Greenland ice melts from the bottom up

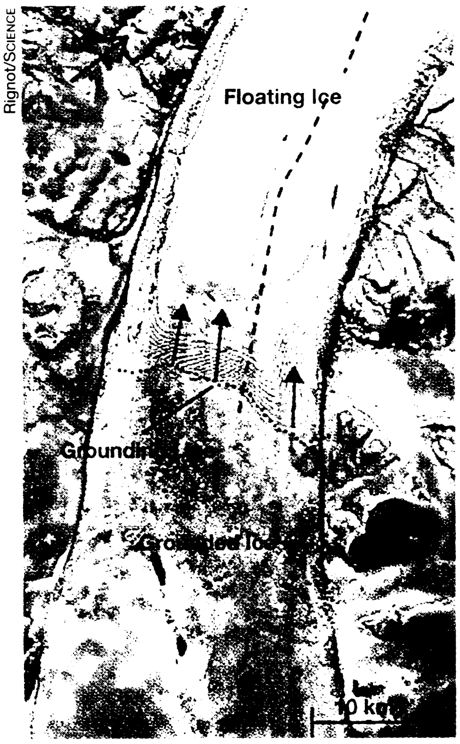
When it comes to predicting future sea levels, scientists are adrift in an ocean of uncertainty. Climate researchers expect the seas to swell over the coming century as global climate warms, but they can't tell whether the rising tides will prove relatively modest or drenchingly severe.

The two biggest question marks lie at opposite ends of the world. Glaciologists know so little about Greenland and Antarctica that they can't even say whether the two regions are currently gaining or losing ice. Now, a team of scientists reports that the issue is even more complex than previously thought.

In the past, scientists had monitored the ice loss from Greenland principally by measuring the icebergs that break off into the sea. Satellite measurements in northern Greenland, however, reveal that glaciers there lose more ice by melting from beneath than by forming icebergs, according to a report in the May 9 SCIENCE.

The satellite method represents a new way to survey glaciers, says Eric J. Rignot, leader of the team and a researcher at the Jet Propulsion Laboratory in Pasadena, Calif. "We were able to find some very new things about the glaciers of Greenland without ever stepping foot in Greenland," he says.

Rignot and his colleagues used the two



Radar image of northern Greenland glacier. Arrows show direction of ice flow.

European ERS satellites to study the northern glaciers of Greenland. Both satellites carry onboard radars that can survey the entire globe.

The scientists gauged the speed of 14 glaciers in northern Greenland by combining radar pictures of the same glacier taken by the two satellites only a day apart—a technique known as satellite interferometry. In a second part of the study, Rignot and his coworkers used interferometry to locate each glacier's grounding line—the place where ice flows down to the sea and forms a floating glacial shelf.

When ice flows past the grounding line, it either melts as it encounters the ocean or eventually breaks off as an iceberg. In the past, glaciologists had assumed that iceberg formation was the more significant cause of ice loss. Rignot's group, however, found that only 30 percent of the ice disappeared through iceberg formation, with the rest lost by melting, principally at the base. Taken with other data, the new results suggest that the ice sheet of northern Greenland is thinning, raising the global sea level.

The story for the rest of Greenland is not as clear, says H. Jay Zwally of NASA's Goddard Space Flight Center in Greenbelt, Md. Zwally's studies of southwest Greenland hint that ice there is thickening, which would take water away from the ocean.

Zwally calls the new radar method an "amazing technique." Scientists cannot acquire more images, however, because one of the ERS satellites is no longer working. New interferometry studies must await another satellite radar mission, as yet unplanned. In the meantime, NASA expects to launch a laser mission in 2001 that can precisely track changes in the height of the Greenland and Antarctic ice caps. —*R. Monastersky*

Cosmic axis begets cosmic controversy

What's the fastest way to get an astrophysicist to write a paper? Publish a report claiming the universe has a special direction.

That's the way it seemed last week, when a flurry of new papers, none of them peer-reviewed, appeared on the Internet. The authors lambasted a recent study suggesting that the cosmos has a distinct axis, along which the polarization of radiation is rotated more than it is in other directions (SN: 4/26/97, p. 252). If correct, that finding could overturn long-cherished notions about the birth and evolution of the universe.

In the latest reports, astronomers using newer, higher-quality data say they have failed to replicate the controversial finding, while theorists assert that they have identified fatal flaws in the statistical analysis performed by the original study's coauthors, Borge Nodland of the University of Rochester (N.Y.) and John P. Ralston of the University of Kansas in Lawrence.

Astronomers John F.C. Wardle of Brandeis University in Waltham, Mass., Rick A. Perley of the National Radio Astronomy Observatory in Socorro, N.M., and Marshall H. Cohen of the California Institute of Technology in Pasadena analyzed 26 galaxies and quasars—far fewer than the 160 galaxies used by Nodland and Ralston. However, the new data consist of high-resolution images from the Very Large Array radio telescope in Socorro and the W.M. Keck Telescope on Hawaii's Mauna Kea.

The researchers used an easy-to-see reference—the alignment of jets of radio waves emitted by many of the quasars and galaxies in their study—to measure the polarization angle of radiation. Because polarization is generally thought to start out perpendicular to the jet direction, any extra rotation, or twist, in the polarization of light should be readily apparent, Wardle and his colleagues assert.

Their new data "directly refute" the presence of cosmological rotation, the researchers write. They add that Nodland and Ralston, who had to rely on lower-resolution images, calculated net polarization by averaging the polarization of radio waves from several different regions within a galaxy, a technique that provides "a very blunt tool for searching for systematic [rotation]."

Ralston disagrees, arguing that averaging minimizes the confounding effect of a galaxy's magnetic field, which also twists the polarization of the radiation the galaxy emits. Nodland adds that the extra twist which he and Ralston found along a particular direction in space is a statistical effect apparent only as an average over a large sample of galaxies distributed evenly across the sky.

The team's statistical analysis has also come under fire. Daniel J. Eisenstein of the Institute for Advanced Study in Princeton, N.J., and Emory F. Bunn of Bates College in Lewiston, Maine, assert that Nodland and Ralston did not properly test whether the cosmic twist they found is real. Sean M. Carroll of the University of California, Santa Barbara and George B. Field of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., come to a similar conclusion.

Ralston says, however, that the statistical comparison recommended by these researchers would fail to detect a genuine twist. —*R. Cowen*