Due to their high temporal resolution, Greenland ice cores can be dated very precisely by annual layer counting. An effort of manual annual layer counting using multiple chemical components has resulted in the Greenland Ice Core Chronology (GICC05), common to several Greenland deep ice cores. The oldest part of the chronology is based on data from the NGRIP ice core, which has particularly high temporal resolution with depth. Yet, with depth the annual signal in most components weakens. Below 2430m (age: 60 ka) only annual layering in the visual stratigraphy is still intact. However, due to a high noise level in this record, objective annual layer counting only using these data is difficult.

Therefore, an automated method has been developed, which takes into account the statistical properties of the visual stratigraphy data. Data is modeled using a Hidden Markov Model (HMM) with algorithms originally developed for speech recognition. Preliminary results agree to within 5% of the GICC05 annual layer counting. More noise in the visual stratigraphy data during warm periods, cause the counting uncertainty to be larger during these. Fortunately, a concurrent increase in annual layer thicknesses makes it possible to use other parameters than visual stratigraphy for annual layer counting here. Hence, the combined data can be used for developing a high-resolution chronology for the NGRIP ice core extending back to 90 ka. In the future, a similar approach might be used for a general multi-parameter stratigraphic dating of ice cores and other paleoclimatic records displaying annual layering.