Abstract View

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A Model Study of Upper Ocean-Sea Ice Interactions

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ABSTRACT

A thermodynamic sea-ice model, including leads, has been coupled to a one-dimensional oceanic mixed layer model in order to investigate the upper ocean-sea ice interactions. The oceanic heat flux at the base of the ice layer (F_b) is predicted, not imposed, assuming a thermodynamic equilibrium between the bottom of the ice and the water just below. For testing of the model, the annual cycle of the Arctic sea ice and upper ocean is simulated along longitude 169.5° W. The model produces a realistic evolution of the sea-ice thickness and extent and of the upper mean salinity and temperature profiles. The major deficiencies in the simulation are linked to the absence of ocean and ice dynamics. The modeled value of F_b is far from being constant. Below thin ice, it can be larger than 5 W m^{-2} due to the important fraction of the solar irradiance that is transmitted through the ice, absorbed in the mixed layer and then returned to the ice. Below the thicker perennial sea ice, F_b takes values between 0 and 2 W m^{-2} and exhibits a well-marked annual cycle: it is maximum in March and April and vanishes during the summer months. It is also found that the changes of the sea water freezing temperature due to changes of salinity have an important effect on F_b and on the vertical density profile of the upper ocean.

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