Spatial distribution of DOM absorption and fluorescence along Spitsbergen Shelf and in the Barents Sea

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Absorption spectra and induced fluorescence excitation emission matrices of colored dissolved organic matter (CDOM) were measured in water samples collected along the Spitsbergen Shelf in 2013 and 2014 and in the Barents Sea in 2014. In 2013 highest values of CDOM absorption coefficient at 350 nm ($a_{CDOM}(350)$) were observed in the western Spitsbergen Shelf and lowest in the northern part of Svalbard Archipelago. In 2014 highest values of $a_{CDOM}(350)$ were observed near Isfjorden and in the Barents Sea, lowest in the northern and southern part of Svalbard Archipelago. Distribution of absorption spectrum slope coefficient calculated in range 300-600 nm ($S_{300-600}$) was reversed compared to $a_{CDOM}(350)$. In 2013 highest values of the $S_{300-600}$ were observed in the northern part of Svalbard Archipelago and lowest in the western Spitsbergen Shelf. In 2014 highest values of the $S_{300-600}$ were observed in the southern part of Svalbard Archipelago and lowest in the western Spitsbergen Shelf and in the Barents Sea. The significant non-linear relationship between $a_{CDOM}(350)$ and $S_{300-600}$ was observed. Spatial distribution of $a_{CDOM}(350)$ in 2013 and its dependency from salinity suggest terrestrial input of DOM from Spitsbergen and weak relationship between $a_{CDOM}(350)$ and salinity across the Arctic Front in oceanic waters adjacent to the north-east Svalbard Archipelago. Preliminary five-component PARAFAC model was developed, based on measured Excitation Emission Matrix spectra (EEMs). The PARAFAC model identified fluorescence signatures of five components in the study area in 2013. Three components: C1, C2, C4 represent the terrestrial humic substances, component C3 represents marine fulvic substances, and component C5 represents protein-like substances. Spatial distribution of spectral indices and selected EEMs components were examined. Fluorescence intensity was measured in situ along ship track and in vertical profiles with use of the WET Labs WET Star three channels fluorometer. Depth distribution fluorescence intensity measured in three spectral channels in the section along main polygon axis (Nordkapp, Norway to Sorkapp, Spitsbergen) is presented.

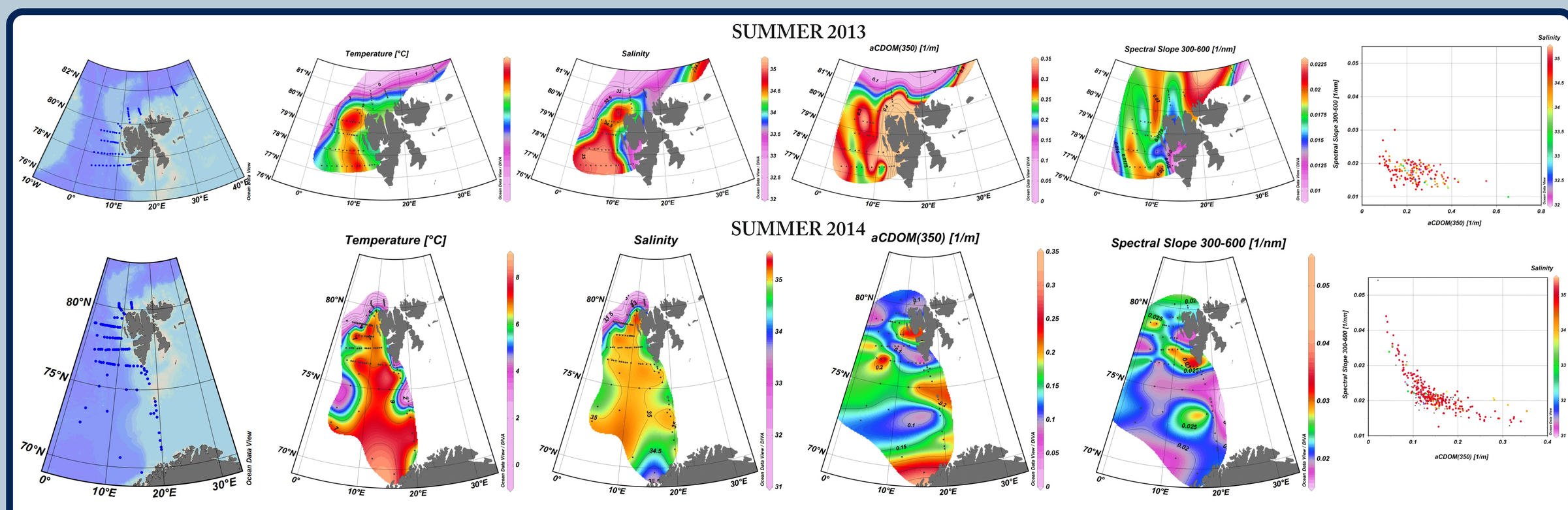

Figure 1. Spatial distribution of the temperature, salinity, $a_{CDOM}(350)$ and spectral slope coefficient 300-600 nm in the surface water layer measured in summer 2013 and 2014 on board research vessel r/v Oceania. The relationship between $a_{CDOM}(350)$ and spectral slope coefficient 300-600 nm measured in summer 2013 and 2014.

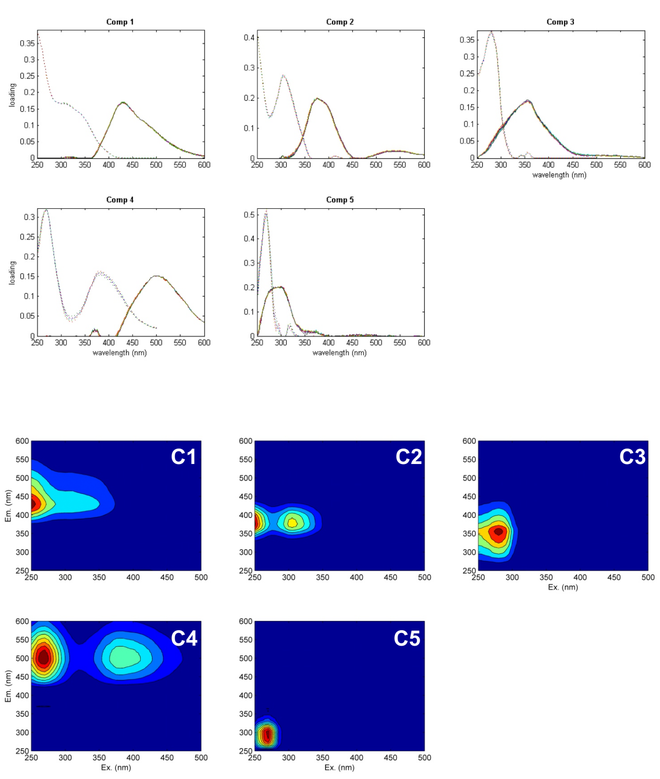

Figure 2. The PARAFAC model output showing fluorescence signatures of 5 components identified in the study area in 2013. Contour plots present spectral shapes of excitation and emission of derived components. Components C1, C2, C4 represent the terrestrial humic substances, component C3 represents marine fulvic substances, and component C5 represents protein-like substances.

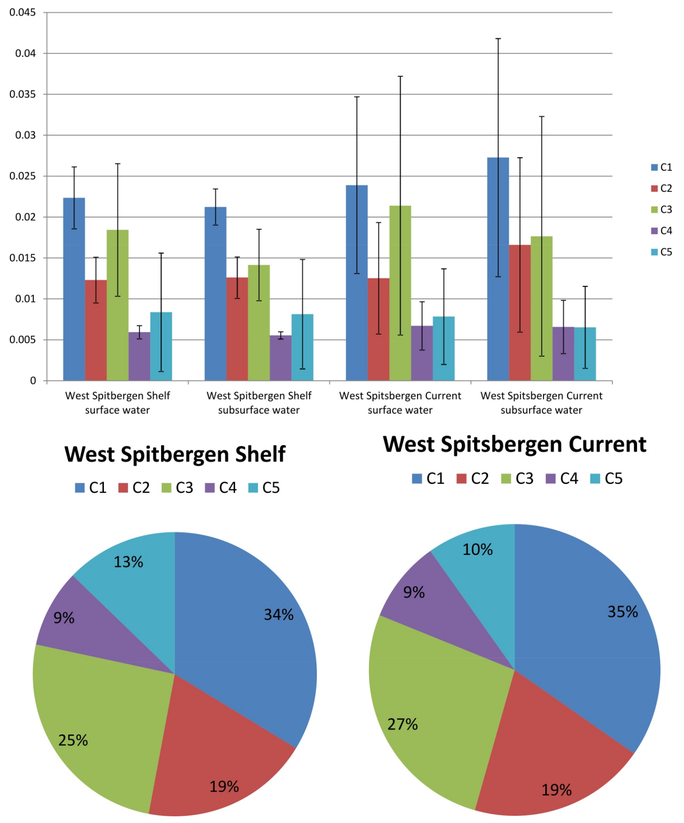

Figure 3. Dissolved Organic Matter composition in West Spitsbergen Shelf and West Spitsbergen Current surface and subsurface water based on EEMs components identified by PARAFAC model from data measured in 2013.

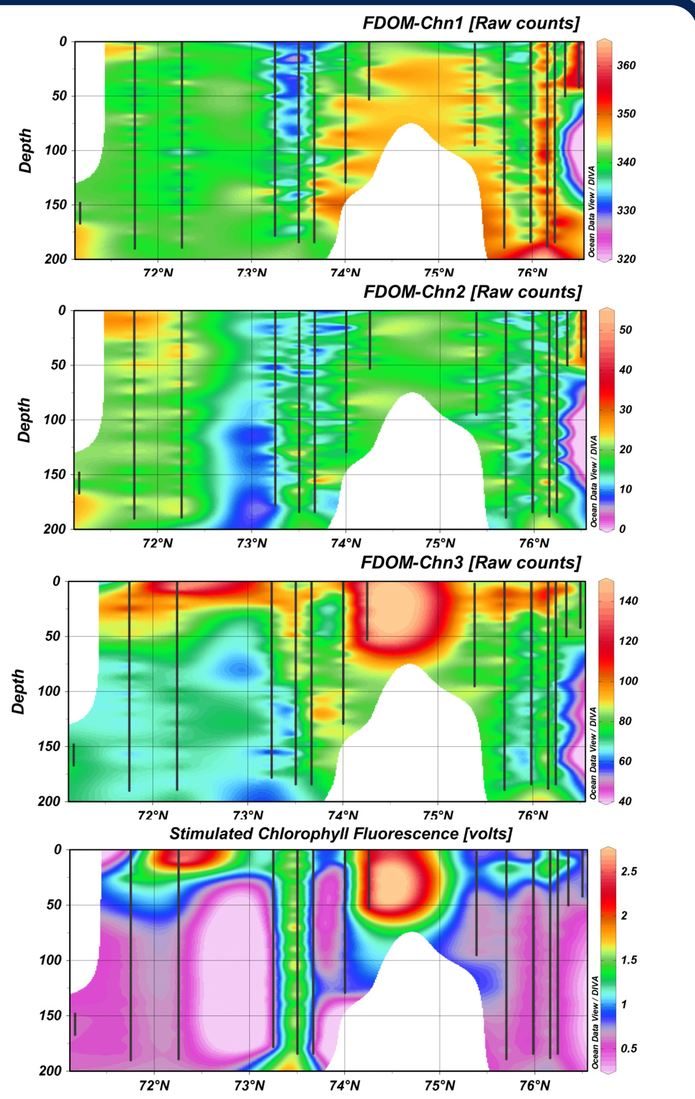

Figure 4. Depth distribution fluorescence intensity measured in three spectral channels in the section along main polygon axis (Nordkapp, Norway to Sorkapp, Spitsbergen). Stimulated chlorophyll fluorescence measured with use TriOS chlorophyll-a fluorometer.

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