Proc. NIPR Symp. Polar Meteorol. Glaciol., **8**, 194, 1994

GROWTH PROCESSES OF SEA ICE IN ONGUL STRAIT (ABSTRACT)

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As part of the Antarctic Climate Research (ACR) program, a study of the atmosphere/sea-ice/ocean interaction was conducted off Queen Maud–Enderby Land, Antarctica. Two-year field observations were carried out to clarify the effect of snow cover on growth processes of sea ice in Ongul Strait from April, 1990 to December, 1991. Routine measurements of the length of snow stakes, snow depth and ice thickness were made about every month at three stations across the Strait. Sea ice cores were collected to assess their structure and temperature. Then, salinity and oxygen isotope concentration profiles of the melted ice samples were determined at intervals of about 0.1 m.

The snow depth varies consistently from 0 to about 1 meter across the Strait, increasing with distance from the Antarctic Continent. The snow depth affects both the growth and structure of sea ice. In winter, the growth rate is higher in bare ice regions than in snow-covered regions. However, over the year, the ice thickness itself is lower in bare ice regions than in snow-covered regions, in contrast to the common notion that snow cover is associated with a decrease in the growth rate of sea ice. Sea ice in the snow-covered regions increased in thickness in spring rather than in winter. The analyses of the sea-ice structure and the oxygen isotope concentration suggest that such growth processes are caused by the formation of snow ice and by ice formation related to the melting of snow cover. Ice thickness decreases drastically in bare ice regions in summer owing to melting at the bottom surface and inside the ice due to oceanic heat flux and absorption of solar radiation, respectively. In contrast, the decrease is not so great in snow-covered regions due to thermal insulation by the snow cover, leading to thicker sea ice.

Major ion concentration profiles of the melted sea-ice samples were also determined. These measurements show that the sea ice samples have a tendency to enrich the concentrations of K^+ and Na^+ and to reduce that of SO_4^{2-} relative to sea water.

(*Received December 5, 1993*)