New gravity mission on track to map Earth's shifty mass

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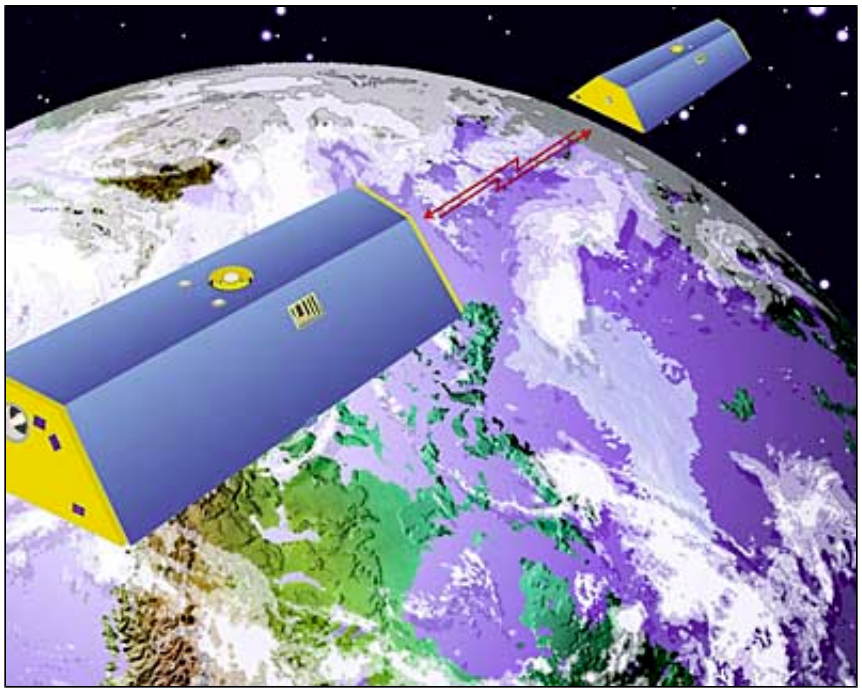
Six months into its mission to precisely measure Earth's shifting water masses and map their effects on Earth's gravity field, the joint NASA-German Aerospace Center Gravity Recovery and Climate Experiment, or Grace, is already producing results of considerable interest.

Using just 14 days of data, a preliminary Grace gravity field map has already been produced and is proving to be substantially more accurate than the combined results of more than three decades of satellite and surface instrument gravity measurements collected before Grace.



An artist's concept of GRACE satellites with ranging link between the two craft. Photo: NASA

Grace Principal Investigator Dr. Byron Tapley of the University of Texas Center for Space Research in Austin said preliminary data analyses provide strong validation for the Grace mission concept and its on-orbit sensor and satellite performance. "The quality of these preliminary Grace gravity fields tells us that the mission is on

track to achieve its performance objectives," Tapley said. "In addition to improving our knowledge of Earth's mean gravity field, the ability to measure time variations in gravity will be a new and important Grace contribution."

"This first Grace gravity field data is about 10 times more accurate for large-scale features than any pre-Grace gravity model of Earth," said Dr. Michael Watkins, Grace project scientist at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "While these first fields are already extremely promising, we expect to do up to 10 times better after we perform additional calibrations of the instruments."

"The Grace mission will soon demonstrate its mission goal to help us better understand how variations in Earth's gravity field reflect changes in climate," said Dr. Christoph Reigber, Grace co-principal investigator at the German Geo-Research Center and principal investigator for the German Challenging Minisatellite Payload, or Champ, mission. Champ was launched two years ago as the first in a series of dedicated Earth gravity field missions planned for this decade and is operating in parallel with Grace.

"Our joint U.S.-German science team continues to process and evaluate Grace's diverse geophysical data in preparation for the release of our first science products in the near future," Reigber added.

Launched March 17, 2002, Grace senses minute variations in Earth's surface mass and corresponding variations in Earth's gravitational pull. The monthly gravity maps generated by Grace will be up to 1,000 times more accurate than current maps, substantially improving the accuracy of many techniques used by oceanographers, hydrologists, glaciologists, geologists and other scientists to study phenomena that influence climate.

Among the first and most important applications for Grace's data will be to improve our understanding of global ocean circulation. The hills and valleys in the ocean's surface are due to currents and variations in Earth's gravity field. Grace enables separation of those two effects to better measure ocean currents and their effect on climate.

"These first results from Grace look very promising from an oceanographic point of view," said Dr. Lee-Lueng Fu, Topex/ Poseidon and Jason-1 project scientist at JPL. "Even with this preliminary gravity field, Grace has enabled us to use Topex/ Poseidon and Jason-1 data to determine ocean circulation features more accurately."

Grace measures Earth's gravity field by measuring the separation

between the twin satellites with an accuracy of one millionth of a meter (less than 1/10th the width of a human hair). Grace's instruments must all work together and be very accurately calibrated and aligned, a process the Grace project is just now completing during the mission's commissioning phase, which began in early April. Science instruments and supporting systems such as ground data processing have been activated, evaluated and calibrated.

Watkins says the twin satellites and the mission's science data system are generally performing well. "We're basically observing the smallest details of how these satellites behave on orbit, 'fine tuning' them, and adjusting our analyses to take those details into account," he said.

Grace is a joint partnership between NASA and the German Aerospace Center (Deutsches Zentrum fuer Luft und Raumfahrt, or DLR). The University of Texas' Center for Space Research has overall mission responsibility. GeoForschungsZentrum Potsdam is responsible for the German mission elements. JPL manages the U.S. portion of the project for NASA's Office of Earth Science, Washington, D.C. Science data processing, distribution, archiving and product verification are managed under a cooperative arrangement between JPL, the University of Texas' Center for Space Research and the Geo-Research Center in Germany.

JPL is a division of the California Institute of Technology in Pasadena.

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