

General Comments

1. The authors need to spend more time on proofreading the manuscript. In its current state, the grammar does not hold up to the standards of Biogeosciences unfortunately. I have included a list of 27 items in technical corrections *for only the first five pages* of the manuscript. I encourage the authors to find a colleague to proofread or to use a reviewing service before the next submission.
2. In the paper, you are trying to combine several methods in a novel way to characterize the lake hydrology. Because of this, the methods must be clearer and not assume that the readers are familiar with the various components. The purpose of a certain method, the details of the models used, the interpretation of results needs to be more extensive. For example:
 - a. The PARAFAC analysis: How do you get/What is the interpretation of the results in Figure 3?
 - b. The determination of WRT is unclear still. The text (Line 156) briefly describes that WRT was estimated through tracer concentrations if no degradation took place. There is no further mention beyond this paragraph and needs to be elaborated upon.
3. I have some reservations on the approach taken with determining the groundwater discharge areas and lake WRT (section starting from line 215) or the methods have not been described adequately. I appreciate that this section was added but it is still not clear. When reading the methods, the reader needs to be able to see how you took your data and processed it, and arrive at the resulting figure or results. Additionally, I am not convinced that the equations used in this section were used correctly (see specific comments below).

Specific Comments

Line 111 - The PARAFAC analysis was described as a three-way modelling tool but it is not clear between what three things

Line 149 – What are the lambda values here? You should briefly comment on what this is

Line 153 – The text is describing the degradation of tracer concentrations in the previous sentence. Then it is followed by “This equilibrium estimations”... Is this referring to equilibrium concentrations? Degradation rates?

Line 165 – The Vollenweider equation that you provide as equation 2 is not the form provided in the 1975 paper you cite and has been used erroneously. From a mass balance approach, the mass fraction that is exported ($C_{\text{outflow}}/C_{\text{initial}} = 1/(1+k*WRT)$)

- If you have decided to replace the removal rate constant k with $WRT^{0.5}$, you need to justify this with further literature
- The general form of the equation that is presented in your paper looks to be the percent *export*, rather than percent *retention*. You will have to use $1 - (1/(1+k*WRT))$ to get retention
- In fact, the form given in this manuscript shows that the percent retained increases with decreasing WRT.

Line 169 – I find it difficult to see how equation 3 is applicable. The equation only applies for lakes that have a WRT of approximately 0 – 6.2 years (and I agree the study site fits

inside this range). However, the source that was cited for this equation is in a Danish report published over twenty years ago and is not easily accessible. As an empirical equation, it is extremely difficult for the reader to understand the limitations, assumptions and the overall validity of this equation for this study (e.g. anyone trying to replicate your methods)

Line 178 – It is unclear if the authors developed equation 4 on their own or was from literature and thus should be clarified. Regardless, it appears that this equation is not internally consistent with respect to units. The monthly flushing rates are in units of 1/Time; thus the first two terms on the right hand side of the equation are in concentration units, whereas the last two terms are in concentration/time

Line 180 – Is the peak degradation through UV-radiation determined linearly from the UV-time relationship? I.e. is the peak degradation of 100% assumed to coincide with the peak UV radiation?

Line 200 – “...combination of peaks N and T produced biological (Coble, 1996).” does not make sense. What Ns and Ts are you talking about? What biological is produced?

Line 218 – The conclusion that the concentrations of TDN do not support a WRT value of over 2 years is wholly dependent on the model you choose. With the limited support provided for the model, this claim is not strong.

Line 297 – I do not think the manuscript does an adequate job in convincing the reader that this method can capture uncommon or stochastic events. It did not seem like the samples taken were taken at different times of the year when extreme conditions occur. Is there literature that supports your claim that these environmental tracers capture these stochastic events? Even so, how would a single sampling campaign be used to extrapolate beyond the timeframe or snapshot of when you sampled?

Line 320 – I’m not sure that claiming the analysis remaining generally unchanged by running the CATS model with a 10% perturbation of tracer concentrations is sufficient. The tracer concentrations in your supplementary material show that TP, TN and DOC all can vary by an entire order of magnitude between sites. Can you be certain that they also cannot fluctuate by an order of magnitude throughout the year?

Technical Corrections

1. Line 17 – WRT has not been introduced yet, do not use abbreviation
2. Line 17 – WRT was estimated to be 2 years
3. Line 17 – Isolation of groundwater recharge areas was
4. Line 18 - ...sites with a high degree of recharge were
5. Line 29 - ...which to some degree
6. Line 30 - ...the groundwater contributes nutrients
7. Line 37 - ...particularly in small water bodies. For example
8. Line 53 – ³⁶Cl
9. Line 60 - You are talking about the nutrients (plural) so it should be “which are either remineralized when dying...”. Also poorly phrased as nutrients (which is the subject of this sentence do not die)
10. Line 66 – fluorescent

11. Line 75 – use consistent style for lists throughout your paper. Either use (1) as you did in line 52 or keep to 1). Also use a colon to introduce your lists, not a semicolon
12. Line 84 – Subularia aquatic
13. Line 90 – preliminary work
14. Line 93 – within 5-45m of what?
15. Line 96 – hermetically sealed
16. Line 100 – quartz
17. Line 101 – $\delta^{18}O$ is a ratio, not a concentration, please fix this throughout your paper
18. Line 107 – borate buffer was
19. Line 117 – were subtracted ... to remove
20. Line 117 is a run on sentence; separate is at “the data were then Raman normalized...”
21. Line 129 – biologically inert
22. Line 134 is not a full sentence
23. Line 137 – atmospheric deposition
24. Line 139 – ...linear in features. What features are you talking about?
25. Line 142 – What is the FD package?
26. Line 143 – In the present study
27. Line 147 – The model outputs maximum entropy probability fractions