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Centennial Scale Holocene Alpine Glacier Fluctuations

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Holocene climate is thought to be of relatively stable character compared to the late glacial and glacial fluctuations. However, many records show evidence for periods of rapid and substantial climate change on a centennial scale throughout the Holocene. Most such events document a change to cooler conditions related to glacier advances. Little is known about the periods between specific cold events. In particular, the positions of glaciers during recession periods need to be more precisely confined. In order to improve our understanding of mechanisms that drive holocene climate change we have to know e.g. the full amplitude of glacier fluctuations.

Here we present amplitudes and frequencies of holocene glacier fluctuations and discuss paleoclimatic implications.

The sedimentary record of 6 glaciers in the Swiss Alps show that glacier recessions occurred repeatedly on a multi-centennial scale based on more than 140 radiocarbon datings. Spatial reconstructions of former glacier extent imply that e.g. the equilibrium line altitude must have been approximately 200 m higher than at present during periods like the Holocene optimum warm phase (7.5 to 6.6 cal ka BP).

After the Younger Dryas, glacier recessions occurred soon but were still interrupted by major cold events. After 9 ka BP extended recessions persisted culminating between 7.5 to 6.6 ka BP. Then glaciers fluctuated around present levels with short but well defined advances. After 3.4 ka BP recessions occurred less frequently and glaciers advanced with cold and wet conditions peaking with the Little Ice Age. The reconstructed glacier fluctuations imply that the general holocene trend follows summer insolation values and changing seasonality. The early holocene instabilities are suggested to be influenced by perishing ice sheets and meltwater input to the North Atlantic. This forcing seems to be reduced after 7.5 ka BP. Comparisons with other

climate archives, such as Δ14C of the calibration curve, tree-rings, North Atlantic ice rafted debris or Be-10 of ice cores suggest a change in the impact of the different forcing factors.