

Interactive comment on “**Combined use of FORMOSAT-2 images with a crop model for biomass and water monitoring of permanent grassland in Mediterranean region”** by **D. Courault et al.**

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Thank you for your careful reading of our manuscript and your very useful comments to improve our text. In the enclosed revision, I modified the text according to all your remarks.

> *is STICS also accounting for soil dynamics as indicated on page 3654 line 5*

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The STICS crop model simulates the dynamics of the soil moisture and nitrogen in the soil at a daily time step for each soil layer. The soil texture and structure (number of layers and the soil type) remain constant during the simulations. I added a sentence p 3654 to clarify this point.

> *LAI was estimated from FORMOSAT data by using an empirical relationship. It is assumed that the relationship at least partially depend on the sensor characteristics. Was the NDVI/LAI relationship obtained with FORMOSAT data?*

Yes, the relationship NDVI/LAI was obtained with FORMOSAT-2 data and ground based measurements. The method is described in Bsaibes et al, (RSE 2009). FORMOSAT data were acquired with the same viewing angle during all the period. Leaf Area Index (LAI) was derived from hemispherical images that provided Effective LAI. For LAI estimation, ground based measurements and FORMOSAT-2 pixels were collected or selected in order to consider representative values at the field scale. Ground samples were collected within each field according to a cross-pattern protocol, and next averaged. For each field, FORMOSAT-2 overlaying pixels were selected by excluding borders, and the corresponding waveband reflectances were averaged to computed NDVI.

> *Please also describe alternative methods to estimate the LAI.*

Other approaches were proposed to estimate LAI, based for example on the use of radiative transfer models, or neural network, recently reviewed by Baret and Buis (2008). Radiative transfer model inversion is potentially a very powerful approach (Darvishzadeh et al., 2008; Goel, 1989; Meroni et al., 2004; Schlerf & Atzberger, 2006; Weiss et al., 2000), able to explicitly account for available information such as known peculiarities of targeted canopies thanks to a priori knowledge. However, radiative transfer model inversion is often limited by the realism of canopies structure description, and is known to be severely ill-posed, which induces equifinality problems (Combal et al., 2002;

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Durbha et al., 2007). Although using deterministic approaches has more portability than empirical approaches, it required first inversion strategies that face the ill-posed problem and related equifinality troubles, so empirical approaches easy to implement have been chosen for this study. I added some sentences in the text to clarify better this part.

>As reported in the text, NDVI tends to saturate with LAI above 4 which introduces additional errors. Please estimate these errors using your in-situ data set.

The error is already taken into account since we used ground based measurements in our relationships.

> on page 3656 - line 2 - it is indicated that airborne data was acquired, too. How was the data set used in your study?

I removed this sentence indicating that ‘airborne data was acquired’ because these data are not used a lot in this study. They were acquired simultaneously with some satellite data and were used mainly to give information on the soil moisture variability described in Courault et al, sensors 2009. As the spatial resolution of these airborne data was very high (3m in the thermal range 1.5m in the visible range, these data were also useful to define better some fields for the digitalization (made manually).

>please also consider in your discussion that future high-temporal SAR data (e.g. Sentinel-1 or a constellation of different SAR) will provide a mean to estimate soil moisture in field scale

I added some sentences in the discussion on the future high temporal SAR data

‘It should be noted that the future high-temporal SAR data ‘eg Sentinel-1, see http://space.skyrocket.de/index_frame.htm?http://space.skyrocket.de/doc_sdat/sentinel-1.htm) should provide also data at high resolution useful for the surface moisture monitoring.

>is it true that SPECTLA is from the Earth Explorer candidate SPECTRA

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I removed this sentence .

I have corrected in the text for all the technical comments noted by the reviewer 1.

I changed all sentences starting with ‘we found or we developed’... by passive sentences

I changed agricultural practice variations by agricultural practice changes, let us mention by it should be noted, these last years by during these last years, large by great. . .

I removed (3 to 5) p3653 for soil type, because it was not clear

I deleted ‘ vernal o thermal index because it is a thermal index. Vernalization corresponds to a cold period necessary for development of some plants

I corrected the reference:

The reference Baillarin et al 2004 appears p3657 line23 and reference is listed p3670 line 26

Corrected Mailhol p3657, Varella, 2010

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 3649, 2010.

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