days.

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In 2005, when Hurricane Katrina formed over the Atlantic Ocean, scientists

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wanted to understand the storm. How intense was it, what was its size and structure and what

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would be its final path? NASA satellites continuously monitored many aspects of the storm

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from windspeed, rainfall and sea surface temperature to the storm's three-dimensional structure.

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To get a more complete picture of the storm and predict its evolution, scientists entered

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the data into a computer model. Then, high-powered supercomputers capable of trillions of calculations

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per second crunched the numbers. This process is called data assimilation.

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Data assimilation is a two-step cycle that repeats itself whenever new data becomes available.

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In the first step, the model runs forward in time to provide an estimate of the atmosphere. In the second

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step, this estimate gets corrected using observations. The cycle begins again, each step

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building upon the last and accumulating the information from satellite and ground observations.

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Weather models are updated every six hours to include the most current observations for the next forecast.

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This approach prevents the model from straying too far from reality and acts as a checks-and-balance system

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to acheive the most accurate forecast. While weather models predict

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conditions for up to ten days, climate models predict trends over much longer periods of time.

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[Phil Webster] The climate models that are run at the NCCS are numerical expressions of the

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various processes that make up climate. This includes things like land surface,

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water in the ocean and the movement of air in the atmosphere. [Narrator] Just as in weather prediction,

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data assimilation is a way of bringing all the observations of the earth together to provide an analysis of our clir

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. One example of this technique is MERRA - the Modern Era Retrospective Analaysis for Research

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and Applications. MERRA incorporates data from the entire satellite record.

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Over 30 years of data. Its results are a data encyclopedia that can be used for research and

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analysis. MERRA can help meteorologists understand the variations associated with specific

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weather events in the past. While MERRA gives us a climate picture across decades, the Goddard Institutde

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for Space Studies, or GISS, can extend that view across centuries. GISS models

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have already unraveled average temperature trends over 200 years. New GISS simulations will cover the last

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1,000 years to verify model accuracy. They'll also look forward, projecting climate

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trends to the end of the 21st century. With each satellite launched, we gain billions of measurements

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that tell us more about our planet. Having so much more data will require increases in

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computing power to synthesize this information into meaningful representations of the climate system as a whc

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[Phil Webster] At Goddard Space Flight Center, we have a tremendous amount of observational data,

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captured by our satellites. We have probably the largest collection of earth scientists

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in the world. And we have this new state-of-the-art computing center. So the combination of