Forty years later

High resolution continuous flow analysis of the Dye3 ice core

Kjær, Helle Astrid; Harlan, Margaret; Valdelonga, Paul; Svensson, Anders; Blunier, Thomas; Sowers, Todd; Menking, James Andrew; Campo, Aylin de; Venkatesh, Janani; Liisberg, Jesper; Soestmeyer, David; Morris, Valerie; Vaughn, Bruce; Vinther, Bo

DOI:
10.5194/egusphere-egu21-11820

Publication date:
2021

Document version
Publisher’s PDF, also known as Version of record

Document license:
CC BY

Citation for published version (APA):
Forty years later: High resolution continuous flow analysis of the Dye3 ice core

Helle Astrid Kjær1, Margaret Harlan1, Paul Vallelonga1,6, Anders Svensson1, Thomas Blunier1, Todd Sowers2, James Andrew Menking3, Aylin de Campo4, Janani Venkatesh1, Jesper Liisberg1, David Soestmeyer1, Valerie Morris5, Bruce Vaughn5, and Bo Vinther1

1University of Copenhagen, Niels Bohr Institute, Physics of Ice, Climate and Earth, Copenhagen Ø, Denmark (hellek@fys.ku.dk)
2Penn State, College of Earth and Mineral Sciences, Earth and Environmental Systems Institute, State College, Pennsylvania, USA
3Oregon State University, College of Earth, Ocean, and Atmospheric Sciences, Geology and Geophysics, Corvallis, Oregon, USA,
4Graz University of Technology, Graz, Austria
5Institute of Arctic and Alpine Research, University of Colorado, Boulder, USA
6UWA Oceans Institute, University of Western Australia, Crawley, WA, Australia

The Dye-3 ice core was drilled to bedrock at the Southern part of the central Greenland ice sheet (65°11′N, 43°50′W) in 1979-1981. The southern location is characterized by high accumulation rates compared to more central locations of the ice sheet. Since its drilling, numerous analyses of the core have been performed, and the ice has since been in freezer storage both in the USA and in Denmark.

In October and November 2019, the remaining ice, two mostly complete sections covering the depths of 1753–1820m and 1865–1918m of the Dye-3 core, were melted during a continuous flow analysis (CFA) campaign at the Physics of Ice, Climate, and Earth (PICE) group at the University of Copenhagen. The data represents both Holocene, Younger Dryas and Glacial sections (GS 5 to 12).

The measured data consist chemistry and impurities contained in the ice, isotopes, as well as analysis of methane and other atmospheric gases.

The chemistry measurements include NH$_4^+$, Ca$^{2+}$, and Na$^+$ ions, which besides being influenced by transport, provide information about forest fires, wind-blown dust, and sea ice, respectively, as well as acidity, which aids in the identification of volcanic events contained in the core. The quantity and grain size distribution of insoluble particles was analyzed by means of an Abakus laser particle counter.
We compare the new high-resolution CFA record of dye3 with previous analysis and thus evaluate the progress made over 40 years. Further we compare overlapping time periods with other central Greenland ice cores and discuss spatial patterns in relation to the presented climate proxies.