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Establishing the timing of chemical deposition events on Belukha glacier, Altai Mountains, Russia, using pollen analysis

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Ice cores from mountain glaciers in mid- and low- latitudes, although covering shorter time scales than those from polar ice sheets, allow for high-resolution analysis due to the high snow accumulation rate. Pollen, a regular component in mid- and low- latitude glaciers, has been shown to have major potential as a useful marker for separating several seasonal layers in snow pits and ice cores because pollen grain production and liberation follow a distinct seasonal phenology depending on the taxon. The pollen analysis in the samples is expected to complement chemical, biological and physical analysis with seasonal resolution, leading to better understanding of past climates and environments. However, there is only one report that has compared pollen-dated profiles with in situ observations based on only one year of data. The purpose of the present study were to verify the accuracy of the seasonal layers by replicating the previous study using a 4.00-m pit on the same site and to interpret chemical data profiles in detail by utilizing the seasonal layers. The pollen analysis indicated that the snow deposition on the glacier originates mainly from summer precipitation, and the accuracy of the dating was supported by in situ observations. The record of oxygen isotope ratios showed a relatively high mean value of -13.3 per mill, seeming due to absent winter depositions. The formate concentration records displayed seasonal variation with the highest emission in spring, and a dust event in spring 2003 was detected from the records of Mg²⁺ and Ca²⁺ and dust concentrations.