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DEVELOPMENT OF A COUPLED ICE-OCEAN GENERAL CIRCULATION MODEL (ABSTRACT)

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A three dimensional ice-ocean coupled model has been developed, and some basic experiments for examining effects of ice cover on ocean circulation are done using the model.

Our ice model is based on the two-dimensional dynamic model of W. D. HIBLER, III (J. Phys. Oceanogr., **19**, 815, 1979) and the one-dimensional thermodynamic model of G. L. MELLOR and L. H. KANTHA (J. Geophys. Res., **94**, 10936, 1989). The variables predicted or diagnosed are ice concentration, ice thickness, horizontal ice velocity, and temperature at the upper and lower surfaces of the ice and in the middle of the ice layer. We use the beta-plane version of the ocean general circulation model developed at Center for Climate System Research. The level 2 closure scheme of G. L. MELLOR and T. YAMADA (Rev. Geophys. Space Phys., **20**, 851, 1982) is included in the upper layer of the ocean model to represent the sea surface mixed-layer.

Numerical experiments are performed under idealized basin geometry and surface boundary conditions. We consider a rectangular ocean in the northern hemisphere with the equator as the southern boundary. Boundary conditions at the sea surface are derived from prescribed surface air temperature, relative humidity, and wind velocity and shortwave and longwave radiation. All the forcings except the winds have seasonal variations. Precipitation and evaporation as water flux forcing is not considered (zero everywhere). Salinity flux at the sea surface is taken to be nonzero only when and where sea ice forms or melts.

Four cases under the same sea surface conditions are calculated, *i.e.*, cases where ice motion is included or not, and cases where salinity rejection from ice is included or not. These case-studies suggest that the thermohaline circulation is heavily affected by the coupling of ice motion and salinity rejection. With ice motion included, ice drifts away from the formation region. With both salinity rejection and ice motion included, ice formation and consequent salinity rejection is quite active in the formation region. Thus ice cover strengthens the horizontal density gradient and enhances the thermohaline circulation.

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