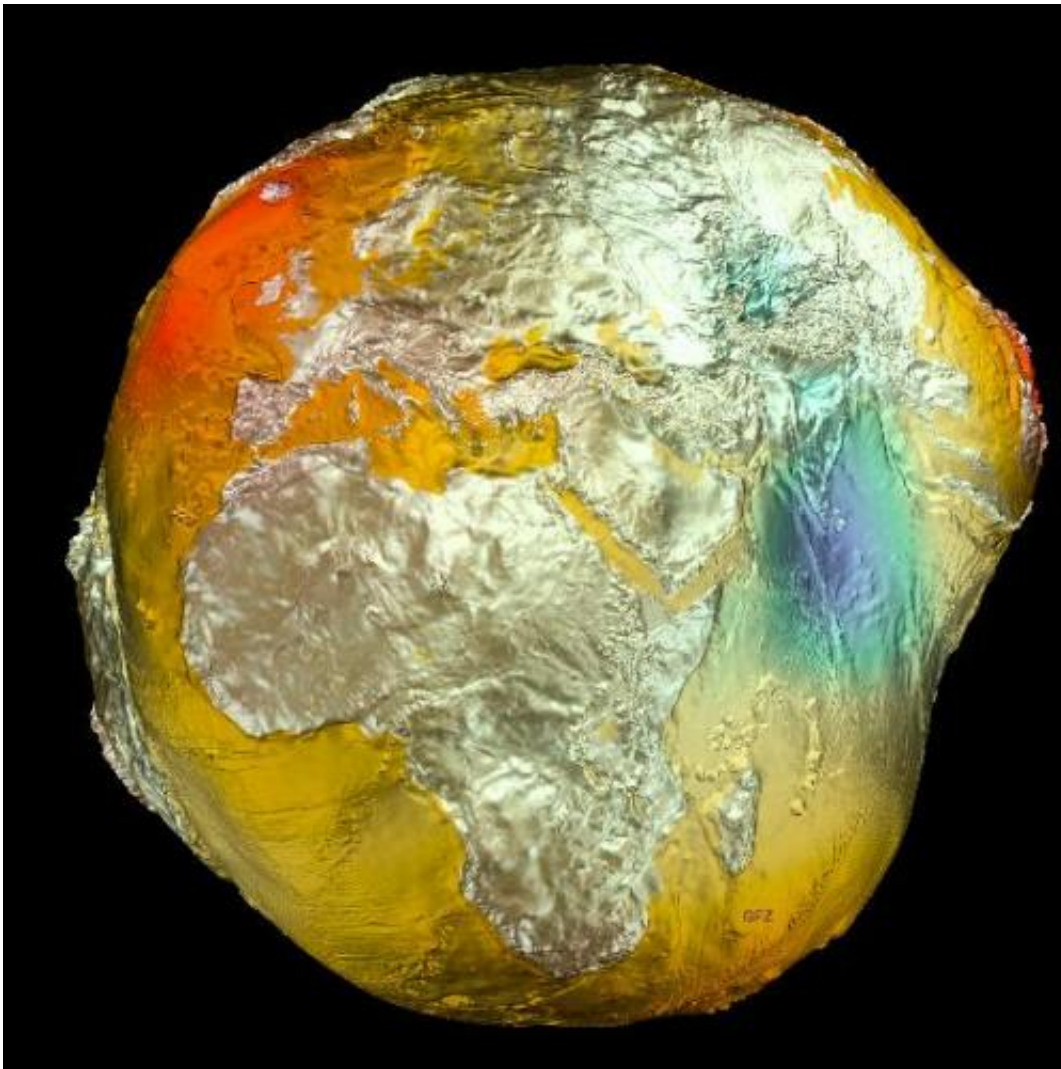


The "Potsdam gravity potato" shows variations in Earth's gravity

December 1 2014, by Matt Williams



The Earth's gravitational model (aka the "Potsdam Potato") is based on data from the LAGEOS, GRACE, and GOCE satellites and surface data. Credit: GFZ

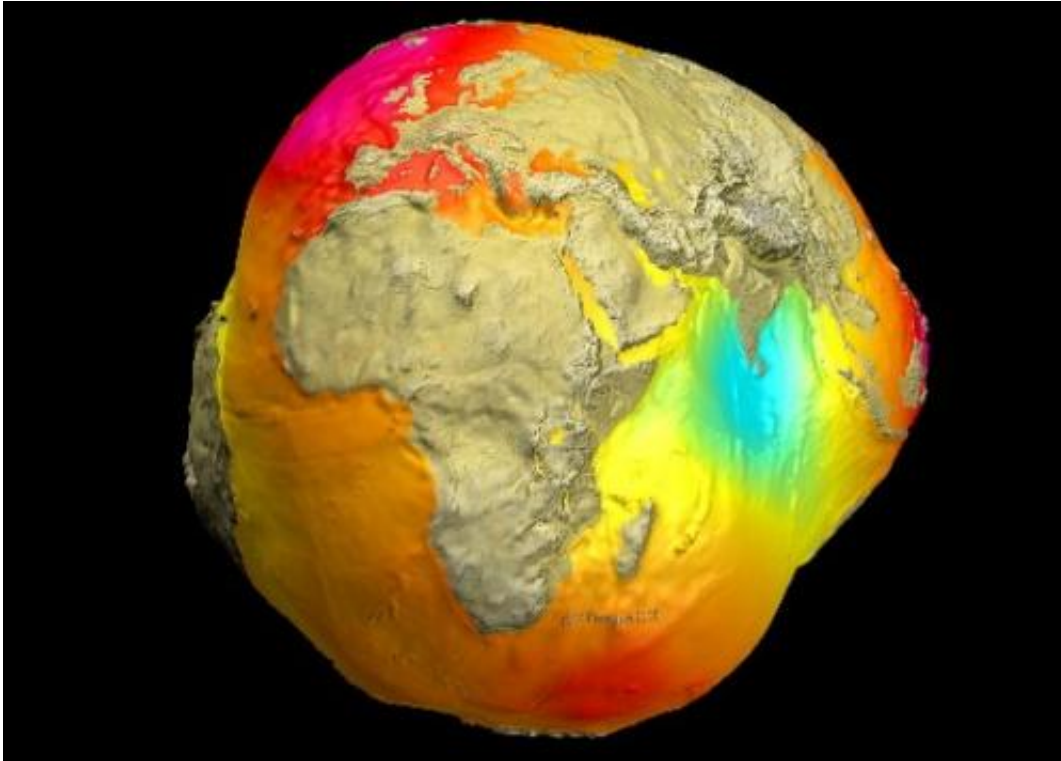
People tend to think of gravity here on Earth as a uniform and consistent thing. Stand anywhere on the globe, at any time of year, and you'll feel the same downward pull of a single G. But in fact, Earth's gravitational field is subject to variations that occur over time. This is due to a combination of factors, such as the uneven distributions of mass in the oceans, continents, and deep interior, as well as climate-related variables like the water balance of continents, and the melting or growing of glaciers.

And now, for the first time ever, these variations have been captured in the image known as the "Potsdam Gravity Potato" – a visualization of the Earth's [gravity field](#) model produced by the German Research Center for Geophysics' (GFZ) Helmholtz's Center in Potsdam, Germany.

And as you can see from the image above, it bears a striking resemblance to a potato. But what is more striking is the fact that through these models, the Earth's gravitational field is depicted not as a solid body, but as a dynamic surface that varies over time. This new gravity field model (which is designated EIGEN-6C) was made using measurements obtained from the LAGEOS, GRACE, and GOCE satellites, as well as ground-based gravity measurements and data from the satellite altimetry.

Compared to the previous model obtained in 2005 (shown above), EIGEN-6C has a fourfold increase in spatial resolution.

"Of particular importance is the inclusion of measurements from the satellite GOCE, from which the GFZ did its own calculation of the gravitational field," says Dr. Christoph Foerste who directs the gravity field work group at GFZ along with Dr. Frank Flechtner.



The 2005 model, which was based on data from the CHAMP and GRACE satellites and surface data, was less refined than the latest one. Credit: GFZ

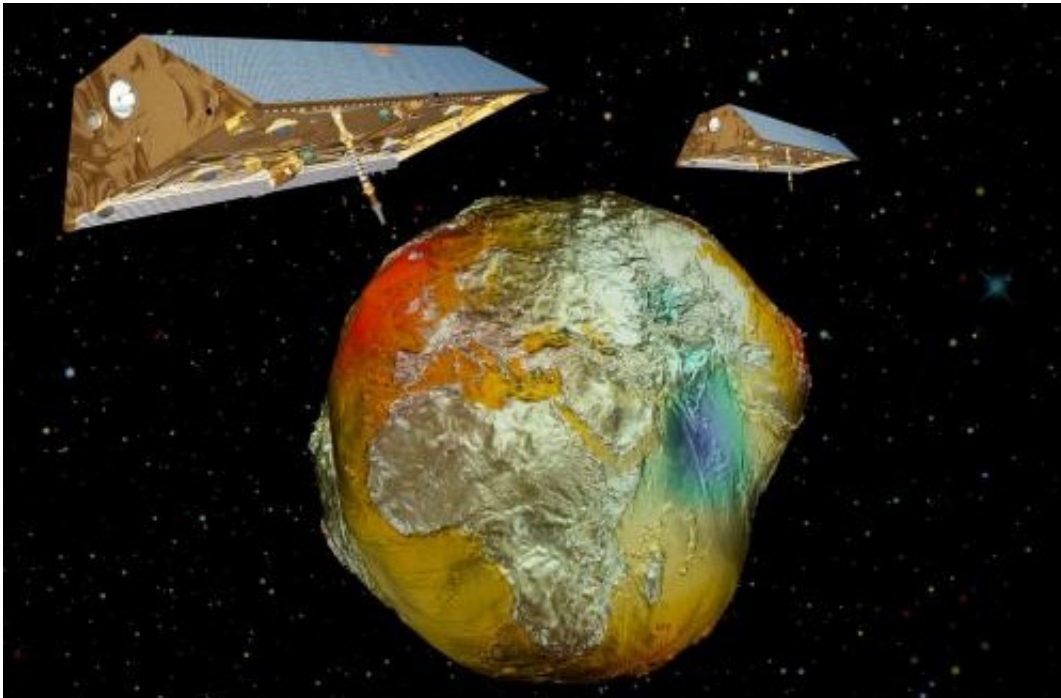
The ESA mission GOCE (Gravity Field and Steady-State Ocean Circulation Explorer) was launched in mid-March 2009 and has since been measuring the Earth's gravitational field using satellite gradiometry – the study and measurement of variations in the acceleration due to gravity.

"This allows the measurement of gravity in inaccessible regions with unprecedented accuracy, for example in Central Africa and the Himalayas," said Dr. Flechtner. In addition, the GOCE satellites offers advantages when it comes to measuring the oceans.

Within the many open spaces that lie under the sea, the Earth's gravity field shows variations. GOCE is able to better map these, as well as

deviations in the ocean's surface – a factor known as "dynamic ocean topography" – which is a result of Earth's gravity affecting the ocean's surface equilibrium.

Long-term measurement data from the GFZ's twin-satellite mission GRACE (Gravity Recovery And Climate Experiment) were also included in the model. By monitoring climate-based variables like the melting of large glaciers in the polar regions and the amount of seasonal water stored in large river systems, GRACE was able to determine the influence of large-scale temporal changes on the gravitational field.



Twin-satellites GRACE with the earth's gravity field (vertically enhanced) calculated from CHAMP data. Credit: GFZ

Given the temporal nature of climate-related processes – not to mention the role played by Climate Change – ongoing missions are needed to see

how they effect our planet long-term. Especially since the GRACE mission is scheduled to end in 2015.

In total, some 800 million observations went into the computation of the final model which is composed of more than 75,000 parameters representing the global gravitational field. The GOCE satellite alone made 27,000 orbits during its period of service (between March 2009 and November 2013) in order to collect data on the variations in the Earth's [gravitational field](#).

The final result achieved centimeter accuracy, and can serve as a global reference for sea levels and heights. Beyond the "gravity community," the research has also piqued the interest of researchers in aerospace engineering, atmospheric sciences, and space debris.

But above all else, it offers scientists a way of imaging the world that is different from, but still complimentary to, approaches based on light, magnetism, and seismic waves. And it could be used for everything from determining the speed of ocean currents from space, monitoring rising sea levels and melting ice sheets, to uncovering hidden features of continental geology and even peeking at the convection force driving plate tectonics.

More information: www.gfz-potsdam.de/en/media-co ... sdam-gravity-potato/

Source: [Universe Today](#)

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