

Features of water dynamics in semi isolated tidal estuary of the Kandalaksha Bay of the White Sea

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The Karelian coast of the White Sea has a numerous of firths of the small rivers, and because of the rugged shore coastline of these areas represent complex systems of interconnected reservoirs.

There are special features of dynamics of waters of semi isolated small tidal estuary because of tidal cycles and topography. These features influence on species of zooplankton which are focused on tidal cycles. Incompleteness of the description of physical processes and uncertainty in these direct observations both force us to use the combined method of a research of dynamics of waters in a tidal estuary.

Water exchange of tidal estuary (Keret Bay) with the White Sea is carried out through three straits. Podpakhta strait, together with a Lebyazya Bay, represents the water area closed from the sea, semi-isolated. Nearby semi-isolated passage Suhaya Salma is located, connected with the open sea only during spring tide. Tidal foreshore, high speed tidal currents and complex morphology important influences all hydrology of this type of straits and bays. Semi isolated small bay Sukhaya Salma is refreshing only during spring tide. At this bay we observed special sea level time series, different to nearby bays and straits. In complex hydrodynamic numerical simulations communities of hydrobionts considered, as usual, as passive impurity.

We have investigated tides in Keret Bay using complex approach, including analysis of in situ measurements (Smagin et. al, 2009; Ionov et. al, 2013; Ionov et. al, 2016), remote sensing (Krylov, 2014), and results of numerical simulations (Ionov et. al, 2015). Special fieldwork was carried out to measure in situ currents speed at different depth in 2015-2016. We have found contradirectional currents in different parts of Podpakhta strait. During the maximum tidal current in northern part of the strait current has southern direction and in the southern part northern direction. During an opposite tidal phase direction were on the contrary. This feature could be explained by considering Lebyazya Bay as accumulating reservoir for this complex system of adjoining straits and bays. During tidal level rise, filling of the reservoir will be carried out by streams of the waters arriving from the open sea and from the Keret Bay. With lowering of the level, we could see the opposite current system. M2 tidal wave has different phase in Keret Bay, Podpakhta strait and Lebyazya Bay (in the sum on two degrees). High tide should be observed in Podpakhta strait after 2 minutes and in Lebyazya Bay 4 minutes after high tide in Keret Bay. Numerical modelling showed that the current (up to 80 sm/sec) could be observed in south part of Podpakhta strait and up to 50 sm/sec in north part. We could assume there are three residual cyclonic gyres in this area. Obtained results were very similar to numerical model simulations, especially for residual tidal circulation.