Interactive comment on “Reviews and Syntheses: Effects of permafrost thaw on arctic aquatic ecosystems” by J. E. Vonk et al.

O. S. Pokrovsky (Referee)
oleg@get.obs-mip.fr

Received and published: 3 August 2015

The manuscript of Vonk et al (Reviews and Syntheses: Effects of permafrost thaw on arctic aquatic ecosystems...) was examined regarding its suitability for Biogeosciences and was found fully satisfactory from the view point of novelty and scientific quality. The overall added value of this manuscript is extremely high. It clearly represents a reference work in its genre, fully up-to-date, state-of-the-knowledge of aquatic systems in the permafrost-affected regions.

The majority of cited references are dated 2010-2015 showing highly attractive research topics discussed in the paper. The summary, feedback and future research needs can be especially appreciated.

The organization of the paper is logic, thoughtful and the Discussion is well developed. The Abstract represents fundamental approach of high academic value, thorough and insightful.

The only major shortcoming of this work (which does not necessarily require serious revision) is that “Wetland processes are not specifically discussed in this review” (L 25-26, p.1072). The wetlands represent significant coverage of the permafrost surface and contain huge stock of potentially vulnerable soil carbon. In addition, they contain significant water stock, much larger than that of the slopes.

In this regard, it would be important to clearly distinguish 1) slopes, 2) river deltas, 3) river valleys, and 4) watershed divides (plateau). In each of these elementary landscapes, the permafrost development is different and often unique. This is highly pertinent to what is stated in L 24-27 of p. 10775. As such, the status of aquatic systems related to thawing permafrost will be different among different landscapes. A synthetic cartoon of various water landscapes subjected to permafrost thaw would be very welcome but probably too difficult to produce at this stage...

Minor comments (in the order of their appearance) p. 10725, L 11: The number of lakes requires definition of the lake size range


p. 10728, L 2: Note the possibility of full freezing of shallow thermokarst lakes in winter and pronounced solute concentration process (Manasypov et al., 2015, BG)

p. 10728, L 28: diurnal variations are unlikely to be pronounced during May-July, probably only in August
Is it possible to provide some details on this issue?

Consequences of "Thermokarst expansion into new soils at the lake margin" for water chemistry are also discussed for western Siberia frozen peat (Shirokova et al., 2013, Biogeochemistry).

Permafrost thaw induced by forest fire and the consequences on stream water chemistry are discussed for Central Siberia zone (Parham et al., 2013, Biogeochemistry).


Consideration of local conditions for permafrost thaw is very important remark, often neglected in global estimations. As such, GIS-based evaluation of type of landscapes in the permafrost-affected region is highly needed.

Section 2.3. Metal contaminants in thermokarst lakes of different stage of development are addressed in a seasonal scale in Manasypov et al (2015, BG), and the average concentrations of metals in t/k lake waters across the gradient from discontinuous to continuous permafrost are discussed in Manasypov et al. (2014, The Cryosphere, doi:10.5194/tc-8-1177-2014).

Why 320 nm? Normally, this is 280 or 245 nm!

Specify that this is relevant to mainly mountainous regions, not on flat surfaces.

End of section 3.3: Potential bioavailability and speciation of metal contaminants changes progressively, in the sequence of t/k lakes development, from small depressions and thaw ponds to large thermokarst lakes the concentration of metals decrease whereas the molecular weight also decreases thus increasing metal – OM complexes bioavailability (Pokrovsky et al., 2011, BG; Shirokova et al., 2013, Biogeochemistry).

Similarly, both CO2 and CH4 concentrations were found to be higher in smallest thaw depressions at the beginning of permafrost thaw (Shirokova et al., 2013, Biogeochemistry).

What is the mechanism, coagulation of DOC?

2 times "overall", may be re-phrase

Explain what exactly S. Tank found for the Mackenzie catchment.

The variation of riverine DIC flux across watershed with different permafrost coverage is thoroughly discussed in Pokrovsky et al., 2015 BGD.

In much of the Russian Arctic, organic carbon transport from land to ocean…" – relative to the Canadian Arctic and the Mackenzie River?

Ref. Kirpotin et al. 2008, not easily available to readers, can be replaced by one of


Interactive comment on Biogeosciences Discuss., 12, 10719, 2015.