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Interactive comment on "Seasonal variation in vegetation water content estimated from proximal sensing and MODIS time series in a Mediterranean Fluxnet site" *by* G. Mendiguren et al.

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Title: Seasonal variation in vegetation water content estimated from proximal sensing and MODIS time series in a Mediterranean Fluxnet site

Note to reviewers:

We would like to thank both reviewers for their comments and valuable suggestions that help us to improve the clarity of the manuscript. We have followed the recommendations of the referees and made changes accordingly. Changes can be seen colored

in the new manuscript version. In red the parts that have been removed from the previous version and in green the new text that has been included. Detailed answers to each of the comments of the referees can be found below.

Comments to reviewer 1: The discussion of results would benefit by extending statistical relations with more explicit references to biophysical processes, such as relations of water stress to LAI chlorophyll reduction, which is particularly evident in the case of grasslands. - We agree in this comment with the reviewer. Is something that we tried to improve now in the new version. We followed the recommendation of the reviewer and included in the text explicit references the relationships between water stress and LAI, and chlorophyll. As example we have included in the discussion. - Page 16, lines 11-19."The relationship between these indices and water metric is indirect, since none of them include spectral bands in the SWIR region where water absorption is strong. However, there is a strong link between grassland water content, chlorophyll activity and LAI in this ecosystem. During wet periods the grassland grows very rapidly, increasing the LAI, biomass and chlorophyll content, but as soon as the dry season starts with high temperatures and low rainfall the grassland becomes cured rapidly losing all chlorophyll and quickly decreasing the LAI and biomass..."

The conclusions drawn by the authors are very much related to grasslands physiology, but it would not hold for other vegetation types, such as trees or shrubs. For this reason, indices that are not directly linked to water content (such as NDVI or EVI) provide high explicative power. The authors should state this clearly in both the abstract and the conclusions. For this reason, I strongly recommend using grasslands instead of vegetation throughout the paper, including the title and the abstract, as they cannot extend their conclusions to other vegetation types other that what they actually sampled. - - We definitely agree with the reviewer that the conclusions from this study cannot be extended to other type of vegetation that is not grasslands. Therefore we have changed the title to better adapt to the paper contents to. "Seasonal variation in grass water content estimated from proximal sensing and MODIS time series in a

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Mediterranean Fluxnet site". Following reviewer's recommendations we have added some additional sentences to both the abstract and the conclusions to clarify this point. - Grass was also used instead of vegetation all over the manuscript where suitable.

Another issue is to better explain why certain indices provide higher explanation than others, and first test whether those R2 or RMS values are statistically significant or not. To explain these differences, proximal sensing measures only grasslands at nadir view angle, but MODIS includes also trees, their shades, and other artifacts at up to 20_ view angle. - In the new version we have included two figures, one for R2 and a second for RRMSE. In this figure we show the confidence interval for each of the parameters. Since we used bootstrap, we considered more adequate presenting this rather than the significance. 1. Introduction. Include formulas of all referred terms - Following the suggestion of the referee, we have included in the introduction section the formulas of all referred terms 2. For this introductory section, you may gain by reading the Yebra et al.'s (2013) review.

- Thanks for the recommendation. We have incorporated some of the valuable information in Yebra et al.'s 2013 in the introduction.

3. Page 5505:5: "These indices monitor the vegetation water content by indirectly relating it to another biophysical parameter that is used as a proxy of water stress. This is the case of the Normalized Difference Vegetation Index (NDVI) (Tucker, 1979)". I think this is a misleading sentence, as NDVI has very little relation to plant water content, and therefore it should never be used as a proxy of water stress. It can eventually estimate indirect effects of changes in water content, particularly when reaching stress conditions, such as reductions in chlorophyll or LAI, which is a different issue. - We removed that sentence and rephrase: - Page 5, line 7: "In the case of grasslands the relationship with bands in the Visible (VIS) and Near Infrared (NIR) spectral region, has shown a close relationship between vegetation biomass, chlorophyll and water content. . ." 4. Avoid using qualitative terms in the description of results. Correlations are not better or worse, but higher or lower. - As recommended, qualitative terms have been avoided in

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the new version of the manuscript.

5. You compare empirical models with RTM models. It is not clear whether the RTM models used were the originals developed by Jurdao et al. (which did not intend to estimate CWC but only FMC), or do you parameterize them somehow. In this case, please include technical details. Otherwise, state why. - Following the referee recommendation we have included in the manuscript a section describing the approaches used in the study to estimate FMC and CWC from RTMs. CWC was estimated following Trombetti et al 2008 while for FMC we followed Yebra et al 2008 and 2009 and Jurdao et al 2013 models. - - 6. page 5517/5: "Therefore, the strategy to capture better the variability of vegetation water content in this ecosystem should be to sample more times but fewer plots". Check grammar.

- We have changed the sentence: - Page 15, line 10-line 13. "Therefore, the strategy to better capture the variability of grassland water content in this ecosystem should consist in increasing the number of samples in time and but sampling less number of plots per day".

7. page 5517/17: "CWC depends on LAI which is even higher correlated than those two variables". Several studies have shown that LAI contribution to total reflectance variability is much higher than water. You may refer to (Bowyer and Danson 2004). For this reason also, CWC should provide more accurate retrievals than FMC, as it depends on LAI, which is highly correlated to the spectral indices - We changed that sentence to: "CWC depends on LAI which is showing higher correlation values to the empirical models than other metrics such as FMC or EWT. Some studies have shown that LAI contributions to total reflectance variability is much higher than water (Bowyer and Danson, 2004) this would explain that CWC provides more accurate retrievals than FMC or EWT." - Page 15, lines 27-31 8. Conclusions. "Results indicated that FMC and EWT showed lower spatial variation than CWC". This is pretty obvious, as CWC includes another factor which also varies throughout time. - We have removed the sentence from the manuscript.

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Figure 4 is too complex. Think about alternative ways or restrict the information you consider relevant for displaying. From comparison with Figure 5 is very difficult to extract any conclusion. Why figure 8 is not in color?

- We have simplified figures 4 and 5. Now only the results regarding the R2 (Figure 4) and the RRMSE (Figure 5) is displayed in the figures. We have included in these two figures the confidence interval of the parameters. - Figure 8 now is displayed with colors.

Please also note the supplement to this comment:
http://www.biogeosciences-discuss.net/12/C4570/2015/bgd-12-C4570-2015-supplement.zip

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Interactive comment on Biogeosciences Discuss., 12, 5503, 2015.