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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: Data analysis: (1) There are no data on precipitation and other climate variables for each of the sub-watersheds. (2) Would climate make a difference in affecting the water isotope and water balances and water yield contribution? (3) The complex topography suggests that hydrology is extremely complex and detecting the contribution of

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vegetation may be difficult. (4) The researchers sampled on one year in 2004. Would this particular year be representative?

R: (1) There is only one climatic station in our study area and we have provided the climate variables in section of Study area of the revised version, based on the more than 20 year climatic record of the station, as the study background. Mainly, we provided spatial distribution of mean annual precipitation and AET in the Heishui Valley (Fig. 2a.b: modification from Jiang et al. 2004) in the revised version. In Fig 2a,b, we found that most area of the seven watersheds was under condition of similar AET and precipitation. Meanwhile, in our study, the effects of rainfall were not taken into account due to there was no rainfall in sampling period according to the weather image and our experimental design was to study water yield under condition of no rainfall.

(2) Yes, climate should make a difference in affecting the water isotope and water balances and water yield contribution. In this study, we wanted to study the relationship between vegetation and water yield by spatial scale changes while assumed temporal scale was the same. To avoid the effect of climate on the water isotope, water balance and water yield contribution, our sampling period was shorten to 3 days, The differences of water isotope between each pair of 3 days in 13 sampling sites were conducted by ANOVA analysis and the results showed that there was insignificant difference among days, which was added in section of 3.3 “Methods of computing contributions of different water” in revised manuscript.

(3) Yes, it is. But, as a very important region in China, we should try to do it. The better way to direct this topic is a large-scale study as we conducted.

(4) We have checked the climatic records of this region before we begin the study, and we found the year 2004 should be a representative year. The real recorded data of this year verified our inference So, we used the data for this study.

(Precipitation(mm)(1971-2004): month mean: 1 (5.5), 2(9.1), 3(31.9), 4(67.8), 5(124.2), 6(151.3), 7(125.3), 8(94.9),9(128), 10(73.1), 11(12.6), 12(4), total(827.7);

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Precipitation(mm)(2004): 1(6.4), 2(13.8), 3(46.4), 4(61.6), 5(138.1), 6(149.9), 7(89.8), 8(102.9), 9(130.5), 10(95.1), 11(11.8), 12(6.3), total(852.6). Actual evapotranspiration(AET)(mm)(1980-2004): month mean: 1(31.6), 2(43.4), 3(65.9), 4(81), 5(84.9), 6(71.8), 7(76.4), 8(74.6), 9(55.7), 10(47.6), 11(39.4), 12(36.8), tatal(703.9); Actual evapotranspiration(AET)(mm)(2004): month mean: 1(23.7), 2(45.7), 3(67.9), 4(82.9), 5(71.9), 6(69.3), 7(71.9), 8(71.7), 9(43.6), 10(40.5), 11(31.4), 12(31.2), total(657.1)). Note: there is insignificant difference between the mean and that of 2004 for precipitation and AET, respectively, by T-test.

Q2: Data Interpretation: The authors presented the relations between forest cover and water yield contribution. Based on this, they concluded that more forests resulted in lower water yield, but higher shrub cover rate caused more water yield - a 'different trend'. I believe the logic here may not be correct. Firstly, needless to say, contribution of water yield depends on the size of the watershed. For example, basin H and K are the largest ones. They certainly contributed most of the flow - this has nothing to do with vegetation cover. So, Fig 5 was not informative. There would be no surprise to see that watersheds that have more shrubs will have water yield contribution since these large watersheds happen to have higher shrub cover. Secondly, the precipitation in H, K might be different from others that can cause the difference among watersheds. Thirdly, there was no statistical analysis on the trend.

R: In our studies, forest and shrub are very different vegetations. The forests included subalpine coniferous forest, deciduous broadleaved forest, mixed broadleaved coniferous forest, their dominants were pine, spruce and hardwood trees; while the shrub is dominated by oak bush. The different vegetation leads to a different water yield.

Another referee (referee 2) also pointed out the presentation shortage, which are very valuable comments and suggestion. We have reanalyzed our data based on all the suggestion. Firstly, we recalculated water yield on a unit-area basis (contribution per square kilometer), Secondly, we reanalyzed relationship between vegetation type coverage and water yield, and found that relationship between vegetation coverage and

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water yield was not changed while altitude effects didn't happen in revised version. The results were shown in 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"

Q3: Data Presentation: I would like to see the seasonal (sampled dates) dynamics of water yield and tracer concentration, and the decimal points for all values in Table 1- 3 should be consistent.

R: There are only two hydrological stations at the regional outlet and the middle of the region, dynamics of water yield (flow) is described as a study background in section of study area. In Fig. 2c (seasonal dynamics of runoff in the Heishui and Shaba station), the low-flow period is from Nov. to Apr. and the high-flow period is from May to Oct..

Tracer concentration was given in Table 2 in the original manuscript. The decimal points for all values in Table 1- 3 was corrected in the revision

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Q4: Terminology unclear: P1022 line 24 hydrologic traits, should be hydrologic characteristics P1026 line 5 'level-flow' period, not clear about this term P1026 L17 SMOW? P1032 L20 mis-cited 'Jian et al. (2004). That paper concluded that 'water yield positively correlated with forest cover'. That conclusion is questionable itself as well. If one looks carefully, forest cover percentage does not correlate well with water yield (mm) in their study.

R: "On the effects of vegetation on hydrological traits" was corrected as "On impact of vegetation on water yield" in the revised version.

The level-flow period was that there was no floodwater, but "the level-flow period" was removed in the revision to avoid the reader's confusion.

The "SMOW" was abbreviation of "Standard Mean Ocean Water". We add the phrase in the revised paper.

We agree to the referee's comments on the paper published by Jiang et al. (2004). In that paper (Jiang et al., 2004), they believed "It seems that the pattern of low percent vegetation cover is associated with high annual runoff amount, and high percent cover is associated with low runoff. However, the patterns of forest cover in relation to annual runoff are irregular" (in page 755) and "Increasing the percent vegetation, forest and conifer cover increases the runoff rate in Minjiang valley and its catchments. And the relationship between percent vegetation, forest, and conifer cover and annual runoff amount is uncertain" (in page 760). In our original manuscript, we wrote as "Jiang et al. (2004) believed that the increasing of the total vegetation cover decreased annual runoff amount, while the relationship between forest cover and annual runoff was irregular in the Minjiang' catchments at different scales from 2 338km2 to 7 621 km2;" Thus, we found relationship between forest coverage and water yield was complex with the increasing of scale, and our conclusions that the increase of forest coverage decreased the water yield were established in the scales from 222 km2 to 2 248 km2".

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