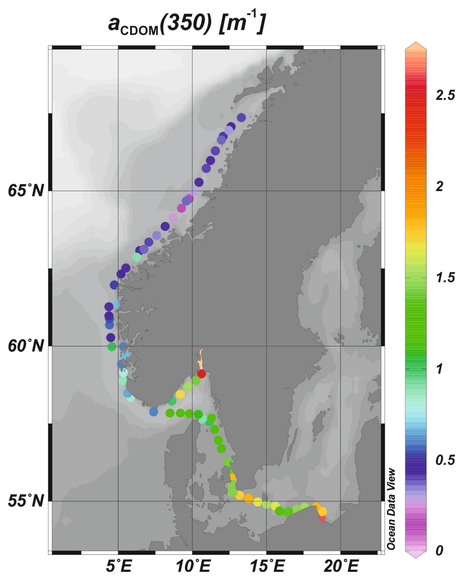
Assessment of Baltic Sea waters outflow impact on the spectral properties of CDOM absorption and fluorescence in the Norwegian Coastal waters.

Piotr Kowalczuk[1], Monika Zabłocka[1] Karolina Borzycka[1], Anna Raczkowska[1], Sławomir Sagan[1]

[1] Institute of Oceanology, Polish Academy of Sciences, ul. Powstańców Warszawy 55, PL-81-712, Sopot, Poland



The Baltic Sea acts as the major source of the fresh water to the North Sea. The fresh Baltic Sea brackish waters undergo rapid mixing in the Skagerrak and Kattegat, and are carried into North Sea by Norwegian Coastal Current. Optical properties of the Baltic Sea waters are dominated by absorption by Chromophoric Dissolved Organic Matter. The Dissolved Organic Matter fluorescence in the Baltic Sea water is dominated by the humic like compound of terrestrial origin. The aim of this study is to evaluate the maximal range of Baltic Sea water outflow based on spectral properties of CDOM absorption and DOM composition. The experimental material has been collected in the field surveys along the transect from Gdansk, Poland to Trømso, Norway. The CDOM absorption and Excitation Emission Matrices have been measured in the water samples collected during field surveys. In 2013, DOM fluorescence, FDOM, have been measured in situ along the ship track on the passage. The DOM composition was assessed using fluorescence spectroscopy, Excitation Emission Matrix spectra (EEMs) and the Parallel Factor Analysis (PARAFAC) model in addition to spectral indices calculated from CDOM absorption spectrum and EEMs. Both, CDOM absorption and FDOM were significantly correlated with salinity and indicated rapid mixing in the Danish Straits. The humic like EMMs components were decreasing along the salinity gradient at proportionally higher rate then protein-like components. The spatial distribution of the humic-like FDOM components suggest that terrestrial material outflowing from Baltic Sea reaches the Atlantic Ocean background level between 60-62 degree N.

CDOM HEAT

norway grants

POLISH-NORWEGIAN RESEARCH PROGRAMME

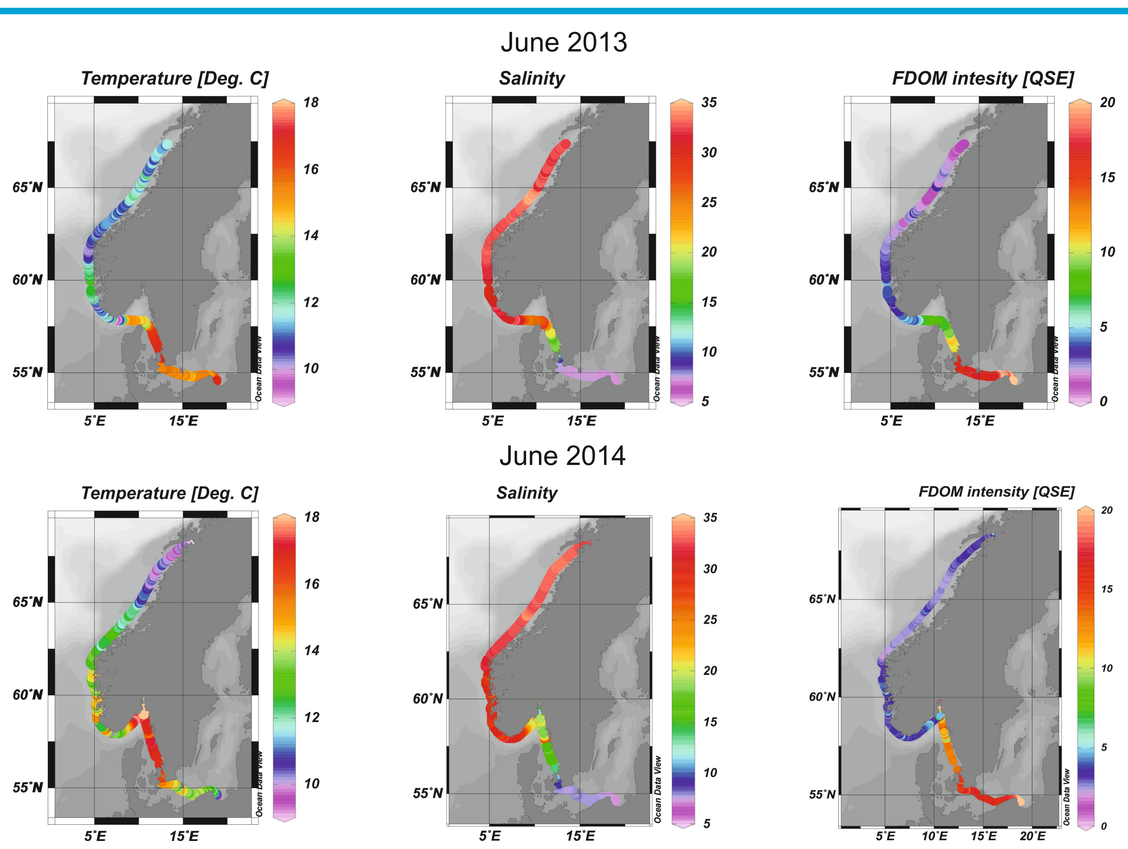


Figure 1. Distribution of temperature salinity and DOM fluorescence intensity measured along track of r/v Oceania passage from Gdańsk, Poland to Trømso, Norway in June 2013 and 2014. The DOM fluorescence was measured with use TRIOS microFlu_CDOM fluorometer (ex. 370 nm/em. 470 nm). Fluorescence intesity in QSE units.

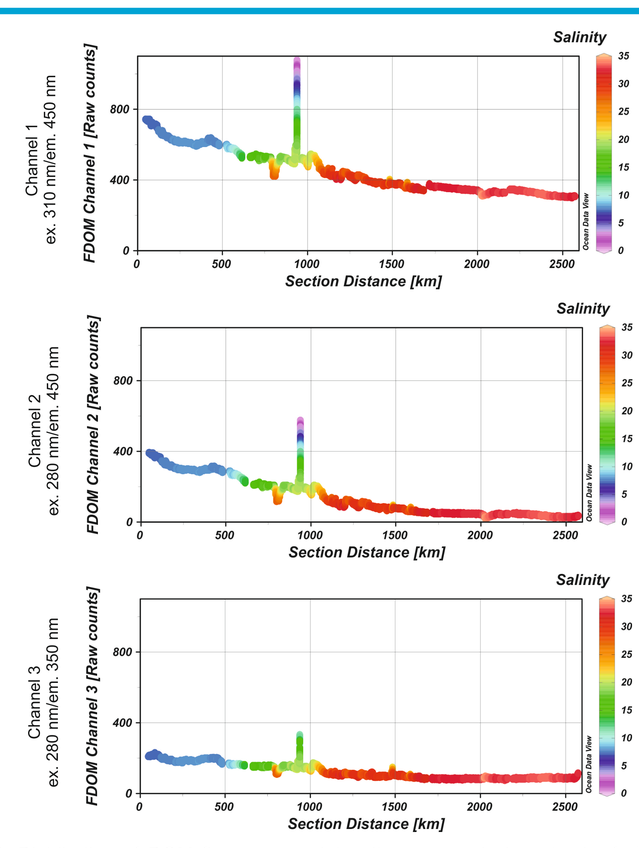


Figure 2. Distribution of DOM fluorescence intensity measured along track of r/v Oceania passage from Gdańsk, Poland to Trømso, Norway in June 2014. The DOM fluorescence was measured with use WetLabs WETStar 3 Channel CDOM fluorometer.

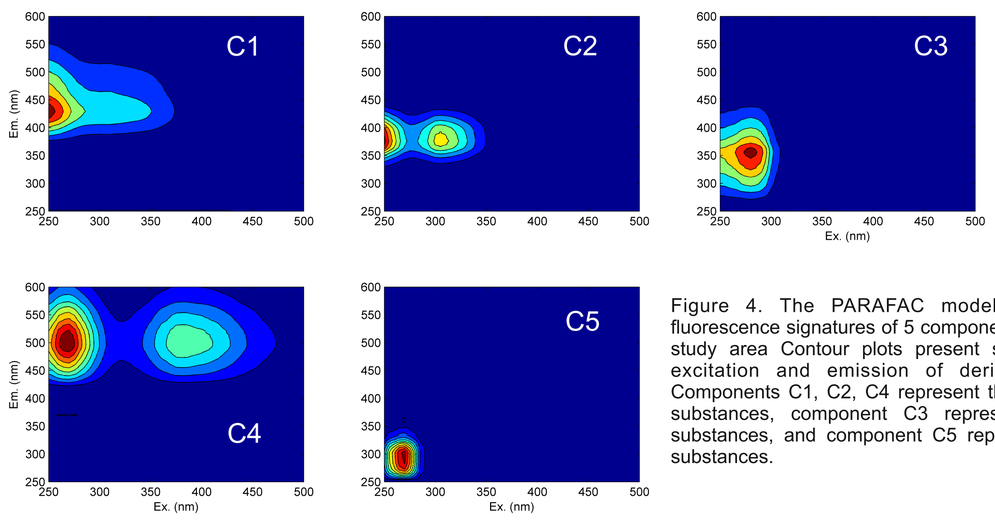
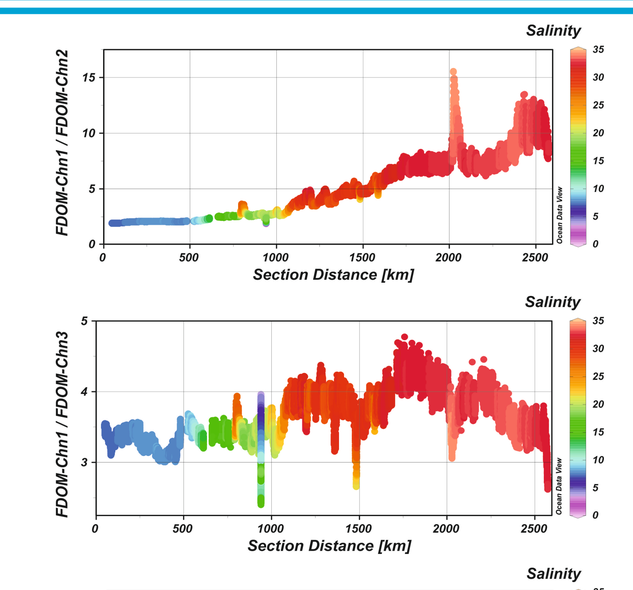


Figure 4. The PARAFAC model output showing fluorescence signatures of 5 components identified in the study area Contour plots present spectral shapes of excitation and emission of derived components. Components C1, C2, C4 represent the terrestrial humic substances, component C3 represent marine fulvic substances, and component C5 represents protein-like substances.



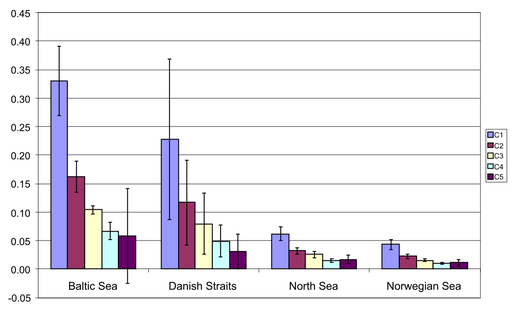
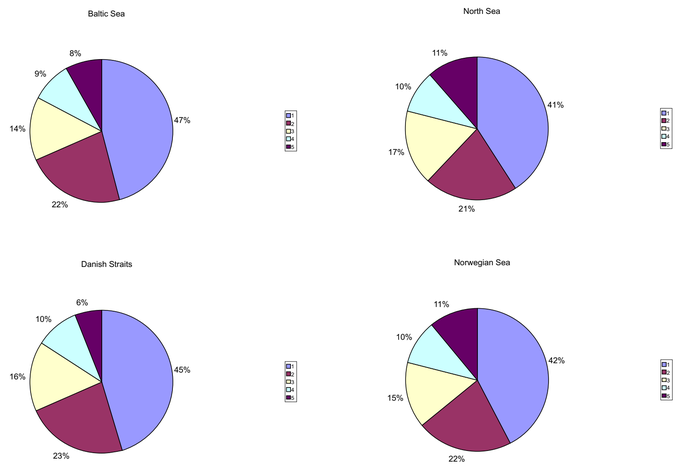


Figure 5. Dissolved Organic Matter composition is Baltic Sea, Danish Straits, North Sea and Norwegian Sea based on EEMs components identified by PARAFAC model.



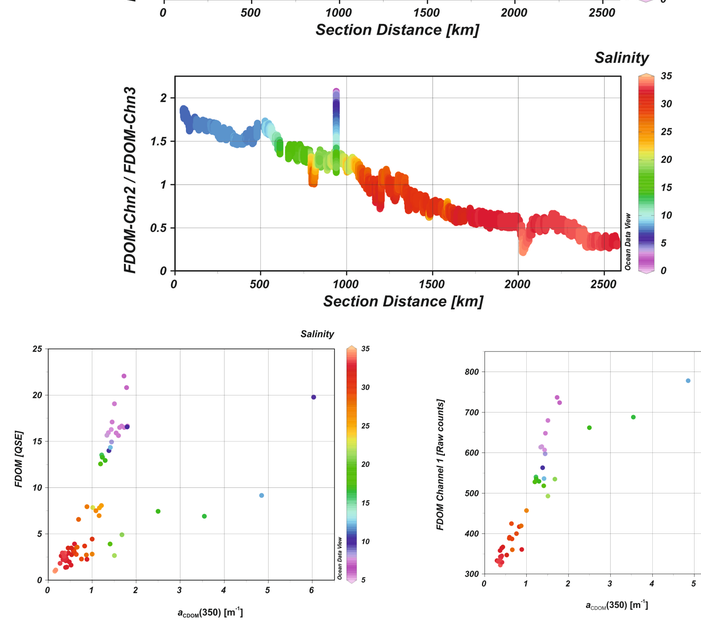


Figure 3. The relative change in DOM fluorescence intensity along the cruise track from Gdańsk, Poland to Tromso, Norway in 2014. The relationship between CDOM absorption coefficient $a_{CDOM}(350)$ and fluorescence intensities measured with use of TRIOS micro_Flu CDOM and WET Labs WETStar 3 fluorometers.

Acknowledgements: This study was financed by the project "Source and transformations of Chromophoric Dissolved Organic Matter and its role in surface ocean heating and carbon cycling in Nordic Seas and European Arctic"CDOM-HEAT funded from Norway Grants in the Polish-Norwegian Research Programme operated by the National Centre for Research and Development. Contract Pol-Nor/197511/40/2013. **PK, MZ, KB** and **SS** were patrially supported by the SatBałtyk project funded by the European Union through the European Regional Development Fund, (contract No. POIG.01.01.02-22-011/09 entitled 'The Satellite Monitoring of the Baltic Sea Environment') and the Research Grant no. UMO-2012/05/N/ST10/03648 awarded by Polish National Science Centre.