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Direct linking of Greenland and Antarctic ice cores

Anders Svensson (1), Matthias Bigler (2), Thomas Blunier (1), Hubertus Fischer (2), Sigfus J. Johnsen (1), Sepp Kipfstuhl (3), Sune O. Rasmussen (1), Jørgen P. Steffensen (1), Bo M. Vinther (1), and Anna Wegner (3)

(1) University of Copenhagen, Niels Bohr Institute, Ice and Climate, Copenhagen, Denmark (as@gfy.ku.dk), (2) University of Bern, Physics Institute, Climate and Environmental Physics, Bern, Switzerland, (3) Alfred Wegener Institute, Glaciology, Bremerhaven, Germany

Accurate and precise linking of paleoarchives is crucial for the interpretation of paleorecords and reconstruction of past climate. Ice cores from Greenland and Antarctica are used as reference for a variety of other paleoarchives and the ice cores are of great importance for understanding inter-hemispheric interactions of the climate system. In the last glacial period, the relative timing between Greenland and Antarctic ice core records is well constrained from records of Greenhouse gases and two spikes in Be-10 concentration at the Laschamp event occurring at around 41 ka BP. Due to an offset in the age of ice and air bubbles in the ice cores of up to several hundreds of years (delta-gas-age) there is, however, still some uncertainty in the relative phasing between ice cores from the two hemispheres.

In this pilot study, we attempt for the first time to match the Greenland NGRIP and the Antarctic EDML ice cores directly using glacial volcanic reference horizons and annual layer counting in both cores. Annual layers can be identified in sections of the EDML ice core using continuous records of visual stratigraphy gray scale, insoluble dust, and Calcium and Ammonium concentrations. Annual layer counting has been performed in an EDML depth interval around the Laschamp event. The new layer counting is verified by comparison of the well-defined Laschamp interval to the existing layer-counted Greenland ice core chronology GICC05. When comparing records of Sulfate and liquid conductivity from the two cores on their respective time scales, inter-hemispheric volcanic reference horizons can be identified. The matching is not straight forward as most acidity spikes are regional rather than global. If, however, the approach can be extended, it has the potential of improving the synchronization of Greenland and Antarctic ice cores.