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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Effects of cultivation and reforestation on suspended sediment concentrations: a case study in a mountainous catchment in China" *by* N. F. Fang et al.

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Point–by–point responses to the reviewer's comments/questions: Dear reviewer #2: General Comment: The topic of this paper is of particular interest not only in China but also in many places where land use changes have occurred as a result of socio-economic development. This paper by Fang et al., is well written and based on a vast number of paired Q-SSC samples collected over 30 decades. Such dataset is usually difficult to find and this is one of the strengths of the paper. However, some changes should be made before publication of this manuscript, which I specify in the following points. Reply: Thank you very much for your time on our manuscript and the

opportunity to revise the work. Specific Comment: I would change the units used in the paper. Consider using tons/year (or kg/year) for the SSY and mg/l (or g/l) for the SSC. - If you mention the Du basin before specifying that the station's name in this basin is Zushan, I would use the sub-index D in the subsequent variables (i.e. QD,SSYD,etc). I think that would help the reader which is not familiar with the names. - Be consistent and use Figure or Fig. throughout the manuscript. Reply: Thank you for your good suggestions. We used kg/year (kg yr-1) for SSY, sub-index d for Zhushan station, and consistent used Figure throughout the revision. However, the g m-3 is the original unit for SSC. The g l-1 is good for large values of SSC but not very good for low values. We still use g m-3 in the revised manuscript. We used the sub-index d for the variables of Du catchment. (i.e. SSCd, SSYd, and Qd).

Comment1: P7585-L15-16. Could you provide more details on the sampling frequency? What do you mean by "the sampling measurement frequency was increased several times each day"? Reply: Thank you for your comment. Suspended sediments were collected by manual samples. During rainfall events, samples were collected based on the variation of the discharge and magnitude of SSC. Generally, samples collected frequently during events with high value of SSC, while collected infrequently during event with relatively small magnitude of SSC. The time between sampling changed from minutes to hours. The total number of samples varied from several to dozens.

Comment2: P7558-L15-16. You compute the variable Di, which is correct since this allows the comparison of runoff volumes in both basins regardless of their different area. The units of this variable is in mm (l/m2), however it is computed as Q/A (with Q being the mean discharge during the period i). I think this variable should be specified as R/A; with R being the mean annual Runoff for each period (in hm3 -or dm3 for the computation of Di in mm-). I assume that each "period" refers to the three periods (1980, 1990 and 2000). I think the same should be done for the suspended sediment yield (SSY). In this case it would be the Specific Sediment Yield (SSY=SY/A). For clarity, instead of using SSY for the Suspended Sediment Yield, I would use SY (in tones/year) and SSY

for the Specific Sediment Yield (in tones/year/km2). Reply: We apologize to confuse you. We agree with you that D should be specified as R/A. However, in this study, D, Q, SSC, and SSY were discussed at different time scales (e.g. during event, daily, monthly, and yearly). The word "period" may have different meanings. The "period" refers to the sampling time during event but not "the three periods" when calculate D. Suspended Sediment Yield may confuse with Specific Sediment Yield, thus we avoid to use Specific sediment Yield.

Comment3: Figure 3. I would use colors in this Figure as it's confusing as it is. I would also consider using lines for indicating the temporal trend in SSY in both basins. Maybe just two lines with different colors (one for each basin) joining the annual values would be enough. Reply: Thank you for your comment. We used colors in Figure 3 and used lines for indicating the temporal trend. We changed the unit of SSY follow your previous suggestion.

Comment4: P7591-L1. Add the values of Q variations that you are referring to in this part of the text. This would help the reader. Reply: Thank you for your comment. We added variations of Q in the revised manuscript: "The annual Dd and Dx varied between 253 to 873 mm and 279 to 931 mm, respectively". (see P 9 L196)

Comment5: Figures 4 and 5. The captions are interchanged Reply: We apologize for our carelessness. We revised the captions in the revision. (see P27)

Comment6: P7591-L9. You mention that a Mann-Kendall was applied to annual Pi, Di and SSYi data. However in Figure 5 the results of Di are not shown. Instead Qi trends are shown. Clarify this and use Di in the Figure. Reply: Thank you for your comment. We apologize for our carelessness. The trends of Q is the same of the trends of D. We used D in revised manuscript.

Comment7: P7591-L12. How do you apply the Mann-Kendall test? Using annual data for the 30 year period? Hence you get one value of the test indicating the trend for this period. What are the values shown in Figure 5? A space is missing in "and_Q

and SSY" Reply: Thank you for your comment. M-K test was performed using annual data. We added the threshold value of the test. The Z values indicated in formula-(7). We clarified the values in the revised manuscript. We added the space in the revised manuscript.

Comment8: Tables 4 and 5. I would also include a line at the bottom of the table indicating the mean annual values of Q and SSY for each period. Also, specify in Table 5 what C1and C2 mean (as in Table 4). Reply: Thank you for your comment. We added lines at the bottom of the Table 4 and 5 to indicate the average annual values of Q and SSY. We also added note for C1 and C2 below Table 5.

Comment9. P7591-L25. I would not say the Table shows the "dynamics" of SSC, but only the monthly mean SSC values. Reply: Thank you for your comment. We deleted "dynamics" in the revised manuscript.

Comment10: P7592-L3-5. Why is the "monthly SSC calculated by SSY and Q"? Why you do not use the actual SSC from the samples collected? Specify in the methods section how monthly values are computed. Reply: Thank you for your comment. Actual SSC acquired by sampling is an instantaneous value, thus, monthly SSC can't be calculated by actual SSC. We explained monthly SSC in the section "2.3 Data acquisition". (see P6.L146)

Comment11: Is there any explanation for the intra-annual variability of the results? Q and SSC decrease in some months while they increase in others Reply: Thank you for your comment. The discharge and suspended sediment load showed opposite trend with rainfall through the M-K test. We concluded that the decreasing trend of Q mainly caused by land use change. However, intra-annual variability of Q and SSC could different with the annual trend. Monthly rainfall effected Q and SSC. Thus, Q and SSC decrease in some months while they increase in others.

Comment12: P7592-L7-8. The number of samples should be part of the methods section, not the results. Reply: Thank you for your comment. We deleted this sentence

and added it to the part of methods section. (see P6.L150)

Comment13: P7592-L8-9. The scatter in the Q-SSC relationship seems to be higher for low discharges (<1000 m3/s), while for larger values of Q the scatter seems to be smaller. Reply: Thank you for your comment. The Y axis is logarithmic in Figure 6. For larger values, the values of Q vary over many orders of magnitude. The numbers of larger values were much less than small values, thus, the scatter of larger and low values can't compared by i.e. R2. We added a figure below using no logarithmic value. You can see the "real" relationship of Q-SSC. The large values look like more linear than small values but actually not. Insert Figure

Comment14: P7592-L11. Include here the values of the maximum SSC in both stations Reply: Thank you for your comment. We added the values in the revised manuscript. (See P11.L248)

Comment15: P7592-L12. How do you evaluate the stability in the Q-SSC relationship. Reply: Thank you for your comment. We used R2 to evaluate the stability of the Q-SSC relationship and we indicated R2 in Figure 6.

Comment16: I would merge sections 3.2 and 3.3 into a single one under the name of "Q-SSC" dynamics. Also, I would explain first the contents in section 3.3, which are quite descriptive of the values found during the study period, and then move to the contents in section 3.2. Reply: Thank you for your comment. We merged sections 3.2 and 3.2 and used the name of "Q-SSC dynamics". We adjust the order of these two sections.

Comment17: P7592-L18. You mean Figure 7? Reply: We apologize for our carelessness. It should be Figure 7.

Comment18: Figure 7. I would specify the years for each period in the x-axis as well. Original (1980); Cultivation (1990) and Reforestation (2000). Also use colors in the lines of the Figure, not only in the symbols. Do not use curves for joining the points,

use straight lines. Reply: Thank you for your comment. We have redrawn Figure 7 followed your suggestion. We use straight lines colors in the lines for the revision. According to your suggestion of comment 16, Figure 7 changed to Figure 6 in the revision.

Comment19: P7593-L3-6. Could you explain the classification of flows in detail? What do you mean by minimum 25% , middle 50% and maximum 25%? Do you refer to the values that are equaled or exceeded 25%, 50% and 75% of the time respectively? Why such thresholds? Reply: Thank you for your comment. We apologize to confuse you. We revised this sentence as: "SSC was sorted by ranking the paired Q values, which were classified using a threshold level approach (e.g., low flow ($Q \leq 25\%$), moderate flow ($25<Q<75\%$), and high flow ($Q \geq 75\%$))." The thresholds are subjective. Similarly, we can use 33% and 77% as the threshold. However, during rainfall event, large runoff caused by peak flow or low runoff which can load sediment is relatively scarce. Most SSC data were acquired from moderate flow. Thus, we classified moderate flow to have more number of samples.

Comment20: P7593-L18-24. How to you perform the mean comparisons in the ANOVA test? You say you perform 6 one-way anova, but the table shows 18 values.. Did you perform a one-way anova or a two-way anova (using the cultivation period and the flow category as categorical variables?) or did you perform individual anovas for each flow category and period? The way you performed the anova tests is not clear, you specify this on the footnote in Table 6 but I think all the information should be on the text to help the reader. Also, I think it would be worth doing the same analysis for Q values. Last, I would include a table showing the anova results (statistic and p-value) instead on only adding a * in the table showing the mean SSC and Q values. Reply: Thank you for your comment. Table 6 indicated both mean values and one-way ANOVA results, but not ANOVA of mean values. We apologize to confuse you. The ANOVA tests were performed using the all samples of SSC. Each flow category has three periods, thus 18 values indicated 6 tests. We added information to explain the ANOVA test in the revised

manuscript. We modified Table 6 to show both statistic and p-values. We compare the variances of SSCs of the same flow categories during different periods. Thus Q values have already been classified.

Comment21: P7594-L7. I don't see why the authors mention here the effects of impoundment in runoff and sediment yield when impoundment is not mentioned either in the results section. Is there any reservoir or dam in the studied basins that can affect the results? This statement is very general, and out of the context of the paper if this is not mentioned earlier in the previous sections. Reply: Thank you for your comment. We apologize to confuse you. It was an expression mistake caused by language problem. We wanted to express forest can hold water. We deleted "impoundment" in the revised manuscript.

Comment22: P7594-L19. For the first time in the manuscript the term "water yield" is used here, do you mean the mean annual runoff volume (in hm3/year) or what you specify as Discharge Depth (in mm). The use of different terms throughout the manuscript is confusing. Reply: Thank you for your comment. We apologize to confuse you. It should be mean annual runoff volume. (See P13.L317)

Comment23: P7594-L19-20. From the Study Basin section I understand that both basins are nested, and thus the Xinzhou is a nested basin within the Du basin (Zhushan station). Hence, I don't understand how the combined water yield of the catchment (the Du?) and the sub-catchment (the Xinzhou?) are nearly half of the total catchment output.. Do you mean that the water yield at the Xinzhou station is nearly half of the water yield in the Zhushan station? That half of the water yield is produced in the sub-basin? This paragraph is not clear. Could you explain this further? Reply: Thank you for your comment. You are right. The mean annual runoff volume at Xinzhou station is nearly half of the water yield in Zhushan station, and half of the water yield is produced in the sub-basin. We reorganized this paragraph. (See P13. L318)

Comment24: The last paragraph of the discussion talking about the model is interest-

ing; however, I don't think this is a discussion of the results found in the paper and an objective of the paper. This part of the discussion related to broader scale geomorphic processes, involving area and basin properties, which are not analysed in this manuscript. The manuscript aim is to analyse the trends in the SSC-Q relationship over a 30 year period and under different land covers. If the authors want to explain the importance of such model for their results, they should expand this section and explain further the relationship between the model and their results and why this is relevant for their case study. Reply: Thank you for your comment. In this study, SSCx shows more variable than SSCd. We conclude sediment delivery ratio (SDR) is one of the main reasons. Our previous study found that the area scale dominates the SDR. We simplified these sentences and deleted the model in the revised manuscript. (See P13.L326)

Comment25: I don't think these are the main conclusions, this should be part of the discussion section. Reply: We put parts of conclusions into discussion, and we added new conclusions.

Thank you for your time and instructive advice.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/12/C4629/2015/hessd-12-C4629-2015-supplement.pdf

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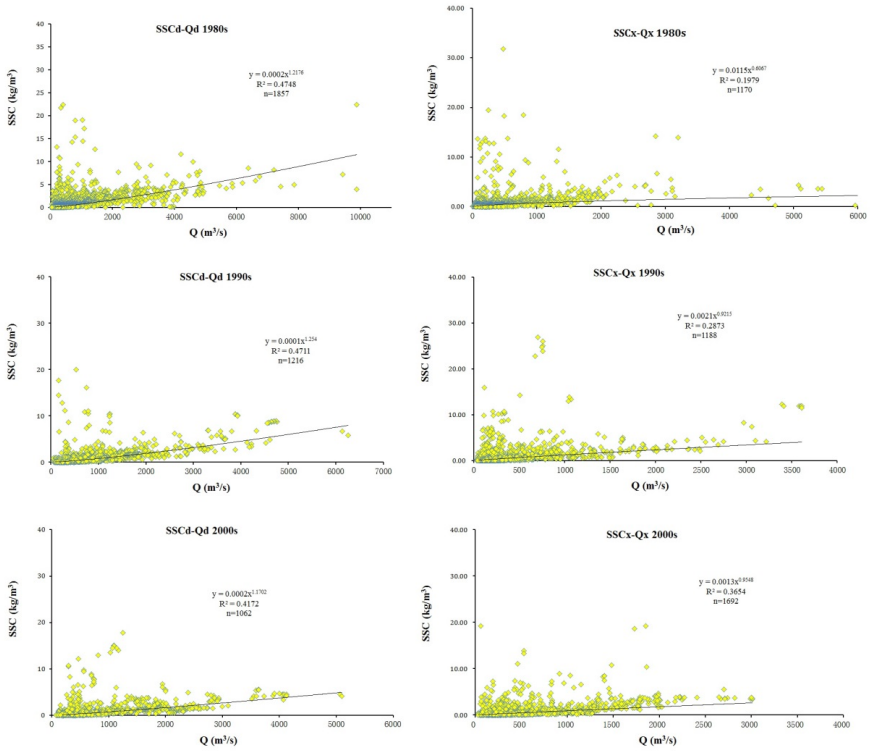
Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 7583, 2015.


SSCd-Qd 1980s
y = 0.0002x^1.2178
R² = 0.4748
n=1857
SSCx-Qx 1980s
y = 0.0115x^0.4667
R² = 0.1979
n=1170
SSCd-Qd 1990s
y = 0.0001x^1.254
R² = 0.4711
n=1216
SSCx-Qx 1990s
y = 0.0021x^0.9215
R² = 0.2873
n=1188
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y = 0.0002x^1.1702
R² = 0.4172
n=1062
SSCx-Qx 2000s
y = 0.0013x^0.8548
R² = 0.3654
n=1692
SSC (kg/m³)
Q (m³/s)

Fig. 1.