

Holocene glacier chronology of the Southern Alps/New Zealand – a critical re-assessment based on geomorphological and glaciological principles

Stefan Winkler

University of Würzburg, Department of Geography and Geology, Würzburg, Germany (stefan.winkler@uni-wuerzburg.de)

The Southern Alps of New Zealand is one of few suitable study sites for the investigation of Holocene glacier chronologies in the mid-latitude Southern Hemisphere. As a result, several studies have been carried out during the past decades applying diverse approaches and using different numerical dating methods (Radiocarbon dating, terrestrial cosmogenic nuclide dating – TCND) or combined methods like Schmidt-hammer exposure-age dating (SHD) or weathering-rind thickness. The availability of a regional ^{10}Be production curve has improved the calibration of TCND-ages and modern calibration programmes allow re-calculation of old, non-calibrated radiocarbon ages.

Despite this progress and an increasing number of studies, there still remains considerable discrepancy if these studies are analysed in detail. And although the Southern Alps of New Zealand are included in more recent global reviews, the corresponding paragraphs are somehow biased towards few selected chronologies and an ostensible ‘supremacy’ of age information obtained by TCND. Reason for this practise is most likely a comparably high number of individual boulders precisely dated, but moraine ridges on those glacier forelands investigated have been primarily clustered on basis of boulder ages rather than on their geomorphological, sedimentological, and lithological properties. Detailed geomorphological investigation has, however, revealed that disregarding the latter mentioned creates artefacts in form of wrongly introduced advances within existing glacier chronologies alongside uncertainties caused by not paying attention to the concept of ‘Little Ice Age’-type events (neoglacial events) and diverse glacier response times.

In an attempt to resolve or at least reduce existing uncertainties and contribute towards a future representative regional Holocene glacier chronology for the Southern Alps, the most prominent existing chronologies have to be re-assessed. Although the raw data of some studies needed at first to be calibrated to modern standards (non-calibrated radiocarbon ages), these raw data has in general not been put into question and taken as presented. The geomorphological interpretation has, however, been carefully reviewed alongside all potential consequences for the subsequent relation to the underlying glacier dynamics. Different glacier response times have been considered as well as a more conservative approach to the precision and accuracy of certain dating methods. The latter was seen as more appropriate due to the highly dynamic geomorphological process-systems, strong neotectonic activity, and specific regional glaciological properties like for example frequent extensive supraglacial debris-covers complicating every chronological approach in the Southern Alps.

The preliminary results of this critical re-assessment presented here reveal that too optimistic judgement of achieved accuracy lead to an overestimation of the true number of regional glacier advances during the Late Holocene. More conservative error margins and application of the neoglacial event concept instead of displaying ‘glacier pulses’ in form of advances at individual glaciers would create a better albeit less accurate correspondence between chronologies developed at different localities. This more critical evaluation would in the end be beneficial to any subsequent attempts of intra-hemispheric and global correlation of glacier chronologies.