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Biogeosciences Discussions

Interactive comment on "Long cold winters give higher stream water dissolved organic carbon (DOC) concentrations during snowmelt" *by* A. Ågren et al.

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We want to thank the anonymous referee for the comments which we believe have greatly improved our manuscript. We have now changed the scope of the manuscript, and performed additional analysis. The new analysis strengthens the previous results and also highlights the ecological significance of our study. Detailed answers to Referee comments are found below.

Referee #1

General Comments: General Comments: This manuscript presents the results of a

study designed to investigate the affects of multiple variables on peak stream water DOC concentrations in a boreal catchment. Through analysis of a long term data set, the authors demonstrate that discharge is an important control on peak DOC concentrations. Then, through application of a model, the authors control for the effects of discharge to identify four other variables that are important non-discharge controls on peak DOC. Further, a soil-frost-duration experiment was conducted to support the finding that winter conditions (winter length, temperature, soil frost thaw date) influence DOC concentrations. In general, the manuscript presents novel ideas that are supported by appropriate data analyses. The appropriate literature is cited and the presentation is clear. My main concern is that the findings of others are presented in a very general context. These generalizations may lead to misinterpretation and are discussed in detail below.

Comment: 1) In the Introduction section of the manuscript the authors cite the findings of many other studies. While these findings are relevant and useful to the present study, they are presented in a very general fashion and I recommend that more specific information is included with the citations. For example, on pg 4859, lines 23-24 the authors state, "Between 70-90% of the water that enters the stream during snowmelt will be old water previously stored in the soil (Rodhe, 1989, Laudon et al., 2007)." This sentence implies that this is true in all types of systems. While this may be true in the streams included in the cited studies, it is not necessarily true in all systems (e.g. alpine systems, urban systems, etc.), and this should be clarified. Similarly, I suggest that the authors to be more specific about their statements throughout the introduction (e.g. pg. 4859, lines 13-15; lines 19-20, lines 24-27, etc.).

Answer: Good point, we have now clarified the introduction and state clearly what kind of watershed we are discussing.

Comment: 2) The authors do an excellent job of separating out the effects of discharge-related variables and non discharge-related variables on peak DOC concentrations. However, as indicated by other studies (which are cited here) and the data in the

present study, discharge does play an important role in controlling peak DOC concentrations. I encourage the authors to more clearly state this point in the Discussion section. Highlighting this point does not take away from the finding that non-discharge variables are also important contributors to peak DOC concentrations in the stream studied here.

Answer: Yes, we have now expanded the discussion and added sections on the on the hydrological effect on DOC concentrations. Additional analysis has also been included, see details below. We now also discuss the importance of a short and intense snowmelt and a high previous export that created a "memory effect".

Comment: 3) The results of the study show that certain variables (e.g. length of spring flood,length of winter, temperature, etc.) influence peak DOC concentrations in the stream,as measured by DOCM and DOCF. However, the fact that only data on the "peak DOC concentrations" were investigated is not specified throughout the Discussion section. I recommend that the Discussion section is revised to highlight this point.

Answer: We found that we could strengthen the results from this study by incorporating three more variables: the average concentration during snowmelt, the export of DOC during snowmelt and the slope of the Log Q Log DOC relationship during snowmelt. DOCAVERAGE was also inserted into fig 4 for an overview of the data. [See Fig 1 here.] We have also clarified in the discussion what variables we are discussing.

Reference

Haei, M., Öquist, M. G., Buffam, I., Ågren, A., Blomkvist, P., Bishop, K., Löfvenius, M. O., and Laudon, H.: Cold winter soils enhance dissolved organic carbon concentrations in soil and stream water, Geophys. Res. Lett., 37, L08501, doi:10.1029/2010gl042821, 2010.

Detailed figure caption Fig. 1. The top panel show the inter-annual variation in DOCAVERAGE (Black bars), DOCF (Grey bars) and DOCM (White bars) and the lower

panel show the residual DOCAVERAGE (Black bars), DOCF (Grey bars) and DOCM (White bars) after subtraction with the RIM modelled values. A positive residual DOC indicates high soil water DOC during spring inferred from stream DOC concentrations, and vice versa.

Interactive comment on Biogeosciences Discuss., 7, 4857, 2010.

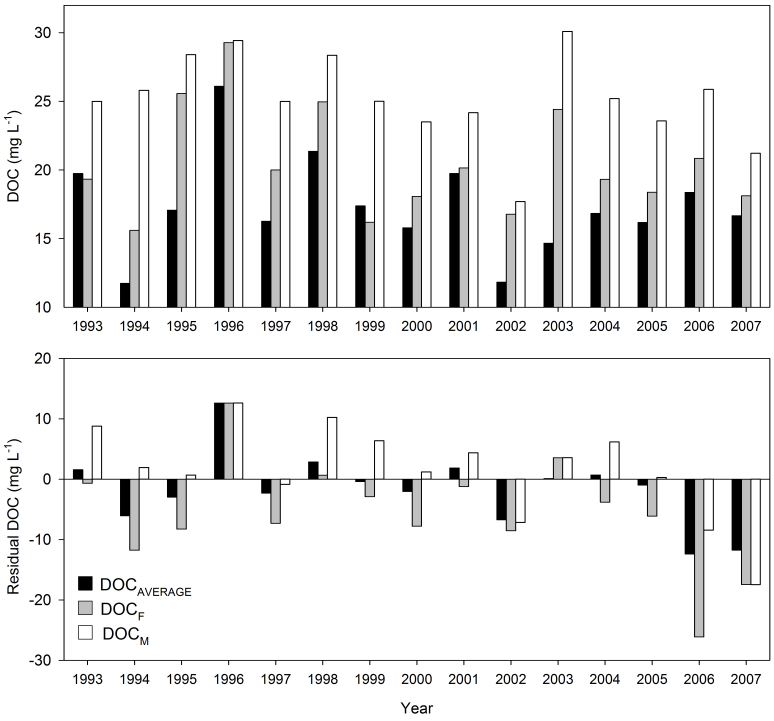

Fig. 1. Interannual variations in DOC