Answer to the Referee 2

After reading the comments, we list them as following.

1. The general utility of the model presented in this research is of concern. The initial saturated chemical concentration must be known, which is very difficult to do at the field or basin-scale.

Reply: This paper is based on the laboratory experiments. The main objective of this paper is try to find a way to identify and analyze the incomplete mixing parameters for the two-layer model with different conditions, and to give us more accurate predictions in future. After we have a full look at the model and experiments for the laboratory scale, it is our further work to apply it to the field scale. We have added some sentences to indicate that in the conclusion part.

2. Solute sources are spatially heterogeneous in most catchments and the degree of heterogeneity of solute sources within the landscape and their mobilization dynamics during runoff must first be understood in at least a conceptual sense in order to incorporate spatial variability into the model.

Reply: This paper is based on the laboratory experiments. After we have a full look at the model and experiments for the laboratory scale, it is our further work to apply it to the field scale. We have added some sentences to indicate that in the conclusion part.

3. The model is applicable only to a single solute source.

Reply: This paper is based on the laboratory experiments. We want to study the solute transfer from soil to the surface runoff from the simplest case with a single soluble solute. However, it is our further work to apply it to the field scale, and we have added some sentence in the conclusion part to talk about it.

4. As the solute undergoes biogeochemical processes between rainfall events, the value of C_0 will vary over time.

Reply: This paper is based on the laboratory experiments, and we did not consider the complex solute undergoes biogeochemical processes between rainfall events. However, it is our further work to apply it to the field scale, considering these complex processes.

5. As it is unfeasible to assume real measurements will exist for pre-event conditions in the field as opposed to the laboratory, some additional work or references to other relevant published papers that address this must be included to improve the utility of the model.
Reply: This paper is based on the laboratory experiments. However, it is our further work to apply it to the field scale.

6. The model is only valid for estimating concentration for a single storm event for which the initial conditions were known.
Reply: This paper is based on the laboratory experiments, so the initial conditions were known with a single storm event. However, it is our further work to apply it to the field scale, considering real complex conditions.

7. The explicit inclusion of a surface runoff trigger in the model would enable the equations presented in this work to be included in a general solute transport model in which transport via both infiltration and surface runoff are modeled, and the equations presented in this work would be used when the surface runoff trigger is exceeded.
Reply: This paper is based on the laboratory experiments, and it is for the fields in the southern part of China, where exist ponding-runoff water and infiltration with storm event. So the surface runoff trigger is exceeded in equations of this paper.

8. The authors neglect sorption processes in Equation 3.
Reply: This paper is based on the laboratory experiments. We want to study the solute transfer from soil to the surface runoff from the simplest case with a single soluble solute. However, it is our further work to apply it to the field scale, considering the complex sorption processes.

9. The description of the experimental conditions provides inadequate explanations as to why various conditions were chosen.
Reply: We have described the experiments in detail in Tong et al. (2010). We have done different experiments with different conditions and compare the results for them. The coherent scientific objective is to find the identified parameters to fit the observed data and get general conclusion for us.

10. The experimental soil types are not typical of soil found in the Midwestern US (silt loams). What is the significance of the soil types chosen for the experiments? Discuss the selection of these soil types.
Reply: This paper is based on the laboratory experiments, and it is for the fields in the southern part of China. So the soil types are typical of soil in those places.

11. Number of times the experiments were run appears to be arbitrary.
Reply: We have described the experiments in detail in Tong et al. (2010). We get the observed data to describe the trend of the solute concentration in the surface runoff with time. The sampling times is based on the real condition in the laboratory during the experiments, so the number of times appears to be arbitrary.

12. Why were 3 experiments conducted for the fine loamy soil and 7 experiments conducted for the sandy soil?
Reply: We have described the experiments in detail in Tong et al. (2010). 3 experiments are conducted for the fine loamy soil and 7 experiments are conducted for the sandy soil based on the soil type available in the laboratory.

13. The authors appear to neglect the dissolution of KCl, as they claim that the solute concentrations they are measuring are KCl (p. 3909 line 10). If the solute concentration being measured is stated incorrectly, then clarification is necessary in the text and throughout the table and figures.
Reply: All the KCl is soluble in the water, so we do not consider the dissolution of KCl. What we measured is the KCl solution with water. We have shown the chemical is KCl on line 131 and 209. We also added sentence "The soluble chemical is KCl, and we measure the chemical concentration KCl in surface runoff. To avoid the other chemical, the distilled water is used as rain water." on line 202-204. We have also shown KCl throughout the table and figures.

14. Given the high-resolution at which the authors attempt to prediction concentration changes (as shown in the bottom part of Figure 3), errors should be included. At minimum, errors in the analytical methodology used to measure the aqueous concentrations should be discussed (i.e., what is the accuracy of the instrument and analytical method?) Is the level of accuracy obtained by the analytical method is greater than the small changes in concentration that the authors are claiming to predict accurately?

Reply: In this paper, the analytical solution is assumed to be perfect and accurate. The instrument is also considered to be perfect since experiments are conducted in laboratory. So we do not take into account of the observation error. We also indicate this on line 205-206.

15. Model errors also need to be addressed. What are the errors associated with the estimates of the two model parameters, α and γ? Without this information about measured and modeling errors, the validation approach is questionable.
Reply: Because it is a certain model, we do not consider the model error.

16. The main points get lost in the details for the results and discussion and need to be emphasized. Discussion regarding the implications of the main conclusions would help to strengthen this section.
Reply: We have modified the discussion and conclusion part in the paper now.

17. The results should be put into the context of field and basin-scale solute transport dynamics so that it is clear to readers that the authors have an understanding of how their work is applicable outside of the laboratory. It is unclear how the equations and methods presented can be used outside of the laboratory because the methods used to validate the model and assess the values of the two parameters, α and γ, require that data be collected before the temporal variability of these parameters can be determined. Therefore, the authors need to develop the non-stationarity of these parameters from a theoretical basis in order for the results obtained from these experiments to be applicable outside of the specific conditions used in the experimental design.
Reply: This paper is based on the laboratory experiments. However, it is our further work to apply it to the field scale, and we have added some sentence in the conclusion part to talk about it.

18. The number of grammar errors is quite large.
Reply: We have read the paper carefully and modified it.