

Interactive comment on “Evaporation from Savanna and Agriculture in Semi-Arid West Africa” by Natalie C. Ceperley et al.

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The paper by Ceperley et al. describes a year and half of energy fluxes in two eddy covariance sites (forest and agricultural field) of a semi-arid, mixed-used catchment in West Africa. The material is appropriate for a scientific study and the data obtained “appear” to be high-quality. The work seems interesting and worthy of publication in HESS journal however, before it can be accepted for publication a major revision is required.

Major Comment: Firstly, the paper is poorly organized, with much extensive content, though not exhaustive and too much interpretation in the results. While the methodology, in particular the eddy covariance data treatment requires a particular attention to have reliable turbulent fluxes, this was partially presented by the authors and the units

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of keys variables were omitted. In addition, there was a total confusion in the signification of such variables. For example, the available energy is not the sum of turbulent fluxes ($H+LE$) but rather the difference between the net radiation and the soil heat flux (R_n-G), see L13, L25, p5; and section 3.2.2.

Secondly, one of the main points of this paper was in the site comparison; however, basic information about the research sites was lacking. Did both sites have similar soil characteristics? The large differences in soil water content may indicate site differences in soil texture. Also, more information is needed about the flux footprint. What was the fetch? Was the vegetation in particular (the rain fed site) within the flux footprint homogenous? The forest site seems to be located in a very complex topography according the map of the site (Figure 6). How this has been taken into account in the analysis of eddy covariance data? These aspects are important for understanding and interpreting the results. Finally, what is the value of the slope? Some of the writings throughout the text may be rewritten in more compact and yet concise style without losing the message they want to convey to the readers. Some conclusions are drawn without the support of data. Details can be found at the specific comments.

Specific comments

Abstract L18 – 20: Which period of the year? I am very surprised with this result! L18 – 22: I don't agree with this deduction. The presence of rocks and trees cannot, from my point of view, allow you to say that the soil heat flux is higher in the fields. You should take care with this assertion since you don't have any in situ measurements or direct calculation/estimation of this term of the energy balance to reinforce your conclusion.

Introduction L15 – 25: Give the units of all variables the first time that they are used. . L14 – 16: The cited reference Foken, 2008 “The energy balance closure problem: An overview” is not an appropriate reference. T. Foken has never worked on the link between global atmospheric processes and the land surface atmosphere interaction. Please provide an appropriate reference. L18: Write LeE is “latent heat flux” instead

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of latent energy flux. L29: Replace Evaporation by Evapotranspiration since you were talking about vegetated surface. L30 – 33: It is true that in situ data of energy and water vapor fluxes were limited “in the past”, but today there are a lot of studies which have been conducted in this part of Africa (Guyot et al, 2009; 2012; Mamadou et al., 2014 and 2016; Velluet et al., 2014; Timouk et al., 2009; Ramier et al., 2009).

L12 – 15, p3: THIS is not general but depends on the region; authors should specify the region in which this result has been obtained. L1 27, section 2.1 there are too much information’s which are from my point of view not really essential for the interpretation of fluxes. An example “the village is made up of a majority...”. I cannot get the importance of this sentence and elsewhere in the section 2.1. L32 p4: Infrared gas analyzers. Open path or closed path? Need to be precized L1 p5: Replace eddy correlation by eddy covariance. What is the distance between the two studied sites?

In Section 2.3 : L10: This is not true!! Sensible and latent heat fluxes cannot be measured at a half hour time step if you really used eddy covariance system to measure the fluctuation. How the sampled data have been then processed? What are the selection criteria? Given the complexity of these measurements, it is very shocking to see that certain details were not presented. Why do you use day light measurements (8am – 4pm) for the comparison? Give the reason of this choice. L20: Give the unit of different variables of Eq 4. L25: Here instead of using the day light measurements as mentioned in L10, you preferred to use midday average. Why? L9, section 2.6: What do you called the incoming shortwave infrared radiation? Is it the incoming shortwave radiation? If yes, make it clearer. P7, Give the units of variables of Eq 9 to Eq12. L5, p7: Longwave incoming or reflected radiation? L8: Write T_s instead of T s

Section 3.1, L5: I cannot get the meaning of this sentence. Section 3.2.1, L17: You started by saying that energy balance varied according to the month, i agree and now you compare a single day in April and in July. This is not coherent with the title of the section. L23: Write the sensible heat flux L24-25: In the sentence, “by July the latent heat has surpassed the sensible heath..”. How do you explain this fact? Replace heath

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by heat in the sentence. L26-27: What was the magnitude of this residual in the morning? residual is lower over the savanna (which values?) and what about the agricultural field? L30: What is the dust season? How was it objectively defined? Although the dust is something common over the region, it should affect also the measurement of the second site. How do you explain the fact that the net radiation was lower over the savanna-forest? L31-32: I am very surprised with these results. They are contrary to those obtained over the region. . . I would like to see the temporal evolution of H and LE based on half hourly data over the two studied sites. L1 – 4, p9: I cannot get the meaning of the sentence “The timing of the peaks of latent energy. . .the peak in the diurnal was after noon”. This sentence may be rewritten in more compact and yet concise way. Replace latent energy by latent heat flux and elsewhere in the paper. L6- 7: I would like to see the diurnal cycle of the available soil moisture Section 3.2.2: What is the general correlation? L25: It is normal since the reflected longwave radiation depends on surface temperature (Eq. 9) Section 3.2.3: it is very surprising that the savanna-forest contributed more sensible heat flux throughout the year than the agricultural land. The convection above the agricultural field should be more than that of the forest because the “exposed area” and also the presence of vegetation over the forest which should limit this process.

Section 3.3.1 Could you give the values of coefficient correlation and their associated p-values? It seems that wind speed is also correlated with EF. How have you identified the two dominant variables? How landscape moisture availability can be expressed as both NDVI and soil moisture? Higher levels of soil moisture? Which levels? What is the total net radiation? In the sentence “Total net radiation does not show a strong influence, suggesting that this is not a radiation limited system”, I do not see the data which support this conclusion. In L21, replace supposition by hypothesis. Section 3.3.2: Give the values of coefficient correlation and their associated p-values of your fit. Section 4.1, L13-16: I am not sure for these explanations. . . L19-20: What allow you to say that the level of water availability is permanent? Show then the water table in dry and wet season? L21: Replace latent heat by latent heat flux (and elsewhere in

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the paper) L7-9, p12: I cannot get the meaning of the sentence In table 1: The Li-7500 measures both H₂O and CO₂ concentrations not “HO concentration”. It seems that authors only provided the height of sensors above the agricultural field. What is the height of eddy covariance and additional measurements above the savanna-forest? Figure 4: Environmental parameters at study site (which one?) Figure 5: Write in the title Diurnal cycle of the energy balance components. In the title of Figure 6 : H+LeE is not the total available energy!!! Figures 11 and 12 are not cited in the paper.

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