In general, this reviewer offers a favorable review of this work. The reviewer agrees that this work should be of interest to the readers of HESS and comments on the concise presentation and well written text. There are a few specific comments and more technical corrections suggested by the reviewer. Here, we present short versions of the specific comments followed directly by our response and (when appropriate) notes on how the manuscript text is changed. With respect to technical corrections, which are more editorial/minor in nature, we have accepted all of the reviewers suggestions and do not comment on them.

In addition, we would like to thank this reviewer for a very thorough and thoughtful review. The comments (in particular the technical corrections) have helped us greatly improve the overall presentation of this study.

SPECIFIC COMMENTS

P1680/L14: What is the hypothesis of your study?

The main hypothesis is that the dissolved carbon fluxes from a catchment are influenced by how water flow and travel time are represented. As such, our main objective was to determine water flow and mass transport effects on the present-day release rates of dissolved carbon from the subsurface landscape to the surface water system for the sub-arctic Swedish Abiskojokken catchment. We have made this clearer in the closing paragraph of the revised introduction.

P1681/L17: Please improve the structure of your site description…

We have restructured the site description section per the suggestions of the review by adding more information and editing where appropriate. In particular, precipitation observed in the region ranges from higher values around ~900 mm/yr near the Norwegian border to lower values around ~300 mm/yr near the outlet of the Abiskojokken catchment (Åkerman and Johansson, 2008). The mean annual air temperature for 1913-2006 at Abisko (located a few kilometers east of the catchment outlet) was -0.6^{o}C (Abisko Scientific Research Station). With respect to the soils, while no formal soil survey is available, we have clarified the description of the soils in the region.

P1682/L18: Is there a literature reference for equations (1) and (2)? Please define all variables of the equations and give the units.

There are not as these are simple rearrangements of conservation equations. The definitions and units for all variables here (and throughout) have been added.

P1682/L22: It is difficult to understand how exactly you validate estimates with Eqs. (1) and (2).

This section has been edited and rearranged to make it clear how Eq. (1) and (2) are used to validate the modeling estimates. The hydrograph separation defines the average annual flow volume coming from the shallow flow domain Q_{sh} and the deeper flow domain Q_d. By modeling the present-day advective solute transport travel time distribution (Section 2.4), it is possible to estimate $\overline{q_{sh}}$ and $\overline{q_d}$ values that are dependent on the assumed hydraulic properties of the shallow and deeper flow domains. Substituting into Eq. (1) and (2), it is possible to calculate the average aquifer thicknesses (Zsh and Zd, respectively) for the Abiskojokken catchment. These values can be compared to aquifer thickness observations as a check on the validity of the adopted hydraulic properties used to estimate the advective solute travel times.

P1683/L14ff: The explanation for is currently rather complicated…
This paragraph has been simplified and clarified in the revised text.

P1683/L20ff: The paragraph explaining your eq. (4) should be improved…
This has been modified such that the variables are presented in the order used in the equation and better explained. In addition, per the suggestion of the reviewer, we have removed the original Eq. (5) from the text.

P1684/L17: What is an 'accumulated area threshold'? Please explain for readers that are not familiar with this approach.
We have added text to clarify this method to readers not familiar with this approach. At each 50x50m grid cell along each flow pathway delineated from the DEM, the upslope contributing area was calculated and used to create a map showing the accumulated area draining to each point in the catchment. On such a map, the highest values (i.e., the positions in the landscape with the most accumulated area) typically correspond to stream network and can, thus, be used to define the extent of the stream network. This is done by thresholding the map of accumulated area at a critical value such that positions with higher accumulated areas than that critical value are considered part of the stream network.

P1684/L26: What does this sentence mean, 'the measurements are in agreement with estimates made using the techniques. . .'? Please rephrase…
We have chosen to eliminate this confusing sentence. We have made it clear what hydraulic property values we have used and how these are validated (see response to previous comments).

P1686/L1-6: It is not necessary to repeat eqs. 6-8 for DIC (i.e. eqs. 9-11)…
We have eliminated these equations and merely stated that DIC related calculations were done in a manner similar to those for DOC.

Figure 2: Please improve your legend…
Better explanation of Figure 2 in the legend has been provided clearly stating what the symbols and lines in the figure represent. In addition, it has been noted that uncertainty bounds are not shown in the hydrograph separation as this estimate is intended to give a first-order approximation of the partitioning of flow between the shallow and deeper domains. We do, however, report the standard error associated with the separation of the annual flow volume in the text.

P1688/L4ff: Please be more concise in your description of seasonality… provide the reader with more detailed information.
Text has been added to better present the DOC and DIC data. DOC concentrations are small prior to spring thaw, show a peak at 3.9 mg/L immediately following spring thaw and decline towards late summer. DIC concentrations drop markedly during the spring thaw and reach a minimum at 1.8 mg/L during the summer. Inference that the seasonal patterns are opposite has been dropped since it is not clearly supported. In addition, standard deviations and medians have been reported for DOC and DIC concentrations along with the arithmetic and flow-weighted averages.

Table 1: Please give measures of uncertainty (e.g. standard errors) for all your data…

The standard deviations and resulting standard errors for all values have been reported in the revised table. In addition, we have grouped values that are to be compared next to each other and made all other review suggested corrections.

P1689/L26: Please improve your final sentence of the section…
We have decided to remove this final sentence as it was ambiguous and not required.