Point-by-point responses to all review comments

NOTE: To facilitate the evaluation of our responses, original review comments are listed first in their originals (**in bold font**), followed by our itemized responses (in red).

Editor's Comments:

The reviewer report(s) for your manuscript are now complete. According to the reports, they recommend that you make some revisions before further consideration. Please consider the reviewers' comments and amend your manuscript according to their recommendations.

Response: Thank you for your information and the two anonymous reviewers' comments. Those comments are very helpful for revising and improving our paper. We have revised the manuscript based on their comments and suggestions.

Referee #3:

We thank the reviewer for the constructive comments and suggestions, which are in black bold text below. Our itemized response is followed (in red).

The manuscript still has various issues that require clarification. More details of the modeling parts are needed.

Response: Based on your comment, we added more details of the modeling part.

(1) To facilitate understanding, we modified the descriptions about the DOC runoff and leaching flux, please see Lines 129-135:

"*The fluxes are described as follows:*

$$DOC_{runoff} = [DOC]Q_{surf}k_{adsorb} - SR, \quad (2)$$

$$DOC_{leaching} = [DOC]Q_{dis}k_{adsorb} - SR, \quad (3)$$

where DOC_{runoff} *(g C* m^{-2} s^{-1}*) denotes the soil DOC runoff,* $DOC_{leaching}$ *(g C* m^{-2} s^{-1}*) denotes the soil DOC leaching,* Q_{surf} *(kg*H_2O m^{-2} s^{-1}*) denotes the surface runoff,* Q_{dis} *(kg*H_2O m^{-2} s^{-1}*) denotes the subsurface discharge*".

(2) We added Equation (11) for the effective riverine flow velocity, please see Lines 170-172: "

$$v = max(0.05, \beta^{1/2}), \quad (11)$$

where v (m s^{-1}) is the effective riverine flow velocity, which is estimated by grid cell mean topographic slope β (Oleson et al., 2013); ".

(3) In addition, we added some detailed statements on the processes of DOC transfer induced by reservoir interception, surface water withdrawal, and groundwater extraction, please see Lines 213-225:

" *The process of reservoir interception leading to retention of carbon in rivers can be expressed as:*

$$F_{DOC,r} = \frac{v(con_r \Delta Q_r)}{d}, \quad (18)$$

where $F_{DOC,r}$ (kg C s^{-1}) denotes the DOC flux retained by the reservoir; con_r (kg C m^{-3}) is the DOC concentration in the reservoir; ΔQ_r (m^3) is the water volume change in the reservoir. Therefore, the riverine DOC flux leaving the current grid cell is updated to:

$$F^{out}_{DOC} = F^{out}_{DOC} - F_{DOC,r}, \quad (19)$$

The DOC flux extracted from surface water is calculated based on the intake rate and the solute concentration con_{DOC} (kg C m^{-3}) in the current grid cell and return to the soil DOC pool after irrigation:

$$F^{out}_{DOC} = F^{out}_{DOC} - q_{sw} con_{DOC}, \quad (20)$$

The reduction in soil DOC leaching due to groundwater extraction is then calculated based on soil DOC concentration and groundwater pumping rate:

$$DOC_{leaching} = DOC_{leaching} - q_{gw}[DOC]. \quad (21)$$

".

For more details please see Sect.2 in the revised manuscript.

We also added thanks to the editor and two anonymous reviewers for the helpful comments in the acknowledgments section.