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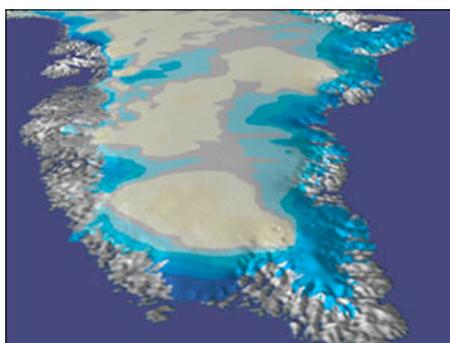
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Date: December 21, 2006

## NASA Provides New Perspectives On The Earth's Changing Ice Sheets

*Science Daily* — It's widely documented that climate change is causing the Greenland and Antarctic ice sheets to shrink. Air temperatures in many parts of the polar regions have increased and waters that surround parts of the ice sheets have warmed up. What most do not know is that until just six years ago, we had no real way of measuring whether the ice sheets were shrinking or growing, or at what rate.

Today, advances in remote sensing, the use of highly sensitive instruments aboard satellites and aircraft, have enabled scientists to examine the mass balance of the ice sheets and to determine just where and how quickly the ice is growing or shrinking. Of particular importance is the mass balance of the ice sheet, which is the difference between how much ice it has lost versus gained over a period of time, and is a direct measure of an ice sheet's contribution to sea level rise.



Change in Ice Sheet Thickness (cm/year)  
-60 -20 -2 +2 +20 +60

NASA's ICESat measures changes in the thickness of ice sheets in Greenland and in Antarctica. This image is of glacial ice along Greenland's shoreline, which is thinning rapidly up to 60 cm per year while the interior ice is thickening at a rate of only 10 cm per year. (Credit: NASA)

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"The media has reported a lot about how ice is changing, particularly in Greenland, but the numbers vary depending on the time period examined and the technique used. As a result, there may be some confusion out there about what's really happening," said Waleed Abdalati, a glacier expert and head of the Cryospheric Sciences Branch at NASA's Goddard Space Flight Center, Greenbelt, Md. "We have all these techniques and some are giving different answers than others. But what's significant is that we have the ability to even debate ice sheet measurement results at all when we could not have a few years ago. Now, we're talking about how much ice sheet shrinkage there is and how rapidly it's taking place."

Researchers now use aircraft altimetry, satellite radar and laser altimetry, radar interferometry, gravity measurements from NASA's Gravity Recovery and Climate Experiment (GRACE) mission and precise elevation change measurements from NASA's Ice, Cloud, and Land Elevation (ICESat) satellite. Each tool has its own strengths, and when used together, these technologies produce a comprehensive

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**ICESat's Lasers Measure Ice, Clouds And Land Elevations** (October 7, 2003) -- NASA's Ice, Cloud and Land Elevation Satellite (ICESat) has resumed measurements of the Earth's polar ice sheets, clouds, mountains and forests with the second of its three lasers. Crisscrossing the ... > [full story](#)

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look into the ice sheets' behavior that have changed the way the world thinks of climate change and its impact on ice sheets and glaciers.

Each of these provides important information for unraveling the behavior of the ice sheets, and collectively they tell a story. In Greenland, they reveal an ice sheet that is shrinking dramatically at the edges and growing at its higher interior elevations, such that there is a net loss of ice that is far greater than it was in the last decade. These losses are a result of increased melting, and faster flow at the edges, as the floating ice that surrounds parts of Greenland and buttresses some of the outlet glaciers melts.

In Antarctica, these observations tell us that the West Antarctic ice sheet is currently shrinking substantially, and has been for the last decade. They also tell a story of a second much larger ice sheet in East Antarctica that has been growing slowly. The net result in Antarctica is that the ice sheet as a whole has been shrinking, contributing to rising sea levels, and probably much more so in recent years.

"We did not appreciate in the past how the changes in ice sheets respond so quickly to changes in climate. The story these measurement techniques are all telling is that the ice sheets are shrinking more than they were 10 years ago," said Abdalati. "The borders of the ice sheets are melting in waters that are warming."

"Of the techniques for measuring ice sheet change, the laser altimetry approach of the ICESat mission is the most effective because it provides a detailed look at the overall integrated changes in the ice sheets," offered Abdalati. "And continuous observations like those by ICESat would greatly enhance our ability to understand what's really happening to the Earth's dramatically changing ice cover. The most telling comprehensive picture, however, is created when all the techniques are used together."

*Note: This story has been adapted from a news release issued by NASA/Goddard Space Flight Center.*

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**NASA Survey Confirms Climate Warming Impact On Polar Ice Sheets** (March 9, 2006) --

In the most comprehensive survey ever undertaken of the massive ice sheets covering both Greenland and Antarctica, NASA scientists confirm climate warming is changing how much water remains locked in ... > [full story](#)

**Changes Tracked In Polar Ice Sheet Elevations**

(April 9, 2001) -- In a world that measures everything from hemlines to the speed of light, the Antarctic and Greenland ice sheets present a special challenge. Whether they are shrinking or growing has become a focus ... > [full story](#)



**NASA'S ICESat: One Billion Elevations Served**

(November 26, 2005) -- NASA's Ice, Cloud and land Elevation Satellite (ICESat) fired its one billionth laser shot earthward on Nov. 18, to obtain elevations from objects on the land, sea and in the air. ICESat measures the ... > [full story](#)

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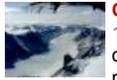


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