The CO_2 system variability in the vicinity of the Vistula River mouth

MARCIN STOKOWSKI*, ALEKSANDRA WINOGRADOW, BEATA SZYMCZYCHA AND KAROL KULIŃSKI

The Institute of Oceanology of the Polish Academy of Sciences, Powstańców Warszawy 55, 81-712 Sopot, Poland (correspodence: stokowski@iopan.pl)

Ocean Acidification (OA) is believed to be one of the greatest threats for nowadays marine ecosystems. In the Baltic Sea, the effect of OA is reduced due to the continuous increase of total alkalinity (TA), which counteracts the acidification effect. However, the source of that TA increase remains unclear. It has been found that continental rivers like Daugava, Vistula or Odra, carry significant loads of TA to the Baltic Sea as a consequence of eroding the limestone-rich drainage basin. They supply the coastal zone also with organic matter and nutrients driving both organic matter production and respiration, which shape the CO_2 system structure and potentially the final loads of the TA to the Baltic Sea.

The Vistula River is the second biggest river entering the Baltic Sea. The mean discharge of 1065 m^3 s^{-1} and high TA concentrations (>3000 µmol kg^{-1}) make the Vistula River likely the largest source of TA to the Baltic Sea. The aim of the study was to preliminary asses the short-therm influence of the Vistula River on the CO_2 system structure in the vicinity of the river mouth.

In October 2017, February 2018, March 2018, May 2018 and September 2018, three measurable parameters of the CO_2 system were investigated – TA, pCO_2 and pH, together with salinity, temperature and oxygen conncentration. The TA varied from 3474 to 1662 µmol kg^{-1} along the mixing zone in the Vistula River mouth. The linear TA-S relations suggest conservative mixing and reveal the river end-member seasonal variability between 3138 and 3631 µmol kg^{-1}. The pCO_2 showed the highest values of ~700 µatm in October 2017 and lowest of ~200 atm in May 2018. The inverse correlation to oxygen concentration suggests that pCO_2 fields are controlled by the biological activity in that region. The pH showed high seasonal variability (7.97-8.69), which was shaped by both, the pCO_2 and TA changes. For the first time, the Vistula River TA daily loads were quantified. They varied between 120 and 492 Mmol day^{-1} and were driven mostly by the oscillations in river runoff.