wind speed distribution, on the basis of the relation between drifting snow and wind speed at Mizuho Station (70°42′S, 44°20′E) in Mizuho Plateau.

The horizontal divergence of drifting snow results in local net mass balance on a ice sheet surface. Positive value of the divergence means erosion of snow from the surface, which is loss in the mass balance, while negative value means accumulation of snow on the surface, which is gain in the mass balance.

At Mizuho Station, the annual net accumulation of 70 mm is much smaller than estimated precipitation about 200 mm, even by taking account of the vapor evaporation from a snow surface. This difference is explained by the negative divergence of drifting snow due to the convex topography around Mizuho Station.

Around the southern region of the Yamato Mountains, about 300 km westward from Mizuho Station, the divergence of drifting snow was high negative value due to convex topography and comparatively large inclination of the slope. This high negative divergence, adding to vapor evaporation from the ice surface, can explain the origin of the bare ice field in this region.

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THERMAL OSCILLATION IN POLAR OCEAN–SEA ICE SYSTEM (ABSTRACT)

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A two-layer model is presented to study the interaction between sea ice and convection in the ocean. The convection in the ocean is parameterized by two discrete values of vertical diffusion according to the stability of the stratification. The cooling rate at the surface also has two discrete values according to the surface temperature. This represents the insulation effect of the sea ice. The lower layer is continuously supplied with heat and salinity is subtracted from the upper layer to maintain the basic feature of the polar ocean.

This model shows self-sustained oscillation in which the sea ice disappears periodically. This oscillation mechanism is considered to be related to the polynya in the Antarctic Ocean.

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NUMERICAL SIMULATION OF TURBULENT HEAT TRANSFER PROCESSES OVER A MARGINAL ICE ZONE (ABSTRACT)

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Marginal ice zones (MIZs) are sites of transition from large ice floes to many small disintegrated floes, and so when an air mass moves over these zones, it encounters abrupt changes in surface temperature; a cold ice surface to a warm water surface, then back to ice (E. L. ANDREAS *et al.*: J. Geophys. Res., **84**, 649, 1984). The local turbulent heat transfer processes over an MIZ under the passage of thermally different air masses are numerically investigated by solving two-dimensional steady-state diffusion equations for heat and moisture.

In a model region with the total fetch of 1 km, the surface consists of four ice floes, each measuring 2 m thick with the same fetch, and open water between them. Aligning them in the wind direction, on one side of the MIZ the surface is covered by a continuous ice field and the other side by an ice-free ocean. The surface temperature of ice floes is determined taking the surface heat balance (comprising atmospheric radiation and turbulent and conductive heat) into account. The turbulent fluxes of sensible and latent heat are formulated by a semiempirical mixing-length approach. To examine the effects of heat and moisture advection, the simulation is conducted for several different ice concentrations under two typical winds. Case 1 is the advective condition of cold, dry air from the continuous ice field to the MIZ, while case 2 is a warm, moist one from the ice-free ocean.

Model results predict that in case 1 a large amount of turbulent heat is transported from the surface to the atmosphere; the net turbulent heat flux averaged over the MIZ increases with the ratio of open water to the entire MIZ. The turbulent heat supply from the ice-free water is primarily responsible for this heat loss. Ice floes also serve as a weak source for sensible heat but their heat loss is found to be almost an order of magnitude lower than the heat loss from the ice-free water.

In contrast, in case 2 the entire MIZ acts as a heat sink; the average turbulent fluxes are toward the surface and increase with the ice concentration. The magnitude of turbulent fluxes over the MIZ is much greater in case 1 as compared with case 2, due to the development of unstable air stratification caused by the contact of cold air blowing over the MIZ and warm water.

Model results reveal that the atmospheric transport of heat and moisture from the outside of the MIZ has a crucial effect upon the net melting or freezing of ice.

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AN EXPERIMENTAL STUDY ON PROCESSES OF HIGH SEA ICE PRODUCTION: PRELIMINARY REPORT (ABSTRACT)

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The problem of ice production in an open water polynya is important because the open water is continually being swept free of ice, so that the polynya serves as an efficient ice factory. Further, because of the high ice production rates, there is also the fascinating but ill-understood problem of the ice interactions with the haline convection due to salt rejection and the Langmuir rolls which form in the wind-swept open water. To study the different aspects of the ice and water physics associated with the polynya, we are starting to perform the following two related laboratory experiments:

1) Quantitative observations of a rapid production of frazil ice and the resulting haline convection;
2) Observations of transitional processes of frazil ice—grease ice—sheet ice and their crystallographic observations.

The results of the observations will be reported in the near future.

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