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Gravity map shows Earth is very lumpy

Larry O'Hanlon
Discovery News

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Earth is a lumpy, squishy place - or so the newest, best-ever gravity map of the planet has revealed.

A flying pair of American and German satellites, known as GRACE, has measured the uneven gravity of the Earth with unprecedented accuracy, allowing for precise new views of ocean currents and tidal changes that will help in predictions of El Niños and other climate troublemakers.

"We can really weigh the water as it moves around," said Dr Michael Watkins, a project scientist for GRACE (Gravity Recovery and Climate Experiment) run from NASA's [Jet Propulsion Laboratory](#) in California, USA.

The new gravity map is a preliminary taste of what soon will be putting out monthly, Watkins said. The gravitational lumpiness that GRACE measures is caused by the uneven distribution of mass on the Earth, he said.

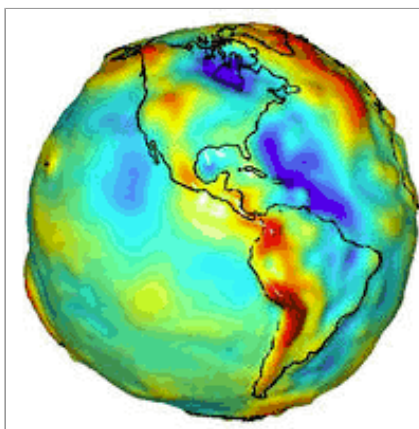
Ocean currents, mountain ranges - even groundwater - concentrate a lot of mass to specific places. Since everything with mass also exerts gravitational force, a gravity-force map of the Earth shows the subtle differences in mass from one place to another.

The twin GRACE satellites measure the gravitational force by flying an orbit 500 km up and 220 km apart, sweeping the entire planet once a month.

One satellite keeps a very close watch on the other, using finely tuned microwave signals, and can pick up as little as a millionth of a centimetre in change in the distance between the satellites. Such changes are signals that one satellite is flying over a part of the planet with slightly different gravitational force.

The first application of GRACE will be to better chart ocean currents, said Dr Victor Zlotnicki, an oceanographer at the Californian laboratory who has been using satellite data to measure year-to-year changes in ocean heights, which signal currents like El Niño.

"It's [been] a little bit like the weatherman telling you how many degrees warmer it is today from yesterday," without actually telling you the temperature, said



Uneven distribution of mass makes the Earth a lumpy planet (NASA/GRACE)

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Zlotnicki of the days before GRACE. The two satellites, on the other hand, provide a 'carpenter's level' so that the ocean heights can be worked out exactly - without having to just rely on year-to-year comparisons.

When GRACE starts supplying month-by-month global gravity maps, researchers expect that ongoing mass changes on Earth will pop out.

Besides changing ocean currents, other known, but previously hard-to-measure mass changes include that of polar ice caps and seasonal shifts in groundwater supplies in different parts of the world, Watkins said.

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