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GROWTH PROCESSES OF SEA ICE IN LÜTZOW-HOLM BAY (ABSTRACT)

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As part of the Antarctic Climate Research (ACR) program, a two-year study of atmosphere/sea-ice/ocean interaction was conducted off Queen Maud–Enderby Lands, Antarctica in 1990 and 1991. Research on the spatial characteristics of snow depth and sea-ice thickness and of the growth processes of sea ice was carried out in Lützow-Holm Bay. The lengths of snow stakes, snow depths and sea-ice thicknesses were all measured at ten offshore stations on two latitudinal lines in April, August and October of both years. Sea ice cores were also collected to assess structure, temperature and salinity in 1991.

Spatial variations of snow depth and sea ice thickness were clearly noticed. The stations near the Antarctic Continent have little snow cover. However, the snow depth increased consistently with distance from the Continent, reaching a nearly constant maximum value of 1 to 1.5 m during the winter. The increase of ice thickness paralleled that of snow depth, the maximum thickness at the offshore stations being 2 to 3 m. No differences in these variations were recognized between the two observation lines.

The snow depth was found to significantly affect the sea-ice growth processes. At the station with little snow cover, the sea ice grew in the austral winter months and decayed in summer to the thickness of the previous year. The sea ice repeats this growth and decay cycle annually and consequently is limited in thickness to approximately 2 m. On the contrary, in the heavily snow-covered regions, the sea ice showed little growth even in the winter, because the thick snow cover and sea ice itself reduced the vertical heat flux and accordingly the growth rate due to bottom freezing. In summer, however, an extreme increase of sea ice thickness of 0.5 to 1 m was observed. The growth is probably caused by refreezing of low-salinity meltwater from the snow cover. An aquifer about 0.2 m deep was found to exist on the snow/ice interface in January 1992. This fact suggests that the sea ice growth can be attributed to the formation of superimposed ice.

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