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MIXING PROCESSES IN THE GORLO STRAIT OF THE WHITE SEA

G.I. Shapiro (1,2), L.Latche(1) and A.N.Pantiulin(3)

(1) Institute of Marine Studies, University of Plymouth, PL4 8AA, UK; (2) Shirshov Institute of Oceanology, Moscow, Russia; (3) Moscow State University, Russia (gshapiro@plymouth.ac.uk)

This paper presents comprehensive analysis of 3D water mass structure in the Gorlo strait and adjacent regions of the White Sea Basin and Dvina Bay. Measurements were conducted from 17 to 21 June 2000 and covered the region where water masses from the Basin, Dvina Bay and Gorlo strait come into contact. Strong tides and shallow and ragged bottom topography intensify the mixing process there. Observations consisted of a dense grid of 50 CTD stations with typical distance between stations being 3-6 km. Although large scale water mass structure in the White Sea has been studied previously, this study gives much more details of the mesoscale water structure and mixing process due to dense grid of stations and high vertical resolution.

The 'source current' brings waters from Voronka, where it is well mixed due to intensive tidal mixing, into the Gorlo strait. Influence of the Dvina Bay gyre and the adjacent Tersky Coastal Current are evident from the intrusion of colder Gorlo Strait Water (GSW) into the western end of the Gorlo strait along the Tersky Coast in the north. In the central part of the study area, the measurements reveal a mesoscale patch (lens) of the White Sea Surface Water (WSSW), which is surrounded by colder (GSW) from the north and a mixture of GSW / Dvina Bay Water(DBW) in the south. Despite it has a diameter of only 7-8 km and the thickness of 8-10 m, the lens core is well defined and justified by measurements on four adjacent stations. The lens is separated by a sharp thermocline (drop in temperature by 6oC over 5m depth) from the underlying water.

Closer to the White Sea Basin, the core of the GSW is considerably reduced across the strait due to mixing caused by surrounding water masses. In the thin surface layer sharp gradients of temperature and salinity show a region of mixing between the DBW and GSW. Colder and more saline White Sea Intermediate Water (WSIW, -0.1 to -1ĎaC and below, 27.7 to 28.5 psu and more) occupies depth range below 25 m and is believed to be formed by previous winter cooling and salinisation due to incoming current from the Gorlo strait along the Tersky Coast.

The mixing area between WSSW and DBW concentrates in a narrow band not exceeding 5 km. The temperature front between warmer GSW and colder WSIW occupies the water column from 15-25 m down to the seabed. Frontal mixing takes place in a strip of 20-25 km width and coincides with the shallowest area on the transect. Resultant water mass leaks into the White Sea as thin intrusion at depth 15-25 m. Along its way the water mixes with the overlying DBW and WSSW, producing well-developed temperature and salinity inversions as well as quasi-homogeneous layers (steps).