Biogeosciences Discuss.,
doi:10.5194/bg-2015-652-EC1, 2016

Biogeosciences Discussions
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EGU

Interactive comment on "The asynchronous response of carbon gain and water loss generate spatio-temporal pattern of WUE along elevation gradient in southwest China" *by* Xiangyang Sun et al.

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Received and published: 18 May 2016

At first, I considered this an interesting manuscript with the goal to assess environmental factors that control water use efficiency (WUE) along an elevation gradient. As the authors state correctly, "WUE are a factor of many variables, including: soil water content, atmospheric CO2; concentration, air temperature, vapor pressure deficit and solar radiation, and physiological factors such as canopy conductance and nutrient content (Hultine and Maeshell, 2000; Li Chunyang et al., 2009; Goulden et al., 2012) (lines 70-73). As such, various figures and discussion sections (e.g., Figure 6, Figure

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11) that aimed to address relationships of such variables (e.g., temperature, precipitation) to WUE seemed interesting and worthwhile results for an in-depth review of the manuscript in Biogeosciences Discussions. Two external reviewers that supplied a quick review agreed on this so I decided to publish the manuscript as a discussion article. Only during my detailed review of the manuscript, however, did I notice that this manuscript has significant underlying flaws. The most important flaw is that not a single of the explanatory and controlling meteorological or physiological variables that control WUE (soil water content, atmospheric CO2, air temperature, vapor pressure deficit, solar radiation, physiology) was actually measured along the elevation gradient. Unfortunately, this only becomes apparent when reading the methods section in great detail. In fact, presented meteorological variables that are shown as correlative variables in Figures 6 and 11 were actually derived from another elevation gradient at some distance away. Presented meteorological data were linearly interpolated to this site from measurements somewhere else. I talked to one previous reviewer that suggested publication of this manuscript as a discussion article before, and neither that reviewer nor I initially realized that this was done this way (note that this is not mentioned in the discussion section, introduction, nor in any of the figure legends where such data is presented). It is completely unclear how the interpolation of meteorological variables was done, how these measurements were confirmed, and if the approach works at all given strong spatial heterogeneity in meteorological conditions in mountain terrain. For a manuscript addressing controlling variables of WUE along an elevation gradient, I is inconceivable that no climatological measurements or soil moisture measurements were performed, although several figures suggest so. In my view, therefore, this manuscript has the inherent flaw that the major goal, i.e., “that temporal and altitudinal variations in ecosystem WUE are largely unexplained, and that further research is needed to reveal the main influences and the response relationships among the carbon gain, water loss and environmental factors for different forest types” cannot be addressed. In addition, I cannot understand that no data or discussion on the effect of soil moisture availability was presented, as soil moisture availability is a key variable

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determining WUE. I therefore think that the major goal of this study, i.e., “to reveal the main influences of environmental variables and forest types on WUE (and carbon gain)” cannot be addressed in this study. Similarly, the second goal of this study, “to demonstrate why WUE of Abies fabri increased or decreased with altitude in the subalpine mountains” (Line 104-105)”, cannot be addressed due to a complete lack of measurements of underlying environmental and soil moisture variables. Neither of the stated goals can be achieved without detailed measurements of underlying soil moisture and climatic variables. Therefore, I recommend rejection of this manuscript for publication in Biogeosciences. Having said that, I think that various components of this study may be publishable under a different focus of the manuscript. At one station of the altitudinal gradient, there were actual measurements of WUE measured by an Eddy Covariance station, and I could see an opportunity to focus on measured ET and WUE of this station and measurements. Possibly, these direct measurements could be compared to modelled WUE, focusing a study on direct measurements-modelling comparisons, but since I am not an ecosystem modeler I cannot address the suitability of such a study for publication.

Interactive comment on Biogeosciences Discuss., doi:10.5194/bg-2015-652, 2016.

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