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# High Resolution Continuous Flow Analysis System for Polar Ice Cores

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In the last decades, Continuous Flow Analysis (CFA) technology for ice core analyses has been developed to reconstruct the past changes of the climate system 1), 2).
Compared with traditional analyses of discrete samples, a CFA system offers much faster and higher depth resolution analyses. It also generates a decontaminated sample stream without time-consuming sample processing procedure by using the inner area of an ice-core sample..

The CFA system that we have been developing is currently able to continuously measure stable water isotopes 3) and electrolytic conductivity, as well as to collect discrete samples for the both inner and outer areas with variable depth resolutions. Chemistry analyses4) and methane-gas analysis 5) are planned to be added using the continuous water stream system 5).
In order to optimize the resolution of the current system with minimal sample volumes necessary for different analyses, our CFA system typically melts an ice core at 1.6 cm/min. Instead of using a wire position encoder with typical 1mm positioning resolution 6), we decided to use a high-accuracy CCD Laser displacement sensor (LKG-G505, Keyence). At the 1.6 cm/min melt rate, the positioning resolution was increased to 0.27mm. Also, the mixing volume that occurs in our open split debubbler is regulated using its weight. The overflow pumping rate is smoothly PID controlled to maintain the weight as low as possible, while keeping a safety buffer of water to avoid air bubbles downstream.

To evaluate the system's depth-resolution, we will present the preliminary data of electrolytic conductivity obtained by melting 12 bags of the North Greenland Eemian Ice Drilling (NEEM) ice core. The samples correspond to different climate intervals (Greenland Stadial 21, 22, Greenland Stadial 5, Greenland Interstadial 5, Greenland Interstadial 7, Greenland Stadial 8).
We will present results for the Greenland Stadial -8, whose depths and ages are between 1723.7 and 1724.8 meters, and 35.520 to 35.636 kyr b2k 7), respectively. The results show the conductivity measured upstream and downstream of the debubbler.
We will calculate the depth resolution of our system and compare it with earlier studies.

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