THE MODEL AND NATURE RESULTS FOR PLUME FRONT OFF THE DARDANELLES

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On the basis of nature data and high resolution two-dimensional thermohydrodynamic model the plume front off the Dardanelles is studied. The complete system of Reynolds hydrodynamic equations with nonlinear terms and the terms for turbulent exchange is used. The system is solved numerically using a special small-scale grid. The typical temperature and salinity distributions to the fall of the Marmara Sea and the Aegean Sea are adopted as the initial conditions. The real bottom relief is used. The water mass discharge through the Dardanelles is determined. At the first stage the solution is derived in the absence of wind and for the sea at rest.

The movement of the plume slows down with time. After 4 days the thermohaline front was about 28 km off the Dardanelles. The temperature and salinity gradients across the front were 1.0°C/km and 1.6 psu/km, respectively. Numerous observations showed that a position of plume front depends essentially on wind activity. Its location may be different in a short time. With south-westward winds blowing the locking effect is often observed. This situation was simulated at the second numerical experiment. The wind speed was 7 m/s, and such wind blowing for one day. After wind forcing the frontal interface was displaced to a distance of about 8-10 km near a mouth of strait.

Due to the Marmara Sea water discharge and opposite-oriented drift circulation (induced by south-westward wind) a complicated thermohaline structure of waters within the subsurface layers is being thereby generated. The front became sharp and the thermal and salinity gradients increased. Besides, in the area of interaction of differently-oriented flows the thermohaline intrusions formed.

During the next days following the cessation of wind forcing, the structure of the plume frontal zone was evolving. Notwithstanding the termination of the locking wind, the sharpness of the front did not alter. Residual effects of the wind forcing, in the form of a "two-cell" pattern of drift circulation, are readily visualized in the vertical transect of the horizontal current component. Because of the delay intrinsic to the system, currents directed towards one another in upper layer facilitate a collision of two different water masses. This results in the formation of a very narrow frontal interface, about 600-800 m in width, with large gradients in both the salinity field and the temperature field, with the layering of waters continueing. The latter fact is confirmed by the occurrence of separate lenses in the lower strata, having closed salinity/temperature isolines, however, at different ranges from the front.

The north-easterly wind blowing from the Dardanelles during one day with the speed 7 m/s was used in the third numerical experiment. Here, under the impact of a wind-induced drift current an increase of the frontal zone width and formation of an isolated lens in the salinity field (detached from the main front and transported by the residual drift current) is observed. Further evolution of the thermohaline fields within the frontal zone results in the formation of a new front 20-25 km away from the strait. Similar to the results of the previous numerical experiment, the thermohaline structure of waters in the subsurface layers incorporating a system of inversions and intrusions is very complex. Such phenomena were documented regularly *in situ*.

In general, the model shows detailed vertical and horizontal physical features of the Dardanelles front. A comparison of model results and data of nature observations shows their similarity.

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