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Biogeosciences Discussions

Interactive comment on "Soil moisture control on sap-flow response to biophysical factors in a desert-shrub species, *Artemisia ordosica*" *by* Tianshan Zha et al.

Anonymous Referee #1

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General comments

The paper presents an interesting analysis of soil moisture control on the response of sap-flow to biophysical factors in a desert-shrub species. As sap-flow is a powerful indicator of water transport in the soil-plant-atmosphere system, understanding the effect of dry conditions on sap flow is very valuable. The topic is suitable for the journal. However the analysis can go deeper as suggested below. The clarity of the analysis and writing should be improved.

*As the paper is about the soil moisture control on sap-flow and its response to meteorological variables, a physical basis for the definition for drought condition and its severity should be included. Instead, the authors keep on changing their definition of

dry conditions for each year and in various figures. What is the reason for using 0.08 m3 m-3, as the threshold to identify drought periods? Is it for severe, moderate or mild drought? The analysis lacks consistency (Example figures 2 6). In section 2.4, they used 0.08 m3 m-3 as the threshold to identify drought conditions. In Figure 2, it is 0.11 m3 m-3 for the drought year 2013 and 0.09 for the wet 2014. Why don't they use 0.08 m3 m-3 in both years? They change threshold, definition of dry condition and VWC values in figure 6. I strongly suggest being consistent in their definition of drought conditions and use the same threshold in all figures.

*The root zone depth for this species is around 60cm (Line 291). The water deep in the root zone can maintain transpiration rates even at low VWC. I think a better way is to define threshold based on root zone soil water content in this paper. Is there any field capacity or wilting point measurements available at the site? If so mention that in the paper and use relative available water content in the root zone. If not, use relative water content (based on maximum and minimum VWC values at the site) in the 30 cm soil layer to identify the drought conditions. The value of VWC shown in Figure 1 indicate that soil drying occurred mainly in shallow layer, not in the deep layer (30 cm), especially during pre and post growing periods.

*Is it possible to include transpiration (mm) values in this paper? That will add more value to understand the acclimation process of plants to the dry conditions.

*The methods section reports leaf area measurements, but its values are not mentioned in the paper. Even in conclusion they have mentioned leaf expanded periods, but no data to support it. *Statistical significance should be evaluated for each figure and include p value along with R2 in figures. Even though authors say they used p=0.05 (Line 185), the value of R2 and number of points suggests some relations are not statistically significant. All those figures that shows statistically significant results ($p<0.05$) only should be included in the paper, else should be removed (see specific comments below).

*The 2013-2014 data shown clearly indicate that there is no direct control of VWC on sap flow (Figure 2 first vertical panel). Figure 2 also clearly shows that the relation between Js with Rs , T and VPD are non-linear (check previous comments on p-value). If the relationships are non-linear how can they explain the linear regression slopes shown in Figure 3? Is the linear relationships shown are statistically significant?

Specific Comments

Abstract: 0.11 m3 m-3 is only for 2013, not for 2014.

Introduction: The section need to highlight what is the need for sap-flow measurements and how it influence ecosystem water transport and balance. The importance and need for the study is not properly addressed even though the authors explain the effect of environmental variables on sap-flow in this section. In addition to this the section should refer more recent papers on sap-flow measurements.

Line 131: Also include root zone depth, and mean leaf area values. Is it possible to include field capacity and wilting point here?

Line 140: 'after dynamax 2005', what is that?

Line 141: What is the frequency of measurements?

Line 143: What was the mean leaf area? How did it vary with season?

Line 151-155: decoupling coefficient re-expresses gs, and can be removed.

Line 164-171: Be consistent with label style. It is better to italicize all mathematical variable labels. Only u, gs and Js are italicized

Line 178- What is the reason for selecting VWC =0.08 m3 m-3 as the threshold to determine the drought condition. It is not explained in the paper. The time series of VWC (Figure 1) don't show any severe drought conditions in 30 cm depth. It is useful if the authors can include relative water content within 0-30 cm layer.

Line 183: Is it linear regression? See general comments on the same.

Line 197: 'Lower than. . .' What is the reduction in percentage?

Line 201-204: See general comments above.

Line 205-210: Can you add time series of gs here?

Line 215: See general comments above. The threshold to define drought conditions should be the same in both years

Line 222-228: How can you explain the use of the slope of linear regression relationship if the variation of Js with Rs, T and D are non-linear? Use values only when $p<0.05$

Line 233-243: What is the reason for this delay?

Line 246-252: Figure 6 shows data from three days. What are those days in day number? A meaning full explanation should be given for the use of VWC limits. The first panel shows VWC variation within 0.001 m3 m-3! Is it meaning full considering the errors in VWC measurements? Also use only significant digits while using VWC values. The data is only three days. Is it possible to add more data in this figure, also from both years? Using only three days for this analysis is not conclusive.

Line 252: Figure 8 should be included in the results section.

Line 263-265: This is already known. Provide some references here.

Line 271: Rewrite this sentence. VWC don't show any direct effect on Js in the figure shown

Line 288:'rate of transpiration' See general comments on the inclusion of transpiration

Line 291: Provide information on root zone depth in the methods section.

Figure 1: Dotted line is not explained in the figure caption.

Figure 2: Use the same definition for dry periods in 2013 and 2014 as mentioned

above.

Figure 6: Use only most significant digits for VWC. See the comments above on the consistency on the definition of dry conditions. The data is shown for only three days. Is it possible to include more data like a month or more from both the years?

Figure 8: This figure is not mentioned in results sections. Look like p value is low (both N and R2 low) and not statistically significant. If it is below 95

Conclusion: It should be rewritten based on the comments above.

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