

## Re: Melting icecaps

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- *From:* brad <[lbjohnson1949@xxxxxxxxxx](mailto:lbjohnson1949@xxxxxxxxxx)>
  - *Date:* Thu, 27 Nov 2008 04:43:04 -0800 (PST)
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On Nov 26, 5:53 am, patmpow...@xxxxxxxxxx wrote:

On Nov 24, 10:13 am, brad <[lbjohnson1...@xxxxxxxxxx](mailto:lbjohnson1...@xxxxxxxxxx)> wrote:

On Nov 23, 6:55 am, patmpow...@xxxxxxxxxx wrote:

Assume that the polar ice caps melt. (You don't have to believe it, just humor me, OK?) Then the weight of the water will be redistributed over the Earth. Suppose the oceans rise by two meters. Now my question is, how will this affect the shape of the Earth? It seems to me the bulge in the center would grow and move southward since most of the water is in the south. How much could one expect the shape of the Earth to change?

Google GRACE . This question is more complicated and dynamic than it seems .

Brad

I looked up GRACE and it is clear that redistribution of weight on the

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Earth changes the shape of the Earth. No surprise. The change has been measured, but none of these articles tells me how much. The best they seem to be able to do is that the change is "significant." It is possible to find the data showing the change in the shape of the Earth due to weight distribution and estimate how much weight was involved. It is also possible to calculate how much and where the weight would move if, say, the oceans increase by one meter. Then one can make a rough estimate as to how much the shape would change. It wouldn't be terribly accurate but it would be much better than nothing.

[http://www.hokudai.ac.jp/bureau/populi/edition34/littera34e\\_pdf/litte...](http://www.hokudai.ac.jp/bureau/populi/edition34/littera34e_pdf/litte...)

Looking at changes in gravity in North America (Fig. 2), the reduction of mountain glaciers in southern Alaska as well as continental ice sheets in southern Greenland caused by global warming is manifest in the decreased levels of gravity. The gravitational force decreases by an amount equivalent to the attractive force of the ice that disappears. Conversely, gravity is increasing in northern Canada, where the last glacial period was many thousands of years ago. The ice sheets that blanketed the nation thawed, and the earth's crust that had been beneath the ice sheets has slowly been upheaving. The gravitational force increases by the increase in the amount of rock. If all the ice in Greenland thaws in the future, the same will happen. Surprisingly, gravity does not change if ice thaws in the Arctic Ocean, a habitat of polar bears. This is because the ice simply turns to water, and the quantity of matter remains unchanged. Once land-based ice thaws and flows into the sea, however, terrestrial gravity decreases (in turn, ocean gravity should also increase, but since the change is spread thinly over a large area, it is difficult to see). These fluctuations amount to several microgals annually, representing a change of around one billionth of the earth's gravity.

So icecap melting doesn't matter but other melting does.– Hide quoted text –

– Show quoted text –

When glaciers form on continents their weight depresses the land beneath them. The continent, in turn, depresses the mantle underlying it. But, mantle material cannot be compressed by surface mass. So it responds by flowing away.

In the case of N America during the last glaciation the entire

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continent \* tilted \* to the north and mantle material responded by flowing to the south .

As the ice on the continent melted that water flowed off and into the ocean . The loss of ice mass would have been reflected as a decrease in the pull of gravity . However , the weight removed allowed the land to rebound and mantle material flowed back in under the continent and this is reflected as an increase in gravity .

So ice on the oceans is not a problem in terms of sealevel rise . The big question is continental ice and when it melts. Considering that N America is still rising after 13000 years mantle flow cannot protect us from imminent sealevel changes due to melting glaciers.

In addition , mantle movement from beneath ocean basins to compensate for continental rebound actually makes those basins slightly deeper . So the answer is complex and the dynamics of mantle movement provide hints , that In effect , the planet changes shape every second of every day .

Does this help ?

Brad .

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