

## ***Interactive comment on “Identifying hydrological responses of micro-catchments under contrasting land use in the Brazilian Cerrado” by R. L. B. Nobrega et al.***

### **Anonymous Referee #2**

Received and published: 15 October 2015

Manuscript: Identifying hydrological responses of micro-catchments under contrasting land use in the Brazilian Cerrado. Hydrol. Earth Syst. Sci. Discuss., 12, 9915–9975, 2015.

The manuscript investigates some components of the water budget in the Brazilian Cerrado. This biome has been the main agricultural expansion region in Brazil, and therefore are expected several changes in the hydrological processes. To evaluate some of these changes the authors used experimental data from three micro-catchments (< 1 km<sup>2</sup>) under undisturbed cerrado ("cerrado sensu stricto"), pasture, and cropland (corn-soybean rotation). Several hydrological and hydrometeorological data were measured

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from October 2012 through September 2014. I recognize the hard work done by the authors to obtain and evaluate all these data; however I did not find in this study a clear objective and a relevant contribution to the literature. I also found some problems in the methodology, results and discussion sections. The manuscript is too long, and in some parts looks like a report. Overall, the manuscript has some potential for publication, but should be substantially improved for its consideration in HESS.

I have some comments/suggestions that hopefully will help the authors to improve the manuscript.

### General comments

**Abstract** This section should be rewrite. Please find some suggestions below: First: Writing about the GAP found in the literature. Second: Make your study objectives clear and straightforward. What exactly you set out to achieve and why. E.g. The objective of the study was, Here we assessed, The objective of the investigation was, This study evaluated..... Third: Write short phrases about the data and methodology used in the study. Fourth: You should show just the main findings of the study, i.e. findings that will support the study's conclusion. Fifth. Conclusion: The most important section. What is the study's contribution for the literature? You should point out the implications for the science here.

**High and Low.** Overused and misused when large or great and small are more appropriate. High and low are in essence, degrees of elevation. Please change these words through the text.

You should avoid using unnecessary words through the text. Be clear and straightforward. Some examples: P9916L5. "This study uses empirical data from field measurements" = We used experimental data; P9916L15. "The results of this study show" = Our results show

Why do the authors use a constant  $K_c=1$  for the cerrado? What are the uncertainty in

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this approach? The approach used to compute ET can works well to croplands and pasture; however, I'm not sure to use it for the undisturbed cerrado. The authors also can compute ET using other approaches such as by remote sensing data (see Mu et al., 2011; da Silva et al., 2014; Oliveira et al., 2015). I also suggest computing the uncertainty in the ET estimation.

As there are several uncertainties in all computed water balance components I suggest inserting an uncertainty analysis section in this study.

The studied catchments have different characteristics (e.g. soil type, texture, slope steepness, drainage morphometry...) that should be better investigated and discussed.

Conclusion section should be rewrite. I suggest starting with a brief summary about the study, then paragraphs with general and main conclusion.

Specific comments:

P9916L5. Why is Amazon here? It is not necessary.

P9916L10."native cerrado vegetation". Make clear that the cerrado physiognomy studied was the "cerrado sensu stricto".

P9916L10. Rewrite as: pasture for extensive cattle ranching

P9916L10. Rewrite as: cropland (corn-soybean rotation)

P9916L12. Exclude "Additionally". We also determined...

P9916L18. Rewrite as: Baseflow plays a significant

P9916L20. Rewrite as: evapotranspiration in the cerrado (986 mmyr<sup>-1</sup>) was greater than that found for the cropland (828 mmyr<sup>-1</sup>) and pasture (532 mmyr<sup>-1</sup>)

P9916L25. no-till ?

P9916L24-27. The authors did not show these differences. How many soil types are there? Average slope steepness for each catchment?? croplands? / rotation? / soil

tillage? The readers know nothing about it so far.

P9916L26-30. Why was the main conclusion about riparian gallery forests?

P9916L27-31. Exclude. It is not a adequate conclusion. Please, point out the implications for the science here.

P9917L6. Rewrite as: "underrepresented in the literature"

P9917L24-26. What of these cited papers reported that 80% of the native Cerrado vegetation has been converted in farmlands? Beuchle et al (2015) reported values of nearly 50%. Please, check it!!

P9918L10. Rewrite as: "Cerrado conversion into farmlands"

P9919L26-28. The objective of the study is very confuse. Rewrite!!! Make your study objectives clear and straightforward. What exactly you set out to achieve and why.

P9919L28-33. Here the authors try to justify the study; however, it is better to do it before the objective.

P9920L5-8. Exclude. Unnecessary text. "The results presented in this paper are part of a collaborative research project ([www.carbiocial.de](http://www.carbiocial.de)) that aims to investigate viable carbon-optimized land management strategies for maintaining ecosystem services under changing land use and climate conditions in the Southern Amazon." If the authors need to cite some grant project, please make it in the Acknowledgements section.

P9920L9-10. Rewrite as: grass pasture for cattle, and cropland (corn-soybean rotation).

P9920L13. Rewrite as: the undisturbed cerrado to pasture and cropland

P9920L15. "increase"

P9920L16. "increase" groundwater recharge

P9920L21. Does the cerrado...

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P9920L3-28. Remove. There are several general information about the entire biome. Please, insert more details about the study areas.

P9921L9-10. "with a minimum depth of 3 m from the ground surface". This is a misleading information. For example, Villalobos-Vega et al. (2014) studied ten monitoring wells with water tables ranging from 0.18 to 15.56 m in an undisturbed cerrado. Check it!!

P9921L9-13." To reduce the effects of spatial variability". What is it means?

P9921L9-19. December through March..... March through September

P9921-22. I suggest inserting all this into a well organized Table (location, area, land cover, soil type, texture, slope steepness....). Right now it's scattered around in the prose, and a struggle to get much from it.

P9923L1-2. Which data gaps? Be more specific!

P9923L15. Rewrite as: Hydrometeorological Data

P9923L16. Rewrite as: "...we used three tipping bucket rain gauges..."

P9923L22-23. " by using the Penman–Monteith equation (Allen et al., 1998)"

P9924-L7-25. I suggest inserting all necessary data to compute ET, Ks, TAW, and Dr<sub>i</sub> into a well organized Table.

P9924-L18. Dr<sub>i</sub> is a function of root depth. What is the main implication to use this approach considering that the authors have monitored soil moisture in a soil profile < 2 m? The root zone in the cerrado is usually deep (more than 10 m in depth) (see Oliveira et al., 2005)

P9924-L7-25. Why do the authors use a constant K<sub>c</sub>=1 for the cerrado? Where did you get it? What are the uncertainty in this approach? The approach used to compute ET can works well to croplands and pasture; however, I'm not sure to use it for the

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undisturbed cerrado. The authors can compute ET using other approaches such as using remote sensing (see Mu et al., 2011; da Silva et al., 2014; Oliveira et al., 2015). I also suggest computing the uncertainty in the ET estimation.

P9925-L1. "the water table is more than 1m" Rewrite as: "the water table is deeper than 1m"

P9925-L6-180. I did not understand this sentence. It will be good considering rewrite to make the point clearer.

P9925-L11. How was LAI obtained? Data source?

P9926-L6. wilting point?

P9926-L16-17. Significance level?

P9926-L18-25. How long was soil moisture monitored? What was the temporal resolution to get samples? Is the 140 cm enough to study soil moisture in the cerrado?

P9928-L13-19. What was the temporal resolution? Daily, Monthly or Annual.

As there are several uncertainties in all computed water balance components I suggest inserting an uncertainty analysis section in this study.

P9929-L7. Topographic Wetness Indices (TWI)

P9929-L25. In the catchment under pasture the total rainfall was ~200 mm greater than the other catchments. Catchment under cerrado and pasture are separated from each other by ~ 1km, So, how can explain this difference? Data gaps? Do the authors have used the same rain gauge model? or Is it common in this region?

P9930-L18. I suggest applying a statistical test to evaluate whether these results are significantly different.

P9931-L10. Predominant Land Use (PLU)

P9931-L10. "same bulk densities". "substantially lower". I suggest applying a statistical

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test to evaluate whether these results are significantly different.

P9931-L12. Runoff coefficients nearly 0.5 are not so small to farmland. It will be good discussing it citing other papers.

P9935-L10. "annual water balance"

P9935-L17-21. How depth? I did not understand this sentence. It will be good considering rewrite to make the point clearer.

P9939-L9-251. The studied catchments have different characteristics that need to be better investigated and discussed.

P9940-L9-27 - P9941-L1-13. Conclusion section should be rewrite. I suggest starting with a brief summary about the study, then paragraphs with general and main conclusion. What is the study's contribution for the literature? You should point out the implications for the science here.

Tables and Figures:

Table 2 and 5. PLU?? Tables and Figures should be self-explanatory... Table 6. RC? BFI? BF:P? Again, Tables and Figures should be self-explanatory. Figure 3 and 5. Join these Figures.

References:

Beuchle, R, R.C. Grecchi, Y.E. Shimabukuro, R. Seliger, H.D. Eva, E. Sano, F. Achard Land cover changes in the Brazilian Cerrado and Caatinga biomes from 1990 to 2010 based on a systematic remote sensing sampling approach, *Appl. Geography*, 58, 116–127, doi:10.1016/j.apgeog.2015.01.017, 2015. da Silva B. B., Wilcox B. P., da Silva V. d. P. R., Montenegro S. M. G. L. and de Oliveira L. M. M. Changes to the energy budget and evapotranspiration following conversion of tropical savannas to agricultural lands in Sao Paulo State, Brazil, *Ecohydrology*, DOI: 10.1002/eco.1580, 2014 Mu, Q., Zhao, M., and Running, S. W.: Improvements to a MODIS global terrestrial evapotranspiration

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algorithm, *Remote Sens. Environ.*, 115, 1781–1800, doi:10.1016/j.rse.2011.02.019, 2011. Oliveira, P. T. S., Wendland, E., Nearing, M. A., Scott, R. L., Rosolem, R., and da Rocha, H. R.: The water balance components of undisturbed tropical woodlands in the Brazilian cerrado, *Hydrol. Earth Syst. Sci.*, 19, 2899–2910, doi:10.5194/hess-19-2899-2015, 2015. Oliveira, R. S., Bezerra, L., Davidson, E. A., Pinto, F., Klink, C. A., Nepstad, D. C., and Moreira, A.: Deep root function in soil water dynamics in cerrado savannas of central Brazil, *Funct. Ecol.*, 19, 574–581, doi:10.1111/j.1365-2435.2005.01003.x, 2005. Villalobos-Vega, R., Salazar, A., Miralles-Wilhelm, F., Haridasan, M., Franco, A. C., and Goldstein, G.: Do groundwater dynamics drive spatial patterns of tree density and diversity in Neotropical savannas?, *J. Veg. Sci.*, 25, 1465–1473, doi:10.1111/jvs.12194, 2014

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