Earth Syst. Sci. Data Discuss.,
https://doi.org/10.5194/essd-2018-113-AC1, 2019

Open Access Earth System Science Data Discussions

Interactive comment on "A leaf area index, LAI, data set acquired in Sahelian rangelands (Gourma, Mali) over the 2005–2017 period" *by* Eric Mougin et al.

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Received and published: 12 April 2019

Reviewer #1:

Review Assessment This paper contains a number of errors that makes the reading flow difficult. Now it also contains numerous spelling and technical errors. However, the most important question I have is what is the science here? I understand the value of some of the variables but what is the science here is hard to get. This review finds this paper border line between rejection and major reviews. This is because this journal seems to focus on data. However, science data should be explained in the more compelling and more justifiable scientific framework.

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Author response: Yes, you are right. The journal focus on data and the main objective of a 'data paper' like the one we submitted, is to present the data, their potential scientific value, and the associated open data base. We think we fulfilled all these criteria.

Comments

Delete LAI from the title.:

OK, corrected.

Change rangelands of Gourma in Mali – Eliminate parenthesis:

OK, corrected.

Through the abstract there are three instances in which you define acronyms that are not used through the abstract. - then I would suggest to use the entire word and then when the paper start in the Introduction you define those acronyms.

OK, corrected. The acronyms are now defined in the Introduction section.

Why these variables are climate essential? You are giving swepping statement without justification. Please restrict you writing to the specific of what the variable is about without loading any extra concept.

These vegetation variables are among the 13 so-called terrestrial essential climate variables (ECVs) identified by the Global Climate Observing System (GCOS) to be monitored from systematic long term measurements collected by satellite and in situ observation networks (GCOS, 2011). To make it clearer, we added the Bojinski et al. (2014) reference which describes ECVs.

Bojinski, S., Verstraete, M., Peterson, T. C., Richter, C., Simmons, A., Zemp, M.: The concept of Essential Climate Variables in support of climate research, applications, and policy. Bulletin of the American Meteorological Society, 95(9):1431-1443, doi:10.1175/BAMS-D-13-00047.1, 2014.

Change “understorey” by understory :

OK, corrected.

Abstract evaluation: this abstract si unspecific. The abstract should summarize overarching objective, what the project is about and what the main results are. Your abstract does not respond to any of those parameters.

As suggested, the abstract was modified. To follow the reviewer suggestion, we added the following sentence at the end of the abstract:

“This paper aims to present the field work that was carried out during 13 successive rainy seasons, the measured vegetation variables, and the associated open data base. Finally, a few examples of data use are shown.Âż

Line 3: explain what you mean by “one half the total leaf area index”

This definition was adopted by the Global Climate Observing System, GCOS. It corresponds to the one half the total green leaf area per unit horizontal ground surface area (Watson, 1947; Chen and Black, 1992; GCOS, 2011). Leaf should be seen here as a generic term for designing the above-ground areal extent of green vegetation.

. Watson, D.J., 1947. Comparative physiological studies in growth of field crops. I. Variation in net assimilation rate and leaf area between species and varieties, and within and between years. Ann. Bot., 11, 41-76, https://www.jstor.org/stable/42907002. . Chen, J.M and, Black, T.A., 1992. Defining leaf area index for non-flat leaves. Plant Cell Environ., 15(4), 421–429, doi: 10.1111/j.1365-3040.1992.tb00992.x. . GCOS, 2011. Systematic Observation Requirements for Satellite-based Products for Climate, Supplemental Details to the Satellite-based Component of the Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (update, December).

Line 4-off: References should go in chronologic order.

The references have been modified according to your recommendations.

Line 15: what are production efficiency models?

Production efficiency models are well known models, based on the theory of light use efficiency which states that a relatively constant relationship exists between photosynthetic carbon uptake and radiation absorption at the canopy level. Production efficiency models have been widely used in agronomy and more recently using available satellite data, to estimate Net Primary Production at different spatial scales.

To make it clearer, we added the following reference which describes efficiency models used in combination with satellite observations.

McCallum, I., Wagner, W., Schmullius, C., Shvidenko, A., Obersteiner, M., Fritz, S., et al.: Satellite-based terrestrial production efficiency modeling. Carbon Balance and Management, 4:8, doi: 10.1186/1750-0680-4-8, 2009.

In general acronyms are expressed in parenthesis. Western African Monsoon (WAM)

As suggested, this has been changed.

Line 43: check if you can use an internet link as reference.

Yes, web pages can be given as references under the form: Title, URL.

Normally at the end of an introduction the paper should describe a roadmap of what the paper is about. Missing here.

As suggested, the end of the introduction has been modified as:

ÂńThe main objective of the current field monitoring is to document the seasonal, inter-annual and decadal variations of LAI and thus primary productivity in relation to the rainfall variability, at different spatio-temporal scales. More precisely, this monitoring aims to provide relevant data to investigate how the WAM and its spatio-temporal variability affect the vegetation density and cover in Central Sahel. This data set can also

be used in the interpretation of Sahelian surface processes that are mainly modulated by the vegetation cover such as the partition between latent and sensible energy fluxes (Timouk et al., 2009), dust and biogenic chemical emissions from soils (Pierre et al., 2012; Delon et al., 2015). In the following, we describe the experimental protocol used for the estimation of vegetation variables, the associated open data base and show a few examples of data use."

Lines 11 and 20: there is a mismatch in the use of supersite and then super-site. You should keep coherency across the paper.

The correction has been made and we changed "supersite" to "super-site".

Lines 25 – off change numbers by the actual word.

As suggested, the requested corrections have been made.

Line 39: change "metre" by meter :

As suggested, the correction has been made.

Line 22: moderate remote sensing sensors. You need to put examples and references here.

A suggested, we modified the sentence by adding the examples of three moderate remote sensing satellites, MODIS, SPOT-VGT and PROBA-V. These satellites have also been indicated in the Introduction section.

Line 25: here you express variations of estimates of LAI and PAI. From where these number so are coming from?

As indicated by the given reference (Mougin et al., 2014), the accuracy of the LAI was estimated in a previous study which detailed the whole methodology for the herbaceous canopies. We use the same approach in the present study for the forest PAI. This is now more clearly specified in the text:

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“The accuracy associated to the field LAI estimates is approximately ±17.3% for the herbaceous canopies (Mougin et al., 2014). Following the same approach and by taking into account the errors of classification and spatial sampling, the accuracy on the Acacia forest PAI is approximately ±36.5% (this study).Âż

Line 31: please use a more academic verb instead of “catch”

Following your recommendation, ‘catch’ has been changed to ‘characterize’.

Section 4: what is this? I really don’t understand the purpose of this section.

We just follow the guidelines of the journal. The description of the data base and the different measured variables, and also, the availability of the data via an open access, are mandatory for submitting a ‘data paper’.

Figure 1. This illustrate very-well the sites but it is difficult to see where this is located. Can you please add a larger area map with an inset so that we can see where this region is actually located.

Following your recommendation, this figure has been modified and a larger map has been added. The new figure 1 is as follows (see the attached file):

Figure 1. The validation sites used in this study: a) Location of the 50 km x 50 km AMMA super-site in Mali, West-Africa, and b) map (on a Google-Earth image, 2016/31/12) of the super-site showing the location of the 8 vegetation canopies: Agoufou (#17, Ag), Timbadior (#18, Ti), Hombori Hondo (#19, Hh), Tara (#31, Ta), Kelma forest (#21, Kf) and Kelma plain (#21b, Kp), Eguerit (#40, Eg), Bilantao (#41, Bi), the national meteorological station at Hombori and the automatic meteorological, flux and soil moisture stations installed during the AMMA project during the 2005-2010 period. The vegetation sites refer to Hiernaux et al. (2009a).

Figure 3. time series of LAI. These series are not clearly explained why Kelma herbs peaks far away from Agoufou?

The ‘Kelma herbs’ site corresponds to the herbaceous canopy of the seasonally inundated forest site (see Section 2) which contrasts strongly with the other herbaceous sites located on sandy dunes. This explains why the LAI peak is not time coincident with those of sandy sites. These differences are explained in the text (Section 3, P6 L2-4):

“The strong temporal dynamics of the herbaceous cover justifies the 10-day resolution sampling to precisely characterize the seasonal vegetation cycle, particularly the maximum LAI, LAImax, which is usually observed towards the end of the rainy season. Afterwards, on sandy soils the herbaceous green canopy composed of annual plants, rapidly dried out. In the forest site, on clay soils temporarily flooded, the understorey did not dry as fast and is partly composed of a perennial grass Sporobolus helvolus. Âż

Figure 4. Here you show rainfall and LAI. However LAI is known to be very sensitive to temperature and therefore inversely dependent to rainfall. Then for datasets that focus on vegetation that eventually respond to climate shift it it mandatory to know the time series of rainfall rather than the accumulated rainfall. The vegetation onset depends not only on radiation and temperature but also on the precipitation during the beginning of the season.

It is true that LAI is very sensitive to temperature in temperate and boreal regions. Under the dry tropics, air temperature has little effect on vegetation growth which is largely controlled by soil moisture availability in the rooting zone. Accordingly, we agree that time series of rainfall are essential to interpret vegetation growth. However, in a first approximation, the annual cumulated rainfall can be used to interpret inter-annual variations of herbaceous vegetation mass.

Figure 5. Kelma Forest exhibits a different dynamic behavior than Agoufou for LAI below 1 m2m-2.” No explanation in the text what is the attribution to this feature. Also the scattering dispersion is larger in the second plot compared to the first plot for LAI

larger than 1 m2m-2.

This figure shows the comparison between field LAI measurements and LAI estimated by the MODIS sensor. We reran the analysis since we found a numerical conversion error when extracting the MODIS data. Figure 5 has been changed by the following figure. The observed scattering dispersions are related to the complexity of the observed canopies (much higher for the open Acacia forest than for the savannah).

Figure 6. It is difficult to understand the meaning of this comparison. I think you should clearly explain why this comparison is needed. And. Actually why the series diverge differently.

Again, this is an illustration on the use of LAI data, here to estimate the performance of land surface models. Using a meteorological forcing and soil and vegetation characteristics, such models can simulate the time variation of vegetation density. The estimation of model performances requires accurate field measurements such as the ones presented in this paper.

Please also note the supplement to this comment:
https://www.earth-syst-sci-data-discuss.net/essd-2018-113/essd-2018-113-AC1-supplement.pdf

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Interactive comment on Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2018-113, 2018.

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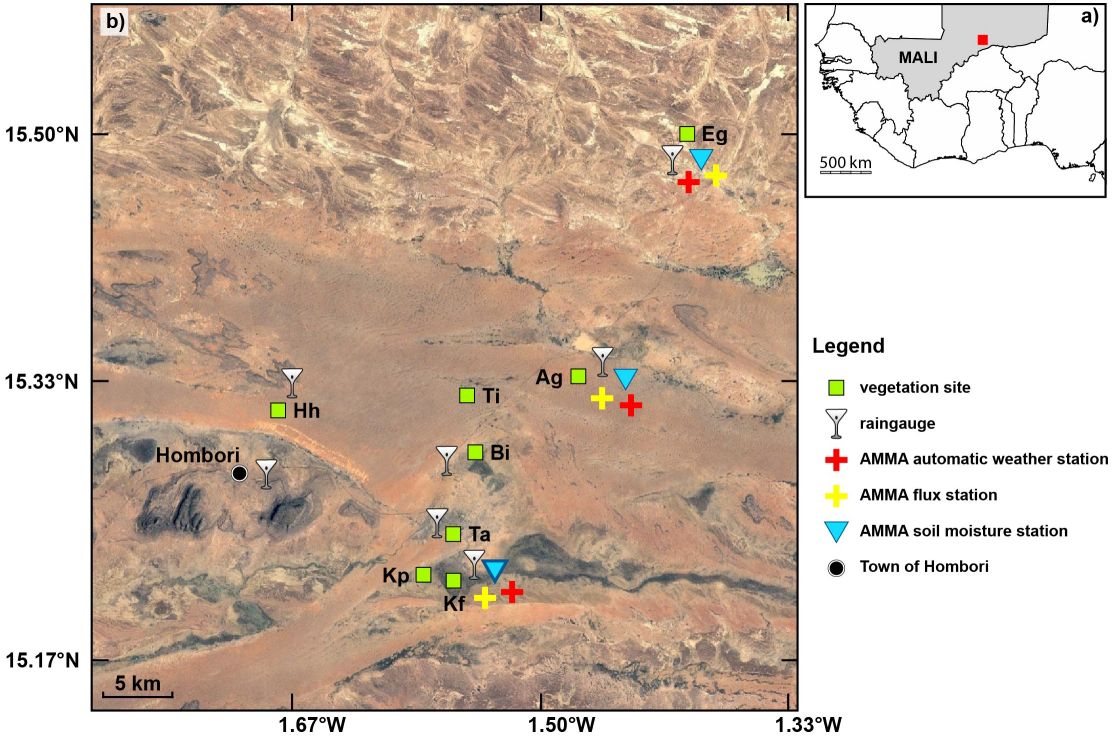

Fig. 1. Figure 1. The validation sites used in this study: a) Location of the 50 km x 50 km AMMA super-site in Mali, West-Africa, and b) map (on a Google-Earth image, 2016/31/12) of the super-site showing the

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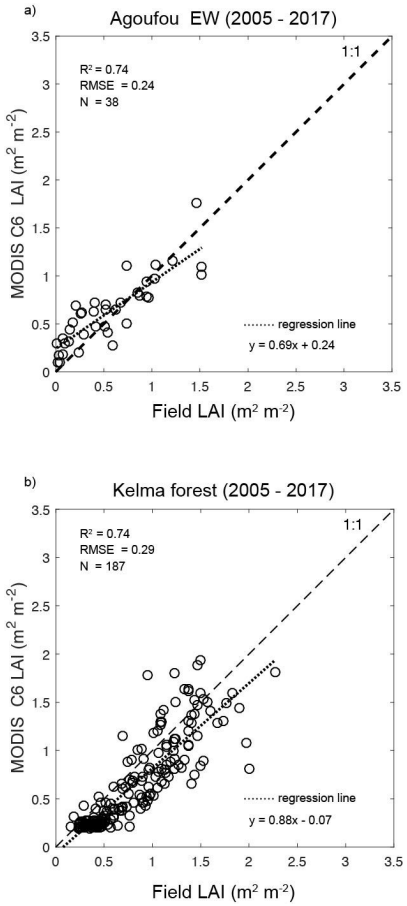

Fig. 2. Figure 5. Comparison between field LAI or PAI estimates and MODIS Collection 6 LAI products for the period 2005-2017: a) Agoufou herbaceous canopy and b) Kelma forest site. In this later case, the MOD

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