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An investigation of anticyclonic circulation in the southern Gulf of Riga during the spring period

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Previous studies of the gulf-type Region of Freshwater Influence (ROFI) have shown that circulation near the area of freshwater inflow sometimes becomes anticyclonic. Such a circulation is different from basic coastal ocean buoyancy-driven circulation where an anticyclonic bulge develops near the source and a coastal current is established along the right hand coast (in the northern hemisphere), resulting in the general cyclonic circulation. The spring (from March to June) circulation and spreading of river discharge water in the southern Gulf of Riga (GoR) in the Baltic Sea was analyzed based on the results of a 10-year simulation (1997-2006) using the General Estuarine Transport Model (GETM). Monthly mean currents in the upper layer of the GoR revealed a double gyre structure dominated either by an anticyclonic or cyclonic gyre in the near-head southeastern part and corresponding cyclonic/anticyclonic gyre in the near-mouth northwestern part of the gulf. Time series analysis of PCA and vorticity, calculated from velocity data and model sensitivity tests, showed that in spring the anticyclonic circulation in the upper layer of the southern GoR is driven primarily by the estuarine type density field. This anticyclonic circulation is enhanced by easterly winds but blocked or even reversed by westerly winds. The estuarine type density field is maintained by salt flux in the northwestern connection to the Baltic Proper and river discharge in the southern GoR.