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Posted on Sun, Sep. 08, 2002



Amazing 'Grace'

Dual satellites track Earth's field of gravity

By ANDREW BRIDGES
Associated Press

LOS ANGELES - A pair of identical satellites orbiting the Earth 16 times a day have helped produce maps of the planet's lumpy, bumpy gravitational field that scientists say are 10 times better than previous ones.

Earlier maps were slowly cobbled together using a combination of satellite and ground data. The new ones were produced by the U.S.-German Gravity Recovery and Climate Experiment, or Grace, mission with data retrieved from space in just a matter of days.

"It took 30 years to get what we had before," Mike Watkins, the mission's project scientist at NASA's Jet Propulsion Laboratory, said Friday. "Grace in just 14 days of data does better."

Variations in the density and types of material that make up the Earth leave its gravitational field full of lumps. Large-scale movements of mass - including when glaciers melt - also can alter the field.

The new maps track variations in the gravitational field about 620 miles across and larger, showing them as large blobs. Preliminary maps created by using another 35 days of data have shrunken the resolution to about 310 miles.

Launched in March, the twin Grace satellites - Tom and Jerry - orbit the Earth 16 times a day at an altitude of 311 miles. Separated by 137 miles, a precise microwave ranging system constantly measures the distance between them to within the equivalent of one-tenth the width of a human hair.

That ability, coupled with Global Positioning System technology, permits scientists on the ground to monitor changes in the speed and distance between the German-built spacecraft.

Those changes indicate differences in the mass of the Earth's surface below and any corresponding variations in its gravitational pull. For example, a region of higher gravity will cause each spacecraft to alternately speed up and slow down as it passes overhead.

A software upgrade, due to be uploaded to the spacecraft in October, should further improve the pointing accuracy. By year's end, scientists hope to be churning out gravitational field maps every month that represent a 100-fold improvement over those currently available.

"This is a substantial step forward, but it's a long way from where we expect to be," Grace scientist Byron Tapley of the University of Texas at Austin said of the initial results.

Among those most eager to receive results from the \$127 million mission are oceanographers. The ocean surface tends to mimic in its topography the shape of the geoid, or imaginary surface on which the pull of the Earth's gravity is uniform.

However, that topography or shape is also influenced by the ocean's temperature and by large-scale currents; separating out the contribution of gravity is crucial for scientists tracking phenomena like El Niño.

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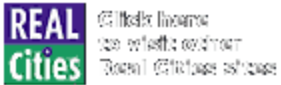
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