



1  
00:00:00,050 --> 00:00:11,060

[music]

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[Narrator] The Earth is a complex system and scientists are continually

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investigating the intricate workings of our home planet.

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Part of what makes the Earth so unique is its climate.

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Many scientists are concerned that Earth's climate is changing at an unprecedented rate.

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How do scientists study how warm the planet is? Here's a look at the tools NASA scientists use

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to take Earth's temperature. Models are powerful tools for understanding Earth's complex system.

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To create a model, scientist must first characterize a system by identifying

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the processes that govern its evolution. Those processes are represented by equations

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that are solved on powerful computers.

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This animation comes from an atmospheric assimilation.

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It uses observations of temperature, moisture, and wind

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to provide a picture of Earth's hydrological cycle.

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Once a model is in place, the resulting simulations must be proven to match

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00:01:07,430 --> 00:01:10,490

real world measurements.

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[Michelle Rienecker] Well, models are important for the scientific community because they capture

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really the essence and basic understanding that we have of how our system works

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on a lot of different timescales and space scales for a lot of different applications

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00:01:23,570 --> 00:01:27,590

from weather all the way through to climate.

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[Narrator] In the 1970's, Dr. James Hansen and colleagues at NASA built a simple

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climate model to simulate how changes in the atmosphere cause Earth's average

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temperature to change over time. Hansen's early climate models showed that both human and

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00:01:42,670 --> 00:01:46,730

natural activities could force Earth's climate to change.

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The model revealed that natural forcings like volcanic eruptions

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00:01:50,740 --> 00:01:55,770

or changes in the sun's activities tend to go up and down over long periods of time.

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00:01:55,770 --> 00:02:00,780

But, human forcings from greenhouse gas emissions are steadily increasing.

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Hansen's early simulation revealed that human forcings on climate would dominate

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00:02:06,790 --> 00:02:11,800

in the future. But, he needed real world temperature data on a global scale

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00:02:11,800 --> 00:02:16,830

to determine when. The most reliable measurement of global temperature came

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00:02:16,830 --> 00:02:19,890

from weather stations scattered around the globe.

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Hansen knew that weather fluctuations would cause short-term changes

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at individual stations, but he reasoned that taking averages over several years

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and appropriately weighting each stations data would deliver meaningful temperature information

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A consistent trend of warming is visible in both the global temperature data

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and the global climate model.

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[James Hansen] We have a pretty good understanding now of how sensitive the climate is

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00:02:45,990 --> 00:02:52,010

to the increases in the greenhouse gases. This comes particularly from the history of

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the Earth. Our climate models give us an answer too, but there are a lot of uncertainties

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00:02:57,020 --> 00:02:59,030

in the climate models.

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00:02:59,030 --> 00:03:03,040

[Michelle Rienecker] The challenges associated with modeling are manifold.

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The Earth really acts as system. You know, the ocean interacts with the atmosphere

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00:03:07,080 --> 00:03:14,090

interacts with the land surface, so representing all of this sort of complex system

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00:03:14,090 --> 00:03:17,110

really are a major challenge.

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00:03:17,110 --> 00:03:21,150

[Narrator] NASA's upcoming Glory mission will measure two key climate forcings

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:solar irradiance and atmospheric aerosols.

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00:03:25,170 --> 00:03:29,180

These measurements will help to improve the accuracy of global climate models.

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00:03:29,180 --> 00:03:35,200

NASA missions like Glory will help scientists fine-tune their understanding of Earth's climate

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00:03:35,200 --> 00:03:41,210

providing a more accurate diagnosis of the Earth's health today and far into the future.