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# A Semi-Automated Method for Stratigraphic Dating of Deep Ice Cores

Mai Winstrup and Anders Svensson
Centre for Ice and Climate, Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark (mai@gfy.ku.dk)

Given the high temporal resolution of ice cores, these paleoclimatic archives have the potential of being extremely well-dated far back in time. Recently, an effort of cross-dating several Greenland deep ice cores has resulted in the Greenland Ice Core Chronology 2005 (GICC05). This timescale is based on annual layer counting using high-resolution records of multiple chemical species in the ice cores, which display an annual variation. The timescale reaches back to 60 ka BP, at which point the annual layers become too thin to allow for reliable annual layer counting.

However, the visual stratigraphy of the ice core presents a way to overcome this issue. The seasonal variation of dust in the precipitating snow gives rise to a visual stratigraphy of the ice core, and as a result of the very limited diffusion of dust particles in the ice, this stratigraphy is preserved at large depths. Due to large variability in this record, it is however not possible by eye to do annual layer counting solely based on the visual stratigraphy. A semi-automated statistical approach is therefore being developed, which takes into account the statistical properties of annual precipitation.

As a first step, the most likely value of the average annual layer thickness in a given depth is identified by imposing on the stratigraphic layer sequence to display a certain degree of regularity. In a second step, this information is deployed in a next-layer detection algorithm, which more precisely identifies the statistically most likely positions of the spring peaks in the visual stratigraphy record. The resulting timescale is compared to that of the GICC05 timescale, and when the method is able to reproduce GICC05 reasonably well, it will be used to extend GICC05 back to 90 ka BP or as long as the stratigraphy allows.