

Laboratory experiments on the evaluation of the post-depositional snow isotopic composition changes

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Isotopic composition of ice cores recovered from polar ice sheets is a commonly accepted reliable proxy of paleo-temperature. Detailed measurements of deuterium and oxygen 18 content in deep firn and ice layers has allowed reconstructing the past climate over 120,000 years in Greenland and about 800,000 years in Antarctica. However, isotopic-temperature calibration is related to several assumptions, which makes the absolute magnitude of the reconstructed temperature somewhat uncertain. In particular, more and more evidences appear that isotopic composition of ice deposits has been altered from its initial value due to the post-depositional (PD) processes in upper snow thickness, which is also supported by theoretical considerations and scarce laboratory experiments.

In this work the experimental results are overviewed demonstrating likely existing not-negligible isotopic PD effects in central Antarctica snow, mainly based on data from the vicinities of Vostok Station. In order to quantitatively estimate and explain the magnitude of these PD changes, a laboratory set-up, aimed at reproducing natural PD processes, has been developed and constructed in the Institute of Low Temperature Science of Hokkaido University. The main advantages of this experimental device are 1) large temperature span, covering the whole range of central Antarctic warm period (down to -45 deg.C), when most of post-depositional processes take place and 2) control of isotopic composition of water vapor that isotopically exchanges with the snow sample. In this work, we describe the experimental set-up and present the preliminary results of the artificial PD snow changes study.

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