What is glacial isostatic adjustment?

Glacial isostatic adjustment is the **ongoing movement of land** once burdened by **ice-age glaciers**.

The last ice age occurred just 16,000 years ago, when great sheets of ice covered much of Earth's Northern Hemisphere. Though the ice melted long ago, the land once under and around the ice is still rising and falling in reaction to its ice-age burden. This ongoing movement of land is called glacial isostatic adjustment.

Earth is always on the move, constantly, if slowly, changing. Temperatures rise and fall in cycles over millions of years. The last ice age occurred just 16,000 years ago, when great sheets of ice, two miles thick, covered much of Earth's Northern Hemisphere. Though the ice melted long ago, the land once under and around the ice is still rising and falling in reaction to its ice-age burden.

This ongoing movement of land is called glacial isostatic adjustment. Here's how it works: Imagine lying down on a soft mattress and then getting up from the same spot. You see an indentation in the mattress where your body had been, and a puffed-up area around the indentation where the mattress rose. Once you get up, the mattress takes a little time before it relaxes back to its original shape.

Even the strongest materials (including the Earth's crust) move, or deform, when enough pressure is applied. So when ice by the megaton settled on parts of the Earth for several thousand years, the ice bore down on the land beneath it, and the land rose up beyond the ice's perimeter—just like the mattress did when you lay down on and then got up off of it.

That's what happened over large portions of the Northern Hemisphere during the last ice age, when ice covered the Midwest and Northeast United States as well as much of Canada. Even though the ice retreated long ago, North America is still rising where the massive layers of ice pushed it down. The U.S. East Coast and Great Lakes regions—once on the bulging edges, or forebulge, of those ancient ice layers—are still slowly sinking from forebulge collapse.

Forbulge collapse is one of the larger causes of ground movement in the United States. Many places in the Eastern U.S. have been sinking for thousands of years and will continue to sink for thousands more. In fact, estimates say land around the Chesapeake Bay will sink as much as half a foot over the next 100 years because of the forebulge collapse. Other big contributors to ground movement in the U.S. include earthquakes and subsidence. Subsidence is when the ground sinks, either due to natural causes or when resources like water, gas, and oil are pumped out of the ground.

All of these movements are monitored by NOAA's National Geodetic Survey through its nationwide network of nearly 2,000 permanent Global Positioning System stations, called Continuously Operating Reference Stations or CORS. These CORS make it possible for NOAA to provide products for use in construction, navigation, mapping, and other industries.

Did you know?

The movements of the Earth are monitored by NOAA's National Geodetic Survey through its nationwide network of nearly 2,000 permanent GPS stations, called Continuously Operating Reference Stations or CORS. CORS makes it possible for NOAA to provide products for use in construction, navigation, mapping, and other industries.

More Information

- What is the geoid?
- What is geodesy?
- Is the Earth round?
- NOAA's National Geodetic Survey

Get Social

Last updated:
06/16/24

Author: NOAA

How to cite this article

Contact Us

Contact Us | Report an error