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Biogeosciences Discussions
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Interactive comment on "Deriving seasonal dynamics in ecosystem properties of semi-arid savannas using in situ based hyperspectral reflectance" *by* T. Tagesson et al.

Anonymous Referee #1

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The manuscript shows an interesting study on the use of multiangular spectral measurements to describe the physiological status of the vegetation canopy in a complex tree-grass ecosystem. In this context it contributes to the research done within scientific networks such as Fluxnet, SpecNet , Eurospec, Optimise, etc. that have worked on the integration and standardization of in situ optical and flux-tower measurements with the ultimate goal of determining ecosystem fluxes in a spatially and temporally continuous mode. It is extremely difficult to obtain accurate/reliable in situ spectral measurements, particularly in a continuous and multiangular mode due to a number of potential errors caused by instrumental and environmental factors. Therefore, the manuscript represents a substantial contribution in that field due to the scientific sig-

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Interactive Discussion
Discussion Paper

nificance of the in situ dataset analyzed. Also the study site selected in this paper is very interesting from the remote sensing perspective as, in this savanna ecosystems, the estimation of biophysical properties is still an issue owing to the challenge of determining some variables in a highly heterogeneous canopy. The research questions addressed are relevant and clearly fall within the scope of Biogeosciences. Specific comments addressing particular scientific issues:

1. Abstract and introduction are concise and summarize relevant research to provide context. However, in the introduction I miss a review of previous works on continuous multiangular hipersepectral observations for ecosystem monitoring such as the ones from T. Hilker using the AMSPEC system.

2. In the methods section some key information on data acquisition is missing. This information is necessary in order to properly interpret the results, especially in the case of the hyperspectral reflectance measurements but also for the ecosystem properties. In the manuscript there is only one paragraph describing hyperspectral reflectance data acquisition. Authors refer to the work of Huber et al (2014) for additional information, however, the importance of this data in the context of the paper justifies a more detailed description in the methods section. One of the key issues related with continuous spectral observations are the potential errors caused by instrumental and environmental factors. Those should be at least briefly described in the paper. Another important information which should be included regarding spectral measurements is the area observed by the sensor which, in this ecosystem, is assumed to be a mixture of trees, grass and tree-shadows at the different viewing angles (including nadir observations). This is a relevant issue because authors are building empirical models comparing spectral measurements with some ecosystem parameters as GPP which results from the mixed contribution of the different ecosystem fractions and others (as is the case in biomass) where the information comes only from the grass fraction.

3. Another key issue in this paper is the representativeness of the empirical relations found. There is an obvious limitation of the dataset in the spatial domain as it is only

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one instrument providing spectral observations. However, for the temporal domain, there are a large number of observations (1.5 years) that would allow an independent validation by using only part of the observations to calibrate the statistical model and another one to validate it.

4. Authors should better justify the negative correlations found between NIR bands and biomass. Previous works have demonstrated negative correlations in the visible but positive in the NIR both for total and green biomass (could the tree and shadow fractions of the ecosystem included in the sensor FOV be influencing this relationship?)

5. An interesting issue addressed by the paper is the effects of sun and sensor viewing geometry on NDSI. Did the authors analyzed how the mixed effect of the different ecosystem fractions (proportions) observed by the sensor at the different observation angles is contributing to these directional effects? Discussion about the potential of this dataset for BRDF modeling would be needed.

Specific comments addressing formal/technical corrections: (Line/page numbers are referred to the marked up version of the manuscript)

Abstract

Line 115. Use hemispherical conical reflectance factor (HCRF) instead of reflectance (also throughout the paper)

Introduction

Lines 137-138. Review commas in these sentences

Line 152-153. Suggest to change "....indices are ratio type of indices" by ..."those based on band ratios" in order to avoid repetition

Line 175-176. Suggest to change "The influence from sun-sensor variantions..." by "The influence of sun-sensor geometry..."

Lines 177-179. Not only goniometers but also multiangular satellite data, as the one

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provided by Chris Proba, has been used to analyze these effects.

Line 187.Avoid repetition in the same sentence “hyperspectral reflectance”

Materials and method

Line 220. Review the sentence. . . .grass and (other) herbaceous vegetation. . ..?

Line 259. The second sensor head is a cosine receptor? If so, please specify

Lines 311-312. How the ANIF thresholds for data filtering were stablished?

Lines 313-317. Move to section 2.4

Lines 369-370. Those relationships obtained using filtered or not filtered data? Please specify also for other ecosystem properties.

Figures

Figure 1. I would suggest replacing pictures by a high resolution image with the location of the towers and showing the area observed by the spectroradiometer. Additional information on the location of the biomass sampling plots and the EC mean footprint would be also useful.

Figure 5. How the authors explain the correlations peaks in all the graphs at approximately 1200 nm? Also the information included in the figure caption would be quite useful in a separated table in the methods section summarizing the main characteristics of the different datasets (units, n) but also data range, aggregation (if any), data gaps, etc.

Interactive comment on Biogeosciences Discuss., 12, 3315, 2015.

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