Abstract

The Kolyma River in Northeast Siberia is among the six largest arctic rivers and drains a region underlain by vast deposits of Holocene-aged peat and Pleistocene-aged loess known as yedoma, most of which is currently stored in ice-rich permafrost throughout the region. These peat and yedoma deposits are important sources of dissolved organic matter (DOM) to inland waters that in turn play a significant role in the transport and ultimate remineralization of organic carbon to CO_2 and CH_4 along the terrestrial flow-path continuum. The turnover and fate of terrigenous DOM during offshore transport will largely depend upon the composition and amount of carbon released to inland and coastal waters. Here, we measured the optical properties of chromophoric DOM (CDOM) from a geographically extensive collection of waters spanning soil pore waters, streams, rivers, and the Kolyma River mainstem throughout a ~250 km transect of the northern Kolyma River basin. During the period of study, CDOM absorbance values were found to be robust proxies for the concentration of DOM, whereas additional CDOM parameters such as spectral slopes (S) were found to be useful indicators of DOM quality along the flow-path. In particular, CDOM absorption at 254 nm showed a strong relationship with dissolved organic carbon (DOC) concentrations across all water types ($r^2 = 0.958$, $p<0.01$). The spectral slope ratio (S_R) of CDOM demonstrated statistically significant differences between all four water types and tracked changes in the concentration of bioavailable DOC, suggesting that this parameter may be suitable for clearly discriminating shifts in organic matter characteristics among water types along the full flow-path continuum across this landscape. The heterogeneity of environmental characteristics and extensive continuous permafrost of the Kolyma River basin combine to make this a critical region to investigate and monitor. With ongoing and future permafrost degradation, peat and yedoma deposits throughout the Northeast

Résumé des commentaires sur bg-2015-316-manuscript-version1 IL commented.pdf

Page : 2

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:40:55

There are too few main results provided in the abstract. For example the + or - 4% of DOM that was found to be bioavailable (and the absence of a trend onlong the continuum) is a fundamental discovery. Also interesting is the evidence of increased photolysis. And there are a few other points that could be put forward, at the expense of the usual general blabla.

biological processes within streams alter the transport of organic matter to downstream ecosystems (e.g., Webster and Meyer, 1997), but the fate of terrestrial organic matter in arctic streams and rivers has only more recently been explored (e.g., Frey and Smith, 2005; Neff et al., 2006; Holmes et al., 2008; Denfeld et al., 2013; Spencer et al., 2015). Furthermore, a variety of conceptual and pragmatic issues complicate the study of arctic rivers, including: (i) large seasonal variations in discharge accompanied by large seasonal variations in nutrient and organic matter inputs from rivers to the coastal ocean (e.g., McClelland et al., 2012); (ii) the heterogeneity of vegetation, permafrost extent, topography, and soil attributes within arctic watersheds (e.g., Frey and McClelland, 2009); and (iii) spatial and temporal inaccessibility hindering comprehensive sampling; among others.

Hydrologic flow-paths and organic matter transport in arctic regions dominated by permafrost are markedly different than temperate regions with well-drained soils. In particular, permafrost-dominated watersheds lack deep groundwater flow-paths owing to the permafrost boundary in soil that prevents deep groundwater movement (Judd and Kling, 2002; Frey et al., 2007). As a result, the delivery of terrestrial-permafrost organic matter to aquatic ecosystems may in fact lack significant terrestrial or groundwater processing. Once dissolved organic matter (DOM) enters aquatic ecosystems, multiple processes remove DOM from the water column: (i) photochemical reactions, where DOM is degraded to CO_2 or to compounds bioavailable for bacterial uptake (Moran and Zepp, 1997; Cory et al., 2014); (ii) loss via aggregation of DOM owing to changes in ionic strength when freshwater mixes with sea water (Sholkovitz, 1976); (iii) DOM sorption to particles (Chin et al., 1998); and/or (iv) bacterial uptake and utilization of the bioavailable fraction (Bronk, 2002; Karl and Björkman, 2002; Mann et al., 2014; Spencer et al., 2015). Measurements of waters along a hydrologic flow-path may indeed give insight into

Page : 4

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:43:29

is there any papers on precipitation of DOM as a loss process before reaching seawater (when DOM forms microgels?), especially when there is large concentrations of DOM such as in the presence of thaw slumps?

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 13:16:06 -04'00'

There are so few studies on DOM photolysis in permafrost aquatic systems, I think it's worth citing (here or elsewhere) the paper by Laurion & Mladenov 2013, especially that it shows a slightly different trend as Cory et al., at least in terms of CO2 production

Nombre : 3 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-22 16:22:19 -04'00'

and sedimentation?

wetlands and allowing the water to slowly seep into the collection vessel. In shallow streams, less than 0.5 m in depth, samples were collected approximately midway below the surface and the bottom. In larger tributaries and rivers, samples were collected at a depth of ~0.5 m. Water samples were then filtered through precombusted (450°C for 6 hours) Whatman 0.7 μm GF/F filters in the field and stored in acid-washed HDPE bottles without headspace to minimize degassing and algal growth. Upon returning to the laboratory (typically within ~1 day), DOC samples were acidified with concentrated HCl to a pH of ≤2 and stored refrigerated and in the dark until analysis via high-temperature combustion using a Shimadzu TOC-VCPH Analyzer (within one month of collection). DOC was calculated as the mean of 3 to 5 injections with a coefficient of variance less than 2%.

We additionally conducted a series of organic matter bioavailability assays to assess the total and relative amounts of bioavailable DOC in soil, stream, and river environments. These assays relied upon 5-day biological oxygen demand (BOD) experiments, with methods similar to those in Mann et al. (2014). The Winkler titration method was used to measure initial (t=0) dissolved oxygen (DO) concentrations (i.e., in situ dissolved oxygen) after a 5-day incubation at 15°C using water collected in triplicate glass 300 mL BOD bottles, where bottles were kept in the dark in between measurements. BOD was calculated as the difference between DO concentrations at t = 0 and following incubation. We assumed 100% of DO consumed was converted to CO_2 via aerobic respiration and that the carbon source respired was DOM, where resulting BOD measurements were used an analog for bioavailable DOC. The Winkler method we used here has been used extensively and is attractive for a variety of reasons, including: (i) enabling DO to be measured with precision of 0.01 mg/L, thus low respiration rates can be accurately measured; (ii) allowing for convenient replication of assays within habitats; (iii)

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:48:39

(In line with referee 1 comment on oxygen content of water at start and during your incubations) Could there be chemical O2 consumption, especially from DOC-rich pore water? Was pore water oxic to start with? (upon in situ sampling) permitting experimental manipulation of standard bioassays (e.g., N and P amendments, photolysis experiments, alteration of initial microbial consortia, and temperature manipulation; (iv) helping to segregate the relative roles of water column and sediment processes; and (v) helping to inform more realistic ecosystem-level experiments that are much more laborious and time intensive.

In order to investigate the optical characteristics of the DOM in these samples, we additionally measured the ultraviolet-visible absorption spectra of CDOM from this broad collection of waters. CDOM absorbance was measured immediately after collection (within ~1 day) at the Northeast Science Station in Cherskiy using a using a Thermo Scientific GENESYS 10 UV/Vis Spectrophotometer across wavelengths 800–200 nm (1 nm interval) using a 1 cm quartz cuvette. All sample spectra were blank corrected and referenced against Milli-Q water (18 Ω). Measurements were made after samples had equilibrated to laboratory temperature in order to minimize temperature effects. CDOM absorbance was assumed to be zero across wavelengths greater than 750 nm and the average absorbance between 750 nm and 800 nm was subtracted from each spectrum to correct for offsets owing to instrument baseline drift, temperature, scattering, and refractive effects (Green and Blough, 1994; Helms et al, 2008). CDOM absorption coefficients were calculated as:

$$a(\lambda) = 2.303A(\lambda)/l \qquad (1)$$

where a is the Napierian absorbance coefficient (m^{-1}) at a specified wavelength (λ, in nm), $A(\lambda)$ is the absorbance at the wavelength, and l is the cell path length in meters (Green and Blough, 1994). Several samples with the highest CDOM concentrations (primarily the soil pore waters) were diluted with Milli-Q water before analysis to avoid saturation of the spectra at short wavelengths, where the final CDOM absorbance values were corrected for these procedures.

Page : 8

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 14:04:16 -04'00'

how if only water is incubated in BOD?

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 13:52:21 -04'00'

I guess in separate bottles where no acidification was done? (i.e. not the same as DOC)

Nombre : 3 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:50:33

isn't this the same?

Nombre : 4 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:51:04

this is called null-point adjustment

Nombre : 5 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 14:08:45 -04'00'

what was the criteria for diluting? ABS<X at Xnm

CDOM spectral slopes (S, nm^{-1}) between 290–350 nm ($S_{290–350}$), 275–295 nm ($S_{275–295}$), and 350–400 nm ($S_{350–400}$), calculated within log-transformed absorption spectra, were also utilized to investigate DOM characteristics of contrasting water types, and were calculated as:

$$a(\lambda) = a\,(_{\lambda ref})\; e^{-S\,(\lambda\,-\,\lambda ref)} \qquad (2)$$

where $a(\lambda)$ is the absorption coefficient at a specified wavelength, λ_{ref} is a reference wavelength, and S is the slope fitting parameter (Hernes et al., 2008; Helms et al., 2008; Spencer et al., 2009a). All slopes are reported here as positive values, such that higher (i.e., steeper) slopes indicate a greater decrease in absorption with increasing wavelength. Additional CDOM parameters investigated here include the spectral slope ratio (S_R), calculated as the ratio between $S_{275–295}$ and $S_{350–400}$; the ratio between CDOM absorbance at 250 nm and 365 nm (a_{250}:a_{365}); and specific UV absorbance ($SUVA_{254}$), determined by dividing UV absorbance at 254 nm by the sample DOC concentration and reported in units of L mg C^{-1} m^{-1} (Weishhar et al., 2003). These six CDOM parameters ($S_{290–350}$, $S_{275–295}$, $S_{350–400}$, a_{250}:a_{365}, $SUVA_{254}$, and S_R) have been shown to provide insights for various DOM characteristics such as molecular weight, source waters, composition, age, and aromatic content for a variety of geographic regions (e.g., Weishaar 2003; Neff et al., 2006; Helms et al., 2008; Spencer et al., 2008; Spencer et al., 2009a; Spencer et al., 2009b; Mann et al., 2012).

3. Results

Total DOC concentrations (and the variance among values within each water type) decreased markedly downstream along the flow-path continuum from soil pore waters to the Kolyma River mainstem (Figure 2a). Mean (±1 standard deviation) DOC values were 33.35 ± 22.79 mg L^{-1} (soil pore waters), 11.63 ± 2.97 mg L^{-1} (streams), 4.89 ± 1.61 mg L^{-1} (rivers), and

Page : 9

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 16:06:00 -04'00'

I suggest you consider applying Loiselle method for spectral slope calculations in the future, to avoid any effects of slope variations within the chosen wavebands, and more importantly to generate the spectral slope signature which has the potential to bring even more insights. Moreover, the use of a linear fit on log-transformed data could be problematic as it does not give the same weight to all data over the waveband

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 14:17:21 -04'00'

please be careful thoughout the ms to distinguish between absorption coefficients (a) and absorbance (A). As you know, SUVA254 for example is calculated with A while other indices could be with a (for ex. apparently your a250:a365)

Nombre : 3 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 14:21:33 -04'00'

does the second digit really mean something considering analytical errors?

3.61 ± 0.41 mg L^{-1} (mainstem waters). Soil pore waters, in particular, showed highly variable DOC concentrations (ranging from 13.19 to 64.74 mg L^{-1}) demonstrating the heterogeneous supply of DOM from terrestrial systems to streams. By contrast, DOC concentrations in the Kolyma mainstem along the ~250 km stretch sampled were remarkably similar (ranging from 2.97 to 4.36 mg L^{-1}) during this mid-summer July period (Figure 2a). Furthermore, DOC concentrations of the four water types sampled were found to be significantly different from one another (two-sample t-tests, $p<0.05$).

Concentrations of bioavailable DOC showed similar patterns to DOC, declining downstream along the flow-path continuum with increasing water residence time in the system (Figure 2b). Bioavailable DOC concentrations averaged 0.93 ± 0.24 mg L^{-1} (soil pore waters), 0.33 ± 0.15 mg L^{-1} (streams), 0.27 ± 0.17 mg L^{-1} (rivers), and 0.16 ± 0.15 mg L^{-1} (mainstem waters), and showed relative greater variability than DOC within the stream, river and mainstem water types. Concentrations of bioavailable DOC in soil pore waters were statistically different from the other three water types (two-sample t-tests, $p<0.05$), although by contrast, streams, rivers, and mainstem waters were not statistically different from one another ($p<0.05$). Importantly, the percentage of bioavailable DOC (i.e., calculated as the amount of bioavailable DOC divided by total DOC) did not significantly decrease downstream (two-sample t-tests, $p<0.05$) and showed relatively similar values among the four water sample types along the flow-path continuum (Figure 2c), where percentages averaged 3.93 ± 3.81% (soil pore waters), 3.21 ± 1.94% (streams), 6.23 ± 4.31% (rivers), and 4.46 ± 4.55% (mainstem waters).

CDOM absorption spectra (200–800 nm) showed clear separation between soil pore waters, streams, rivers, and the Kolyma mainstem, where soil pore waters exhibited values markedly higher than the other three water sample types (Figures 3a). CDOM absorption also

Page : 10

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 14:27:01 -04'00'

an ANOVA would be better suited to test the "water type" effect all at once instead of pair by pair

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 15:16:02 -04'00'

then I guess you mean >

clearly declined downstream from streams, rivers, to mainstem waters when assessing those waters only (Figure 3b). Furthermore, we investigated the potential for utilizing CDOM absorption as a proxy for DOC concentrations in these waters. Our data revealed that independent of water type along the stream-river-mainstem flow-path, CDOM absorption was strongly linearly correlated to DOC concentrations at 254, 350, and 440 nm (Figure 4). In particular, CDOM absorption at 254 nm had the highest predictive capability of DOC (r^2 = 0.958, p<0.01), with CDOM absorption at 350 nm (r^2 = 0.855, p<0.01) and 440 nm (r^2=0.667, p<0.01) less strongly predictive (Figure 4).

We additionally investigated the quantitative distribution of the six derived CDOM parameters ($S_{290–350}$, $S_{275–295}$, $S_{350–400}$, a_{250}:a_{365}, SUVA$_{254}$, and S_R) across the four water types (Figure 5). In general, four parameters ($S_{290–350}$, $S_{275–295}$, a_{250}:a_{365}, and S_R) showed an increasing pattern along the flow-path continuum, whereas two parameters ($S_{350–400}$ and a_{250}:a_{365}) showed a decreasing pattern. Spectral slope and other CDOM parameters for soil pore waters, streams, rivers, and mainstem waters averaged: (a) 15.35 × 10^{-3} nm^{-1}, 17.08 × 10^{-3} nm^{-1}, 17.17 × 10^{-3} nm^{-1}, and 18.10 × 10^{-3} nm^{-1}, respectively, for $S_{290–350}$ (Figure 5a); (b) 15.27 × 10^{-3} nm^{-1}, 17.39 × 10^{-3} nm^{-1}, 17.79 × 10^{-3} nm^{-1}, and 18.57 × 10^{-3} nm^{-1}, respectively, for $S_{275–295}$ (Figure 5b); (c) 18.65 × 10^{-3} nm^{-1}, 18.89 × 10^{-3} nm^{-1}, 18.19 × 10^{-3} nm^{-1}, and 17.50 × 10^{-3} nm^{-1}, respectively, for $S_{350–400}$ (Figure 5c); (d) 5.47, 6.44, 6.27, and 6.53, respectively, for a_{250}:a_{365} (Figure 5d); (e) 3.52 L mg C^{-1} m^{-1}, 2.94 L mg C^{-1} m^{-1}, 2.77 L mg C^{-1} m^{-1}, and 2.56 L mg C^{-1} m^{-1}, respectively, for SUVA$_{254}$ (Figure 5e); and (f) 0.82, 0.92, 0.98, and 1.06, respectively, for S_R (Figure 5f). In terms of whether the values of the six parameters were statistically significantly different among water sample types, two-sample t-tests (at the 0.05 level) revealed inconsistent results. Most commonly, soil pore waters were statistically different from all other water types for four of the

Nombre : 1	Auteur :	Sujet : Commentaire sur le texte	Date : 2015-12-21 11:52:48

I guess you mean SUVA254??

Nombre : 2	Auteur :	Sujet : Commentaire sur le texte	Date : 2015-12-21 11:53:03

give this in a table instead, but here you could highlight the most interesting differences or averages that you will be discussing (if any is discussed) parameters ($S_{290–350}$, $S_{275–295}$, a_{250}:a_{365}, and S_R), but no consistent pattern was observed in significant differences across other water types. However, the spectral slope ratio (S_R) was the only parameter of the six that showed statistically significant differences between all four water types (p<0.01).

Lastly, we examined the relationships between CDOM optical properties and DOM bioavailability. To this end, we performed linear regressions between all six of our derived CDOM parameters and bioavailable DOC concentrations to determine the strength of their ability to predict bioavailable DOC. Our results indicated that five of the CDOM parameters ($S_{290–350}$, $S_{275–295}$, a_{250}:a_{365}, $SUVA_{254}$, and S_R) were statistically significant predictors at the 0.05 level (Table 1). In particular, S_R showed the strongest relationship with bioavailable DOC concentrations (r^2 value = 0.45, p<0.01). The relationship between bioavailable DOC concentrations and S_R (Figure 6) showed a distinct negative trend (bioavailable DOC mg L^{-1} = -2.204(S_R) + 2.518), with the highest bioavailable DOC concentrations and lowest S_R values for soil pore waters, and lowest bioavailable DOC concentrations and highest S_R values for Kolyma River mainstem waters. We found a clear gradation in the relationship between S_R and bioavailable DOC down the flow-path continuum, as one would also expect by examining these parameters individually (e.g., Figures 2b, 5f). In summary, not only was S_R the only CDOM parameter that showed statistically significant separation between all four water types examined, but it also had the strongest relationship when compared with concentrations of bioavailable DOC.

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:53:28

would it be more valuable to use stepwise regressions?

4. Discussion and Conclusions

In this study, we present a full suite of DOC, bioavailable DOC, and CDOM parameters throughout the permafrost-dominated Kolyma River basin in Northeast Siberia with the purpose of helping to elucidate the processing of DOM along a full flow-path continuum from soil pore waters to the mainstem. Our findings show that average concentrations of DOC and bioavailable DOC generally decrease as waters travel downstream from soil pore waters, streams, rivers, and ultimately to the Kolyma River mainstem. This pattern suggests the occurrence of rapid in-stream processing of DOM and potential remineralization of DOC to atmospheric CO_2 during this July baseflow period well before these waters reach the Arctic Ocean (e.g., Denfeld et al., 2013, Spencer et al., 2015, Mann et al., in press). In general, the river continuum concept predicts that relative diversity of organic molecules decreases from the headwaters to the river mouth (Vannote et al. 1980). As energetically favorable compounds are converted to living tissue or respired as CO_2, bulk DOM in the Kolyma basin has indeed been shown to become less diverse moving from headwaters to mainstem waters before exported to the Arctic Ocean (Spencer et al. 2015).

Despite these downstream shifts in DOM composition however, we find a relatively constant proportion of DOC that was bioavailable (~4.4% total DOC averaged across all samples) regardless of relative water residence time. This suggests that continual microbial processing of organic matter occurs over similar rates during transit from headwaters throughout the Kolyma River drainage network to the Arctic Ocean concurrent with ongoing downstream CDOM compositional changes. Microbial demand in headwater streams of the Kolyma River basin is subsidized by significant quantities of DOC specifically derived from permafrost and aged soils, yet the proportion of permafrost supporting DOC mineralization declines as waters

Page : 13

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:54:28

(In line with referees 1 & 2) What is the residence time (or transit time) of the water from soil to mainstem?

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 16:47:45 -04'00'

you found in average 3-6% of total DOC putatively lost to remineralization; worth discussing that it's only a small fraction that is remineralized. It's only this fraction that is remineralized "well before waters reach the Arctic Ocean", right?

Nombre : 3 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 16:49:17 -04'00'

from which index can you say this? are you talking about your own study?

Nombre : 4 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 16:56:22 -04'00'

can you be more specific/explicit on why your results indicate so?
And is this (unchange in % bioavailable DOC) supporting the last sentence of previous paragraph?

move downstream through the fluvial network (Mann et al., in press). Thus, our results importantly show that microbial metabolism continues at similar rates independent of dominant DOM source and radiocarbon age.

The higher overall amounts of bioavailable DOC we measured in soil pore waters may reflect a highly bioreactive permafrost or aged surface soil derived DOC fraction (e.g., Vonk et al. 2013, Mann et al. 2014). Further downstream in larger tributary and Kolyma mainstem waters, it has been shown that lower total amounts of bioavailable DOC is supported almost entirely from predominantly modern radiocarbon aged surface soils and vegetation sources (Mann et al., in press). Aquatic microorganisms must therefore readily adapt to significant shifts in DOM composition caused by selective losses of unique DOM fractions (Kaplan and Bott, 1983; Spencer et al. 2015) alongside high-internal demand for labile DOM by stream communities in lower order streams, which is generally expected to result in decreased DOM lability with increasing water residence time (Stepanauskas et al., 1999a,b; Wikner et al., 1999; Langenheder et al., 2003; Sondergaard et al., 2003; Fellman, 2010; Fellman et al., 2014).

CDOM parameters presented in this study give further insight into characteristics of DOM along the full flow-path continuum throughout the Kolyma River basin. Previous studies have indicated that CDOM spectral slopes (particularly $S_{290–350}$ and $S_{275–295}$) can serve as indicators of DOM source and composition, where a steeper spectral slope typically suggests lower molecular weight material with decreasing aromatic content and a shallower slope typically suggests higher molecular weight material with increasing aromatic content (Green and Blough, 1994; Blough and Del Vecchio, 2002; Helms et al., 2008; Spencer et al., 2008; Spencer et al., 2009a). Furthermore, $S_{275-295}$ has been identified as a reliable proxy for dissolved lignin and therefore terrigenous DOM supply across Arctic Ocean coastal waters, as well as

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 16:59:15 -04'00'

why "highly bioreactive" if simply more in quantity but not more reactive in percentage bioavailable?

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 17:00:38 -04'00'

is it an adaptation or an acclimation? (depend on transit time, see question above)

Nombre : 3 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:56:03

unless photolysis generates labile molecules, which needs time (exposure to light).
And that is what you are discussing in next paragraph, but unfortunately you do not make the link with lability (smaller molecules are known to be more labile than aromatic large molecules). Maybe the more abundant "virgin" bioavailable molecules upstream are replaced downstream by photobleached smaller molecules (originating from aromatic compounds), making the % used relatively constant or without any clear pattern overall?

Nombre : 4 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-24 17:07:32 -04'00'

is this the correct word?

evidence of on-going photochemical degradation of surface water DOM during transit. Additionally, of all the CDOM parameters, S_R values were most closely related to concentrations of bioavailable DOC ($r^2 = 0.454$, $p<0.01$), suggesting that this value may be correlated with the rate of decline in bioavailable DOC through the network. However, biological degradation has previously been shown to typically slightly decrease S_R values (Helms et al., 2008), which indicates that the relationship observed here may be a consequence of co-variance with photodegradation of DOM, or demonstrate that S_R values reflect a range of physical and biological processes. Unlike many previous studies that focus on only mainstem rivers in the Arctic, we focus here on a variety of waters along a full flow-path continuum, showing that CDOM metrics (in particular, S_R) reflect important compositional differences in waters along the transit from headwaters to the Arctic Ocean. The range in DOM properties of waters travelling downstream through the Kolyma Basin often spanned wider ranges than DOM compositional differences reported annually among the six major arctic rivers. For example, S_R values across the major arctic rivers over the years 2004 and 2005 spanned a minimum of 0.79 in the Yenisey River, to a maximum value of 1.11 in the Mackenzie River (Stedmon et al., 2011). It is therefore essential that changes taking place in the quality of CDOM exported by these rivers be examined throughout entire river basins in order to adequately assess climate driven shifts in terrigenous carbon supply and reactivity.

Future work that includes both photo- and microbial degradation experiments may further elucidate the ability for S_R to serve as a direct proxy for these processes along a flow-path gradient. Our overall results thus far demonstrate promise for utilizing ultraviolet-visible absorption characteristics to easily, inexpensively, and comprehensively monitor the quantity and quality of DOM (over broad ranges) across permafrost landscapes in the Arctic. This is

Nombre : 1 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-25 15:26:32 -04'00'

being correlated to the bioavailable portion of DOM does not mean it is related to the **rate** of decline of this fraction, does it?

Nombre : 2 Auteur : Sujet : Commentaire sur le texte Date : 2015-12-21 11:58:04

this sentence needs to be clarified

Nombre : 3 Auteur : Sujet : Commentaire sur le texte Date : 2015-09-25 16:13:41 -04'00'

in DOM