Geophysical Research Abstracts, Vol. 8, 06964, 2006
SRef-ID:

Changes in atmospheric methane concentration in the Arctic and Antarctic regions for the last 110,000 years deduced from NGRIP and Dome Fuji deep ice cores

S. Aoki (1), K. Kawamura (2), T. Nakazawa (1), T. Mori (1), D. Jensen (3), S. Johnsen (3), Y. Fujii (4) and O. Watanabe (4)

(1) Center for Atmospheric and Oceanic Studies, Tohoku University, Sendai, Japan, (2) Scripps Institution of Oceanography, University of California, San Diego, USA, (3) Niels Bohr Institute, University of Copenhagen, Denmark, (4) National Institute of Polar Research, Tokyo, Japan (aoki@mail.tains.tohoku.ac.jp/+81-22-795-5797)

Variations of atmospheric CH4 concentration in north and south polar regions for the last 110 kyrs were deduced from deep ice cores from NGRIP, Greenland and Dome Fuji, Antarctica, respectively. The results showed that their temporal variations are similar to each other. The CH4 concentration increased rapidly from low values of 350-400 ppbv to high values of 700-750 ppbv during the period of 20-10 kyrs BP (Termination I), in association with glacial-interglacial transition. During the last ice age of 110-20 kyrs BP, the CH4 concentration decreased gradually toward the lowest value in the last glacial maximum, showing fluctuations with amplitudes of more than 100 ppbv. Such large fluctuations are attributable to changes in the strength of CH4 sources and sinks, which are associated with global climate change. We also found that the CH4 concentration from the NGRIP core was always higher than that from the Dome Fuji core, and that the concentration difference between the two cores was changed with time. In order to interpret such a phenomenon especially in terms of changes in CH4 source strength in the tropics and northern middle and high latitudes, we analyzed the temporally-varying concentration difference using a three-box model consisting of the tropics and middle to high latitudes of the northern and southern hemispheres. The results suggested that the CH4 concentration variations during the last ice age, as well as in the transition from the Younger Dryas to the Holocene, were mainly caused by changes in CH4 sources in northern middle and high latitudes. This is consistent with variations of the continental ice volume in those periods, which were

estimated from delta-18O values of atmospheric oxygen measured for the NGRIP core. On the other hand, the CH4 concentration variations during the Termination I and the Holocene were expected to ascribe mainly to tropical CH4 sources. Since northern middle and high latitudes were covered with thick ice sheets during the Termination I, only tropical CH4 sources could be activated in that period. For the Holocene when air temperature was almost stable, other meteorological factors such as precipitation could affect tropical CH4 sources.