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Processes of the Protrusion of Near-Coastal Anticyclonic Eddies through the Rim Current in the Black Sea and their Impact on the Pollution Transport

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The mesoscale circulation structures of the Black Sea play an important role in exchange processes of the near-coastal zone and the open basin. The main role here is played by near-coastal eddies (NAEs), which can accumulate pollutants entering, e.g., with river runoff and retain them in the near-coastal zone for a long time, thereby significantly degrading the ecology of local regions between the shore and the Rim Current (RC). NAEs are usually formed as a result of different types of RC instabilities and caught between the RC and the coast. However, under certain conditions, NAEs can protrude through the RC and hence carry pollutants from the near-coastal zone to the open sea.

The eddy-resolving (1/30)° version of the low-dissipative DieCAST ocean circulation model is used for modeling processes of the protrusion of near-coastal anticyclonic eddies (NAEs) through the Rim Current (RC). Under mean climatic forcing, the model realistically reproduces the evolution of the Caucasian NAE from its generation, formation of an attached anticyclonic meander, protrusion through the RC, and, finally, to the formation of an isolated anticyclonic eddy and its dissipation within the Eastern Cyclonic Gyre of the Black Sea. The process of double protrusion of the Caucasian and the Kizil-Yirmak NAEs into the RC, their passages through the RC, and merging in the eastern part of the Black Sea is also considered. The modeled space-time parameters of NAE evolution agree well with satellite observations. Effects of the protrusion and eddy detachment processes on the spreading of oil pollution along the Caucasian coast are discussed.