



Long-term variations of hydrological and hydrobiological parameters in the southern Baltic Sea

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The long-term studies prove that over the last 40 year occurred essential changes of the hydrological and hydrobiological conditions in the southern Baltic Sea (Gdańsk Deep). Quantitative expression (a trigonometric polynomial of type:

$$V = V_0 + V_a (Yd - 1960) + V_b \sin(\omega \text{day} + a) + V_c \sin(2\omega \text{day} + b)$$

is presented describing the seasonal and long-term variations of the following parameters: water temperature, oxygen and phosphate concentrations on the selected layers and Secchi's depth. The curve V was averaged using the last squares method, where $Yd = \text{Year} + \text{day}/365$ (Yd = time in years; i.e. year + subsequent day of the year divided by 365), $\omega = 2\pi/365$.

The coefficients of this function were calculated on the basis of experimental data from the southern Baltic Sea for the Gdańsk Deep (Renk 2000). The measurements were carried out for the period 1960-1998. The tendency of the average water temperature to increase in the euphotic layer by $0.006^\circ\text{C year}^{-1}$ has been observed over the last 40 years (1960-1998), while the benthic water temperature has shown a tendency to decrease. Also, an increase in the oxygen concentration ($0.017 \text{ cm}^3 \text{ dm}^{-3} \text{ year}^{-1}$) and phosphate concentration ($0.0032 \text{ mmol PO}_4 \text{ m}^{-3}$) in surface water were observed for this period.

Assuming above conception for the last 40 years, the seasonal variations of surface

water temperature for 2000, 2050 and 2100 year were obtained. An increase in the average surface water temperature is 0.3°C over the next 50 years and 0.6°C over 100 years, i.e. at the beginning of March when the surface water temperature is the lowest, T is equal to 1.56°C in 2000, 1.85°C in 2050 and 2.13°C in 2100 year and in August when the surface water temperature is the highest, T is equal to 17.62°C in 2000, 17.91°C in 2050 and 18.19°C in 2100 year. Assuming four others conceptions, the simulations were carried out for different values of Ta : 1) the average annual rice in surface water temperature Ta is equal to 0.01°C , 2) the average annual rice in surface water temperature Ta is equal to 0.02°C , 3) the average annual rice in surface water temperature Ta is equal to 0.03°C , 4) the average annual rice in surface water temperature Ta is equal to 0.05°C .

The Secchi's depth (the water transparency) in the Gulf of Gdańsk varies periodically, reaching the highest values in winter and the lowest during periods of abundant phytoplankton vegetation. The tendency of Secchi disk visibility to decrease by about $0.07\text{-}0.11\text{ m year}^{-1}$ (i.e. 1-1.5% by year) has been observed over the last 40 years in the Southern Baltic Sea (open sea). Assuming above conception, the seasonal and long-term variations of the water transparency in the Gdańsk Deep was calculated. The long-term variations of the primary production, chlorophyll-a concentration and Secchi disk visibility in the southern Baltic Sea (Gdańsk Deep, Bornholm Deep, Gotland Deep) for the period 2000-2050 year were obtained according to conception for the last 40 years.