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Three-dimensional Caspian Sea Circulation and Ice Model

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Abstract

A free surface three-dimensional primitive equation dynamical model coupled with ice thermodynamics and air-sea interaction sub-models are used for the study of seasonal variability of the Caspian Sea circulation. The formulation of boundary conditions includes momentum and buoyancy fluxes through the air-sea interface and the open lateral boundaries. General circulation of the sea is a complex combination of eddies in deep water regions and shelf currents. Our results support the hypothesis that the Volga River inflow plays an important role in driving the alongshore current in the southwestern direction from the source. The freezing ice and dense water formed in winter on the northern and eastern shelf regions and its subsequent sinking along the continental slope constitute the main driving mechanism for deep-water ventilation in the Caspian Sea. Predominantly west and southward winds over the Middle Caspian throughout the year constitute an additional mechanism of deep water ventilation, as they result in downwelling along the western coast and upwelling along the eastern coast, clearly indicated by a belt of cold water in summer.