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Alpine Glacier Oscillations and Climate in the Early Holocene

Andrew Moran (1), Susan Ivy-Ochs (2), and Hanns Kerschner (1)

(1) Institute of Geography, University of Innsbruck, Innsbruck, Austria (andrew.moran@uibk.ac.at), (2) Laboratory of Ion Beam Physics, ETH Zurich, Zurich, Switzerland

Well preserved glacial advances represent a valuable information source of climate history because glaciers react directly to changes in climate. In this context, several moraine systems located morphostratigraphically between Younger Dryas moraines ("Egesen Stadial") and the "Little Ice Age" moraines are investigated in the Eastern Alps of Austria. Hitherto few investigations of such sites have been undertaken in this region and those that have been, have often yielded a broad range of ages within the early Holocene. Based on stratigraphy and morphological characteristics of Alpine moraines as well as corresponding ELA (equilibrium line altitude) depressions, possible early Holocene moraine systems are identified. The field investigations encompass sites in the western Austrian Federal States of Vorarlberg and Tirol ranging from the central Alps to the northern Alpine fringe. The dating of these glacial advances takes place by means of exposure dating. Thereby, clast supported boulders associated to the respective moraines are sampled and the ages determined with 10Be and 36Cl. This study aims at shedding light on this particular time frame between 11.5 and 10 ka and to determine whether a correlation of glacial stadials to various known short termed ($\sim$100-200a) climatic oscillations can be achieved. The regional distribution of investigated field sites within western Austria helps to gain spatial climate knowledge. The interpretation of climate history is supported by the use of energy and mass balance calculations at the equilibrium line and on empirical precipitation-temperature models and positive degree-day models. Additional necessary climate information (especially summer temperature) is taken from the available proxy data sources of the respective time segment. Therewith changes in precipitation structures throughout the Alpine region and indications of atmospheric circulation conditions in times of rapid climate change can be derived.