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Establishing past firn accumulation records from ice caves of the European Alps

Tanguy Racine¹, Christoph Spötl¹, and Paula Reimer²

¹Innsbruck Universität, Atmosphere and Geosciences, Geology, Austria (tanguy.racine@student.uibk.ac.at)

²Queen's University Belfast, School of Natural and Built Environment

Mid-latitude, cave-hosted temperate ice is increasingly scrutinised for its palaeoclimatic potential. Findings of dendrochronologically dated wood trunks and radiometrically dated woody macrofossils demonstrate that underground ice accumulations records may locally span several millenia. The cave geometries conducive to underground firn accumulation were additionally shown to favour the preservation of a winter signal, making cave-hosted ice an attractive and complementary archive to existing and largely summer-biased proxy records. Proxy derivation from these ice accumulations first requires the establishment of firn accumulation/ablation chronologies from stratigraphic mapping and radiometric dating of organic inclusions. Decadal to centennial trends in accumulation/ablation recorded by the ice stratigraphy thus provide insight in past variations of solid precipitation .

Preliminary results from several well-dated ice caves of the Northern Calcareous Alps in Austria suggest local preservation of ice since ca. 3600-3300 BC. Inclusion-rich unconformities in the ice stratigraphy from these alpine caves mark short breaks in firn accumulation between 250 BC and 250 AD and longer hiatuses during Late Antiquity and the 8th and 9th century AD. The majority of dated ice sequences testify the onset of rapid ice accumulation from the 11th and 12th century AD onwards and build up throughout the 'Little Ice Age'.