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Late Holocene glacier chronology of the Southern Alps/New Zealand - a methodological challenge?!

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There is universal agreement that mountain glaciers are important and sensitive indicators of past and present climate changes. Reconstructing the Late Holocene glacier chronology of the Southern Alps of New Zealand is particularly important as this is one of the few key study sites in the southern hemisphere, and because the relative timings of New Zealand and northern hemisphere climate variations reflect interhemispheric climate signals. Unequivocal timings are necessary to understand these signals, and moraines in New Zealand are increasingly dated for this purpose.

There is, however, considerable disagreement between existing studies on Late Holocene glacier variations using different techniques. Earlier work used radiocarbon dating, weathering-rinds, or lichenometry, but promising new dating methods like TCND (terrestrial cosmogenic nuclide dating) and SHD (Schmidt-hammer exposure-age dating; Winkler 2005, 2009) have recently been introduced in the Southern Alps.

The abovementioned inconsistency with existing New Zealand chronologies seems to be mainly caused by uncertainties about the geomorphological origin of Holocene moraines. Although research e.g. in Norway and the European Alps has clearly demonstrated the need for accurate investigation of processes of moraine formation and their relationship to glacier dynamics prior to any palaeoclimatic interpretation, no study of Late Holocene moraine formation, or their classification/relationship to glacier dynamics, has yet been performed in New Zealand. The Southern Alps are, furthermore, located on an active plate margin, whose dynamic geomorphical environment has e.g. clearly impacted Late-Glacial moraine formation, so this lack has to be seen as major impediment.

On basis of these methodological restrictions, results from studies on Late Holocene from various glaciers in the Southern Alps using a "multi-proxy approach" of Schmidt-hammer exposure-age dating (SHD) combined with terrestrial cosmogenic-nuclide dating (TCND) will be presented. At least three Late-Holocene (Neoglacial) "Little Ice Age"-type events predating the "Little Ice Age" have been clearly detected. The patterns of this Late-Holocene glacier chronology correspond relatively good with glacier variations in maritime South Norway, as do the more recent glacier variations during the 20th century. By contrast to other recent studies, it will be demonstrated that the New Zealand glacier chronology does in fact correspond to some extent to some chronologies in the Northern Hemisphere. The previously suggested high number of major glacier advances obviously needs to be adjusted by taking realistic uncertainties with moraine dating into account.