



An annual layer counted ice-core chronology from EDML, Antarctica, over the termination of the last glacial

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Accurate and consistent timescales for paleoclimate records are crucial for advancing our understanding of the governing mechanisms and inter-hemispheric coupling involved in rapid climate change. For ice cores, very high-resolution chronologies can be established far back in time by identifying and counting annual layers in the ice core records. This is in particular true for the Greenland ice cores, for which the relatively high accumulation rates act to preserve the annual signal to great depths. The Greenland Ice Core Chronology 2005 (GICC05) is based on annual layer counts in data records from multiple Greenland ice cores, and it reaches back to 60 kyr BP. In Antarctica, only few ice core locations have sufficiently high accumulation rates for the annual signal in the ice core data to be maintained back into the last glacial. An annual layer counted timescale (WDC06A-7) reaching back to 30 kyr BP was recently completed for WAIS Divide, West Antarctica. Overall, the timescale is in good agreement with GICC05 within their respective uncertainties. Over the last glacial termination, however, significant discrepancies exist between the two chronologies, which cannot be reconciled within the specified uncertainty of the respective annual layer counts.

Here, we present an independent annual layer counted chronology for the EPICA ice core from Dronning Maud Land (EDML), Antarctica, over the termination of the last glacial (10-15 kyr BP). The chronology is based on the annual signal visible in high-resolution impurity records and electrical conductivity measurements (liquid conductivity, DEP). The timescale is constructed using a novel Bayesian framework for multi-parameter annual layer counting in ice core records, which originates from sophisticated speech-recognition algorithms. It provides an objective estimate of the most likely number of layers within a section, as well as a confidence interval judging the uncertainty involved in layer identification. Resulting automated layer counts are validated against manual layer counts over parts of the data section.

By use of bipolar volcanic marker horizons, a synchronization of the EDML ice core to GICC05 was recently completed. While the synchronization over the termination of the last glacial is less certain than during the Holocene, it can nevertheless be used for testing the consistency of the annual layer counts from both continents. The obtained EDML chronology is also compared to existing Antarctic ice-core chronologies.