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Earth's Gravitational Field Mapped

By ANDREW BRIDGES : AP Science Writer
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LOS ANGELES (AP) -- Data gathered over two weeks by a pair of identical satellites have yielded one of the best-ever maps of the Earth's lumpy, bumpy gravitational field, scientists said Friday.

The low-resolution look represents a tenfold improvement over previous maps, said scientists on the joint U.S.-German Gravity Recovery and Climate Experiment mission, called Grace for short.

Earlier maps were slowly cobbled together using a combination of satellite and ground data.

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

Due to variations in the density and types of material that make up the Earth, its gravitational field is 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 big 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.

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