

Interactive comment on “Post-depositional changes in snow isotope content: preliminary results of laboratory experiments” by A. A. Ekaykin et al.

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The discussion (more likely absence of a discussion in relation to this paper) shows interesting situation in the climate and cryosphere scientific community, formed around snow–stable water isotopes research. The isotopes profiles from ice cores are the base for many paleo climate reconstructions. The interpretation of profiles are based on the recent-time empirical correspondence between isotopic content of snow and temperatures in zone of formation of the clouds and in the sites of deposition. The processes affecting the isotopic content between the moment of deposition and the time of final incorporation into ice (10th meters of snow-firn in case of Antarctic, though just

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hundreds years in duration) are still almost purely-theoretical speculations, rarely discussed in presentation of hundreds thousand years climate variability “extracted” from ice cores. There is some interest in finding experimental support to results of existing models of evolution of isotopic content of the snow-firn layer above ice (wind pumping, for example), but there is almost no interest in collecting new data allowing building of new physical constructions and models, possibly greatly improving understanding of the processes resulting in observed isotopic profiles in ice cores. This paper shows such kind of data.

It is possible to argue that some kind of simple interpolation between the surface of snow and surface of ice already incorporates the effect of the “post-depositional” isotopic content change. It is also possible to argue that the change is caused by some processes not much related to temperature and thus not varying over the thousands years periods (air movement in snow). There is always possibility to state that the change is negligibly small, either due to relatively short time period or very low temperature in, for example, Antarctic. Much better would be quantification of the “post-depositional” isotopic content change. The latter is only possible through experimental investigations.

The authors are presenting results of experimental studies on the change of isotopic content of snow due to the processes, clearly acting in Nature. Very few such experiments had ever being conducted (at least in comparison with the number of ice cores and paleo-climate reconstructions). Even less experiments were conducted with well-known and regulated environmental conditions. And this is the first time when the time-change of isotopic content profiles in the snow samples exposed to sublimation in regulated environmental conditions are documented.

In the reviewer’s comments the evident inconsistency exists between the expected “further experimental work” before the results “can be presented”, and necessity of data to be in existence (published) for new models to be developed. I can agree that the paper can be modified by deleting modeling part (though why not to show it, especially

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since the model's results are in agreement with the established already fact of orders of magnitude higher water vapor flux in the pore space of snow than possible net flux from snow surface to the atmosphere?) and word "preliminary" in the title and in the text. I do not think there is much sense in comparison of the directly measured mass losses due to sublimation with the results of the model, based on humidity measurements (the problems with such measurements are well known in the "cold-lab users" community). Also, I do not like some terms used in the paper (like "snow thickness", or "isotope modification"). But I do not think the authors should wait for another opportunity to run new experiments or to get other data (*D*) before attempting to report in details the experimental set-up and the isotopic profiles obtained.

To finalize: Being reviewer (which I am not), I would strongly suggest publishing the paper after text (not content) edition. "Specific revisions" suggested by both the reviewers cover most of the requirements.

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