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Numerical Investigation of the Wind-Driven Turbulence and Cooling Process in the Black Sea

Diana Kvaratskhelia (1), Demuri Demetrashvili (2), and Khatuna Chargazia (3)

(1) M. Nodia Institute of Geophysics of Iv. Javakhishvili Tbilisi State University; Sokhumi State University, Tbilisi, Georgia (diana_kvaratskhelia@yahoo.com), (2) M. Nodia Institute of Geophysics of Iv. Javakhishvili Tbilisi State University, Tbilisi, Georgia (demetr_48@yahoo.com), (3) M. Nodia Institute of Geophysics of Iv. Javakhishvili Tbilisi State University; I.Vekua Institute of Applied Mathematics of I. Javakhishvili Tbilisi State University, Tbilisi, Georgia (Khatuna.chargazia@gmail.com)

The 3-D basin-scale z-level model of the Black Sea dynamics (BSM-IG, Tbilisi, Georgia) and several climatic dates customized on the model are applied to investigate the Black Sea upper mixed layer mean features in cold season formed due to the strong turbulence driven by wind. This model is probably one of the best instruments for more sophisticated estimation of the Black Sea mixed layer nature by means of the variable coefficients of vertical turbulent eddy viscosity and diffusion, which are nested in this model as a last version of original Pacanovsky -Philande parameterization developed by Bennis as far as this parametrization prevents numerical instabilities of the model within context of the gradient Richardson number. Besides, it allow us select the adjustable coefficient of Richardson number according to a sharply change of Richardson number, which in its turn, regulates the variable coefficient of the vertical turbulent viscosity and diffusion in the following diapasons 30 -70 cm^2s^{-1}, 5-15 cm^2s^{-1} during computing processes respectively.

The model integration started on the 1st of January and proceeded one year range from the time interval 342-436 hours January. The Black Sea UML depth variability is estimated using well known criteria of temperature 0.2 ^{0}c and sigma-t (Dsigma-0.125) .

As the numerical investigation shows: in wintertime when heat fluxes (with constant value) act maximally from the sea to the atmosphere the intense wind-driven turbulence promotes strong mixing. Mixed layer depths is changeable in the space of the Sea and time. The Ilustration of the quantitative difference of the simulated fields for both properties between Sea Surface and the upper 36 meter levels of the Sea allow us to distinguish the mixed layer in the Black Sea basin as several relatively homogeneous subzones, which have both qualitative and quantitative individual different thermal state and physical configurations.

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