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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Rapid Phase Transfer of DOC and DIC Transport in a Subtropical Small Mountainous River" *by* Yu-Ting Shih et al.

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This paper aims to reveal the ratio of hydrological pathways of dissolved carbon in mountainous catchment using field experiment (and chemical analysis) and simulation. I guess the results of this study are so important to assess the carbon runoff under climate change condition. However, I have the following some comments that may improve the quality of the paper. Reply: We appreciate that the reviewer acknowledges the merit of this study. We addressed all the following comments raised by the reviewer to improve our manuscript.

In equation, I guess the symbol which was used in equation should be the italics. Therefore, please revise them. Reply: Corrected. In this revision, all the symbols in

equations were changed to italics.

Introduction: Line 70 – I didn't understand correct meaning of this sentence because of gabled characters between "30" and "N" or "S". Please revise them. Reply: The gabled characters were typos which could not show properly. It should be: ". . .between latitude 30° N and 30° S transporting. . .." [Line: 76]. They have been carefully revised in this version.

Material and Method, Study site: Line 101 – I couldn't understand what is meaning of "a.s.1". I'm not familiar with this. Reply: The term, "a.s.l", is the abbreviation of "above sea level". We added it in Line: 111.

Overall: You sometimes used "âĹij" before number in this paper. However, I didn't understand this meaning, since I'm not familiar with this. I thought this meaning is "about", is it correct? If it is so, I guess you should write correctly "about". Reply: In this revision, all the symbol "∼" were replaced by either "about" or "approximately".

Material and Method, Sampling and chemical analysis: Line 126 – I know water temperature, pH and electrical conductivity were not used for the analysis and simulation, so you wrote them as site information. However, in this paper, these measurement value were not shown anywhere. So, I guess it is not necessary to demonstrate this information. And also, I guess water temperature changes while you moved from the field to lab. Therefore, I didn't understand why you measured water temperature in situ, not in field. Reply: DIC is defined as the sum of [CO2] + [H2CO3] + [HCO3-] + [CO32-] and [HCO3-] is the largest component in the natural water system, which could be estimated by the pH and temperature. The EC could be used to estimate [HCO3-] through ion balance method. The three indicators are important background for DIC composition. In fact, we sampled 4 bottles of water in the field and measured water temperature, pH and EC with a portable multi-parameter water quality analyzer (EUTECH® PC300) immediately. So, the parameters could be regarded as measured real-time. Therefore, we rephrased "in situ" instead of "in the field" [Line: 140].

Material and Method, Estimation of DOC and DIC concentration and flux: Eq. (1) – "a1, a2, a3 and a4" are the optimized value, right? If it is so, how did you optimize them? I mean how event does it used for calibration and validation period to optimize them? Although you demonstrated the performance of estimation value with LOADEST, you didn't mention calibration and validation period. Reply: Sorry for the unclear descriptions. We re-wrote the paragraph to demonstrate the details about LOADEST. The revised sentences were: "The coefficients in Eq. 1. (a0, a1, a2, a3, a4) are estimated by the Adjusted Maximum Likelihood Estimation (AMLE, Cohn 1988; Cohn et al., 1992) method, which is built in the LOADEST program." [Line: 164-166]. For event flux estimation, since our data were sampled in high frequency, we estimated the event-based fluxes through flow-weighted method directly. Therefore, it is not necessary to calibration and validation. We added the following description, "Note that LOADEST was only used for the estimation of annual dissolved carbon fluxes. The event-based fluxes were estimated by flow-weighted method directly, since the sampling frequency was high." in Line: 174-176 For the issue of calibration and validation in LOADEST, we did not do the validation of LOADEST. We think that the main goals of modeling work are simulation and estimation. For simulation which is used for unknown scenarios or assessments, the calibration and validation are essential. If the modeling work is just for estimating the values within an observed period, the validation is not strictly required. In such a case, the LOADEST used for estimation is somewhat like the use of a regression model. It just helped us to estimate the unmeasured values between observations.

Material and Method, Streamflow Simulation: Line 159 – I guess "in detail" does not need in this sentence since you already wrote "the detail of ...". Reply: Yes, we removed "in detail" from this sentence [Line: 181].

Line 166–167 – You mentioned the detail of the model is described the reference. So, I understand if we want to know the detail of the model, we need to read the reference. However, parameters which were used to simulate the runoff in this model should be

described. Reply: As the reviewer suggested, we added supplementary information for demonstrating all the details in HBV hydrologic simulation. In this supplementary information, the meaning of parameters and the procedure of calibration and validation, and daily/hourly simulations were provided. [Supplementary].

Results, Temporal dynamics of DOC and DIC concentration and flux: Line 193 – I didn't understand where November to the April is in Fig.2. So, could you designate the month in Fig.2? Reply: As the reviewer suggested, the monthly tics were set in the new Fig. 2.

Results, Temporal dynamics of DOC and DIC concentration and flux: Line 193 – You already described the performance of the LOADEST. However, reader will not understand the difference of between observed and simulated value. Therefore, for example, figure which is shown observed and simulated value should be created. Reply: Figure 2 showed the observed DOC and DIC concentration during the sampling period. The LOADEST is only used for annual flux estimation, not for concentrations. Therefore, we were not able to put the simulated DOC and DIC concentration in Figure 2.

Results, Streamflow composition and sources of DIC and DOC: Line 224-226 – You already described the performance of the model. However, please show the calibration and validation result by figure (hydrograph). Reply: As the reviewer suggested and we mentioned above, we put all information about HBV hydrologic simulation in supplementary information. The observed and simulated hydrographs were illustrated in Fig. S2 and the performances were shown in Table S2. [Supplementary].

Fig 6 : In this figure, the values were estimated in two typhoon events, right? If it is so, I didn't understand why did you write "Low flow" and "High flow"? In this figure, only high flow result was show. Therefore, I didn't understand these meaning. Please explain more detail about this figure. And also, "Conceptual model for DOC (a) and DIC (b) ..." => "Conceptual model for (a) DOC and (b) DIC ..." Reply: All values of DOC and DIC concentration were real observations, but they were simplified into this

conceptual model. Therefore, the values were just illustrated by relative magnitude. The empty circle and colored triangular represent the concentrations in the low flow (base flow period) and high flow (typhoon period) regime, respectively. During low flow, only base flow (no significant RSR (rapid surface runoff) and SSR (subsurface runoff)) recharges the riverine dissolved carbon. We added the base flow flux in the left panel. We also added the following sentences, “The DOC and DIC concentrations from different C sources are illustrated in the left part. The proportional transport by different runoff pathways (e.g., RSR, SSR, DG) are illustrated by arrows.” to clarify this figure and change the location of “(a)” and “(b)” [see the caption of Figure 6].

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