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Recent developments in dating ice cores with 210Pb and 14C

Content

Radiometric dating has the particular strength to yield absolute dates. Dating with 210Pb and 14C of the water-insoluble organic carbon fraction (14C-WIOC) has become an important dating tool to constrain the age of ice cores from mid-latitude and low-latitude high-elevation glaciers. 210Pb dating covers an age range of around 150 years, providing independent absolute confirmation of the dating derived by annual layer counting. More recently, its application obtained increasing attention because of climate warming with a rising number of glaciers now experiencing a negative mass balance even in their (former) accumulation zone, resulting in a surface age not corresponding to the time of ice core sampling. To date, 14C-WIOC dating, covering an age range from around 500 up to around 20,000 years, is the only available, routinely applied method allowing to date the oldest ice core sections from typical alpine glacier archives. We will present and summarize results from the latest applications of these two techniques with a particular focus on radiocarbon dating. This technique was steadily developed and improved over the past >10 years with a newer application using the dissolved organic carbon fraction (DOC) more recently being applied and investigated for comparison with 14C-WIOC. We will show recent insights to this dating technique, gained on the one hand from the increasing number of applications on study sites from different continents with individual, site-specific glaciological (e.g. temperature, flow) and glacio-chemical characteristics (ice impurity content), and on the other hand from the newly available dating results from 14C-DOC. Considering the continuous improvements and increasing number of applications, we further like to discuss the now arising potential for a better understanding of the observed depth-age relationships in terms of ice flow for such, comparably small, glaciers of highly complex geometry.

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