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Hydrology and Earth System Sciences Discussions

Interactive comment on "Effects of vegetation patterns on yields of the surface andsubsurface waters in the Heishui Alpine Valley in west China" *by* Y. Liu et al.

Y. Liu et al.

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Thanks for your constructive comments and suggestion. We have modified our paper according to all the comments and suggestion. Specially, the major modification has been made on introduction, results and discussion. We hope our responses and modification could meet the requirement of you.

Note: Figure is not added in response for system limit of this magazine.

Q1.(1) Most importantly, the main conclusions of the paper (that total vegetation cover, and the type of vegetation, influences runoff contributions from sub-basins) are not supported by the results, at least as they are presented in the current manuscript. The authors need to analyze their data (basically those presented in Fig. 5) on a unit-area

basis (i.e. runoff per square kilometer): the current results are apparently determined by the absolute size of the sub-catchments. Only if this scale effect is eliminated, vegetation (and altitude) effects may be deduced from the data. (2) Also, the data probably need to be corrected by precipitation (see comment 9).

R: (1) Valuable suggestion, thanks. We have reanalyzed our data on a unit-area basis and found that if this scale effect was eliminated, the similar vegetation effects still existed and altitude effect didn't occur. The results were shown in the Fig. 6. (Relationships between vegetation cover patterns and water yield from surface and subsurface in the seven watersheds of the Heishui valley during transitional period from low-flow to high-flow (a) total vegetation coverage versus surface subsurface water, (b) forest coverage versus surface subsurface water, (c) subalpine coniferous forest coverage versus surface subsurface water, (d) alpine shrub coverage versus surface subsurface water and (e) alpine meadow coverage versus surface subsurface water) in the revised manuscript, as described below.

"As for the relationship between different vegetation types and surface subsurface water (Fig. 6), Our results showed that there was negative correlation trend between vegetation coverage and surface subsurface water, and similar relationship occurred in forest and subalpine coniferous forest, respectively; namely, high coverage was associated with low water yield and low coverage results in high water yield (Figs. 6a, b, c); It was also obvious that surface subsurface water yield increased with increasing coverage of alpine shrub, but this positive correlation trend was not significant between coverage of alpine meadow and water yield (Figs. 6d, e). Therefore, the distribution pattern of vegetation coverage within every watershed could influence water yield at large scale during transitional period from low-flow to high-flow in the Heishui Valley"

(2) Because we wanted to study water yield under condition of no rainfall happening in this study, there was no rainfall in our sampling period. Based on this study results, our next experiment will mainly concentrate on studying the relationships among rainfall, vegetation and water yield.

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Q2. p. 1022, lines 14-23: certainly remote sensing is important in hydrological studies; but as these are not part of the current investigation (except that landuse was derived from remote sensing data, which however is only a technical aspect of the study), they don't need to be discussed in the introduction. Instead, I would expect more discussion on observed vegetation effects on runoff, of which there are many.

R: We have removed the paragraph about remote sensing in the introduction and strengthened the discussion on vegetation effects on runoff in the introduction of revised manuscript, as described below.

In the original manuscript, we wrote "On the effects of vegetation on hydrological traits, many studies have been carried out in paired-watershed. Hibbert (1967) reviewed 39 experimental catchments and concluded that the reduction in forest cover increased water yield; Bosch and Hewlett (1982) summarized 94 experimental catchments and believed that different vegetation types, such as coniferous forests and deciduous hardwoods, caused different variations in annual water yield; and then Sahin and Hall (1996) drawn a similar conclusion according to their reviews of 145 experimental catchments. But most of these experimental catchments are smaller than 2 km2 (Andreassian, 2004) and the results needed scaling to and verifying in the larger catchments (Brown et al., 2005)."

In the revised manuscript, we rewrote as "On impact of vegetation on water yield, many studies, including afforestation experiments, deforestation experiments, regrowth experiments and forest conversion experiments, have been carried out in paired-watershed. Hibbert (1967) reviewed 39 experimental catchments and concluded that the reduction in forest cover increases water yield; Bosch and Hewlett (1982) summarized 94 experimental catchments and proposed that different vegetation types, such as coniferous forests and deciduous hardwoods, caused different variations in annual water yield; and then Sahin and Hall (1996) drew a similar conclusion according to their analysis of 145 experimental catchments. Although some differences in climate, soils and vegetations exist due to catchments in various geographic regions around

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the world, many studies showed that forest cover was negatively correlated with water yield and baseflow, and there was more uncertainty on the impact of forest change on peakflow than that on annual water yield and baseflow (Jones and Grant, 1996; Bruijnzeel, 2004; Andreassioon, 2004; Sun, et al. 2005). However, these results need scaling to and verifying in the larger catchments (Brown et al., 2005) for most of these experimental catchments being smaller than 2 km2 (Andreassian, 2004), meanwhile, the effects of vegetation on season, monthly and daily flows are less well understood and the impact of vegetation change on season water yield can be as or more important than that on annual water yield (Brown et al., 2005).".

Q 3. p. 1024, last paragraph of Study area section: I think it is not necessary to list the altitudinal distribution of vegetation types and species in such detail. A reference to table 3 is probably sufficient. And, is this information derived from your analysis of satellite data? In that case, you may mention this here (by fitting section 3.4 into this paragraph).

R: We have removed last paragraph of study area section and combined section 3.4 (Vegetation classification with remotely sensed data) and 4.2 (Vegetation patterns in the different basins) in the study area section of revised manuscript, as described below.

Based on the optimal iterative unsupervised classification (OIUC) method (Jiang et al., 2004) and distinct natural vegetation types distributed along various altitudes in the Heishui valley (Jiang, 1994; Zhuang et al., 1995; Zhang et al., 2002; Jiang et al., 2004), the classification results of Landsat 7 TM satellite image acquired on 10 July 2002 (path 130, row 38) showed: the vegetations of the Heishui Valley included deciduous broadleaved forests, mixed broadleaved and coniferous forests, subalpine coniferous forests, alpine shrub, alpine shrub meadow, alpine meadow and croplands (Fig. 4); At catchment scale (Fig. 5), the total vegetation cover in catchments F, A, I, E, B, H and K was 97.59

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Q 4. p. 1025: how representative are the few sampling days for the overall situation?

R: In this study, we want to reflect the relationship between vegetation pattern and water yield in spatial scale but not time scale; and only to study the effects of vegetation on water yield during transition period from low flow to high flow. So, we collected water samples at the same time within the seven watersheds in order to avoid effects of time change and large climate change. Based on the former climatic records, we decided the sampling period. Maybe, it is the best way to determine the sampling time although it may have some uncertainty.

Q 5. Title of section 3.2: What is delta D? Please explain. And what is SMOW (same section)?

R: Title of section 3.2 was corrected as “Measurement of stable hydrogen isotope”. And hydrogen isotope ratio is expressed by 948;D (delta D). SMOW is abbreviation of “Standard Mean Ocean Water”. And these have been added in section 3.2 “Measurement of stable hydrogen isotope” of in the revised manuscript.

Q 6. p. 1028, second paragraph of results: Refer to table 2 only: this list of numbers is not necessary.

R: Thanks. The list of numbers in the paragraph was removed in the revised manuscript.

Q 7. section 4.2.: This section should be part of the site description.

R: This is good suggestion. We have moved this section to the site description. Detailed response has been displayed in Q3.

Q 8. Discussion, second paragraph: Please show the results of the T-test! And what does it mean, “test of mean and min altitudes”?

R: According to new results in Figure 5, altitude effects of vegetation cover on water yield didn’t exist. So we removed the second paragraph of the discussion in the revised

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manuscript.

Q 9. Same paragraph: You discuss altitude-dependent temperature effects: Are there data available? And, more importantly, wouldn't differences in precipitation pattern across the valley affect the relative runoff contributions from the sub-basins? Generally, the explanation of in terms of flow velocity of melt water is probably too simplistic, or at least not clear enough.

R: this paragraph was removed in the revised manuscript because the altitude effects didn't occur in new Fig. 6. So the discussion on these topics was not necessary.

Q 10. End of discussion: I don't see a contradiction of the present results and previous studies: they all show lower discharge if vegetation cover is high.

R: Thank you for this comments and you are right. Our results were consistent with the results of previous studies and further verified the conclusions of previous studies at relatively large scale.

Q 11 Technical corrections The paper needs major improvements of the English; some typical errors are the use of "the" instead of "a"; unclear expressions (e.g. "in hydrological cycle aspect", p. 1022 l. 21, which probably should read "in hydrological studies"; "level flow": I don't know what that is; "mentions above": probably means "what was stated above"), or hard to understand (e.g. p. 1023, l. 22: "1048 m of falls"). Please indicate more clearly what "water" stands for, every time it is mentioned (sometimes runoff, or groundwater, or else, is confused). Table 3: Mention that

R: Thanks. We have invited a native speaker to improve the language of our revision. The "in hydrological cycle aspect" was corrected as "in hydrological studies". The "mentions above" was corrected as "what was stated above". The "1048 m of falls" was corrected as "with 1,048 m of fall in elevation" The Water yield should be described as surface and subsurface water yield. The "The arid shrub was removed. The "DEM" was corrected as "topography"

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 3, 1021, 2006.