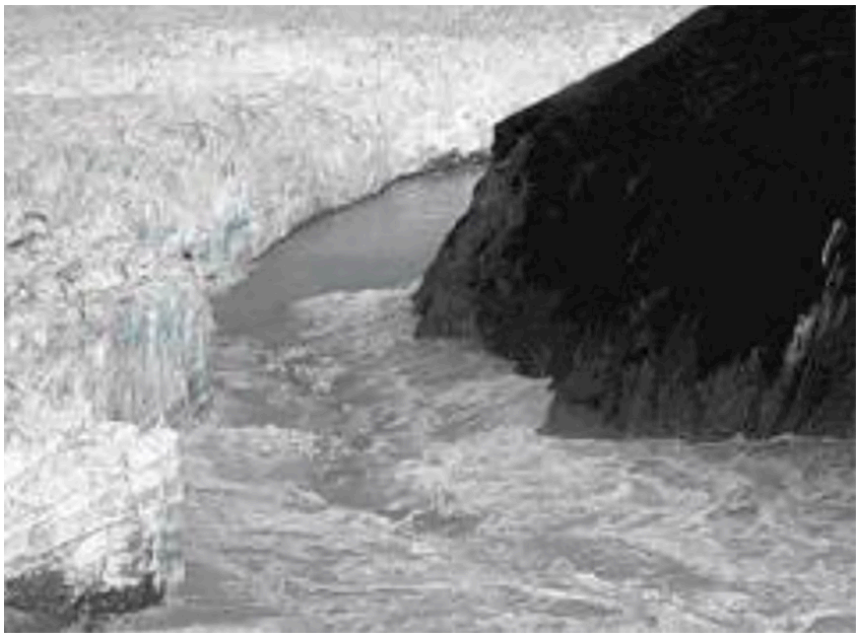
Post-Glacial Cooling 8,200 Years Ago

Following the end of the last glacial period about 11,500 years ago, Earth's climate system began to look and behave more like it does today.

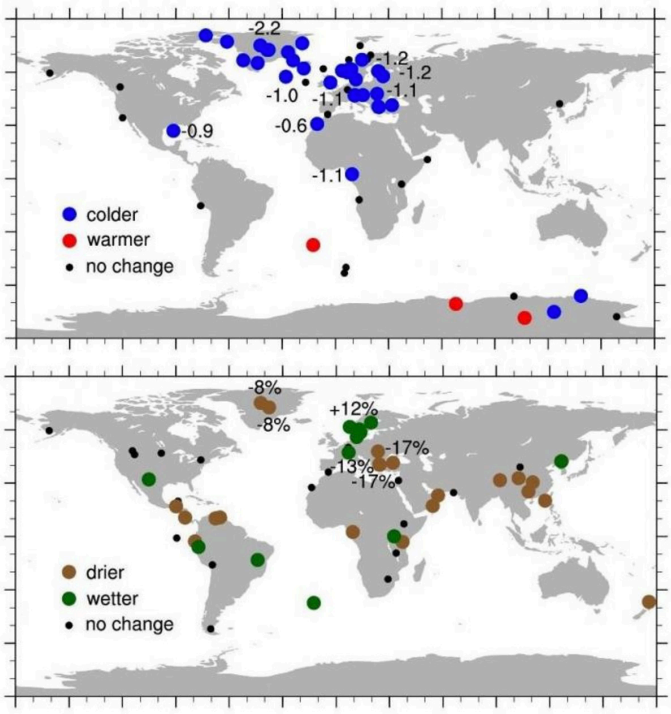
The large continental ice sheets shrank, sea level rose, temperatures ameliorated, and monsoons grew in strength. Around 8,200 years ago, however, a surprising event occurred. The 8.2 ka event was first discovered in the Greenland ice core GISP2, where high-resolution analyses indicate that over two decades temperature cooled about 3.3°C in Greenland (Kobashi et al. 2007). The entire event lasted about 150 years (Thomas et al. 2007; Kobashi et al. 2007) and then temperatures warmed, returning to their previous levels.



Jökulhlaup (outburst flood from a glacial lake) at Hubbard Glacier in Alaska on August 14, 2002. Courtesy of USGS.

How widespread was the 8.2 ka event?

Climate changed globally during the 8.2 ka event. There is clear evidence from lake and ocean sediments that European climate was affected, with mean annual temperatures dropping about 1°C (2°F) for a century or more (von Grafenstein et al. 1999). Paleoclimate records from other parts of the world are sparser, but there is evidence from speleothems, ocean sediments, and lake sediments that many parts of the Northern Hemisphere tropics became drier (Hughen et al. 2000; Lachniet et al. 2004; Cheng et al. 2009; Liu et al. 2013). Shrinking of tropical wetlands in a drier climate might also explain the 10%–15% drop in atmospheric methane that is recorded in air bubbles of Greenland ice cores (Kobashi et al. 2007). Patterns in the Southern Hemisphere have yet to be fully delineated.



Maps of climate anomalies during the 8.2 ka event identified by Morrill et al. (2013) from published paleoclimate records and using a statistical test to objectively identify anomalies. Numerical values indicate size of climate anomaly, in degrees Celsius for temperature and in percent for precipitation, averaged over the approximately 150-year duration of the event.

What caused the 8.2 ka event?

The cause of the 8.2 ka event remained a puzzle for some time, but research is converging upon a consistent picture. In the early Holocene, as the large ice sheets of the last glacial period were wasting away, a large lake formed south of the Hudson Bay from meltwater. A remnant of the Laurentide ice sheet to the north dammed the newly formed lake. At some point prior to 8.2 ka, this dam failed catastrophically, releasing the waters of Lake Agassiz and icebergs from the ice sheet to the Hudson Bay and downstream to the Labrador Sea. Once in the Labrador Sea, these freshwaters changed the density structure of the ocean and slowed deepwater formation and the thermohaline circulation (Ellison et al. 2006).

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Some important datasets related to the 8.2 ka event:

- von Grafenstein et al. (1999), stable isotope data from Ammersee in Germany
- Hughen et al. (2000), sediment grayscale from core PL07-58PC in the Cariaco Basin
- Lachniet et al. (2004), speleothem isotopic measurements from Venado Cave, Costa Rica
- Ellison et al. (2006), sediment data from Core MD99-2251 in the North Atlantic
- Thomas et al. (2007), high resolution $\delta^{18}O$ measurements from Greenland ice cores
- Kobashi et al. (2007), methane and $\delta^{15}N$ measurements from the GISP2 ice core
- Cheng et al. (2009), speleothem isotopic measurements from the tropics
- Liu et al. (2013), speleothem geochemical measurements from Heshang Cave, China
- Morrill et al. (2013), compilation of multiple proxies at 8.2 ka