Abstract View

Volume 19, Issue 12 (December 1989)

Journal of Physical Oceanography
Article: pp. 1865–1880 | Abstract | PDF (1.10M)

A Simple Ice–Ocean Model for the Greenland Sea

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(Manuscript received September 30, 1988, in final form July 11, 1989)

DOI: 10.1175/1520-0485(1989)019<1865:ASIMFT>2.0.CO;2

ABSTRACT

A steady, coupled model of the upper ocean circulation and ice cover in a meridional channel is presented and applied to the Greenland Sea. The main ocean gyre is driven by wind stress; however a nonzero boundary condition on meridional velocity is applied at the western side to produce a southward-flowing coastal current, representative of the East Greenland Current (EGC). To match the EGC to the interior Sverdrup solution, a Munk-type western boundary layer is introduced. The upper ocean temperature is governed by an advection-diffusion equation, which is forced at the boundaries, and by heat exchange with the atmosphere. The ice model is purely thermodynamic and the ice-edge position is determined iteratively since the streamfunction and temperature fields depend on the ice cover and, in turn, the ice cover is determined by both the ocean and air temperature. The range of behavior of the temperature field and ice-edge position is studied as a function of the ice–ocean drag, the wind stress transmission factor of the ice, the eddy heat diffusion coefficient, the various heat exchange coefficients, and the boundary conditions. The results are compared with observed ice and ocean temperature data.