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Interactive comment on "Rainfall pattern greatly affects water use by Mongolian Scots pine on a sandy soil, in a semi-arid climate" *by* Hongzhong Dang et al.

Anonymous Referee #2

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The MS by the authors presents data from 3 years of measurements of Mongolian Scots Pine. While such data will be very useful for our understanding of this species plant water use and strategies, as well as ecosystem functioning in which this species is found, the collection of sap flow data and subsequent statistical analyses were poor and do not warrant publication.

The authors deployed the Granier technique, or thermal dissipation probe (TDP), to measure sap flow in Mongolian Scot's Pine. The TDP sensor only has one measurement point that the authors installed at an unknown depth in the sapwood. The width, or depth, of the sapwood is also unknown. From the single measurement point, sap flow data were scaled upwards to tree and then entire forest stand. Such a scaling

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approach no doubt introduced significant errors as it is known, from a vast amount of research, that sap flow varies across the radial profile of sapwood. Measuring at a single point in the sapwood will then significantly over- or under-estimate true sap flow. Furthermore, the Granier technique is an empirical technique and requires a species specific calibration. The authors chose a generic calibration which may lead to further errors in their estimate of sap flow. Therefore, the sap flow data collected by the authors cannot reliably be used to estimate total tree or stand water use.

The statistical approach by the authors is also incorrect. The authors analysed a series of collinear variables across a series of univariate or a multivariate regression analysis. All the environmental variables are related to each other therefore the author's approach will introduce a significant amount of error. Collinearity in regression models is a commonly overlooked statistical error. I recommend the author's read the chapter on collinearity in Quinn and Keough (2002) "Experimental Design and Data Analysis for Biologists". The authors can run their predictor variables through a Principle Components Analysis to reduce their related variables to a series of unrelated variables. The factor scores that come out of the PCA can then be used in a multiple linear regression analysis as the predictor variables.

The analyses and results have the feeling that the authors are fishing through their data set looking for significant patterns and then presenting those patterns. There is no systematic analytical approach and it is extremely difficult to follow and comprehend. For example, several drought periods are declared based on REW and a regression analysis between Ts and ETo is presented in Figure 4. But what is the significance of REW <= 0.24? Why is it not 0.25 or 0.23? These REW values may be important but it just seems some random numbers were chosen.

The MS would be far stronger, and much easier to read and comprehend, if there was a systematic and biologically realistic designation of drought periods.

Figure 5 also suffers from this problem. What is EW? Is this something the authors

have just created? If it is so important, why is it being introduced deep into the Results section and not in the Introduction section? Why is the power model important? Does it have a slightly better R2 than a linear regression model? But does it carry greater explanatory power in terms of an AIC analysis or other statistical approach?

Throughout the MS, there are several grammatical and spelling errors. For example, “sapflow” should be “sap flow”.

Other points:

- the linear regression in figure 1 is in appropriate and statistically incorrect. Is the purpose of the regression to demonstrate that rainfall decreased and temperature increased over this time period? If yes, probably consult the climate science literature to determine the methods they use to statistically quantify such changes.

- can you please provide more details about the soil profile – for example, is the texture consistent down the profile or are there distinct horizons? Is the texture described in the text only for the top 40cm of soil where, presumably, most of the MP root activity is?

- where were the soil moisture sensors installed? Next to the weather station outside of the plot? or somewhere inside of the plot?

- what was the sapwood width of MP?

- why were the TDP sensors installed on the north-face of the trees? Presumably, this is where sap flow would be lowest around the circumference of the trunk.

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