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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Effects of terracing on soil water and canopy transpiration of Chinese pine plantation in the Loess Plateau, China" *by* H. Zhang et al.

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Dear referees,

Thank you for your valuable comments concerning our manuscript. These constructive comments are very helpful for revising and improving our manuscript. We have studied the comments carefully and have made extensive changes. Revised portion are marked in red in the revised manuscript. The major changes in the manuscript and the responses to the referee's comments are listed as following:

Comment 1: Lines 24-25, re-phrase.

Response: Thank you for your detailed comments. According to the reviewer's com-

ment, we have changed the sentence of "Transpiration as an important role part of the soil-plant-atmosphere continuum has considerable implications regarding forest management and water yields, . . ." to "Transpiration constitutes an important part of the water budget in the soil-plant-atmosphere continuum. It can affect forest water yields and mechanism-based study on transpiration will provide theoretical guidance for forest management, . . .".

Comment 2: L37-38, re-phrase.

Response: According to the reviewer's comment, we have changed the sentence of "Stomatal closure as an important physiological process was employed by plants to regulate water use and . . ." to "Stomatal closure is an important physiological process employed by plants to regulate water use and . . .". Furthermore, we had the manuscript polished professionally.

Comment 3: L80-81, this statement should be backed up with some additional information. What is the water table depth? Are there measurements of root depth? How can the author be certain that trees are not reaching groundwater or the capillary fringe?

Response: Thank you for your valuable advice. For this study area, previous studies have indicated that the soil depth varied from 40 to 60 m, deep percolation can be neglected and groundwater is unavailable for vegetation growth. We did not measure the root depth of pine, however, as mentioned in previous studies, the roots mainly distributed within 60 cm soil layers (Liu et al., 2007). We added references to support these statements.

Comment 4: L83, it would be good to say here how large the plots are (100 cm2 according to Table 1) and what percentage of the entire slope and terrace they cover.

Response: Thank you for the comments. As suggested, we added the plot size and coverage information.

Comment 5: L85, when were the trees planted? Do they have the same age in both

sites? What is the tree density and how many trees are in each plot?

Response: Thank you for your valuable advice. By the end of the introduction we had mentioned that the pines were similarly aged, and now we added the specific year when these trees were planted and the mean canopy coverage of each plot. The tree density was also mentioned in Table 1.

Comment 6: L94-96, how many soil moisture profiles were in each plots? It looks like there was only one profile per plot. Considering that the plots are about 10 m $\times$ 10 m, is one profile enough to compare the two plots? The authors should justify this.

Response: Thank you for your valuable advice. For each plot we chose four profiles, with three profiles uniformly distributed in the upper, middle, and bottom of the plot and measured with TRIME-FM time domain reflectometry (TDR) twice a month, another one in the middle of the plot and measured with HOBO U30 continuously in every 10 minutes. We compared the data of each profile, and it showed that the soil water content monitored by U30 can well represent the plot. The related information has been added in Page 6, Line 95-100.

Comment 7: If the two plots have the same soil and vegetation, REW should be the same. By using different θmax and θmin in the two years and in the two plots, the comparison between plots becomes rather confusing. I would calculate REW based on the minimum and maximum θ in the two years irrespective of the plot, so that the comparison between plots is done using the same scaling of soil moisture data.

Response: Thank you the comments and sorry about the confusion. For calculating the REW, we actually used the same θmax and θmin.

Comment 8: Eq. 4, how was the xylem (sapwood) area measured? Since the DBH of the trees in the two plots is rather different (that is why it is important to know whether the trees were planted at the same time), larger As will be associated with larger transpiration rates. Errors in estimating As are going to affect the estimates of Ec.

Response Thank you for the constructive comments. Sapwood area was estimated by differing the different colors between sapwood and heartwood. Furthermore, we also tested our results with previous studies and established an equation .

Comment 9: Eq. 5, it is said that 6 trees per plot were instrumented with sap flow sensors. Is the average of these fluxes used in this equation? It is not really clear how the measurements in 6 trees were used in Eqs. 4 and 5.

Response: Thank you for the comments. Data of individual tree were used to calculate the sap flux (Eq. 4) and canopy transpiration (Eq. 5). Then, when comparing the differences between slope plot and terrace plot, the average of sap flux and canopy transpiration were used.

Comment 10: L142-143, the authors should explain in detail why the measurements at 10 cm were not used. Since it is likely that the majority of the root system of pines is in the first 30-40 cm of soil, using soil moisture data only at 30 cm and below will reduce the ability to link transpiration and soil moisture.

Response: Thank you for your valuable advice. In 2015, the probe in 10cm was loose (apart from the soil), so the data were not correct. So in order to make the data consistent, when comparing the differences of soil water content between slope and terrace, the first layer (0$\sim$20 cm) were not calculated. We added the detailed reason in the manuscript.

Comment 11: L193, what does “in each layer” refer to here?

Response: Thank you for your comment. The words “in each layer” in the text means the different soil layers (20$\sim$40 cm, 40$\sim$60 cm, 60$\sim$80 cm, and 80$\sim$100 cm). For each layer, terrace plot had higher soil water content than slope plot. We clarified this in the revision.

Comment 12: Table 1, what is the meaning of 6/14 and 6/21

Response: Thank you for your comment. In this table, the 6/14 and 6/21 means the

sample number/ total number of trees in slope plot and terrace plot, respectively.

Comment 13: Figure 1 could be removed

Response: As suggested, we moved it to supplementary materials.

Comment 14: Fig 2, I would add rainfall in the figures with REW (and I would calculate REW as suggested above). It is said that the 2 plots are under the same conditions; however, looking at the delay between the increases in REW in the two plots, it seems that there might be differences in rainfall.

Response: Thank you for your valuable advice. As suggested, we added the rainfall in the figure. The differences between the increases in REW in the two plots may be caused the different soil characteristics and the different percolation rate. Studies showed that land preparation may cause differences in soil characteristics.

Comment 15: Fig 3, in the text, it is said that there are 6 trees with sap flow, while here n=3. Why?

Response: Thank you for your detailed comments and sorry about the confusion. All of the 12 trees (six for each plot) were used to calculate the sap flux density, and the number (n=3) represents the days that used for comparing the differences of diurnal variation of sap flux density between two plots to eliminate the error caused in one individual day. We clarified this in the revision.

Comment 16: Fig 5, it should be explained better what this figure shows. It looks like the two axes are θ terrace –θ slope and E terrace – E slope. Is that correct? Are these daily values or values every 30 minutes? What is the message of this figure?

Response: Thank you for your detailed comments. It is correct that the two axes are θ terrace – θ slope (x axis) and E terrace – E slope (y axis). Daily values were used in this figure. Soil water content was almost stable in a short temporal scale. This figure was mainly used to indicate that the differences between slope plot and terrace plot can significantly affect the canopy transpiration. We clarified this in the revision.

Comment 17: Fig 6, I would show here how Ec (not gc) relates to solar radiation and VPD.

Response: Thank you for your valuable advice. In our opinion, the correlation between gc and solar radiation and between gc and VPD can more directly reflect the plant response to drought.

Comment 18: Fig 7, this is not a frequency distribution of maximum sap flux density. It seems that this figure shows the percentage of time the daily maximum flux and the daily maximum VPD occurred at certain times of the day.

Response: Thank you for your detailed comments. We are sorry for the inaccurate expression. This figure shows the frequency distribution of the time for the maximum sap flux density occurred and the VPD peak times in the form of diurnal patterns. And the corresponding revision has been made in the manuscript.

Thank you again for your constructive comments and suggestions.

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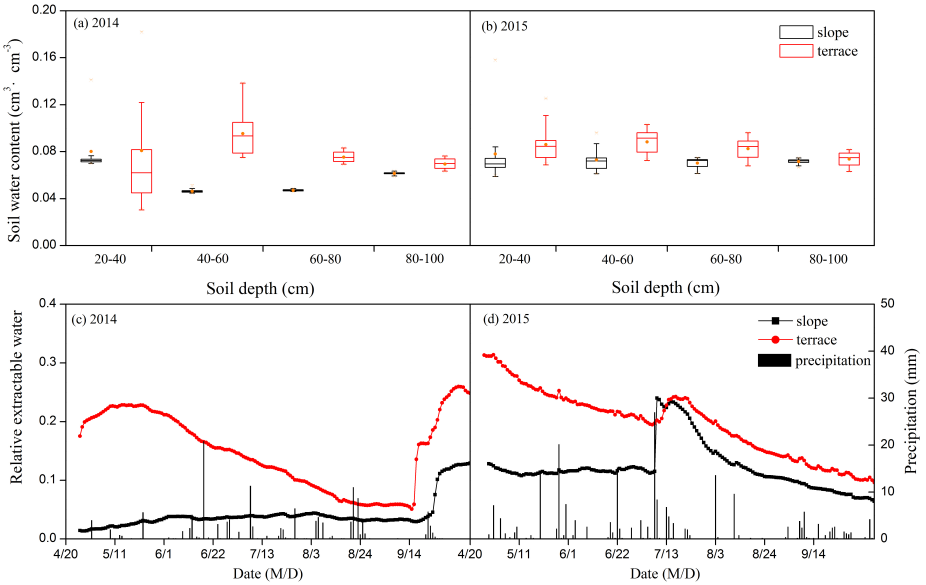
(a) 2014
(b) 2015
slope
terrace
Soil water content (cm^3· cm^{-3})
0.20
0.16
0.12
0.08
0.04
0.00
20-40
40-60
60-80
80-100
Soil depth (cm)
(c) 2014
(d) 2015
slope
terrace
precipitation
Relative extractable water
Precipitation (mm)
0.4
0.3
0.2
0.1
0.0
50
40
30
20
10
0
4/20
5/11
6/1
6/22
7/13
8/3
8/24
9/14
Date (M/D)

Fig. 1.