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## Twin Satellites To Track Earth's Water and Gravity

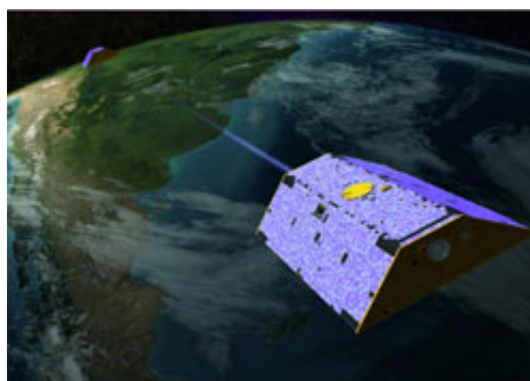
A joint project between USA and Germany will soon be launched, opening new eyes to the transportation of water on our planet.

by NASA/JPL  
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NASA and the German Space Agency are preparing to launch the Gravity Recovery and Climate Experiment (Grace), a scientific pathfinder mission that will test a novel approach to tracking how water is transported and stored within the Earth's environment.

The mission, managed by NASA's Jet Propulsion Laboratory, Pasadena, Calif., will precisely measure the planet's shifting water masses and map their effects on Earth's gravity field, yielding new information on effects of global climate change.

The twin Grace satellites are set to launch March 16, 2002, from Russia on a five-year mission that will revolutionize understanding of changes in the Earth's gravity field over time and space. The mission will provide measurements of the gravity field that are far more accurate and sensitive than any that can be obtained by ground-based observations or single remote-sensing spacecraft.



"Grace marks the first launch of NASA's Earth System Science Pathfinder program, designed to develop new measurement technologies for studying our Earth system," said Dr. Ghassem Asrar, associate administrator for NASA's Earth Science Enterprise, NASA Headquarters, Washington, D.C. "Through NASA's continuing investment in technology development, we've been able to create an innovative mission at a fraction of the cost of missions formulated just a decade ago. Grace will provide us with a new view of our home planet and help us to better understand climate change and its global impacts such as changes in sea level and the availability of water resources," Asrar said.

A more precise gravity map of Earth is expected to increase the accuracy of many techniques used by scientists who study Earth with space-based instruments. These techniques -- ranging from satellite altimetry and radar interferometry to digital terrain models covering large land and ice areas -- provide critical input to many scientific models used in oceanography, hydrology, glaciology, geology and related disciplines.

As they race around the globe 16 times a day, the satellites will sense minute variations in the Earth's surface mass below and corresponding variations in the Earth's gravitational pull. Regions of slightly stronger gravity will affect the lead satellite first, pulling it slightly away from the trailing satellite. By measuring the constantly changing distance between the two satellites and combining that data with precise positioning measurements from Global Positioning System instruments, scientists will be able to construct a precise Earth gravity map.

Grace is the first Earth-monitoring mission in the history of space flight whose key measurement is not derived from electromagnetic waves bounced off the Earth's surface. Instead, the mission will use a microwave ranging system to accurately measure changes in the speed and distance between two identical spacecraft flying in a polar orbit about 220 kilometers (137 miles) apart, 500 kilometers (311 miles) above Earth. The ranging system is so sensitive it can detect separation changes as small as 10 microns -- about one-tenth the width of a human hair over a distance of 220 kilometers.

An additional instrument aboard the satellites called an atmospheric limb sounder will measure the amount by which the Global Positioning System satellite signals are distorted by Earth's atmosphere. Scientists will use these data to improve the accuracy of key atmospheric observations, which serve as input for weather forecast models.

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Grace is a joint partnership between NASA and the German Center for Air and Space Flight (Deutsches Zentrum für Luft und Raumfahrt). The U.S. portion of the project is managed for NASA's Office of Earth Science, Washington D.C., by JPL. Science data processing, distribution, archiving and product verification are managed under a cooperative arrangement between JPL and the University of Texas' Austin-based Center for Space Research in the United States and Germany's Earth Research Center (or GeoForschungsZentrum).

## Related links

**1. GRACE official home page**

This is the official web site for the GRACE mission, short for the Gravity Recovery And Climate Experiment, with mission updates, science background information and other useful content.

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**2. GRACE - Measuring Earth's Gravitational Field**

This is the home page of GRACE - Gravity Recovery and Climate Experiment. The mission consists of two satellites in polar orbit which will measure the Earth's gravity field.

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