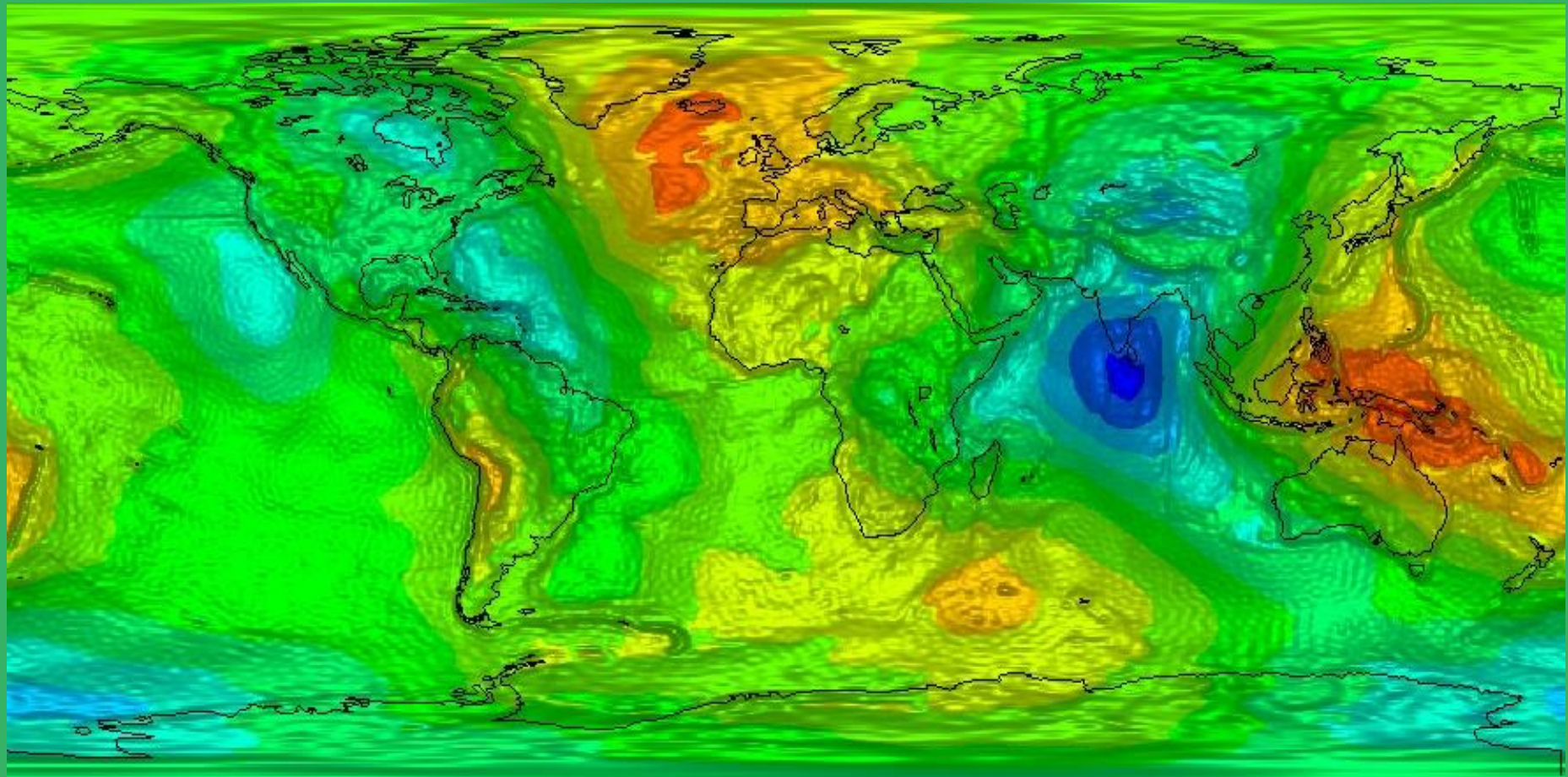
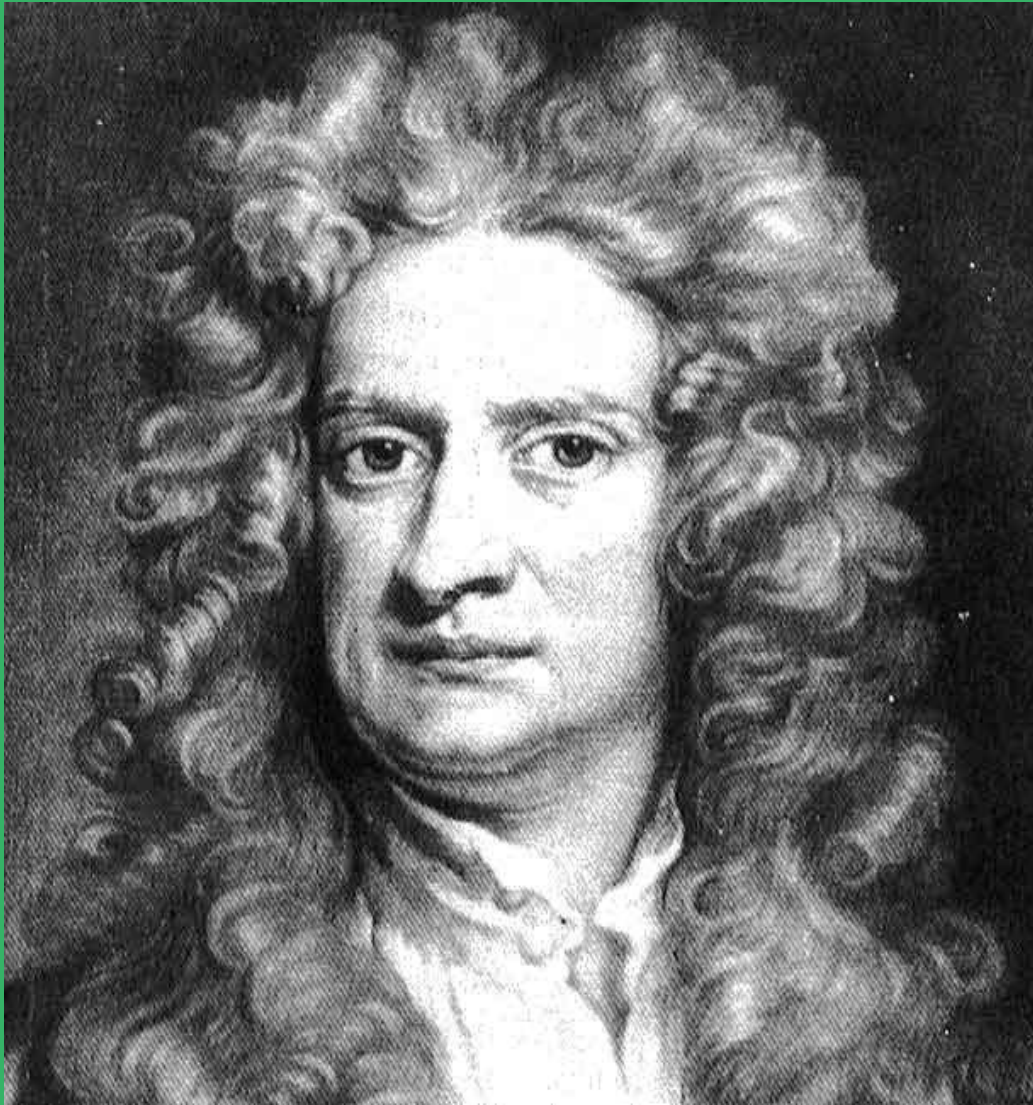


Mapping The Earth's Gravity

Christopher Berry



Gravitation



$$F = \frac{GMm}{r^2}$$

Weight



$$F = mg$$

$$g \approx 9.81 \text{ m s}^{-2}$$

Changing Gravity

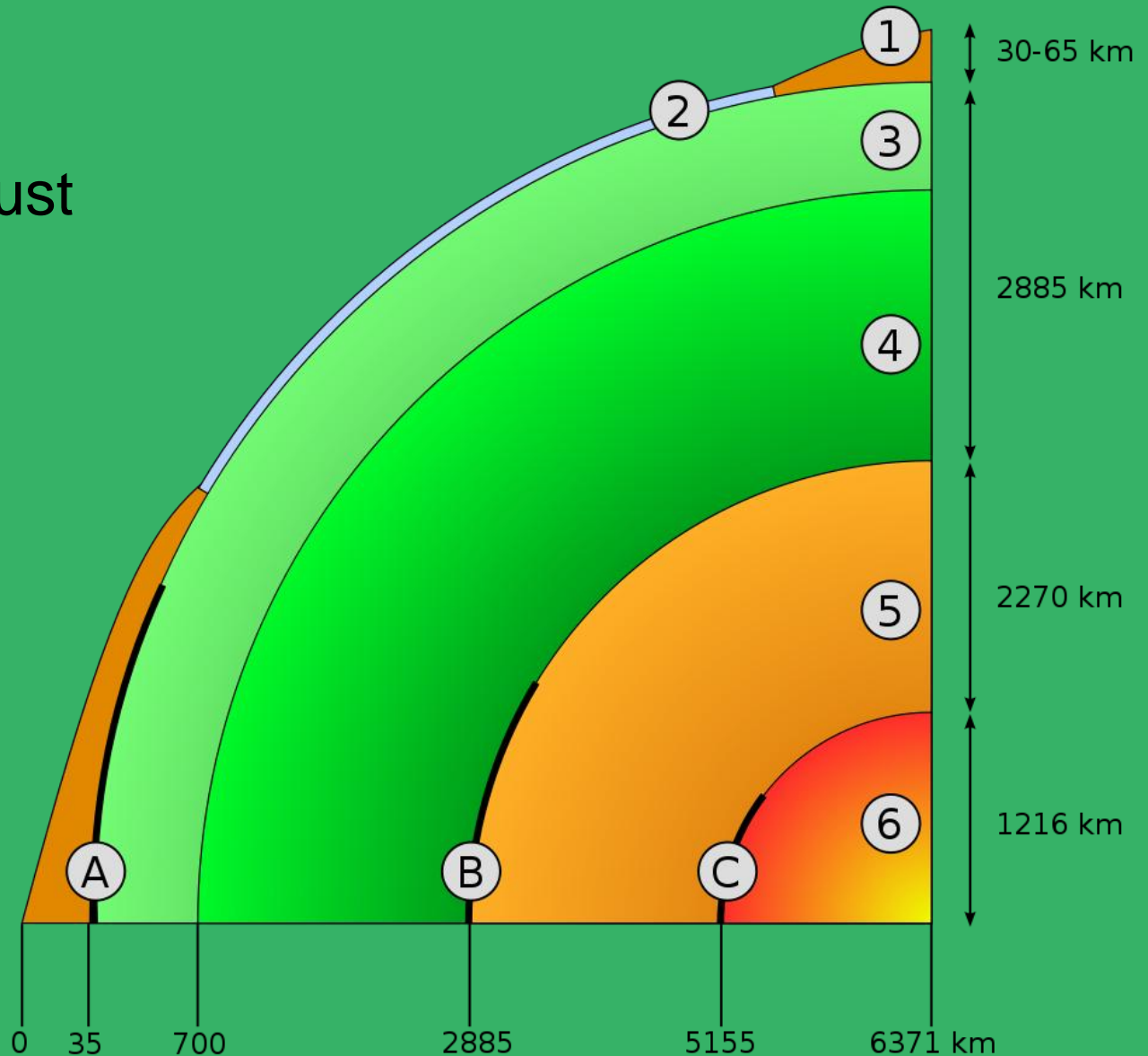


Centrifugal Force

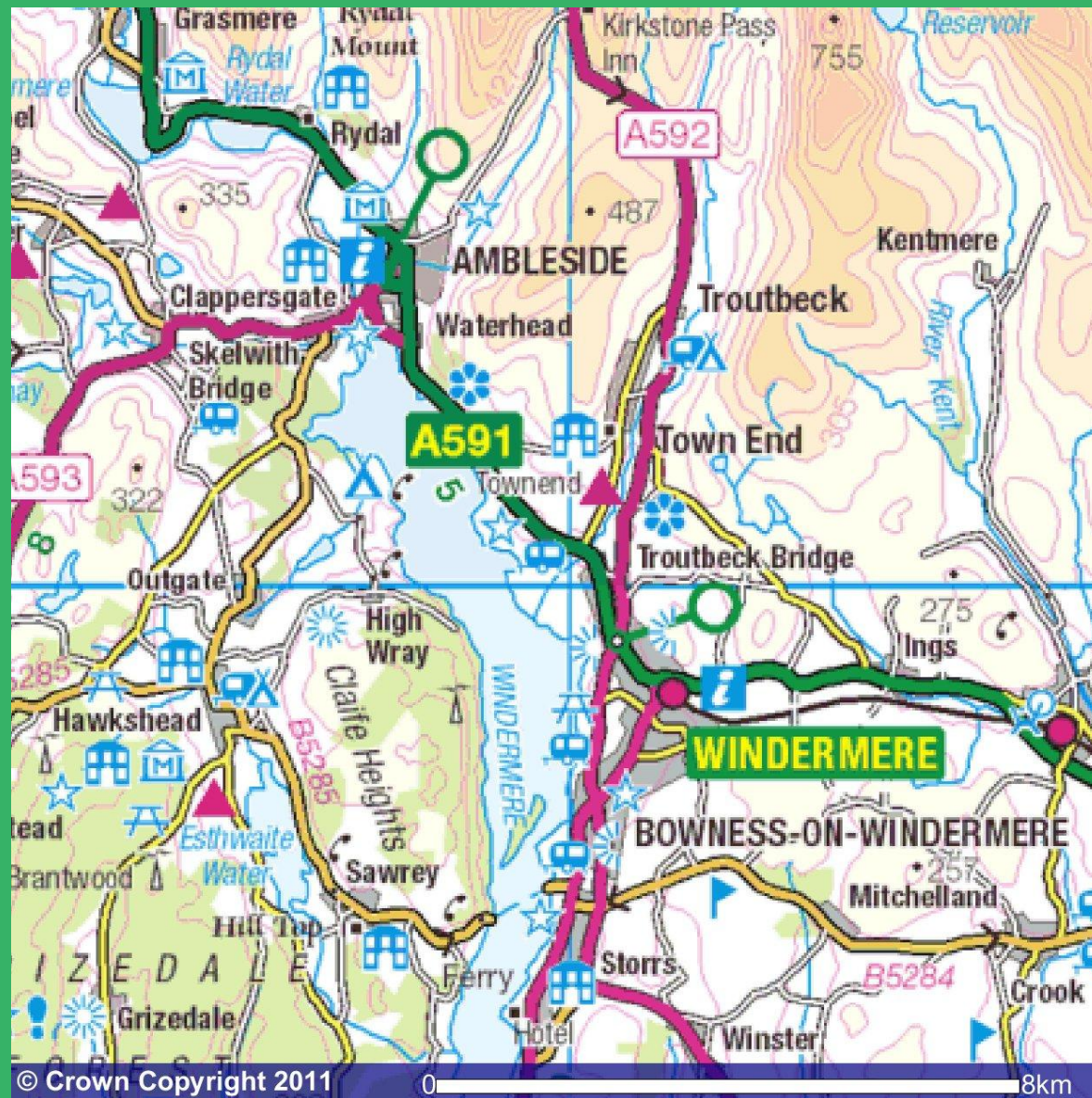


The Earth

1. Continental crust
2. Oceanic crust
3. Upper mantle
4. Lower mantle
5. Outer core
6. Inner core



Sea Level

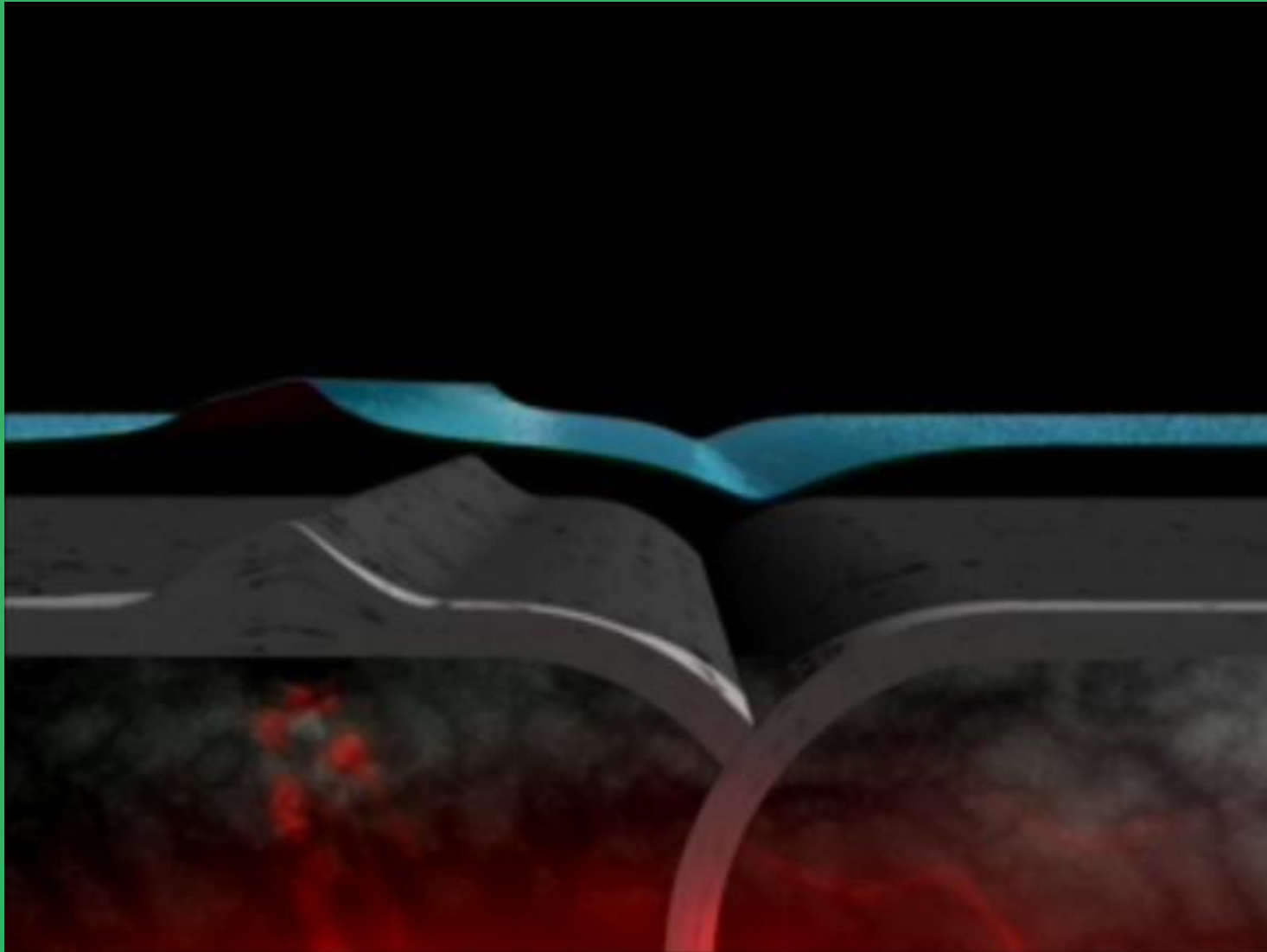


Credit:
Ordnance
Survey

The Geoid



Tectonic Plates & Ocean Currents



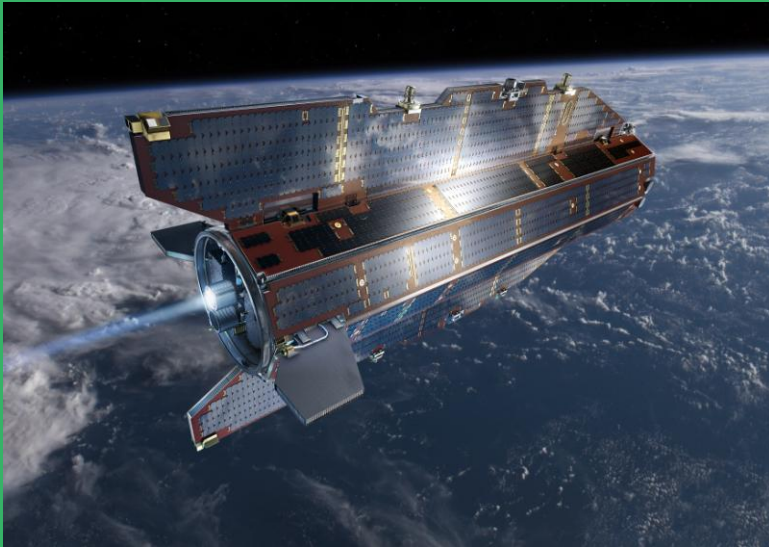
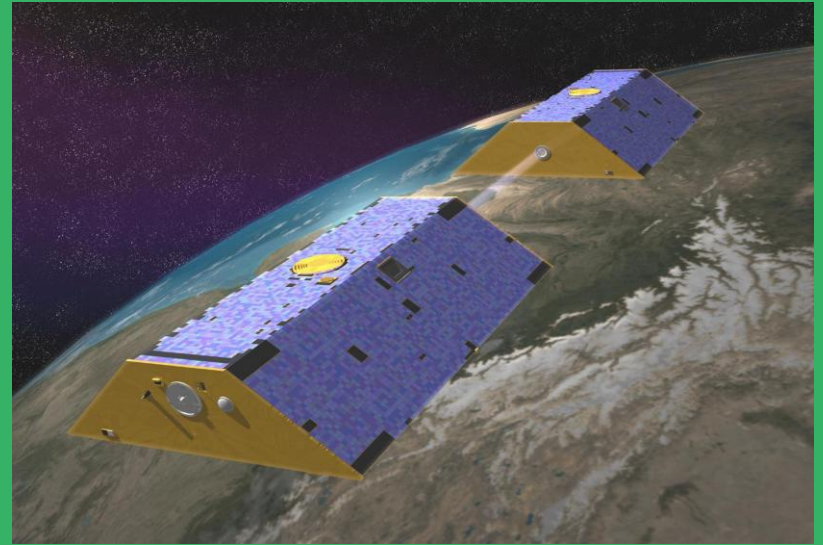
Credit: ESA/AOES Medialab

Mapping The Earth's Gravity

Gravity Recovery And Climate Experiment (GRACE)

Launched March 17 2002

Credit: NASA/JPL



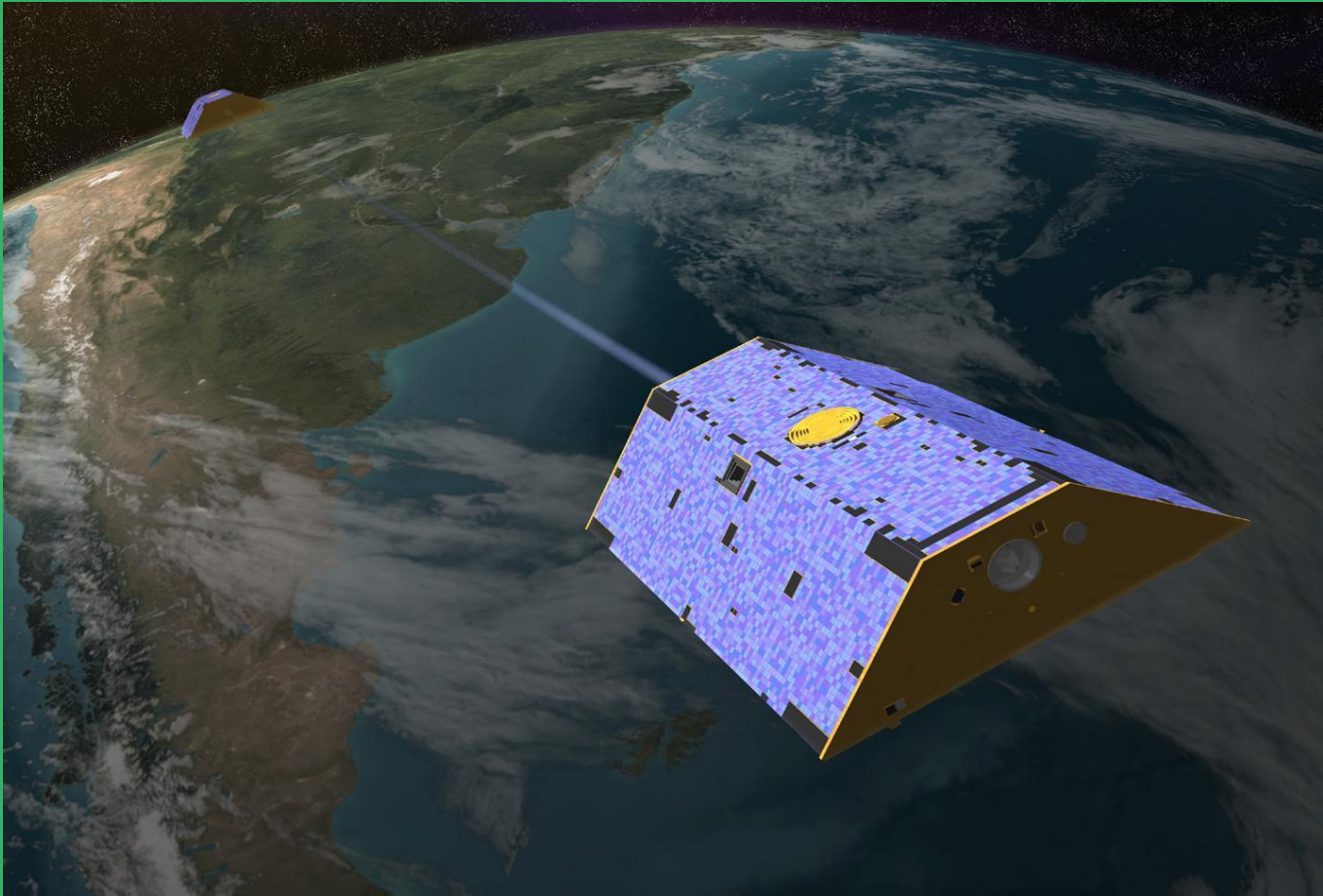
Gravity Field and Steady-State Ocean Circulation Explorer (GOCE)

Launched March 17 2009

Credit: ESA

GRACE

A movie of the Earth's gravity



Credit: NASA/JPL

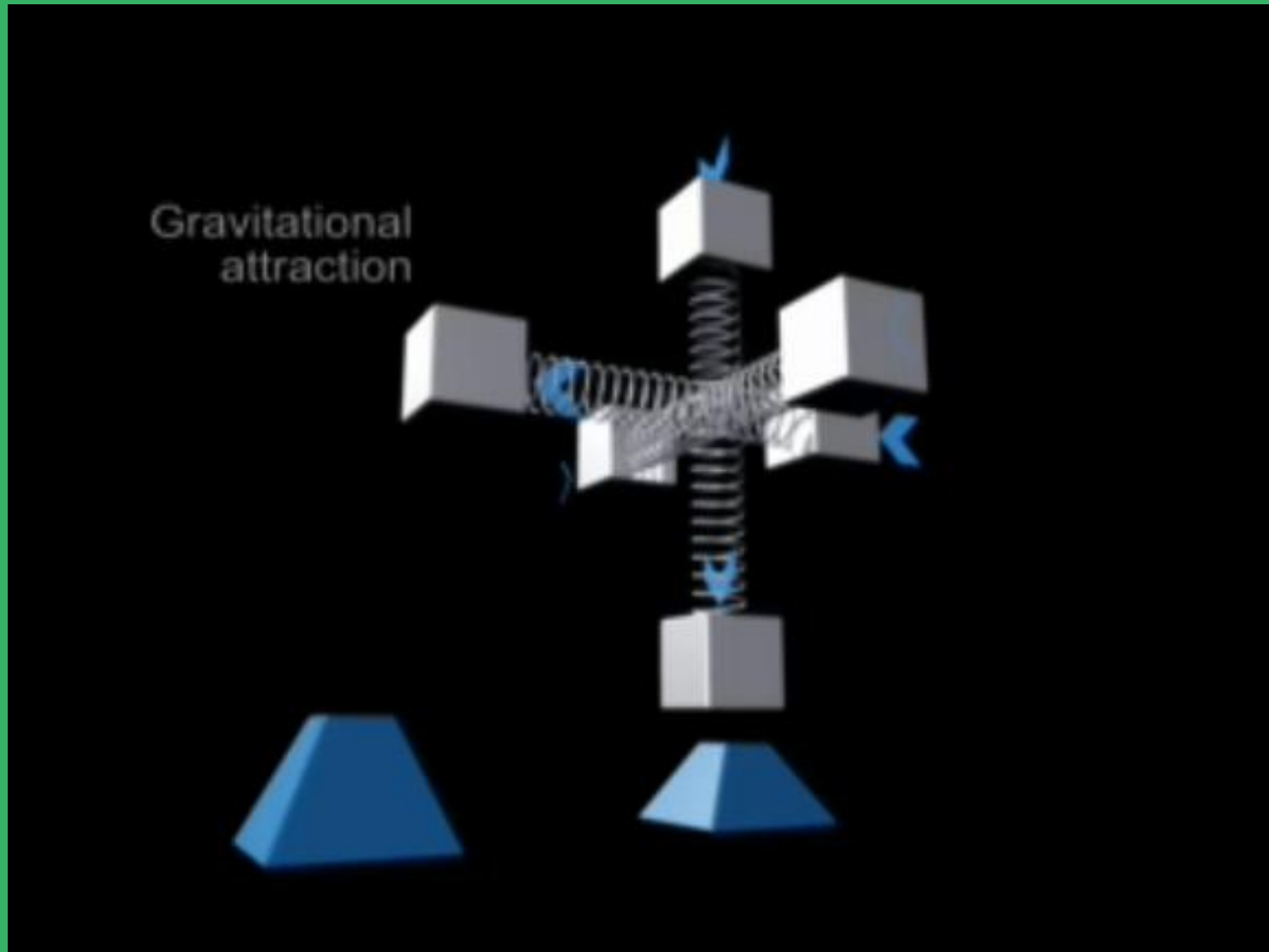
GOCE



A snapshot of
the Earth's
gravity

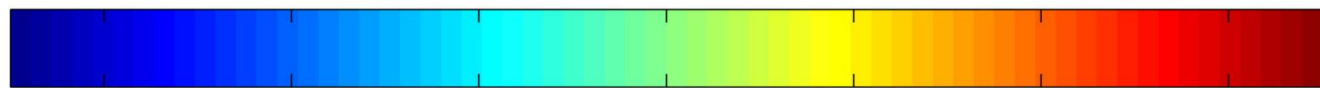
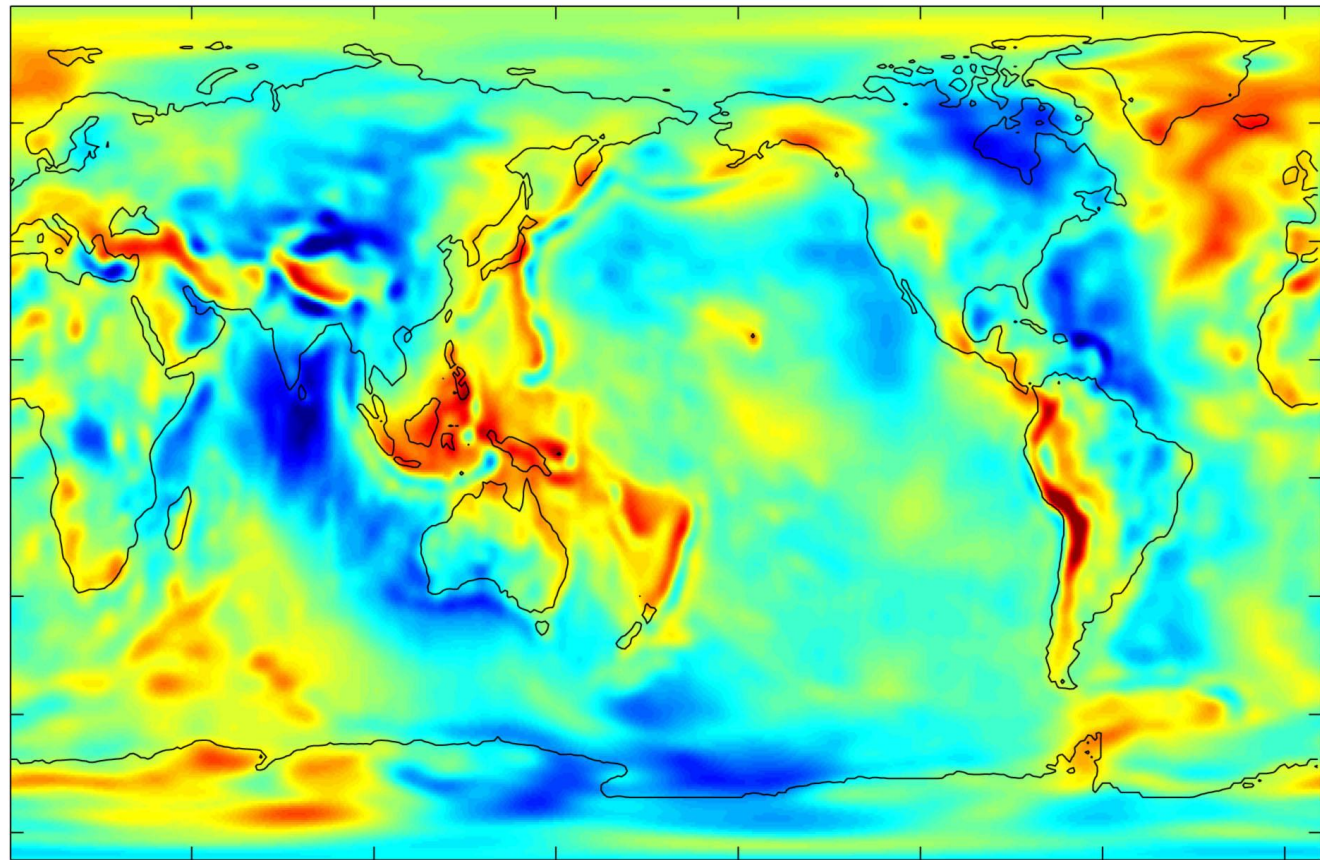
Credit: ESA

Gradiometers



Credit: ESA/AOES Medialab

GRACE Gravitational Anomaly

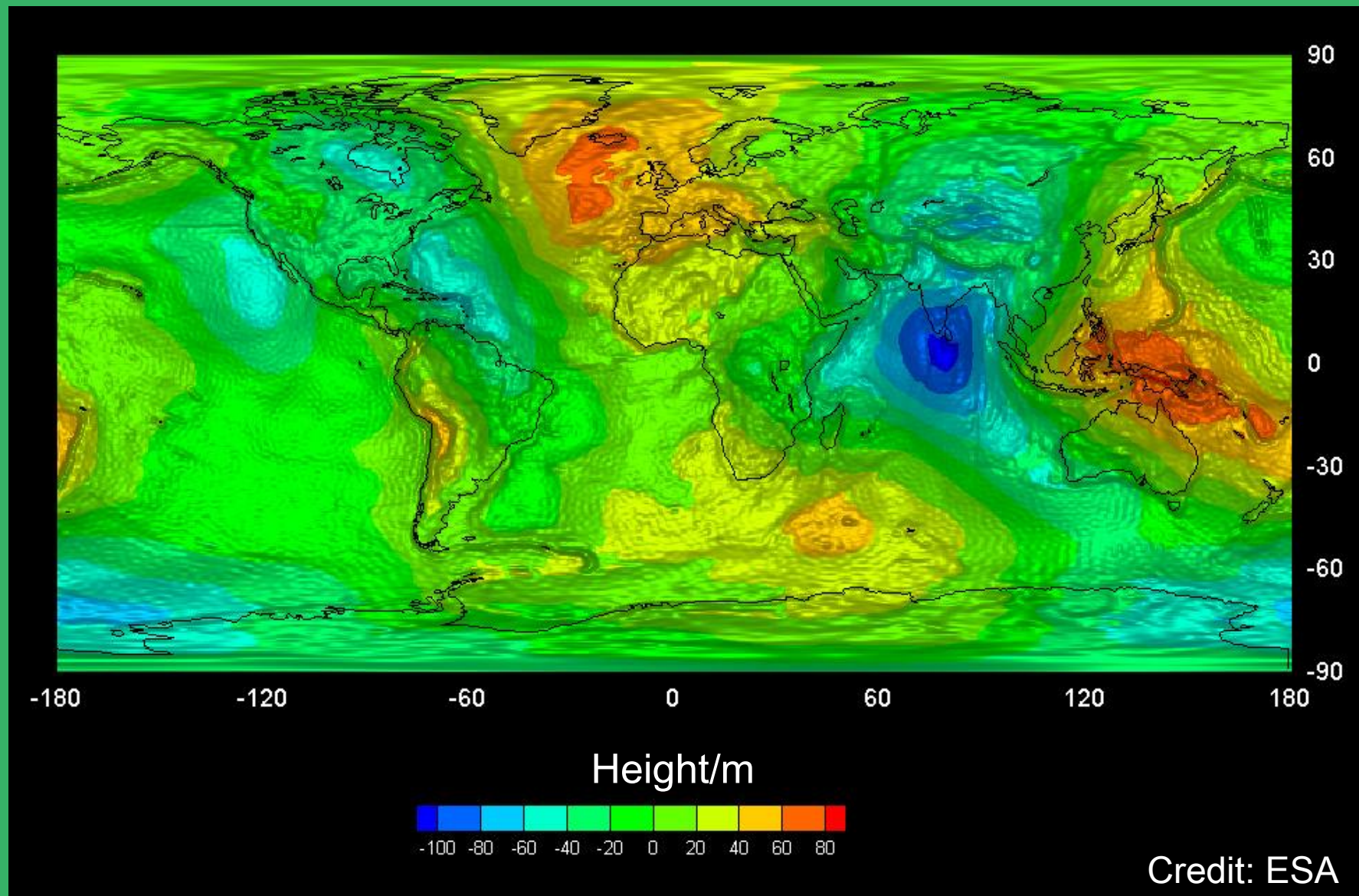


-60 -40 -20 0 20 40 60

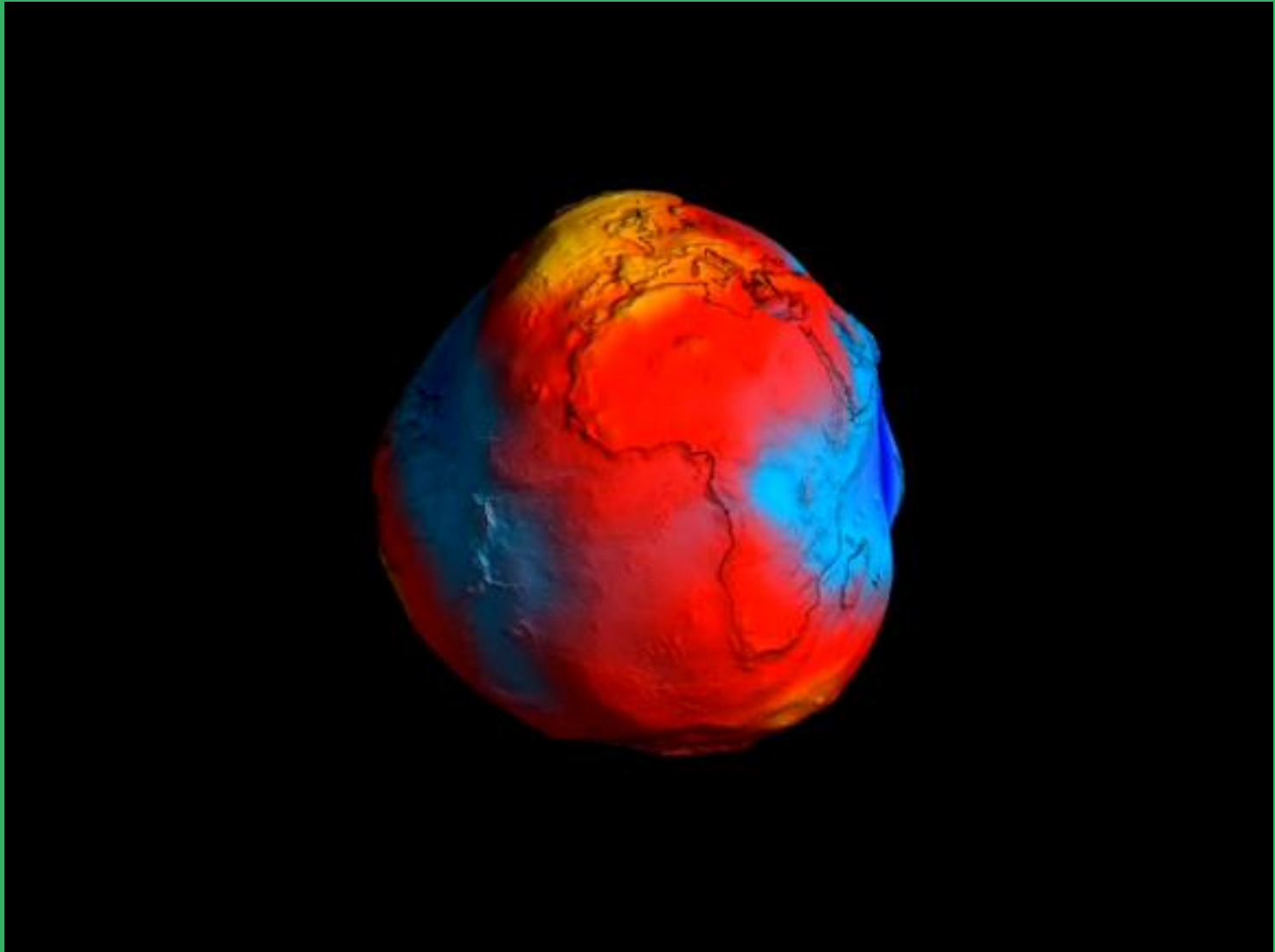
Gravity Anomaly (mGal)

Credit: JPL/
U. Texas/
GFZ Potsdam

GOCE Geoid



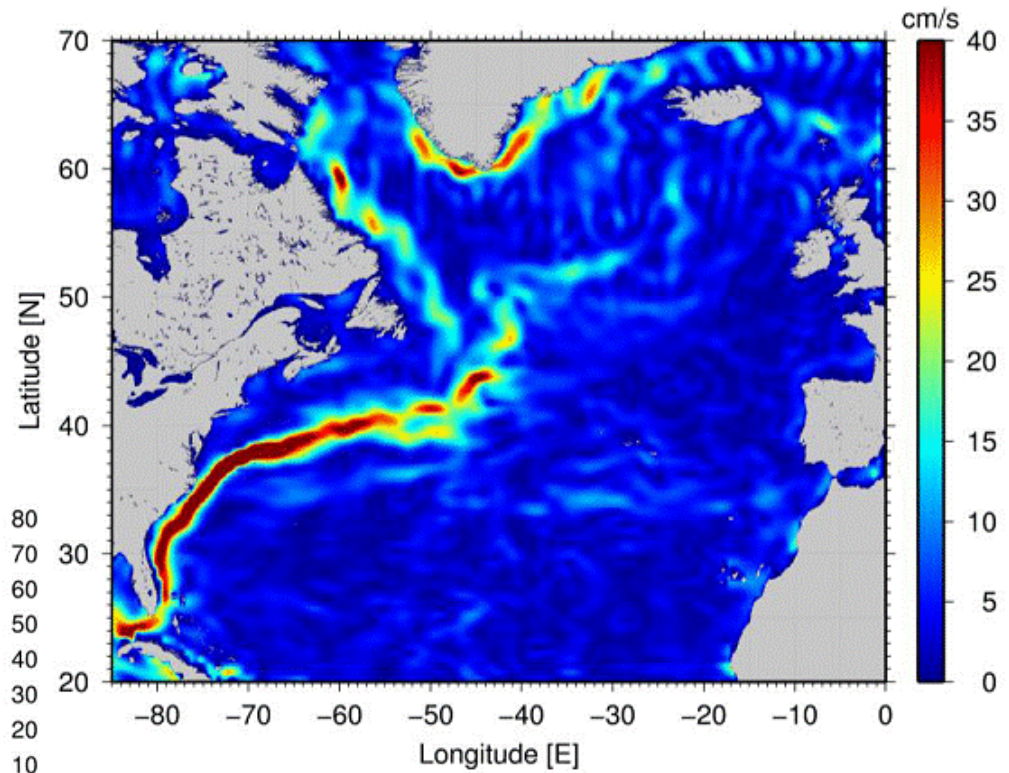
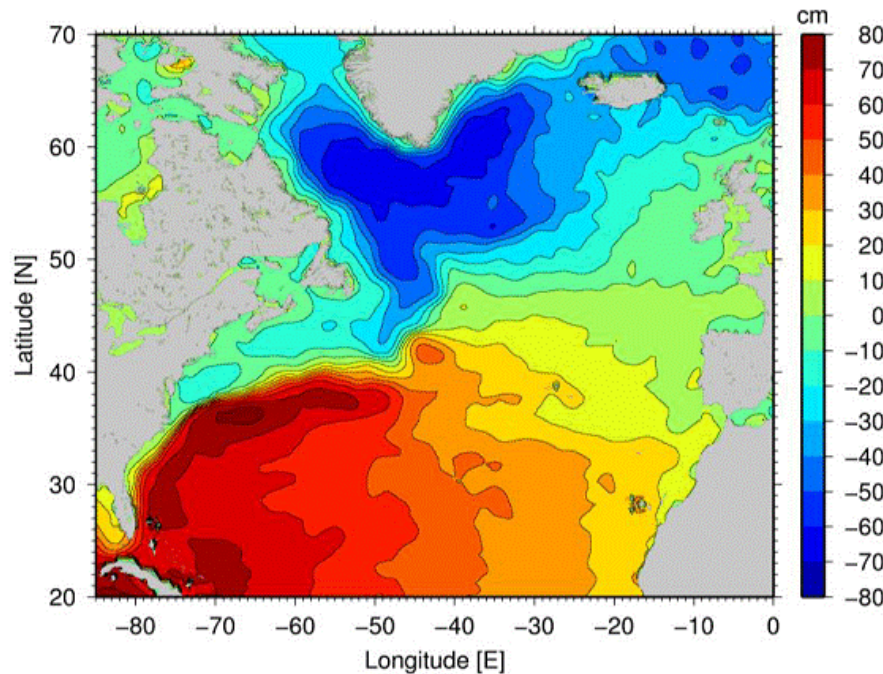
GOCE Geoid



Credit: ESA/HPF/DLR

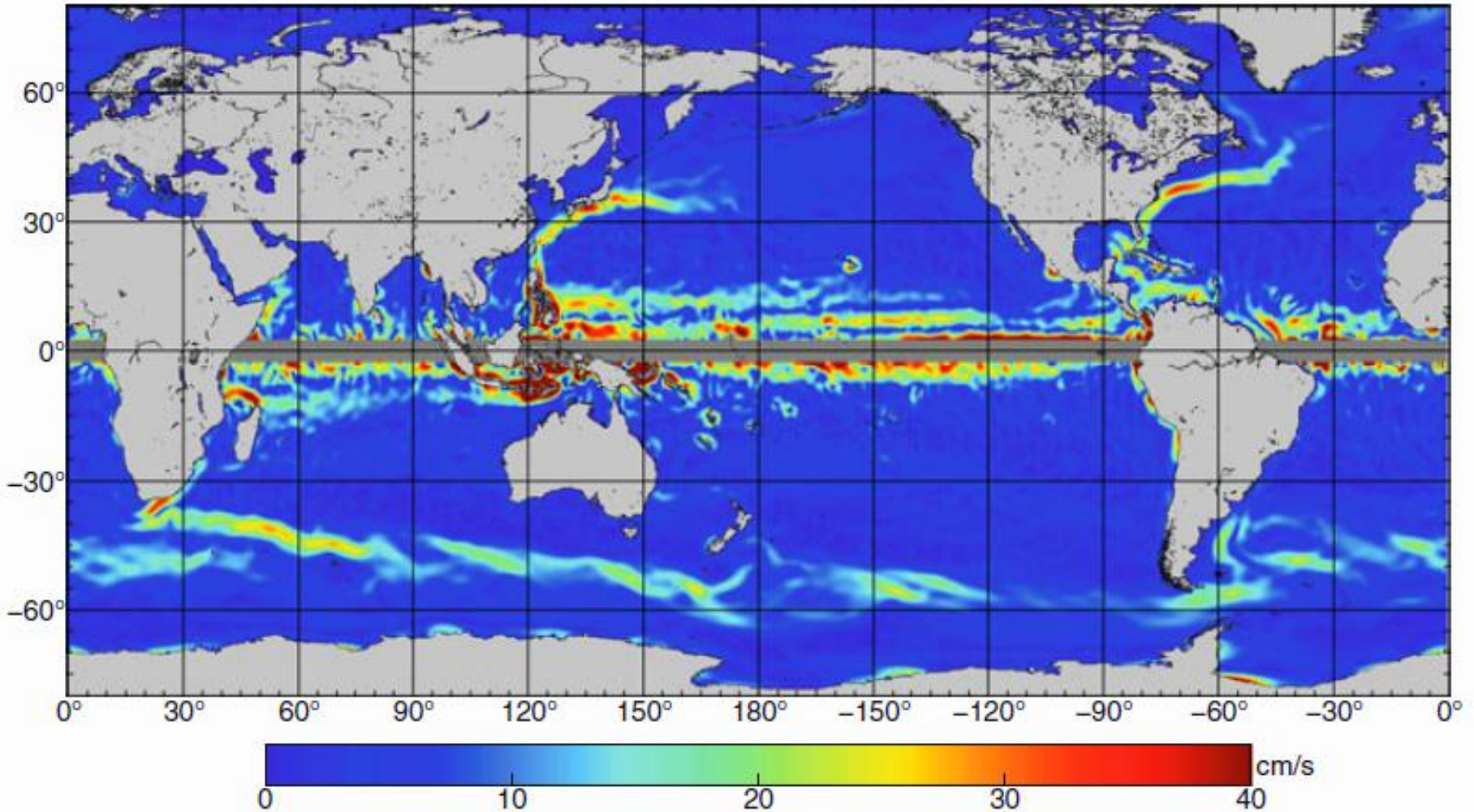
Ocean Currents

The steady-state Gulf Stream



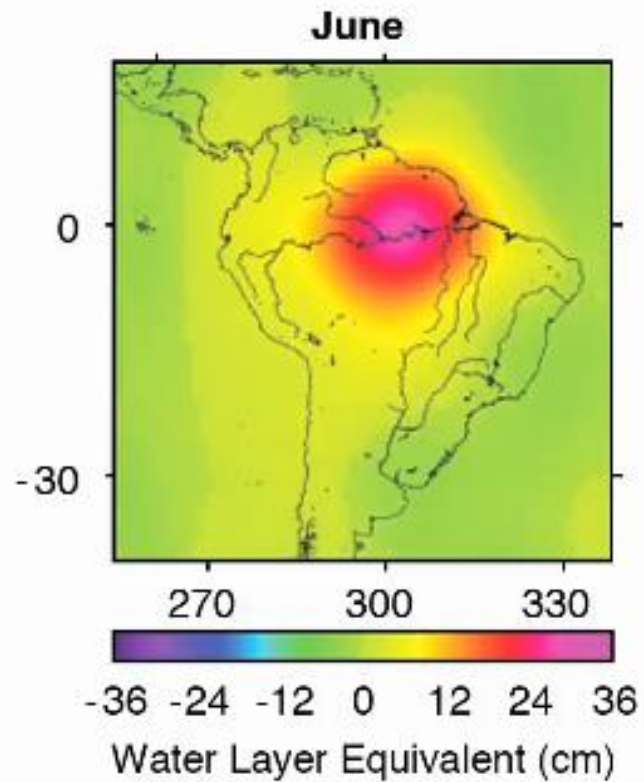
Credit: Bingham et al.

World Currents



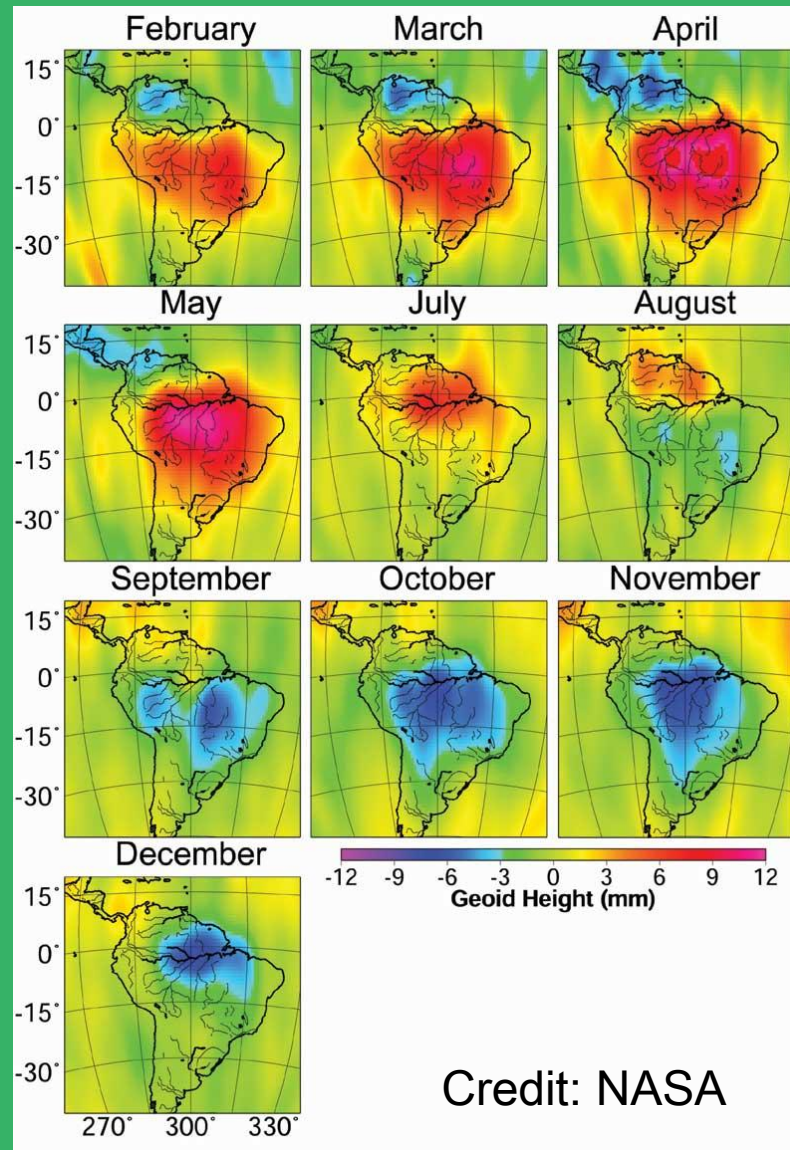
Credit: Bingham et al.

Amazon Water Storage



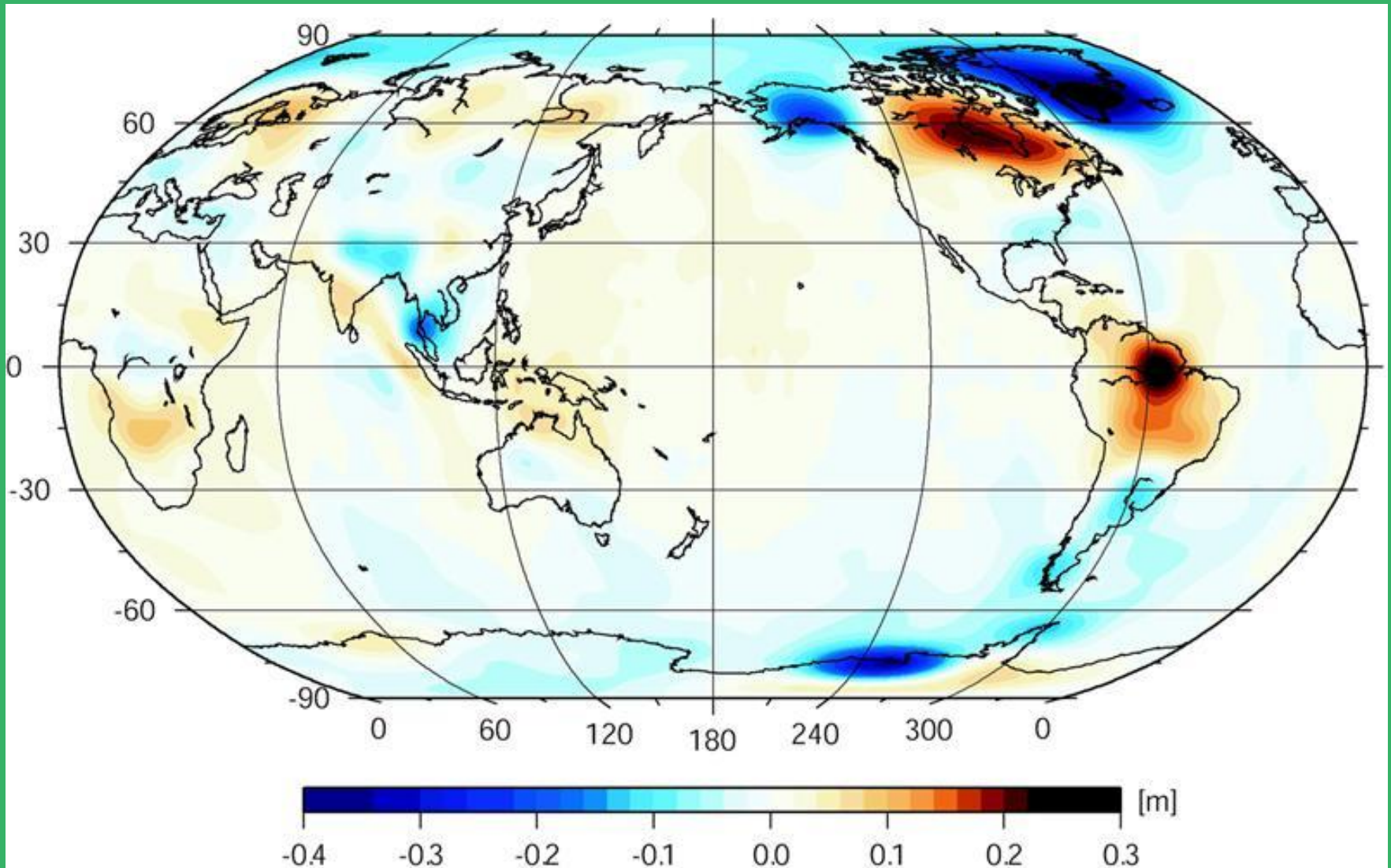
Credit: NASA

Amazon Water Storage



Credit: NASA

Climate Change

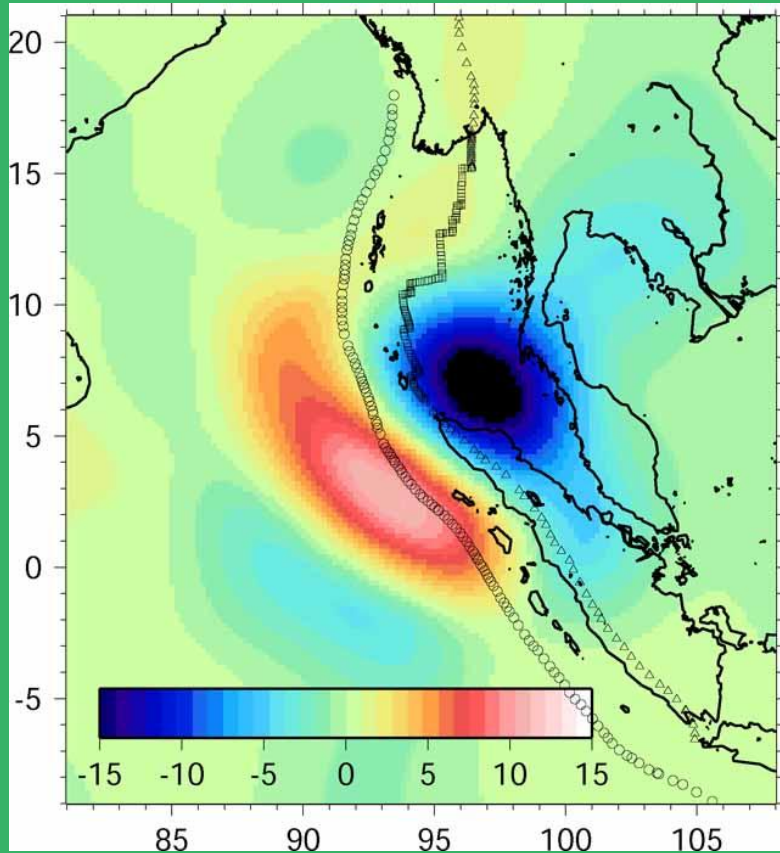


Credit: University of Stuttgart

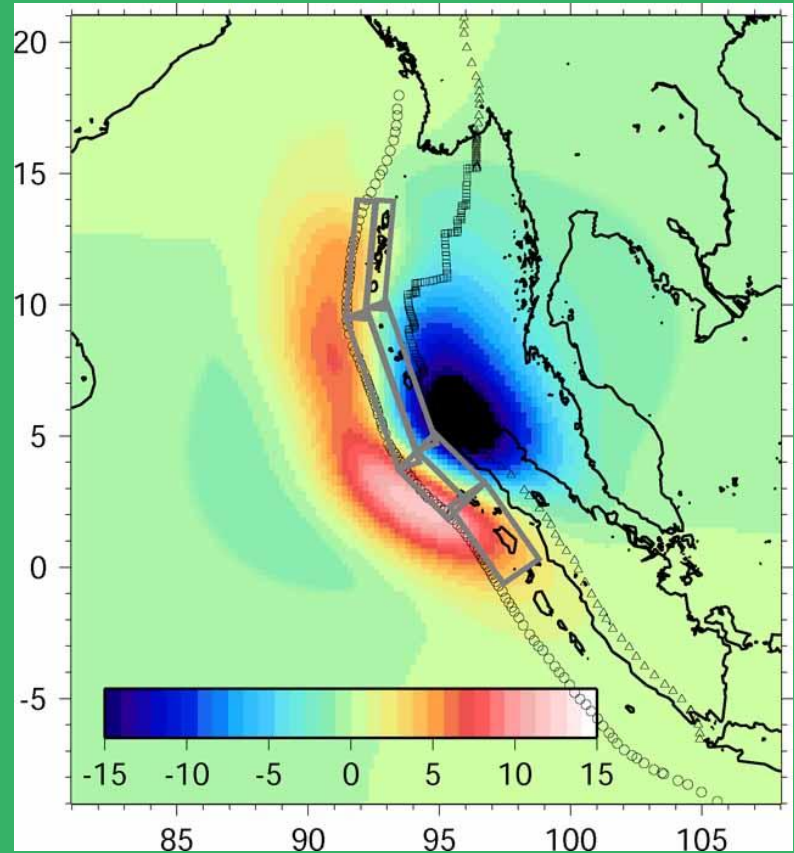
Seismic Activity

Sumatran earthquake December 26 2004

Before



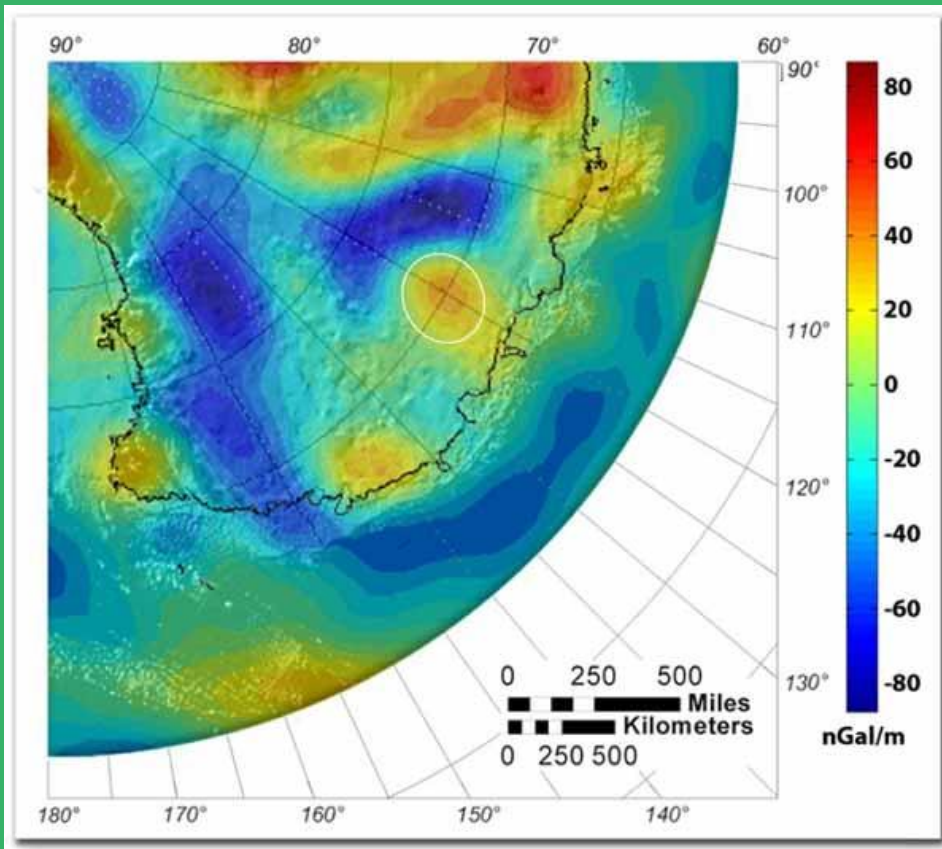
After



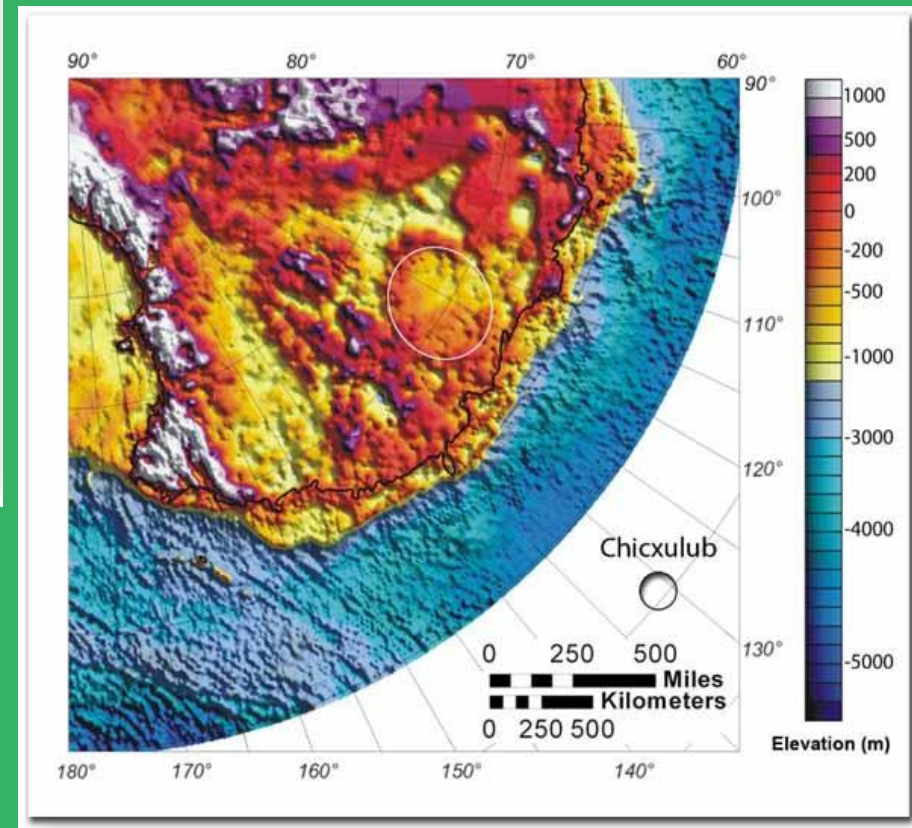
Credit: Ohio State University

Wilkes Land Crater

Characteristic mascon
discovered 2006.

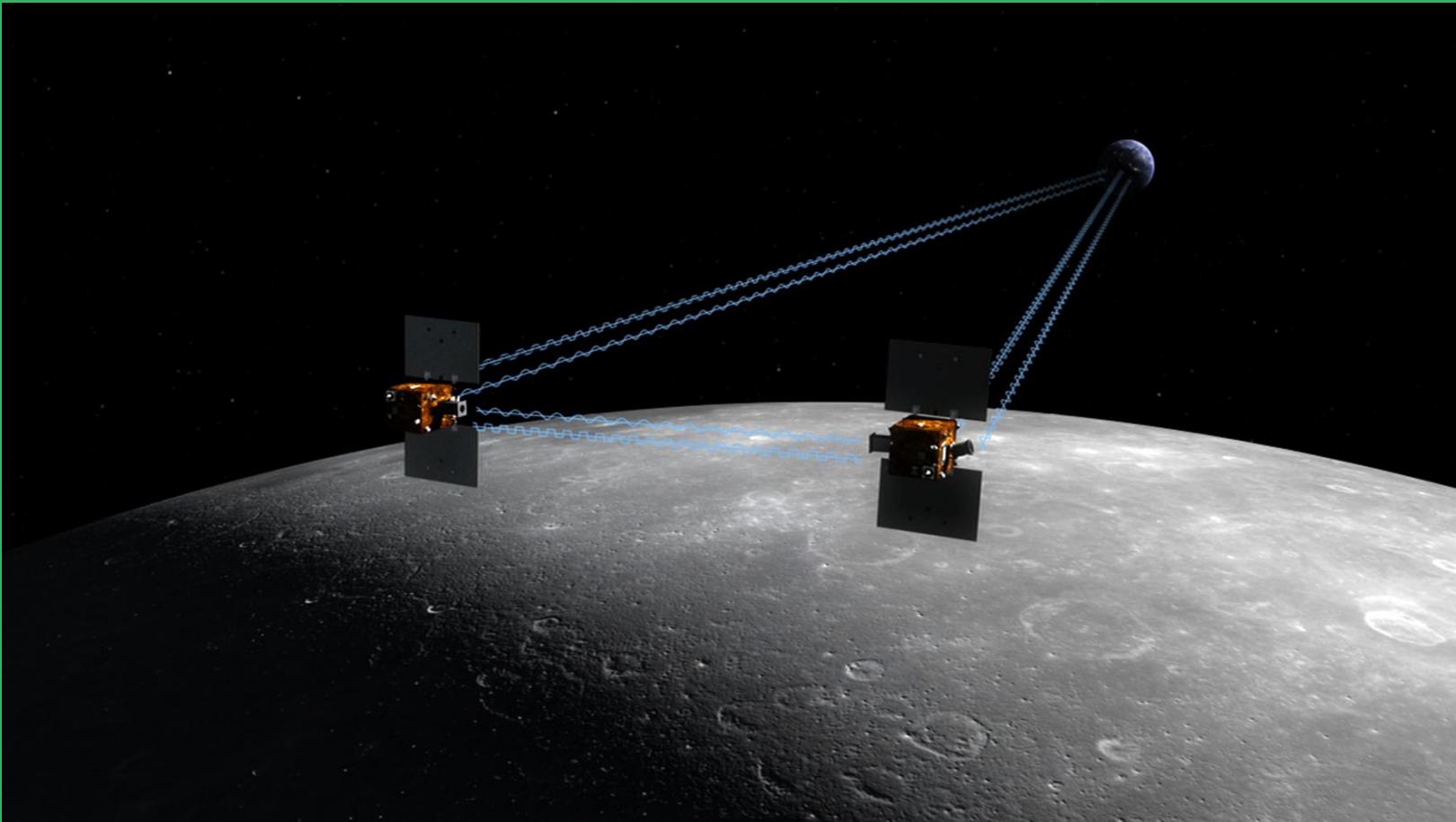


Credit: Ohio State University



The Future

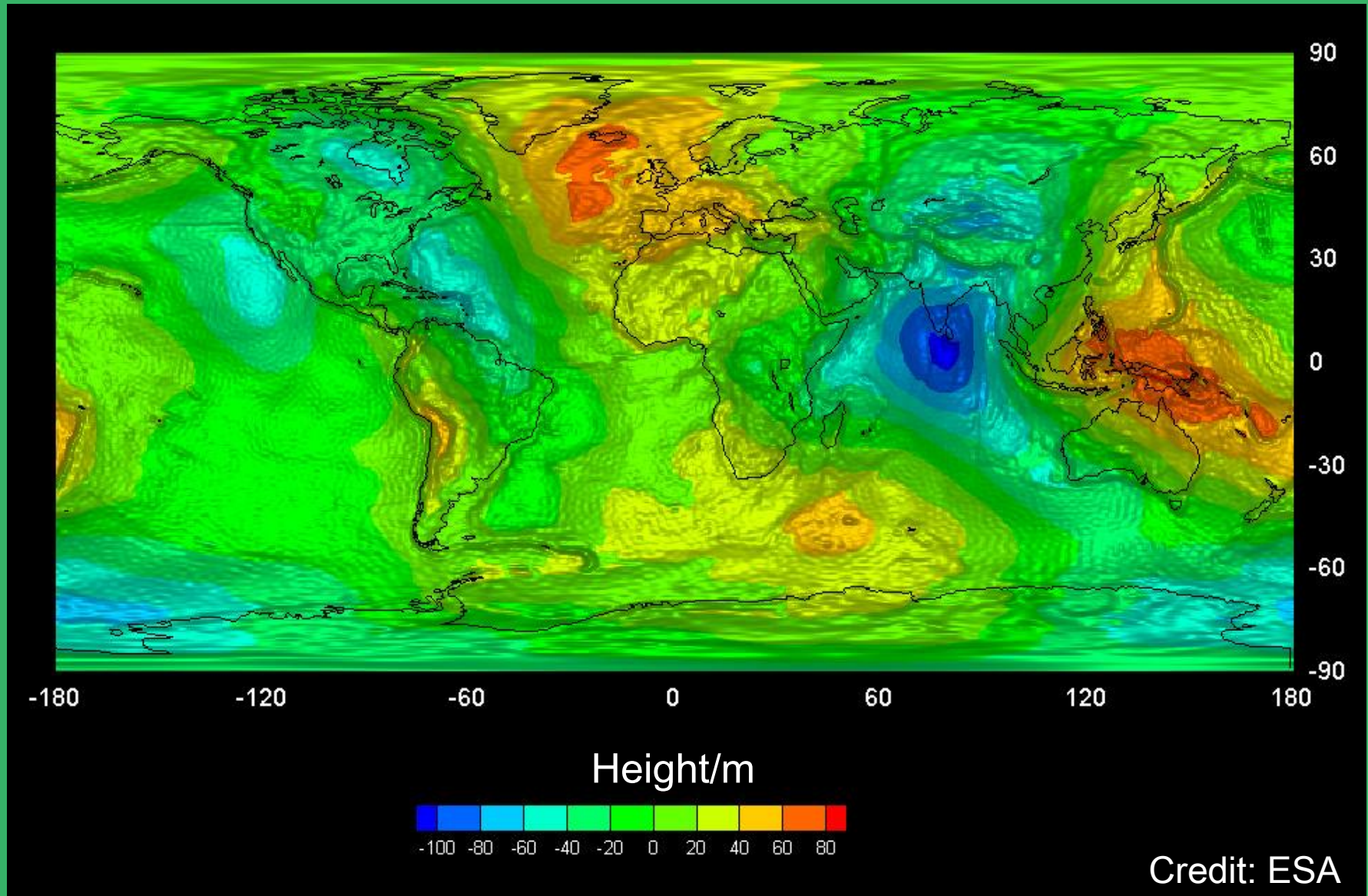
Credit:
NASA/JPL



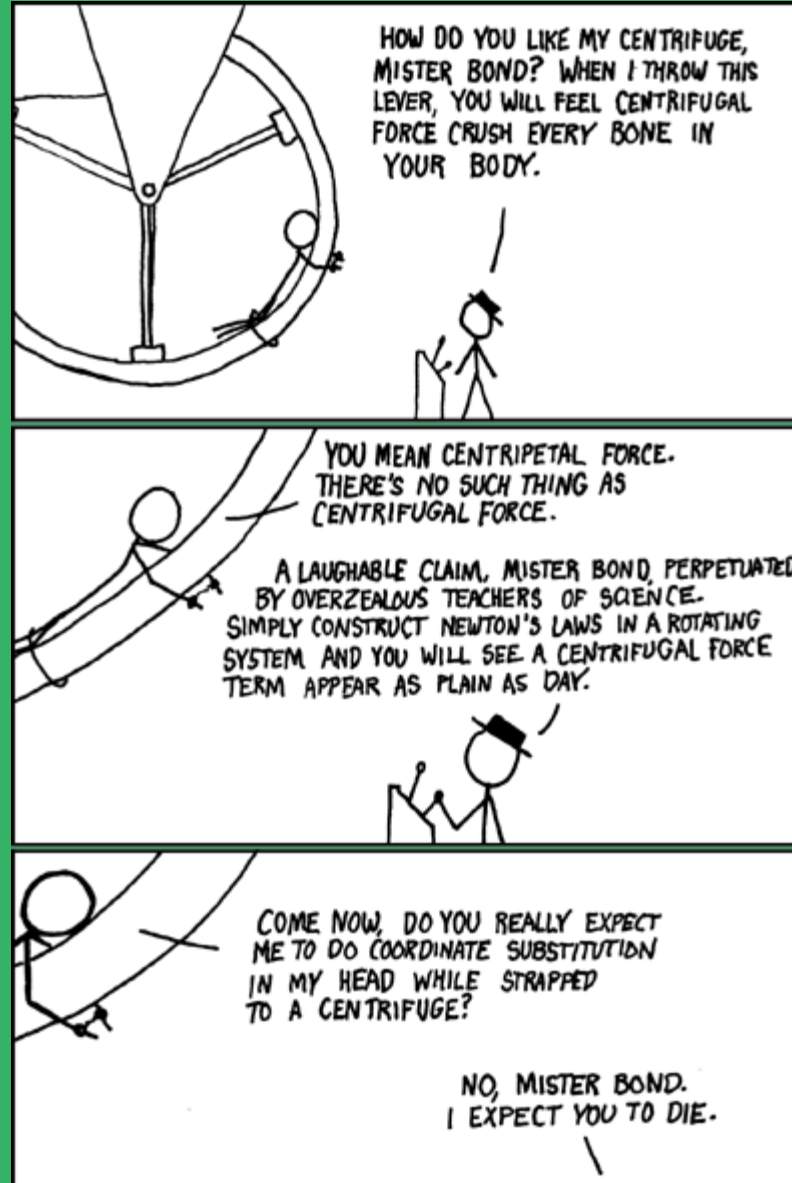
Gravity Recovery and Interior Laboratory (GRAIL)

Launched 10 September 2011

Mapping The Earth

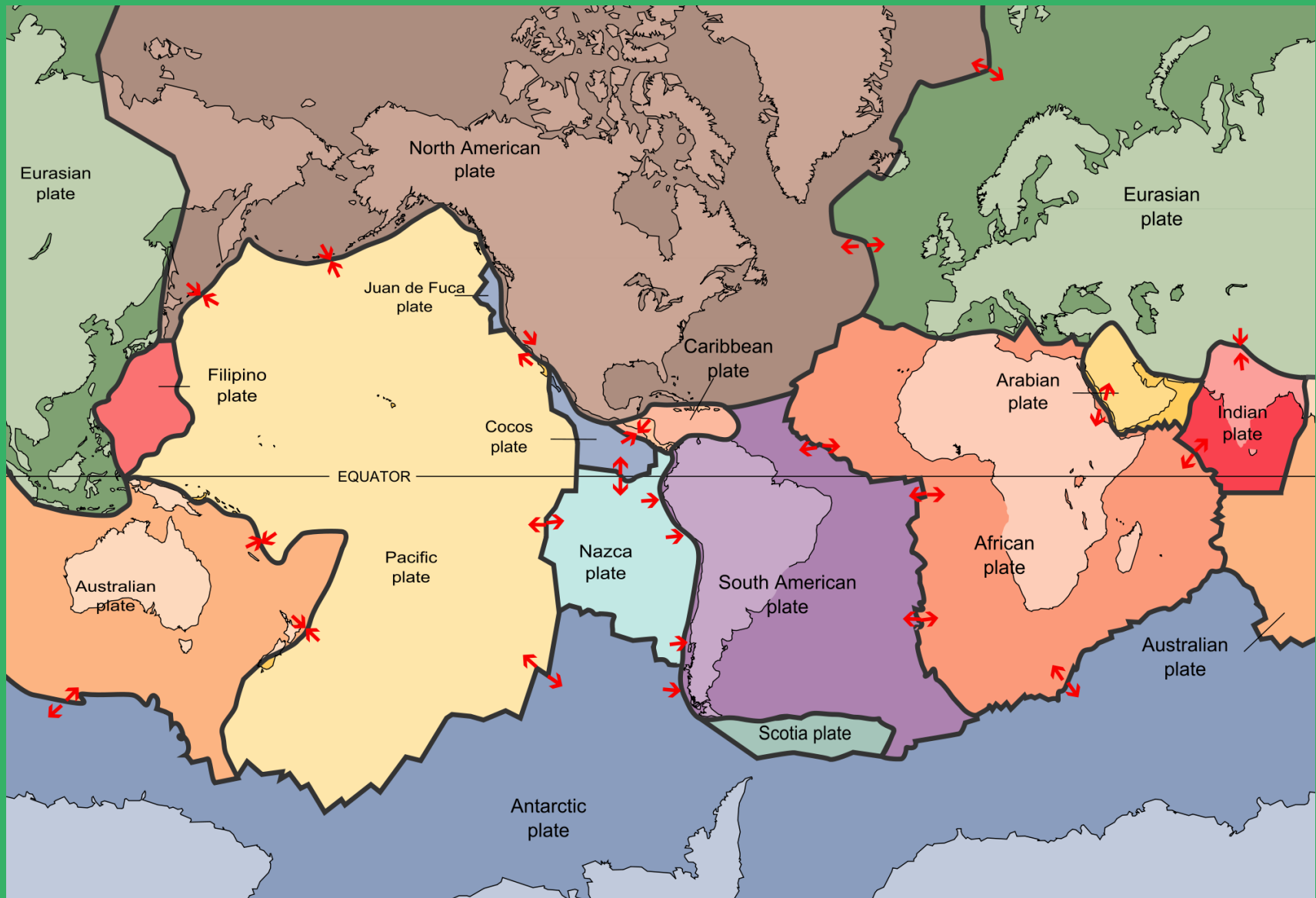


Centrifugal Force



Credit: xkcd

Plate Tectonics

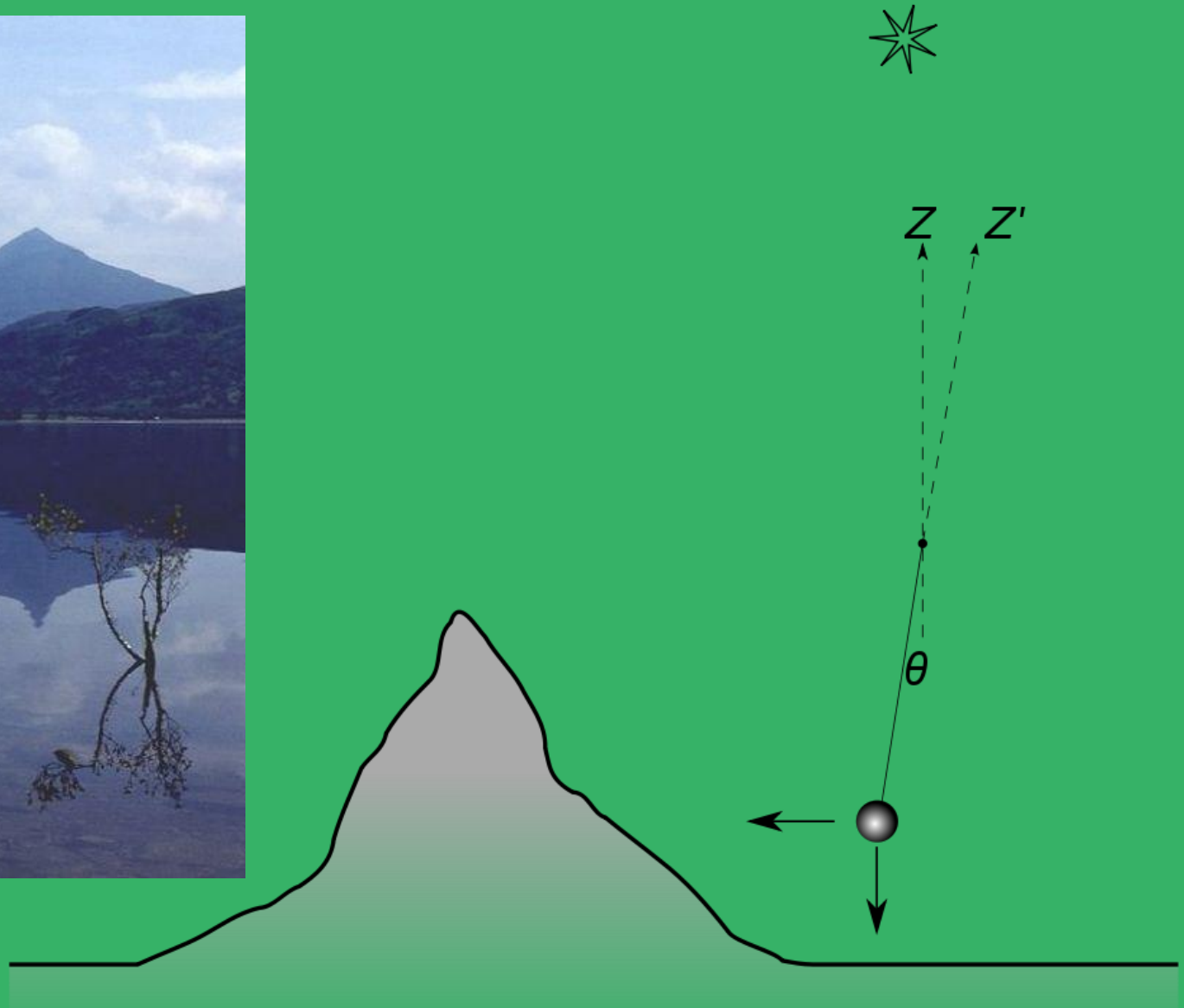


Local Gravity

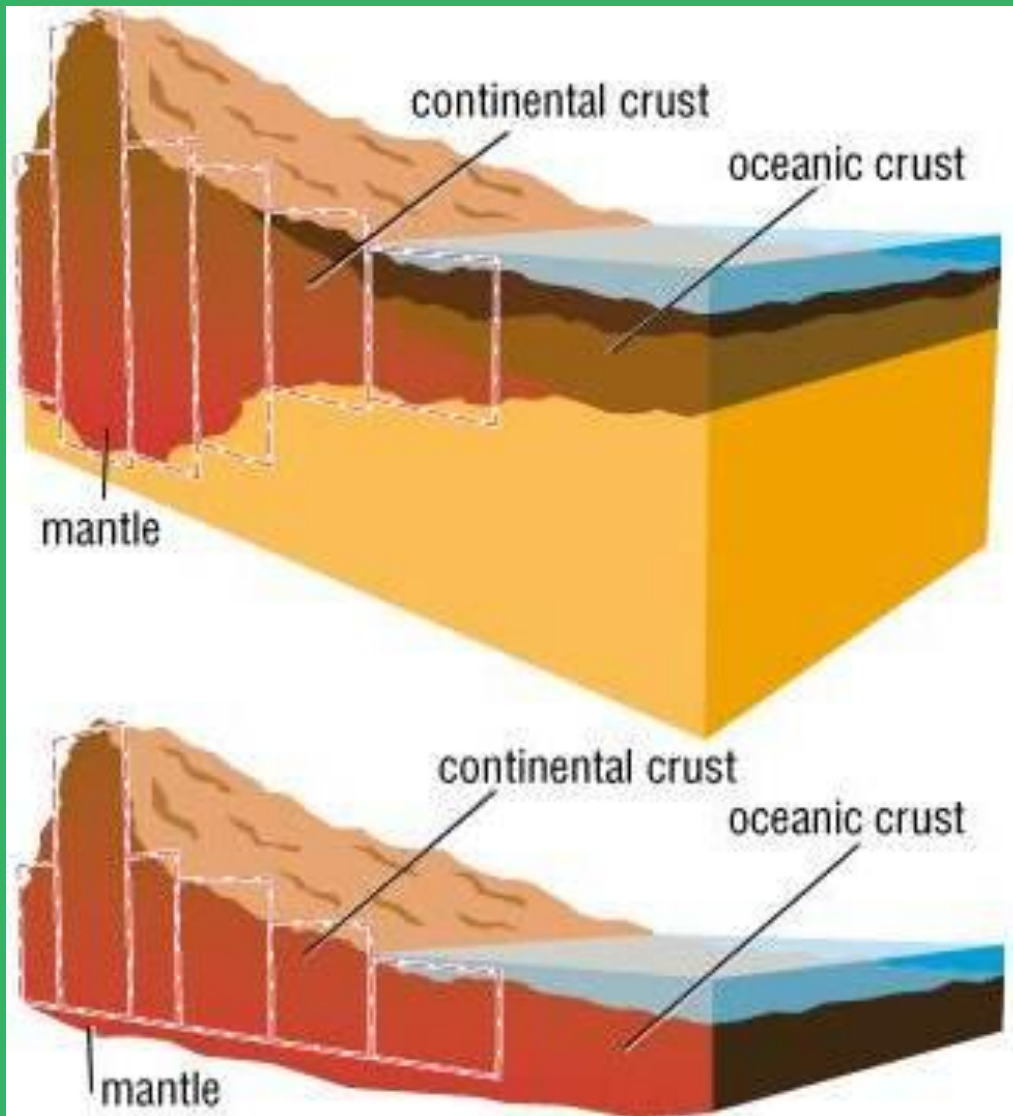


Credit: xkcd

Schiehallion Experiment



Isostasy

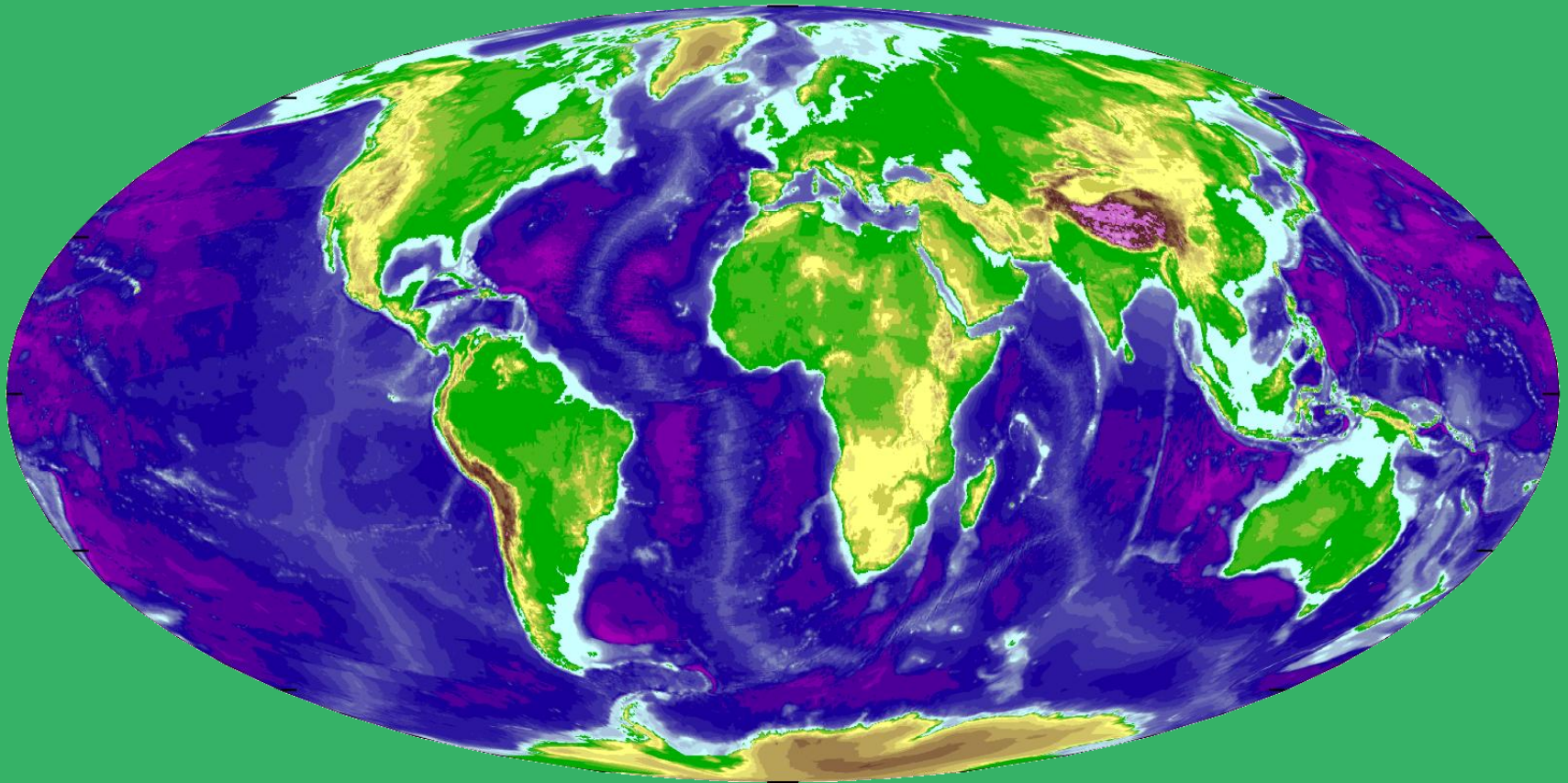


Effect of mountains on gravity reduced through isostasy.

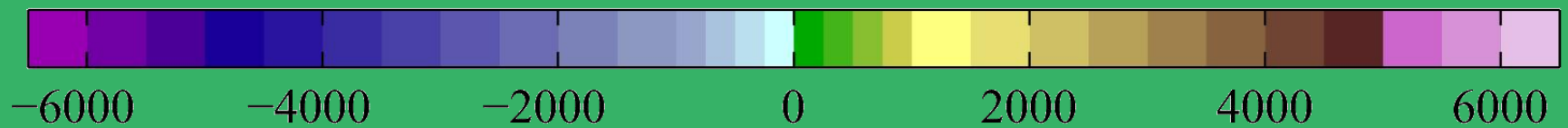
Isostasy is a buoyancy effect.

Credit: Hutchinson Encyclopaedia

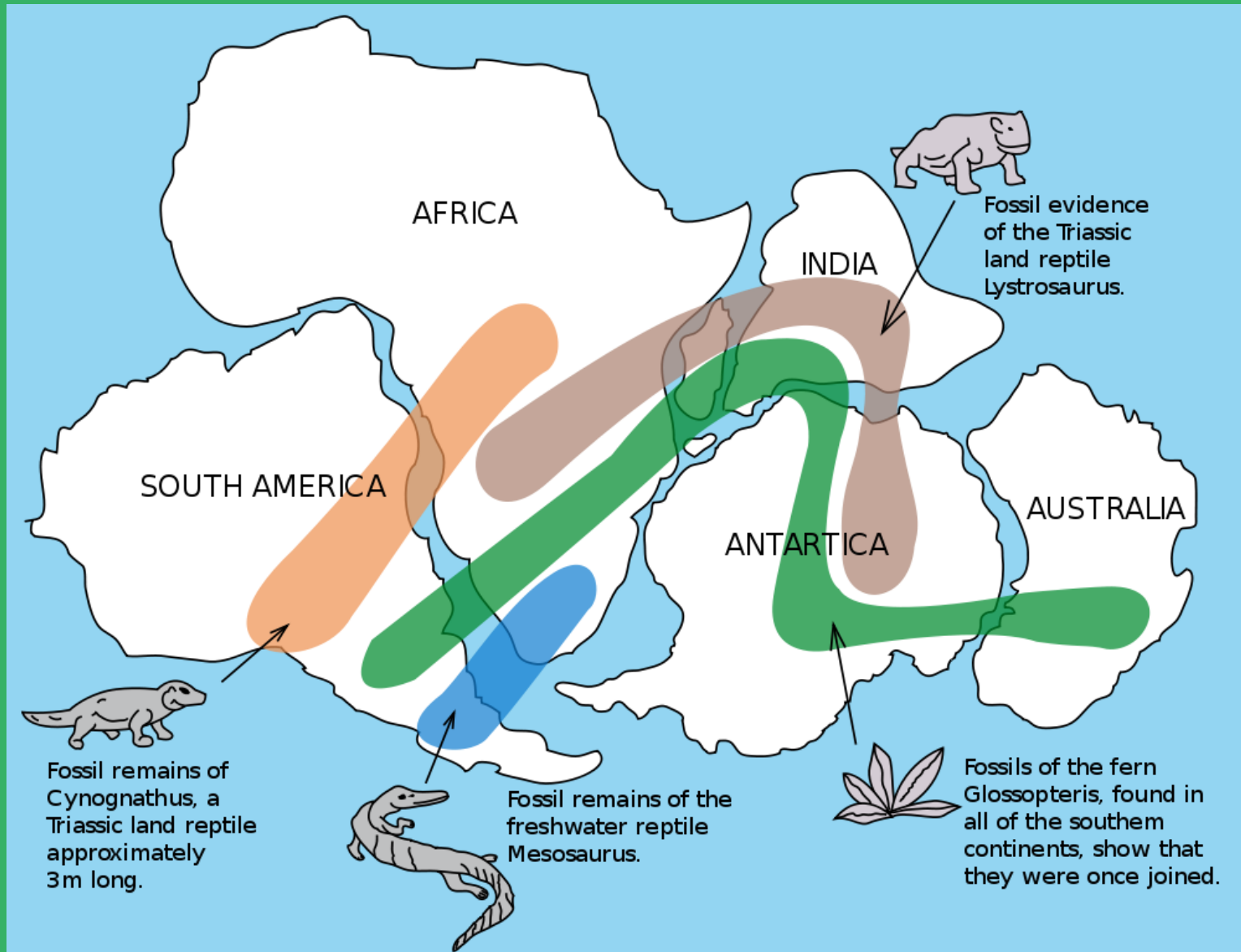
Topography



Present day Earth topography [m]



Gondwana



Gamburtsev Mountain Range

