Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)
©2011. Japan Geoscience Union. All Rights Reserved.

ACC029-17 Room:102 Time:May 26 17:30-17:45

Water stable isotope of near surface snow and environment of snow accumulation at inland of Antarctica

Yu Hoshina[1*], Koji Fujita[1], Fumio Nakazawa[2], Yoshinori Iizuka[3], Takayuki Miyake[2], Motohiro Hirabayashi[2], Takayuki Kuramoto[2], Hideaki Motoyama[2], Shuji Fujita[2]

[1]Nagoya University, [2]National Institute of Polar Research, [3]ILTS, Hokkaido University

Water stable isotope ratios in ice cores are believed to represent pale-temperature. It was also often pointed out by modeling studies, on the other hand, that isotope ratios were altered after snow deposition due to the water vapor transport within the sub-surface snow. In the inland of Antarctica, snow accumulation is extremely low and thus snow should stay for several years near the surface. Therefore, significant change isotope ratios are expected. This phenomena has not been so far confirmed by observational approaches.

We dug two snow pits at Dome Fuji (DF) and Meeting Point (MP) (approximately 380 km from Dome Fuji Station) at 2007. Water stable isotope ratios, major ion concentrations, tritium contents of the snow pits are analyzed. We put time seals on the snow pits using tritium contents, non-sea-salt sulfate ion, nitrate ion and crust layers. Annual accumulation rates of the MP and DF pits are estimated as 40.3 and 29.3 kg m^{-2} a^{-1}, respectively. The oxygen isotopic profile in the MP pit seems to preserve clear seasonal cycle, whereas several-year cycle with large amplitude of oxygen isotope ratios is found in the DF pit. This DF cycle corresponds to neither seasonal cycle nor any fluctuation of air temperature in Antarctic stations. Calculations of the water vapor flux using the observation snow temperature indicate that the maximum convergence of water vapor from surface to 20 cm depth. If snow accumulation rate was constant, every snow layer would get the same amount of water vapor and thus the seasonal cycle of oxygen isotope ratios should be preserved. However, observation data at DF shows the variability of snow accumulation rates ranging from -20 to 90 kg m^{-2} a^{-1} with several-year cycle. We simulate water vapor convergence of each snow layer with taking the observed variability of snow accumulation rate into account. The results show temporally inconstant fluctuation of water vapor condensation. This water vapor profile is consistent with the isotope ratios cycle of DF pit. We conclude that the oxygen isotope cycle of DF snow pit should be formed by vapor condensation at the sub-surface and large variability of snow accumulation rate.

Keywords: Antarctica, water stable isotope