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Biogeosciences Discussions

Interactive comment on "Space-time dynamics of carbon stocks and environmental parameters related to carbon dioxide emissions in the Buor-Khaya Bay of the Laptev Sea" *by* I. P. Semiletov et al.

Anonymous Referee #1

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Coastal Arctic systems are extremely complex in terms of carbon cycling because of their physically unique character and often limited accessibility. Between river discharge, coastal erosion, sea ice dynamics, and biological processes it is difficult to tease carbon fluxes apart. This manuscript shines some very interesting light on a poorly understood environment, uses state of the art techniques and is therefore well suited for Biogeosciences.

Major remarks: I was wondering if the comparison of pCO2 concentration along a salinity gradient would need to be based on normalized values (both to salinity and

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temperature). River water has lower levels of DIC (about 1000 μM for the Lena) and is warmer than sea water (about 2200 μM). To compare the two it might be more appropriate to use saturation levels. Alternatively, the concentration of DIC could be shown along the salinity gradient relative to the conservative mixing line based on known DIC values for the Lena and Atlantic water. Other studies (Tank et al. 2012) have indicated CO2 supersaturation in Arctic rivers and implicated that the degradation of river DOM is responsible for the surplus CO2. In general, I am confident that the trends reported here are real and that eroded POC from the coast is the main substrate for respiration in this system, but the above suggestion might help to represent the data more clearly.

Minor remarks: Page 2170: 1-11; very depleted stable carbon isotope values have also been observed in green algae collected from the Ob and Yenisei rivers estuaries. Is this a possible alternative source for the very depleted values (< -30 per mill). See Kodina et al. for reference: Kodina, L.A., 2001. The carbon isotope composition of phytoplankton along the Ob- Kara Sea transect in August-September 1999. Reports on Polar Research, 393: 157- 160. Kodina, L.A., 2002. Carbon isotope composition of phytoplankton in the Yenisei River estuary-open sea system and the application of isotopic approach for evaluation of phytoplankton contribution to the Yenisei POC load. Reports on Polar and Marine Research, 419: 143-150.

2070 and 2171:1-8; In Arctic rivers the POC fraction is usually older than the DOC fraction because POC is mainly derived from erosion rather than vegetation and DOC is mostly derived from vegetation (see Goni et al.)

8-12. Also, HMW compounds are in general terms often more bioavailable than the bulk of low molecular weight compounds in natural waters (Amon and Benner 1996). Recently, studies have shown that a significant fraction (30%) of Arctic river DOC is degradable on short time scales (Holmes et al. 2008) and a recent study in all the major Arctic rivers suggests that the degradation of most labile river DOM happens before the material passes the estuarine filter (Amon et al. 2012). This section should

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be revised to reflect the current state of knowledge about organic matter in Arctic rivers.

2175:1-6; this statement can be supported by a recent satellite based survey of river CDOM on a pan-arctic scale (Fichot et al. 2013).

8-12: Do you mean undersaturation because photosynthesis would reduce pCO2?

2177: 8-15; Emphasize that these comparisons to the tundra environment are on an aerial basis, I suggest to include a comparison of total fluxes from the tundra to total fluxes on the shelf.

Figures: All figures that refer to surface water and bottom water layers should include the actual depth ranges of the two.

Interactive comment on Biogeosciences Discuss., 10, 2159, 2013.