Greenland ice core analysis shows drastic climate change near end of last ice age

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Caption: The North Greenland Ice Core Project camp. Credit: NGRIP

Temperatures spiked 22 degrees F in just 50 years, researchers say
Information gleaned from a Greenland ice core by an international science team shows that two huge Northern Hemisphere temperature spikes prior to the close of the last ice age some 11,500 years ago were tied to fundamental shifts in atmospheric circulation.

The ice core showed the Northern Hemisphere briefly emerged from the last ice age some 14,700 years ago with a 22-degree-Fahrenheit spike in just 50 years, then plunged back into icy conditions before abruptly warming again about 11,700 years ago. Startlingly, the Greenland ice core evidence showed that a massive "reorganization" of atmospheric

circulation in the Northern Hemisphere coincided with each temperature spurt, with each reorganization taking just one or two years, said the study authors.

The new findings are expected to help scientists improve existing computer models for predicting future climate change as increasing anthropogenic greenhouse gases in the atmosphere drive up Earth's temperatures globally.

The team used changes in dust levels and stable water isotopes in the annual ice layers of the two-mile-long Greenland ice core, which was hauled from the massive ice sheet between 1998 to 2004, to chart past temperature and precipitation swings. Their paper was published in the June 19 issue of *Science Express*, the online version of *Science*.

The ice cores -- analyzed with powerful microscopes -- were drilled as part of the North Greenland Ice Core Project led by project leader Dorthe Dahl-Jensen of the Centre for Ice and Climate at the Neils Bohr Institute of the University of Copenhagen. The study included 17 co-investigators from Europe, one from Japan and two from the United States -- Jim White and Trevor Popp from the University of Colorado at Boulder.

"We have analyzed the transition from the last glacial period until our present warm interglacial period, and the climate shifts are happening suddenly, as if someone had pushed a button," said Dahl-Jenson.

According to the researchers, the first abrupt warming period beginning at 14,700 years ago lasted until about 12,900 years ago, when deep-freeze conditions returned for about 1,200 years before the onset of the second sharp warming event. The two events indicate a speed in the natural climate change process never before seen in ice cores, said White, director of CU-Boulder's Institute for Arctic and Alpine

Research.

"We are beginning to tease apart the sequence of abrupt climate change," said White, whose work was funded by the National Science Foundation's Office of Polar Programs. "Since such rapid climate change would challenge even the most modern societies to successfully adapt, knowing how these massive events start and evolve is one of the most pressing climate questions we need to answer."

Both dramatic warming events were preceded by decreasing Greenland dust deposition, indicating higher tropical temperatures and significantly more rain falling on the deserts of Asia at the time, said White. The team believes the ancient tropical warming caused large, rapid atmospheric changes at the equator, the intensification of the Pacific monsoon, sea-ice loss in the north Atlantic Ocean and more atmospheric heat and moisture over Greenland and much of the rest of the Northern Hemisphere.

"Here we propose a series of events beginning in the lower latitudes and leading to changes in the ocean and atmosphere that reveal for the first time the anatomy of abrupt climate change," the authors wrote. White likened the abrupt shift in the Northern Hemisphere circulation pattern to shifts in the North American jet stream as it steers storms around the continent.

"We know such events are in Earth's future, but we don't know when," said White. "One question is whether we can see the symptoms before big problems occur. Until we answer these questions, we are speeding blindly down a narrow road, hoping there are no curves ahead."

Each yearly record of ice can reveal past temperatures and precipitation levels, the content of ancient atmospheres and even evidence for the timing and magnitude of distant storms, fires and volcanic eruptions,

said White. The cores from the site -- located roughly in the middle of Greenland at an elevation of about 9,850 feet -- are four-inch-diameter cylinders brought to the surface in 11.5-foot lengths, said White.

Source: University of Colorado at Boulder