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Interactive comment on "Spatial and temporal variations in plant Water Use Efficiency inferred from tree-ring, eddy covariance and atmospheric observations" *by* Margriet Groenendijk et al.

Anonymous Referee #2

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In this manuscript, the authors used data from eddy covariance measurement and tree-ring observations to derive an empirical relationship that links fractional change in water use efficiency (WUE) to changing atmospheric CO2 and atmospheric humidity deficit. The authors then reconstruct fractional change in WUE during historical period, and compare the results with those from CMIP5 simulations. It is found that reconstructed global fractional increase in WUE is much larger than that simulated by CMIP5 models.

The method used in this study is scientifically sound, the analysis is comprehensive, and the results are important for understanding land surface response to increasing atmospheric CO2 and climate. I recommend publication after the following issues are addressed.

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Discussion paper

Specific comments:

Line 121: In what years are those data taken from eddy-covariance observations?

Line 138: In what years are those data taken from tree-ring observations?

Line 146: "WUE is estimated using equation 2". equation 2 should be equation 4.

Line 157: "We rewrite equation 3". equation 3 should be equation 5.

Lines 187-190: It would be helpful to the readers to specify some possible missing constraints in the optimization theories.

Line 248: It would be great if the authors can also discuss the difference in historical WUE change between observational based reconstructions and CMIP5 results at regional scales. In the following section, the authors discussed substantial regional difference in WUE after all. It would be useful to know at what regions, there exist large discrepancy in WUE change between reconstructions and models, and among CMIP5 model members

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