

# 3D Numerical Modeling of Wind Driven Circulation Pattern in the Caspian Sea Using the Primitive Equations in the Sigma Pressure Coordinate

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## Abstract

The purpose of this study was to design and develop a three-dimensional numerical model using primitive equations in spherical coordinates of the Earth with the Sigma pressure vertical array to simulate currents in the Caspian Sea. In this study, the finite difference method was used for numerical solution and discretization of equations using the two step Lax-Wendroff scheme for advection terms and DuFort-Frankel scheme for diffusion terms. The results of the study showed that the clockwise eddy in the middle and the counterclockwise alongshore current near the western coast of the southern Caspian Sea continued throughout the year. Furthermore, due to the steeper slope of the bed in this basin, it is more stable than the currents pattern in the North and Middle basins of the Caspian Sea. Also, the divergence of the current in the surface Ekman layer is balanced by the convergence of current in the bottom Ekman layer in the middle and southern basins of the Caspian Sea, which indicates that the bed topography beside the wind plays a key role in the production and steering of the currents in the Caspian Sea.

Keywords: Numerical modeling, Sigma pressure coordinate, Wind driven circulation, Caspian Sea.

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