Effects of vegetation change on evapotranspiration in a semiarid shrubland of the Loess Plateau, China

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Major remarks

The manuscript attempts to quantify the effects of land use change and vegetation phenological change on evapotranspiration in a shrubland ecosystem in China using eddy covariance measurements. Evapotranspiration is a critical ecosystem variable but the controls on ET and particularly its interaction with vegetation processes remain relatively poorly quantified. As the authors point out, ET changes are critical for water resources in dry regions and as such the study addresses an important aspect of coupled hydrological and land surface processes.

However, despite much effort in analysing the data, the authors do not clearly explain their findings and present somewhat conflicting conclusions. The authors state seasonal vegetation greening increases ET but so does the clearing of natural vegetation. In particular, the reported increase in ET due to land clearing is somewhat counterintuitive. Studies generally report a decrease in ET when vegetation is cleared or reduced (e.g. Bosch and Hewlett, 1982; Gordon et al., 2005) due to declining transpiration. Furthermore, transpiration usually forms the greater proportion of total ET and as such declines in vegetation would likely reduce total ET. Clearing of vegetation should also lead to reduced access to groundwater, diminishing water supply for ET and resulting in decreased ET in a water-limited area such as the study site. The reviewer accepts these generalisations may not apply to the specific conditions at the study site, particularly given the sparse vegetation cover, and increasing ET after land clearance may well be

plausible given site characteristics. However, the authors need to discuss this in more detail to propose specific mechanisms for why this would be the case in their study site. More generally, the authors need to clarify why vegetation is the main control on ET if ET at the study site is dominated by soil evaporation and why both seasonal greening and vegetation clearance appear to increase ET.

Minor comments

P13575 L12: What do you mean by “vegetation coverage”? Foliage fractional cover or something else?

P13576 L5: The FLUXNET network now comprises of 650 towers (fluxnet.ornl.gov/), the authors should consider replacing “several” sites.

P13579 L9-15: Why was this particular potential evapotranspiration (PET) formulation chosen? PET is a key variable in the study to estimate actual ET and as many equations for PET exist, the authors should clearly justify the choice of PET formulation. The equation appears (near) identical to the Penman formulation (Penman, 1948) but this is not clear from the text.

P13579 L18-20: Why was MODIS Terra chosen? The Terra satellite is known to have suffered from sensor degradation in recent years (e.g. Wang et al., 2012), including the current study period. Why was MODIS Aqua data not used or a combination of the two sensors to overcome data quality issues (e.g. cloud) and Terra limitations?

P13582 L5-9: This information should be stated in the figure caption, not the main text.

P13582 L11-12: The authors state the area of zone B changed over time but was fixed in the study. Was the mean or maximum extent of cleared area used for analysis and how much did the area vary?

P13584 L26: I don't think S_s and S_r are defined anywhere in the main text.

P13585 L21-23: The normalisation parameter appears to be an important method for attributing ET changes to specific drivers; a clearer explanation for what it represents and why it is adopted would be useful. The meaning of the parameter is not immediately clear (to the reviewer at least) and the authors should spend more time explaining the method.

P13587 L7: What is the unit of increase?

P13588 L16-20: The two sentences appear to contradict each other. On one hand, the authors state vegetation cover *above* a certain threshold can increase ET but on the other, vegetation cover *under* a threshold can also increase ET.

Figure 3 caption: Needs clarification and further details on what the different lines and symbols represent.

Figure 9 caption: In the main text *M* signifies monthly mean vegetation coverage but in the figure caption is represents "land use change". This is somewhat confusing.

Parts of the manuscript are poorly written and hard to follow, for example (but not exclusively) P13572 L8-10, P13588 L4-5 and Discussion in general.

Technical corrections

13572 L1: grammatical error.

13573 L19: typo.

References:

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Penman, H. L.: Natural evaporation from open water, bare soil and grass, Proc. R. Soc. London Ser. A Math. Phys. Eng. Sci., 193, 120–146, 1948.

Wang, D., Morton, D., Masek, J., Wu, A., Nagol, J., Xiong, X., Levy, R., Vermote, E. and Wolfe, R.: Impact of sensor degradation on the MODIS NDVI time series, Remote Sens. Environ., 119, 55–61, doi:10.1016/j.rse.2011.12.001, 2012.