Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2018-415-AC2, 2018

Hydrology and Earth System Sciences
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Discussions

Interactive comment on "Hydrological trade-offs due to different land covers and land uses in the Brazilian Cerrado" *by* Jamil A. A. Anache et al.

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Received and published: 21 October 2018

We would like to thank the anonymous **referee 2** for the kind words in support of our manuscript and for the time spent reviewing our text. Here, we replied the referee's comments, which were highly insightful and enabled us to improve the quality of our manuscript. Note that the original referee's comments are identified as R2Cxx and written in **bold**, and the authors' responses are labeled as AR-R2Cxx. In addition, all comments are numbered (xx).

R2C1: The authors assess the impact of four different land uses (bare soil, sugarcane, pasture and wooded cerrado) on water balance components (mainly runoff and actual evapotranspiration) monitored in experimental plots (5 m

width, 20 m length and 9% slope). The paper is potentially interesting for the readers of Hess, however it requires major revisions.

AR-R2C1: We appreciate the reviewer's comments and suggestions and we recognize that our manuscript requires more detailed descriptions of some topics listed by Reviewer 2. We hope to solve the problems found along the text to improve its comprehension and quality. In addition, it is important to remark that this is a site-specific study, and the discussion and conclusions stated in here are based on field observed data, without any pretention to generalize to a larger area. Our scope was to investigate the hydrological process in detail by adopting the hillslope scale as the design criteria of the experimental setup. Thus, our results will help further studies supporting them with 5-year experimental data that confirms the significant influence of the land use in the water partitioning in a subtropical region.

R2C2: In sub-Section 2.2 ("Experimental setting and instrumentation"), please clearly describe the monitoring infrastructure (refer to Fig. 2) by adding information on soil moisture probes, monitoring wells which are described in other parts of the manuscript. Please add the thickness of the unsaturated zone (40 m) in Fig. 2.

AR-R2C2: Thank you for the suggestion. We added the thickness of the unsaturated zone in Fig. 2 (see Fig. 2) and additional information will be added in section 2.2 to better describe the monitoring wells and soil moisture probes.

R2C3: Not clear Kc-values for sugarcane in Table 2. Do they refer to monthly values during the growing season? How do you obtain field capacity and saturated hydraulic conductivity? Please specify the root zone depth for sugarcane and wooded cerrado.

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AR-R2C3: Thank you for requesting this information. The Kc value vary along the year. We will specify in a new version of Table 2 (see the supplement to this comment) the months that the different Kc values are referring to. We obtained the soil field capacity and saturated hydraulic conductivity using Büchner funnels and Richards extraction chambers (information to be added in the revised manuscript). The root zone depth for sugarcane was specified on Table 2 (see the second column). However, the root zone depth for the wooded Cerrado will be specified in the revised version in section 2.2 (row 25, page 3): "The soil root zone in the wooded Cerrado may reach up to 18 m (Rawitscher, 1948). However, most of the water used for plants' transpiration comes from the first layers (up to 7.5 m) (Oliveira et al., 2005;Canadell et al., 1996)".

R2C4: In sub-Section 3.2 ("Groundwater table fluctuation"), the results are suspicious. The authors declare Ks=10-3 m d-1 for a sandy soil (very low if compared to tabulated values, see publications of Clapp and Hornberger, 1978; Schaap et al., 2001; Twarakavi et al., 2009 to mention a few). The main problem is the relationship between water storage change and water table fluctuation in Fig. 4. If Ks=10-3 m d-1, and hypothesizing full saturation of soil profile, we can apply the Darcy law with the unit gradient and water takes about 4000 days to bypass 40 m of soil and reach the water table. Please check if I am wrong. If I am approximately right, the relationship between soil water storage change and water table fluctuation should be influenced by a time lag.

AR-R2C4: Thank you for the remark. Our idea was to verify the aquifer hydraulic conductivity in both wells (pasture and wooded Cerrado) to be sure that the wells conditions were the same and consequently comparable in terms of water table fluctuation. The hydraulic conductivity mentioned in the section 3.2 was obtained by a slug test. Thus, it is not referring to the hydraulic conductivity for the sandy soil from the unsaturated zone. In fact, it is referring to the aquifer hydraulic conductivity, which

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is a sandstone. The soil hydraulic conductivity in the upper layers of the soil (up to 1 m depth) is around 10^{-1} m d^{-1}. Thus, the soil porosity, and consequently, the soil hydraulic conductivity may vary along the unsaturated zone.

R2C5: The main concern of this study is that the authors draw general conclusions on a small-scale, quite "homogeneous" test-site (experimental plots of 5 m width, 20 m length and 9% slope) by ignoring large-scale spatial heterogeneity of soil properties and topography. Hence this study can be considered as a preliminary survey for a more ambitious scientific investigation.

AR-R2C5: We appreciate your concern about the scale factor. There is a need to understand the water partitioning in the Cerrado region at multiple scales (Oliveira et al., 2014). In this study, our priority was to investigate the water balance at the hillslope scale in multiple land uses. The choice of the evaluated LCLU was based on the current LCLUC dynamics in the Cerrado described in the introduction and in the comment AR-R1C2. In the future, the findings of the present study can be used for data validation in spatial scale studies and be part of a multi-scale approach to evaluate the water balance in the Cerrado.

Figure caption

Figure 2: Hydrological monitoring performed on the four treatments: (1) relative humidity and air temperature probes at 2 m (site 1) and 11 m (site 2); (2) rainfall gauges; (3) soil moisture sensors; (4) solar radiation sensor; (5) wind speed and direction (anemometers) at 2 m (site 1) and at 11 m (site 2); (6) surface runoff collectors; (7) monitoring wells equipped with water table pressure transducers; (8) net radiation sensor; (9) soil heat flux plate.

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Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2018-415/hess-2018-415-AC2-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-415, 2018.

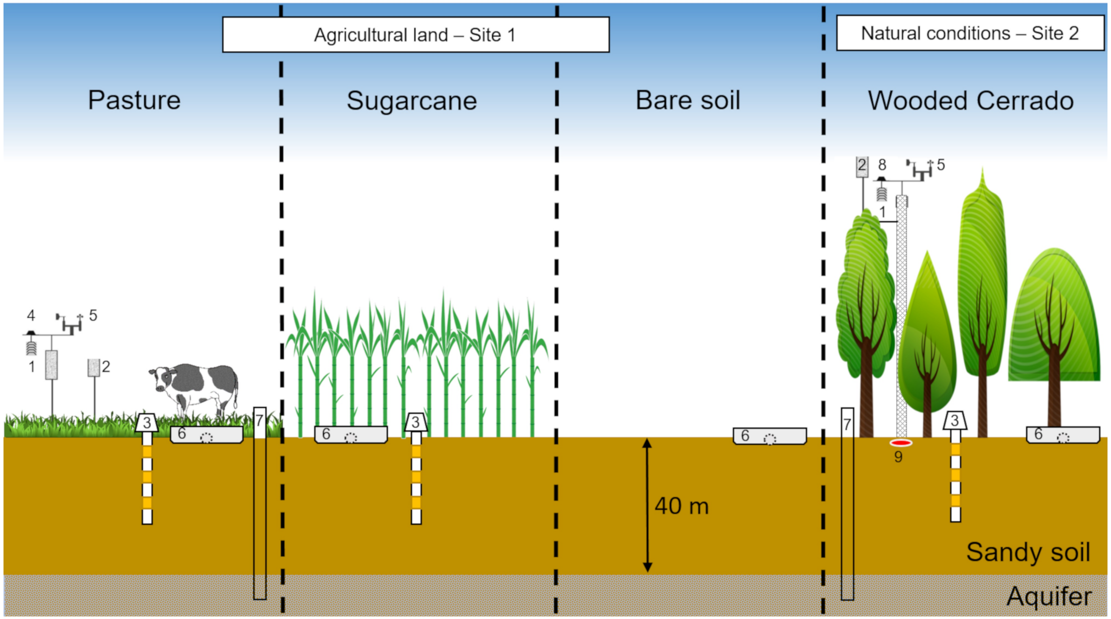

Fig. 1. Figure 2 (see caption above)