



Ice Mass & Sea Level Change Unit 3: GRACE Preparation Exercise

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Part 1: GRACE video

Navigate to the following URL to watch a 7-minute video entitled, “GRACE: Tracking Water From Space.”

[http://www.amnh.org/explore/science-bulletins/\(watch\)/earth/documentaries/grace-tracking-water-from-space](http://www.amnh.org/explore/science-bulletins/(watch)/earth/documentaries/grace-tracking-water-from-space)

1. Start by watching the movie — do not write anything down, just watch the movie.
2. Now, watch the movie a second time and answer the questions below.

(1) Which sentence below correctly characterizes the relationship between an object’s mass and its gravity?

The more massive the object, the greater its gravity.

The more massive the object, the less its gravity.

(2) The movie mentions that other parts of the Earth system in addition to rocks and magma have mass. Name four other parts of the Earth system mentioned in the movie that also have mass.

(3) In general, do these four parts of the Earth system that you listed in question 2 change more rapidly *or* more slowly than the solid Earth?

(4) Is Earth’s gravity field uniform? Briefly explain your answer.

(5) What do you notice happens to the first GRACE satellite when it encounters a massive object (the movie uses a mountain range as an example)?

(6) Why does Earth's gravity field change daily, weekly, monthly, etc.?

(7) At about 3:45, Dr. Famigleitti displays a global GRACE map and some graphical data. Make a sketch of the time series for snow water storage in the Tibetan plateau. Include a trend line in your sketch. Do the GRACE data illustrate water loss or water gain in this area?

Part 2: GRACE USA map

(8) The NASA map below illustrates the rate of freshwater storage change between 2003 and 2012. Which color is used to show areas in which the amount of groundwater has increased between 2003 and 2012? Which color is used to show areas in which the amount of groundwater has decreased between 2003 and 2012?

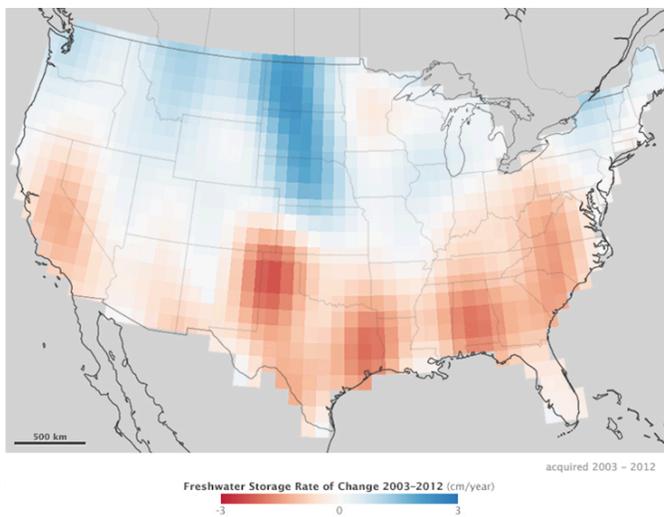


Figure 1: Freshwater storage in the United States, as measured by GRACE. Image credit: NASA Earth Observatory image by Jesse Allen, using GRACE data provide courtesy of Jay Famigleitti, University of California Irvine and Matthew Rodell, NASA Goddard Space Flight Center. Caption by Holli Riebeek (<http://grace.jpl.nasa.gov/news/>).

(9) Which area on the map has experienced the greatest decrease in groundwater between 2003 and 2012? Propose a reason for what could be causing this decrease.

(10) Which area on the map has experienced the greatest increase in groundwater reserves between 2003 and 2012? Propose a reason for this increase.