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Application of the in situ three channel WET Star fluorometer to characterize FDOM sources and determine water masses in the Nordic Seas

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Water masses exchange between the Atlantic Ocean and the Arctic Ocean occurs in Nordic Seas and this process represents a crucial component of the northern hemisphere climate system. Nordic Seas are dominated by Atlantic Waters (AW) and Polar Waters (PW) and water formed in the mixing process or local modifications like precipitation and sea-ice melt. Classification of water masses only on the basis of temperature, salinity or density not take into account different sources of fresh water in the Nordic Seas. In this study we propose that measured signal from the in situ three channel WET Star fluorometer could be a useful tool for characterization of dissolved organic matter (DOM) and refinement of water masses classification .
Spectral properties of Chromophoric Dissolved Organic Matter and Fluorescent Dissolved Organic Matter (CDOM and FDOM) were characterized in different water masses along a section across the Fram Strait at 79°N as well as in the Nordic Seas in 2014 and 2015. Observations of CDOM and FDOM were carried out with use of in situ three channel WET Labs WET Star fluorometer and Excitation Emission Matrix spectra (EEMs) measured in the water samples. The WET Labs WET Star three channels in situ fluorometer was designed to measure emission of humic and protein-like FDOM fractions. Instruments output was calibrated against respective fluorescence intensity of EMMs measured with use of Aqualog fluorometer (Horiba Scientific) at excitation and emission ranges corresponding to in situ fluorometer channels. The correctness of the calibration was confirmed by empirical linear relationship between WET Star in situ fluorescence intensities and aCDOM(350) derived from water samples. Measured WET Star fluorometer signal enabled to asses distribution of different FDOM fractions in the Nordic Seas. The distribution of humic-like fluorescence intensity in the function of salinity revealed three distinct mixing curves: the first indicates mixing between surface PW diluted by sea ice melt with core of PW from East Greenland Current, the second imply transition from PW to AW, the third curve is an indicator of modification of AW by sea ice melting in the area of Western and Northern Spitsbergen Shelf. Furthermore, fluorescence intensities of humic-like DOM fraction is very low and remains practically constant in the core of AW. In the AW there is a strong subsurface maximum of chlorophyll a fluorescence which was aligned with protein-like fraction of DOM. The linear relationship between phytoplankton fluorescence and fluorescence intensity of protein-like DOM fraction proved that phytoplankton was primary source of protein like fraction of DOM in the AW.