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Revision of the Holocene glacier chronology in the Southern Alps/New Zealand and comparison with Norway – characterising maritime mountain glaciers and improving the spatial differentiation in a global context

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Reconstructing Holocene glacier chronologies and the related climate history helps to improve the knowledge how glaciers respond to changes of the climate. Detailed Holocene glacier chronologies offer the opportunity to assess the recent glacier dynamics, and to verify predictions and simulation of the future glacier development. Within the project "MaMoGla" (Holocene and recent dynamics of **ma**ritime **mo**untain **gl**aciers), the Southern Alps of New Zealand and maritime Scandinavia are investigated in a comparative study in order to focus on maritime mountain glaciers and their characteristics. The project should deliver a contribution towards a better spatial differentiation in the application of glaciers as indicators of climate change in a global context.

The existing Holocene glacier chronology of the Southern Alps/New Zealand is yet not on a comparable detailed standard as the Scandinavian counterpart. Comparative studies, therefore, are to some extent limited in the present situation. In addition, previous research has revealed the need for revision due to methodological uncertainties, and especially due to the focus on a meanwhile disregarded key locality (i.e. Tasman Glacier). A new attempt to combine the already established relative-age dating technique of the Schmidt-hammer with *in situ* (terrestrial) cosmogenic nuclide (^{10}Be)

surface exposure dating offers the opportunity to improve the New Zealand glacier chronology. It represents an alternative approach to radiocarbon (^{14}C) dating of organic material and offers the possibility to avoid earlier results exclusively derived from Tasman Glacier.

Preliminary results of this combined approach at Strauchon Glacier, a valley glacier west of the Main Divide of the Southern Alps in Westland/*Tai Poutini* National Park, will be presented. On a large lateral moraine complex with several individual moraine ridges, Schmidt-hammer measurements have been used to group the seven moraine ridges into three groups and detect a related number of Late-Holocene LIA ("Little Ice Age")-type events that occurred prior to the youngest major advance (the original "Little Ice Age"). A number of samples have been dated by cosmogenic ^{10}Be revealing an age of c. 2,400 a BP for the outermost (oldest) and c. 1,700 a BP for the intermediate moraine ridges. The innermost ridge was dated by a simple dating curve to c. 1,000/1,100 a BP. A pattern of three major pre-LIA Late-Holocene glacier advance periods (= Little Ice Age-type events) is in good agreement with the configuration of the glacier forelands at other glaciers east of the Main Divide.

These results, in accordance to earlier studies, lead to a reduction of the number of confirmed major LIA-type events in New Zealand compared to earlier work. There is little/no evidence of major Early Holocene advances as e.g. the preboreal Erdalen event or the 8.2 ka BP event clearly established in Norway. One hypothesis for this difference is the major influence on melt-water outburst from the disintegrating remnants of the Laurentide ice sheet into the North Atlantic sector representing a limited regional factor. However, the reduction of LIA-type events since Neoglaciation, the occurrence of a long Mid-Holocene period without any indication of glacial activity, and the resulting more accentuated Holocene chronology in New Zealand is comparatively well corresponding with the Norwegian situation. In addition, detailed analysis of the recent glacier behaviour clearly shows major parallels between both study areas, e.g. the most recent advance in the late 20^{th}-century and its climatic forcing. Especially the importance of regional circulation patterns for the glacier mass balance and the dominant position of precipitation (apart from air temperatures) within the glaciological regime has to be taken into account if the Holocene glacier chronology is used for a reconstruction of the related climate history. In contrast to more continental mountain glaciers, those reconstructions cannot be performed entirely depending on temperature signals. There is, however, the need of further investigations and spatial differentiation before the potential of indicating possible interhemispheric teleconnections and causal links can be drawn further.