Investigation of the dynamics and transport in the southern Baltic Sea with a numerical model and observations

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The Baltic Sea is the largest brackish water estuary in the world. Its hydrology is highly dependent on water exchange with the deep-sea upstream. Oxygen-reach water from the North Sea is the main source of Baltic Sea bottom waters, advected from one basin to another via channels. One of these channels is Slupsk Furrow, the only passage for salty water moving from the Arkona and Bornholm basins to Gdansk and Gotland Deep.

A three dimensional z-coordinate coupled ice-ocean model is used to investigate water circulation, and transport in the southern Baltic Sea. The model is based on the Bryan-Cox-Semtner model configured at two horizontal resolutions of about 9-km (1/12°) and 2-km (1/48°) and at 21 vertical levels. It consists of a regional adaptation of the Parallel Ocean Program (POP) developed at the Los Alamos National Laboratory coupled to a parallel version of the original Hibler dynamic-thermodynamic model with a viscous-plastic rheology. The model was forced using daily-averaged reanalysis and operational atmospheric data derived from European Centre for Medium-range Weather Forecast (ECMWF). A 9-year spin-up integration using 1979-1981 realistic forcing repeated 3 times was followed by a 1979-2000 interannual run. Results from the 22-year simulation are presented. Model is capable of simulating characteristic hydrographic features of the South Baltic and the model response to the atmospheric forcing is reasonable as well.

During many cruises in the region of South Baltic Institute of Oceanology Polish Academy of Sciences have made measurements using CTD and vessel mounted

Acoustic Doppler Current Profiler (VM-ADCP). Carefully calibrated measurements allow computing both baroclinic and total transports in Slupsk Furrow. Those results are compared with simulations results.