Abstract View

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Eddy Processes in Semienclosed Seas: A Case Study for the Black Sea

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ABSTRACT

The enclosed boundaries and small scales of some seas lead to the formation of specific physical balances, which motivates the oceanographic interest in studying the dynamics of semienclosed ocean basins. The focus in the paper is on the specific appearances of eddy processes when the basin scales and the ones of the topographic features are comparable with the baroclinic radius of deformation. The Black Sea is used as a test basin. Eddy variability is analyzed using simulation results and compared with existing observations. The Bryan–Cox model with horizontal resolution $\Delta\varphi = 1/10°$ and $\Delta\lambda = 1/6°$ is forced with annual-mean wind stress data. Buoyancy flux at the sea surface is proportional to the deviation of the model density from the annual-mean climatological data. Sensitivity studies on different forcing and on the topographic control are carried out. Synoptic periods are estimated to be about 0.5 yr. Eddies form in the eastern Black Sea and propagate westward with a speed of about 3 cm s^{-1}. The narrow section of the Black Sea, between the Crimea Peninsula and the Turkish coast, strongly affects eddy propagation. Dissipation increases in the western basin, where eddies slow down and their scales become small. This process is dependent on topography, which is dominated by a large shelf area in the western basin. Eddy kinetic energy exceeds the kinetic energy of the mean motion over large areas. Energy transfer between external and internal modes shows that the topographic control and the nonlinear transfer almost compensate each other. Energy spectra indicate that an inverse cascade may occur.