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Change of isotopic content of snow by temperature gradient–induced water vapor diffusion

S.A. Sokratov (1), M. Schneebeli (2), V.N. Golubev (1)

(1) Faculty of Geography, Moscow State University, (2) WSL: Swiss Federal Institute for Snow and Avalanche Research (sokratov@geol.msu.ru)

Snow recrystallization and amount of resublimating mass at the ice matrix surface is observed by computed microtomography in two experimental runs of applying of temperature gradient to snow samples under controlled experimental conditions. Comparison of the results of D and ^{18}O isotopes analysis shows different change in isotopic content of snow due to water vapor diffusion in the direction of the applied temperature gradients at different positions in investigated snow samples from the beginnings to the ends of these experimental runs. The experimental results show that, despite general validity of the layer-by-layer mechanism of ice matrix sublimation and zero mass balance throughout investigated snow samples, repeating resulblimation results in considerable variation in isotopic content of snow subjected to temperature-gradient metamorphism. The finding suggests separation between the total mass balance of a sequence of snow from balance of its components such as stable isotopes, for which the system can be open. This gives a new insign on analysis of reported results on isotopic content change of snow under isothermal evaporation. The data support previously suggested dependence of stable isotopes' fractionation in snow on its microstructural characteristics. A model of the process of isotopic fractionation in snow becomes part of a model of snow metamorphism. First attempt of such combination is planned to be presented. The study is supported by joint Russian Fund of Basic Research/China grant 05-05-39011-GFEN.