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Numerical investigation of sensitivity of the Black Sea mixed layer to vertical turbulent diffusion processes

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The upper mixed-layer of seas and oceans is one of the important water areas, the thermodynamic state of which defines many important physical, chemical or biological processes in the sea- atmosphere environment. The same can be note concerning the Black Sea turbulent mixed layer, which represents the object of our investigation.

It is well known that the depth of the mixed layer is generaly determined by measurements of water properties: temperature and sigma-t (density) but here the depth of the mixed layer and its variability are investigated by using of the basin-scale numerical model of the Black Sea dynamics of M. Nodia Institute of Geophysics (BSM-IG, Tbilisi, Georgia).

The main object of this study is to investigate the Black Sea upper mixed–layer generation and its evolution in connection with the nonstationarity atmospheric circulation and thermohaline action in the inner-annual time scale. Besides, how the temperature and salinity fields of the Black Sea upper layer are substantially reacted by the vertical diffusion coefficient are the centre of our attention. Therefore, the coefficient of vertical turbulent diffusion for heat and salt are tested as constant equal to 10 cm2s-1 and it was parameterized by modified Oboukhov's formula.

The results of the numerical investigations show that: in wintertime for any choosing of this vertical diffusion coefficient the intense wind-driven turbulence promotes mixing aproximetly till 16-26 m in deep layers of the Black Sea. Except for that, cold fluxes through the surface and precipitation-evapuration system play aditionally role on the mixed layer forming as well. During the transitive spring season (in difference from the cold season), when the depth of the mixed layer is aproxometly 2-4 m., the role of vertical turbulent viscosity insignificantly grows. In the warm season (summer), when the mixed layer does not observe in the upper layer of the Black Sea, the role of the vertical diffusion coefficient is more visible reflected on the forming of the temperature fields than salinity fields. From September is being tendency to forming new mixed layer, which grows and its depth approaches 8-12 m in middle October for any choosing of the vertical diffusion coefficient .
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