



Mapping the Bølling-Allerød transition in the Greenland Ice Sheet using radio-echo sounding data

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Ice cores have provided high resolution data of the chronology of the Greenland Ice Sheet enabling reconstructions of temperature, accumulation and surface elevation back in time. However, ice core data are inherently point-measurements and are thus spatially limited. The introduction of radio-echo sounding (RES) in glaciology provides a method for linking independent ice core chronologies between drill sites by using the internal reflectors observed in the RES data.

Here we apply the ice core chronology from the NorthGRIP drill site in combination with RES data (acquired by the Center for Remote Sensing of Ice Sheets) to map the extent and depth of Holocene ice in North Greenland. We make use of the fact that the transition from the last glacial to the warm Bølling-Allerød interstadial (at 14.7kyr b2k) is clearly visible in the majority of the RES data from central Greenland. The depths and extent of the transition are influenced by past surface accumulation, basal properties as well as temporal and spatial changes in ice flow dynamics. This provides not only a basis for directly mapping the existing pre-Holocene ice in the Greenland Ice Sheet but also a valuable tool for obtaining information on past mass balance and ice flow.

Results show that the transition is located in the upper 30%-50% of the ice column in the central part of the ice sheet indicating that a substantial amount of ice pre-dating the Holocene is present in the central part of North Greenland. At the margins the transition is located significantly deeper which is most likely due to high velocity areas dragging the layers down. However, this effect varies between different areas and may be related to the geometry and ice flow dynamics of the particular region and/or the timing of the initialization of the ice stream.

Modelling studies of the Greenland Ice Sheet may incorporate this dataset to answer questions related to large scale dynamics of the ice sheet such as the extent of the ice during the last glacial, or to investigate the spatial and temporal scales of ice flow in more localised regions.