# Sector Sector Absorbance and Fluorescence of Dissolved Organic Matter in Nelson River Estuary, Hudson Bay ArcticNet



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### Introduction

Aquatic dissolved organic matter (DOM) is a complex mixture of soluble organic compounds derived from both terrestrial and aquatic sources. DOM plays an important role in the biogeochemistry of carbon, nitrogen and phosphorus and in the mobility and fate of inorganic and organic pollutants such as heavy metals. Colored DOM (CDOM) represents the light absorbing fraction of the DOM pool. The optical properties of DOM, and particularly its fluorescence properties, have been used to distinguish compositional characteristics and discriminate between terrestrial and marine DOM sources. Recent advances in fluorescence spectroscopy have resulted in the development of excitation emission matrix fluorescence (EEM). EEMs are obtained by concatenating successive emission spectra at a series of excitation wavelengths and can be used to discriminate among different fluorophore classes of terrestrial, autochthonous and anthropogenic origin according to their excitation/emission maxima [Coble, 1996; Guéguen et al., 2011].

This study presents absorbance and fluorescence measurements in Nelson River estuary in winter and summer, and in the Hudson Bay System (Hudson Bay, Hudson Strait and Foxe Strait) with an emphasis on the interior domain.

#### Materials and methods

DOM samples were collected in Nelson River estuary during ice covered conditions (March 2009) and open waters (July/August 2007, July-August 2009 and July 2010). A more comprehensive survey of the interior domain was undertaken in July 2010 (see map). Seawater samples were collected from Niskin bottles mounted on a rosette together with a conductivity-temperature-depth profiler.



CDOM absorbance measurements were made on a Shimadzu UV 2550 spectrophotometer in the region 260-700 nm with a 1 cm guartz cuvette using Milli-Q water as a reference. Emission-excitation matrix (EEM) fluorescence was measured using a Fluoromax-4 Jobin Yvon fluorometer (Ex/Em 260-460/300-600nm). The fluorescence intensity was normalized to the area under the Milli-Q water Raman peak [Lawaetz and Stedmon, 2009] and reported in equivalent water Raman units (r.u.).Fluorescence EEMs were modeled using parallel factor analysis (PARAFAC) which decomposes complex mixtures of CDOM fluorophores into their main components (i.e. humic-like and proteinlike) [Stedmon et al., 2003; Guéguen et al., 2011].





Fig.1: Dissolved organic carbon (DOC) concentration and absorption coefficient at 355 nm (a255) as a function of salinity in Nelson River estuary. Despite higher a355 and DOC values in winter, the slope of the a355-DOC relationship is comparable in both seasons (p < 0.05), reflecting similar contribution of CDOM in the Nelson River system.

## II- CDOM and water masses in the Hudson Bay System

	Depth [m]	Salinity [PSU]	Temperature [℃]	DOC [ppm-C]	a <sub>355</sub> [m <sup>-1</sup> ]
surface	4 ± 3	$27.23 \pm 2.58$	6.56 ± 2.66	1.43 ± 0.29	
HBSSW	32 ± 18	30.24 ± 1.33	-0.09 ± 2.01	1.31 ± 0.37	0.59 ± 0.26
HBWSW	75 ± 34	$32.49 \pm 0.35$	-1.36 ± 0.17	0.99 ± 0.11	0.34 ± 0.07
HBIW	135 ± 20	$33.10 \pm 0.04$	-1.39 ± 0.13	$0.89 \pm 0.08$	$0.31 \pm 0.04$
HSBW	166 ± 18	$33.22 \pm 0.07$	-1.43 ± 0.05	1.37 ± 1.14	0.31 ± 0.03

Table 1: Characteristics of water masses found in Hudson Bay. The DOC and a355 values are significantly higher in Hudson Bay Summer Surface Water (HBSSW) than in Hudson Bay Summer Surface Water (HBWSW).





C1

C2 C3



Fig.2: Contour plots of a355 and terrestrial humic-like fluorescence in estuarine surface waters. Isohalines 17 PSU and 25PSU are superimposed on map contours to highlight the similarity in distribution pattern with absorbance and fluorescence properties of DOM.

#### III- CDOM and spatial distribution



Fig.4: Spatial distribution of terrestrial humic-like C1+C2 in surface (<10m) and winter surface waters (HBWSW). Strong terrestrial signal was confined to coastal regions whereas the interior domain shows very little spatial differences.

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