Guidelines

The Role of Ice Sheet Feedbacks in Northern Hemisphere Ice Ages

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Abstract.

Climate feedbacks arising from the expansion of the great Northern Hemisphere ice sheets have long been thought to play a fundamental role in driving Late Pleistocene ice ages. Yet the magnitude of atmospheric temperature depression stemming from ice-sheet feedbacks have been difficult to assess, hindering determinations of past atmospheric temperature sensitivity to CO_2 changes. Here, we propose to examine the role of ice sheets in Northern Hemisphere climate change by reconstructing glacier snowlines in the northern middle latitudes during the transition from late-glacial to early Holocene time, when boreal summer insolation and atmospheric CO_2 concentrations attained maximum interglacial values, but the Laurentide and Scandinavian Ice Sheets were still extensive. We aim to apply ^{10}Be surface-exposure dating methods and snowline reconstruction techniques to mountain glacier moraine sets located in the Wind River Range of the western United States, and the Tien Shan of western China. If ice sheet feedbacks dominated Northern Hemisphere climate during the late glacial and early Holocene, then climatically sensitive mountain glaciers at northern latitudes should bear a history similar to that of the great ice sheets. If the influences of boreal summer insolation and/or atmospheric CO_2 overpowered ice-sheet feedbacks, then mountain snowlines should have risen to (or above) pre-industrial levels well before the final disappearance of the large ice sheets. To address this problem, we specifically request funds to assist with ^{10}Be dating a subset of samples collected from moraines deposited by mountain glaciers in the Wind River Range, USA, and Tien Shan, China.